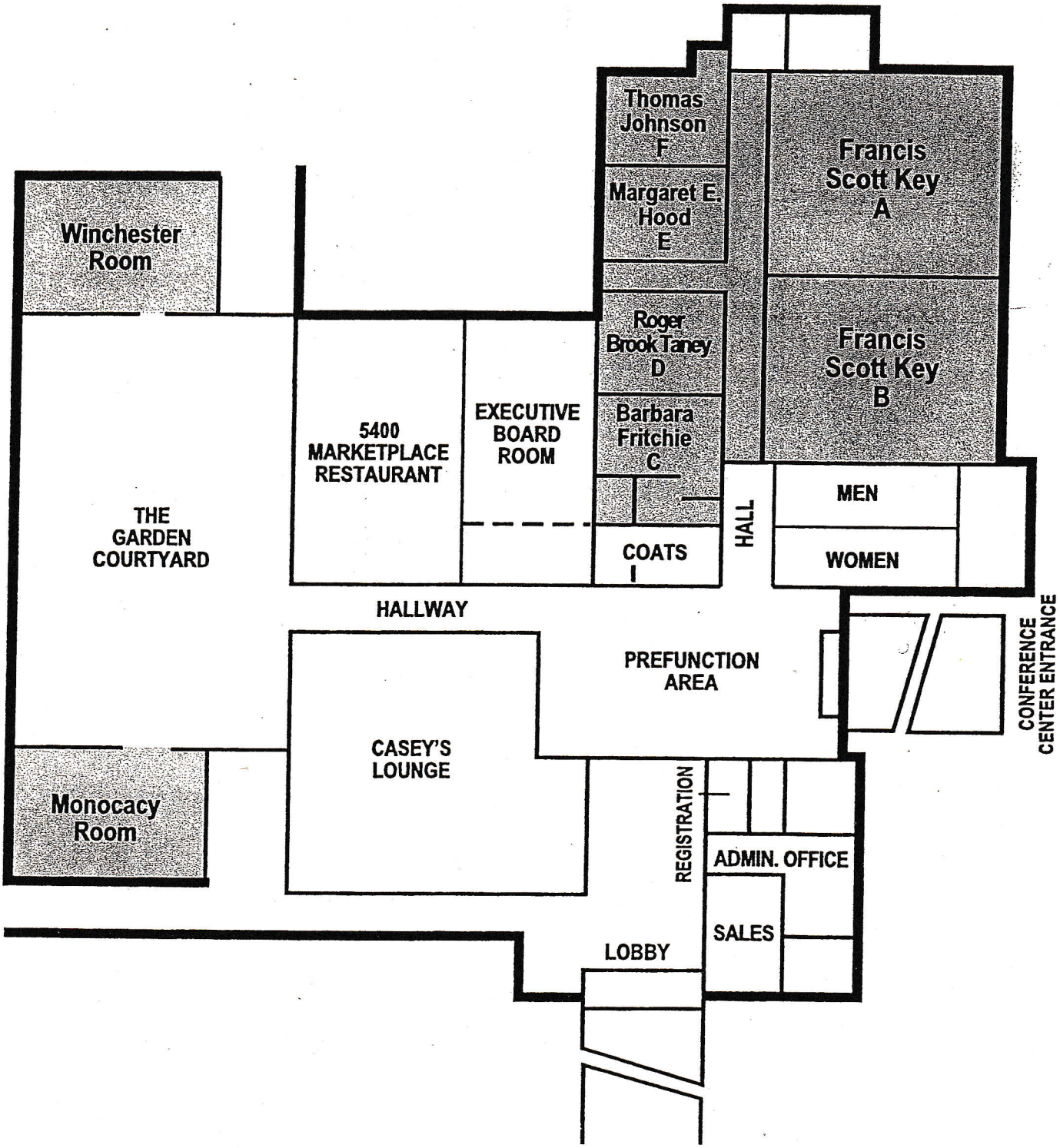
2002 MAAFS Annual Meeting
23-26 April 2002
Francis Scott Key Holiday Inn
Frederick, Maryland

Hosted by: **Hagerstown Police Department**
Armed Forces DNA Identification Laboratory

2002 MAAFS Annual Meeting

Francis Scott Key Holiday Inn
5400 Holiday Drive
I-270 & Route 85
Adjacent to Francis Scott Key Mall
Frederick, Maryland
301-694-7500

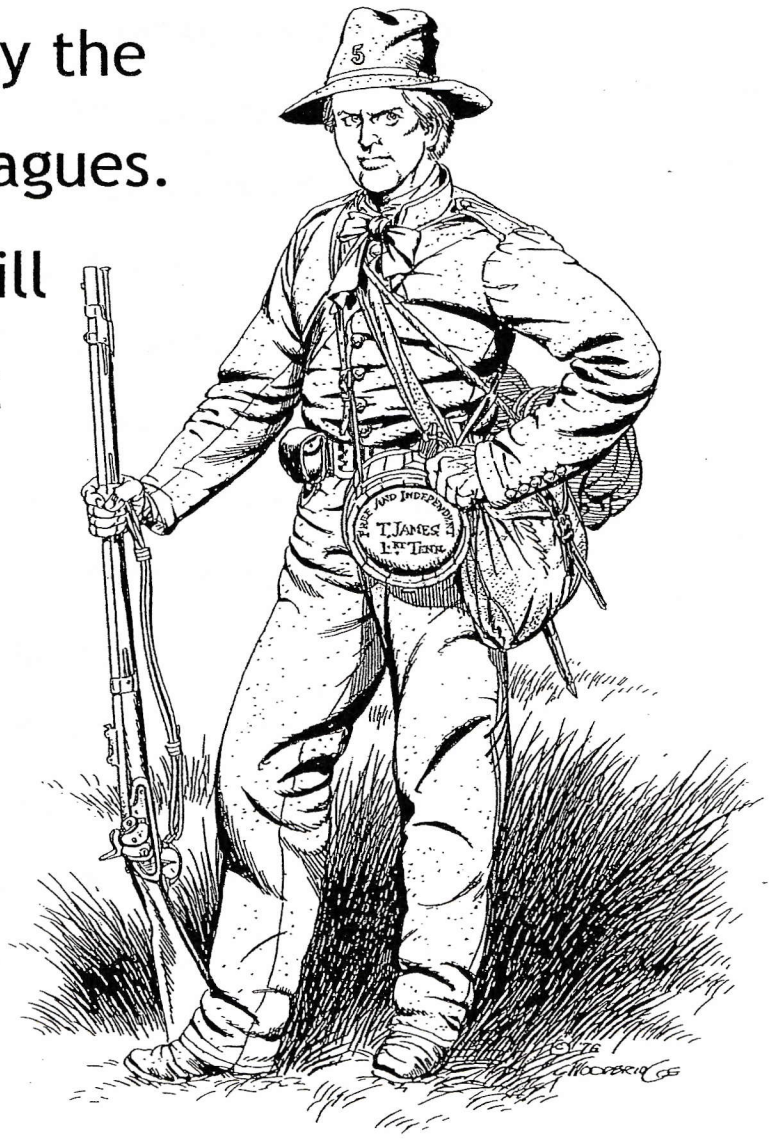
MAAFS
Frederick, Maryland 2002



"Rally 'round the flag, troops"

Frederick, Maryland 2002

Join us in the FSK Holiday Inn Courtyard to attend a reception following the business meeting on 25 April 2002 (7:30pm until 9:30pm). Please plan to attend, relax and enjoy the company of your colleagues. A civil war era band will provide entertainment (music and dancing). Finger food and a 2-hour open bar will be available.



Welcome

We hope that ALL participants - vendors, presenters, workshop attendees, generalists, biologists, questioned document examiners, members, non-members and students - **have an enjoyable and enriching experience at the 2002 MAAFS Annual Meeting in Frederick, Maryland. We also hope that you will share in our expression of gratitude toward Mr. Paul Sledzik – AFIP, Dr. Brion Smith – AFDIL and Chief Arthur Smith – HPD.**

Best wishes,
2002 MAAFS Annual Meeting Organization Committee

Meeting Organizers

Susan Blankenship, HPD (General Session)

Gerhard Wendt, PA State Police (QD Session & Workshop)

Demris Lee, AFDIL (Biology Session)

Ted Anderson, AFDIL (Biology Session)

Committee Chairs

Chad Ernst, AFDIL (Vendors)

Amanda Blanchard, AFDIL (STR Workshop)

Erin Dulaney, FBI (Microscopy/Digital Imaging Workshops)

Jennie Groover, AFDIL (Registration Desk)

Rob Fisher, AFDIL (Door Prizes)

Tracey Johnson, AFDIL (Poster Session)

Mike Fasano, AFDIL (Reception)

Gail Conklin, AFDIL (Hospitality Suite)

Miriam Narvaez-Thompson, AFDIL (Advertising)

Schedule of Events

23 April 2002

7:00am – 6:00pm **Registration**
Lobby

8:30am – 5:00pm* **Performance Level Auditing Workshop (Day 1)**
Room 105 **National Forensic Science Technology Center**

To have an effective quality assurance program, laboratories should perform internal audits of its operations. This workshop will produce trained auditors to populate those internal audit teams. The course is aimed at all staff, not just managers. The 2-day workshop will utilize lectures and practical exercises. NFSTC will confer 2 CFE (Continuing Forensic Education) units to students successfully completing the workshop. Workshop objectives are to:

- Understand the application of auditing in quality improvement and maintenance
- Become aware of key issues in the ASCLD/LAB accreditation program
- Develop an understanding of the accreditation program format
- Become knowledgeable of the standards and criteria necessary to achieve accreditation

It is suggested that the participants review and bring a copy of the ASCLD/LAB Manual to the workshop.

* complimentary continental breakfast and snacks & beverages will be provided

24 April 2002

7:00am – 6:00 pm **Registration**
Lobby

12:00pm – 5:00pm **ABC Examinations**
Room 183

8:30am – 11:30am* **Digital Imaging Workshop**
Room 183 **John Ossi, Vashaw Scientific, Inc.**

An overview of digital cameras available for microscopy will be discussed. Other topics to be covered include selecting the correct camera-to-microscope mount for your digital camera, discerning digital camera specifications such as resolution, noise, dynamic range, bit depth and speed, and using Adobe Photoshop® to work with digital images.

Schedule of Events

24 April 2002 - continued

1:30pm – 4:30pm **Optical Microscopy Workshop**
Off-Site **John Ossi, Vashaw Scientific, Inc.**

Hands-on session including assembly, alignment, operation and cleaning of a light microscope as well as phase contrast, interference contrast, brightfield, darkfield, and fluorescence methods for forensic applications.

8:30am – 5:00pm* **Performance Level Auditing Workshop (Day 2)**
Room 105 **National Forensic Science Technology Center**

8:30am – 4:00pm* **Disguised Handwriting Workshop**
Fritchie/Taney **POC: Gerhard Wendt, Pennsylvania State Police**

This hands-on workshop will involve examination of original standards and disguised handwriting through the use of standard, microscopic processes. Participants will have the opportunity to study sample packets during the morning session. The afternoon session will encompass reviewing the sample packets followed by a panel discussion related to the issues associated with disguised handwriting. Some topics to be covered include:

- A review of commonly utilized disguise techniques
- Feasibility of author identification or nonidentification from disguised writing
- Recognizing disguise in questioned documents and/or standard documents
- Examination limitations of disguised handwriting

8:30am – 5:00pm* **STR Analysis – Beyond the Core 13**
Hood/Johnson **Applied Biosystems, Promega, FBI, Maryland State, Baltimore City and Pennsylvania State Crime Labs**

The objectives of this workshop include:

- Manufacturer's introduction to the latest DNA quantitation and STR typing kits (scientific discussion & validation recommendations)
- Regional user's experience with DNA quantitation and STR typing kits
- Results of a regional data interpretation survey and a SWGDAM update

* complimentary continental breakfast and snacks & beverages will be provided (lobby)

5:00pm – 6:30pm **MAAFS Executive Committee Meeting**
Executive Board Room

6:30pm – 9:30pm **Hospitality Suite**
Poolside Suite complimentary food & beverages will be provided

Schedule of Events

25 April 2002

7:00am – 6:00pm **Lobby**	**Registration**
7:00am – 6:00pm* **Fritchie/Taney/FSK-B**	**EXHIBIT HALL** (door prizes awarded during breaks)
7:00am – 6:00pm **Lobby**	**Poster Presentations**
8:30am – 4:30pm* **Hood/Johnson** **FSK-A** **Room 105**	**Oral Presentations (schedule & abstracts follow)** General Session Biology Session Questioned Documents Session
11:30am – 1:30pm **Courtyard**	**Lunch with Keynote Address** **Paul Sledzik, Armed Forces Institute of Pathology**
5:00pm – 6:30pm **Courtyard**	**MAAFS Business Meeting** attendance is mandatory for membership requirements!!!
7:30pm – 9:30pm **Courtyard**	**Reception with Civil War Entertainment** food, beverages, music & entertainment will be provided

* complimentary continental breakfast and ice cream sundae bar & beverages will be provided (exhibit hall)...ice cream sundae bar compliments of **Abacus Diagnostics**

26 April 2002

7:00am – Noon **Lobby**	**Registration**
8:30am – Noon* **Hood/Johnson** **FSK-A**	**Oral Presentations (schedule & abstracts follow)** General Session Biology Session (final door prizes awarded at close of meeting)

* complimentary continental breakfast & beverages will be provided (lobby)

Poster Session

25 April 2002:

High-Performance Liquid Chromatography - Electrospray Ionization Mass Spectrometric Method for the Comparison of Smokeless Powders

John A. Mathis & Bruce R. McCord - Ohio University, Chemistry and Biochemistry

Smokeless powders are commonly used as propellants for small arms ammunition. Considered low explosives, smokeless powders have also been used as the main energetic material in improvised explosive devices such as pipe bombs. Smokeless powders consist of nitrocellulose and other organic additives. The additive compounds are used to facilitate processing, enhance energetic efficiency, and prevent degradation during storage. Following liquid extraction with methylene chloride, powder analysis is typically performed using gas chromatography mass spectrometry.1 In these methods pyrolysis of certain additives can occur. An alternative method using gradient reversed-phase high-performance liquid chromatographic (HPLC) has been developed to separate the major constituents in smokeless powders and avoid these probelems.2 The HPLC method has been further modified to facilitate electrospray ionization mass spectrometry (ESIMS).

The analysis method was optimized for ESIMS detection for the comparison of powders. Several commercially available smokeless powders were prepared by methylene chloride extraction, dried under nitrogen and reconstituted in methanol. A gradient HPLC method was performed using a Hewlett-Packard HPLC system with a Restek Pinnacle octyl (C-8) column and a Bruker Esquire ESIMS (quadrupole ion-trap). The additives were identified by their characteristic protonated molecular ion $[M+H]+$.

The gradient HPLC-ESIMS method provides a profile of the different powders with positive identification of individual additives. The information obtained has been used to distinguish powders from different manufacturers with respect to their additive package. Additionally, comparisons were made using different lots of the same powder from one distributor.

1 Martz R.M.; Lasswell L.D. Identification of smokeless powders and their residues by capillary column gas chromatography/mass spectrometry. In: Proceedings of the First International Symposium on the Analysis and Detection of Explosives; 1983; Quantico (VA). Washington, DC: US Government Printing Office, 1983;145-154

2 Wissinger CE, McCord BR. A Reversed-Phase HPLC Procedure for Smokeless Powder Comparison. J. Forens. Sci. 2002; 47: 168-174.

Degradation of DNA in bone material recovered from soil: Impact of soil environmental conditions and incubation time

Wera M. Schmerer - University of Goettingen, Germany (AFDIL)

Decomposition of bone material and degradation of bone macromolecules like DNA has been the subject of a number of investigations, applying different experimental designs and studying different aspects. As to the study of the process of DNA degradation, experiments carried out so far have been investigating the context of DNA preservation in dependence on single parameters like temperature (1, 2), or a limited complex combination of factors like pH-value and temperature (3), or temperature and moisture (2) respectively.

Besides these laboratory experiments, the analysis of experimentally soil stored bone material enables a simulation of the "natural" environmental conditions corresponding to that of exhumed skeletal material analysed within the anthropological and forensic context. In reverse, data resulting from this kind of study may render possible prognoses according to the state of DNA preservation within skeletal material found in a similar soil environment.
The aim of the study presented here was to acquire data concerning the process of DNA degradation within bone material recovered from different soil environments after different burial times, and the resulting changes in amplifyability and typability of the DNA recovered when applying forensically relevant STR loci (4).

(1) Waite E (1996) Analysis of heat-damaged DNA in bone. Taphonomy and Diagenesis Newsletter 5: 63

(2) Waite ER, Child AM, Craig OE, Collins MJ, Gelsthorpe K, Brown TA (1997) A preliminary investigation of stability in bone during artificial diagenesis. Bull Soc Geol France 168(5): 547-554

(3) Lindahl T (1993) Instability and decay of primary structure of DNA. Nature 362: 709-715

(4) Schmerer WM (2000) Degradierung von DNA im Knochengewebe in Relation zu Liegemillieu und Liegezeit. In: Schmerer WM (2000) Optimierung der STR-Genotypenanalyse an Extrakten alter DNA aus bodengelagertem Skelettmaterial. Cuvillier, Goettingen

Integration of the TaqMan assay into mtDNA sequence analysis

Kathryn B. Walters, BS - GWU (Cellmark); Kerri Dugan, PhD – FBI &
David Foran, PhD - GWU

Integration of quantitative PCR into forensic mtDNA sequence analysis was assessed using the TaqMan assay and the ABI 7700 instrument. The potential advantages of using this system for DNA quantitation include reduced preparation time and improved quantitative accuracy. The TaqMan system has the potential to be used to quantify the amount of mtDNA contained within total DNA extracts and could be used lieu of slot blot hybridization for pre-amplification DNA quantitation. Issues explored in this study included probe design, PCR reagents and optimization of quantitative PCR parameters. The TaqMan assay was evaluated for reproducibility, ease of preparation and time efficiency.

General Session

25 April 2002: Moderators – Sherry Brown (AM) & Rich Meyers (PM)

8:30am What Happens When the Military Loses Eight Mobile Howitzer's?... AKA...Is This Crime Scene A Health Hazard?
Jeff Kercheval - Hagerstown Police Department

Hagerstown, Maryland is nicknamed the "Hub City" because of it's dominance as a railroad hub at the turn of the twentieth century. On these very railroad tracks once traveled by trains of yesteryear, the United States military misplaced a shipment of eight mobile howitzer's. The M109A6 (Paladin) Howitzer is the most technologically advanced self-propelled cannon system in the U.S. Army, resembling an M1-A2 Abrams battle tank. It can fire it's 155 mm cannon up to 30 km. with an accuracy variation of approximately one meter. Once the Paladin's were located, it was discovered that four of these Howitzer's had been breeched and entered. Concerns arose over the potential loss of expensive top secret targeting systems and specialized optical equipment. The Western Maryland Regional Crime Laboratory was contacted by the FBI to process the units as a crime scene. At the conclusion of the scene investigation, an important and unforeseen lesson was learned regarding safety precautions (and I don't mean ordnance) at this most unusual crime scene. The items missing from each unit also proved to be most interesting.

8:45am The Hemp Controversy
Sandra Hartsock - Maryland State Police Crime Laboratory

The Marihuana Tax Act of 1937 placed the first restrictions on Cannabis plants. The definition of Marihuana was taken from this act and incorporated verbatim into the Controlled Substances Act of 1970. Since that time there has been many interpretations as to where "hemp" fit into the legislation. This presentation will examine the regulative history of marihuana and hemp from 1937 to the present. It will also discuss how these different regulations have influenced Marihuana and Tetrahydrocannabinol (THC) analyses in the past and what may be necessary alternations for the future due to recent legislation.

9:05am The Current Status of Microscopic Hair Comparisons
Walter F. Rowe - GWU

Although the microscopic comparison of human hairs has been accepted in courts of law for over a century, recent advances in DNA technology have called this type of forensic examination into question. In a number of cases, postconviction DNA testing has exonerated defendants who were convicted in part on the results of microscopic hair comparisons. A Federal judge has held a Daubert hearing on the microscopic comparison of human hairs and has concluded that this type of examination does not meet the criteria for admission of scientific evidence in Federal courts. A review of the available scientific literature on microscopic hair comparisons (including studies conducted by the Royal Canadian Mounted Police and the Federal Bureau of Investigation) leads to three conclusions: (1) microscopic comparisons of human hairs can yield scientifically defensible conclusions that can contribute to criminal investigations and criminal prosecutions; (2) the reliability of microscopic hair comparisons is strongly affected by the training of the forensic hair examiner and (3) forensic hair examiners cannot offer estimates of the probability of a match of a questioned hair with a hair from a randomly selected person.

9:25am Crash of United Flight 93
Joyce and David Williams

Identification of the remains of victims of a Mass Fatality Incident (MFI) requires a multi-disciplinary approach. We will be reviewing the events surrounding the crash of United Flight 93, and how this multi-disciplinary approach worked in the identification of the 44 passengers of that flight.

We will cover the actions taken before the incident, and the history of the flight deployment, including security, logistics, and personnel concerns. We will also review procedures at the family assistance center, the crash site, and the morgue including the protocols used in identification.

9:45am BREAK

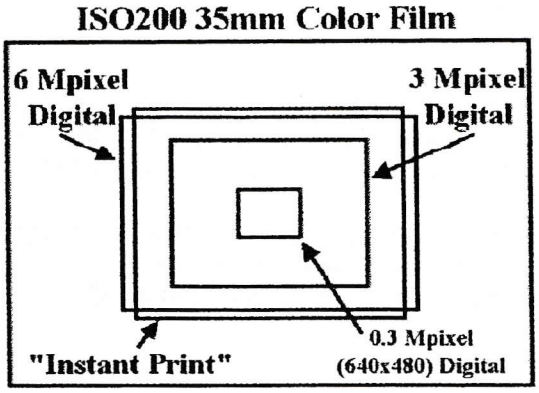
10:00am Comparing the Resolution of Film to Digital Cameras: Cautions for the Forensic Community
Richard W. Vorder Bruegge* - FBI & William R. Oliver - AFIP

This presentation will provide the forensic community with a better understanding of how much more information can be recorded by film than by most digital cameras; and to alert the community to some possible consequences if the resolution available with film is abandoned for mere convenience.

Law enforcement agencies across the country and around the world are rushing to convert their photographic and imaging systems from traditional film systems to digital ones. Many of the decisions to do so are being made based on the perception that digital imaging is better than traditional film systems. Although digital cameras can provide some benefits over film, those who must conduct detailed analysis of photographs taken in a forensic environment - such as footwear and tire tread examiners - are discovering that the quality of digital photography does not, yet, match that of film. This paper will explain one reason for this observation.

"Resolution" is defined in ANSI/AIIM Technical Report TR26-1993 "Resolution as it Relates to Photographic and Electronic Imaging" as: "The ability of a photographic system to record fine detail." Although the quality of images recorded using any imaging system depends upon a number of factors, including the quality of the lenses used and the lighting conditions, the intrinsic resolution of the detectors represents the most fundamental measure of the system. Thus sensor resolution is the focus of this paper.

The figure below demonstrates just how much more information film could record than digital detectors, under idealized conditions, if one fixes the resolution within the scene. In other words, the same size feature - such as a single ridge on a fingerprint - can be seen in each of the areas noted, but the film covers more area at that resolution than the digital detectors do.



Consequences: Examiners of footwear and tire tread impression evidence are already facing the consequences of reduced image quality. Although no formal studies have been conducted, discussions with numerous examiners indicate that the number of "Inconclusive" results in these examinations is increasing at a rate that parallels the rate at which digital images are submitted for comparison. Another type of examination that could suffer from reduced image quality is blood spatter examinations. One community - the latent fingerprint community - is fortunate enough to have a recommended standard in place for the capture of latent impression evidence - 1000 pixels per inch. Although this standard was designed to meet transmission standards, it has the added benefit of placing a minimum resolution standard for image capture. Using this standard, a photographer who chooses to photograph a latent print with a typical 3-Megapixel camera (2000 x 1500 pixels) will be restricted to photographing an area 2" x 1.5" - an area slightly larger than that covered by a single fingerprint.

10:30am Glucose Formation and the Age of Newspaper

Charles S. Tumosa* & David Erhardt
Smithsonian Center for Materials Research and Education

Cellulose is a polymer of glucose and on reaction with naturally occurring moisture hydrolyzes to yield glucose, and smaller glucose polymers including dimers, trimers etc. Extraction, derivatization and gas chromatographic analysis can easily detect and quantify these compounds. The rate of reaction is a function of temperature, relative humidity, and the type of paper (especially its pH). In newspaper, the acidity of the paper increases the rate of hydrolysis to the extent that measurable changes occur even over relatively short periods of time. Under some circumstances, the environment is constant enough to allow the amount of glucose formed to be correlated to the age of the paper. Specimens from the Washington Post, spanning a range of ages, that had been stored under controlled laboratory conditions were analyzed. The results show a general correlation of glucose formation with age.

11:00am Comparisons of Liquid Gasoline Samples via GC-MS Utilizing an Automated Approach to Data Analysis

Julia Ann Dolan* & Chrisopher Ritacco - ATF

Research in the late eighties demonstrated that comparisons of gasolines can be conducted, and that the finding of similarities in the compositions of gasolines may be meaningful in determining a potential common origin.[i,ii]

The work conducted by Mann however, required substantial data processing by the analyst, and was fairly labor intensive in that aspect. This work utilizes many of the same principles originally presented by

Mann, and was designed to determine the following: (1) Will these types of comparisons demonstrate meaningful discrimination amongst reformulated gasolines? (2) Can the data analysis be automated so as to simplify the process? (3) Are there particular components of gasoline that are better for comparative purposes than others? (4) Can a GC-MS be effectively used?

It was hypothesized that by careful selection of components, that gasolines could be distinguished as having originated from different sources based on comparisons of sequential peak ratios. The use of sequential peak rationing has been validated, and involves comparing the abundance of one peak to the next eluting peak. This method of component comparison is used in order to minimize the potential effects of unequal states of evaporation amongst samples. Selecting the peak-pairs to be incorporated into the comparison method required that the ratios selected must be reproducible within a sample, and that they be useful in discriminating samples from different sources. It was determined that the analysis of additive packages would not be useful in a typical forensic examination due to the low concentrations present, and the typical volumes recovered in forensic casework.

Gasoline samples were analyzed via gas chromatography-mass spectrometry. This data was then processed through a target compound program, which integrated and tentatively identified compounds of interest. The abundance values used in the ratio process were not total abundance values, but rather base peak abundance values. It is recognized that without quantitation via an external calibration chart, these values will not be useful for actual quantitation of an individual component. However, these values can be reproduced with precision, and are useful indicators of abundance. Data regarding retention time and base peak abundance for each of the target compounds could be exported into a Microsoft® Excel template, which automated the data processing portion of the comparison.

Utilizing data from several different gasoline samples, including multiple runs of individual gasolines, and weathered samples from known gasolines, data from the list of potentially useful target compounds was examined. Peak-pair ratios were eliminated if they were not reproducible within multiple runs of a single sample, or if they were not reproducible within a set of evaporated samples (up to 50%) from a single source. This step was necessary in order to insure that the comparison method would not falsely exclude samples having a common origin based solely on differences in states of evaporation or due to inconsistent integration of poorly resolved peaks. The list of potentially useful target compound peak-pairs was then further reduced based on their ability to distinguish gasolines from different sources. A final set of 20 peak pairs was selected for use in the comparison method.

Gasoline samples from a variety of sources were run through this method, and compared to one another. In addition, some were evaporated to 25% and 50% weathered conditions. Utilizing the instrument's custom reports software in conjunction with user-created spreadsheet templates, data from samples can easily be compared. Using this method, all evaporated samples were correctly matched to their source. In addition, of the 30 gasolines tested, the vast majority could be distinguished from one another and a series of blind samples were correctly matched to their corresponding source gasolines.

The utilization of the autosampler, in conjunction with automatic data processing makes not only the comparison process easier, but also the process for validating peak selection. By incorporating user-created templates, one can present data graphically, and therefore make the process much easier to understand.

[i] Mann, DC, Comparison of Automotive Gasolines Using Capillary Gas Chromatography I: Comparison Methodology, Volume 32, Number 3, (1987), Pages 606 – 615.

[ii] Mann DC, Comparison of Automotive Gasolines Using Capillary Gas Chromatography II: Limitations of Automotive Gasoline Comparisons in Casework, Volume 32, Number 3, (1987), Pages 616-628.

11:30am LUNCH

1:30pm Critical Thinking in the Forensic Sciences
Lawrence A. Presley - National Medical Services

There is nothing either good or bad, but thinking makes it so (Shakespeare, *Hamlet. Act ii. Sc. 2)*

Cogito, ergo sum: I think, therefore I am. Thinking is natural to the human experience. Everyone can think, but thinking clearly and skillfully about important issues is essential to many professions, including forensic science. For example, the DNA Advisory Board (5.2.3.2 b) requires the technical leader to "be responsible for technical problem solving of analytical methods..." SWGMAT (January, 1999, 4.2.6) states that the "*Technical Manager (However Named)...* have the overall responsibility and authority for the technical operations ... (that) include, but are not limited to...evaluating report writing and conclusions." SWGDRUG (2000, 2.3.4) recommends that supervisory chemists will "exhibit knowledge necessary to evaluate results and conclusions."

The tasks of evaluating results and conclusions and technical problem solving require critical thinking skills and training. A critical thinker can distinguish between a high quality and sound line of reasoning from a line of reasoning that has less or little factual support. Some individuals are 'naturally' proficient in highly developed critical thinking skills, while others are less endowed; however, my hypothesis is that specific training in critical thinking can enhance or more fully develop the skill. This presentation is designed to define critical thinking[1] and its application to the forensic sciences, to offer examples of how critical thinking is taught, and to explore the value of critical thinking to forensic professionals.

[1] Diestler, Sherry, Becoming a Critical Thinker (Prentice Hall, Inc.: Upper Saddle River, NJ) 2001.

2:00pm Fields of Green: A Review of Marihuana Legislation and How it May Affect the Forensic Drug Chemist
Lorinda Titus - Anne Arundel County Police Department Crime Laboratory

In the spring of 2000, Maryland passed HB1250, requiring that the Maryland Department of Agriculture establish a pilot program to study the growth and marketing of industrial hemp in the State. In addition to reviewing current and potential markets, a hemp field is to be planted to test agricultural conditions. This has the potential to raise some legal issues. This presentation will review the status of hemp legislation in the US, discuss three different viewpoints regarding industrial hemp, review the Canadian industrial hemp program, and raise issues that forensic labs should take into consideration.

2:45pm BREAK

3:00pm Analysis of Artificial Logs by High Temperature Gas Chromatography
Raymond J. Kuk - ATF

High temperature gas chromatography is used to analyze the wax of artificial fireplace logs (firelogs). Firelogs from several different manufacturers are studied and compared. It was shown that the wax within a single firelog is homogeneous and that the wax is also uniform throughout a multi-firelog package. Different brands are shown to have different wax compositions. Firelogs of the same brand, but purchased in different locations, also have different wax compositions. With this information it may be possible to associate an unknown firelog sample to a known sample, but a definitive statement of the origin can not be made.

3:20pm Heroin Processing in Columbia
Sini Panicker - DEA, Special Testing and Research Laboratory

Colombia has been playing a major part in the heroin market of the United States for the last decade. The cultivation of opium poppy, which is the first step in the heroin production, has taken over the agricultural farms and forests of Colombia since the 1980s. The harvest and the subsequent extraction methods of opium employed by Colombians are very unique to Colombia. The step by step Colombian processing of opium into morphine alkaloid is discussed. The conversion of morphine into heroin HCl in Colombian clandestine labs is also discussed in detail.

4:00pm Crime Scene Evidence Case Study:
Interpreting Evidence to Recreate the Crime
Kimberly Dunn - Montgomery County Crime Laboratory

This presentation will review the crime scene evidence found at an extremely brutal homicide scene in Montgomery County and explain how investigators interpreted the scene to develop a case theory.

In August of 2001 homicide investigators responded to the scene of a murder in a locked apartment within a highrise building in Takoma Park. The victim, a young woman who was almost eight months pregnant, was found stabbed to death in her home. Key aspects of this case were blood spatter pattern interpretation and DNA evidence. This presentation will discuss how such evidence was analyzed to tell the story of the crime.

Please be advised some graphic photographs from the crime scene will be shown during this presentation that may be disturbing to viewers.

5:00pm Business Meeting

26 April 2002: Moderator – Lori Titus

8:30am SWGDRUG (Scientific Working Group For The Analysis of Seized Drugs) 2002 Update
Richard Gervasoni - Montgomery County Crime Laboratory &
Eileen Waninger - FBI

The mission of SWGDRUG has been the formulation of recommendations for internationally accepted minimum standards for the forensic analysis of seized drugs. The SWGDRUG recommendations have been disseminated on the Internet (www.swgdrug.org) and in Microgram. The recommendations are now available in an official publication, which has been distributed to the Microgram mailing list.

The SWGDRUG Core Committee met in January 2002 to discuss changes in core committee membership and to begin formulating the next set of SWGDRUG recommendations. Three sub-committees were formed: The Methods and Reports Sub-Committee, The Quality Assurance Sub-Committee and The Ethics, Competence and Certification Sub-Committee. The objectives of each of these sub-committees and the possible changes in Core Committee membership will be discussed.

9:00am Overview of the University of Baltimore Forensics Program
Mark Profilli & Jami Grant - University of Baltimore

The University of Baltimore has begun a degree program in forensics with two concentrations: one in police science and one in forensic science. The program is being run in conjunction with local crime laboratories including Baltimore City which will provide instruction, internships and the use of the facility as part of the students' education. The forensic science concentration has three tracts the student can follow, either Trace Analysis, Forensic Biology or Identification (fingerprints, firearms, qd etc).Only in its second semester the program has met with great success and this spring the students have formed a "Student's Forensic Science Organization" on campus. They also plan on hosting workshops and guest speakers.

9:25am Preparation of an Explosives Library by IR/ATR
Rena A. Merrill* & Edward G. Bartick – FBI

The advent of portable infrared (IR) spectrometers, utilizing Attenuated Total Reflection (ATR) as the sampling method, has provided forensic investigators with a valuable tool. Digital ATR libraries are needed to supplement this tool. An ATR library has been prepared of commercial and homemade explosives, explosive components, residues from burned explosives and several solvents and materials associated with explosives. A total of 235 samples were obtained from numerous collections within the FBI and analyzed using an extended range IR equipped with a single reflection, DuraSamplIR ATR accessory and a diamond/KRS5 internal reflection element (IRE). Resulting spectra, from 4000 to 260 cm^{-1}, were used to build a digital library in Nicolet format for use in the laboratory. The spectra were also used to build a digital library for use on the portable TravelIR used outside the laboratory. Field analysis with portable IR equipment and the digital explosives library can assist with the identification of many suspected explosives and explosive components prior to moving the material to the laboratory for more detailed studies. Analysis of explosives by ATR is fast, involves no sample preparation, and requires only a minimal amount of sample. An indexed hardcopy version of the spectral library has also been prepared which includes the ATR spectrum, chemical structure, and characteristic frequency assignments for each of the 235 samples studied. The preparation of the library will be presented along with testing results, pitfalls, and recommend procedures for using the library.

9:45am BREAK

10:00am Developing an ISO 17025 Quality Management System:
Part 1 – Overview and Management Requirements
Hank Frenz - EHS Services

ISO 17025 provides an alternative to ASCLD-LAB's accreditation program. Furthermore, as discussed at last year's annual meeting, ASCLD-LAB is exploring the possibility of incorporating ISO 17025 into its existing program. This presentation will provide an overview of the ISO 17025:1999 quality system development and accreditation process, and discuss the contents of Section 4 of the standard, entitled "Management Requirements".

Organizations seeking to develop an ISO 17025 quality system complete a number of activities, some of which are recommended and others that are required. Among the recommended activities are a gap analysis and a preliminary assessment. The required activities include document development and administrative tasks leading to the formal assessment by a 3rd party accreditation organization.

The standard's management requirements encompass 14 essential items, including the development of a quality manual, and procedures addressing document control, handling of complaints, controlling records, corrective and preventive action, management review, and more. Attaining accreditation requires diligent

conformance to these requirements, including the development of procedures to be followed by laboratory management and staff.

At the conclusion of this presentation, attendees should have a basic understanding of 1) the ISO 17025 assessment process, 2) the tasks required to be completed under Section 4 of the standard, and 3) the documentation necessary to successfully implement a 17025 quality program.

10:35am **Developing an ISO 17025 Quality Management System: Part 2 – Technical Requirements**
Curt Bluefeld - EHS Services

Many factors determine the accuracy and reliability of tests performed by forensic laboratories. These factors include personnel training, education and skill level, laboratory environments, test methods and method validation, equipment, and measurement traceability. This presentation will discuss these technical issues from the perspective of ISO 17025 –"General requirements for the competence of testing of calibration laboratories".

Compliance with ISO 17025 significantly enhances a laboratory's ability to withstand third party scrutiny of its analytical data. While this presentation will address all technical requirements contained in Section 5, including test and calibration methods and method validation, control of data, quality control, and reporting, a primary focus will be on measurement uncertainty and measurement traceability.

11:10am **Hair Sampling for Organic Gunshot Residues (OGSR)**
William MacCrehan & Malinda Layman - NIST

The application of gunshot residue analysis has been somewhat limited by the challenge of effectively collecting residues. Adhesive taping or stub lifting from the hands has been the primary means for collecting inorganic primer residue metals, such as barium, lead, and antimony. The metallic residues are then most commonly determined using SEM/EDS. In an approach that proved successful in casework, Zeichner et al. sampled hair for inorganic gunshot residues using tape lifting and a swabbing-and-comb method.

An alternative approach to detecting firearm use is the analysis of the organic residues resulting from incomplete combustion of the smokeless powder. These residues may be collected directly by a very fine comb or by tape lifting. The residue analysis depends on the measurement of three characteristic organic gunpowder components (COGC): propellant nitroglycerin (NG) and two stabilizers, diphenylamine (DPA) and ethyl centralite (EC). Residue additives are recovered from the extracting medium with organic solvent, typically methanol. In this study, ultrasonic solvent extraction (USE) of the collected residues followed by a micellar capillary electrophoresis (CE) determination was used to determine the COGC.

We have evaluated the effectiveness of two residue collection media, tape lifting and hair combing. A variety of evidence tapes were evaluated for physical and chemical interferences in OGSR collection from the firing hand and from the head hair of the shooter. Combing was also tested as a means of collecting OGSR using a fine-toothed comb (a flea comb for pets). Both coated and uncoated combs were tested for residue collection efficiency from real shooters and mannequin heads covered in human wig hair. The mannequins were positioned relative to the weapon to simulate a shooter and a victim. Four weapons -- revolver, semi-automatic handgun, semi-automatic shotgun, and rifle -- were used to determine the effect of the weapon type. Overall, the combing protocol was found to provide good recovery of OGSR from both the shooters and the victims with much less interference from impurities than was noted with tape lifts.

11:30am Problem tape examination:
Development of latent fingerprints from the adhesive side of tape
Elizabeth Toomer - GWU

The purpose of this study was to determine guidelines for the amount of time crumpled or folded tape should be placed in a normal household freezer, then processed with sticky side powder, to effectively visualize latent fingerprints. This method would negate the current method of separating crumpled or folded tape using a chemical solvent, which may lead to the contamination of valuable trace evidence present on the tape.

The tapes were studied to distinguish those that easily yield latent fingerprints on the adhesive side, as compared to those tapes identified as problem tape (required either solvents or additional time in the freezer in order to separate and yield latent prints). The tapes studied were clear tape, black electrical tape, waterproof medical tape, duct tape, and masking tape. The primary factors investigated were: quality of latent fingerprints, and the ability to separate the tape without destroying the evidence. The duct tape and masking tape resulted in 0% development of latent fingerprints when placed in the freezer for 2 days or less and processed with sticky side powder. After up to 7 days in the freezer, the duct tape and masking tape resulted in 100% visualization of latent fingerprints with quality ridge detail visible. Further work is needed to test the best procedure for the recovery of trace evidence on the adhesive side of crumpled tape, when latent fingerprints must also be recovered.

12:00pm Door Prizes in Biology Session @ close of meeting

Biology Session

25 April 2002: Moderators – Heather Thew (AM) & Julie Kidd (PM)

8:30am Opening Remarks and Welcome to Participants

8:45am Comparison of FTA Paper (Whatman BioScience) and IsoCode Paper (Schleicher & Schuell) for collecting and isolating DNA from Buccal Swabs
Dan Katz, Delaware Office of the Chief Medical Examiner

The Delaware Office of the Chief Medical Examiner DNA Unit is the designated SDIS laboratory in the state of Delaware and is responsible for collecting convicted offender database samples to be entered into CODIS. Currently, samples are collected as whole blood by the state correctional facilities and then stained on cards by the DNA Unit. Collecting samples in this manner is both time consuming and labor intensive for both the correctional facility and the DNA Unit. Therefore, a proposal has been made to switch from collecting whole blood samples to collecting buccal swab samples. Such a switch would allow for the sample to be collected using a less intrusive manner and then immediately transferred to a stain card. Although a buccal swab procedure would make collection easier, there are issues regarding this method. For example, it is desirable that samples can be amplified without quantitation and still yield consistent and quality data that would not require sample reruns at the analysis stage. This may be a challenge because DNA yields from buccal swabs are likely to be more variable than DNA yields from bloodstains. Therefore, a study to compare FTA paper to IsoCode paper is being conducted to see which provides the best all around results. Factors such as processing time, yield consistency, and practicality will be addressed in this presentation.

9:05am P30 Antigen Standard Comparison
Tina Andrews*; Rhonda L. Craig & Anthony J. Onorato - FBI

Prostate Specific Antigen (PSA) is often used to confirm the presence of semen in forensic casework. Since 1998 the FBI has used the Abacus OneStep ABA P30 cards as our confirmatory test for semen identification. To ensure accuracy in card performance new ABA card lots are tested before being incorporated into casework with a semen standard for calibration. Abacus has recommended the use of a specific standard for calibrating their PSA cards, the Stanford University Free PSA Standard. The FBI purchased the Stanford Standard, as well as the Serological Research Institute's Semen Standard (SERI) for comparison to the previously used Scripps Semen Standard. Studies were done that evaluated the performance of these standards on four different Abacus lot numbers of cards, as well as on two other manufacture's cards (Seratec and Veda Lab). Comparison of these standards gave no indication that the Stanford Standard is significantly better for calibration of PSA cards.

9:25am Alternate approach for sexual assault casework
Julie Ann C. Kidd*; Mary Louise Koehl; Charles Hough; Kristina Losquadro & Jenifer Smith - FBI

Evidentiary items submitted for DNA analyses in sexual assault cases usually include swabs, panties, and other clothing, collected from the victim at the time of examination by nurses or doctors. These items, submitted to crime laboratories, are screened for the presence of sperm or semen and utilized in PCR STR analyses for the inclusion or exclusion of potential suspects. In cases where these items are void of sperm or semen, evidentiary items obtained from the suspect may be examined for the presence of DNA from the victim. This approach applies to cases when a suspect is apprehended shortly after the sexual

assault occurs. This presentation involves an approach to identifying probative stains in suspect's clothing and the subsequent analyses using the PCR STR technologies. Several cases will be referenced showing successes in casework using this approach.

9:45am BREAK

10:00am Evaluation and Validation of a Modified DNA Extraction Procedure
Kristina Losquadro*; Jill Smerick; Deborah Hobson & Jenifer Smith - FBI

The FBI DNA Analysis Unit I employs a DNA extraction procedure comprised of a lysis/digestion step followed by clean-up using phenol/choloroform and Microcon dialysis. The original protocols for blood and saliva require an overnight digestion. Studies were conducted to determine if the duration of the digestion step could be reduced. Factors examined included varied time points, quantity of DNA recovered, and balance of amplified DNA using the AmpFLSTR® Profiler Plus□ kit. Initial studies focused on pristine blood and saliva specimens. Aged casework stains consisting of blood and saliva were then evaluated. The results of these studies will be presented.

10:20am Evaluation of the ABI Prism® 3100 Genetic Analyzer for Use in Forensic Casework
Jill Smerick* & Deborah Hobson – FBI

The 3100 Genetic Analyzer is a high-throughput capillary electrophoresis instrument which shows promises for use in forensic casework. A single injection analyzes sixteen samples in less than one hour. However, while speed and through-put are a plus, challenges exist for implementing the 3100 into routine casework. These challenges include data management and instrument maintenance. Precision, resolution, and sensitivity studies were conducted on both the 3100 and 310 Genetic Analyzers. These data, as well as cost analysis, through-put, data management and instrument maintenance concerns will be discussed.

10:40am Forensic DNA Identification using STR analysis in Military Aircraft Mishaps
Susan W. Jones*, PhD, MFS - AFDIL; Demris A. Lee, MSFS – AFDIL; Brion C. Smith, DC, ME – AFDIL & Robert C. Veasey - OAFME

The Office of the Armed Forces Medical Examiners' (OAFME) mission is to investigate any military aircraft crash and retrieve and identify any individuals involved in these mishaps as rapidly as possible. Short Tandem Repeat (STR) DNA profiling is performed on biological specimens retrieved during the investigation of an aircraft accident and used for identification of the involved service members.

The first item in the investigation of an aircraft accident is to remove any ordinance and to neutralize any jet propulsion fuels or other flammable substances that may have leaked from the aircraft. OAFME investigators get an overview of the mishap and initiate photodocumentation of the crash site and surrounding area. A highly organized recovery, that involves removal of pieces of aircraft and careful retrieval of remains, is performed. The on-site medical examiner(s) often have to retrieve tissues or bones from the crash victims under "field" conditions. These remains include specimens that may have been subjected to extreme environmental insults, such as incineration, submersion in wet or swampy soil, exposure to multiple organic or synthetic compounds from the aircraft, or prolonged outdoor exposure, due to an environmentally hazardous or remote crash site. The samples are catalogued, packaged and labeled, then sent to the laboratory for DNA Identification using STR analysis.

The MV-22 Osprey was recently under scrutiny due to multiple aircraft mishaps. During the first Osprey accident in Arizona on April 2000, 31 samples from desiccated and burned human remains from 19

individuals were retrieved from the desert crash site, and sent to the laboratory for analysis. The bloodstain reference cards for the involved individuals were retrieved from the Armed Forces Repository of Specimen Samples for the Identification of Remains (AFRSSIR). STR DNA profiles from known bloodstain reference cards were compared to the profiles obtained from the remains for confirmation of identification and reassociation and all 19 individuals involved in the incident were identified. In another Osprey incident occurring on December 2000, four individuals were killed in Jacksonville, NC. The incineration of the aircraft and the individuals involved made the DNA analysis more challenging due to the extensive charring of the remains and the muddy environment where the remains were retrieved. Constant communication was required and STR analysis was being performed in "real time" to ensure representation of the individuals involved in the mishap. Since the remains were heavily burned numerous specimens were sent to the lab for analysis. All specimens except one yielded full STR profiles and all four individuals involved in the incident were identified.

Another aircraft crash involving a T-34 Sherpa in Florida, necessitated a partial underwater recovery. The excavation of remains of the two involved individuals was initiated and 12 samples sent to the laboratory by 6:30 PM the night of the recovery. The DNA extractions, STR amplifications and electrophoresis were completed by 3 AM and the DNA identification and reassociation results were sent by text message using a wireless pager, the following day by 1:46 PM. Due to the exposure of these samples to harsh environmental conditions, many of the DNA extracts yielded STR profiles characteristic of degraded DNA. Both individuals were represented in the remains that were sent to the laboratory for analysis and both individuals were identified.

The OAFME often recovers a real variety of biological casework samples with environmental insults to them. It is the nuances of STR analysis and interpretation of degraded DNA extracted from biological samples exposed to harsh environmental conditions and recovered by the OAFME, in these incidents and others, that will be specifically addressed in this discussion.

11:00am STR mixture analysis: an evaluation of the Peter Gill approach

Hal Deadman - GWU

The power of forensic STR analysis has revolutionized forensic science. This is true even when the STR technology is compared to the DNA typing methods of the early and mid 1990's. A tremendous ability to discriminate is combined with great sensitivity. In addition to working with trace amounts of most biological fluids, it is now possible that sufficient DNA for analysis can be recovered from just about anything touched or worn by man. Another factor that makes STR typing so powerful is the simplicity of interpretation. It is almost impossible to make either a false positive or a false negative without mixing up samples or reporting errors. The great sensitivity of STR analysis, however, often results in mixtures. Mixtures are usually more difficult to interpret and can be especially difficult when the DNA genotype of the minor contributor is sought. Although current STR technology does simplify the interpretation of most mixtures by producing quantitative information that depends on the amount of DNA present, mixture analysis can still be problematic.

Peter Gill, et al, of the Forensic Science Service, in England, published a paper in 1998, entitled "Interpreting simple STR mixtures using allele peak areas". It describes a simple method for determining the genotypes of both the major and minor types of simple (two person) mixtures where the major contributor makes up greater that 75% of the mixture. At loci where there are four peaks, the determination of the genotypes of the major and minor contributor is simple, however, when only two or three peaks are present, genotype determination of the contributors may not be straightforward. Although the procedure does not work with mixtures where the DNA of the contributors is present in similar amounts, many case situations result in a major and a minor contributor. Gill explains that the purpose of the paper is to develop a framework to analyze simple mixtures so as to make a preliminary assessment of a given case against a background of possible minor artifacts. It uses a simple computer model to estimate the proportion of the components of a simple mixture of two individuals and then proceeds to rank all possible genotype combinations for all loci based on a comparison of observed peak

areas with expected peak areas. Gill suggests that the procedure be used prior to considering the genotypes of any known individuals that might be contributors to the mixture. The ability to determine objectively the DNA types of contributors to a mixture with no information about the possible sources has great value in this day where "subjective" analysis is frowned on.

The Gill procedure works quite well in many situations, but, unfortunately it does work all the time. The purpose of this presentation is to introduce the audience to the Gill approach and attempt to define under what conditions his procedure produces the correct genotypes of the contributor's. Gill's procedure has been used on over 40 two-person mixtures prepared during validation studies at the FBI Laboratory and in several actual cases. In those instances where Gill's procedure doesn't provide the correct genotypes, possible explanations for the incorrect results are being examined and simple modifications to the procedure will be discussed. For those planning to attend this presentation, it would be very helpful to review Gill's paper (P. Gill, R. Sparkes, R. Pinchin, T. Clayton, J. Whitaker, J. Buckleton, Forensic Science International, 91 (1998) 41-53).

11:30am LUNCH

1:30pm Kinship Determination: How Accurate Are The 13 Core STR Loci?
Nicole M. Laurent* & David R. Foran - GWU

The ability to accurately determine the biological relationships among individuals has important consequences in the field of forensic science. Kinship analyses may be advantageous in paternity cases or mass disasters when direct reference samples are impossible to obtain, in reassembling of families that have been separated by war, emigration or adoption, or when a profile from crime scene evidence partially matches a sample in a DNA database. The ever-increasing use of kinship testing necessitates reliable results. Today, most forensic laboratories in the United States perform these analyses using the 13 CODIS (core) STR loci. While this small set of markers is highly discriminating for individual identification, are they sufficient in providing an accurate determination of the relationship between two individuals?

On average, approximately half of the alleles of full siblings and one quarter of the alleles of half siblings are identical by descent, that is, replicates of an allele from the mother, father, or both are inherited. With unrelated individuals, it is expected that the majority of alleles at highly variable loci will not be shared, but a small number of alleles may be identical by state due to chance and limited possible outcomes. In general, assessing the accuracy of the core loci in kinship determination entails analyzing large sets of sibling pairs, which can be time-consuming and laborious, or sampling computer-simulated populations, which present only theoretical results.

We sought to circumvent the difficulties in identifying potentially misrepresented relationships by taking advantage of a far larger STR data set. Here, full siblings, half siblings or unrelated individuals, categorized as such based on customary methods of family records and interviews, were typed at almost 200 (range of 181-191) STR loci in a gene mapping/pedigree study conducted at the National Institute of Health. Utilizing this large data set was advantageous because it provided a far more powerful representation of the biological relationship between individuals, which was then used as a standard to judge the accuracy of the core loci. From 168 individuals, 34 pairs were chosen based on the fact that their allele sharing values were outside of the range expected for their stated relationship.

We investigated these "outliers" that shared either a greater or smaller number of alleles than expected, as they would logically represent the most problematic comparisons for standard forensic analyses. A comparison of the allele sharing values at both sets of loci demonstrated whether the core loci are powerful enough to identify the same problematic pairs or if they misrepresent the true biological relationship. MtDNA sequencing and Y-chromosome STR analyses were then conducted to independently establish maternal and paternal relationships of these samples. Our results indicate that the 13 core loci

commonly misrepresent the relationships of all but the most closely related individuals, and even among those mistakes will occur.

1:50pm **New DNA Tests for Improving Analysis of Degraded DNA and Male-Female Mixtures**

John M. Butler* – NIST; Richard Schoske – NIST/AU, Chemistry; Margaret C. Kline – NIST & Peter M. Vallone - NIST

Two of the primary challenges for analysis of biological evidence in a forensic context are separating mixtures of male and female DNA from sexual assault cases and producing useful results from degraded DNA obtained from mass disaster scenes or missing persons investigations. At the National Institute of Standards and Technology, we are funded by the National Institute of Justice to develop new DNA tests to aid the forensic community. This presentation will focus on recent efforts to make shorter PCR products for the CODIS core STR loci to help with identification of remains from the World Trade Center disaster. The development of a male-specific DNA test that simultaneously amplifies 20 Y chromosome STRs will also be covered along with potential applications.

2:10pm **Evaluation of short amplicon STR primer systems ("mini-STRs"): Target size reduction and its impact on STR genotyping of degraded DNA**

Wera Schmerer – AFDIL; John Butler – NIST & Thomas Parsons - AFDIL

When amplifying STR loci from degraded DNA - as present in decomposed human remains - the size of amplifiable template DNA frequently represents the limiting factor concerning genotyping by means of primer sets and multiplex systems established so far. With the decline in DNA preservation, allelic dropout and locus dropout become increasingly prevalent (e.g. 1, 2), especially for loci with larger fragment size (2).

Allelic dropout and the resulting possibility of false-homozygous typing can be ruled out by combining the results of multiple amplifications (2, 3). This type of strategy can likewise serve to deal with locus dropout (3), given that the state of DNA preservation is not so low as to render amplification in the size range of this locus impossible.

A more promising approach to dealing with amplification dropout in general is to attempt to reduce its occurrence in the first place through design of primer systems that span a significantly shorter target sequence at the desired loci. John M Butler (NIST) has developed such "mini-STR" systems that target the 13 CODIS loci and further forensically relevant STRs (4). By moving both primers as close as possible to the repeat region of the locus, allele fragment size at these loci was reduced by up to 152 bp. In the design of these primer systems all known information on flanking sequence variation was taken into account to rule out the occurrence of null alleles, as caused by single nucleotide polymorphisms in the primer binding sites (unpublished data). Since the primer design does not affect the informative part of the locus - the repeat region and hence the characteristic length polymorphism – these "mini-STRs" yield the same genotyping information content than the larger fragment size primer sets established in forensic analysis.

To evaluate these new primer systems, combined into "mini-STR" multiplexes, their performance in amplifying non-degraded and degraded DNA was compared to that of standard forensic STR multiplexes (e.g ProfilerPlus).

(1) Burger J, Hummel S, Herrmann B (1999) DNA preservation: A microsatellite-DNA study on ancient skeletal remains. Electrophoresis 20: 1722-1728

(2) Schmerer WM, Hummel S, Herrmann B (1997) Reproduzierbarkeit von aDNA-typing. Anthrop Anz. 55:199-206

(3) Gill P, Whitaker J, Flaxman C, Brown N, Buckleton J (2000) An investigation of the rigor of interpretation rules for STRS derived from less than 100 pg of DNA. Forensic Sci Int 112: 17-40

(4) Butler JM, Becker CH (2001) Improved analysis of DNA short tandem repeats with time-of-flight mass spectrometry. Science and technology research report, NIJ, NCJ 188292

2:25pm **The Effect of DNA Extraction and Purification Procedures on STR Profiles from Degraded DNA Using Redesigned Primer Sets**

Kerry L. Opel*; Yin Shen; John Butler; Nancy Tatarek & Bruce McCord

Two issues that are associated with obtaining STR profiles from forensic DNA samples are minimal or incomplete DNA templates and the presence of Taq polymerase inhibitors. These problems prevent full PCR amplification of STR loci and can result in allelic dropout or incomplete profiles. We are examining a number of different approaches to address these problems. In one procedure we utilize miniplex STR primers to improve the amplification of degraded DNA. These primer sets, which were developed in collaboration with the National Institute of Standards and Technology, produce shorter (<200 base pair) product sizes without change in the alleles. The shorter products are more readily obtained from degraded DNA. The second issue is being addressed by use of two different pre-amplification purification procedures: NaOH rinse and silica based spin columns (QIAGEN). These procedures have been previously used to increase the quality and quantity of amplified DNA [Bourke et al, Yang et al]. We were interested in examining the effect of such treatments on the newly developed miniplex sets. A series of samples including bloodstains and human skeletal remains were tested using these techniques. The results show improvement in the intensity of larger loci alleles when sample pre-treatment techniques are used.

2:45pm BREAK

3:00pm **The Armed Forces DNA Identification Lab's role in September 11, 2001**

Amanda Blanchard*; Demris A. Lee; Suzanne M. Barritt; Kimberly B. Murga & COL Brion C. Smith - AFDIL

After the tragic events of the terrorist attacks on the United States in September of 2001, AFDIL was tasked with the identification of the victims from the Pentagon and the United Airlines flight # 93 crash in Somerset, Pennsylvania. A team of forensic anthropologists, odontogists, medical examiners, military personnel, civilian DOD employees, NTSB, FBI, and NCIS individuals worked at Dover Air Force base for almost four weeks. Evidence was sorted and collected at Dover before and during autopsy to target the best specimens for DNA analysis. Samples were taken from whole bodies and also from fragmented and disassociated remains after anthropological analysis, and possible dental and/or fingerprint identification. A similar compliment of experts was simultaneously processing the crash site in PA also to include members of the region III Disaster Mortuary Operational Response Team (DMORT). Scientists from AFDIL were deployed to Dover Air Force base to assist in evidence collection. A mobile version of our Laboratory Information Management System (LISA) was developed and used daily at both recovery sites for sample numbering, tracking, chain of custody and producing labels for the specimens. While some analysts were in the field, the remaining AFDIL staff used the teamwork approach to divide tasks across all 7 days of the week in order to identify and reassociate the remains as quickly as possible. Family assistance centers were created near the Pentagon and near the crash site in PA for victims' families to donate blood or to give direct references that were available from the victims themselves. In three months AFDIL faced the challenge of testing over 938 samples and 348 references from the Pentagon and 592 specimens and 53 references from Somerset. Testing resulted in all 40 identifications from the

passengers on flight #93 and all but 5 of the 188 individuals from the Pentagon, with a greater than 95% success rate. Using its knowledge and experience of previous mass disaster involvements, AFDIL was able to quickly act and identify the victims of these terrorist attacks. This presentation will describe AFDIL's approach to successfully managing and processing these two mass disasters.

3:20pm **DNA Identification of the Victims of the World Trade Center Disaster**
Shelley Johnson, MFS – BTG

The events of September 11th set off, amongst other things, the world's largest DNA identification project ever. In order to generate and report results in a timely fashion a blending of techniques and staff from high throughput data banking and forensic casework was required. Since October 12th over 17,000 samples have been processed ranging from skeletal remains, soft tissue remains, DNA extracts and family reference samples. One of the greatest challenges has been sample quality, as many of the remains had spent several weeks in burning rubble of >2000 °F. From tissue extracts we are only recovering profiles from ~30% of the samples and obtaining ~70% no results. At present we are obtaining results from ~71% of the skeletal remains while getting no results from ~29% of the bones. This can be directly compared to the analysis of skeletal remains of the AA587 crash where remains recovery occurred more quickly. Using the same methods profiles were obtained from 93% of the bones tested with only 7% no results.

3:40pm **Automation of Forensic Mitochondrial DNA Analysis in Response to the Attack on the World Trade Center**
Matthew Reardon, MFS*; Mark Adams, PhD; Dana Busam; Susanne Dietz, MS; Tina McIntosh; Danita Pitts; Yu-Hui Rogers, MS; Timothy Stockwell; Sherita Williams & Rhonda Roby, MPH – Celera Genomics & Applied Biosystems

Celera Genomics and Applied Biosystems have been asked to conduct mitochondrial DNA (mtDNA) sequence analysis on extracted DNA from the evidentiary material recovered from the disaster at the World Trade Center and reference specimens from the victims' families or personal effects. The tools implemented for sequencing the human genome at Celera have been incorporated into this high throughput environment for mtDNA sequencing for forensic DNA identification purposes. Execution of and advancements in automation as adopted for forensic mtDNA analysis at Celera will be presented. These advancements are in LIMS, advanced laboratory robotics, multicapillary electrophoretic systems, and data analysis. The DNA samples received from the submitting agencies are re-arrayed and set up for amplification using the Tomtec Quadra 9600 into a 384-well plate format. The evidence samples are amplified for Hypervariable Region 1 (HV1) and HV2 and the references are amplified in a separate room for an 1100 bp mtDNA amplicon in the control region. The 384-well plates are placed in a PassThru® box and amplified in the ABI PRISM® GeneAmp® PCR System 9700 With Dual 384 Well Blocks. In an assembly-line environment, the samples are processed for SAP/EXO I, cycle sequenced with a library of sequencing primers, precipitated, re-suspended, and then placed on the ABI PRISM® 3700 DNA Analyzers for sequencing. Currently, the data are analyzed by two (2) analysts using SeqScape® Software. Data analysis is the largest challenge for mtDNA testing of this magnitude. Clearly, automation in the laboratory has exceeded the automation for data analysis. Efforts to reduce the time for data analysis will be presented including a tool for evaluating controls.

4:00pm Mitochondrial Databases, Phylogenetic Trees and September 11th
Michael Coble, MFS*; James DiFrancesco, MFS; Robert M. Fisher, MSFS; Kimberly Murga, MFS; Demris Lee, MSFS; Col. Brion Smith, DDS and Thomas Parsons, PhD – AFDIL

The Armed Forces DNA Identification Laboratory (AFDIL) played a critical role in the identification of the victims from the Pentagon (American Airline flight 77) and Somerset, PA (United Airline flight 93) tragedies of September 11. Nuclear STR profiles were generated for 177/183 victims of the Pentagon/AA #77 crash. Five putative terrorist profiles were generated from the DNA recovered from the crash. Forty-four unique nuclear STR profiles were determined from the Somerset/UA #93 crash site. Forty of these profiles were used to identify the victims aboard UA # 93.

Two of the five terrorists involved in the Pentagon attack were suspected as being brothers. Mitochondrial DNA (mtDNA) sequencing of these templates revealed an identical match in hypervariable segments (HV) I and II. A comparison of the terrorist mtDNA sequence with the MitoSearch database showed that 6/1773 Caucasians shared this same mtDNA type. MtDNA sequence data was also generated for the remaining three Pentagon terrorists and the four Somerset terrorists. None of these sequences match the 1773 Caucasians in the database.

The focus of this presentation is to show how a recent paper containing 1088 mtDNA HVI sequences from the Near East (Richards et al., *ASHG*, **67:** 1251-1276; 2000) was used as a database to compare the frequencies of the suspected terrorist sequences to Caucasian sequences. Additional phylogenetic analyses of terrorist sequences from the Somerset crash are included.

5:00pm Business Meeting

26 April 2002: Moderator – Thomas Parsons

8:30am An Update on the Federal Convicted Offender (FCO) Program
Richard E. Wilson, MS & Thomas F. Callaghan, PhD - FBI

The Federal Convicted Offender (FCO) Program is part of the DNA Analysis Unit II and was officially established as a result of the DNA Backlog Elimination Act of 2000 (PL 106-546). The law is retroactive and, therefore, covers individuals currently incarcerated or under supervised release/probation/parole. The program is responsible for developing and registering DNA profiles from individuals convicted of qualifying Federal and District of Columbia offenses. The program also develops DNA profiles from offenders convicted of qualifying military offenders under supervision by Federal Probation or the Bureau of Prisons. Liquid blood samples are received by the FCO Program and processed using short tandem repeat (STR) analysis of the 13 CODIS loci. FCO DNA Sample Collection Kits are provided by the FBI to all agencies responsible for collecting offender database samples. The FCO kit contains all supplies necessary to collect the liquid blood sample and fingerprints of a qualifying offender. Upon kit receipt and acceptance, each liquid blood sample is assigned a unique bar code that allows tracking throughout the analytical process. Once the samples have been analyzed, they are uploaded into the National DNA Index System (NDIS). The samples will be registered and regularly searched against forensic samples submitted by the FBI and other law enforcement agencies to identify suspects in open investigations. Specific details regarding samples received to date as well as laboratory processes utilized by the FCO Program will be presented in greater detail.

8:50am Molecular Techniques Applied to Botanical Trace Evidence

MT Cimino; ME Hopkins*; RS Wingrove; BG Remortel & RA Bever - BTG

The broad objective of this research was to further explore DNA analysis of botanical trace evidence. Many botanical elements can be characterized based on their inherent physical properties, however numerous dust particulates and botanical fragments offer few morphological characters for reliable identification. Additionally, determining an exclusion or match among different evidence items is further impeded when they contain similar botanical mixtures. For example, in late summer common ragweeed (*Artemisia*) may contribute pollen and leaf material to dust samples deposited on outdoor exposed clothing, no matter where one is located.

An experiment was designed to match or exclude mock evidence using socks as the collection substrate for botanical material. The samples were collected in late summer, across the geographically diverse state of California and included regions along the coast, mountains, deserts, and cities. Particulate material associated with these samples was separated into two size classes that included visible vegetative fragments and dust, the fragments were removed by hand with forceps and the dust was concentrated by vacuum filtration. Particulate material from each of the two size classes was analyzed using DNA based procedures. DNA was isolated from each set of collected botanical fractions and the nuclear internal transcribed spacer region (ITSI) was amplified, a genetic locus that is well characterized in botanical systematics. The amplified product was then cloned and sequenced using an ABI 3100 DNA sequencer. DNA sequence data was analyzed using standard molecular phylogenetic methods and a variety of plants were discerned from each of the mock evidence sock items. Based on the data generated in this study, we conclude that evidence items can be matched or excluded based on the botanical material they contain. We also found that large and small particles associated with our mock evidence generally do not represent the same botanical elements and suggests that at least two particle collection techniques be applied to clothing items. Our findings further suggest that evidence items can be geographically placed within California based on their associated botanical material.

9:10am Recent Advances in Plant DNA Profiling

Sue Mischke – Alternate Crops and Systems Laboratory (ACSL); Monica J. Pedroni – Insect Biocontrol Laboratory, Plant Sciences Institute, Agricultural Research Service, USDA & James A. Saunders - ACSL

In a forensic setting, the usual context of DNA analysis is the use of human DNA profiling for identification of suspects in homicide, rape and paternity cases. However, powerful tools are presently being developed for identification of non-human DNA . Microsatellite (SSR) analysis and determination of Amplified Restriction Length Polymorphisms (AFLP) are the protocols currently most useful for practical plant identification at a molecular level. The principles behind these techniques will be explained, and the types of investigations using these methods in our laboratory will be reviewed.

9:30am Mitochondrial DNA Casework at the FBI Laboratory

Constance L. Fisher - FBI

Mitochondrial DNA (mtDNA) analysis is often performed on forensic casework samples when the amount of DNA in the sample is limiting, or when direct reference samples cannot be obtained. The most forensically important differences between nuclear DNA and mtDNA involve copy number and the mode of inheritance. The difference in copy number stems from cells having two copies of each nuclear gene, but thousands of copies of mtDNA, on average. The difference in the mode of inheritance is due to the biparental inheritance of nuclear DNA, while mtDNA is maternally inherited, so that all individuals of a maternal line will have the same mtDNA sequence. Because of these features, mtDNA analysis is usually the method of choice for analyzing hair shafts and skeletal remains.

The FBI Laboratory first started accepting casework for mitochondrial DNA analysis in June 1996, resulting in the first mtDNA testimony in August 1996. Since then, about 500 cases have been processed, and mtDNA testimony has been accepted in about 30 states, as well as in the Federal court system. At the FBI DNAUII , hairs comprise two-thirds of the questioned items tested. Hairs which have been microscopically associated are routinely processed for mtDNA, with a high degree of correlation between both techiques. Also, hairs which are unsuitable for microscopic comparison purposes, such as fringe and limb hairs, typically produce mtDNA results.

The National Missing Persons DNA Database program within the DNAUII aids in the identification of missing persons. Profiles from skeletal remains are contained in a CODIS index, and compared to profiles from relatives of missing persons which are stored in another CODIS index. The mtDNA population database currently has mtDNA sequences from over 5000 individuals, and is available as CODIS^{mt}. Interesting casework and current areas of research will also be discussed.

9:45am BREAK

10:00am **Mitochondrial DNA Analysis of the Domestic Dog: Control Region Variation Within and Among Breeds**

Rebekah L. Gundry, MSFS – GWU/FBI (Johns Hopkins University, Medicine); Marc W. Allard, PhD – GWU; David R. Foran, PhD – GWU; Tamyra R. Moretti, PhD – FBI & Rodney L. Honeycutt, PhD - Texas A&M University

Animal hair and other non-human trace evidence can often be associated with a crime or crime scene. Like other types of trace evidence, sufficient variation among the samples is required in order to provide information about an individual source. However, since many pets are bred to retain specific phenotypic characteristics (i.e. breed standard), there may be insufficient morphological variability among animals to match a hair to a specific individual. In these instances, genetic analysis may be required for exclusionary testing. To determine whether there is sufficient genetic variation to differentiate individual animals, the entire mtDNA control region of 126 domestic dogs of 45 breeds, in addition to one coyote, and two wolves was sequenced. Forty informative variable sites and 50 haplotypes, including 33 unique haplotypes, were found. The sequence data obtained allowed for analysis of the variation within and among breeds in addition to providing information about the utility of mtDNA analysis of dog samples for forensic casework. Substantial variation was found both within and among breeds, indicating that mtDNA analysis of pet hairs may be a productive avenue for forensic investigations.

10:20am **The correlation between the visual appearance of bone and mitochondrial DNA amplicon size**

Jennifer L. Dreier – GWU; Dr. Douglas H. Ubelaker - The National Museum of Natural History, Smithsonian Institution & Dr. David R. Foran - GWU

One of the primary ways to obtain information on skeletal remains is through DNA analysis. However, skeletal remains are often not found in good condition; as they age and are exposed to the environment they weather and degrade. Bone degradation can result from many variables including chemical, physical, geological, ecological, and biological factors. As it ages, the outer composition of bone breaks down, as may the molecular components that make up the specimen. This process may directly or indirectly influence DNA recovery, making DNA typing from aged skeletal remains complicated and often unpredictable. The goal of this study was to analyze the relationship between the appearance (level of weathering or degradation) of skeletal remains and mtDNA amplification success.

To address this question in an objective and systematic way, a collection of burials recovered from the Voegtly Cemetery in Pittsburgh, PA was examined. Because the samples were buried at the same location and have been interred for the same amount of time, the potential confounders to the study were removed. The bones exhibit a complete distribution of aging and weathering characteristics from largely intact to small bone fragments in soil. The overall condition (degree of weathering) of each burial was assessed according to the modified Behrensmeyer (1978) scale. The scale was characterized by Buikstra and Ubelaker (1994) and consists of six stages: Stage 0 – No cracking or flaking, Stage 1 – Some cracking, usually longitudinally in long bones, Stage 2 – Cracks and some flaking of bone, Stage 3 – Bone surface has rough patches of weathered compact bone down to 1.5 mm, with extensive flaking although bone fibers are still attached to each other, Stage 4 – Bone surface is course, splinters may exist and fall out, and weathering reaches the interior portions, Stage 5 – Bone is easily broken and is disintegrating, original shape may be hard to determine.

Ribs were used for the comparisons in this study because they were frequently recovered during excavation and were not needed for other measurement or collection study purposes. A minimum of twenty rib samples from the Voegtly Cemetery were collected from each weathering stage. Each rib was weighed and cut if necessary to reach 0.2-0.3g. The external surface of the bone was cleaned and DNA from each sample was then extracted by a standard phenol:chloroform method.
The level of DNA degradation in a sample can be assayed by attempting to amplify progressively larger and larger DNA segments, determining the largest size class of human mtDNA existing in each sample. Amplicon sizes included 1000, 600, 400, 300, 200 and 100 base pairs in length. The largest size of amplifiable mtDNA was compared to the degradation stage of the bone, and any correlations statistically analyzed. Determining the relationship between the level of bone degradation and the success of mitochondrial amplification will allow researchers to be much more discriminatory as they decide which bone samples to target for DNA extraction.

10:40am **Reducing reagent blank contamination in mtDNA analysis of bones and teeth**

Holly B. Bratcher; M. Deanna Pope-Rainey & Constance L. Fisher - FBI

The evidentiary sample types commonly submitted for forensic mitochondrial DNA (mtDNA) analysis include hairs, bones, and teeth. Although hairs comprise the bulk of submitted samples, bones and teeth, commonly received in missing persons and homicide cases, tend to be the most difficult samples encountered in casework. The ability to obtain mtDNA sequence from bones and teeth is periodically confounded by contamination in the reagent blank. This study involved the evaluation of DNA-OFF, a non-corrosive cleaning solution marketed for decontamination of PCR workstations, for cleaning of equipment used in the extraction of bones and teeth.

The FBI uses a freezer mill and cylinder assembly to pulverize bones and teeth into a fine powder suitable for extraction. This assembly consists of a plastic cylinder, metal endpieces, and a metal impactor bar. Although the plastic cylinder can be used once and discarded, the metal endpieces and impactor bar are used repeatedly. The standard protocol for cleaning the endpieces and impactor bar consists of scrubbing with detergent, briefly incubating in a 10% bleach solution, and UV irradiating. Longer incubation of the assembly components in the 10% bleach solution results in corrosion of the metal. The experiments presented here demonstrate that DNA-OFF treatment of the metal endpieces and impactor bar significantly reduced the amount of contamination seen in the reagent blanks derived from swabbing of the cylinder assembly. These studies also demonstrate that other corrosion-sensitive equipment may benefit from treatment with DNA-OFF.

11:00am Observed mtDNA substitutions among maternal lineages of the European Royalty

James A. Thomas – AFDIL; Margaret M. Ewing – AFDIL/GWU(BTG) & Thomas J. Parsons – AFDIL (genealogy by William Addams Reitwiesner)

Mitochondrial DNA profiling is widely used for forensic identification, especially in cases of highly degraded DNA, and where reference samples are often maternal relatives. Due to its non-coding nature, the control region of mtDNA has a higher tolerance for mutations than the surrounding coding regions. Initial studies performed by this laboratory uncovered a control region mutation rate much higher than that predicted by phylogenetic studies, and since then, a steady progression of work has confirmed this initial observation. It is important for forensic interpretation that the rate and pattern of mtDNA mutations between generations be well characterized. We report here a substantial addition to the number of pedigree generations that have been compared for observed mtDNA mutations. The data derive in large part from maternal lineages of the European Royalty, for whom accurate historical records have allowed identification of deep maternal pedigrees. Our comparisons over the entire mtDNA control region span 683 generations and reveal 7 intergenerational substitutions, as well as a greater number of sites with heteroplasmic variants segregating within the lineages. These observations shall be combined with other familial studies to reduce possible stochastic effects, and the observed mutation rate shall be discussed in relation to its possible influence on forensic identification.

11:20am Resolving Problems Associated with Forensic mtDNA Analysis: Cloning as a Method of Identifying Mixtures, Heteroplasmy, and Trace Amounts of DNA

Amanda Fata*; James A. Thomas, PhD & Thomas J. Parsons, PhD - AFDIL

A study was performed in an attempt to utilize DNA cloning analysis to solve a variety of problems associated with investigation of ancient mtDNA. Forensic mtDNA extracts previously sequenced to show evidence of mixtures due to human or unknown contaminants, of heteroplasmy, and of generally unreadable sequence data due to trace amounts of DNA in original amplifications, were obtained from previous AFDIL casework and research experiments. Cloning results of samples containing mixtures indicated success in resolving the component molecular species from the contaminant. Similarly, samples displaying C-T heteroplasmy at position 16185 of HV1 were verified through analysis of multiple clones. Finally, because cloning can exponentially increase the amount of DNA in an original amplification, even ancient samples with trace amounts of DNA were successfully analyzed. Therefore, cloning is a valid and useful method in which to decipher problems encountered with ancient mtDNA analysis.

12:00pm Door Prizes @ close of meeting

Questioned Documents Session

25 April 2002:

8:30am Opening Remarks and Welcome to Participants

8:45am The Examination of the Sequence of Signatures and Dry Seals
Hollis Taylor, MFS, BS - FBI (photography by Brian Sullivan)

This presentation will provide a protocol in conducting an examination to determine the sequence of signatures and dry seals.

Occasionally, a forensic document examiner receives a request to determine the sequence of pen lines, folds, dry seals, or markings on a piece of documentary evidence. It may be pertinent to the investigation to know what was placed on the paper first. In the case of a dry seal, such as a notary seal, the signature is prepared prior to placing the dry seal in the paper. This may be the protocol used by a government office, a business office, or by a Notary Public. For this reason, the results of the examination may reveal the document to be fraudulent or counterfeit, or demonstrate a deviation from protocol.

This sequence examination requires the submission of the original piece of evidence, which is examined using appropriate lighting and magnification. Under magnification, the examiner must look for the presence or absence of three main characteristics: pen pressure compressing the paper, pen skips, and the side of the pen leaving marks on raised areas. Each of these characteristics indicates that the dry seal was placed in the paper prior to the signature or writing. The absence of those characteristics may indicate that the signature was prepared prior to the dry seal being placed in the paper.

It should be noted that there are several factors which can affect the examiner's ability to reach a definite conclusion. These include the dry seal tool having been too lightly compressed into the paper when creating the seal, and damage to the document prior to examination. For these reasons, the absence of the above listed characteristics cannot be unequivocally associated with the signature being placed in the paper first until it has been determined that the dry seal was placed in the paper with enough pressure to enable the examination.

9:05am The Forensic Examination of Thermal Printers
Gerald M. LaPorte & Jeffrey A. Payne* - Secret Service

Thermal printing generally applies to printing processes which utilize heat to produce an image by either physical or chemical means, or by a combination of both. The tragic events of September 11, 2001 have particularly caused an increased awareness in the importance of identity documents thus resulting in many agencies now incorporating thermal printing processes as opposed to more conventional methods such as offset lithography, inkjet and laser printing on their security documents. As the technology of these processes has improved, printers and ribbons have become less expensive, and the use of thermal printing in the personal and business markets has increased significantly. Although there are numerous types of thermal printing processes, only two types will be discussed in this paper due to their predominant use in the production of counterfeit credit cards, driver's licenses, and other types of documents produced on plastic media. The first process is dye diffusion thermal transfer (D2T2), also referred to as dye sublimation, dye diffusion, or thermal dye. D2T2, typically a "specialist" application commonly used for graphic arts and photographic applications, produces a continuous tone and works by heating the ink so that it is converted from a solid into a gas, thus bypassing the liquid stage. Once the

ink passes into the substrate it condenses back into the solid phase to produce the image. The second process is thermal wax transfer, also known as thermal mass, direct thermal transfer (D1T2), or hot wax transfer. Thermal mass involves the heating of a thermal printhead consisting of an array of pins which causes a wax based colorant to be transferred from a donor ribbon to the substrate. Unlike D2T2, this process does not produce a continuous tone, rather it operates on an "all or nothing" principal, that is, the wax is either transferred or it is not. Hence, both of these processes can be microscopically identified because of the differences in their respective technologies. The authors will discuss characteristics which allow one to identify the thermal process, as well as important factors surrounding the operation and hardware of the printers which may help to enhance the information obtained from printer ribbons. As well, a feasibility study will be conducted to ascertain if a make and/or model can be determined based on the analysis of a printed product.

9:25am The DOWAP Process: Deciphering Obliterations Without Altering the Paper
Tiffany L. Ford, M.S. – ATF

After attending this presentation, the forensic document examiner will learn a new technique to demonstrate obliterations without altering the questioned document.

There are many ways to detect obliterated writings: VSC (Video Spectral Comparator), ESDA (Electrostatic Detection Apparatus), visualization fluids, chemicals, or simply scraping off the correction fluid with a scalpel. I will demonstrate an additional method to decipher the hidden writing without altering the paper or the obliteration. The photocopying process, named DOWAP (Deciphering Obliterations Without Altering the Paper), will be demonstrated using several different sheets of paper with varying brightness, smoothness, gloss, and caliper; donated by the Mead Corporation. Several different tools will be used to make the initial entry on each type of paper: A blue ballpoint pen, red ballpoint pen, rubber stamp, notary seal, and a pencil. Each entry will be obliterated using correction fluid and then different instrumentation will be used on top of the obliteration to demonstrate the process. The DOWAP process will be performed and demonstrated on all samples to determine the limitations of the process on different types of paper using different instrumentation.
The DOWAP photocopying process discussed in this presentation will enable the document examiner to examine obliteration problems without having to alter the evidence. This process will allow for courtroom exhibits to show the final corrected questioned evidence as well as the initial hidden entry in a side–by-side comparison without changing the evidence in question.

9:45am BREAK

10:00am Nomination and Election of Chairperson-Elect for the QD Section

10:15am An Examination of the Correlation Between Handwriting and Latent Fingerprint Examination in the Bureau of Alcohol, Tobacco and Firearms Laboratories (Pilot Project)
Rick P. Johnson, MFS*; Carl R. McClary, BA & Jacqueline Williams - ATF

The Bureau of Alcohol, Tobacco and Firearms (ATF) Forensic Laboratory System in one form or another has a long history of providing forensic services for Federal Law Enforcement, dating back to 1886. ATF currently has three laboratories, located in Rockville, MD, Walnut Creek, CA and Atlanta, GA. In addition to providing forensic services, ATF performs regulatory analytical examinations on alcohol and tobacco products, ensuring they meet United States regulations and standards. Forensic capabilities include Questioned Documents, Latent Fingerprints, Trace Analysis, Explosive and Arson Chemistry, Firearms and Toolmarks Analysis, plus bullet and casing automated identification. ATF routinely provides forensic services to local and State agencies; as well as other Federal agencies.

In an ongoing effort to provide independent validity and empirical data supporting results of forensic comparisons and analytical examinations, the Questioned Document and Latent Fingerprint units of ATF have undertaken a pilot project of correlating results of their respective examinations over a period of two years. This presentation will reveal the initial results of the data from the Rockville, MD and Atlanta, GA Laboratories.

ATF Forensic Laboratories use the accepted Nine Point System for reporting the results of Questioned Document examinations. A majority of the ATF Questioned Document cases are also submitted for Latent Fingerprint examination. Many ATF Questioned Document cases involve several items with varying conclusions; however, only those cases / items with identifications or highly probable results were queried for fingerprint results and later correlation. Cases submitted for Questioned Document examinations that produced positive results were correlated to results from the Latent Fingerprint examinations performed on these same cases.

The results reflect conclusions based on cases that meet the experimental criteria, submitted in calendar years 1999 and 2000. Based on the results of the pilot project, a comprehensive examination of the independent corroborative nature of the Latent Fingerprint Identifications to the Questioned Document Identifications should be undertaken. This should span several years and encompass various examiners at all three ATF Forensic Laboratories.

10:35am **The Effects of Latent Print Processing on Questioned Documents Produced by Office Machine Systems Utilizing Inkjet Technology and Electrophotographic Processes**
Gerald LaPorte - Secret Service

With rapid technological advances and superior performance, office machine systems utilizing inkjet technology and toner have undoubtedly evolved into the most dominant print technologies used in offices and homes. This tremendous popularity has paved the way for a significant increase in criminal acts involving inkjet and toner systems. Forensic examiners are routinely required to analyze questioned documents (QD) produced by printers and photocopiers. Physical examinations can be performed to determine the printing process employed to manufacture a questioned exhibit. Additionally, chemical examinations can be used to compare two specimens, or the document examiner may be confronted with the task of classifying or identifying the make and model of a potential printer. Occasionally, evidence submitted for analysis may be processed for latent prints (LP) prior to QD examination. The physical and chemical processes involved may alter the visual appearance of a document and possibly affect the chemistry of inks and toners. Therefore, the forensic examiner must be aware of each aspect of LP processing, as well as consider the impact of chemical treatment on the ink or toner on a QD when conducting physical and chemical examinations. Accordingly, the objective of this study was two-fold:

1) To determine if latent print processing would preclude an examiner from correctly determining the type of printing process employed and

2) To ascertain what effects latent print processing may have on the results of thin layer chromatography (TLC) of printer inks and toners.

In this study, samples were taken from a number of inkjet and laser (toner-based) printers. Each sample was subjected to a three step latent print development process which included the application of ninhydrin, physical developer, and an oxidizing bleach solution. The samples were microscopically examined, as well as chemically analyzed using thin layer chromatography after each step of latent print development. The results were then compared to examination results prior to treatment.

The ninhydrin treatment did not impede the microscopic examination, nor did it have any substantive affect on the retardation factor (Rf) of the colorants in the TLC examination of inkjet printed documents.

However, processing with physical developer did result in extreme fading of the ink, and the bleach processing step virtually obliterated the color components. Although the inkjet samples were faded significantly, the color components that remained did not appear to be chemically altered, and, in some instances, it was possible to make a "qualified" determination of whether the document was produced with inkjet ink or toner. Unlike the previously described samples produced with inkjet ink, the color components in the toner samples were neither partially nor completely removed following any of the treatments. Evidence of the impact of physical developer and bleach treatment could be observed microscopically after their respective application; however, these effects did not preclude an accurate determination of the printing process employed, i.e. inkjet versus toner. Furthermore, TLC results indicated that the colorants in the toner printed samples were not altered by any of the three latent print processing methods used.

10:55am The Use of an Electrostatic Detection Device (EDD) to Identify Class Characteristics on Documents Produced by Printers and Photocopiers
Brittany King - Secret Service

The use of an electrostatic detection device (EDD), first marketed by Foster and Freeman, Ltd. of England as ESDA (Electrostatic Detection Apparatus), is an invaluable tool that provides forensic examiners with a method to examine indentations in a document. Since ESDA is a non-destructive examination (with exception to a brief humidifying process) which is highly sensitive and capable of creating a permanent record of results, its use in forensic laboratories is ubiquitous. As well, the ESDA technique is well documented in the literature and numerous articles have been published exploring parameters affecting quality and methods of enhancing results. After conducting a literature search, the authors found limited references with regards to detecting physical impressions left on a document subsequent to being produced on a printer or photocopier. Printing devices and photocopiers are fast becoming a rampant resource for criminals, and their forensic identification can be critical to an investigation. Examinations such as chemical analysis of colorants and the identification of trash marks are essential tools for the forensic examiner, but new techniques to identify a machine model or group of models are essential. The market is inundated with inkjet printers, laser printers, and photocopiers, but many of these office machine systems are built by various manufacturers, or their hardware design (e.g. "rolling" and "grabbing" mechanisms) have been changed over the years due to technological advances. In this study, ESDA was used to examine documents produced using various printers and photocopiers to determine if class characteristics could be employed to determine the make and/or model of the machine. As well, the authors attempted to ascertain the feasibility of identifying individual characteristics to compare documents produced by the same machine.

11:15am Photocopiers, Past, Present and Future
Tom Seymour - Industry Representative

An overview of the history of photocopiers, the present, and the future direction of the industry. Mr. Seymour will address technical questions related to photocopiers.

11:30am LUNCH

1:30pm Election Results

1:45pm **Comparing the Resolution of Film to Digital Cameras: Cautions for the Forensic Community**

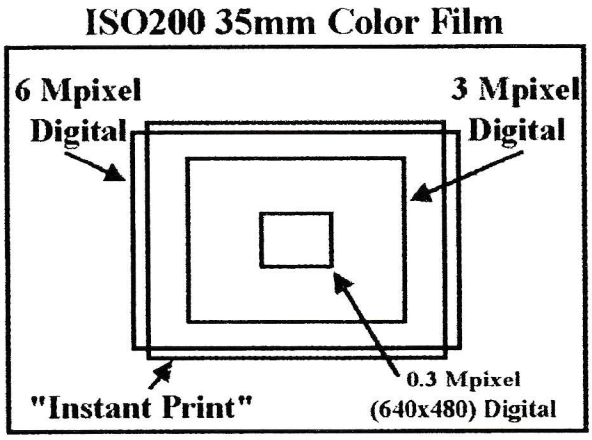
Dr. Richard W. Vorder Bruegge – FBI & William R. Oliver, M.D. - AFIP

This presentation will provide the forensic community with a better understanding of how much more information can be recorded by film than by most digital cameras; and to alert the community to some possible consequences if the resolution available with film is abandoned for mere convenience.

Law enforcement agencies across the country and around the world are rushing to convert their photographic and imaging systems from traditional film systems to digital ones. Many of the decisions to do so are being made based on the perception that digital imaging is better than traditional film systems. Although digital cameras can provide some benefits over film, those who must conduct detailed analysis of photographs taken in a forensic environment - such as footwear and tire tread examiners - are discovering that the quality of digital photography does not, yet, match that of film. This paper will explain one reason for this observation.

"Resolution" is defined in ANSI/AIIM Technical Report TR26-1993 "Resolution as it Relates to Photographic and Electronic Imaging" as: "The ability of a photographic system to record fine detail." Although the quality of images recorded using any imaging system depends upon a number of factors, including the quality of the lenses used and the lighting conditions, the intrinsic resolution of the detectors represents the most fundamental measure of the system. Thus sensor resolution is the focus of this paper.

The figure below demonstrates just how much more information film could record than digital detectors, under idealized conditions, if one fixes the resolution within the scene. In other words, the same size feature - such as a single ridge on a fingerprint - can be seen in each of the areas noted, but the film covers more area at that resolution than the digital detectors do.



Consequences: Examiners of footwear and tire tread impression evidence are already facing the consequences of reduced image quality. Although no formal studies have been conducted, discussions with numerous examiners indicate that the number of "Inconclusive" results in these examinations is increasing at a rate that parallels the rate at which digital images are submitted for comparison. Another type of examination that could suffer from reduced image quality is blood spatter examinations. One community - the latent fingerprint community - is fortunate enough to have a recommended standard in place for the capture of latent impression evidence - 1000 pixels per inch. Although this standard was designed to meet transmission standards, it has the added benefit of placing a minimum resolution standard for image capture. Using this standard, a photographer who chooses to photograph a latent

print with a typical 3-Megapixel camera (2000 x 1500 pixels) will be restricted to photographing an area 2" x 1.5" - an area slightly larger than that covered by a single fingerprint.

2:05pm Forensic Document Examination and Daubert
Kirsten Jackson, BA, MFS - USPS

This presentation consists of a brief overview of the history of forensic document examination and US courts, then addresses specific court decisions that have impacted the forensic document discipline since the US Supreme Court's decision in Daubert v. Merrell Dow Pharmaceuticals. Information will also be provided to assist the forensic document examiner in preparing for Daubert/Kumho challenges and the "expert critics."

2:25pm Is It Fabricated?
Ronald N. Morris

2:45pm BREAK

3:00pm Review Poster Session & Visit Vendors

5:00pm Business Meeting

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