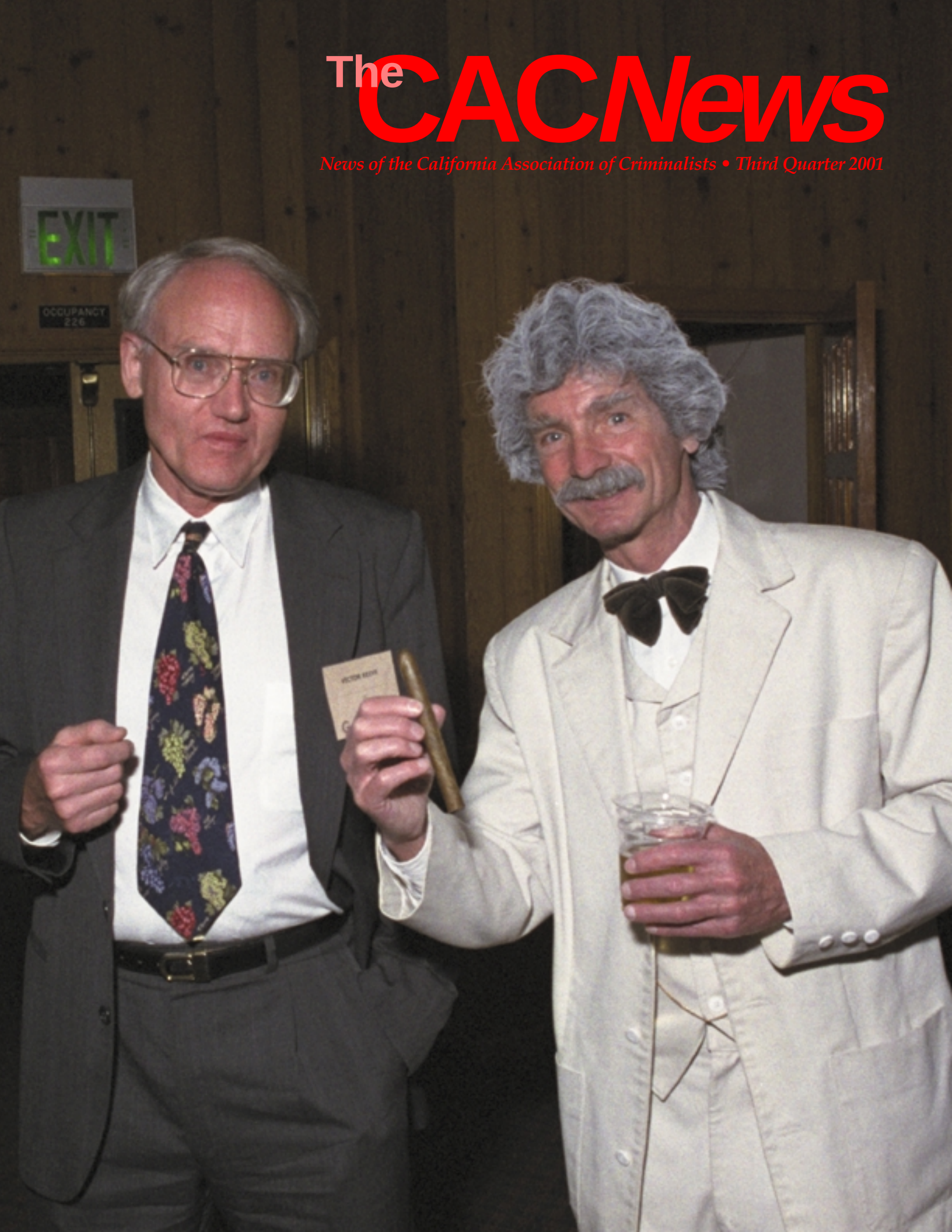


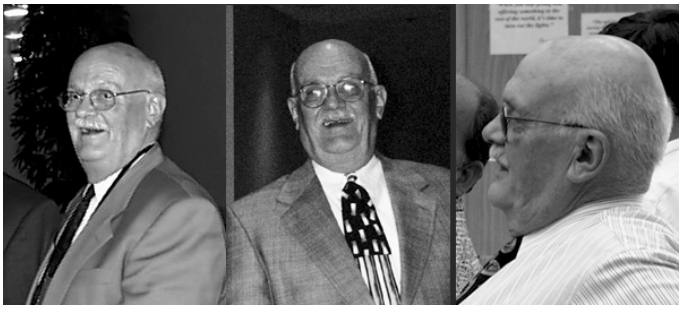
The CAC News

News of the California Association of Criminalists • Third Quarter 2001

The President's Desk

"It's only our connection to truth that leads to justice under the law"[1] set the spirit for the 97th Semi-Annual Seminar held at the Granlibakken resort in Tahoe City May 7th-May 12th 2001. It is an appropriate standard to bear as the CAC continues its fine traditions into the new millennium. The efforts of the California Department of Justice California Criminalistics Institute and the Sacramento Laboratory were well received by those attending the eclectic collection of workshops as well as those who listened to an excellent collection of scientific presentations.

The workshops covered both the old and the new. The old was represented by a comprehensive archeological field trip to see how bad decision making, poor team work and a lack of leadership can result in having to eat each other as the Donner Party did in 1846. The new included workshops in the use of Adobe PhotoShop and the "New World of Digital Evidence at Crime Scenes…". Also well received were workshops on the Microscopy of Rape Evidence, the Use of Fluorescein at Crime Scenes, GHB & Related Compounds, The Invincible Witness, Interviewing and Promotional Skills and the ever-popular DNA molecule.



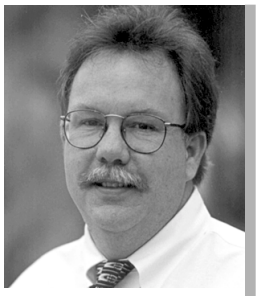
Tony Longhetti 1928-2001

For those who went, you probably gained some weight. The food was excellent and abundant. The Thursday night banquet was highlighted by the Ghost of Mark Twain who proceeded to remind us that politicians and the press haven't changed and that any subject, including flatulence, can be the subject of extensive humorous rhetoric.

Thank you to all of the people who worked on the seminar and to those individuals who contributed papers and taught the workshops. You made it seem easy and I know it was not.

One of the faces missing from the seminar was Tony Longhetti's. Sadly, Tony passed away on June 11, 2001. He is the reason that I am a member of the CAC and I'm quite certain that there are many more members that can say the same. Tony hired me at the San Bernardino Sheriff's Department in 1979 (he started the San Bernardino Lab as a Criminalist in 1957—the year I was born). Tony always encouraged people to become involved in the *Profession* of Criminalistics, of which the CAC and other regional associations are an integral part. He set an example of involvement as, among many other chairmanships, offices and responsibilities, the CAC President in 1962-1963 and again in 1971-72 and AAFS President in 1982-83. His legacy continues through the many programs in which he was involved, the numerous coworkers and employees that worked with or for him and the countless number of students that he taught. I'm proud to say that I am part of that legacy. For myself as well as a very large group of people whose lives Tony touched, I know we'll miss his wisdom, wit and friendship.

Tony is the reason that I am a member of the CAC and I'm quite certain that there are many more members that can say the same.



Daniel J. Gregonis
CAC President

[1] Opening remarks by Steven Staveley, Director of the Division of Law Enforcement, CA State Department of Justice

The CACNews
www.cacnews.org

Third Quarter 2001

On the cover...
CCI Director Victor Reeve shares a timeless moment with Mark Twain (McAvoy Layne) who visited the CAC banquet. Mr. Twain said he was fresh off of Halley's comet.

Calico Press

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CACBits • Section News

Hollywood Invades the Crime Lab

Orange County Sheriff's Crime Lab was turned upside down for a couple of days last month as a television film crew swarmed over microscopes and IR spectrometers to complete a pilot called, "DNA." The project stars *Law and Order*'s first deputy DA Ben Stone (actor Michael Moriarty)

CAC Well Represented on ABC

Jennifer Mihalovich was named president of the American Board of Criminalistics. "Unfortunately there is no set time limit on the term as President. However, she plans on only serving three years," said Jennifer. That three years started in February 2001. In addition, Greg Matheson was re-elected as ABC Member-at-Large for the CAC. She also managed to twist his arm into serving as vice-president.

New Web Discussion List

The Forensic Science Society is setting up a discussion list hosted by JISC, a supporter of academic lists in the UK. CAC members are welcome to join.

To join the list, point your browser at http://www.jiscmail.ac.uk/lists/forensic-science-uk.html and follow the instructions.

Joining the list isn't automatic and membership is restricted to F. Sci. Soc. members, CAC members, academics teaching a course with "forensic" in its title, and practitioners.

—Robert Forrest, A R W Forrest LLM, FRCP, FRC
Path Editor, Science & Justice, r.forrest@sheffield.ac.uk

Supervising Forensic Scientist (TRACE)

SALARY: $4505 - $6320 per month ($54,058 - $75,844 ann.)
EDUCATIONAL INCENTIVE: Possible educational incentive of $2702 - $3792 per year based on completion of a Master's degree.
FINAL FILING DATE: CONTINUOUS
Ventura Sheriff's Department

THE POSITION: Under general direction of the Manager-Forensic Sciences Lab, supervises laboratory personnel and case work in the Forensic Trace Evidence Section. The Supervising Forensic Scientist performs more difficult and complex physical and chemical analyses in one or more specialty areas of forensic science. Additionally, the Supervising Forensic Scientist performs analysis, writes reports, provides expert testimony, trains and evaluates personnel, prepares statistical reports, evaluates and develops methods and procedures, ensures compliance with regulatory agencies and with the Sheriff's Department and county policies, assigns work, reviews and approves completed casework, and performs other duties as assigned.

THE REQUIREMENTS: These are entrance requirements to the examination process and assure neither continuance in the process nor placement on an eligible list. Education, Training and Experience: Any combination of training, education or experience, which would demonstrate the required knowledge, skills and abilities. The knowledge, skills and abilities can be obtained by graduation from an accredited college or university with a Bachelor of Science degree in biochemistry, chemistry, physics, biology, criminalistics, forensic science, or a closely related field which has included at least 3 semester units of quantitative analysis and eight semester units of general chemistry and five years of professional forensic science work experience in Trace Analysis. Necessary Special Requirement: Possession of a valid California driver license.

Ventura County Sheriff's Personnel Bureau – 800 S. Victoria Ave., Loc. #3300 – Ventura, CA 93009 (805) 654-2375.

Applications must be submitted to the Personnel office. For information about this position, contact Renee Artman, Lab Manager, 805-662-6878.

Crime 'Lab' Retires

For Frank Oglesby, Los Angeles City Fire Investigator, it must feel strange going to work while his partner gets to stay home and play all day. For the past six years, Frank's partner in fighting arson has been a black labrador named Flower, the only ATF certified accelerant detection canine in the state of California. She and Frank have generously made themselves available to counties all over the southland and often nationwide as part of the National Response Team (NRT).

Eight-year-old Flower almost didn't have a career after she stuck her nose into a live light socket when she had been on duty only a short time. After months of retraining, however, Frank was able to return her to full service.

In June, Frank will return to Connecticut where he will be paired up with a new dog and begin the arduous process of training. Meanwhile, Flower will stay at his house and enjoy the rest of her life as a family pet.

Last month, a special retirement party was held in Flower's honor. Over a hundred people were in attendance— and one dog. A few grumbled, "I'll bet that many people won't show up for MY retirement." While we aren't sure she understood why so many folks had turned up, we did see lots of tail-wagging.

LA City Fire Investigator Frank Oglesby and Flower perform their special brand of magic at a recent John DeHaan class on arson investigation.

Calico Press

Calico Press

(Molotov) Cocktail Party

A workshop on collection of fire debris evidence was the product of a joint effort between Ventura County Fire Department and the Ventura County Sheriff's Forensic Laboratory, with CAC member Kristin Rogahn (left) and Fire Investigator Scott Quirarte as presenters. Attending were representatives from a combination of seven local and federal agencies. Highlighting the demonstration portion was the burning of a furnished cubicle that included two pig's heads, each bound with duct tape simulating a homicide victim. After the demonstration, participants proceeded to make their own molotov cocktails using a variety of volatile substances. Techniques for collecting debris from the firebombs were also practiced. At the conclusion of the class, the local bomb squad made off with one of the pig heads to use in a demonstration on explosive injuries later that day.

San Francisco Convention & Visitor's Bureau Photo

99th CAC Seminar, Spring 2002 at Fisherman's Wharf.
May 8-11, hosted by SFPD, Bonnie Cheng, Chair, 415.671.3248

Beginnings

…thoughts from your new editor.

So it begins. This is my first column as editor-in-chief. In many ways, I find this column harder to write than the QA column. The editor's column can cover just about anything and that makes choosing a topic all that much more difficult. For this first column I have chosen two subjects "Beginnings," and "Whose team are we on?"

You will see new beginnings on the publication team. I begin as editor. Brenda Smith from Kern County steps up as the new advertising editor. Jennifer Shen has volunteered to be the new technical editor. John Houde, with our thanks, is still going to be our Art Director even though he is setting down new roots in Washington State. As far as we know, his move will have little impact on *CACNews* and we hope it stays that way. We also hope that Mark Traughber will remain Webmaster.

The CAC itself is seeing new beginnings. Dan Gregonis from San Bernardino has begun his term as president. The Quality Assurance column begins anew with a rotation of authors, the first of whom is Kathy Wagner, Quality Assurance Manager from the San Diego Sheriff's Crime Laboratory. We will read the perspectives of a number of Quality Assurance Managers in the upcoming issues. As a result of Lou Maucieri's retirement, Tom Abercrombie is beginning as DOJ's new Quality Assurance Manager.

Unfortunately, we also see the beginnings of another crime laboratory scandal, this time in Oklahoma City. There are suggestions of evidence and program mismanagement as well as charges of distorted or outright incompetent or dishonest forensic casework and testimony. Thinking about the Oklahoma City case brought me to the question:

Whose Team Are We On?

In looking at the published report that was part of the *60 Minutes II* (check their website) televised program, there are several catch phrases that should make us think about this question: "Employee of the year." "She was on the police team…on the prosecution team." "A police honorary citation." "A commendation from the District Attorney for…skillful work and careful analysis."

Take a long look at these phrases. Do they sound familiar? In most jurisdictions, forensic laboratories are very intimately connected to some law enforcement agency. They are either part of a police department, sheriff's department, state bureau of investigation, DA's office, or federal law enforcement arm, such as the FBI.

In this intimate relationship, are we part of the investigation team? Are we part of the prosecution team? I think that most detectives think so, and I think that most DA's also think so. If you were to ask your fellow forensic scientists in the laboratory, you would probably get a mixed response. Some will say, yes, unavoidably we are part of the police/prosecution team. Others will claim independence. Is there a problem with being part of the team? The answer depends on what that means to the individual. We exist as a support function, ready to respond to a crime scene or rush case as needed. We need to draw lines, however, when the analysis requested doesn't make sense scientifically, and is being requested frivolously, or is solely to enable the DA to put on a flashy dog and pony show in the courtroom. There are times we're asked to examine evidence when there is *no potential* for the results, whether positive or negative, to truly bear on the guilt or innocence of the accused. We are asked to do those tests so the DA can launch an argument based on the results, regardless of how weak the basis. When we refuse requests of detectives and DA's, we are thought of as other than a "team player."

Everyone loves praise. Few, if any of us, feel that a sufficient amount of it comes our way. When a forensic scientist reaches for it, however, problems can arise. The weakest among us would be tempted to establish links that an unbiased eye wouldn't see. Do we ever become so wrapped up in the case that we start rooting for a conviction?

Whose team are we on anyway? It begins to get blurred sometimes because of all the hype and pressure, but the bottom line is: we had better be on the side of science and objectivity and not on the side of the detective or prosecutor who tend to be biased and focused on a conviction.

What if our results help the prosecution? What if we get a critical link that ties the suspect to the victim? If it is on a big case, here is what happens: Employee of the Year. Department citation. District Attorney commendation. We are all human, and the bestowing of praise does fulfill one of our most fundamental human needs. We get a rush. And we want to feel it again.

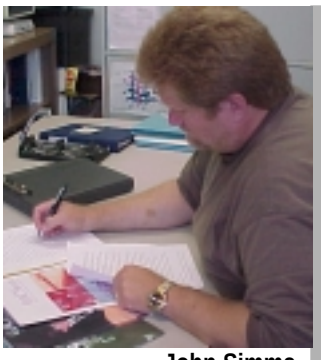
The DA's tend to praise our testimony more when we reach a little bit, when we speculate to some extent, for example, in a reconstruction of events at a crime scene. The testimony valued by the prosecutor may be testimony with no basis in science.

I am not advocating shunning the citations and commendations, but we need to keep our heads level. We must remember that our job is to interpret and give voice to evidence that exists, not to manufacture it in the name of the "team." I probably share the feeling with most of you that the vast majority of forensic scientists can remain unbiased.

We are on the side of science. It is not our job to convict. It is not our job to defend. It is our job to analyze the evidence and present our findings with the objectivity that we as scientists are so proud of claiming as a defining characteristic.

Final Note

I am indebted to my new technical editor and my boss for their assistance with this column. As I said earlier, writing this column is quite different from writing the QA column. I am only in the beginnings of understanding the scope of this new assignment.



John Simms
CAC Editorial Secretary

Anthony Longhetti

January 28, 1928 – June 11, 2001

Tony was a native of Pittsburg, CA, attending high school in Burlingame. He graduated from the UC-Berkeley with a B.A. in Technical Criminology in 1950. After military service at the US Army CID Laboratory at Ft. Gordon, GA (1950-1954) and a brief stint with the Minnesota Bureau of Criminal Apprehension Laboratory in Minneapolis(1954-1957), Tony returned to California to start the San Bernardino Co. Sheriff's Laboratory in 1957. Tony went from the Department's only criminalist to Deputy Chief in charge of the Scientific Investigations Division, from which position he retired in 1989. At the time of his retirement he was made a Life Member of the CAC and had earned an MPA at Cal State, San Bernardino. After periods filling in between other faculty members with the Criminalistics Program at CSULA, on 1989 Tony became the Criminalistics Program's then one-and-only fulltime faculty member and continued on the faculty until the time of his passing.

Tony became an Associate Member of the California Association of Criminalists in 1958, by which time he was already a Fellow of the Criminalistics Section of the American Academy of Forensic Sciences. By today's standards his election to membership in the CAC looks like a close thing – there were only 13 votes cast in his favor. Of course, I hasten to add there were only 13 members in attendance ! He was promoted to CAC Regular Member in 1959, served the AAFS Criminalistics Section as Secretary in 1961-1962 and Chairman in 1962-1963. Tony's first term as CAC President came in 1963-1964. Tony's contributions at CAC were not limited to helping operate the Association, but included papers and publications on questioned documents, identification of man-made fibers, and the gas chromatographic identification of gasolines.

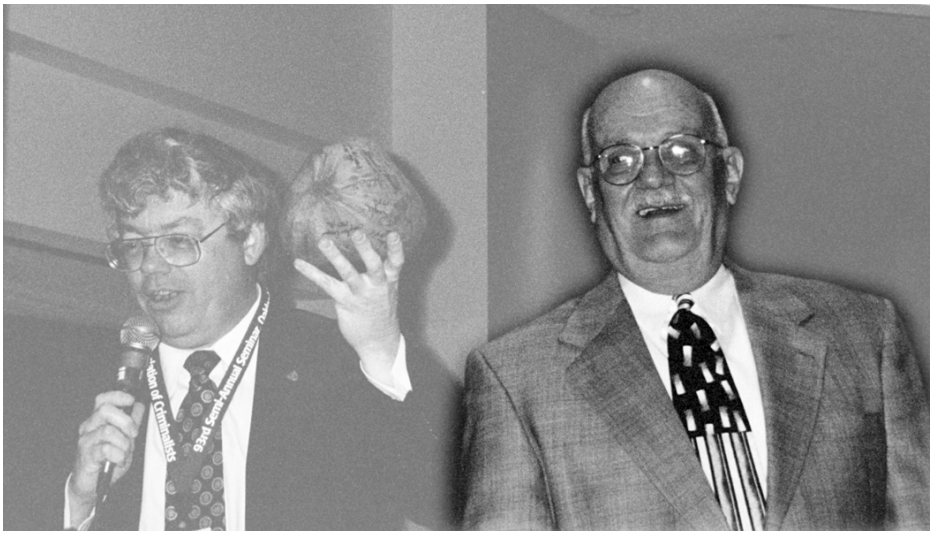
The lasting *physical* token of Tony's long involvement with CAC came as part of his second presidency in 1971-1972. Herman Meuron, a CAC member working in Hawaii, presented Tony with a coconut, complete with shiny outer husk, noting the striking resemblance of the husk to the glossy pate of then-President Longhetti. To this day, incoming CAC presidents are presented that same coconut on which to inscribe their signatures and the dates of their presidency.

Tony continued his involvement with AAFS by serving as Criminalistics Section representative on the Executive Committee from 1976 to 1979 and served as program chairman 1977-1978. By this time, Tony was also active in the American Society of Crime Laboratory Directors (ASCLD), serving as chairman of the Committee on Laboratory Evaluation, from which ASCLD/Laboratory Accreditation Board evolved. His long involvement with AAFS reached a pinnacle with his service as president in 1982-1983. His involvement with ASCLD/LAB has continued with current service on its Board of Directors and as trainer of virtually all its inspectors.

Tony's contributions to the profession have been recognized with the AAFS Criminalistics Section's Paul L. Kirk Award in 1989, AAFS Distinguished Fellow Award in 1993, and CAC's Distinguished Member Award in 1996.

He is survived by his wife of 50 years, Alma, children Terry and Tom, grandchildren Kandice, Michael, and Paul and to them we extend our most sincere condolences.

—Hiram Evans



ESSAY

Every Drop of You

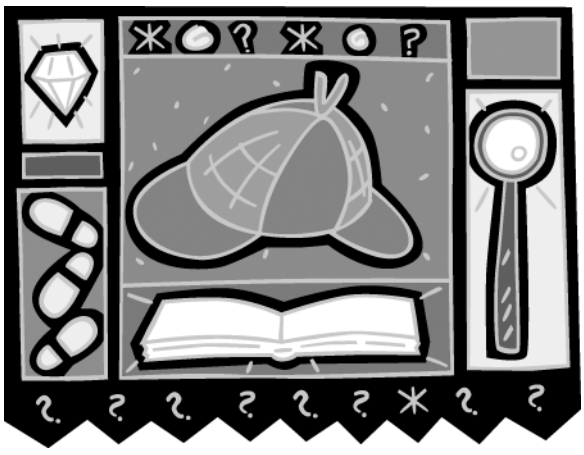
Englishman Eric Blair saw it coming fifty years ago, of course. Sure, the cops on the streets of LA and NYC may have more firepower, but it is here in Britain - land of the unarmed bobby on the beat — that the future of crime fighting is unfolding into the brave new world of the DNA Police. (1) Spearheaded by government legislation and supported by Mister DNA himself, Sir Alec Jeffreys, the British are only a hair's breadth from passing legislation that will require anyone taken into custody to donate their DNA to the National Databank. Unlike the American healthcare system, the British government believes prevention is the best cure for an undesirable condition. You never know when grandma may pick up an Uzi.

Police in Britain already have the right to take (by force if necessary) DNA samples from anyone taken into custody and **suspected** of violent crime, burglary or sexual offences. The British Parliament is currently contemplating new legislation that would be unthinkable by American or European standards. Known as the *Criminal and Justice Bill*, it is being pushed forward by a zealous Jack Straw, head of Britain's Home Office, the Government department responsible for criminal justice in England and Wales. If passed, the bill will permit DNA swabbing, without consent, of anyone who is ***suspected of any*** offence. Nick a pack of smokes? Open wide for a buccal swab. Your sixteen year old suspected of smoking pot? Welcome to the databank. Furthermore, unlike in California, once the police retain a person's genetic details, the sample will not be destroyed and remains property of the State even if the suspect turns out to be innocent.

Sir Alec Jeffreys is viewed by many scientists in Britain, including the director of the King's College Forensic Unit, as the modern day 'Father of Forensic Science'. Jeffreys, who received knighthood for his profiling work, has gone on record as saying DNA testing of the entire population may not be a bad idea. "When this idea was first put forward about ten years ago, I had considerable concerns over civil liberties issues," offers Jeffreys. "On reflection, I'm now actually in favor (of mandatory DNA profiling). The technology is there to make a DNA database for everyone of the UK's 60 million citizens," Jeffreys said recently. (2)

Astonishingly, my British classmates on the King's forensic course voice no objection to this proposal. Like the rest of the UK, they steadfastly maintain a sleepwalking mentality as their government rumbles onward, without fanfare or protest, with the new crime-fighting plan. As the Home Office likes to point out, if you are an innocent, law–abiding person, why should you worry about having your DNA profile scanned on a nightly trawl for criminals? (3) What is not being said about the lumping together of innocent people and criminals is that deep down the British government believes that DNA profiling can be an effective deterrent to crime. And besides, aren't people who have a brush with the law more likely to become future criminals? In the US, the people are suspicious of the government; in the UK, the government is wary of the people.

Big Brother may be just a paranoid delusion, but there are still a lot of Little Brothers squirreling away useful information about British lives.



Ironically, the English choose to ignore their fellow Brit, Eric Blair, (who preferred the pen name George Orwell), or they would smell a rat whenever they pick up a British newspaper and read what's going on. Big Brother may be just a paranoid delusion, but there are still a lot of Little Brothers squirreling away useful information about British lives. For example, the UK is already the surveillance capital of the world. Her Majesty's subjects are being filmed on the average of three hundred times a day (4) as they go about their daily business on the streets and buildings of London. Cameras are stashed out of sight everywhere in this capital city. These are not those fuzzy, jumpy-frame, convenience store videos either. Rather, they are hi-tech digital images whose quality is good enough to be routinely accepted as evidence in court. Teams of humans monitor the cameras 24 hours a day, waiting for crime to happen. Also being considered is the incorporation of live microphones that are capable of picking up conversations to augment the visual images being recorded.

Laws Americans take for granted can change quickly over here without anyone noticing. For instance, earlier this year the Brit-

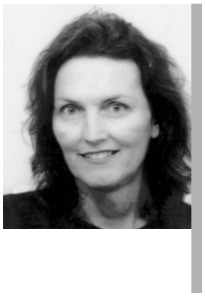
ish ended the historic ban against a person being tried twice for the same crime, the so-called 'double jeopardy' law. This information came to my attention while riding the tube one morning—a small blurb buried on page eight of the daily fish wrap. The British government now allows suspected murderers who have been found not guilty to face a second trial if it is felt that 'justice has not been served.'

Some people feel a bigger concern is what happens to the stored saliva samples. Although the 10 loci DNA profiles (the Forensic Science Service uses SGM+) are of themselves non-coding 'genetic junk', so then, what happens to the cotton swabs that contain a person's entire genetic blueprint? They are currently stored in giant underground freezers outside of Birmingham — the largest collection of human DNA anywhere in the world. It is a collection that is silently growing larger to the tune of 3000 new samples everyday and its enormity does not go unnoticed. For instance, the British insurance industry is drooling at the mouth for access to the swabs in order, some say, to evaluate the future health of their clients. When considering the fact that since 1991 the Forensic Science Service has been run as a capitalistic entity, the British concept of "value for money" may one day include the selling of genetic profiles. Publicly, the FSS denies any possibility of this ever happening, but private insurance companies, in an attempt to pacify fears, have gone on record as saying they will not access any genetic information for "at least the next two years."

As forensic scientists, we should be aware of the impact made on our profession whenever a government agency shapes the way we do our jobs. As ordinary people, we need to openly discuss what it means to have the government keeping tabs on our DNA. Sure, it may never happen in America, but in Britain gross public indifference combined with the creeping erosion of small freedoms and rights of privacy is silently generating a New World with Orwellian overtones. And the DNA juggernaut is leading the way.

References:
(1) Concar, D. *New Scientist,* May 5, 2001 p10.
(2) Fisher, D. *The Metro Newspaper,* February 19, 2001 p2.
(3) Ibid (1) p11.
(4) Clark, J and Gadher, D. *The Sunday Times,* March 11, 2001 p10.

Dianne Burns is currently on a lab placement at the Edinburgh Police Forensic Crime Laboratory in Scotland, as part of her MSc program with King's College of London. If anyone wishes to contact her about either the King's or Strath-clyde forensic programs, she can be reached at:
diane.burns@kcl.ac.uk



Things that go boom in the night.

On March 8th Phil Teramoto arranged for thirty-three interested CAC members and others to tour Pyro Spectaculars of Rialto. The company's fireworks displays could be seen during the recent Superbowl halftime show as well as during the 1996 Olympics. The tour was lead by Les Joslin, described as the "Pyrotechnic Personnel and Systems Manager."

Those in attendance were treated to a video presentation describing the labor intensive steps that go into making the airborne shells. Most of the larger ones are manufactured overseas and then imported by Pyro Spectaculars from Italy, China and Spain. Some of the smaller shells and all of the custom "set pieces" are made locally by Pyro. Those set pieces include fiery words and logos that can easily measure a dozen or more feet across.

Of particular interest to investigators was the placement of a small state fire marshal's sticker on all of the devices manufactured or sold through Pyro. Some of the large class "C" fireworks, called "cakes," consist of a cluster of cardboard tubes that fire a rapid sequence of aerial flaming balls. They are frequently seized by local fire departments during the July 4th season. When these are imported legally from other states they have the fire marshal's sticker. It was pointed out that if a device with such a sticker is seized, an identification number on the sticker will reveal the importing company. If the sticker (*far right*) is absent, then it was probably brought into California illegally.

Joslin, a retired military man, described how banks of roman candles and batteries of mortars are synchronized to music and program material, and ignited either by computer or manually. "This isn't rocket science" he says, noting that many of the chemical formulations include rice husks and other inorganic material. These are added at the factory to give incendiary chemicals a starting place to form a combustible ball about the size of a pea. The way in which these chemicals are mixed and arranged in the shell gives an almost infinite variety in the ultimate design and appearance of the explosion.

Pyro Spectaculars maintains an inventory of shells and other devices in a series of bunkers. They employ up to 500 licensed operators at the height of their operation. At the time of the tour, they were already beginning to get ready for July 4th. "We do about 2000 shows a year," Joslin said.

—John Houde

Both pages, Calico Press

Quality Assured

I'm sitting here reminiscing about my early days in QA while a few doors down we are having a pre-inspection to get us ready for the real thing, at last, *at last*. What a road it's been! I remember being a brand-new QA manager and I laugh at the things I worried about back then (Times New Roman, 12 point font?) and the decisions I made (Gosh, I'm sure three binders will be plenty…). I eagerly opened the package containing my brand new, midnight blue ASCLD/LAB manual and was relieved to find it only had 137 criteria. How hard could THAT be? I was just sure that with everyone *eagerly* pitching in to help, we'd do a couple of those puppies each day and we'd be getting inspected within a year. Pretty funny, huh? Fast forward: today it's three years and dozens of binders later, and yes, we're still dragging a few behind the bandwagon but all in all we're doing well. And I'm still sane! The orderlies tell me so every morning.

What did I find most helpful along the way? I'm glad you asked.

The first time I couldn't quite see the answer to a thorny problem, I asked my supervisor for advice. "Call some other labs," he suggested. "Find out what they do in this situation." Excellent idea really, but at the end of a frustrating afternoon of phone-tag I had reached only half of the people on my list. Of the three I did reach, none agreed with the other two. Argh. Now what?

A few weeks later, I heard the excellent news that a CAC QA Study Group was forming, to be chaired by John Simms (thanks, John!). I made an embarrassingly huge list of questions and off I went. The group was incredibly helpful and it was a great relief to know I wasn't the only one struggling to swim upstream in the accreditation waterfall. But the group only met every other month. An idea began to form in my head…what if we could all be connected by e-mail? I had recently been introduced to the concept of e-mail discussion lists and wondered if it might work. Could we really get answers the same day a problem arose? It would certainly be awesome if it worked.

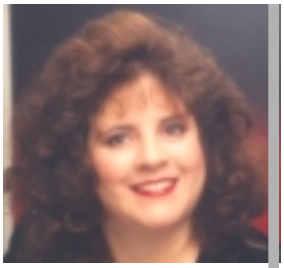
At the next QA study group meeting I discovered that most of the dozen study group members had e-mail and the rest planned to get it soon. They were willing to try it, and ForensicQA@onelist.com (now @yahoogroups) was born in March of 1998. I had heard complaints about other forensic lists and was determined to prevent as many problems as I could. The list was kept private and unlisted. We added a disclaimer at the bottom of each post. We fended off non-QA people or people who wanted to subscribe because "it might be interesting." We limited it to one person per lab, with the occasional rare exception; the last thing I wanted was for one of the list members to be scolded by a co-worker:

"YOU TOLD THE WHOLE WORLD ABOUT OUR ____!?!?"

Other QA managers started hearing about the list and asking to join. It was brought up at classes, meetings and seminars. Soon I was fielding requests to join from all over the country, plus Puerto Rico. Today our membership is over 70 members strong. When someone posts a problem or a question, he or she will start seeing replies and advice within minutes. Ya gotta love that.

As our lab starts down the final stretch of the accreditation road, I see that some of my most valuable tools were 1) a sense of humor, 2) a small committee made up of some brave laboratory colleagues, 3) the QA study group and 4) the Forensic QA discussion list. My apologies to Hillary Clinton for stealing her line, but it *does* take a village, or in our case, a village PLUS a nearby e-village to get a laboratory accredited. And a whole, uh….*truckload* of binders.

An idea began to form in my head…what if we could all be connected by e-mail? I had recently been introduced to the concept of e-mail discussion lists and wondered if it might work.



Kathy Wagner

Granlibakken 2001 • Lake Tahoe

Story by Victor Reeve/CCI, photos by John Houde/Calico Press, LLC

The 97th CAC meeting held from May 7 through May 12, was blessed with a gorgeous setting and wonderful sunny weather. All nine of the workshops and twenty-five General Session presentations were flawless in timing and delivery. The food was superb, as were the evening happy hours, entertainment, and CAC hospitality suites.

Special thanks is extended to all workshop presenters, including Ed Jones for his marathon three-day *Microscopy of Rape* workshop; and Rory Doyle, James Hamiel, and Lara Walker for the one-day *GHB and Related Compounds* workshop presented at CCI in Sacramento. Charlene Marie, ably assisted by Dawn Sorenson, conducted the one-day *Fluorescein* workshop. Roger Clark of ExecuTrain also provided an *Adobe Photo Shop* workshop commencing on Monday at Granlibakken. This *Adobe Photo Shop* workshop continued into Tuesday. *The Donner Party Archaeology* workshop convened at the Granlibakken Conference Center and concluded at the Donner Museum in Truckee. Professor Donald Hardesty, Professor P. Willey, and Mike Giusto enchanted all in attendance with information about this harrowing incident. Wednesday, the last day of workshops, brought the packed *DNA* workshop to Granlibakken. Terry Spear, Neda Khoshkebari, and David Stockdale shepherded fifteen papers delivered by sixteen presenters to completion. Meanwhile, a panel consisting of Carrie Whitcomb, Robert Bianchi, Erin Kenneally, and Michael Weil delivered the topic entitled *New World of Digital Evidence at Crime Scenes: How to set up a computer forensics program*, Ray Davis entertained his attendees with a half-day workshop entitled *The Invincible Witness – 10 Winning Strategies* and in the afternoon delivered another half-day workshop entitled *Interviewing and Promotional Skills.*

As Ray's presentation was winding down, the Pavilion area opened with seventeen vendor booths. The CAC Board meeting began and Wednesday's pre-dinner activities concluded with a hosted happy hour.

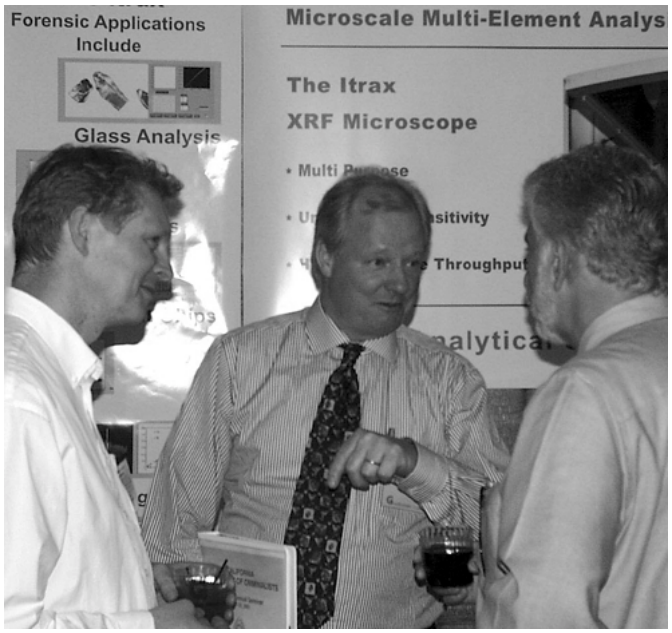
Thursday began with Steve Staveley's inspirational address in the General Session. The Director of the Division of Law Enforcement spoke of a brighter future for Criminalistics and training. His keynote adventure outlined future developments for the California Criminalistics Institute and laid the foundation for Jan Bashinski's presentation *The Attorney General's Task Force on Forensic Services an Update.* After vendor introductions, Carrie Whitcomb and Michael Weil delivered an *Overview of Digital Evidence.* Carrie continued with an informational presentation about the National Center for Forensic Science. After lunch, Jan Bashinski presented *The California Cold Hit Program: "Solving Sex Crimes with DNA."* Kerstin Gleim offered *Conceptual Tools for Making Casework Decisions*, and Virginia Sanchez outlined the *CCI Forensic Library and Sherlock Database Access: A Closer Look*. Kerstin Gleim took another opportunity and presented her second paper: *Effects of Dry Cleaning on Semen Deposits*. Nancy McCombs presented *38 vs. 357: An Examination of the Bases of Lead Bullets,* and Erik Randich provided a new viewpoint with *An Improved Method for Imaging and Comparing Deep Ballistics Marks Using the Scanning Election Microscope*. Erik followed this with a second presentation – *A Metallurgical Review of Bullet Lead Compositional Analysis.* The Thursday evening included

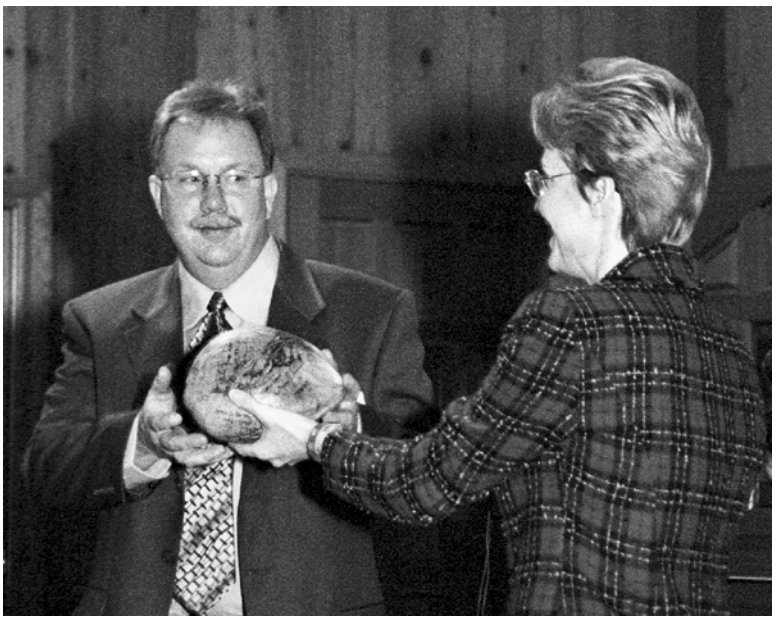
the hosted Happy Hour, the meeting banquet, and concluded with the entertainment *The Ghost of Mark Twain Dispensing Wit and Wisdom* by McAvoy Layne.

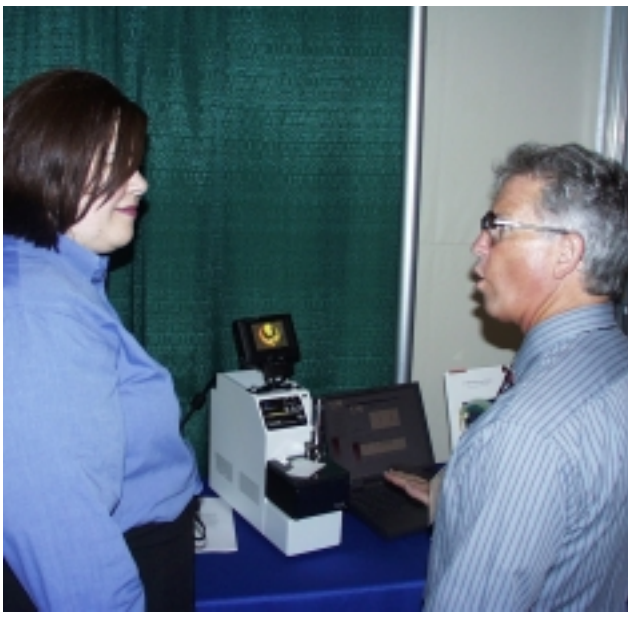
Friday commenced with Jennifer Mihalovich's presentation *Typing DNA Recovered from Steering Wheels: Detecting Evidence of Non-Habitual Driver* followed by Ray Davis offering *The Guerilla Witness.* Nicolas Leonard and Joseph Merydith enlightened with *The World of Questioned Documents.* Mark Kalchik gave us *The CALMS Signature Project.* Marla Richardson presented *CALMS: Methamphetamine Quantitation and Signature Profiling.* Matt Vona sparked major interest with *The CALMS Project and Neural Networks.* Robert Reckers presented *Major Breakthrough in Breath Alcohol Testing Technology.* Lance Silverman offered *Comparison of Gaseous Ethanol "Dry Gas" Standards with Wet Gas Simulators of Breath Analyses and their Use with EPAS Programs.* Katina Repp presented *Taking That First Breath: Reflections on Implementing a New Forensic Breath Alcohol Program.* Joshua Mateo followed with *The Incidence and Persistence of Carry-Over in the Alcosensor IV* and Steve Scott and Michelle Salata concluded the session with *Evidential Portable Alcohol System (EPAS) Overview.* The CAC Business meeting commenced and the New Members Welcome was an introduction to the hosted Happy Hour and dinner.

Saturday brought a smaller yet energetic group together for Glen Davis' presentation *"GSR Mapping": The Study of Gunshot Residue Distribution of Known Firearms in a Closed Environment.* Tara Fruchtenicht stepped up to the plate with *Discrimination Value of Wear Patterns in Two-Dimensional Footwear Impressions* (A. Reed and Virginia McLaughlin Funded Study) and Gloria Louise Nusse wrapped it up with *Facial Identification and Facial Reconstruction.*

After lunch the remaining few wrote their ABC Certification examinations and the first CAC Seminar of the 21st Century concluded.





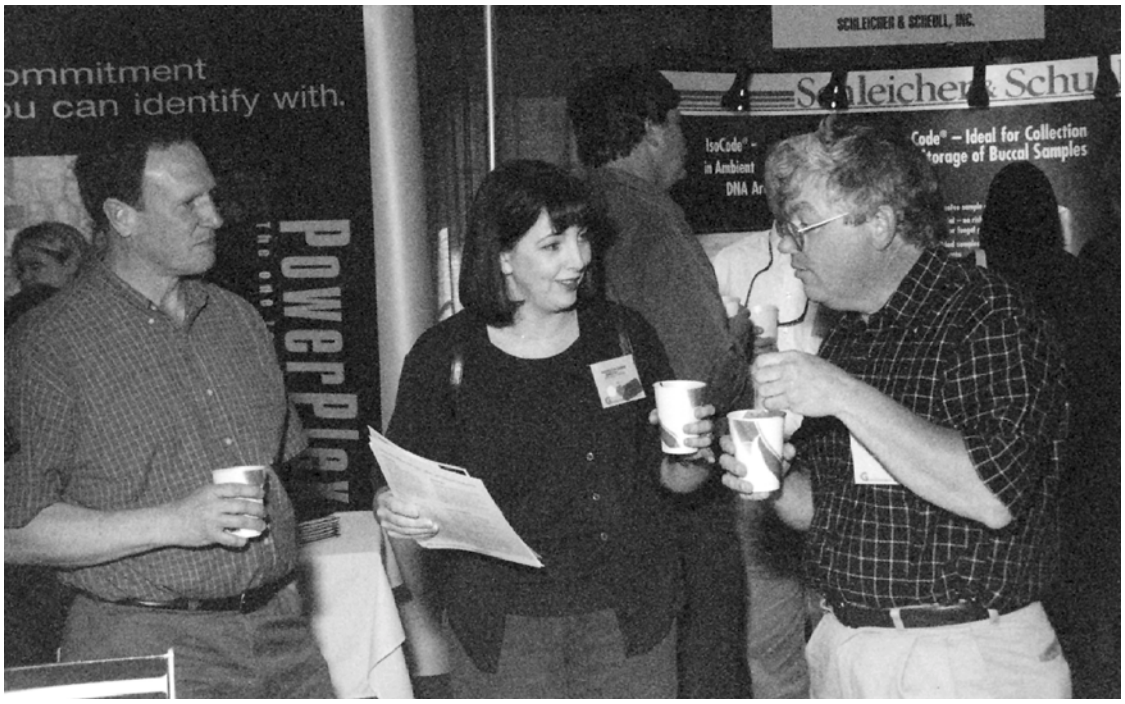


Both pages, Calico Press

Luck played a part in this extravaganza, but most of all the success of the 97th Seminar was due to the hard work of all those listed on the page margin, the input from previous meeting hosts, and a certain amount of risk-taking. We decided to hold the meeting at a site remote to the hosting parties – the DOJ Sacramento Regional Laboratory and the California Criminalistics Institute. The meeting was delivered at 6,500 feet above sea level in the vicinity of Tahoe City, a two-hour drive away over the Sierra mountains, and not far from where the ill-fated Donner Party wintered near Truckee.

Granlibakken Resort and Conference Center draws its power from the Nevada State power grid and can generate electricity on-site. Consequently, this seminar did not have to deal with blackouts. All participants were able to get to the site without mishap and the meeting had approximately 130 attendees originating from Arizona, California, Florida, Maryland, Nevada, New Mexico, Virginia, Washington State, and Washington, D.C.

Seminar Chairperson *CCI, Sacramento* Victor Reeve; Workshop Coordinator *CCI, Sacramento,* Fred Tulleners, Terry Spear, Neda Khoshkebari; Budget Coordinator *DOJ – Sac. Lab,* Eva Steinberger; Registration Coordinator *DOJ – Sac. Lab,* Tanya Vermeulen; Hospitality Coordinator *DOJ – Sac. Lab,* Caroline Garcia Duncan; Exhibitor Coordinator *CCI, Sacramento,* Jim Weigand; Audiovisual Coordinator *DOJ – Sac. Lab,* David Koenitzer; Sponsor Coordinator *DOJ – Sac. Lab,* Terry Fickies; Technical Program Coordinator *CCI, Sacramento,* Jerry Massetti, Mike Guisto.



Recent Advances in Scientific Service to Law Enforcement

By Lowell W. Bradford

**Director, Laboratory of Criminalistics, Office of the District Attorney, Santa Clara County San Jose, California.*

This subject affords an opportunity for considering past events, historical trends, personalities, tributes, special contributions, areas which need further progress, educational trends, evolution of criminalistics and the eventual outcome of scientific application to police work.

Beginning signs of application of science to enforcement problems began to stir after 1900, like the first cry of a newborn infant, and a real revolution occurred in the 1920's when this infant became of age.

FINGERPRINTS as identification have been traced to ancient Babylonian clay plates, but it remained for Sir Francis Galton and Sir Edward Richard Henry to perfect a system useful to the police. The Galton - Henry System was first introduced in India and in 1901 was adopted by Scotland Yard.

FIREARMS IDENTIFICATION interests were also beginning to stir. Publications concerning this subject made their first appearance around the turn of the century. Developments were led by personnel of the U. S Army Ordnance Department, initially by Col. Calvin S. Goddard (passed away a few months ago after an active career in firearms identification) and followed closely by Major General Julian S. Hatcher who, at the time, was a junior officer. Firearms identification developed into full blossom in the 1920's and culminated in 1935 with Julian Hatcher's book "Firearms Investigation, Identification and Evidence."

BERKELEY DEVELOPMENTS: In these years after the turn of the century, some notable "firsts" were taking place in Berkeley:

First Police Bicycle Patrol in the U.S.A. —1905
First Police Motorcycle Patrol in the U.S.A. —1909
First Police Automotive Patrol in the U.S.A. —1913
First Use of Scientific Crime Detection in the U.S.A. —1915

The impetus for these developments came from one of the greatest police leaders of all time: Chief August Vollmer of the Berkeley Police Department. This individual, imaginative, a man of action and executive ability, showed the world how business, engineering and scientific principles could be applied to police problems. The lie detector or "polygraph" as it is known began to be developed in 1921 under his guidance and sponsorship. He later went on to help reorganize many large police departments in this country along modern lines. He has given his ideas and sponsorship to many organizations and projects aimed at the solution of criminal problems. He has been behind all of the advances in police education in California and has been a consultant to many other areas. There is a great tribute owed to *August Vollmer* in respect to his role in the advancement of police techniques.

His presence in Berkeley gave rise to a curriculum in criminology at the University of California. This is today the only *university* in the world offering a curriculum in criminology at the graduate level and a program in *criminalistics* for the undergraduate. It likewise is the only fountainhead of new methods and data in criminalistics

In recognition of the application of scientific principles to police administration, he was awarded the Academy of Science "Public Welfare Medal" in 1934.

NATIONAL SCENE: Of basic importance and interest to identification people was a move by the International Chiefs of Police in October of 1897 when the National Police Bureau of Identification for the maintenance of fingerprint records was established. This bureau was moved to Washington in May, 1902. During a twenty-year period the IACP actively pressed for legislation to create a government sponsored identification bureau. They were successful and in 1924 the Federal Bureau of Investigation took over the job of operating the national fingerprint bureau. Meanwhile, in California, the state division of Criminal Identification and Investigation was created by a legislative act. The role played by the IACP on the national scene was played here in California by the "International Association for Identification." This California state group helped bring about these services of identification on a state level on January 1, 1918. On the national scene, J. Edgar Hoover is a noteworthy individual. Serving as assistant director of the F.B.I. from 1921 to 1924 and as director from 1924 to 1955 he has turned what was originally an inconsequential body into the largest, well-trained, closely coordinated group of its kind in the world. The F.B.I, has been quick to make use of new scientific developments and to offer complete identification service to any law enforcement agency requesting it.

THE EDUCATIONAL SCENE: The idea of professional training in the police field stemmed from August Vollmer as a result of his attempts at modernizing police administration. It is not surprising therefore that the University of California was the first school to offer courses in police work and, until the present time, is the only institution of its kind to offer an advanced degree in criminology. Since the early beginnings in Berkeley, a number of two-year pre-service training schools in police work have sprung up at the junior college or state college level. Likewise in-service training is administered through various state and federal programs. The number of schools offering four-year curricula built around a core of courses designed to provide an educational foundation for the police major is very limited. San Jose State College is the outstanding leader in the four-year vocational program and the University of California conducts the only four-year program in criminalistics in the world, besides maintaining the only graduate school in criminology. In a survey conducted by the Society for Advancement of Criminology it was determined that 22 colleges have one or two courses in criminology and over ten have a core of courses making up a police curriculum. Of these ten two-year or four-year programs, seven are in California. It is interesting to note that almost all of the college level program were started by or are now directed by one of Vollmer's students, associates or proteges or someone who was trained by one of this following.

BOOKS: The buildup of courses of instruction brought forth a sudden requirement for textbooks and manuals describing standard police techniques in regard to the arts and crafts of basic investigation principles as well as the more scientific aspects such as the postmortem examination, forensic psychiatry, and the phases of criminalistics. Some of these works are

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**Presented Before the 39th Annual Conference, California State Division, of the International Association for Identification, May 25, 1955, at Santa Barbara, California, as the Opening Address.*

This article is reprinted as it was submitted.

classic, and are the only media by which so many students of law enforcement could possibly gain the special bits of knowledge which have been developed and put together by so few professionals and scholars. Of these books in the police field which have either or both characteristics of breaking new ground and being peerless in their approach to the particular problem, the following come to mind as milestones:

Le Moyne Snyder on "Homicide Investigation" (1944)

Julian Hatcher on "Firearms Investigation, Identification and Evidence" (1935)

Albert S. Osborn on "Questioned Documents"

Soderman & O'Connell on "Modern Criminal Investigation"

O'Hara & Osterburg on "An Introduction to Criminalistics"

Paul L. Kirk on "Crime Investigation"

PUBLISHERS: In connection with publishers, the Charles Thomas Book Company should be mentioned. Mr. Thomas has an abiding interest in law enforcement and is constantly creating opportunities for authors on police subjects to disseminate their special experiences and information to law enforcement at large. The only professional type journal which offers a medium of exchange of new information in scholarly thinking in criminology and in new developments in criminalistics is the "*Journal of Criminal Law, Criminology and Police Science*," published by the Williams and Wilkins Company.

CRIME DETECTION LABORATORIES: It is interesting to note the first use of a scientist in this country in crime detection was Dr. Albert Schneider, employed by August Vollmer in 1915 and that the first regularly constituted criminalistics laboratory to be established in the United States was created in 1923 by August Vollmer when he was called as a consultant to the Los Angeles Police Department. This first laboratory was closely followed by the inauguration of the Chicago Crime Detection Laboratory at Northwestern University, the New York Police Department, the F.B.I and the California State Department of Justice, Division of C.I.&I.

Ray Pinker as technical director of the Los Angeles Police Department laboratory has served longer than any other criminalist in California in the practice of general criminalistics. Roger Greene of the C.I.&I. laboratory is next in order of service. These men are to be commended for the way in which they have contributed to the profession of criminalistics which they were helping to develop in those early embryonic years. Devoid of guidance or contact from any centers of criminalistic progress except their own, they maintained exceptional standards of ethical conduct and have both brought forth two of the most outstanding criminalistics laboratories in the western part of the United States.

CRIMINALISTICS: All of these scientific and educational developments in the first quarter of the century have provided the ingredients which have brought forth a relatively new profession, "CRIMINALISTICS." The criminalistics laboratory has a single well-defined mission. It provides the law enforcement officer with every possible scientific service which may be available in respect to the *analysis, evaluation*, and *interpretation* of physical evidence. In this connection the criminalistics laboratory makes use of the following principles:

1. Testing by classical methods
2. Departmental work when no classical methods available
3. Consults other scientific resources when the problem at hand exceeds the scope of laboratory facilities or training
4. Constantly interchanges information and developments with other laboratories in the quest for better techniques

The general practice of criminalistics includes a number of specialties which are as follows:

1. Chemical toxicology—tests for poisons, drugs, narcotics on autopsy specimens, pills and capsules
2. Firearms identification (sometimes miscalled "ballistics")
3. Comparative microscopy
4. Serological testing (blood tests)
5. General chemistry
6. General microcopy
7. Spectrochemical analyses (spectrograph - spectrophotometer)
8. Questioned document examination
9. Technical photography:
   a. Photomicroscopy - bullet comparison
   b. Footprint over lay
   c. Photo matches on tool marks
10. X-ray diffraction
11. Specialized aspects of fingerprint work - poroscopy

PROFESSION: The word "profession" has been mentioned in connection with criminalistics. It is interesting here to speculate on the concept of the word "profession." The best definition of "profession" that comes to mind is that given by Vannevar Bush, a great contemporary chemist and former president of the American Chemical Society; these are his words:

"The hallmark of a profession is that its members minister to the people. It is out of the concept of ministry—of the assuming of responsibility for the vital affairs of others because of *superior* (large in amount) specialized knowledge that there have grown the idealism of the professional man and the recognition in him by others of a quality of altruism which is its own reward. Upon this recognition by the people is based the continuance of a profession, for it exists only as the people, because of confidence in its integrity and faith in its general beneficence, permit it to maintain its own prerogatives and to speak with authority in its own field."

It is the formation of this *profession* of *criminalistics*, which I believe is the most recent advance in scientific service in law enforcement. There are at least sixteen persons at the present time trained and engaged in the general practice of criminalistics in California, plus an unknown number of technicians practicing in the various special phases. It may be of interest to this group assembled here to show some evidence that this is truly a profession in the sense described by Vannevar Bush. In this regard, those who are now engaged in the general practice of criminalistics have formed what is known as the California Association of Criminalists. The aims of this common bond are self evident from the preamble of the constitution of the C.A.C.:

PURPOSES OF THE C.A.C. ARE TO:

1. Foster an exchange of ideas and information within the field of criminalistics
2. Foster friendship and cooperation among the various laboratory personnel
3. Stimulate research and the development of new techniques within the field
4. Encourage financial support for worthy research projects
5. Encourage the compilation of statistical data of value in the field
6. Promote wider recognition of the science of criminalistics as an important phase of jurisprudence
7. Maintain a high level of professional competence among criminalists in the state

8. Encourage standard qualifications and requirements for criminalists and other related specialists

9. Disseminate information to the legal profession concerning minimum qualifications for physical evidence consultants

10. Provide a board of arbitration or review in certain cases involving differences of technical opinions when indicated

11. Encourage the use of improved testing procedures and methods of presentation of conclusions

12. When appropriate to review and act upon any pending legislation which appears to be related to the field of criminalistics.

13. Encourage the recognition of this Association and its purposes among other appropriate groups and societies

14. Lend assistance, whenever possible, in the formation of college curricula and law enforcement training programs

15. Establish a code of ethics for criminalists

The Association meets twice annually in seminar type sessions for the purpose of discussing new technical developments, controversial problems, and methods of implementing the purpose of the organization. The code of ethics is of the utmost significance in the guidance of professional conduct. The C.A.C. is shooting for a high standard as evidenced by this first paragraph in the draft now being considered by the Association:

"THE SCIENTIFIC ANALYSIS OF PHYSICAL EVIDENCE SPECIMENS":

1. A truly scientific spirit is by nature inquiring, progressive, logical, and unbiased. The principles of scientific method could be no better expressed than to repeat here "The Four Precepts" of Renee Descartes, philosopher and mathematician of the Fifteenth Century:

"The first, was never to accept anything as true when I did not recognize it clearly to be so—that is to say, carefully to avoid precipitation and prejudice, but to include in my opinions nothing beyond that which should present itself so clearly and distinctly to my mind that I might have no occasion to doubt it.

"The second, was to divide up the difficulties which I should examine into as many parts as possible, and as should be required for their better solution.

"The third, was to conduct my thoughts in order, by beginning with the simplest objects and those most easy to know, so as to mount little by little, by stages, to the most complex knowledge, even supposing an order among things which did not naturally stand in an order of antecedent and consequent.

"And the last, was to make everywhere enumerations so complete, and surveys so wide, that I should be sure of omitting nothing."

All for the purpose of ensuring a uniform and high standard of ethical and moral conduct in the practice of criminalistics. In closing, I wish to point out that all of the beneficial major trends in scientific service to law enforcement have come from the conference principle. The IACP caused the formation of the National Federal Bureau of Investigation. The I.A.I. helped to cause the formation of the State Division of Criminal Identification and Investigation. The gathering together of scientific personnel caused the formation of the California Association of Criminalists. All of these meetings of craftsmen and professionals have brought forth a dissemination and exchange of ideas, the total of which has brought many local successes plus the overall march of progress.

It has been said that the easiest way that a scientific worker can fall into inefficient habits and may cause an atmosphere for errors is for him to practice "ISOLATIONISM."

MEMBERS OF THIS CONFERENCE, do not miss the opportunities of this conference get-together to quiz your neighbor, make new acquaintances and to find out new things. The opportunities for new knowledge are as great at the banquet table and social room as they are at the scheduled program. Put yourself out to talk shop with your new acquaintances, they will like it as much as you will. If each person here can take home one new idea and execute it to the betterment of his own operational activity, your presence here will have been justified and the purpose of the conference will have been carried out. On this note, permit me one closing quote—I read from the proceedings of the 20th annual convention of the International Association for Identification at Long Beach in 1934—the forward to the printed proceedings—by the editor, J. Clark Sellers:

"If education can be described as the assembling, correlating, assimilating and adopting to one's own use the experience of others, then the convention has the distinction of being truly educative."

I hope that the same remark can apply to this conference.

EDITOR'S NOTE ABOUT THE AUTHOR. Mr. Bradford in 1948 organized the Laboratory of Criminalistics in Santa Clara County and has been the director since that time. In addition to rendering official criminalistic services to the law enforcement agencies in that county, he acts as a consultant for law enforcement chiefs of many other areas and is a consultant to many law firms in connection with physical evidence of a civil nature. He teaches physical evidence in the police school at San Jose State College. He is a charter member and first executive secretary of the California Association of Criminalists.

F E E D B A C K

The *CACNews* prints letters to the editor that are of interest to its readers. We reserve the right to edit letters for brevity and clarity. All submissions to this page become the property of the *CACNews*.

Sorry, wrong number

Editor,

Please accept my deepest apologies for giving credit to the wrong Arase for all the great work done by Jean Arase on the fire investigation workshop and cubicles back in 1996 in my paper published in the latest issue of the Cockneys (*CACNews,* 2nd Quarter). I was amazed that my "fun" video paper at the May seminar was selected as the best paper. That meant getting it published (something that is really hard to do when most of the material was in video format!) In the rush to get it out the door before I lost the momentum (again), I did not double-check the participant list from the seminar. By the time I got the video capture sorted out and wrote up the text, I couldn't read my notes from 1996 (a time of extreme stress for me) and I misread "J. Arase" on the participant list as "Jerry."

John DeHaan

Contemplation on a Platter

by Morris Grodsky

I'm clearing the dishwasher. I reach for a plate. I grab it and lift it. To my surprise, I come up with half of a plate. Heat expansion, internal stress, aided perhaps by a sharp rap from another item had caused the plate to fracture. It had appeared to be intact, integral, whole. Of course, at that moment my mind, as would that of any criminalist, turned to thoughts of identification and individuality, of testimony and proof.

What a perfect seamless fit, I thought. Would an expert be required to testify that the two parts of the plate were once a single, intact unit? What if half of the plate appeared at the crime scene and the other half turned up in the vehicle of the suspect? If the prosecutor decided that this was indeed a key item of evidence, what procedures, what testimony would be required for the courtroom presentation?

Certainly we could establish and demonstrate that the fracture edge of one fragment fit perfectly with the fracture edge of the other; an excellent so-called jigsaw puzzle fit. In addition, there is a flowery decoration or picture on the plate. We could show that there is a perfect continuity of color and pattern from one fragment to the other, that when we put the two halves together, the pattern is complete. If this were a unique, hand painted design, perhaps it would have even more significance than a design which was applied with some sort of decal, stencil, or repetitive mechanical process.

If we look closely at the fracture surfaces themselves, we will note that they are not perfectly smooth. They are not featureless plains, but rather a microscopic topography with hills, valleys, peaks, and craters. If we were to examine them very closely, we would discover that for every projection on one fracture surface, there is an indentation on the other surface, for every convexity, a corresponding concavity.

In the photo above, the two parts are in juxtaposition and have been enlarged. Note the irregularity of the surfaces and be aware that the irregularities of part A coincide perfectly with the irregularities of part B.

The visual sense tells us that these two parts were originally joined together. Our tactile sense also tell us that they were united. When the fracture edges are carefully joined, there comes a moment when the two parts "**lock**" together. What occurs is a meshing together of the microtopographical features resulting in the unmistakable sensation of true joining.

But this is such a subjective proof. The most unlettered lay person would arrive at the same conclusion as the most sophisticated forensic scientist. And while the layman's conclusion would be an intuitive one which he might not be able to articulate in elegant or scientific terminology, it would be the result of essentially the same process used by the criminalist.

Lawyers in a court of law, whether representing the prosecution or the defense, are prone to pose questions to the expert. They love to ask about probabilities, the prosecutor thinking to add to the weight of the evidence, the defender attempting to open the gates of uncertainty. Questions which the expert might have to answer are:

What scientific procedures did you follow to lead you to this conclusion of individuality?

Can you cite for me any studies carried out with broken dishes which support your conclusions?

Can you tell me what is the mathematical probability that the two fragments would fit together with such precision?

Within the context of the Daubert decision, could you defend the procedures used to arrive at your conclusion?

What are your thoughts on the subject?

mgrodsky@thebest.net

Part A

Part B

Black Powder Substitutes: Their Physical and Chemical Properties and Performance

by Lucien C. Haag

Key Words: black powder, Pyrodex, Golden Powder, Black Canyon Powder, Arco Powder, Black Mag Powder, Clean Shot Powder, Clear Shot Powder, dicyandiamide, 1-cyanoguanidine, ascorbic acid, sodium benzoate, potassium nitrate, potassium perchlorate, sulfur

Abstract

Federal and local restrictions on the transport and storage of traditional black gunpowder have resulted in the development of a number of black powder substitutes for use in antique and replica firearms. These black powder substitutes are Pyrodex, Golden Powder, Black Canyon Powder, Arco-Black Mag Powder, Clean Shot Powder, Clear Shot Powder and possibly others.

On rare occasion firearms loaded with either black powder or one of these black powder substitutes are involved in crimes and/or accidental shootings. Any of these propellants may also be employed in homemade explosive devices. Each of these materials has a unique physical form and can be placed into one of three basic chemical compositions. Components specific to each of these three groups can be detected by several means in the discharge residues. Knowledge of the physical and chemical nature of these products, their performance and the nature of the discharge residues will provide the examiner a useful starting point when confronted with this type of evidence.

Black Gun Powder

The contemporary standard "recipe' for black gun powder is-

Potassium Nitrate (KNO_3)	75 parts
Charcoal (C)	10 parts
Sulfur (S)	15 parts

The fuel in this classic solid propellant is charcoal (carbon) with potassium nitrate as the oxidizing agent. Sulfur also serves as a fuel but its more important function is to act as a binding agent. It also lowers the ignition temperature of the final mix.

For use in firearms, the rate of burning is controlled by the grain or particle size. The finest form is called $FFFF_g$ (or 4-F). Its use is restricted to priming charges in flintlock arms. The largest granulation commonly used in hand-held arms is FF_g (2-F). This would be employed in large caliber muskets and rifles. A "Cartridge" version comparable in granule size to 2-F, is also available from at least one manufacturer. As the name suggests, this is for use in large capacity cartridges such as the .45-70. 1-F is uncommon and is used in cannons and large bore black powder shotguns. These granulation designations relate to the pass/no pass table below.

BLACK POWDER GRANULATIONS

Granulation	Must Pass	Must Not Pass
F_g	10 meshes/inch	16 meshes/inch
FF_g	16 meshes/inch	24 meshes/inch
FFF_g	24 meshes/inch	46 meshes/inch
$FFFF_g$	46 meshes/inch	60 meshes/inch

Perhaps the simplest way to remember which form burns the quickest is to think of how sawdust (a 4-F version of wood in this analogy) verses wood chips (2-F version) would burn when thrown into an open flame.

In the United States, black powder is federally regulated as a Class A explosive. It has an ignition temperature of about 500^0F.

The combustion products of black powder are about 44% gases (e.g.- CO, CO_2, N_2 H_2S, et al.) and 56% solids (K_2CO_3, K_2SO_4, K_2S, $K_2S_2O_3$, KCNS and unconsumed C, S and KNO_3). Some of these solids are hygroscopic and/or corrosive hence the need to promptly clean firearms (and cartridges) loaded and fired with black powder if they are to be preserved.

At present (2001), there are at least three sources (brands) of black powder commonly available in the United States-GOEX manufactured in the United States, Elephant Brand powder manufactured in Brazil and KIK manufactured in Slovenia and imported by GOEX.

Pyrodex

The first successful black powder substitute was Pyrodex®, manufactured by the Hodgdon Powder Company of Shawnee Mission, Kansas. This product has been available since the mid-1970s. It has achieved considerable popularity among shooters of historic and primitive firearms due to the reduced controls on this product as compared to black powder. It is also slightly more economical to load requiring approximately 20% less propellant, on a weight basis, than black powder. Its unique formulation is as follows:

Potassium Nitrate	45 parts
Charcoal	9 parts
Sulfur	6 parts
Potassium Perchlorate ($KCl0_4$)	19 parts
Sodium Benzoate	11 parts
Dicyandiamide (1-Cyanoguanidine)	6 parts
Dextrine	4 parts
Wax/Graphite	<1 part

As was the case with black powder, the burning rate of Pyrodex is also controlled by grain size (and therefore the type of firearm in which each type is suited). Rather than the 'F' system of nomenclature, this material is designated as "P" (pistol), "RS" (rifle/shotgun) and "CTG" (cartridge). These designations are equivalent to the 3-F, 2-F and 1-F categories for black powder. A "Select" grade is also available which is advertised as an 'accurized' version of the "RS" granulation. Pyrodex is also available in individual cylindrical pellets for specific calibers of muzzleloading firearms. These provide unit charges such as the 50 grain - 50 caliber version. Depending

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Note: preliminary reports on this subject were presented at the Spring 1996 CAC Seminar in Milpitas, California and the 1998 AFTE Seminar in Tampa, Florida. This article represents a report on this subject as of May 2001.

on the gun and projectile, one or two of these preformed cylindrical pellets would be inserted in the muzzle following by the projectile or patched ball then seated with the ramrod.

Pyrodex is regulated as a Class B Flammable Solid with an ignition temperature of about 750^0F. The charges used in muzzle loading and black powder cartridge arms are usually equivalent to black powder on a volumetric basis with comparable velocities achieved upon discharge. On a weight basis, a charge of Pyrodex will weigh about 20% less than an equal volume of the equivalent black powder.

The most outstanding and characteristic combustion product of Pyrodex is detectable levels of unconsumed dicyandiamide (DCDA) which can be detected by TLC, HPLC, FTIR and a simple colorimetric test[1] described later in this article. Benzoic acid (from unconsumed sodium benzoate) provides another 'marker' for Pyrodex residues. More elaborate analytical procedures have been described by Edward Bender of the Materials Analysis Unit of the FBI Laboratory[2]. Sulfur and/or sulfur-containing compounds are *not* useful markers for Pyrodex since both black powder and the various Pyrodex granulations contain sulfur.

Black Canyon, Arco-Black Mag and Clean Shot Powder

Three chemically-related new-comers in this field are Black Canyon Powder (marketed out of Las Vegas, Nevada), Black Mag Powder marketed by Arco of Hollywood, Florida and Clean Shot Powder from Clean Shot Technologies in Whitewater, Colorado. Black Canyon Powder has been regularly seen by this writer in gun shops and sporting goods stores in the West which cater to black powder shooters but appears to be on the way out because of poor performance and poor shelf life.

Samples of Arco's first batch of propellant followed by a sample of Black Mag2 Powder were obtained from one of the popular firearms writers but has yet to be seen by this examiner in retail stores. A 2-page article on this product appeared in the January 1996 issue of *Guns and Ammo* magazine as well as the August-September 1996 issue of *Handloader* magazine both of which provide some performance data. The fourth edition of Wolfe Publishing Company's *Propellant Profiles* also contains information on the BlackMag product on pages 271 and 272.

Clean Shot Powder has been recently advertised and sold through a wholesaler in California. A brief article on this product appeared in the February-March 1999 issue of *Handloader* magazine. Several pounds of this product were subsequently purchased and tested by this writer.

Although these products have different physical appearances, their chemical composition is quite similar with the primary ingredients being ascorbic acid (vitamin C) and potassium nitrate. This is quite similar to a much earlier product called Golden Powder, which was advertised for several years but never became established commercially in the United States. Black Canyon and Clean Shot Powder also contain substantial charcoal giving them dark to light gray colors respectively. Except for the charcoal or graphite in these powders, all three are water-soluble. Characteristic crystals of ascorbic acid and KNO_3 can be seen by polarized light microscopy in the solid residue from slow evaporates of water solutions of these products on a glass microscope slide. Although this writer has not established the exact ratio of ascorbic acid to KNO_3, it appears to be approximately 3:2 for the Clean Shot product.

Like Pyrodex and traditional black powder, these products produce considerable smoke upon discharge (an important part of the black powder experience) and leave residues in the bore of the gun. They do *not* produce the sulfurous odor associated with traditional black gunpowder. Sulfur is not a part of the formulation of any of the other black powder substitutes described in this article. The discharge residues are substantially less for the ascorbic acid/KNO_3 formulations as compared to black powder and Pyrodex. Considerable residue was deposited on downrange witness panels, especially in the case of Black Canyon Powder. Fired cartridge cases loaded with these ascorbic acid/KNO_3 products possess a yellowish to almost white residue that is somewhat flaky, particularly in the case of B.C. Powder. Direct analysis of the solid residues by diffuse reflectance FTIR, while not eloquent, reveals readily recognizable ascorbic acid and KNO_3 peaks.

Clear Shot Powder (not to be confused with *Clean* Shot Powder) is the most recent contender in the black powder substitutes. It appeared at the end of 1999 and is manufactured by GOEX at their facility in Doyline, Louisiana and distributed by Coonie's Explosives, P.O. Box 2062, Hobbs, NM 88241. GOEX also has a website at www.goexpowder.com than can provide more information on their product lines. A full-page advertisement for this product can be found on page 61 of the December 2000 issue of *Handloader* magazine as well as more recent issues of this popular magazine. This novel product is unique in several ways and from the initial performance tests carried out by this writer, stands to take over the market. Good to excellent results were obtained in a 45 caliber Whitworth rifle (a muzzleloader) and two cartridge guns- a Model '73 Winchester in 44-40 and a .50-90 Sharps.

The chemical composition of Clear Shot is unique from all the products previously described. Although the oxidizer is potassium nitrate, the organic portion contains no ascorbic acid or any of the organics associated with Pyrodex. Its physical form is also unique for products of this type. Although labeled with the FF_g and FFF_g nomenclature of black powder, the shiny black particles are almost perfect spheres and look somewhat like slow-burning forms of ball powder. If one crushes a few of these spherical particles on a white piece of paper, the resultant powdery material looks a lot like instant coffee in color. Extracting samples of this product with water dissolves the potassium nitrate and leaves this coffee-colored constituent as a fine, brown precipitate. Upon discharge in a firearm, Clear Shot produces slightly less smoke with a somewhat more grayish color than black powder but lacks any noticeable odor. A pair of photographs showing the discharge of 80 grain charges of 2F black powder and 2F Clear Shot fired in the author's "Big 50" Sharps rifle are included with this article to illustrate the relative smoke production of these products. The residue buildup in the bore of firearms after multiple shots and inside cartridge cases is minimal with Goex's Clear Shot compared to black powder and Pyrodex although there is sufficient residue with which to perform chemical analysis in the laboratory. The black powder naming system for Clear Shot is understandable since this product is a black powder substitute and is manufactured by the most common and popular source of traditional black powder in the United States (GOEX). Charges of equal weight with the equivalent granulations of black powder fired in both muzzle loading and black power cartridge guns gave comparable velocities. **Table 1** provides a performance comparison for these propellants when fired in a cartridge rifle and revolver.

Chemical Tests

[Nitrates/Nitrites]

All of these propellants contain potassium nitrate some of which survives in the fired residues consequently colorimetric tests such as the diphenylbenzidine in concentrated sulfuric acid reagent will give strong, immediate positive responses on such residues due to the presence of either or both inorganic -NO_3 or -NO_2 residues. Particles of modern nitrocellulose propellants also respond with this reagent after a momentary delay (while the sulfuric acid breaks some of the cellulose-NO_3 bonds thereby liberating nitrate/nitrite radicals which cause the color reaction). From the foregoing it should be apparent that this test has *no* discriminatory power but simply confirms that the sooty residues being examined contain some form of nitrates and/or nitrites.

[Dicyandiamide-Sodium Nitroprusside/ Potassium Ferricyanide Test]

As mentioned earlier, one of the constituents unique to all granulations of Pyrodex is dicyandiamide (1-cyanoguanidine). This constituent can be extracted from fired and unfired particles of Pyrodex with ethanol and chromatographed on Whatman K2 cellulose thin layer chromatography plates (along with a standard sample of DCDA) using a solvent system of $CHCl_3$ / Methanol / H_2O (5:5:1). Visualization and detection is accomplished with a spray reagent composed of 1 part each of 10%w/v aqueous solutions of sodium hydroxide, sodium nitroprusside [$Na_2Fe(CN)_5NO$] and potassium ferricyanide [$K_3Fe(CN)_6$] plus 3 parts of water. This reagent for the visualization of cyanamide and its derivatives comes from Stahl's book[3] . The three stock reagents are stable a room temperature for weeks to months. The working reagent is only stable for about 24 hours at room temperature. Upon initial mixing of the 3 stock reagents and the water, a dark brown color will form. After standing for a few minutes, this solution will turn a light yellow color at which time it is ready for use as a color reagent for DCDA. The dried TLC plate should be sprayed *lightly* with the reagent. DCDA will develop a reddish-violet color with an R_f of about .64. Photographing the TLC plate is advised since these colors may degrade and even disappear over time. A greenish spot may also develop with fired residues with an R_f of about .47. This is believed to be a thiosulfate compound.

This reagent can also be used as a spot test by simply evaporating an ethanol or aqueous extract in a white spot plate then adding a few drops of the freshly prepared working reagent.

[Author's note: in the preparation of this article the author purchased a 1 kg. container of dicyandiamide manufactured by Sigma Chemical, product #D8275. Any reader wishing a small sample of this material for their own reference collection or testing is welcome to send a self-addressed, stamped envelope and a sample will be provided at no charge.]

[Sulfur]

Elemental sulfur present in black powder and Pyrodex can be extracted with methylene chloride after which the *slow* evaporation of this solvent on a glass microscope slide will leave characteristic crystals of sulfur. The most useful form being a birefringent pointed tablet. Other crystal forms include dendritic crystals and bipyramids. Any oily droplets should be touched with a fine needle. If sulfur, they will typically crystallize into fine needles. Any of these crystals can, of course, be analyzed by other techniques such as SEM/EDS if deemed necessary.

[SEM/EDS Analysis]

This non-consumptive method of analysis will allow the inorganic components associated with the four categories of propellants to be identified in small amounts of residue recovered from firearms discharges but some caution in interpretation needs to be exercised. Potassium, for example, will be present in the residues of traditional black powder, in Pyrodex residues, all of the ascorbic acid formulations known to date as well as residues of Clear Shot. So long as one is dealing with residues from within the depths of a gun barrel or fired cartridge case, the presence of a large chlorine peak would only be associated with Pyrodex (from the perchlorate); however, chlorine in the sooty residue from the aftermath of an explosive device may have other explanations, e.g. polyvinylchloride tubing or pipe. Consequently the presence of substantial amounts of chlorine in this type of sample is less meaningful.

Performance of Black Powder vs. Black Powder Substitutes

The performance of different sources, and possibly batches of black powder *does* vary for a number of reasons. The type and source of charcoal used, the thoroughness of the mixture of the three ingredients, the particular ratio of the ingredients (it has not always been the 75:10:15 ratio previously shown), the moisture content of the particular batch of powder, brand and/or batch differences and, of course, the granulation used can all affect performance before one even considers barrel length and 'fit' of the projectile to the bore. For these reasons it is not possible to say that a particular charge of black powder of a certain granulation will always generate the same pressure and velocity for a particular projectile/barrel length combination. Actual performance values will usually come close to published values (and sometimes even match such values) but one should be prepared to see measurable and consistent variances between brands or batches of black powder. Indeed there still remains some peculiarities about black powder that are not well understood. For example, although the peak pressures achieved by black powder compared to "smokeless" (nitrocellulose) propellants are substantially lower, it is fairly well known that failing to seat the projectile against a black powder charge and leaving an air space can result in high pressure excursions and even the catastrophic failure (bursting) of the gun. The reason(s) for this remain a mystery but it *is important* that muzzle loaded projectiles be *firmly* seated against the charge and black powder cartridges be filled to capacity and the charge even compressed slightly. This is also believed to be true for Pyrodex and may be true for the newer black powder substitutes.

Some insight into the performance and burning characteristics of black powder and black powder substitutes compared to modern smokeless powders was gained from a simple pressure and velocity test gun constructed from a specially modified SKS rifle and attached to Oehler's Model 43 Personal Ballistics Laboratory strain gauge - chronograph system. (The complete details for the many forensic uses of this system will be the subject of another article.) New 7.62x39mm cartridge cases primed with CCI Magnum primers were volumetrically loaded with all of these propellants to produce mildly compressed charges. This was accomplished by filling each car-

tridge case to within about 0.13 inches of the case mouth and seated lead, gas-checked bullets of the same weight on these volumetric charges. For a smokeless powder round, individually weighed charges consisting of 14.0 grains of Alliant #2400 propellant were loaded and the same type and weight of bullet seated into these cartridges. (Note: this smokeless powder load only occupied about one-half of the internal volume of the cartridge case.) Multiple shots were carried out with each load under the same test rifle and set of conditions (temperature, humidity, station location, gun, positioning of the down range chronograph screens, etc.). Inspection and comparison of the resultant pressure curves from the Oehler M43 system reveals some interesting characteristics of black powder and black powder substitutes in comparison with a modern smokeless (nitrocellulose-based) propellant. A similar series of tests was carried out with FSSI's M43-SKS system. The results of replicate tests shots with the various granulations of black powder and most of the black powder substitutes described in this article are shown in **Table 2.**

Some Matters of Exterior and Terminal Ballistic Interest

Since many firearms examiners may have little experience with so-called primitive weapons, I have elected to include a section on some of the exterior and terminal ballistic aspects of such guns. This should provide a condensed source of information that is otherwise scattered among various books oriented toward the shooting enthusiast and not the forensic scientist.

Up until about the time of the American Civil War, muzzle loading pistols and rifles were loaded with spherical lead balls of slightly *smaller* diameter than the bore of the gun. A patching material, usually cotton, linen and occasionally, thin leather was placed around the ball during the initial loading process. This was a common American technique than arose out of our early frontier development when it was necessary to make every shot count and maximize the service life of the firearm. This technique is *still* employed by present-day shooters of muzzle loading arms using spherical lead balls as projectiles. This has significant forensic implications for a number of reasons:

- If properly done, the spherical projectile does *not* contact the bore of the firearm (this is usually evident during an examination of the recovered ball as is a fabric imprint of the patch on the base of the ball),
- the patch will survive the discharge process and will be expelled from the muzzle of the gun,
- with muzzle-to-target distances of more than several feet, the patch will be in the area where the gun was fired. (Unobstructed, they typically travel 10 to 20 feet down range.),
- at contact to near-contact, the patch will follow the projectile into a wound track but will usually become trapped in the wound track (rather than exit with the projectile),
- the recovered patch can be compared to (and sometimes physically matched back to*) its source,
- the recovered patch is impregnated with residues of the particular propellant used,
- the patch may also contain residues of homemade or proprietary bore lubricants,
- if a 'spit patch' was used, the saliva of the preparer may be identifiable in the recovered patch,

*Physical matches with the source material may be possible when patches are cut off at the muzzle during the loading process leaving irregular edges. If commercially prepared circular patches are used, a physical match will not be possible.

From a performance standpoint, the patched ball technique had a number of desirable effects if done properly, particularly in a rifled firearm. During the subsequent seating of the ball, the patch tended to clean the fouling from the previous shot. With increasingly fouled bores, the seating of subsequent balls was easier than the British or European method of driving an *un*patched, snug-fitting ball down on the powder charge, and, most of all, accuracy was greatly improved due to the better management of powder fouling and reduced deformation of the ball during the loading and discharge process. Complaints of British officers to the authorities in England during our Revolutionary War about "those damned Americans and their bloody *rifles*" and the truly devastating casualty figures in the Battle of New Orleans (Jan. 8, 1815) illustrate the improved accuracy of the patched ball technique. Andy Jackson's militiamen with their Kentucky *rifles* (shooting patched balls) killed 700 and wounded 1400 of General Pakenham's seasoned troops (who were using large caliber *smoothbore* muskets with *un*patched balls). General Packenham was also killed in this famous battle. Although vastly outnumbered, (Jackson's 2100 militiamen vs. 10,000 British troops) Jackson's forces only lost 8 men and 13 wounded. Only a few of General Packenham's men ever reached the breastworks from which Jackson's accomplished backwoods hunters and riflemen laid down their deadly rifle fire.

With the earlier caveat in mind regarding variations in powder performance, it is nonetheless helpful to get some idea of the exterior ballistic performance of spherical lead balls in some historic muzzleloading arms. The majority of the values reported below were derived from the 1975 *Lyman Black Powder Handbook* with Gearhart-Owen (GOEX) powder and Curtis & Harvey (C-H) powder. Those that the author measured with the four propellants discussed in this article appear at the end of these data. Black powder manufactured by DuPont and its successor company, Goex were used by the author.

It is interesting to note the relatively poor ballistic performance of the spherical projectile insofar as its velocity retention over distance. For a 505gr. flat-nosed conical projectile of .575" diameter at a muzzle velocity of about 1240f/s (requiring about 140gr. of FF_g powder) fired from a 58 caliber rifle (cited in Table 3), the conical projectile only drops to 1030f/s at 100 yards compared to 869f/s for the 260 gr. round ball with a comparable muzzle velocity. This substantial performance difference for round balls vs. conical projectiles is even more pronounced for the smaller diameter projectiles.

In one of history's longest recorded shots, Billy Dixon- a buffalo hunter armed with a 50 caliber Sharps rifle in the Spring of 1874 at a place called Adobe Walls in the Texas Panhandle, struck and killed an Indian at a distance later measured and recorded as 1538 yards. From Doppler radar tests carried out at the Yuma Proving Grounds in 1994, the "Big 50" Sharps bullet drops from a muzzle velocity of approximately 1400 f/s to about 450 f/s during a flight time of 6.5+ seconds over this distance. Nonetheless, it considerable weight (ca. 500 grains) and good sectional density gave penetration depths of 26+ inches in calibrated 10% ordnance gelatin- sufficient to kill several adversaries if they were one behind the other. Such a situation was depicted in the film "Quigley Down Under" and, from the tests carried out by this writer, the scene is not so far fetched. [For those interested in a more detailed analysis of Billy Dixon's Long Shot —see R. Nennstiel's article in the July 1995 issue of the *AFTE Journal*] Long range marksmanship contests

out to 1400 yards with black powder firearms were carried out at the end of the 19th century and are still popular with a select group of marksmen as of this writing. These comments are included in this article so that the reader is not under the mistaken notion that so-called primitive firearms are incapable of accurate, lethal fire at considerable ranges. The previously-cited Battle of New Orleans should serve as the best, well-documented example of the capability of *rifled* black powder arms in the hands of skilled marksmen.

Spherical Projectiles

In preparing this article it was realized that there are some matters of forensic interest, not readily found elsewhere, that relate to spherical projectiles. Since I have already listed a number of points regarding the patch used with such projectiles, it would seem appropriate to conclude this article with some data related to these spherical projectiles. This may seem a bit esoteric to some readers but this writer has worked on at least three cases involving the criminal use of percussion revolvers firing cast spherical projectiles.

Moulds are available in most any diameter one wishes to purchase for casting spherical lead balls. Such projectiles will show a seam and a sprue (where the molten lead was introduced into the mould). It is the customary practice to load such balls with the sprue forward. Ball-starter and/or ramrod marks in the forward side of the ball often survive subsequent impact and could be compared with the tool that made them just as with the rammer arms of percussion revolvers.

More recently, commercially manufactured spherical projectiles have become available from a number of manufactures (Speer, Hornady, CVA, the Denver Bullet Co., and others) that are made by a swaging process. These balls *lack* seams and sprues. **Table 4** lists some of the sizes known to be available as of several years ago. The calculated and measured weights given are for spheres made of dead soft lead. The presence of hardeners such as arsenic, antimony and tin would reduce these weights somewhat. Values for the classical ballistic coefficient, (C), are also listed in **Table 4** for some of these projectiles.

The relationship between the diameter of a lead sphere and its weight can be derived from the following formulas.

The volume of any sphere is given by- $4/3\ r^3$ where r is the radius of the sphere. This equation can be rewritten on the basis of the diameter of a sphere and becomes $0.5236d^3$.

The density of pure lead in grains per cubic inch is 2873.5. If metric units are desired the density of lead becomes 0.011345 grams/mm^3.

For American units, the final expression for the weight (in grains) of a pure lead sphere is-

W (in grains) **=** (2873.5) x ($0.5236d^3$) or **$1504.6d^3$ (**where d is in inches)

Since the forensic scientist may be more often dealing with a recovered but deformed ball whose weight has been measured, this expression can be rearranged and simplified to give-

d (in inches) **= 0.08727 ^{3} W** (weight in grains)

The metric equivalents for these two expressions are-

W (in grams) **= $0.005940d^3$** (diameter in mm)

d (in mm) **= 5.522 ^{3} W** (weight in grams)

Summary

Black powder and its contemporary substitutes may, on occasion, appear in casework. The physical characteristics of these propellants and the unique chemical properties of each have been described along with some performance characteristics. The projectiles associated with firearms designed to use black powder and black powder substitutes are also often unique and may possess evidence of having been fired by such propellants. This may take the form of propellant residues on the bases of such bullets or the imprint of the actual powder granules. The imprint of a fabric pattern on the base of a spherical projectile that lacks clearly striated rifling engravings should alert the astute examiner that he or she is dealing with a patched ball. Cloth patches and various types of wadding impregnated with propellant and other residues of evidential value are often associated with primitive firearms using these propellants.

Appended to this article are scale photographs of the unfired propellants described in this article.

Black powder substitutes will presently fall into one of 3 categories: Pyrodex, ascorbic acid/KNO_3 mixtures or Clear Shot.

Unconsumed particles of these propellants as well as copious amounts of residue far in excess of those encountered with modern propellants stand to be deposited on skin and clothing during close-range discharges.

Partial identification of the category of black powder substitutes can usually be obtained with diffuse reflectance F.T.I.R. and/or several simple chemical or microcrystalline tests.

A relatively simple color test and thin layer chromatographic test has been described for detecting dicyandiamide-the unique ingredient in all formulations of Pyrodex.

Scientific References

1. Hedglin, Dirk, *"Identification of Cyanoguanidine in Pyrodex and Post Blast Residues of Pyrodex,"* presented at the 1994 American Academy of Forensic Sciences meeting in San Antonio.

2. Bender, Edward C., "The Analysis of Dicyandiamide and Sodium Benzoate in Pyrodex by HPLC," *Crime Laboratory Digest* 16:3 Oct. 1989 pp. 76-77

3. Thin Layer Chromatograph: A Laboratory Handbook edited by Egon Stahl, Springer-Verlag, Berlin Heidelberg New York (1965), reagent 113, page 497

TABLE 1
PERFORMANCE of BLACK POWDER and BLACK POWDER SUBSTITUTES

The loads listed below were all assembled by the writer in 357 magnum cases with CCI Magnum Rifle Primers and Speer 158 grain LRN bullets (pdt. #4647). A lever action rifle with 20 inch 6-groove barrel and a revolver with a 6 inch 6-groove barrel were used. Chronographic values were obtained at 10 feet beyond the muzzle for all shots. Powder patterns were collected on white cotton cloth at 36 inches from the muzzle of the rifle and 18 inches in front of the revolver. These tests not only provide velocity information but also allow the production and deposition of gunshot residues to be illustrated and evaluated.

20 gr. DuPont 3-F
[mildly compressed]

RIFLE
1029 / 1074 / 982 / 1025 / 997f/s =
1021f/s Ave. ± 35f/s (3.4%C.V.)

REVOLVER
824 / 811 / 769 / 740 / 697f/s =
768f/s Ave. ± 52f/s (6.8%C.V.)

18.5 gr. Pyrodex "P"
[mildly compressed]

RIFLE
1031 / 1064 / 1076 / 1082 / 1053 f/s =
1061f/s Ave. ± 20 f/s (1.9%C.V.)

REVOLVER
698 / 763 / 823 / 828 f/s =
778 f/s Ave. ± 61 f/s (7.8%C.V.)

20.0 gr. Black Canyon Powder
[full case - *heavily* compressed]

RIFLE
922 / 879 / 735 / 860 / 897 f/s =
859 f/s Ave. ± 73 f/s (8.5%C.V.)

REVOLVER
593 / 492 / 378 / 465 f/s =
482 f/s Ave. ± 89 f/s (18%C.V.)

19.0 gr. Arco Powder
[moderately compressed]

RIFLE
1112 / 1012 / 1081 / 1098 / 1156 f/s =
1092 f/s Ave. ± 53 f/s (4.8%C.V.)

REVOLVER
862 / 809 / 809 / 787 f/s =
817 f/s Ave. ± 32 f/s (3.9%C.V.)

19.0 gr. Clean Shot Powder
[moderately compressed]

RIFLE
1077 / 1115 / 1121 / 1105 / 1077 / 1143 f/s =
1106 f/s Ave. ± 26 f/s (2.3%C.V.)

REVOLVER
862 / 907 / 911 / 891 / 811 / 865 f/s =
874 f/s Ave. ± 37 f/s (4.2%C.V.)

19.0 gr. GOEX Clear Shot Powder
[mildly compressed]

RIFLE
1095 / 1072 / 1066 / 1066 / 1083 / 1075 f/s =
1076 f/s Ave. ±11 f/s (1.0%C.V.)

REVOLVER
795 / 817 / 799 / 812 / 797 / 784 f/s =
801 f/s Ave. ± 12 f/s (1.5%C.V.)

Note: All of these shots produced visible smoke and substantial powder patterns on cotton and filter paper witness panels well in excess of what one would obtain with modern smokeless propellants. Black Canyon Powder left the most noticeable deposits and Clean Shot deposited the least. Several particles of these residues were scrapped off of the down range witness panels and mixed with KBr for analysis by diffuse reflectance FTIR. The original formulation could easily be identified from the resultant spectra when compared to standard spectra of the unfired composition.

TABLE 2
VELOCITY - PRESSURE DATA for
REPLICATE TESTS with FSSI's M43-SKS SYSTEM
[Arranged in Order of Decending Velocity/Peak Pressure]

LOAD **[LC cases - Rem. LRP]**	VELOCITY (at 15 ft.) **[f/s]**	PEAK PRESSURE **[psi]**	AREA **[scaled]**	RISE RATE **[µs]**
26.5 gr. *Clean Shot*	1453 / 1456	23,000 / 22,500	354 / 337	144 / 135
30.0 gr. GOEX 4F	1398 / 1317	22,500 / 21,800	365 / 365	115 / 102
30.0 gr. GOEX 3F	1315 / 1292	20,100 / 18,600	362 / 349	131 / 143
30.0 gr. GOEX *Clear Shot* 3F	1290 / 1324	19,600 / 21,600	376 / 371	126 / 122
19.0 gr. PYRO. RS-SELECT	1228 / 1251	18,800 / 19,500	339 / 349	133 / 136
26.0 gr. PYRO. P	1204 / 1223	17,700 / 19,900	359 / 338	194 / 128
24.0 gr. PYRO. RS (old form)	1193 / 1228	18,100 / 17,300	363 / 334	149 / 155
19.0 gr. PYRO. RS (current form)	1170 / 1221	16,400 / 18,500	340 / 321	157 / 120
30.0 gr. GOEX 2F	1196 / 1158	17,500 / 16,700	371 / 379	169 / 157
30.0 gr. GOEX "CTG"	1179 / 1228	16,000 / 18,100	380 / 373	234 / 147
28.5 gr. GOEX *Clear Shot* 2F	1195 / 1148	18,400 / 17,100	369 / 352	155 / 109
20.5 gr. PYRO. "CTG"	1156 / 1217	17,200 / 17,100	354 / 335	163 / 125
30.0 gr. ELEPHANT 3F	1185 / 1121	16,800 / 15,900	355 / 352	177 / 141
26.5 gr. ARCO (batch 1)	972 / 1025	12,700 / 13,600	425 / 391	395 / 350

Note: all loads were individually weighed but designed to fill the cartridge case within approximately 0.2 inches of the case mouth so as to create a moderately compressed load.

TABLE 3
REPRESENTATIVE PERFORMANCE of SPHERICAL PROJECTILES
and **TRADITIONAL BLACK POWDER**

<u>36* CALIBER RIFLE, 32"BARREL, 1 in 66" Twist</u>
[*.365" bore / .384" groove diameter]
.360" diameter ball, 71 grs. with Crisco-lubricated 0.015" thick patch, GOEX brand FFF_g powder.

CHARGE	MUZZLE VELOCITY	100 yd VELOCITY
25gr.	1335f/s	730f/s
35gr.	1579f/s	792f/s
45gr.	1823f/s	850f/s
55gr.	2027f/s	904f/s
65gr.	2189f/s	956f/s

45* CALIBER RIFLE, 36" BARREL, 1 IN 66" Twist

[*.453" bore / .472" groove diameter]

.445" diameter ball, 133grs. with Crisco-lubricated 0.015" thick patch, GOEX brand FFF_g powder.

CHARGE	MUZZLE VELOCITY	100 yd VELOCITY
25gr.	1207f/s	- - -
35gr.	1381f/s	- - -
45gr.	1554f/s	- - -
55gr.	1727f/s	961f/s
65gr.	1895f/s	1023f/s
75gr.	2055f/s	1090f/s
85gr.	2184f/s	1153f/s
95gr.	2281f/s	1211f/s

50* CALIBER RIFLE, 32" BARREL, 1 IN 66" Twist

[*.503" bore / .526" groove diameter]

.498" diameter ball, 180grs. with Crisco-lubricated 0.015" thick patch, GOEX brand FFF_g powder.

CHARGE	MUZZLE VELOCITY	100 yd VELOCITY
50gr.	1506f/s	926f/s
70gr.	1725f/s	1010f/s
90gr.	2000f/s	1129f/s
110gr.	2190f/s	1246f/s
130gr.	2295f/s	1318f/s
150gr.	2329f/s	1341f/s
170gr.	2354f/s	1360f/s

54* CALIBER RIFLE, 34" BARREL, 1 IN 66" Twist

[*.540" bore / .562" groove diameter]

.535" diameter ball, 220grs. with Crisco-lubricated 0.015" thick patch, GOEX brand FFF_g powder.

CHARGE	MUZZLE VELOCITY	100 yd VELOCITY
50gr.	1247f/s	870f/s
70gr.	1439f/s	939f/s
90gr.	1591f/s	998f/s
110gr.	1758f/s	1068f/s
130gr.	1913f/s	142f/s
150gr.	2020f/s	- - - -

58* CALIBER RIFLE, 32" BARREL, 1 IN 72" Twist

[*.575" bore / .583" groove diameter]

.560" diameter ball, 260grs. with Crisco-lubricated 0.015" thick patch, GOEX FF_g powder / (C&H powder).

CHARGE	MUZZLE VELOCITY	100 yd VELOCITY
50gr.	994f/s (845f/s)	737f/s (675f/s)
70gr.	1115f/s (1015f/s)	824f/s (776f/s)
90gr.	1238f/s (1154f/s)	869f/s (838f/s)
110gr.	1352f/s (1244f/s)	910f/s (871f/s)
130gr.	1451f/s (1349f/s)	948f/s (909f/s)
150gr.	1560f/s (1458f/s)	991f/s (952f/s)
170gr.	1669f/s (1567f/s)	1039f/s (997f/s)

Table 3, cont'd

THE "BROWN BESS" — The standard British battle musket during the American Revolution, flintlock ignition
74 caliber smoothbore with nominal 42" barrel using a 494gr. .690" diameter ball with a 0.015" thick patch*
*Note: the British troops would have used an unpatched ball of nominal bore diameter.
80 grains of F_g gives a muzzle velocity of about 810f/s and a 100 yard velocity of 680f/s.
A somewhat larger patched ball of 0.715" diameter weighing 545 grs. loaded with 40, 80 and 120 grs. of FF_g gave the following muzzle velocities: 569f/s, 879f/s and 1088f/s respectively.

THE 58 CAL. MODEL 1807 HARPER'S FERRY PISTOL
(replica with 10" rifled barrel fired by L. Haag with DuPont FF_g powder)
Speer 0.570" ball weighing 278 grains and patched with washed pillow ticking, ca. 0.015" thick

CHARGE	VELOCITY at 15' (3 shots)
20gr.	397 / 400 / 362f/s = 368f/s average ± 17f/s
30gr.	477 / 463 / 452f/s = 464f/s average ± 10f/s
40gr.	571 / 576 / 558f/s = 568f/s average ± 8f/s
50gr.	666 / 630 / 648f/s = 648f/s average ± 15f/s

THE 69 CAL. MODEL 1777 CHARLEVILLE PISTOL
(replica with 7½" smoothbore barrel fired by L. Haag with DuPont FF_g powder)
Dixie Gun Works 0.680" cast balls weighing 463 grains and patched with 0.015" thick pillow ticking

CHARGE	VELOCITY at 15' (2-3 shots each)
50gr.	489 / 513f/s = 501f/s average
60gr.	578 / 600 / 586f/s = 588f/s average
70gr.*	607 / 640 / 618f/s = 622f/s average
80gr.	641 / 682 / 687f/s = 670f/s average
80gr. (no patch)	683 / 654 / 687f/s = 675f/s average

*Note: a shot at approx. 620f/s perforated 22+ in. of 10%-4^{0}C ordnance gelatin. A 500f/s shot stopped in 26" of gelatin.

TABLE 4
COMMERCIALLY AVAILABLE LEAD SPHERES for MUZZLE LOADERS

BALL DIA. (in.)	RIFLE/PISTOL CALIBER	SOURCE*	CALCULATED WT. (grains)	MEASURED WT. (grains)	C
.310	32	H, C	44.8	45	.023
.315	32	H	47.0	47	- -
.350	36	H,S,D	64.5	65	.049
.375	36 rev.	H,S	79.3	80	- -
.395	40	H	92.7	93	- -
.433	44	H,S	122	- - -	- -
.440	45	H,S,D,C	128	128	.062
.445	45	H,S,D	133	133	.063
.451	44 rev.	H,S	138	138	.064
.454	44 rev.	H,S	141	141	.064
.457	44 rev.	H,S	144	143	.064
.490	50	H,S,C	177	177	- -
.495	50	H,S	182	182	.070
.520	53	H	212	- - -	- -
.530	54	H,S,D	224	225	- -
.535	54	H,S	230	230	.075
.570	58	H,S	279	278	- -
.680	69	DGW	473	463	- -
.690	74	D	494	494	- -

*H = Hornady, C = CVA, S = Speer, D = Denver Bullet Co., DGW = Dixie Gun Works

PRESSURE - VELOCITY TESTS with OEHLER M43-SKS SYSTEM

7.62x39mm LC cases with Winchester LRP
161 gr. Lyman #311466 LRN-GC bullets
30.0 gr. compressed charges
M43 Chronograph screen 1 at 10 ft., temp. = 50^{0}F, RH = 20%, Elev. = 3000 ft. MSL

4F GOEX Black Powder	RND	VEL.	PEAK PRESS.	AREA	RISE RATE
Ave. Velocity: 1466 f/s ± 13 f/s	1	1457	23,600	475	99
Ave. Peak Pres.: 23,600 ± 100 psi	2	1460	23,600	452	78
Ave. Area: = 459 ± 13	3	1480	23,500	451	102
Ave. Rise Rate: =93 ± 13					

3F GOEX Black Powder	RND	VEL.	PEAK PRESS.	AREA	RISE RATE
Ave. Velocity: 1159 f/s ± 36 f/s	1	1207	15,700	475	197
Ave. Peak Pres.: 15,300 ± 700 psi	2	1170	14,500	476	136
Ave. Area: = 486 ± 13	3	1171	14,600	480	158
Ave. Rise Rate: =151 ± 28	4	1129	16,200	504	130
	5	1118	15,500	495	136

2F GOEX Black Powder	RND	VEL.	PEAK PRESS.	AREA	RISE RATE
Ave. Velocity: 1272 f/s ± 7 f/s	1	1270	17,500	460	172
Ave. Peak Pres.: 17,900 ± 800 psi	2	1265	18,700	470	137
Ave. Area: = 457 ± 15	3	1280	17,400	441	142
Ave. Rise Rate: =150 ± 19					

2F GOEX CLEAR SHOT	RND	VEL.	PEAK PRESS.	AREA	RISE RATE
Ave. Velocity: 1244 f/s ± 27 f/s	1	1278	18,400	441	134
Ave. Peak Pres.: 17,500 ± 700 psi	2	1210	16,700	482	147
Ave. Area: = 468 ± 18	3	1214	17,100	485	182
Ave. Rise Rate: =148 ± 21	4	1221	17,000	461	121
	5	1231	16,600	462	136
	6	1264	18,100	478	151
	7	1246	17,300	474	181
	8	1259	17,900	473	121
	9	1224	17,200	488	158
	10	1293	18,700	433	146

3F GOEX CLEAR SHOT	RND	VEL.	PEAK PRESS.	AREA	RISE RATE
Ave. Velocity: 1308 f/s ± 27 f/s	1	1298	18,900	493	165
Ave. Peak Pres.: 19,200 ± 600 psi	2	1322	19,600	488	147
Ave. Area: = 482 ± 11	3	1333	18,900	465	127
Ave. Rise Rate: =135 ± 16	4	1288	18,100	470	106
	5	1332	19,700	477	139
	6	1279	19,300	492	144
	7	1257	18,600	487	118
	8	1339	20,000	470	130
	9	1325	19,500	496	137
	10	1303	18,800	478	135

REFERENCE LOAD*	RND	VEL.	PEAK PRESS.	AREA	RISE RATE
Ave. Velocity: 1667 f/s ± 26 f/s	1	1657	26,000	465	136
Ave. Peak Pres.: 27,000 ± 1400 psi	2	1643	25,800	452	125
Ave. Area: = 472 ± 15	3	1665	26,900	486	138
Ave. Rise Rate: =132 ± 5	4	1704	29,300	487	130

*14.0 gr. Alliant 2400, 161 gr. Lyman #311466 LRN-GC bullet, Win. Magnum LRP, LC cases

PARKER-HALE WHITWORTH RIFLE
35 inch barrel, .451 hexagonal bore, 1 in 20" twist
Bullet =475 gr. .451" cylindrical, flat base, 6-lube groove cast bullet
(Navy Arms) lubricated with SPG Lube
PACT IV Chronograph at 15 feet
Conditions: 60^{0}F, RH 20%, Station Elevation 3000 ft. MSL

Dynamit Nobel #1081 wing musket caps and- 65 gr. weighed charges of:

GOEX 2F BLACK POWDER	**GOEX CLEAR SHOT (2F)**
1148 f/s	1164 f/s
1157	1149
1139	1154
1163	1135
1138	1154
Average = 1150 ± 11 f/s	1155
	1168
	Average = 1154 ± 11 f/s

Velocity values obtained at 10 feet beyond the muzzle with a Pact IV chronograph
Notes: recovered bullets had a hexagonal cross-section; bore relatively clean after Clear Shot rounds.

.50-90 SHILOH SHARPS, 33.5 in. barrel
525 gr. 0.512" diameter cast flat base lead bullet,
1.065" OABL, 0.61" bearing surface, 0.30" meplat,
4 lube grooves containing SPG Lube
PACT IV Chronograph at 15 feet
Conditions: 60^{0}F, RH 20%, Station Elevation 3000 ft. MSL

80.0 gr. GOEX Cartridge black powder with 50 cal. Wonder Wad and paper disk, Federal #215 Magnum LRP
Velocity values: 1277, 1285, 1278, 1275, 1282f/s = Average of 1279 f/s ± 4.0 f/s (0.3% C.V.)
Accuracy: 5 in. group at 50 yds.
[bore mildly fouled after these 5 shots]

80.0 gr. GOEX Clear Shot (2F), Federal #215 Magnum LRP
Velocity values: 1332 , 1318, 1320, 1341, 1362 f/s = Average of 1335 f/s ± 18.0 f/s (1.4% C.V.)
Accuracy: 3 in. group at 50 yds.
[bore clean after these 5 shots]

45 LONG COLT - MARLIN CARBINE with 24 INCH BARREL
REM. CASES - WIN. LP Primers
Bullets = Speer swaged 230 gr. LRN
Velociy values with the Chrony #3 unit at 10 feet beyond the muzzle
32.0 gr charges loaded and fired by P.J.F. Mead
Temp. = 60^{0}F, RH ca. 25%, elev. 3000 ft. MSL

GOEX 4F BLACK POWDER
1277, 1289, 1265, 1279, 1248 f/s = 1272 f/s ave. ± 16 f/s

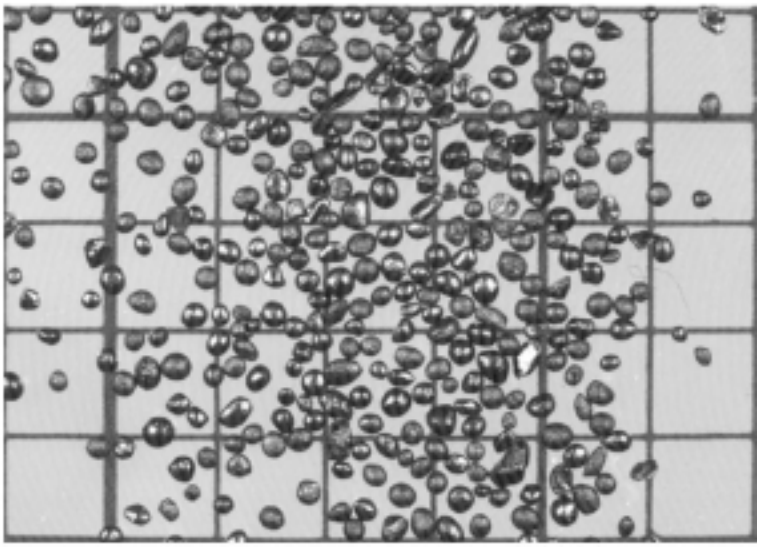
GOEX 3F BLACK POWDER
1053, 1020, 1015, 967, 1013 f/s = 1014 f/s ave. ± 31 f/s

GOEX 2F BLACK POWDER
1002, 999, 945, 991 f/s = 984 f/s ave. ± 27 f/s

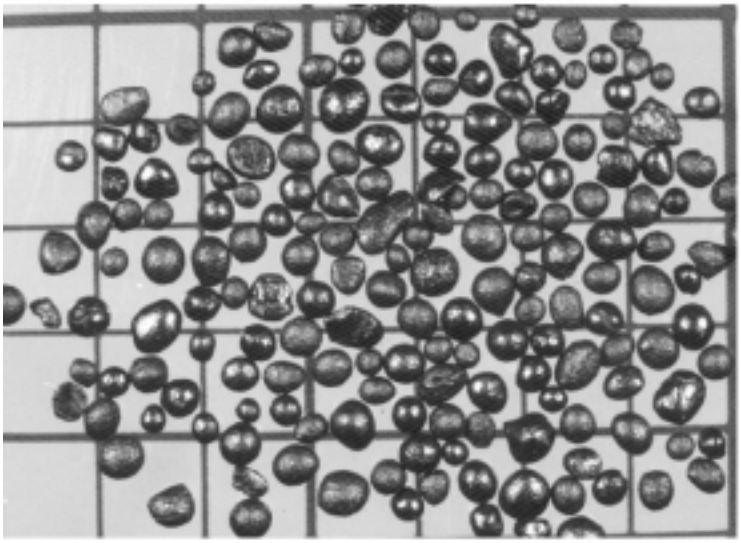
GOEX CLEAR SHOT 3F
1048, 1104, 1136, 1100, 1099 f/s = 1097 f/s ave. ± 32 f/s

GOEX CLEAR SHOT 2F

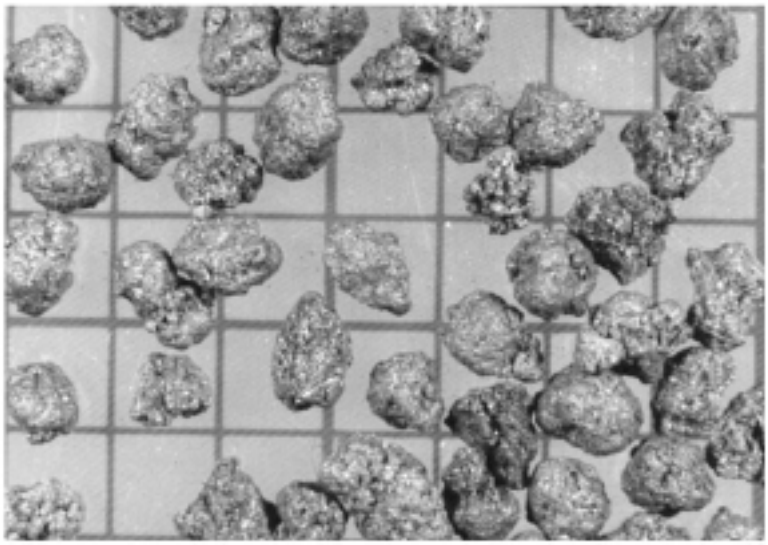
GOEX 3F *CLEAR SHOT* on 1/8 inch Grid



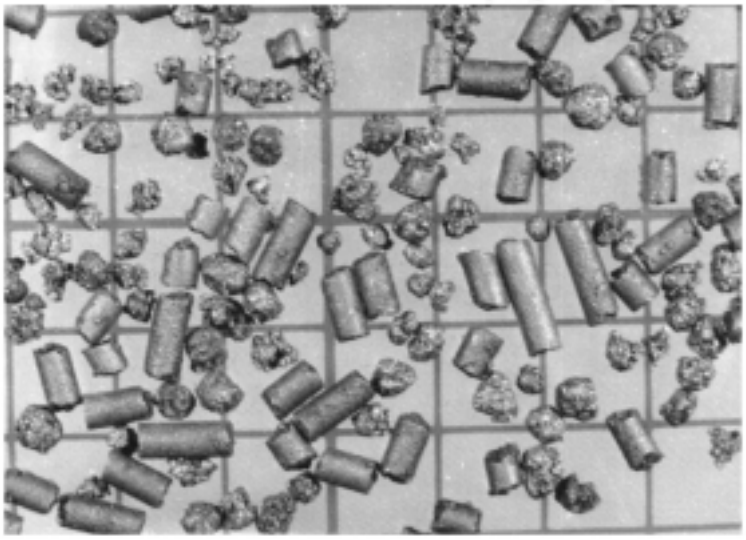
GOEX 2F *CLEAR SHOT* on 1/8 inch Grid



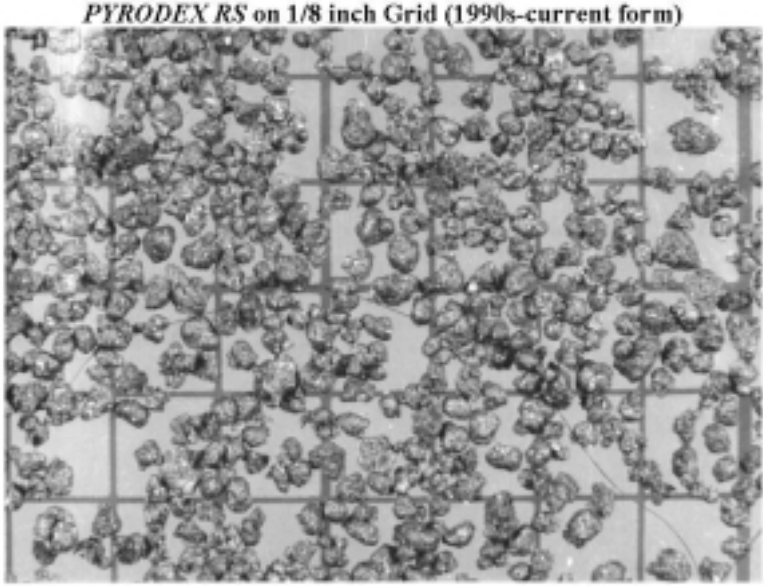
PYRODEX "CARTRIDGE" on 1/8 inch Grid



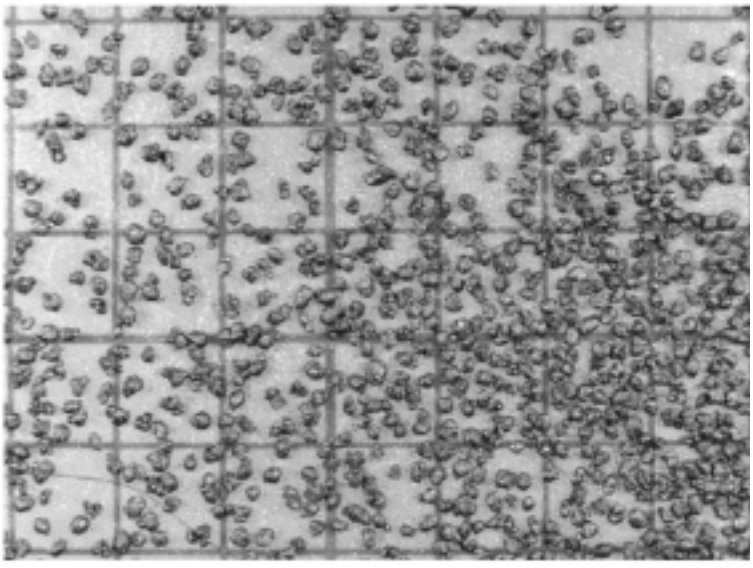
PYRODEX RS on 1/8 inch Grid (early form)



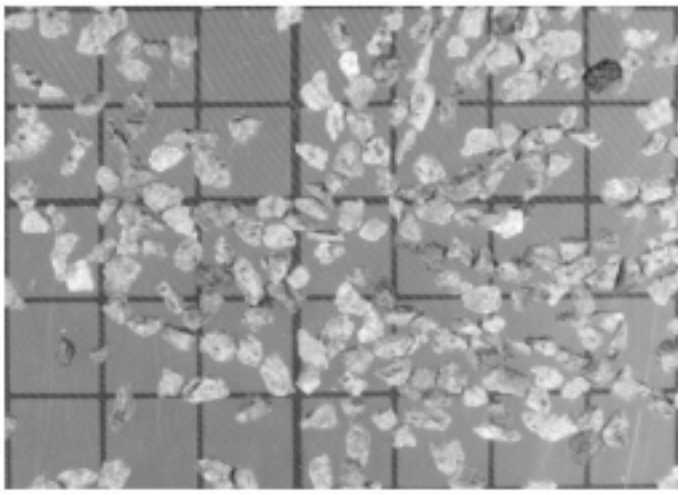
PYRODEX RS on 1/8 inch Grid (1990s-current form)



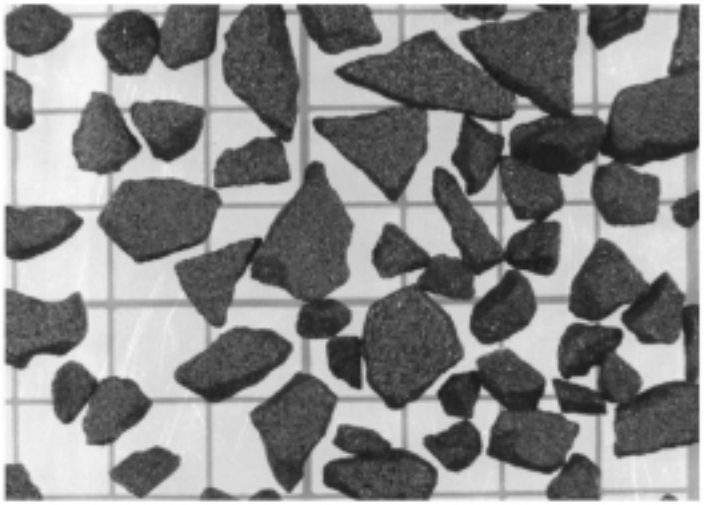
PYRODEX P on 1/8 inch Grid



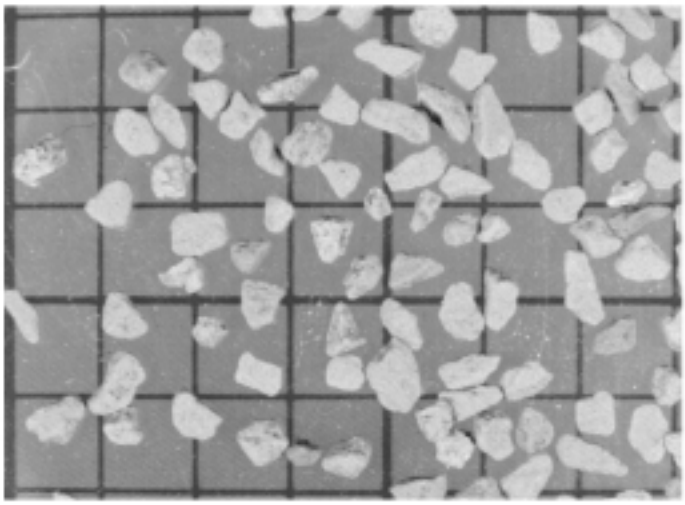
ARCO Batch 1 on 1/8 inch Grid



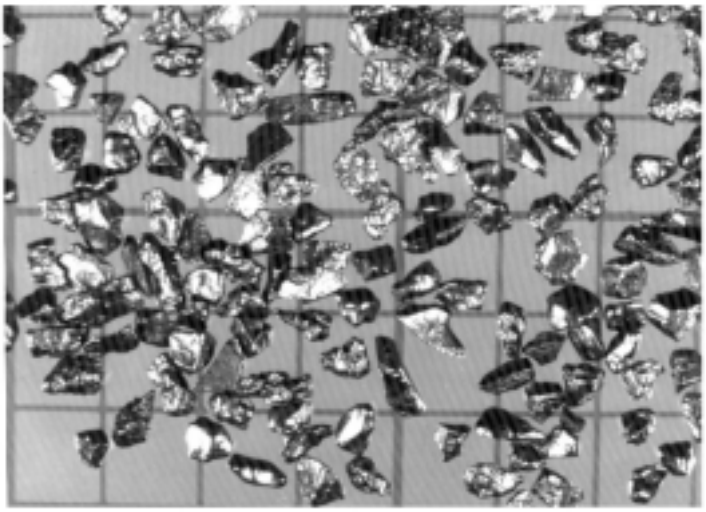
BLACK CANYON POWDER on 1/8 inch Grid



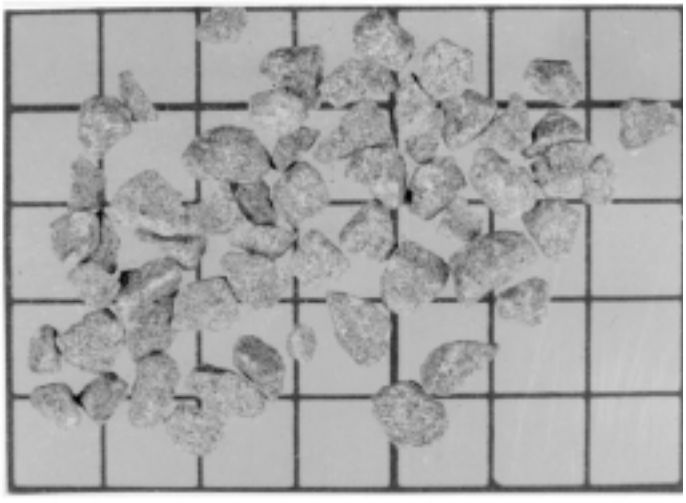
BLACK MAG 2 POWDER on 1/8 inch Grid



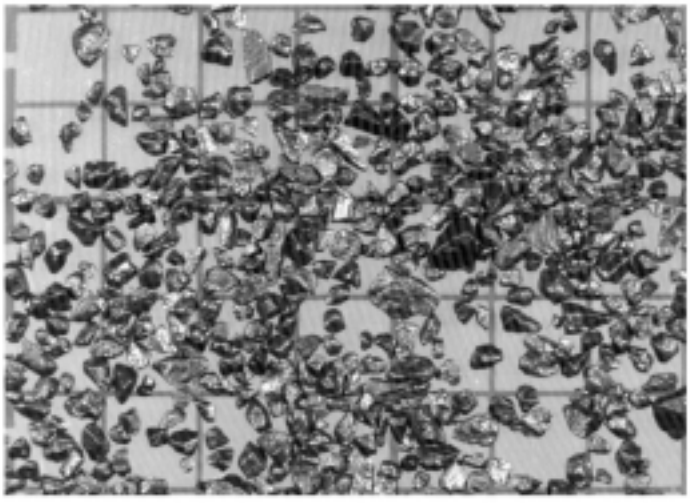
GOEX "CTG." BLACK POWDER on 1/8 inch Grid



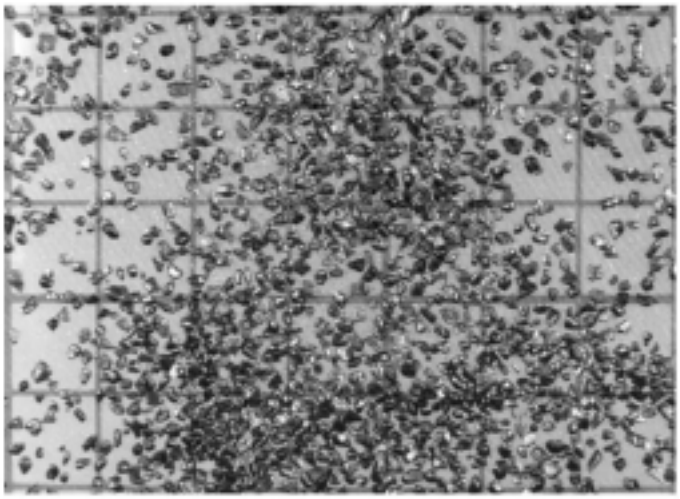
CLEAN SHOT POWDER on 1/8 inch Grid



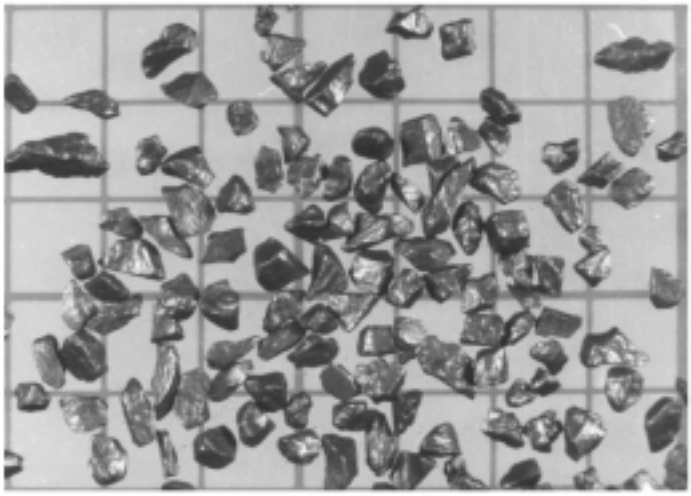
ELEPHANT BRAND 3F BLACK POWDER on 1/8 inch Grid



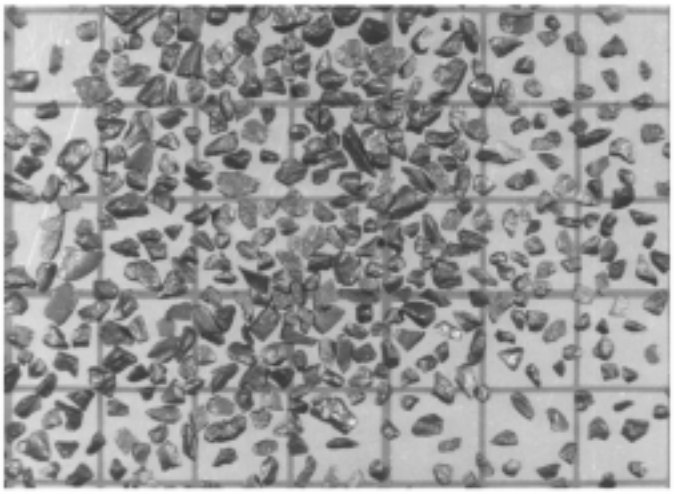
GOEX BRAND 4F BLACK POWDER on 1/8 inch Grid



GOEX BRAND 2F BLACK POWDER on 1/8 inch Grid



GOEX BRAND 3F BLACK POWDER on 1/8 inch Grid



PARTIAL DISPLAY OF BLACK POWDER AND B.P. SUBSTITUTES

Training & Resources

CAC Sponsored Classes

The California Association of Criminalists Training and Resources (T&R) Committee is committed to promoting and encouraging professionalism and excellence of our membership through training. We are the **only** criminalistics association that provides training **and** subsidizes most or all of the course costs for its members.

T&R coordinates and provides several professional training classes and courses throughout each year, many in conjunction with the California Criminalistics Institute (CCI). We provide beginning and advanced specialty courses, as well as non-technical professional subjects, to help you in your criminalistics career.

Surveys

Your input helps us decide which classes we want to sponsor. How do we get that input? Through our T&R committee survey! I'm sure that all of you have seen one and may have even returned one, but most of these inserts are not being returned to us. Without your input, we have no idea what you (our membership) wants and needs as far as training classes.

If there are different classes that you would like to see offered, please give us your suggestions. Visit the CAC website for an expanded T&R section with a link to an online version of the survey (currently under construction). In the meanwhile, please contact a T&R committee member to get a copy of the survey.

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We have a video library offering a comprehensive selection of professional training topics (currently about 100 tapes covering more than 40 subject areas). These tapes are available for loan free of charge to CAC members only. Please contact Elizabeth Thompson with requests and/or a current list of titles.

Admittedly, some of our videos are out of date and/or may have been replaced by new and improved techniques. This is where you can help us further. If you have or are going to be taping any interesting speakers, meetings, or training that you think will benefit our membership, please pass along a copy to us for the library. We have videotaping equipment available for this purpose if you need it (one camera system in Northern CA and one in Southern CA).

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- CAC members get 1st priority in class selections for CAC sponsored courses
- CAC members do not pay a materials fee for CAC sponsored courses
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- Opportunity to attend classes outside of your discipline

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B O A R D O F D I R E C T O R S

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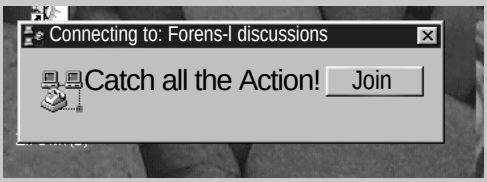

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Abstracts from CAC Spring 2001 Seminar
May 10 – 12, 2001 Tahoe City, CA

The Attorney General's Task Force on Forensic Services: An Update

*Jan Bashinski, Chief, Bureau of Forensic Services, CA State Department of Justice

This presentation will provide an update on the work of the Attorney General's Task Force on Forensic Services. The Task Force goal is "to develop a disciplined vision leading to the best forensic service system in the country." The Task Force is assessing the current status and needs of California's crime laboratories so that a prioritized master plan for improvement can be drafted. Crime laboratory directors have been surveyed regarding their needs for facilities, equipment and personnel. Surveys have been conducted of crime laboratory clients – prosecutors, public defenders, and law enforcement – in an effort to determine their unmet needs. Information is also being gathered on crime lab funding in other large states. This presentation will summarize the results obtained thus far. Several crime lab funding proposals are currently under consideration at both the State and Federal level. The Task Force's work is expected to provide important insight to policy makers as to how these new resources may best be allocated to benefit the criminal justice system.

Overview of Digital Evidence

*Carrie M. Whitcomb, Executive Secretary; Scientific Working Group for Digital Evidence

*Robert P. Bianchi, Retired Director DEA Special Testing Laboratory

*Michael Weil, Defense Computing Forensic Laboratory

*Erin Kenneally, San Diego Supercomputing Center

Discussion on an overview of Digital Evidence and related issues. This will include how traditional crime scenes may have digital components. This will also include an extensive question and answer period.

National Center for Forensic Science

*Carrie Whitcomb, Director, National Center for Forensic Science

To provide an overview of the National Center for Forensic Science, a program of the National Institute of Justice hosted by the University of Central Florida. This will include current programs in DNA, Fire, Explosives, and Digital Evidence.

The California Cold Hit Program: "*Solving Sex Crimes with DNA*"

*Jan Bashinski, Chief, Bureau of Forensic Services, CA State Dept. of Justice

This presentation will describe the status of the California "Cold Hit" program, a $50,000,000 three year Office of Criminal Justice Planning (OJCP) grant program aimed at solving suspectless sexual assault cases through maximum use of the CAL-DNA Offender Identification databank. The program is designed to eliminate the backlog of biological evidence in suspectless rape cases and unsolved sexual homicides in California. In the process, grant funds will also help public crime laboratories enhance their capacity for DNA profiling. The COLD HIT program funds inventory of cases by local law enforcement, evidence screening by public crime labs, and DNA profiling (STR) by both public and private vendor laboratories.

The status of cases will be monitored statewide via a web based tracking system, which will assign a unique OCJP number to each case. OCJP, CA DOJ and the CA DNA Consortium have worked closely together to develop technical guidelines for screening and profiling the evidence and to review grant applications from public crime laboratories. CA DOJ will provide quality assurance oversight of private vendor laboratories, will expand its training courses for forensic DNA analysts, and will be responsible for reviewing and searching unsolved case profiles submitted to its CAL-DNA databank. It is anticipated that California's crime labs will examine evidence in as many as 23,000 unsolved cases over the course of this program and will send 14,000 DNA evidence profiles to CAL-DNA for searching. A very conservative "hit rate" of 5% would predict that cold hits will be obtained on 700 of these cases. This presentation will describe a few of the cases which have already been solved due to the COLD HIT program

Conceptual Tools for Making Casework Decisions

*Kerstin M. Gleim, Forensic Scientist, Pacific Coast Forensic Science Institute, Inc., Seattle, WA

How do we make decisions about casework: what evidence to examine and in what order, what tests to use, and how to evaluate the results? All of us make these decisions daily. Doing a thorough job on a case does not mean examining everything or doing all possible analyses. But how do we make defensible decisions to choose among the possibilities? If asked how these decisions are made, for example if you were asked to write a protocol or asked to defend your decision by your supervisor or in court, would you be able to articulate the tools that you use? This paper is a summary of several formal conceptual tools that are covered in a class taught at CCI, and that can be used to make effective case decisions, with references to related literature articles.

CCI Forensic Library and SHERLOCK Database Access: A Closer Look

*Waheed Jawadi, Supervising Librarian II, LE Library Services, CA State Dept. of Justice, California Justice Department, DLE Library Services: The goal of the Division of Law Enforcement (DLE) Library Services is to serve as an information resource to meet the informational needs of California Department of Justice personnel and forensic communities. The DLE General Library and the CCI Forensic Library are part of the DLE Library Services that provides the following services:

CCI Forensic Library:

The California Criminalistics Institute (CCI) Forensic Library, formerly known as the CCI Library, has been meeting the informational needs of forensic communities and crime laboratories operated by the Department of Justice and local law

enforcement agencies in the State of California and neighboring states since November 1987.

Collection:

The CCI Forensic Library collection consists of approximately three thousand (3,000) circulating books, reports, videos in such diverse areas as: serology, toxicology, latent prints, trace evidence, questioned documents, quality assurance, microscopy, arson/explosives, controlled substances, crime scene investigation, law, courtroom testimony, forensic medicine, and health and safety. Approximately, twenty-five thousand (25,000) bibliographic citations representing books, videos and journal articles of forensic sciences are electronically cataloged.

Online Public Access Catalog:

The CCI Forensic Library collection has been cataloged into a database called *SHERLOCK,* and clients can access this database over the Internet - FREE - 24 hours a day and 7 days a week to search library holdings. Detailed search instructions, the access policy, and web based forms for requesting desired library materials are available online. A user I.D. and password is required to search the *SHELOCK* database.

Current Awareness Services:

The CCI Forensic Library subscribes to sixty forensic science journals. The library staff sends out selected journals' table of contents, once a month, to all BFS clients. Requested Articles are photocopied and sent to clients upon request as a part of current awareness services. This service will be extended to non-BFS clients soon.

Document Delivery and Inter Library Loan Services:

Interlibrary loan services are available for obtaining journal articles and borrowing books from special, academic, and public libraries for items not available in the CCI Forensic Library.

Clients:

The following forensic communities are eligible to access the CCI Forensic Library collection and the *SHERLOCK* database:

- Bureau of Forensic Services employees
- State of Calif. city and county crime laboratory employees
- Former students and visiting instructors of the CCI
- Professionals closely affiliated with the CCI
- Current CAC members
- Federal crime laboratories located in California
- Forensic communities outside the State of California

Contact:

If you have any further questions on the CCI Forensic Library services or the *SHERLOCK* database access, please contact Waheed Jawadi, Supervising Librarian II, DLE Library Services, via phone (916) 227-5994, fax (916) 454-5433, email waheed.jawadi@doj.ca.gov or by U.S. mail at: California Dept. of Justice, DLE Library Services, 4949 Broadway, Room A-107, Sacramento, CA, 95820

Effects of Dry Cleaning on Semen Deposits

*Kerstin M. Gleim, Forensic Scientist, Pacific Coast Forensic Science Institute, Inc., Seattle, WA

Do dried semen deposits on clothing survive the dry cleaning process so that a forensic scientist can 1) detect it, and 2) confirm its presence? It has been documented in the literature that acid phosphatase, the protein used to detect semen, gets washed away in water. Therefore once a garment gets laundered, a forensic scientist may not be able to detect the presence of a semen deposit if deposited before the garment was washed. Dry cleaning is another cleaning process that is used exclusively on a number of fabric types and is optionally used on fabric types that can also be washed with water. It would be useful to know the effect of dry cleaning on semen deposits. To answer the question, two rayon fabric pieces were spiked with semen from a normal spermatozoa producer, the areas marked with a waterproof marking pen, one piece sent to the dry cleaners and the other kept as a control. In Washington State, dry cleaners almost exclusively use tetrachloroethylene (also known as perchloroethylene or "perc") due to state regulations. After the dry cleaning, both fabric pieces were tested in the usual way that semen examinations are done. The results were: 1) the pen marks on the dry cleaned fabric piece were partly obliterated indicating that the fabric had indeed been through the dry cleaning process, and 2) there were no differences in the testing results for the non-dry cleaned fabric and the dry cleaned fabric. Semen deposits on both fabrics yielded strong positive results with the reagent for acid phosphatase, both had positive results with the p30 membrane test at the same dilutions, and both had 4+ spermatozoa. The dry cleaning process used in Washington State does not remove semen deposits from this type of rayon fabric; that is, it does not remove any of the target components that we in the forensic community use to find and confirm the presence of semen. Therefore, a semen deposit on a garment that has only been cleaned by the dry cleaning process may not be "dated" by its cleaning schedule without further testing the particulars of the case. Several other fabrics were tested requesting the dry cleaner to use three different levels of effort to remove the deposits: dry cleaning without any extra attention to the deposits, dry cleaning after treating identified deposits with a pretreatment soap, and dry cleaning after making an effort to remove the identified deposits. Fabrics with saliva and blood deposits were also dry cleaned. This paper will report the results.

38 vs. 357: Examination of the Bases of Lead Bullets

*Nancy McCombs, Sr. Criminalist; CA State Dept. of Justice, Fresno Laboratory

John Hamman, Asst. Laboratory Director; CA State Dept. of Justice, Fresno Laboratory

Robert Shem, AK Dept of Public Safety; Anchorage, AK

The question of whether a bullet was fired from a 38 Special or 357 Magnum firearm is one that frequently cannot be answered by the firearms examiner. Often the class characteristics that assist us in producing a list of possible firearms will contain both types of pistols. Although it has been proposed that impressions from gunpowder will be observed on the bases of lead bullets fired from a 357 Magnum firearm versus a 38 Special, this theory has not been explored to any magnitude. Both 38 Special and 357 Magnum cartridges were hand loaded with LSWC cast bullets and three common pistol powders of different particle shapes. The cartridges were fired from three 357 Colt Python revolvers of various barrel lengths. The bases of the fired bullets were examined to evaluate any notable differences in particle impressions between the two cartridge types and whether the morphology of gunpowder could be determined. Although no significant differences were observed between the two cartridge types, the impressions produced by the three powders could be differentiated. Unexpectedly, the quantity of particle impressions on the bases of the bullets dropped as the barrel length increased which suggests the impressions are occurring as a result of an external and not internal ballistic phenomenon.

An Improved Method for Imaging and Comparing Deep Ballistics Marks Using the Scanning Electron Microscope

*Erik Randich, Lawrence Livermore National Laboratory
Fred A. Tulleners, CA State Dept. of Justice, Sacramento
Michael F. Giusto, CA Criminalistics Institute, Sacramento

The scanning electron microscope (SEM) is presented as a useful alternative to the light microscope for comparison of firearms ballistic marks when the marks are deep or the surface convoluted, or when, because of illumination difficulties the marks are not observable by traditional light microscopy. In the normal operating mode of secondary electron imaging (SEI), the SEM is not particularly useful for examining the ballistic marks: however, to enhance the depth of focus (~3mm at 100X) and to increase the topographical detail, the SEM is operated at a large working distance and using the low angle backscattered electron signal for imaging. A comparison of firing pin impressions in 9mm cartridge cases imaged with the SEM and the conventional light microscope is presented. This method can be used on even the most inexpensive of SEMs.

A Metallurgical Review of Bullet Lead Compositional Analysis

Erik Randich, FMI Consultants, Manteca, CA

A comparison of minor and trace element analyses of bullet lead fragments found at the crime scene with bullets found in a suspect's possession has been used to associate the suspect with the crime scene. Ongoing research in this area has shown that the validity of this method depends on two metallurgical assumptions that may not be valid. A critical review of the interpretation of the method in light of several years of lead alloy data for .22 caliber ammunition for two of the largest ammunition manufacturers is presented. Previous interpretation of data in criminal cases by law enforcement agencies is discussed to demonstrate the possible misinterpretation of results.

Typing of DNA Recovered from Steering Wheels: Detecting Evidence of the Non-Habitual Driver

Michelle Y. Hassler, MS; VA Commonwealth University
*Jennifer S. Mihalovich, MPH; Oakland Police Dept
Mary M. Gibbons, M. Crim., Oakland Police Dept

Learning Objectives: The objective of this study is to explore whether typable DNA can be recovered from steering wheels after the vehicle has been driven by a driver who is not the habitual operator of the vehicle.

Recovering valuable probative evidence from the steering wheels of vehicles involved in crimes can be a challenge. Fingerprints are desirable. However, the recovery of fingerprints is often difficult due to the textures of steering wheels. DNA evidence may be applicable to the investigations of car-jackings, auto thefts, or any major crime involving the operation of a vehicle. The sensitivity of PCR based DNA analysis provides a unique opportunity to use minute amounts of DNA to obtain an individual's genetic profile. The primary transfer of DNA onto various objects has been shown to produce DNA profiles. The purpose of this experiment was to determine if the transfer of DNA to a steering wheel can produce the genetic profile.

Phase I of this experiment was the recovery of DNA from the steering wheels of single driver vehicles. Phase II of this experiment was the recovery of DNA from steering wheels that were driven by a person other than the habitual driver of the vehicle for a period of 15 to 30 minutes. The steering wheels were not cleaned prior to testing in order to simulate real crime conditions. The steering wheels were swabbed with sterile swabs moistened with deionized water. The entire steering wheel was tested with two swabs that were later combined into a single sample. An area on the horn was tested with a single swab. A microscopic examination of the cellular material harvested from the swabs revealed dermal cells along with a few epithelial cells. The majority of the epithelial cells observed contained a nucleus that was partially diffused within the cytoplasm and/or appeared broken. The cellular material was then digested with SDS and Proteinase K. DNA was extracted using phenol/chloroform method and concentrated with spin dialysis. The DNA was quantified by the Slot Blot (Quantiblot^{Ò}) procedure with TMB color development. The samples were amplified using the STR amplification kits, AmpFlSTR^{Ò} Profiler PlusÔ and/or COfilerÔ PCR. The template DNA target range for the amplification was one to two nanograms. Where less than two nanograms of total DNA was recovered, 0 to 1.2 ng were amplified. The PCR products were electrophoresed on the ABIÔ 310 Genetic Analyzer. GeneScan^{Ò} and GenoTyper^{Ò} software was used to analyze the data. The peak height detection parameter was set at 50 relative fluorescence units (RFU).

In Phase I, the range of the DNA yield from the steering wheel samples (n=10) was 0.6 ng to 24 ng with an average of 4.7 ng. Three of the ten horn samples yielded a quantifiable amount of DNA ranging from 0.9 ng to 8.3 ng with an average of 4.4 ng. A previous study was able to recover an average of 12 ng per steering wheel (n=6) [Ladd, C., et. al., *Journal of Forensic Science* 1999; 44(6): 1270-1272]. The recovery of DNA may be affected by the individual driver, the type of steering wheel (smooth vs. textured and leather vs. vinyl) sampled and/or the exposure of the steering wheel to other elements (heat and light).

Complete STR genetic profiles were produced in nine of ten samples from single source driver steering wheels. In all cases, the known profiles of the drivers were concordant with the profiles produced from their steering wheels. Four samples produced peak heights for all alleles above 150 RFU. Four samples showed peak heights above 150 RFU for most of the alleles. One sample produced peaks between 50 and 150 RFU. The remaining sample produced a profile with peak heights between 50 and 150 RFU with the exception of one allele at D7S820 (42RFU).

An unexpected second profile was obtained in three samples. In two of these cases, recent trips to the mechanic could be the source of the second profile. There is a clear delineation between major and minor peaks in two of the three mixtures. The habitual driver was the source of the major peaks in these two samples.

Complete genetic profiles were produced in four of the ten horn samples. Four horn samples with no detectable template DNA produced PCR product with partial profiles limited to the smaller loci. In all cases, the known profiles of the drivers were concordant with the profiles produced from their horn. The larger loci may not have been detected due to limited template DNA concentration and/or degradation. The remaining two horn samples produced no typing data.

In Phase II, the range of the DNA yield from the steering wheel samples (n=4) was 0.8 ng to 16.5 ng with an average of 5.3 ng. Two of the four horn samples yielded a quantifiable amount of DNA of 0.6 ng and 7.6 ng.

Complete STR genetic profiles (RFU>50) were produced in two of the four steering wheels driven by a person other than the habitual driver. A complete genetic profile of the habitual driver was produced in these two samples. One of the four steering wheel samples produced a partial profile (seven of the ten loci) of the habitual driver and a few loci (D8S1179, D21S11, and amelogenin) from the foreign driver. The foreign driver was the minor source in this mixture.

There is significant degradation in this sample as seen by the absence of the larger loci. The remaining steering wheel sample produced the genetic profile of the habitual driver with no contribution from the foreign driver. In some of the samples, alleles were only detected after the injection time was increase from 5 seconds to 10 seconds.

Complete genetic profiles of the habitual driver were produced in two of the four horn samples with no contribution from the foreign driver. The other two horn samples produced a partial profile (smaller loci only) of the driver with no contribution from the foreign driver. Due to the foreign driver's limited contact with the steering wheel, it is not expected that the foreign driver would use the horn enough to leave a significant amount of cellular material on it.

In conclusion, STR profiles of the habitual and limited time non-habitual driver can be recovered from steering wheels. These results reinforce the need to evaluate data of all peaks that fall near the peak height detection threshold in samples containing a limited amount of DNA.

The Guerilla Witness

*Raymond Davis, Forensic Scientist, Quantum Communications, Founder and President, Consultant Instructor to California Criminalistics Inst.

Observing students in my courtroom communication classes over the past 14 years has given me the opportunity to witness two distinct courtroom styles. One of these styles I have called the guerrilla witness. This is the type of witness who regardless of education and experience is uncomfortable on the witness stand. If given the option of mailing in their testimony or delivering it live then this type of witness would opt for the former. Whether it's the result of a lack of confidence, a fear of public speaking or just not enough practice, this type of witness is not effective in the courtroom. The second style, is the gorilla witness. This is the type of person regardless of their education and experience feels comfortable on the witness stand. These people testify from a position of confidence and seem fearless in the courtroom. They don't mind going to court and they see it as an opportunity to show their work to an attentive audience. My presentation will discuss the traits and styles of these two types of witnesses. After hearing my presentation, I want my colleagues to determine whether they're a guerrilla or gorilla on the witness stand.

The World of Questioned Documents

*Nicholas Leonard, *Joseph Merydith, Kimberly, Kreuz, Sean Espley; Questioned Document Examiners, CA State Dept. of Justice, Sacramento and Riverside

This is a capabilities presentation of the Questioned Documents Section of the CA DOJ Crime Laboratory System. Hopefully, what can be done and what cannot be done with document evidence will be made clear to criminalists and be of use to them at crime scenes so that together a team effort will be helpful to the investigator.

The CALMS Signature Project

*Mark Kalchik, Sr. Criminalist, CA State Dept. of Justice, Fresno Laboratory

Over the past two years there has been work on the California Methamphetamine Signature (CALMS) Project. As part of this investigation a procedure had to be developed for the analysis of submitted methamphetamine samples for trace impurities. After working on the samples a protocol was developed. Eighteen samples from a single clandestine laboratory operation was tested. It was found that these divided into several distinct groups, which will be discussed. These results are being compared to other samples that have been previously analyzed to determine significance. Eventually these will be entered into a database for easier searching.

CALMS: Methamphetamine Quantitation and Signature Profiling

*Marla Richardson, Criminalist, Lynn Melgoza, Criminalist, CA State Dept. of Justice, Riverside Laboratory

The precision and reproducibility data from a quantitation method for methamphetamine using Selected Ion Monitoring (SIM) by a 6890 Hewlett Packard Gas Chromatograph coupled to a 5973 Mass Selective Detector is described below. In addition, the strategy for establishing a methamphetamine signature profile for samples seized from clandestine laboratories is presented with the possible extension of this strategy to arson analysis.

Quantitative Precision: Using a Hewlett Packard 7683 autosampler we have established there is a 6% to 7% *coefficient of variation* in three repetitive injections of n =10 sample vials containing the same internal standard solution. In n = 30 injections of two different methamphetamine standard solutions the *coefficient of variation* was 0.8 % for one sample and 1.1% for the other.

Quantitative Reproducibility: We have independently reproduced the calculated methamphetamine percent in 10 of 11 clandestine laboratory samples in all three CALMS pilot laboratories. We have also been able to reproducibly determine the percent of methamphetamine in QC samples and internal unknowns to within +/- 5 % of their actual value. In addition, a sampling procedure for large seizures has been established and has demonstrated reproducible results.

The CALMS Project and Neural Networks

*Matt Vona, Criminalist, CA State Dept. of Justice, Sacramento Laboratory

The California methamphetamine Signature (CALMS) database program must be able to compare a single methamphetamine 'signature' chromatogram (or profile) against a constantly increasing database of other methamphetamine signature chromatograms. Methamphetamine signature profiles will likely never be exactly the same. Because of variations in retention times, cuts, breakdown products, and sample instabilities any software that attempts to match two samples with similar profiles must not be significantly effected by additional or nonexisting peaks (noise).

A neural network has been specifically designed to handle this situation. A brief discussion on the CALMS database and how neural networks will be implemented to solve this problem will be presented. Additionally, a multimedia/film presentation of what a neural network is and how it works, along with exemplars of their deciphering capabilities, shall be shown. Additional

forensic applications of this technology will also be suggested.

Major Breakthrough in Breath Alcohol Testing Technology

*Robert Reckers, Acting Senior Forensic Scientist and Program Coordinator for Roadside Evidential Breath Testing, Orange County Sheriff's Department – Forensic Science Service

Orange County Sheriff's/Coroner's Dept.-Forensic Science Services, a pioneer in adopting new technology, is joining the California Department of Justice as the first two agencies in the nation to deploy devices based on fuel cell technology for evidential breath testing purposes.

In July, 2000, Forensic Science Services was awarded a grant of approximately $400,000 by the California Office of Traffic Safety (OTS) to implement a portable evidential breath test (PEBT) program for DUI enforcement throughout Orange County. This 1-year grant provides for 1 position, 85 instruments, a host computer system and peripheral equipment (i.e. dry gas cylinders, an IR instrument for dry gas verification, gas flow valves for the cylinders, etc).

Bob Reckers was temporarily promoted to Senior Forensic Scientist to spearhead the program. He coordinated extensive effort to evaluate two candidate devices, both using fuel cell technology. The principle is based on the platinum black in the fuel cell, acting as a catalyst, allowing the acidic aqueous mixture of potassium dichromate, within the fuel cell, to break down the ethanol, thus generating a voltage which is measured by the device. One model, Intoximeter's Alcosensor IV-XL @ Point of Arrest, was found to demonstrate superior accuracy and precision. Furthermore, it is compact, light and user friendly.

There are numerous advantages in using PEBT's placed in patrol units over conventional stationary breath testing instruments housed in police stations/jails. Notably, PEBT is administered in the field, thus eliminating the need for the officer/deputy to transport a suspect to and from police station/jail solely for testing purpose.

§ PEBT provides evidentiary results much closer to the time of driving, and should therefore, greatly reduce the number of "rising alcohol" challenges. (i.e. Defendants arguing that their alcohol level was rising during the time lapse between driving and breath testing).

§ PEBT devices will be quality control checked by the officers using dry gas, hence eliminating FSS staff's current monthly field calls to the 25 locations to change simulator solutions. FSS will then receive the accuracy check information as well as that week's breath testing information, transmitted by the officers from the internal modem found within the AS IV XL @ point of arrest case. This accuracy check information will be analyzed by FSS staff, to ensure compliance with Title 17 of the Calif. Code of Regulations and the crime lab's specifications, which may be above and beyond the minimum requirements of Title 17.

The method and operator training protocol was completed in February and submitted to the Calif. Department of Health for approval, a process that usually takes 1-3 months. Upon approval, we will proceed with the purchase of the PEBT devices and supporting equipment as well as start operator/officer training. If all goes as planned, the deployment of the PEBT program should commence in spring, 2001. Judging from the flurry of inquiries from across the country, we believe that the use of fuel cell based PEBT's will spread like wild fire and eventually become the standard equipment throughout the Unites States. Especially if agencies reap all the potential benefits that this type of technology offers.

Comparison of Gaseous Ethanol "Dry Gas" Standards with Wet Gas Simulators for Calibration of Breath Analyzers and Their Use with EPAS Programs

*Lance D. Silverman, Ph.D., Technical Manager, Scott Specialty Gases, Inc., Plumsteadville, PA 18949

This presentation compares compressed gas ethanol breath standards (EBS®) with wet simulators for calibration or calibration checks of breath alcohol analyzers. "Dry gas" standards are being used to verify calibration in California's Evidential Portable Alcohol System (EPAS) program. After reviewing the underlying technology and manufacturing methods used to produce the standards, analytical data verifying the ethanol content of EBS gas is presented. Based on trapping ethanol in an impinger and titration using a modified California Department of Health method, the data establishes the alcohol content of EBS compressed gas by two independently NIST traceable methods. In addition, data comparing wet simulators and EBS compressed gas with commercially available ethanol breath testers is reviewed and discussed.

Taking That First Breath: Reflections on Implementing a New Forensic Breath Alcohol Program

*Katina Repp, Criminalist, CA State Dept. of Justice, Central Valley Laboratory, Ripon

Recently, the Department of Justice has implemented a new forensic breath alcohol program, EPAS – Evidential Portable Alcohol System. This program uses a fuel cell based portable breath analyzer, the Drager 7410 Plus, that can operate in a screening or evidential mode. The EPAS utilizes an ethanol/nitrogen gas reference for accuracy checks. The EPAS program will eventually be used in all the DOJ service areas as a roadside evidential breath test, a first in the United States.

This presentation will share the experiences of the DOJ Central Valley Laboratory, the first of the DOJ Labs to implement the program. The presentation will cover the experiences with Department of Health Services; the training of law enforcement personnel, attorneys, and judges; the criteria used to decide if the program was ready; make recommendations to laboratories facing a similar situation; and finally, if available, the challenges faced in court on the first DUI cases using the new instrument.

The Incidence and Persistence of Carry-Over in the Alcosensor IV

*Joshua Mateo, Forensic Scientist II, Ventura County Sheriff's Crime Laboratory

The Alcosensor IV is an unheated hand-held breath alcohol tester. Without heating, condensation from a breath sample can form on the instrument surfaces, possibly remaining present to contaminate the subsequent subject's breath test. This two-part study was designed to determine how often and how much condensation forms under specific testing conditions, and to determine how long it would last. In study 1, duplicate alcohol positive simulated breath samples were tested on instruments at 20°C and 10°C. After a 5-minute wait period, duplicate alcohol negative breath samples were tested to confirm the presence and to determine the level of carry-over. No carry-over was detected at

20°C. 80% of the time, an average carry-over of 0.007 g/210 L was detected in alcohol negative breath samples when a 0.29 g/210 L simulated breath test had been performed prior on an instrument at 10°C. In study 2, alcohol positive condensation was applied to instruments at 20°C and 10°C before a variable wait time of 5, 20, 40, or 60 minutes was observed after which alcohol negative breath samples were tested to examine the presence of carry-over. After 60 minutes, carry-over was essentially undetectable in instruments stored at 20°C and at 10°C. The condensation formed in a cold instrument from a very high alcohol positive breath test can carry-over into the alcohol negative breath test of the subsequent subject if the two tests are performed within 60 minutes of each other. False positive results such as this could negatively impact a defendant in a zero tolerance case, and therefore, a method, like an air blank, should be developed to prevent this problem from occurring

Evidential Portable Alcohol System (EPAS) Overview

*Steve Scott, Project Lead, *Michelle Salata, Criminalist, CA State Dept. of Justice, Sacramento

The California Department of Justice, Bureau of Forensic Services is committed to providing a statewide evidential portable alcohol system (EPAS) program for DUI enforcement. We will deploy 1,000 EPAS instruments for use in patrol vehicles used by the Bureau's client agencies. In addition to the instruments, the program will include technical support, training, and expert testimony to ensure the requirements of Title 17 of the California Code of Regulations for forensic alcohol testing are met. The automated design of the EPAS insures accuracy and quick distribution of results to DMV and District Attorneys through the Bureau's Statewide Alcohol Information Network (SAIN). The inherent value of this equipment over stationary instruments is the ability to provide evidential results at the time of the DUI stop. With the subject's alcohol level determined in the field, alternate transportation to the jail can be arranged keeping the officer on the street. Additionally, many of the frivolous court arguments based on doubt about the blood alcohol concentration (BAC) at the time of the stop versus time of the test will be reduced. The California Department of Justice is taking a leadership role in being one of the first agencies in the U.S. to provide this new technology for enforcing drinking and driving laws.

"GSR Mapping": The Study of Gunshot Residue Distribution of Known Firearms in a Closed Environment

*Glen Davis, Leslie L. Poole, Faye Springer, Sacramento County District Attorney's Laboratory of Forensic Services, Sacramento

A study of the distribution pattern of gunshot residue in a controlled environment with known firearms by using a grid pattern mapping technique will be discussed. The results of this research will shed light on the possibility of a non-shooter having residue on his hands by being present in the same room at the time a firearm is discharged. The firearms used include a .38 Special caliber revolver, a 9mm Luger caliber semi-automatic pistol, a .22 caliber semi-automatic pistol and a 12-guage top break shotgun.

Discrimination Value of Wear Patterns in Two-Dimensional Footwear Impressions

*Tara L. Fruchtenicht, William P. Herzig, and Robert D. Blackledge, Naval Criminalistics Investigative Service (NCIS), Regional Forensic Laboratory, San Diego

(The A. Reed and Virginia McLaughlin Fund enabled this study.)

Several areas of forensic science (including footwear impression, fingerprint, and handwriting comparisons) have increasingly come under attack in both the media and the courts as "lacking any scientific basis." Other studies involving footwear identification have used image analysis to compare wear patterns and make identifications including one study using similar equipment. However, these identifications were based largely on subjective visual observations. This study aimed to develop objective criteria based on measurements, and additionally to exclude from consideration any individual characteristics (nicks, cuts, gouges, nail holes, embedded pebbles, etc.). A total of one hundred twenty-seven male, right, mostly size ten, military boot outer-sole impressions were obtained from United States Marine Corps recruits who were at the end of their fifth week of training. Impressions were also obtained from new, unworn boots. Using video imaging and video image marker-measurement equipment, a measurement system was developed to show individualized wear patterns and the measurements were entered into a database. All the original impressions were taken away from the operator. In a blind test, twenty-six impressions were presented for measurement and comparison against the database. Some of these twenty-six impressions were from the original group (with original identification markings removed), and some were separate impressions that had been obtained from USMC recruits also at the end of their fifth week of training. A search of the database against measurements from the twenty-six unknown impressions produced impressive results. Of those blind impressions whose measurements were already in the database, sixteen fit the match criteria confirming that the correct measurements were taken and entered previously. A retrospective analysis of the six failures showed that two were due to measurement errors, two were due to original measurements being entered incorrectly into the database form, and two actually met the minimum match criteria but in the manual search of the database had been overlooked by the operator. Significantly, the data produced no false identifications. That is, none of the added impressions (not previously measured and entered into the database) fit the minimum match identified. However, six impressions were designated by the operator as "no match" despite their criteria, nor did any other series of measurements for a boot in the database fit closer or as close to the measurements of the original boot.

Facial Identification and Facial Reconstruction

***Gloria Louise Nusse, Clay and Bones Sculpture Studio, Mill Valley, CA**

There are times when it is not possible to identify a person from dental records or DNA. There may be no name to associate, the person has not been in this country long enough to establish records, or the case is just old. In these instances a facial approximation or reconstruction is one way to gather leads. Using specific points or landmarks on the skull it is possible to determine the facial features in clay. This talk will show the process from beginning to end. An incredible likeness will be established, as well as aging processes, the results for children and cases with missing mandibles. This technique is a unique blend of science and art.

California Association of Criminalists

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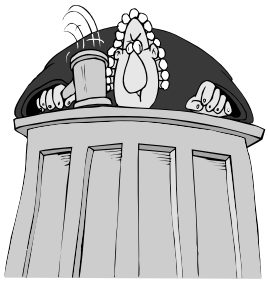

Courtroom Calamities

During a recent court appearance the defense attorney asked, "Have you ever seen someone with a blood alcohol level greater than 0.30.?" I replied, "Yes I have." He then asked, "And where was this?" I told the jurors that I had witnessed several individuals with BACs exceeding 0.30 at DUI checkpoints. His next question was: "Have you ever seen an individual with a BAC over 0.40?" "Yes", I answered. "You have? And how high was it over 0.40?" "0.44. This was a female patient in the emergency room at Santa Monica Hospital." The defense attorney then asked, "Was she a date?"

—Harry Klann LAPD Crime Lab

Deductive Reasoning

Sherlock Holmes and Dr. Watson go on a camping trip, set up their tent, and fall asleep. Some hours later, Holmes wakes his faithful friend. "Watson, look up at the sky and tell me what you see." Watson replies, "I see millions of stars." "What does that tell you?" Watson ponders for a minute. "Astronomically speaking, it tells me that there are millions of galaxies and potentially billions of planets. Astrologically, it tells me that Saturn is in Leo. Time wise, it appears to be approximately a quarter past three. Theologically, it's evident the Lord is all-powerful and we are small and insignificant. Meteorologically, it seems we will have a beautiful day tomorrow. What does it tell you?" Holmes is silent for a moment, then speaks:

"Watson, you idiot, someone has stolen our tent."

Investigator: So you found a sperm cell on the victim's rectal swab, but I still don't understand your report.
Criminalist: What is it that needs clarifying?
Investigator: Well is the suspect guilty or not?
Criminalist: Sir, I believe that is for a jury to decide.

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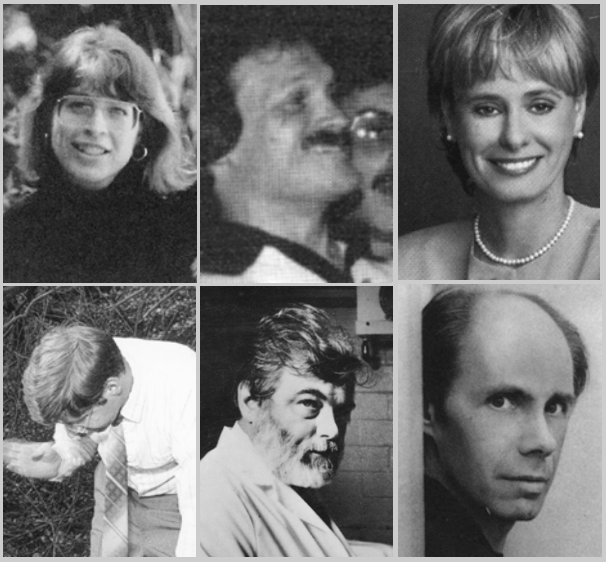
Face Game Answers

(Top row l-r) Margaret Benoit, Marc Scott Taylor, Kathy Reichs. *(Bottom row, l-r)* John Houde, John R. Feegel, Jeffrey Deaver.

Can't Find It?

To reduce the costs of publication, the *CACNews* may place calls for nominations and other items that were previously found in the newsletter mailing as inserts ON THE WEB. Visit www.cacnews.org to see what is offered. Content changes periodically, so visit often!

Ed Jones' Face Game



Fictional Criminalistics II

Try to identify these famous and not-so-famous authors and others who are associated with fictional crime scenes. *Answers at left.*

Share your favorite Tony Longhetti Story!

If you have an amusing, interesting or warm anecdote about Tony you'd like to share with the CAC membership, please forward them by Aug. 15, 2001 for the next issue of the *CACNews* to: John Simms, vis@pd.sannet.gov