California Association of Criminalists
NEWSLETTER

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Upcoming Meetings

INTERNATIONAL ASSOCIATION OF FORENSIC TOXICOLOGISTS

July 1987

The 8th Triennial meeting will be held in Banff, Alberta, Canada. For further information, contact N. Dunnett, Home Office Forensic Science Laboratory, Aldermaston, Berkshire, RG7 4PN, UK.

INTERNATIONAL ASSOCIATION OF FORENSIC SCIENCES

August 2 - 7, 1987

Vancouver, British Columbia, Canada. Contact International Association of Forensic Sciences, 801-750 Jervis Street, Vancouver, B.C., Canada V6E 2A9. 604-681-5226.

THE THIRD INTERNATIONAL MEETING OF THE PAN AMERICAN ASSOCIATION OF FORENSIC SCIENCES

August 10-14, 1987.

The conference will be held at the Holiday Inn Plaza, Wichita, KS. For further information, contact Dr. William G. Eckert, P.O. Box 8282, Wichita KS 67208.

THE FIRST WORLD MEETING OF POLICE SURGEONS AND MEDICAL OFFICERS

August 10-14, 1986

The purpose of this conference, meeting concurrently with the Pan American Association of Forensic Sciences, is to discuss and compare the medical aspects of law enforcement and policing in various countries of the world

CALIFORNIA ASSOCIATION OFCRIMINALISTS- 70th SEMI-ANNUAL SEMINAR

October 22-24, 1987

The 70th semi-annual seminar of the CAC will be held at the Irvine Hilton, Irvine CA. For further information contact Eston Schwecke, Huntington Beach Police Department, Criminalistics Laboratory, 2000 Main Street, Huntington Beach CA 92648. (714) 536-5684.

40TH ANNUAL MEETING OF THE AMERICAN ACADEMY OF FORENSIC SCIENCES

February 15-20, 1988.

This conference will be held at the Wyndham Franklin Plaza, Philadelphia, PA. Contact AAFS, 225 South Academy Blvd., Colorado Springs, CO, 80910. (303) 596-6006.

CALIFORNIA ASSOCIATION OF CRIMINALISTS - 71st SEMI-ANNUAL SEMINAR

May 19-21, 1988

The Spring, 1988, seminar of the California Association of Criminalists will be held May 19-21 at the Marriott Marina Hotel, Berkeley CA. For further information contact Charles Morton. Institute of Forensic Sciences - Criminalistics Laboratory, 2945 Webster Street, Oakland CA 94609. (415) 4512-0767.

41ST ANNUAL MEETING OF THE AMERICAN ACADEMY OF FORENSIC SCIENCES

February 20-25, 1989.

This conference will be held at the Riviera Hotel, Los Vegas, NV. Contact AAFS, 225 South Academy Blvd., Colorado Springs, CO, 80910. (303) 596-6006.

Job Openings

(Job openings are obtained from a variety of sources. Given publication deadlines and delay in receiving announcements from other parts of the country, some of the openings announced here may be filled by the time this Newsletter is received. Job announcements mentsmentsmentswill normally be run only one time. Members actively seeking employment are encouraged to contact the edi torial secretary for information about openings which become available between newsletters.)

FINGERPRINT EXAMINER

SENIOR FINGERPRINT EXAMINER

The Contra Costa County Sheriff's Office has openings for fingerprint examiners for individuals with a minimum of one year experience in fingerprint comparison and either one year in experience in fingerprint comparison or one year experience as a crime scene technician. The senior fingerprint technician requires 30 months of full time experience. For additional information contact Personnel Department, Administration Building, 651 Pine Street, Martinez CA 94553. (415) 372-4047.

LATENT PRINT EXAMINER II

The City of Phoenix has openings for experienced latent fingerprint examiners. The positions require three years experience in a law enforcement environment supplemented by formal training in fingerprints and other police identification techniques. In addition, a Associate's degree, or 60 accredited hours in Criminalistics or a related field are required. For further information, contact The City of Phoenix Police Department, 620 West Washington Street, Phoenix AZ 85003.

SEROLOGY/TRACE EVIDENCE EXAMINER

The Kansas Bureau of Investigation has an opening for an experienced examiner with a BS/BA Degree in a physical or natural science and two years experience in serology or hair and fiber examination in a crime laboratory. Salary range is $26,448 - $35,448, with the starting salary negotiable based on experience. Contact Eileen Burnau, KBI, 1620 S.W. Tyler, Topeka KS 66612, (913) 213-6000.

FORENSIC CHEMISTRY EXAMINER

The Kansas Bureau of Investigation has an opening for an experienced examiner with a BS/BA Degree in a physical or natural science and two years experience in a crime laboratory. Salary range is $26,448 - $35,448, with the starting salary negotiable based on experience. Contact Stan Heffley, KBI, 1620 S.W. Tyler, Topeka KS 66612, (913) 213-6000.

CRIMINALIST

SENIOR CRIMINALIST

The State of Connecticut, Department of State Police, has several openings for criminalists. Areas of analysis include hair and fibers, trace, blood and biological evidence, document examination, comparative evidence, and chemical identification. Qualifications for the criminalist position require a Bachelor's degree in forensic science or a related field and two years of experience. The additional requirement for a Senior Criminalist is three years of experience in a forensic laboratory. For further information, contact Henry C. Lee, Director, Forensic Science Laboratory, Connecticut State Police, 294 Colony Street, Meriden CT 06450.

POSITIONS WANTED

Criminalist with 3-1/2 years of experience, including 2 years of crime scene processing and evidence collection. Experienced in drug analysis, including GC/MS and 6 months experience in serology. B.A. - Chemistry, University of Southern Colorado. Contact Dan Green, 1433 163rd Avenue #16, San Leandro CA 94578. (415) 278-9594.

Recent graduate is looking for employment in forensic science in the U.S., particularly in California. Recently completed MSc. research project involving the extraction of opiates, cocaine and metabolites from bloodstains using solid phase extraction and GC- HPLC. MSc. - Strathclyde University, Glasgow. Contact Graeme C. Young, 2, Braidlaw park, Penicuik, Midlothian, Scotland EH26 9HF, U.K.

Recent graduate with experience in investigation is looking for employment as a crime scene analyst or criminalist. B.S. - Biology (Memphis State) and MFS - Forensic Science (George Washington University). Contact Mary Jane King, 6335 Crown Imperial Drive, Apt. 3, Memphis TN 38115. (901) 366-9873.

Report on California Association of Crime Laboratory Directors Meeting March 26-27, 1987

Eston Schwecke

CAC Regional Director - South

New Requirements For Membership In The American Academy Of Forensic Sciences - Criminalistics Section - (Togneri - WCSO)

To become a "fellow", some activity in the academy must be demonstrated. Professors may qualify for membership. To offer to serve on a committee, contact Carla Noziglia at the Las Vegas Metropolitan Police Laboratory.

Personnel Recruitment - (Kestler - LAPD)

Lists for hiring vary between agencies. DOJ lists last 1-4 years with an option for management to extend. Santa Ana PD lists last two years. LASO lists last one year. Orange County SO has a continuous recruitment program with A, B and C lists with their own managers choosing from these lists.

Only a few agencies use polygraphs as part of their hiring practices. These agencies are Contra Costa SO, San Diego SO, Washoe County SO and Huntington Beach P.D.

Legislative Update - (Cook -LASO)

Senate Bill 1036 increases fine for felony diversion from $100 to $150 and misdemeanor diversion from $50 to $100. The increase was added for lab fees and for processing. It was mentioned that in some agencies the processing was done by the probation department. The probation department indicated they would use all of the increased fine s as processing administrative costs.

California Criminalistics Institute - (Hider - DOJ)

CCI hopes to have space at DOJ Sacramento in October 1987. There is to be an open examination for five Criminalist IV positions. The broad categories for each position will be Biology, Chemistry, Impression Evidence (latent prints), Microscopy and Quality Assurance. Lou Maucieri will fill one of the five positions. There will eventually be a total of 19 positions including a librarian and lab techs. Cecil Hider, who is in charge of CCI, visited several other laboratories for comparisons. The laboratories he visited are the following:

- Illinois State Police
- Center for Forensic Science - Toronto
- Royal Canadian Mounted Police - Ottawa
- BKA Laboratories - Germany
- Scotland Yard
- Home Office Central Research Establishment

Almost none of these labs were involved in any field work. Most of these labs had separate rooms for suspect and victim clothing. Labs outside the U.S. have terrorist sections. The "generalist" concept is frowned upon by others outside of California.

The Illinois System has special training coordinators who use 5% case work in their training process. They have very specific training protocols.

The Center for Forensic Science in Toronto has seven floors with 64 Forensic Scientists. Their Criminalist II's and above must do research and prepare at least one paper per year. They exclusively use the Breathalyzer for their breath alcohol program and have no need to change.

The German BKA labs are their equivalent of our FBI labs. They are well supported with their accent on research. They make much of their own equipment. There is little or no training done at the labs because employees are hired for their specific expertise. Blood alcohol analysis is done only on blood and only by the legal medical community. Medical doctors are the only ones allowed to testify on BA's. Cellulose acetate is the only technique used for enzyme typing. Their philosophy is no starch or multisystems for typing purposes because they feel they are unsuitable, unpredictable and non-reproducible. Their Forensic Scientists must have at lease a M.S. degree and preferably a PhD. Only PhD's testify in court. Technicians do most of the work.

Excavation Techniques of Skeletal Remains and Scene Management (Suchey - Forensic Anthropologist)

A presentation of techniques used in excavation for evidentiary material including and surrounding a body. Several examples were used to show the importance of the scene. The coroner's office for each agency should have a forensic anthropologist on staff who would be available to be called out for any burial scene.

Compusketch (Sumner - Visatechs)

A computerized advance on the Identi-kit was presented. The system was developed with the assistance of Tom Macros of San Jose PD. The system runs on an Apple McIntosh by using the witnesses answers to a series of questions and then narrowing each category by picking shapes. The system contains 100,000 features including folds, wrinkles, and scars. The software alone costs $3500.00 The Total System runs $7000.00. The

total system includes the MacIntosh, Imagewriter II printer, program, one year maintenance, one year updates and installation. It takes approximately one half hour to run through the program with a witness or victim.

AIDS Prevention Techniques in the Lab (Togneri - WCSO)

When blood samples test positive for the AIDS antibody, the following labs will not analyze any of the items containing physiological materials: FBI, Center for Forensic Science, Toronto and one of the labs in New York.

Some preventative measures included laminar flow hoods, double latex gloves, disposable jumpsuits and footwear should be used. Detectives must wear disposable clothing also. Washoe County will work AIDS cases when their hoods are installed.

Legislative Matters - (Mack, Sidebothem, Kestler)

1. AB 330 - Legislative matter to force licensing of toxicology labs, however, this legislation precludes crime labs. Concern was shown here that once private labs are licensed it just a step away for public labs too.

2. Blood alcohol limit of .05 introduced and being discussed.

3. Legislation is being sought to put only cocaine base into Schedule I and all others into Schedule II.

Congress of Criminalists (Schwecke - HBPD)

The California Association of Criminalists Board of Directors voted approval to co-sponsor the Congress of Criminalists on Serology along with the Department of Justice.

Business Meeting

SB 1036 increases lab fee assessments. Re-wording was devised so that the lab fee will truly go to the lab and not for administration costs as previously mentioned through the probation department.

A logistics problem was demonstrated with a joint CAC/CALDC meeting in October. Therefore, it was voted to discontinue such a meeting. The CACLD meeting will be held in Orange County on November 12th and 13th.

A vote was taken to endorse the Congress of Criminalists meeting on Serology.

Management Style Diagnosis - (DeLadurantey - LAPD)

Self test to show the good and bad points of each person's management style.

Photophone, Pictures by Telephone - (Harwood -Video Communicators)

Image and voice sent over phone line by use of modem, computer and video camera. CCD high resolution chip camera with a 300mm lens. The disk drive memory system can hold 40-70 images on the system's floppy disk. There is a black and white limitation due to the phone lines; however, there are 128 shades of grey. Ideas for this system include photographing trace makes, serology plates or sending images from the field back to the station.

DNA Typing of Seminal Stains - (Kuo - OCSO)

Lifecodes of New York will type a seminal stain for $250 and $125 for each blood standard. The fees do not include testimony. The discussion surrounding this topic indicated that it might be too soon for the technique to be used on case samples. The feeling was due to the fact that some necessary background research has not yet been demonstrated.

CAC and FSS at IAFS in BC

Members of the Forensic Science Society who are attending the International Association of Forensic Sciences meeting in Vancouver would like to meet with members of the CAC. An informal meeting is being planned for Wednesday, August 5. For further information about this meeting, all CAC members are encouraged to check at the Forensic Science Society booth.

ANNOUNCEMENTS

Member Recognition

Distinguished Member Award - 1987

Jerry Chisum of the DOJ Modesto Laboratory was the recipient of the CAC Distinguished Member Award for 1987. Jerry was presented with a plaque at the Seminar banquet in Reno, Nevada.

In looking for candidates for the Distinguished Member Award, we look for those among us who have contributed to the profession and the association. Jerry has had a broad background as a Criminalist spanning 25 years. During that time he has worked as a bench criminalist or managing criminalist in 5 laboratories. He has always been active in providing training to criminalists and other law enforcement as demonstrated in his position as Technical Training Coordinator for the DOJ laboratory system and as a co-instructor for over 10 years in a crime scene investigation and reconstruction course. He is also involved as a coordinator and instructor for the DOJ CIRt Team which trains DOJ personnel to provide assistance to law enforcement agencies throughout the state (including crime labs). Chisum has also been active in the establishment of the California Criminalistics Institute (CCI).

Chisum has served the association for 2 terms as president, 5 years as membership secretary and one year as recording secretary. He has also served on several committees. Jerry has presented papers at association meetings and has published papers in forensic journals. He was also selected as one of four criminalists from the United States to speak at the first Chinese American Conference onPolice Science in Taiwan in 1986.

Chisum has been nominated in the past for the Distinguished Member Award which speaks highly of how others n the profession regard his contributions. His involvement is well-rounded - contributing at all levels of the profession (bench, management and law enforcement) and locally, nationally and internationally.

Outstanding Presentation Spring Seminar - 1987

David Stockwell was chosen to receive the Outstanding Presentation for his paper given at the 1987 Spring Seminar in Reno, Nevada. His presentation "An Evaluation of the Non-Equilibrium IEF System for EsD, ACP1, PGM1, AK and ADA (modification of Kou)" was a unaminous choice by the panel of judges.

The following are the comments of the judges regarding David's presentation:

1) Talk was well delivered and well organized. It showed extensive preparation.

2) Great handout, appreciated for future reference

3) Good high quality audio visual aids

4) Showed extensive research and investment in time and effort.

David will receive a Merit Award Certificate and a $100 stipend which will be presented at the 1987 Fall Seminar.

Paul Kirk Award

Nominations for the Paul Kirk Award will begin on August 1 through 31, 1987. See the attached announcement and nomination form for further details.

FORENSIC SCIENCE RBBS ON-LINE

Peter Barnett

Forensic Science Associates
P.O. Box 8313
Emeryville CA 94608
(415) 653-3530 (voice)
(415) 653-3719 (data)

A Remote Bulletin Board System (Forensic-RBBS) is now available to CAC members and other forensic scientists. For those unfamiliar with a RBBS, it is a computer which can be called from another computer equipped with a modem (300-1200 baud). The RBBS system which is operating allows uploading and downloading of software, message facilities (leave a message for everyone or another user), questionnaires, bulletins, etc.

This RBBS is not meant to replace the many fine RBBS's dedicated to computer enthusiasts. If you are interested in downloading general public domain software or playing games, call one of the bulletin boards devoted to that purpose. (You can download a list of these from Forensic-RBBS by reading the bulletin menu and selecting the appropriate listing and capturing the file as it is printed on your computer's screen.) Forensic- RBBS has a couple of public domain (e.g., Shareware) programs that are highly regarded - PCOUTLINE(tm) and HOMEBASE(tm). PCOUTLINE is a very flexible and easy to use outlining program that is better than any on the market. HOMEBASE(tm) is a desktop utility which is far more useful than SIDEKICK(tm), and cheaper. The shareware versions of both of these programs can be downloaded for review.

Also available are copies of the latest CAC Seminar abstract (you could have had these a month ago rather than waiting for this newsletter), job announcements, meeting dates, etc. Efforts are underway to obtain software which is specifically useful for forensic scientists. By the time this newsletter is received, several ballistics programs will be available. Some will be "demo" versions and others will be full fledged programs that will require payment in order to download. Descriptions and demonstrations of the capabilities of these will be available. Check the bulletin menu for further information.

Anyone who has software they would like to share, or suggest some to be obtained, please leave a message for the SYSOP (use the 'C' command at the Main menu when you you are logged on).

RBBS-Forensic is available from 6:00PM to 8:00AM, Monday through Friday, and 6:00PM Friday through 8:00AM Monday. Attempts are underway to obtain funding so that a dedicated computer can be obtained so that we can be in operation 24 hours a day. If you need to call during the day, call me over the voice number, above, and arrangements will made.

To call, set your modem (300-1200 baud) to 8 bits, no parity. If you are a PC-Pursuit subscriber, you may call through the San Francisco node (DIAL415). If you have problems, call me directly or leave a message.

Northern California Drug Study Group

The Past Two Years

Ken Fujii

Contra Costa Sheriffs Department
Criminalistics Laboratory
1122 Escobar Street
Martinez CA 94553

The Northern Section Drug Study Group has been active for about two years. A brief summary of the Study Group activities follows:

DOJ-San Rafael - July 18, 1985

Loren Dunham of Hewlett Packard demonstrated the GCMSD (Gas Chromatograph - Mass Selective Detector) and its application to fentanyl analysis.

Contra Costa County - July 26, 1985

Tom Abercrombie and Ken Fujii pointed out the hazards encountered and errors made while processing Fentanyl drug laboratory scenes.

DOJ-San Rafael - September 23, 1985

Linton von Beroldingen and Mike Potts gave a presentation on Methamphetamine labs including scene process-

ing, sampling, disposal of hazardous chemicals, safety, and a unique analysis of precursors.

DOJ- Santa Rosa - December 14, 1985

Hands on synthesis of Methamphetamine via the phenyl-2-propanone (P2P) route. Set up and demonstrated by Linton von Beroldingen. "Danny the Cooker" and "Rock Cocaine" were viewed during cooking periods.

San Mateo County - February 6, 1986

Andy Allen of DEA, San Francisco, spoke about hydrogenation of ephedrine. He explained how optical isomers can be split 60:40 or 99% depending on synthesis route. He also described production of P2P as a side product of hydrogenation, confirming Tom Abercrombie's observation reported at the CAC seminar in Los Angeles.

Contra Costa County - March 20, 1986

Deputy District Attorneys from several Bay Area counties participated in a roundtable discussion of drug labs in the courts. Of particular interest was the amount of lab work needed to prove 11383 and 11379.6 H & S charges for arraignments, preliminary hearings and trial.

DOJ - San Rafael - April 24, 1986

Mike Potts and John Yoshida gave a report on the Hazard Appraisal and Recognition Plan (HARP) training they received at DOJ. HARP is a program for evaluating and cleaning up chemical spills with emphasis on safety. The application of HARP techniques to clandestine drug lab processing was reinforced. HARP is a function of the State of California Department of Health Services, Toxic Substances Control Division. Direct inquiries to Mark Pheatt or Simone Brumis at (916) 324-1807.

CAC Spring Seminar, Concord - May 14, 1986

Geographic distribution of solid dosage drugs and clandestine drug labs - numerous technical tidbits exchanged during this survey.

HARP training was discussed. Contra Costa County's clan lab protocol (Draft) was distributed. Tabulation of drug analysis methods distributed.

San Mateo Police Department - June 27, 1986

Richard Schorr and Ken Fujii reported on the recent DEA Designer Drug Leadership Conference.

Local Drug abusers were reported to be exhibiting symptoms of Huntingtons Chorea.

Commercially available collection of MSDS displayed.

Report that DOJ's Drug Lab safety protocol is progressing.

Packets of analytical methods from the Southern Drug Study Group were distibuted.

Dinner Meeting - Aug. 26, 1986

Dr. Darryl Inaba, Dr. of Pharmacy, Associate Profesor of Clinical Pharmacology, U.C. Medical Center and Director of the Haight- Ashbury Free Medical Clinic spoke of drug abuse in San Francisco. Dinner arrangements by Lance Gima.

Safety Data Sheets for Janssen Products (Alfentanil-HCl, Sufentanil Citrate, Carfentanil Citrate, Fentanyl Citrate, Lofentanil Oxalate) were distributed. These data sheets were also sent to DOJ laboratories, the Southern Drug Study Group and Professor Shulgin. Additional copies are available from Ken Fujii.

DOJ - Eureka - September 5, 1986

Ken Fujii reported on HARP training and the proposed DOJ-BSF-BNE Clandestine Drug lab protocol.

Toby Baxter discussed his findings at a recent, large scale Ephedrine-red phosphorus laboratory,

Report on a burned out HI-red phosphorous lab where fumes from a phosphorus compound passed through organic-acid vapor respirator cartridges. A garlicy odor was detected, nausea and abdominal tightness were experienced.

A Confirmed synthesis of P2P from lead acetate and phenylacetic acid was reported.

Santa Clara County - October 23, 1986

A report on the Clandestine Lab Safety Panel at CAC Seminar, Palm Springs, was given.

The latest DOJ and LAPD drafts were discussed, and HARP forms and the LAPD draft were distributed.

Ephedrine - red P, HI labs:

-found as far north as Eureka

-3 deaths at LAPD scene, flash flames in condensor

-DEA had a fire when glassware broke while packing barrels for disposal.

-Phosphorus compounds are toxic, must use SCBA's respirators won't work.

Legal Updates - bills in the works:

- AB4145, Narco fund cut 5%, shared with "We-Tip" programs.
- AB2692, DOJ clan lab Enforcement Program assist State and local agencies.

- AB4198 requires sampling each container of hazardous chemicals.

- AB1960, Cocaine Freebase will become Sch. I.

DOJ has presented the study group with three video tapes:

1. 1986 COC on Clandestine Laboratories, Personal Safety Equipment (1 hour 53 minutes)

2. CAL-OSHA Respiratory Requirements and Respiratory Equipment Demonstration (3 hrs 20 minutes).

3. Worker Right to Know (HARP) and MSDS.

Lance Gima retired as co-chairman of the Study Group, anyone wishing to co-chair the group contact Ken Fujii.

Oakland Police Department - May 27, 1987

Ms. Patricia Payne, M.S., C.I.H. of Cal/Osha would require at a clan lab scene. She used the Information Memorandum issued by Bill Krycia as an outline.

Ms. Payne felt that all potential toxics should be screened for prior to working a clan lab scene. She also reocmmended that an Industrial Hygenist not a Criminalist should conduct the environmental testing.

Ms. Payne is no longer with Cal/Osha, but that office is:

CAL/OSHA Consultation
Department of Industrial Relations
5801 Christie, Suite 485
Emeryville, CA 94608
(415) 658-0900

William Krycia may be contacted at:

State of California
Department of Industrial Relations
Division of Occupational Safety & Health
2422 Arden Way, Suite 53
Sacramento, CA 95825
(916) 920-6123

Contra Costa County - April 9, 1987

Ms Jennifer Tacheria, Chief, Office of Legislation and Regulations, Toxic Substances Control Division, State of California, Department of Health Services was the guest speaker.

Proposition 65 requires reporting environmental contamination at clan lab scenes to the County Board of Supervisors and the County Health Department by "Designated Employees". Failure to comply is a felony, 1-3-5 yr, $25,000 fine and loss of all government benefits. County Counsel can determine who the Designated Employees are.

DOHS has Superfund Money for drug lab cleanup. It is available if: County population less than 1.25 million, and the drug lab raid is unplanned and /or presents a hazard to a highly populated area.

Response to questions:

-Yes, each container of hazardous chemical must be sampled - AB4198

-SB2167 -Clarifies the role of local health department to dea with the drug lab premises.

New Bills in the works:

-AB1975 - Changes 2 oz to 1 oz in 11479 H & S. Report hazardous chemical from drug labs within 72 hours to DOHS or County Health Department. State and local agency authorized by DOHS must take remedial action for hazardous substances at drug labs.

-AB2503 - Law enforcement notify local health officer of seizure of drug lab. Health officer undertake corrective action or notify DOHS. DOHS will cover costs of immediate corrective action if a drug lab, or a roadside dump not caused by owner of property.

Old Business:

- 2 or more cookers die at HI red P labs.
- Chemical Properties of Phosphorus handed out
- AB111 adds ephedrine, pseudoephedrine, norpseudoephedrine, and phenylpropanolamine to reportable list, as of April 1, 1987.
- Nick Stumbaugh distributed "CHEMICAL SAFETY: A FIELD GUIDE".

CAC/NWAFS seminar - May 13, 1987

The Drug Study Group held a meeting at the CAC/NWAFS seminar in Sparks, Nevada. Representatives from seventeen laboratories attended including: NIS-Hawaii, NIS-San Diego, Orange County Sheriff-Coroner, Los Angeles County Sheriff, DOJ Fresno, DOJ Salinas, San Mateo County Sheriff, DEA San Francisco, Contra Costa County Sheriff-Coroner, Las Vegas Police Department, Crime Lab-Seattle, Washington State Crime Lab - Seattle, Washington State Patrol Crime Lab, Montana Crime Lab, and RCMP-Vancouver.

Each laboratory was asked to respond to the following survey questins:

1. Clandestine drug laboratories:
   What is being manufactured?
   By what routes?

2. Drug Analysis:
   What drugs, combination of drugs?

What cutters?

3. Analysis problems:
eg. Cocaine freebase cut with procaine or benzocain

4. Has anyone recovered the costs of investigating a drug lab case?

5. Has anyone shared in asset seizure?

6. What new defense strategies or problems in court?

It's no surprise that the majority of clandestine drug labs are manufacturing methamphetamine. There are a few PCP labs and even fewer MDA. In Los Angeles there are reports of mobile labs. Southern California has the highest density of clan labs. The most popular rout is HI-red P/ Further North in Fresno, the labs are less frequent, but the synthesis routes include both P2P and HI, with more HI. Fresno also reports truck trailers full of mushrooms and the synthesis of P2P using CaO, phenylacetic acid and acetic acid. This method has also been reported in Santa Rosa. DEA-SF reports many meth labs, including P2P via phenylacetoacetonitrile, hydrogenation of P2P-methylamine and cocaine freebasing in a Mr. Coffee. Northern California has fewer labs and most of them are using the P2P route, although labs using HI are found. Washington and Oregon labs employ lead acetate to produce P2P. They also report isolated use of thionyl chloride and HI-red P and one MDA lab. There are fugitive cookers from California via UPS in heat sealed bags. The courts there are very lenient with drug cookers. Vancouver reports use of the lead acetate, P2P route, MDA mushrooms and hydropoic marijuana with 10-13% THC. Montana and South Dakota report little drug enforcement because of low population density. Hawaii reports no clandestine laboratories.

Drug case work generally consists of methamphetamine, cocaine, marijuana, tar heroin, PCP, LSD and mushrooms. Throughout most of California cocaine freebase predominates over Coc-HCL, Washington 50% feebase-50 Coc-HCL, Canada no freebase. Marijuana predominates in Hawaii, cocaine next, just starting to see crack. Maui is the cocaine capital of the islands. In the military meth is most prevalent, LSD second, urine screens do not detect LSD. Cutters are the same everywhere, sugars, starches, niacinamide (probably Vitablend) and uncontrolled caines. If anyone encounters "Kryptonite" (150mg MDMA, 25 mg LSD) notify Tom Abercrombie (714) 782-4170. Vancouver reports bulk heroin (6%) from S.E. Asia, also #4 white powder heroin 70% pure (#3 is cut with caffeine) and heroin freebase, 30-40% for smoking, sold in decks (binles). Puffs" Coc-HCL in marijuana and kilos of cocaine in casting material wrapped with a fiberglass tape. Fentanyl seems to have vanished, except for 10-15 per month in San Diego, sold in ballons as heroin.

Various suggestions were offered for the analysis of cocaine cut with another caine including TLC in Clarke; perchlorate ion pair reported by John Hartman at CAC Seminar, use sulfuric acid and sodium bichlorate, extract with chloroform, 90% of the cocaine goes with the sulfuric acid; column chromatography 1M, KNO3, IN HN03, celite column. TLTD or Cobalt as a separation step, run IR on the Pt ppt.

No one has recovered costs of investigating a drug lab case.

Only a couple cases of asset seizure. A very sophisticated lab was busted in Stockton, California. The instruments seized include NMR, IR, etc. Another lab is using the portable generator seized as evidence.

CAC MERCHANDISE

Show your colors (or colours) - at home, at work or at play. Be the first (and probably the only) person on your street to have one of these. Limited stocks on hand at CAC Seminars and by mail (via John DeHaan ATF). Special order items and colors available on request. All CAC clothing items bear a specially embroidered emblem. These goodies are offered to you at cost, so you won't find a better deal.

The current offerings are listed here. if you would like to see a particular product offered, contact John DeHaan or Grady Goldman.

Sweatshirts- various colors (50/50 blend): $10.00

Hats (one size fits all, mesh and foam, various colors with white: $5.50

Patches: CAC logo only, black-on-white: $5.00

Golf Shirts (Hanes Cotton-Polyester, short sleeve): $15.50 Available in: black burgundy, slate grey, eccru, navy, kelly green, red, yellow, light blue, siler and white

Sweaters (long-sleeve acrylic pullovers): $17.50

Challenges to Forensic Serology

CAC Provides Technical Assisstance to the California District Attorney's Association in the Preparation of an Amicus Curiae Brief in the Case of People vs. Kevin Cooper

[Reprinted below, and prefaced by an introduction by CAC President Faye Springer, are the three documents prepared by CAC members to assist the CDAA in their preparation of the Amicus Curiae brief. The entire brief can be obtained by contacting the editorial secretary. There will be a nominal charge to offset the cost of reproducing this document.]

Introduction

Faye Springer

Kevin Cooper was convicted in Southern California of four homicides and one attempted homicide. The death penalty was imposed. Among the evidence in this case were bloodstains. A Kelly/Frye hearing was conducted in May 1984 and subsequently the blood evidence was admitted. This hearing was before the appellate decision in People vs. Brown and the Young decision in Michigan. The Deputy Attorney General handling the physical evidence considerations for the State of California in the appeal of this case to the Supreme Court of California expressed concern that some issues raised in Brown and Young were not addressed in Cooper's Kelly/Frye hearing. For this reason, contact was made with the California District Attorney's Association to see if they would sponsor an Amicus Brief. The California Association of Criminalists would provide the technical support for this brief. A committee of Jim White, George Sensabaugh, and Faye Springer was formed to work on this project. The three documents which follow are the generated by this committee as the technical support for the Amicus.

GENETIC TYPING OF BIOLOGICAL EVIDENCE

Comments for the Cooper Amicus Brief

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THE SCIENTIFIC ISSUE

At the outset, it is important to distinguish between two questions:

a. Can genetic typing be done reliably on biological evidence samples?

b. Is this genetic typing being done well in the nation's crime laboratories? The first is the basic Frye question: Posed in Frye terms, is it accepted within the scientific community that genetic typing of evidence samples can be done? This is a question of what is possible and what is not; it has to be answered from a broad base of scientific knowledge and experience. The question does not imply that genetic testing has to be easy or error free.

The Brown and Young decisions appear to confuse the two questions, implying that if errors are made (or, strangely, if practitioners are concerned about the possibility of error) then the principle must be in question. This is equivilant to questioning the principle of photography because people sometimes do not get good photographs or questioning the internal combustion engine because people have auto accidents.

Another point that needs to be made clear is that the critical issue in this matter is the survival of the genetic markers in evidence samples, not the methodology used for typing. The typing methods used in forensic serology are not significantly different from those used in other scientific fields for the typing of laboratory samples. The question is whether a genetic marker survives in an evidence sample; if it does, then it can be typed. If the marker does not survive, then it can not be typed no matter what method is used. The key point is that marker survival is a function of the chemistry of the marker, not the method used for its detection. The Brown and Young decisions seemed hung up on methodology and this needs to be corrected.

Brown and Young were particularily concerned with genetic typing by electrophoresis. The genetic markers included in this category are the red cell enzyme markers, the blood plasma protein markers, and the enzyme markers present in semen. All of these markers are proteins. The other major group of genetic markers used in forensic work are the markers typed by immunological methods. This group includes the ABO blood group markers which are carbohydrate in nature. Proteins and carbohydrates differ in their chemistry and only the protein markers will be discussed here in any detail.

The assertion that genetic markers can be reliably typed in evidence samples is based on two bodies of evidence:

a. basic knowledge from biochemistry and other scientific fields, and

b. the cumulative experience of workers in forensic science and other fields.

THE GENERAL SCIENTIFIC BASE

Basic biochemical concepts.

A protein can be conveniently represented as a string of beads. The beads are chemical entities known as amino acids. Twenty different amino acids are found in proteins; most of these contribute no electric charge to proteins but some contribute a positive charge and some a negative charge. The sequence of amino acids in a protein is determined genetically; the sequence is a direct translation of the DNA of the genetic material [1]. Thus, the net electric charge on a protein is determined genetically.

Some proteins exist in genetically variable forms. Most genetic variation of this sort results from a single amino acid difference in the sequences of the variable forms. That is, the variable forms are identical in sequence except at one amino acid position. The amino acid difference may result in a charge difference between the forms. In this case, the charge difference between the forms can be detected by electrophoresis. Again, the key point is that the charge states of the variable forms are genetically determined.

The sequence of a protein also determines other properties: the folding structure of the protein, its function, and, importantly, its stability and chemical reactivity [2]. The key point is that the chemical properties of proteins are definable; how a protein will behave in any particular situation is determined by the general rules of protein chemistry and the specific chemistry of the protein. The significance of this is that the large body of knowledge and experience of protein chemistry is pertinent in considering the forensic issue at hand.

What protein chemistry tells us about proteins in evidence samples.

Most biological evidence samples exist in the form of dried stains, e.g., blood stains, semen stains, etc. Thus, protein structure and stability in the dry state is a critical issue. This area has been well explored by biochemists [3]; the interaction of molecules with water is a major research topic in biochemistry. The key lesson is that proteins are exceptionally stable in the dry state. The reasons for this are several: (1)Microbial degradation does not occur in dried material; microbes and microbial degradation reactions require water. (2)Spontaneous degradation is negligible; these reactions also require water. (3)Most chemical modification reactions are slowed to a negligible rate. Chemical reactions require a fluid medium so that the reactants can move into contact with each other; the only reactions that can occur in the dry state are those involving reactants already in contact with each other. (4)Stability at high temperatures is greatly enhanced. Thermal inactivation results from vibrational movement within proteins; in the dry state, this movement is restricted. (5)Once dry, proteins are resistant to organic solvents such as alcohol and gasoline; proteins are not soluble in suchsolvents and do not interact with them chemically.

The stability of proteins in the dry state is well recognized in the practical world. Foods have been preserved by drying for many centuries, principally to protect against microbial degradation. One has only to think of the comparative stability of liquid milk (even in the refrigerator) and dry milk to appreciate this phenomenon. Food chemists have extensively studied protein stability in the dried state and much of what we know of the practical aspects of this come from their studies [4]. Examples abound in other fields as well. Vaccines and other protein based medical products are often prepared dried for long term stability. Blood samples which are required by law to be collected for postnatal testing are dried for shipment to testing laboratories [5]. Similarly, research laboratories such as the Center for Disease Control often ship blood samples from the field in the dry state [6]. Thus interest in dried proteins is not at all unique to forensic science.

Brown and Young seem to accept the contention of the Brown Amicus brief that dried biological evidence samples are somehow significantly different from other dried biological materials in that the former are "possibly contaminated, exposed to unknown environmental conditions, and have uncertain histories". Apart from the fact that the contention that there is a difference is wrong, it misses the point. Biological samples in the dry state, whatever their background, are effectively preserved because the deleterious effects of contamination and variable environmental conditions are neutralized.

Can a protein genetic marker change through chemical modification, environmental exposure, or contamination so that it appears to change genetic type?

The possibility of this occuring is severely constrained by the realities of protein chemistry. The speculative uncertainties of Brown and Young simply don't stand up to a critical look. To see why this is so, we must look at the different kinds of possible deterioration reactions and their consequences:[7]

Chemical Modication

Chemical modification can occur rapidly only in wet and liquid samples; chemical reactions in dry materials are slow and self-limiting. More significant, only a restricted category of chemicals can react with proteins and these are rare in the environment. Consider: our interior and exterior body surfaces are protein and if reactive chemicals were common, we would know it. Even if a protein were to be chemically modified, the kinds of modification chemically possible produce characteristic changes and would be readily apparent. Experimentally, the usual consequence of protein modification is loss of function; chemically modified enzymes loose activity and become undetectable. With regard specifically to the genetic marker enzymes in red cells, Dr. R.A. Fisher testified in Young that efforts to change electrophoretic mobility by chemical modification invariably resulted in loss of enzyme activity; these experiments were never published because the results are in accord with biochemical expectation and hence are not interesting.

Environmental Exposure

Environmental exposure, that is, exposure to light and temperature extremes, has relatively little effect on dry proteins; proteins in liquid solution are affected much more. Regardless of protein state, the consequence is inactivation resulting in a loss of detectability.

Microbial Contamination

Contamination by microbes will have an effect only if the degree of contamination is significant. All surfaces have microbes on them but at a relatively low density. If the microbes have something to grow on, i.e., moist biological material, then they can grow to high densities. Microbes can not utilize dry materials, even if the material would be a growth medium when wet. Under the best growth conditions - a warm humid environment and an artificially rich medium - it takes ten or more hours for microbial growth the achieve significant densities; microbial growth is slower on natural materials such as blood. When microbial growth does reach significant levels, it is manifest in the appearance and smell of the sample; we have all seen and smelled meat that has gone off (a piece of meat is no different biochemically than a pool of liquid blood) and this level of contamination is lower than that having an effect on the protein genetic markers. Thus basic microbiological considerations tell us that microbial contamination is not a significant problem with evidence samples; most evidence samples dry long before microbial growth reaches significant levels and those samples that do sustain substantial microbial growth are recognizable. What are the consequences of significant miocrobial growth if it does occur? Microbes grow by digesting nutrients in their growth medium. Digestion of proteins breaks them down to their constituent amino acids. Thus the protein genetic markers would be destroyed; they would become undetectable. If the microbial contamination level was very high, tests for the human genetic marker enzymes might detect microbial enzymes with the same functional activity. There is a substantial literature on enzyme electrophoretic markers in microbes [8] and this literature shows (a) microbial enzymes do not have the same electrophoretic mobility as the corresponding human enzymes, and (b) the electrophoretic banding patterns are different in appearance. Thus there is virtually no chance that microbial enzymes would be confused for the human genetic marker enzymes.

Other Body Fluids

Contamination with other body fluids has been suggested as a problem because it might result in chemical modification or degradation. As noted above, chemical modification is on chemical principle exceptionally unlikely to cause a change that would make one genetic type look like another; degradation results in marker loss.

Sample Mixture

Sample mixture, such as would occur if bloods from two different individuals were mixed, gives electrophoretic typing patterns that are composites of the patterns that would be given by the individual samples. For some genetic markers, composite patterns cannot be distinguished from one or another genetic type and, were the mixture not recognized, an incorrect typing call might be made. However with other genetic markers, the composite patterns are distinctly different from any individual type and the occurence of such types sends up the warn-

ing flag that a sample mixture exists. In the case of sample mixtures involving human and non-human sources, the existence of the mixture can be readily recognized from the appearance of the electrophoretic patterns since the mobilities of non-human proteins usually differ from the mobilities of human proteins.

In conclusion, the suppositions of what might happen in evidence samples do not stand up to biochemical scrutiny. The suggestion that we know little about contamination effects is false; we know quite a lot from protein chemistry, food science and other fields concerned with protein preservation. Moreover, the intimation that "anything" could happen to markers in evidence samples is false; the fate of markers is determined by their chemistry and only certain kinds of modifications are possible. Markers do not randomly change type.

THE FORENSIC APPLICATION

Validation of markers

As noted at the beginning, the critical validation is the validation of the markers, not of methods. The validation process for protein markers was outlined two decades ago by Culliford [9]. The first stage of marker validation is to study the behavior of the marker in blood stains under a variety of relevant environmental conditions, e.g., stain wetness, temperture, different surfaces, etc.; the objective is to learn how long the marker persists in stains under different conditions, to characterize patterns of deterioration, and to determine whether types are likely to be confused in stain samples. It is usually found either that a marker survives in typable form or that it does not survive at all; this, of course, it what one would expect on basic protein chemistry considerations. The second stage is blind trial testing by experienced analysts; errors indicate that the marker is not ready for use on case samples. The third stage involves the testing of case samples for which the genetic type can be independently ascertained; the results of this testing is not reported in case reports. The objective of this stage is to determine whether there is anything more to be learned about marker behavior in case samples that has not already been learned in the experimental studies. The forensic experience is that marker behavior in case samples very rarely differs from the experimental studies. The testing of case samples for which the genetic origin is known independently provides continuing validation.

Cautionary concerns

Critics of genetic typing in evidence samples have made much of cautionary statements that appear in the literature; the implication is that a cautionary statement masks an indeterminant source of error. In fact, the converse is true. Cautionary papers bring to attention potential sources of ambiguity (in some cases more theoretical than real) with the objective of reducing the actual risk of error. These papers provide signposts to alert analysts to specific potential concerns in the same way that highway road signs are intended to alert drivers to specific road conditions: One should always be careful but under certain conditions one is advised to look out for specific things. Cautionary papers almost universally originate from crime lab practitioners and none are intended to be proscriptive; rather the ultimate goal is to improve the overall state of practice.

Parenthetically, it should be noted that the Brown decision incorrectly characterized the alteration of phosphoglucomutase patterns in semen contaminated with saliva as a "false positive"; the authors described the altered patterns to illustrate a pathway of deterioration, not to proscribe PGM typing of semen evidence.

International acceptance of genetic marker typing in evidence samples

Virtually every major crime laboratory in the world tests for the same suite of genetic markers in evidence samples. Validation of this suite has been carried out with many different variants of the same basic electrophoretic technology; this demonstrates among other things that the technological variation is not all that relevant. The Gaensslen Sourcebook [ref. 1] provides hundreds of references documenting the worldwide acceptance. Indeed, it is a source of some amazement abroad that U. S. courts are questioning this.

Challenges to the validity of stain testing

The Brown amicus brief argues that there is a difference between laboratory prepared stains and case stains; knowledge gained from studies on the former do not necessarily extend to the latter. Jonakeit contends that there is no way to validate tests done on unknowns since the truth of the results can never be checked. Juricek suggests that lack of knowledge about any variable renders testing potentially unreliable.

All of these contentions deny the validity of scientific experiment as a pathway to knowledge. (Indeed, in a general philosophical sense, they deny the possibility of gaining any knowledge from experience.) A major component of scientific experimentation is to distinguish relevant variables from irrelevant ones. Significant relevant variables make themselves known: If overlooked, then experimental results have a nasty way of being incompatible with the real world phenomena the experiments were designed to model. The relevant variables affecting the survival of the protein markers can be predicted on the basis of their chemistry; that markers in case samples behave just as the experimental studies predict in the vast majority of cases is evidence that the relevant variables have in fact been taken into account. This is not to say that we know everything about stains or even that we know everything it would be good to know;

we do, however, know enough to know that genetic typing of evidence samples is fundamentally reliable.

THE PROFICIENCY ISSUE

The proficiency trial results have been purported to show that use of "inappropiate and unreliable procedures and methods" are resulting in an unacceptable rate of error in biological evidence analyses [Brown amicus]. This representation of the proficiency trials and the trial results is selective and misleading.

The purpose and structure of the trials

Since 1978, the Forensic Sciences Foundation (FSF), the service arm of the American Academy of Forensic Sciences, has sponsored a proficiency trial program. This program, like those sponsored by other professional organizations (e.g., the American Society of Clinical Pathologists and the American Association of Blood Banks), is designed to be used by participating laboratories for quality assurance monitoring. These test programs have the same essential features. At periodic intervals, sets of samples are sent to the participating laboratories; the samples are often prepared to pose some particular analytical challenge. The laboratories may use these samples however they wish; there is no obligation to return analytical results back to the parent organization since the objective of the testing is laboratory self-monitoring. Laboratories making errors are expected to ascertain the source of the errors and to take effective corrective action. The FSF proficiency trial program is endorsed by the American Society of Crime Laboratory Directors (ASCLD) and 135 crime laboratories are currently enrolled in the program. The ASCLD laboratory accreditation program recommends participation in a proficiency test program; it requires that starting analysts must pass a proficiency test series before they begin case work.

Proficiency trial error rates

Analysis of the results of all but one of the proficiency trials up to mid-1986 reveals the following findings. 7827 electrophoretic typing tests were reported of which 189 (2.4%) were in error. Of these, 88 errors were made by laboratories that made three or more errors in the particular trial; these laboratories clearly have serious problems. Removing these errors from consideration, we have left 101 errors for a rate of 1.3%. That typing problems appear to be concentrated in a few laboratories is evident from another statistic: on the average, 78% of reporting laboratories were error-free with regard to electrophoretic testing (table 1).

These figures compare favorably with proficiency estimates from other fields. The error level on ABO blood group typing in clinical labs is in the range of 0.5 - 2 % [10]. For electrophoretic testing in genetics labs, the error rate estimate is 0.19 - 0.32 % [11].

In conclusion, the proficiency trial results show that most labs are performing well with regard to electrophoretic testing. The legitimate concern of the courts for quality assurance in crime laboratories is appropiately dealt with on a case-by-case basis.

OTHER COMMENTS

Genetic marker testing does not identify a unique individual as the source of an evidence sample. Rather, genetic marker testing defines the characteristics of a population of individuals, any one of whom could be possible sources of the evidence sample. Individuals not matching these characteristics are eliminated as possible sources. Obviously, the value of genetic testing is its power to eliminate and, indeed, genetic markers are evaluated by their "discrimination potential" [12].

Before any tests are done, all individuals are included in the population of possible sources; each successive test reduces that population by the elimination of non-source individuals. Thus an individual placed in the large "included" population at an early stage of testing may be excluded subsequently as further testing pares away at that population. For this reason, it is important in presenting genetic evidence to indicate the size of the "included" population; this gives an indication of the weight to attach to the inclusion. These points were, I hope, well covered in the Cooper Frye hearing.

Consequences of Error. The effect of an error in genetic typing is to exclude the true source of the evidence as the source. It is possible that a non-source individual may by chance appear in the population of included individuals; the probability of this is simply the probability of any non-source individual being included in this population, that is, it is the probability of picking a person at random with the detected genetic profile. If there has been a reasonable degree of testing, the chance of a random individual matching any particular genetic profile is rather remote.

"Reliable" means "not prone to error". Some of the rhetoric surrounding this issue seems to assert that if a typing result is not obtained on almost every try, the methods are "unreliable" and, by implication, those results that are obtained are also "unreliable". It ought to be obvious that getting no result is different than getting a wrong result. Tests that frequently yield wrong answers are unreliable tests. Tests that give true answers are reliable even if they give results only a portion of the time.

Technicians vs. scientists. In some of the decisions, crime lab personnel have been characterized as technicians. It is important to make clear the distinction between the role of a technician and the role of a scientist.

Technicians perform tasks following strict protocols and under the supervision of a supervisor. They have no authority to alter protocols nor latitude to exercise judgement. They are little more than robotic extensions of the supervisor who sets protocol and policy. The job definition of the forensic analyst includes being able to do a preliminary assessment of the evidence as it is received, determine what legal and/or investigative questions must be answered in the framework of the case, and develop analytical strategies to get at those questions. The analyst must do the analyses or assign them to someone else and, based upon the existing body of knowledge and experience, must interpret the analytical results. Finally, these results must be explained in an impartial and non-technical way to police, attorneys, and the triers of fact. In short, the forensic analyst bears a substantial burden of responsibility for knowing what to do, how to do it, and for the final work product. The Young court seemed to hold the misguided belief that a higher degree (e.g., Ph.D.) is requsite for status as a scientist or, perhaps, that without a higher degree one can't be any more than a technician. A scientist is someone who does science, regardless of degree attainment. Better criteria are the responsibilities and expectations associated with a person's position.

If there is any question about the accuracy of test results, the scientific approach is re-analysis. It has been amply established that genetic markers in well preserved biological evidence deteriorate only very slowly. For many markers, retyping can be done months or even years later. Conditions of evidence preservation are well established and follow common sense: (a) the drier, the better, and (b) the colder, the better.

REFERENCES

1. This is described in many basic text books; one of the best is: Harris, H., Principles of Human Biochemical Genetics, 3rd Ed., Elsevier-North Holland, New York and Amsterdam (1981). It is also described in basic forensic references; see, for example, Sensabaugh, G.F. "Biochemical markers of individuality" in Forensic Science Handbook, R. Saferstein, ed., Prentice Hall, Englewood Cliffs, N.J., 1982, and Gaensslen, R.E., Sourcebook in Forensic Serology, Immunology, and Biochemistry, U.S. Government Printing Office, 1983.

2. A good general review of protein structure - reactivity relationships is Doolittle, R.F., "Proteins" Scientific American 253:88-99 (1985). For more detail, basic biochemistry texts (e.g., Stryer, L. Biochemistry 2nd Ed., Freeman, San Francisco, 1981) and advanced biochemical treatises can be consulted.

3. A recent review is Water in Polymers, S.P. Rowland, ed., American Chemical Society Symposium Series 127 (1980).

4. Various aspects are reviewed in: Labuza, T.P., Food Technology 34:36-41 (1980); Rockland, L.P., and Nishi, S.K., Food Technology 34:42-51 (1980); Schwimmer, S., Food Technology 34:64-74 (1980); and Troller, J.A., Food Technology 34:76-80 (1980).

5. Newborn screening for PKU, galactosemia, and hyperthyroidism is mandated by the California Health and Safety Code, Section 309. This testing involves spotting newborn blood on filter paper, drying it, and sending it to the analytical testing lab. Virtually all states in the U.S. and most countries in Europe employ this procedure.

6. See, for example, H.M. Mathews, "Parasitic disease: testing with filter-paper blood spots" Laboratory Management 20:55- 62 (1981).

7. See: Chemical Deterioration of Proteins, J.R. Whitaker and M. Fujimaka, eds., American Chemical Society Symposium Series 123 (1980).

8. Representative review articles on electrophoretic characterization of bacterial enzymes are found in Microbiological Classification and Identification, M. Goodfellow and R.G. Board, Eds., Academic Press, 1980.

9. Culliford, B.J. "The determination of phosphoglucomutase in bloodstains" J. Forensic Sci. Soc. 7:131-133 (1967). For more recent discussion of the marker evaluation process, see: Sensabaugh, G.F., "Uses of polymorphic red cell enzymes in forensic science" Clinics in Haematology 10:185-207 (1982) on pp. 197-198.

10. Grindon, A.J. and Eska, P.L., Transfusion 17:425-430 (1977); Osborne, R.H. Amer. J. Phys. Anthropol. 16:187-195 (1958).

11. Ashton, G.C. "Mismatches in genetic markers in a large family study" Amer. J. Human Genet. 32:601-613 (1980).

12. Fisher, R.A. "Standard calculations for evaluating a blood group system" Heredity 5:95-102 (1951); Jones, D.A. "Blood samples: probability of discrimination" J. Forens. Sci. Soc 12:355-360 (1972).

TABLE 1

CRIME LABORATORY PERFORMANCE ON SEROLOGY PROFICIENCY TESTS:

DISTRIBUTION OF ERRORS IN ELECTROPHORETIC ANALYSES

LEAA Proficiency Testing Program

Trial	Laboratories Reporting EP	EP Tests Done	Errors	Labs at Error Level 0	1	2	3+ [# errors]
75-3	26	43	3	23	3	0	0
75-8	40	166	13	34	3	2	1 [6]

FSF Subscription Program

Trial	Laboratories Reporting EP	EP Tests Done	Errors	Labs at Error Level 0	1	2	3+ [# errors]
78-1	data not available						
79-18	20	436	13	15	2	2	1 [7]
80-2	29	880	9	25	1	2	1 [4]
80-9	14	62	1	13	1	0	0
81-2	18	570	20	4	11	0	3 [3,3,3]
81-9	13	62	1	12	1	0	0
82-3	14	475	21	6	4	0	4 [4,4,4,5]
82-9	26	822	16	20	2	1	3 [3,4,5]
83-1	29	516	12	25	1	1	2 [4,5]
83-9	33	538	4	29	4	0	0
84-2	39	284	4	36	2	1	0
84-11	34	668	9	30	2	1	1 [5]
85-2	57	903	23	44	9	2	2 [5,5]
85-11	46	414	18	33	10	1	2 [3,3]
86-2	64	988	22	48	11	4	1 [3]

TABLE EXPLANATION: In trial 75-8, 40 laboratories reported electrophoretic test results; 166 typings were reported of which 13 were incorrect.34 labs made no errors, 3 made 1 error,2made 2 errors each, and one made 6 errors.

SUMMARY:On average, 79.1% of the reporting labs made no electrophoretic typing errors, 13.4% made one error, 3.4% made two erors,and 4.2% made three or more errors.Labs making 3+ errors in a trial would be considered to have a serious internal problem requiring correction.

Electrophoresis and the "Multisystem" in Forensic Science

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The relationship of the scientific tool electrophoresis to the forensic sciences.

The various forms of zone electrophoresis and isoelectric focusing which are used in forensic serology can be traced to the work of Tiselius in the 1930's for which he received the Nobel prize in Chemistry in 1948. Tiselius in turn credits Hardy for his foundational work between 1899 and 1905 in showing that proteins and enzymes exhibit "characteristic electrophoretic mobilities which largely depend on the pH of the solution"(1).

Tiselius' work in free electrophoresis led to the development of electrophoresis in porous media such as starch or agarose(2) . Smithies(3) showed that human serum proteins could be separated by starch gel electrophoresis. This technique revealed the polymorphisms present in the human Haptoglobin and Transferrin genes. The presence of polymorphisms in human serum proteins led to the discovery of polymorphisms in known human red cell enzymes(4).

The rapid discovery of many human enzyme polymorphisms in the 1960's led to the transfer of this technology to the forensic laboratory. Many of these genetic discoveries were made at the Galton Laboratories (The MRC Human Biochemical Genetics Unit, University College, London) Brian Culliford of the Metropolitan Police Laboratory took the opportunity of proximity to learn these techniques and to evaluate their use for forensic samples(5)(6). Culliford played a major role in the transfer of this technology to crime laboratories for application to forensic samples. The transfer of this technology was assisted by a grant from LEAA and resulted in the publication of Culliford's basic laboratory manual(7). These techniques were soon adopted in forensic laboratories throughout the world.

A list of references which describe the discovery of human protein polymorphisms which have been adapted for forensic use is found in appendix A.

The original methods suggested by Culliford have not remained the methods of choice in most forensic laboratories in the same way that the classical starch gel electrophoresis procedure of Smithies is no longer used in either forensic or non-forensic laboratories. New methods are developed or old methods are modified to improve the sensitivity and resolution of electrophoretic separations.

Acrylamide electrophoresis (8) and isoelectric focusing(9) are examples of improved separation methods which have become routine tools in forensic laboratories and have replaced earlier electrophoretic techniques. These methods and techniques which offered potential for forensic application were followed by casework studies and blind trials on stains which were performed to ensure that the results on stain materials were valid. A partial list of these studies is attached.

The "Multisystem"

Many US and Canadian crime laboratories have adopted some or all of the methods proposed by Wraxall and Stolorow (10) which has, through jargon, become known as the "Multisystem" approach. None of the methods used in this system were conjured up in the authors' laboratory nor was the analysis of multiple enzyme loci on a single electrophoretic system a novel approach. These authors simply took methods and concepts already in the scientific literature and applied them to a specific problem. Namely, providing timely and reliable procedures for the genetic classification of bloodstains in a high caseload low staff laboratory setting.

The "Group I" system (EsD, PGM and Glo on an agarose gel using a Tris/EDTA/Maleate/MgCl2 (TEMM) buffer) is a good example of this evolution. PGM typing was introduced in 1964 by analysis on starch gel using TEMM at pH7.4.

Other workers later performed PGM analysis on agarose instead of starch but with the same buffer (11). Wraxall and Stolorow determined that this system could also detect EsD and GloI on the same gel. The simultaneous determination of EsD and GloI on the same gel was itself nothing new (12)

As is the example of the "Group I" Buffer above, none of the other buffers which form the core of the multi-system are new to anyone performing enzyme electrophoresis in human genetics . The three buffers used for the basic enzyme analyses of Group I,II and IV of the "Multisystem" are each referred to in the Metropolitan Police Laboratory's Biology Methods Manual(1978) as the preferred buffers for PGM, EAP and PEP A respectively, while the Group III buffer had been previously published for Gc typing (13).

History of Multisystem approach to electrophoretic analysis

The use of a particular buffer system for the electrophoretic analysis of more than one enzyme system is the rule rather than the exception in biology laboratories. There are both theoretical and practical reasons for this. From a theoretical standpoint, certain chemicals are better buffers than others and, therefore, would be the chemicals of choice in formulating buffer systems. Also, most enzymes have pI's (isoelectric points, or the pH at which separation of minor charge differences is greatest) near pH 7 since proteins are a mixture of amino acids which are slightly acidic or slightly basic. Therefore, many enzymes would be expected to separate well at the same or similar pH's.

From a practical standpoint, the use of single electrophoresis systems for the analysis of multiple enzyme systems means that a laboratory analyzing for many systems does not need as many electrophoresis setups or as many buffer components to do their work. This is well reflected in the electrophoresis literature. For example:

1. Shaw and Prasad. "Starch Gel Electrophoresis of Enzymes- a Compilation of Recipes". Biochem Genet, 4, 297 (1970). This paper describes 19 buffer systems suggested for the analysis of 49 different enzyme loci.

2. Conkle et al. Starch Gel Electrophoresis of Conifer Seeds. A Laboratory Manual. USDA, Forest Service. General Technical Report PSW-64 (1982). This laboratory manual uses four buffer systems (three of which have the same components, but at different pHs) for the analysis of 24 enzyme systems.

3. In the field of human genetics, the analytical bible is : Harris and Hopkinson. Handbook of Enzyme Electrophoresis in Human Genetics. Elsevier, New York, 1976 and Supplements (1977, 1978). This manual lists analytical conditions for the analysis of 89 different human enzyme loci. For these analyses it offers 19 basic buffer systems at 46 different pHs. If one eliminates those systems which are used for one enzyme only, one is left with 11 buffer systems at 17 different pHs for the analysis of 60 enzymes. TEMM, which is used in the multisystem for the analysis of PGM, EsD and GloI is one of the more popular systems in the handbook. It is the suggested method for the enzyme systems DASOX, DAMOX, ALD, HK, GUK, PGM, and PP.

4. Additional examples which appear in the human genetics literature include:

a. Polesky and Dykes. "Serum proteins and Erythrocyte Enzymes". Paternity Testing by Blood Grouping. L. Sussman, Ed. Charles C. Thomas, 1976. This contains what is essentially "Group II" of the multisystem i.e. the simultaneous determination of AcP1 (EAP), AK, PGD, and ADA on a single starch gel in a buffer system of Citrate/Phosphate at pH 5.9 (vs 5.5), run overnight.

b. Martin and Vob. "The Determination of the Red Cell Isoenzymes 6-Phosphogluconate Dehydrogenase (E.C. 1.1.1.44) and Acid Phosphatase (E.C. 3.1.3.2.) by Means of Agarose Gel Thin Layer Electrophoresis". Blut 36,35 (1978).

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Note that these papers are from work done by European or American workers. The fact that the British have not chosen this approach for routine casework does not make it de facto wrong, nor does it mean that they have "rejected" it because they do not use it. Several British scientists have published electrophoresis methods which use a "multisystem" approach:

a. Culliford. The Examination and Typing of Bloodstains in the Crime Laboratory. NICJ, 1971. Refers to Parkin, P.H., PhD Thesis, for the simultaneous determination of PCE-C5 and AK (p. 207)

b. Finney and Werrett. "The Use of Isoelectric Focusing (IEF) as a Method for the Combined Phenotyping of Erythrocyte Acid Phosphatase (EAP) and Esterase D (EsD)". J. Forensic Science Soc. 24,312 (1984).

c. Dorrill and Sutton. "Simultaneous Isoelectric Focusing of EAP and PGM1 on 0.15mm Polyacrylamide Gels". J. Forensic Science Soc. 23,131 (1983).

d. Divall and Greenhalch. "The Screening of Blood Samples for Haemoglobin Variation in Conjunction with Glyoxalase Typing." J. Forensic Science Soc. 23,49, (1983)

Also, at the International Symposium on Forensic Applications of Electrophoresis held at Quantico Va in 1984, a panel discussing "Electrophoretic systems-single, multi and isoelectric focusing" was chaired by Graham Divall, head of the Biochemistry section of the Metropolitan Police Laboratory, London. This panel concluded that:

> "a) Both the single and multielectrophoretic systems are in wide use in forensic science.
>
> b. Both the single and multielectrophoretic systems are reliable if used by properly trained analysts and careful interpretation is used.
>
> c. In some instances the introduction of the multi-electrophoretic system was an improvement over conventional electrophoretic systems used prior to 1978.
>
> d. The use of either single or multisystems in themselves do not create error
>
> e. Single systems are in use totally in some laboratories whether on starch, agarose, cellulose acetate or acrylamide.
>
> f. The choice of the system is dependent on the size and condition of the stain and the markers to be analyzed " (14).

Dr Divall also discusses the multi system approach in his review article, which was published in the multi- disciplinary peer reviewed journal Electrophoresis (15) in which he states:

> " 4.5 Multi-system plates
>
> Limited sample size is one of the major problems encountered in blood stain analysis and much research has been directed towards increasing the sensitivity of grouping tests and to developing analytical procedures which group a single blood stain in more than one system (79). One of these approaches has been the evolution of electrophoretic techniques which allow the simultaneous determination of two to four group systems from one electrophoresis plates (80-85). Wraxall(81) for example, has described a method of electrophoresis in agarose/starch gel which allows the simultaneous separation of GLO, EsD and PGM. Techniques such as this not only allow more information to be obtained from a limited amount of stain material but are also a boon to any busy forensic science laboratory which has limited staff and resources. An example of the simultaneous determination of AK and ADA phenotypes is shown in fig 6. "

Note: the photograph showing ADA and AK on the same gel is presumably from Dr. Divall's laboratory as it is unacknowledged.

The relationship between the forensic science community and the general scientific community

The forensic community is not just a borrower of techniques from other disciplines as many advances in genetics have come from forensic laboratories.

Some examples:

1. The human polymorphism Sperm Diaphorase was first described by workers in the UC Berkeley Forensic Science Program(16).

2. The semen specific protein, P-30 (aka prostatic antigen) was first isolated and characterized in the same UC Berkeley Laboratory (17). This discovery has not only been a great aid to casework forensic laboratories in the identification of semen but has led to the development of a powerful new test for the diagnosis of prostatic cancer in clinical medicine.

3. The first description of the further genetic characterization of PGM ("PGM subtyping") by isoelectric focusing was published by scientists in the working Home Office laboratory at Chorley, UK(18).

4. New genetic variants of 6-PGD. (19) and Red cell Acid Phosphatase (20) have been discovered by workers in US crime labs.

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APPENDIX A

Protein polymorphisms which have been adapted for forensic use

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The Community of Forensic Serology

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What is Criminalistics or Forensic Science and what is Forensic Serology?

Criminalistics is that professional occupation concerned with the scientific analysis and examination of physical evidence, its interpretation, and its presentation in court. It involves the application of principles, techniques and methods of physical sciences, and has as its primary objective a determination of physical facts which may be significant in legal cases.[1]

Individuals who work in this profession are generally employed by a government agency or are self employed, contracting their services to private attorneys, district attorneys, public defenders and investigating government or private agencies.

In addition, there are a number of individuals who work in universities and colleges teaching Criminalistics and doing research and development in the field of criminalistics.

Forensic Serology is that area of Criminalistics which is concerned with the examination of blood and other body fluids. The methodology and techniques used in forensic serology are founded in the traditional scientific disciplines of biochemistry, immunology, and genetics.

Who are forensic serologists?

Forensic serologists are criminalists who work in the area of Forensic Serology or they are individuals who do paternity testing for medico-legal purposes.

The majority of forensic serologists work in government laboratories, where they are required to identify bloodstains and stains from other body fluids. They also characterize these samples by identifying and comparing genetic markers. These individuals have degrees in physical or biological science from accredited colleges or universities. They also have specialized training and experience in the field of forensic serology.

According to Kelley, Supra, 17 CAL. 3d 24, a "qualified expert" must have academic and professional credentials which equip him to understand both the scientific principles involved and any differences of view on their reliability. He must also be "impartial", that is, not so personally invested in establishing the techniques acceptance that he might not be objective about disagreements within the relevant scientific community."[2]

Very few and perhaps no criminalists in a government laboratory have any personal or monetary interest in the promotion of one serological technique over another. The primary interest of a criminalistics laboratory is to obtain the most information from a piece of evidence in the most efficient and effective manner possible. The serologist is open to new procedures, but makes every effort not to be influenced by those who have an interest in promoting a technique. The profession has set standards of ethical conduct for itself which are rigorously enforced. These are stated in the California Association of Criminalists Code of Ethics.

> It is the duty of any person practicing the profession of Criminalistics to serve the interest of justice to the best of his ability at all times. In fulfilling this duty, he will use all of the scientific means at his command to ascertain all of the significant physical facts relative to the matters under investigation. Having made factual determinations, the criminalist must then interpret and evaluate his findings. In this he will be guided by experience and knowledge which, coupled with a serious consideration of his analytical findings and the application of sound judgment, may enable him to arrive at opinions and conclusion pertaining to the matters under study. These findings of fact and his conclusions and opinions should then be reported, with all the accuracy and skill of which the criminalist is capable, to the end that all may fully understand and be able to place the findings in there proper relationship to the problem at issue.[3]

The American Academy of Forensic Science has a similar code of ethical conduct.

> Section 2 - Guiding Principles. Separate and distinct from the Academy's mandatory Code of Ethics, yet essential to the attainment of the highest quality of professionalism, the following are deemed to be guiding principles - voluntarily endorsed by all forensic scientists:
>
> (a) The forensic scientist should maintain his professional competency through existing programs of continuing education.
>
> (b) The forensic scientist should render technically correct statements in all written or oral reports, testimony public addresses, or publications and should avoid any misleading or inaccurate claims.
>
> (c) The forensic scientist should act in an impartial manner and do nothing which would imply partisanship or any interest in a case except the proof of the facts and their correct interpretation.[4]

Even individual government agencies which employ criminalists have similar standards of conduct:

> It is the duty of all professional employees to sere the interests of justice to the best of his ability at all times. In fulfilling this duty, he will use all of the scientific means at his command to ascertain of the significant physical facts relative the matters under investigation. Having made factual determinations, he must then interpret and evaluate his findings. In this he will be guided by experience and knowledge which, coupled with a serious consideration of his analytical findings and the application of sound judgment, may enable him to arrive at opinions and conclusions pertaining to the matters under study. These findings of fact and his conclusions and opinions should then be reported, with all the accuracy and skill of which he is capable, to the end that all may fully understand and be able to place the findings in their proper relationship to the problem at issue.
>
> In carrying out these functions, the professional will be guided by those practices and procedures which are generally recognized within the profession to be consistent with a high level of professional ethics. His motives, methods, and actions shall at all times be above reproach and consistent with moral conduct.[5]

We therefore propose that the Forensic Serology community, which would include individuals from both the academic environment and those actually analyzing evidence in the laboratory, be accepted as "the relevant scientific community" for the purpose of judging the acceptability of a serological technique.

The Forensic Serologist should be accepted as the "qualified expert," so long as he/she can show sufficient knowledge and training to demonstrate that he/she understands the scientific principles involved in the technique he/she may use and can reasonably support the use of a technique in the light of some possible disagreements among the scientists.

Criminalists and Forensic Serologists, however, are human beings. Occasionally an error or mistake may be made on a given analytical test or in the interpretation of a test result. Also, issues may arise concerning the test samples' integrity leading to claims of erroneous findings. Many times, samples can be retested or experiments can be done with samples to answer specific concerns about the integrity of samples. These are best dealt with on an individual case-by-case basis at the trial court level.

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PUBLICATIONS

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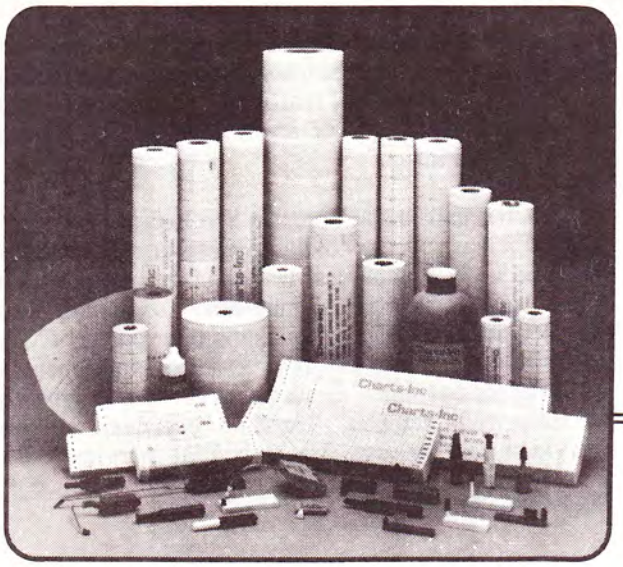

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