

Spring 2004 Meeting Abstracts
Missoula, MT

FBI Laboratory Update

Joe DiZinno, Directory Assistant Director, FBI Laboratory

Dr. DiZinno's presentation will focus on six developments in the FBI Laboratory that are of interest to the state and local forensic laboratory personnel. The six FBI Laboratory developments to be discussed by Dr. DiZinno are listed below:

The development of the Chem-Bio Sciences Unit within the FBI Laboratory. The mission of this Unit is to coordinate traditional forensic examinations on evidence which has been subjected to chemical, biological or nuclear weapons.

The formation of the Terrorist Explosives Device Analytical Center (TEDAC). The TEDAC is a multi-agency effort to perform forensic examinations, disseminate intelligence and provide training from evidence associated with terrorist improvised explosive devices.

The development of four regional mitochondrial DNA laboratories and the effect of these laboratories on state and local law enforcement.

An update on the combined DNA Index System (CODIS).

The status of forensic science training provided by the FBI Laboratory to state and local forensic laboratory personnel.

The creation of the research partners program within the FBI Laboratory and the considerations of this program for state and local forensic laboratories.

Rapid Separation of Spermatozoa and Epithelial Cell Mixture for Forensic Analysis Using Laser Microdissection

Andy Lee, Janice Zhou, Ph.D., Leica Microsystems, Inc.

Rapid and precise separation of specific cell types from mixtures of sexual assault evidence for forensic DNA analysis is now possible using modern laser microdissection technology.

Laser microdissection, originally developed for specific cell microdissection for genomic analysis in cancer research, has been a proven technology for many years for subsequent downstream DNA, RNA, and protein analysis.

The Leica AS LMD is the latest technology in laser microdissection, which offers forensic scientists an easy-to-learn and economical system for quickly separating different cell types from a mixture. Based on an automated upright compound microscope, the Leica AS LMD is a complete turnkey microdissection workstation where the user simply circumscribes on a computer monitor the cells of interest. With the click of a button, cells are isolated and collected into PCR tube caps via laser microdissection.

Spermatozoa or epithelial cells can now be rapidly and precisely separated by laser microdissection for subsequent forensic DNA analysis such as PCR and STR analysis. The laser microdissection process can easily and quickly collect hundreds of spermatozoa or epithelial cells, thereby significantly decreasing the time associated with current processing protocols.

Some Advances in the Silver Physical Development of Latent Prints on Paper

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Silver physical development, a now-abandoned technique used for developing photographic film or paper, is the most powerful method for visualizing latent print on paper. The method develops the water-insoluble components in the print residue. These components include the “fats and oils” or lipids found on the skin of fingers. The resulting developed print, referred to as a silver physically developed (Ag-PD) print, is made up of (gray to black) silver particles adhered to the fingerprint residue. Such prints are usually intensified (made darker) with a hypochlorite treatment. This process converts silver to silver oxide making the Ag-PD print become a Ag₂O-PD prints. Often such (Ag-PD or Ag₂O-PD) prints are found on areas with heavy or patterned printing or a dark background making them difficult to see. This work resolves this problem by chemically lightening the print and darkening (suppressing) the interfering background.

Evidence from the Earth – Forensic Geology

Dr. Raymond Murray

Conan Doyle and Hans Gross suggested the possibility of using soil and related material as physical evidence. Edmond Locard provided the intellectual basis for the use of the evidence. High visibility cases such as the work of the FBI in the Camarena case, the laboratory of the Garda Siochana in the Lord Mountbatten case and G. Lombardi in the Aldo Moro case contributed to the general recognition that geologic evidence could make an important contribution to justice. In Montana, Dr. Jack Wehrenberg examined the material from two cases that have become a model for excellent work and significant evidential value. Today, these examinations are increasingly used in a wide variety of both criminal and civil cases. Forensic examinations involve identification of earth materials, studies of samples to determine if there was a common source, studies that aid an investigation and intelligence studies. The diversity of earth materials and the rapid rate at which they change both horizontally and vertically provides significant discriminating power. The future will witness improved analytical and sampling methods, studies on the diversity of soils, better qualified examiners and increased awareness of the value of soils by evidence collectors.

Lorazepam: “You Wanna Bet”

Jim Hutchison, Montana State Crime Lab

Lorazepam (Ativan®) shares the actions of other benzodiazepines and is used for the management of anxiety disorders or for the short-term relief of symptoms of anxiety or anxiety associated with depressive symptoms. As a schedule IV controlled drug, it is typically available by prescription only, either in liquid form for oral or parenteral use, or in varying dosage tablet forms for oral dosing. The Chemical Analysis Unit has had numerous submissions of white powders, in which “Lorazepam” or **Lorazepam related compound** was identified using GC/MS. Lorazepam (?) has also been identified in the biological samples in several Toxicological cases. The author will present data and information that will, hopefully, serve to caution chemists and toxicologists about identifying (or potentially misidentifying) Lorazepam using GC, GC/MS, or LC/MS.

Validation of a Male-Specific, 12-Locus Fluorescent Multiplex: The PowerPlex® Y Sytem

Kimberly A. Huston, B.S., Benjamin E. Krenke, M.S., Patricia M. Fulmer, Ph.D., Katharine Driftmier Miller, B.S., Cynthia J. Sprecher, B.S., Promega Corporation, Madison, WI.

Short Tandem Repeat (STR) analysis has become the leading technology for genetic human identification. Frequently, autosomal STRs are used for forensic, paternity and anthropological studies. However, the benefits of Y-specific analysis are ushering use of Y-STRs into the mainstream. Y-STR markers consist of polymorphic regions found on the non-recombining region of the Y chromosome. Amplification of these haploid markers occurs only in males and alleles are inherited through the paternal line. These qualities simplify interpretation of complex male/female mixtures and male kinship studies by removing the female contribution.

The PowerPlex® Y System has been developed by general Y-STR haplotyping with a focus on forensic casework. PowerPlex® Y allows for the coamplification and three-color detection of 12 Y-STR loci: DYS19, DYS385a/b, DYS389I/II, DYS390, DYS391, DYS392, DYS393, DYS437, DYS438 and DYS439. The 12 loci of PowerPlex® Y include the “European minimal haplotype” Y-STR loci (DYS19, DYS385a/b, DYS389I/II, DYS390, DYS391, DYS392, DYS393) and the Scientific Working Group – DNA Analysis Methods (SWGDM) recommended panel of Y-STRs (minimal haplotype plus DYS438 and DYS439). In this multiplex, one of the two primers for DYS389I/II, DYS391 and DYS 439 are labeled with fluorescein; one primer specific for DYS19, DYS392, DYS437 and DYS438 is labeled with 6-carboxy-4', 5'-dichloro-2'7'-dimethoxy-fluorescein (JOE); and one primer specific for DYS385a/b, DYS390 and DYS393 is labeled with carboxy-tetramethylrhodamine (TMR). Sizing of amplicons is provided by an internal size standard (Internal Lane Standard 600) labeled with carboxy-X-rhodamine (CXR). Use of standard four-color chemistry allows analysis on the ABI PRISM® 377 DNA Sequencer, ABIPRISM® 310 Genetic Analyzer and ABI PRISM® 3100 Genetic Analyzer. Color deconvolution can be performed with color matrix kits currently available from Promega Corporation. An allelic ladder has been developed to increase consistency and accuracy of sample typing. The PowerTyper™ Y Macro has

been developed to operate within the Genotyper® software and automatically label fragments from GeneScan® data using the supplied allelic ladder and size standard.

The PowerPlex® Y System has been studied as part of an interlaboratory validation effort. The initial phase examined 12-locus haplotype frequencies of North America, mutation rates, concordance with other primer sets and genetic linkage. The second phase involved experiments commonly referred to as developmental validation. Studies of sensitivity, male specificity, sizing precision, average stutter intensity, mixtures (male/female, male/male, etc.), effect of reaction and cycling variation will be discussed.

Fluorescein Presumptive Analysis for Enhancing Latent Blood

David Rossi, CSI/SCSA and Pam McInnis, Crime Lab Director Pasadena Police Dept.

In the course of criminal investigation, blood evidence is becoming more and more significant. With the advances in DNA, bloodstain pattern interpretation, fingerprint technologies, the collection, documentation and preservation of the liquid body tissue is becoming more important than ever.

With the introduction of Fluorescein, a presumptive blood detection chemical, unexplored areas of criminal investigation are now becoming gold mines of information. For example, areas where blood has been cleaned from a surface can now be made evident.

Detecting a visible area of high velocity impact staining, with the ability to document, has not only become possible, but it can be done with minimal effort.

Transferred footwear impressions can now be located with a very dilute layer of blood of over 1:1,000,000. Blood transferred fingerprints can be obtained and photographed on surfaces that may very well be overlooked.

All of this is possible with Fluorescein, with no interference to DNA analysis. Documentation can be performed with standard still photography and videotape with little effort.

Fluorescein is easily prepared in the laboratory or in the field, and far surpasses the current blood presumptive chemicals available today.

Fluorescein has also been proven to detect blood under painted surfaces, compromised surfaces, substrates that have been washed, cleaned, and otherwise any attempts to cover up a criminal act.

Casework Sample Processing and Automation: Demystifying Robotics and Tracking Systems

Benoit Leclair, Corey Schwensen and Tim Kupferschmid, Myriad Genetic Laboratories, Inc., Salt Lake City, Utah

Casework backlogs have been growing steadily over the last several years. Although automation solutions can be developed to assist in the processing of these samples, the variability in quantity and quality encountered with casework samples raises doubts in the mind of many forensic scientists as to whether or not automated solutions can maintain at least as good a quality and sensitivity as those obtained with current manual processes. Furthermore, robotics and tracking systems are often perceived as “black boxes” that can make sample cross-contamination, or worse, sample switching, difficult to detect. This presentation will review the ongoing development of a fully automated casework sample processing platform at Myriad. The fully integrated approach will showcase how chemistries from sample extraction to 3100 sample preparation were moved from a manual environment to a robotic worktable, and the basic concepts behind the tracking of samples that allow for full confidence in the process output. This presentation will demonstrate the startling potential of automated solutions as applied to day-to-day casework sample processing and to the reduction of casework backlogs, and demystify the use of robotics and tracking systems in a casework environment.

Chemical Imaging by FT-IR Microscopy

Sam White, PerkinElmer Instruments

A brief overview of the design and implementation of a FT-IR microscopes will be discussed. This discussion will include traditional infrared microspectroscopy, ATR microscopy and chemical imaging. Several forensic applications will be demonstrated including hair spray on individual hairs, ATR imaging on printed material and chemical imaging on automotive paint chips.

Investigating Methamphetamine Manufacture

Matt Jorgenson, WSP Crime Lab Spokane, and Robbie Heegel, Augustana College

With the increased crackdown on precursor chemicals, the methods being used to manufacture methamphetamine are becoming more involved and varied from cook to cook. Different variations on a theme were studied at and manufactured using different pills, extraction solvents, cook times, and methamphetamine extraction solvents. Does Claritan-D extracted with Denatured Alcohol produce the same amount of methamphetamine and by-products as an extended release tablet with isopropyl? Does the length of cooking vary if you cook for four hours as opposed to twelve? As part of an ongoing research project with the WSP, we looked at two different methamphetamine variations, Red P/HI and Hypo were used to observe these variations. The Hypophosphorus method is becoming popular among manufacturers and is starting to be seen in greater frequency throughout the state of Washington. After all was done, the samples were run on the GC/MS and were subsequently analyzed by looking at the

different trends that separate the variations. Continuing research will be done to be able to distinguish between these variations on the themes and the best instrumentation on which to do that.

Forensic Soil Research at Eastern Washington University

William M. Schneck, Microvision Northwest-Forensic Consulting, Inc.

Soil is often encountered as physical evidence during criminal investigations. To access the forensic significance and probative value of soil, a multi-functional research project was developed in which ten Eastern Washington University Forensic Science students participated. Prior research has suggested that soil color and composition can change over short distances dependent on location. The more variation observed in soil samples at a crime scene, the greater the probative value a questioned soil sample in a suspect's environment will have. This project documented variations observed in soil collected within a well-defined area. 100 soil samples were collected within a 200 square foot grid and processed by wet and dry sieving to separate the sand, silt, and clay soil fractions. Specific study areas included: colorimetric methods, soil pH, soil texture, volcanic glass content, phytoliths, magnetite weathering morphology, soil DNA, and field portable XRF.

Toolmarks in Bone - Evaluation of a "Sawzall"

Matthew Noedel, WSP Crime Lab – Tacoma

A recent homicide in western Washington reportedly involved the dismemberment of the victim using an electric reciprocating saw (Sawzall). When portions of the deceased were located, it was observed that nearly parallel, linear toolmarks were present on the ends of some of the long bones that had been severed. This paper explores the limits and characteristics of testing and evaluating these toolmarks and the potential to identify or eliminate a reciprocating saw.

A Review of UNABOM and the Cabin Search

Douglas W. Deedrick, FBI Laboratory – Quantico, VA

The effectiveness of crime scene searches can be enhanced by utilizing the knowledge and direct assistance of laboratory examiners. Observations in the laboratory can provide valuable insight to the collection process. Direct knowledge of identifications made during a long-term investigation will not only aid the interpretation of evidence at the crime scene, but will help eliminate unnecessary future work in the laboratory. A review of the UNABOM case highlights how identifications assisted in the search of Ted Kaczynski's cabin and property

Resource Guide for Users of Science and Technology and the National Clearinghouse for Science, Technology and the Law

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New challenges for expert witnesses and the legal community have arisen due to recent developments in science and technology. New technologies and methodologies, as well as fields long considered established, such as latent print identification and tool marks are facing increased scrutiny. Given this explosion of scientific evidence litigation, scientists, law enforcement, laboratory personnel, judges and lawyers are overwhelmed by the amount of information required to educate them to meet these legal challenges.

Until now, judges, lawyers, scientists and law enforcement personnel did not have one source that allowed them to navigate all the existing case law, journals, reports, proceedings and other resources necessary to conduct effective investigations and litigation. The *Resource Guide for Users of Science and Technology* was created to fill an information need specifically relating to legal issues implicated by the use of new technology in criminal and civil justice. Supported by a joint cooperative agreement between the NFSTC and NIJ (#2000-RC-CX-K001), the project developed a comprehensive searchable database from a variety of sources covering a wide range of topics. The database provides information on topics such as bloodstain pattern analysis, body scans/retinal scans, digital image enhancement, entomology, expert witness malpractice, fingerprints, questioned documents, smart cards, trace evidence and tool marks. The Resource Guide covers existing court rulings, pending court cases, scientific and legal articles from applicable sources, relevant information from books, current and pending legislation, conference proceedings, university and continuing education courses, and pronouncements from professional organizations. The NFSTC/NIJ project produced a searchable CD. The information contained in the Resource Guide will be included in and expanded upon in the online resource being developed by the National Clearinghouse on Science, Technology and the Law at Stetson University College of Law. The Clearinghouse is supported by a grant from the National Institute of Justice (#2003-IJ-CX-K024). In addition to the development of the online resource, the Clearinghouse Program is building partnerships with law schools, professional associations and federal agencies, sponsoring a forensic science/science and technology seminar series, convening Community Acceptance panels at the request of NIJ, co-sponsoring the National Conference on Science and the Law with the West Virginia University Forensic Science Initiative, the American Association for the Advancement of Science, the American Academy of Forensic Sciences, the Federal Judicial Center, the National Center for State Courts, the American Bar Association, Criminal Justice Section, the Technical Support Working Group, and the National Academies, developing training modules with an emphasis on distance education and building a reference collection of law, science and technology literature available through interlibrary loans to other agencies.

“One-Pot” Methamphetamine Manufacture

Eric C. Person, Washington State Patrol Crime Lab - Marysville

The lithium-ammonia reduction is one of the most common methods of methamphetamine manufacture. A few years ago the use of commercial anhydrous ammonia declined in favor of clandestine generated ammonia. This raises the natural question of whether ammonia can be generated in-situ. Video and photographs will be presented of a demonstration of a one-pot cook where the ammonia is generated in-situ. These conditions offer an efficient and effective, albeit dangerous, method of converting pseudoephedrine to methamphetamine.

The Forensic Toxicology of Drug Abuse Prevention in Sports – A Model Program

Bryan S. Finkle

Substance abuse prevention and detection is important to sports for at least two reasons: the health of the athletes and the integrity of the sport as it is perceived by the fans and general public. For the past twelve years the National Football League together with the Players Association under a Collectively Bargained Agreement has steadily developed a program to control substance abuse that is now a model for sports. The U.S. Anti-Doping Agency has similarly promulgated a comprehensive program in recent years, which is devoted to elite-Olympic class athletes. Both programs depend critically upon expert analytical toxicology to detect drugs and metabolites as well as masking agents at less than ng/ml concentrations in urine specimens. The analytical techniques and methods used will be described, including carbon isotope ratio mass spectrometry, LC-MS-MS, high resolution MS and protein analysis. The range of substances encountered and research efforts currently pursued to improve knowledge of the pharmacology and toxicology of these drugs will be described. The program involves year-round random testing, sanctions and clinical-therapeutic treatment when appropriate. The complete program, its design, operational parameters, and experience to date will be presented.

High Throughput Applications for DNA Databasing

John Ryan, Myriad Genetic Laboratories

Recent and planned mandate expansions for the collection of offender samples for inclusion into the National DNA Index System (NDIS) have highlighted the need to increase the efficiency of sample processing and data analysis. Myriad Genetics Laboratories has a high throughput laboratory process for the processing and analysis of offender samples. However, we continue to design validate and implement improvements in our laboratory to further increase our ability to efficiently process offender samples.

In this presentation, we will be describing recent improvements in our laboratory. These will include the utilization of an expert system for sample analysis, implementation of

appropriate peak imbalance ratios for pristine quality single source samples and improvements in laboratory processing efficiency.