



**Proceedings of the  
2011 ASCLD Forensic Research Committee (FRC)**



## Meeting Notes from the 2011 ASCLD Forensic Research Committee (FRC)

The first meeting of the FRC was held in Denver on 19 Sep 2011 during the ASCLD annual meeting. Committee members are:

First	Last	State
Keith	Morris	WV
Elizabeth	Beninger	OH
Dale	Carpenter	AL
Philip	Kinsey	MT
Gerald	LaPorte	USG
Tracey	Cruz	VA
Patrick	Wojtkiewicz	LA
Eric	Buel	DE
Emma	Dutton	OR
Jeff	Comparin	USG
Howard	Baum	NJ
Dustin	Yeatman	FL
Asharf	Mozayani	TX
Jim	Hutchinson	MT
Mark	Powell	TX
Daniel	Katz	MD

### Agenda:

- 1) Opening remarks from President Greg Matheson and President-elect Jill Spriggs
- 2) Briefing from John Paul Jones II on the Sub-committee on Forensic Science (SOFS) activities
- 3) Review the current NIJ Technical Working Group Needs
- 4) Discuss the efforts of the White House Subcommittee on Forensic Science RDT&E-Interagency Working Group.
- 5) Prioritize RDT&E Needs and Gaps using the following framework:
  - a. Which forensic disciplines are the most susceptible to challenges based on incomplete foundational research?
  - b. What needs to be faster, better, cheaper in our labs?
  - c. Are there new methods or instruments that most ASCLD Laboratories would benefit from having a centralized validation study?
  - d. What breakthroughs in other professions or areas of science should we be considering for transition into forensic science?
  - e. If we could make one new prototype device, what would we want it to do?
  - f. What trends in criminal activity and forensic backlogs could break our current methods?
- 6) Identify the best work product for the FRC to communicate our results (the attached NSF Report is forward for your consideration of a possible format).
- 7) Identify our next steps and opportunities to meet.

**Opening remarks:** President Greg Matheson and President-elect Jill Spriggs expressed the Board of Directors support of the new Forensic Research Committee.

**Presentation #1:** John Paul Jones II discussed the White House Sub-committee on Forensic Science:

Interagency Working Groups (IWG) have been formed for each of the 13 disciplines defined in Chapter 13 of the NAS report. The IWG requests that the FBI's Scientific Working Groups (SWG) provide scientific background for each of the disciplines. Specifically the SWG is requested to provide a bibliography of technical publications that underpin the science in each of the scientific disciplines. The subcommittee is working to make these bibliographies available to the public in the near future. The impact factor of the publications is an important factor; however, some of these journals are not even publically available, which presents a major problem in terms of scientific review.

**Presentation #2:** Jerry Laporte reviewed NIJ's Technical Working Group (TWG) list of needs:

Dr Laporte mentioned that one of the basic problems with forensics is that it lacks solid statistics. Often lab managers have a different view than the bench-top workers. Mnookin and Idor have been funded and there may be an opportunity for collaboration. It would be useful to get laboratory workers and academics on the same page, talking about problems and solutions. As an example, someone did a nice study and recorded the shoes that people were wearing as they entered a business. This provided a method of determining the distribution of shoes in the population. Dr Laporte ended his talk by inviting ASCLD to the Impressions and Pattern Conference in 2012, paper submissions are due in Feb.

<http://www.nij.gov/nij/topics/forensics/forensic-awards.htm>

## **Review and Scoring of NIJ TWG Needs:**

The committee reviewed and ranked the NIJ TWG needs documents (see Appendix B and C). The top scoring needs are listed below. The entire list is available in the appendices. The committee members participating via videoconferencing had the opportunity to vote by emailing their scores to Randy Wampler. The needs were divided into two categories General Forensic R&D (Appendix B) and DNA R&D (Appendix C) needs.

The highest rated general need with 20 points was:

### **1. Description of the Issue**

The lack of knowledge for prevalence of class characteristics within a population (based on regional, year-to-year, group association, population distribution); The lack of standardized non-numeric criteria for identification for impression evidence; The lack of knowledge pertaining to the reproducibility of characteristics between impression evidence made with the same item. For example, fundamental research on how a pattern or impression is formed. Research on the scientific foundational aspects of conclusions (e.g., individualizations, associations) and research into the factors that lead to those conclusions and evaluating the "significance of class characteristics" for pattern and impression evidence.

## **Committee discussion:**

Although fingerprint evidence is presented in court more often than firearms evidence, there are a number of research projects already addressing the statistical underpinnings of friction ridge evidence. Therefore, the committee believes that ASCLD research should be focused onto firearm evidence, since there are fewer research projects in this area. In addition, there is a trend that firearms testimony is being increasingly challenged in the courts. The principal challenge associated with firearms is that it does not employ quantitative instrumental data but instead conclusions are a result of subjective observation. The forensic community in the United States needs to address the statistics used in comparative analysis. A point was made that in Europe, comparative analysis results are presented differently than in the US; often employing a maximum likelihood ratio. Another comment was made that Bayesian statistics may prove useful in this context. The group discussion then broke into two disparate camps. One group advocated for validation studies on the effectiveness of firearms examiners, while the other group pressed for research into quantitative instrumental methods that could ultimately eliminate the human from making a subjective conclusion.

It was suggested that a false positive / false negative error rate study for firearms examiners modeled after the FBI's Blackbox fingerprint study may be a good place to start. The NIJ has funded a project to create identical lands and groove marks – these could potential serve as the “evidence” for the study. Of course cognitive bias is a difficult problem to circumnavigate. Perhaps a “case” could be developed around the test evidence. Within the DNA section, samples

are sent to verify the operator's proficiency. Could similar proficiency samples, perhaps the NIST standardized samples, be sent to firearm examiners? NIST has; however, been very slow in developing a solid standard. The ATF may be able to support a blind study, since they often send samples to labs for analysis. DEA also sends blind samples for proficiency testing; however, we would need buy-in from the lab directors and we would also need background data supporting the evidence. Perhaps an online web-based blackbox study would be effective. With proficiency tests there are many variables to account for including the training/experience of the analyst (some may have no training and many have extensive training) and the quality of the test samples (uniformity of the sample quality as well as the difficulty of the actual comparison). Controlling and/or identifying variables would be needed in order to make the data useful. A comment was made that uncertainty including error rates has been limited entirely quantitative measurements. It was suggested that calculation of uncertainty and error rates in comparative disciplines would have to occur during validation. In Alabama, we video record every match in HD including the lands and grooves and the response to this presentation in court is tremendous.

Alternatively, systems and procedures could be developed to remove the human being from the measurement instrument wherever possible. The community needs to push for more quantitative research on firearms. When backed with significant truth data, correlation techniques provide a means of obtaining error rates. 3-D systems are available, but the NIBIN database is controlled by the ATF and they are not pushing technology. It was suggested that 3-D correlations may improve specificity as compared to 2-D systems. In some states the NIBS doesn't seem to work at all; although in localized urban environments the system performs well, particularly when dealing with high gang activity. One problem with NIBIN system is that lighting isn't controlled in the photo; however, it is capable of doing a free rotation to find a match. Do laser or confocal microscopy systems exist for 3-D imaging?

A related need was expressed concerning the comparison of stamped pills used for illicit drugs. It was suggested that pill punches could be compared using a computer correlation technique – not a human comparative analysis, so this is an example where toolmark analysis could potentially eliminate the human bias from the analysis.

The second highest general need scored 13 points:

**2. Description of Issue**

Accuracy and error rate should be defined by the applicant; The lack of studies that examine the error of individual examiners; The lack of understanding of error rates pertaining to collection issues, examination or analytical. Research to determine accuracy in order to address the error rate issues in Daubert.

**Committee discussion:** see discussion above.

The highest rated DNA need scored 15 points:

**1. Description of Issue**

DNA lab analysts need a system that can perform quantitative interpretation of STR data from mixtures of two or more individuals. Should be able to calculate proportions and statistical analysis on 3-person mixtures, and preserve information content. Should work on partial STR profiles and degraded DNA samples. Could be web-based and compatible with LIMS (Laboratory Information Management Systems). Software Tools for mixture interpretation of casework samples (original title: "Tools for data interpretation of casework samples")

### **Committee discussion:**

The DNA mixture software called, "True Allele" appears to work well; it certainly provides better information than by eye alone. True Allele is able to remove the baseline and to establish a threshold. The committee believes that no crime labs are using True Allele for casework because it needs to be validated. It was suggested that GeneMapper mixture analysis is only useful for mixtures of 2 individuals. Mixture analysis is very time consuming for DNA analysts. Peak height ratios in mixed samples can vary by as much as 1:20, making it difficult to make allele calls. The Combined Probability of Inclusion (CPI) is only about 1 in 10, which means the efforts expended by the DNA analyst yields only minimal probative information. The use of True Allele, or other mixture analysis software could greatly improve lab efficiency. ASCLD should discuss with SWGDAM whether True Allele, or other mixture analysis software could be used as an "Expert System" before extensive validation studies are made. To test the system, ground truth data would need to be known and the number of contributors should be limited to three. NIST has the ability to provide calibrated samples with known truth data. Although real samples will be ultimately be necessary, it may be more cost effective to study the software using computer generated samples. There are other mixture analysis programs that should also be evaluated such as Qiagen's I.D. Mixture.

The second highest rated need with 10 points was:

### **2. Description of Issue**

Technology that would allow individualization of intact cells for downstream separation. Ideally it would be affordable, have reasonably high throughput and effective and include the differentiation of cells from multiple donors contributing to mixtures.

### **Committee discussion:**

It is important when presenting a case in a court of law to be able to state that the DNA sample was taken from a semen stain. This eliminates the argument that the DNA was placed via casual contact.

Being able to separate and profile individual cells will ultimately remove the problem of mixtures. Laser dissection may enable this capability; however, this technology is clearly over the horizon – many years until it will be available in a practical application.

The third highest rated need also with 10 points was:

3. **Description of Issue**

A comprehensive expert system for providing objectivity, assessing DNA data quality, workflow decisions (incorporating pre-amplification data), preserving information content and/ or providing data interpretation for casework. Software Tools for improving Data DNA quality, and enhancing analyst productivity.

**Committee discussion:**

There are many obstacles in developing a global LIMS system for the laboratories because every lab has purchased different equipment items that have different connectivity issues. It seems as though each laboratory will need to develop their own LIMS system. An “Expert System” may improve productivity for the DNA section. The FRC will query laboratories to determine if a consensus can be reached on the requirements of an expert system. Can the labs even agree on a standard protocol?

**Additional research topics posed by the committee:**

Is there a method of male DNA screening for rape kits? This is a very time consuming process. Is there a method of direct Y-quantization to replace microscopic screening of rape kits? This would have a huge impact on the efficiency of crime labs. Many on the committee felt that this need should be ranked very high.

Screening and serology is very time consuming; is there technology such as an Alternative Light Source (ALS) or hyperspectral imaging to speed up this process?

Could LIDAR be used for 10 prints?

Is there a validation for LC/MS<sup>2</sup>?

Law enforcement is not able to keep up with the latest designer drugs being developed such as the synthetic cannabinoids and bath salts. A national testing standard is needed.

There are a lot of new analytical chemistry tools being developed such as MALDI, laser ablation mass-spectroscopy, etc. How can crime labs purchase these expensive equipment items? Which new equipment items should crime labs invest in? Perhaps a solution would be to develop regional centers of excellence where one laboratory has the equipment for trace glass analysis; for example, and when crime labs in that region have a need for glass analysis; they send the evidence to that center of excellence. This would remove the necessity for every crime lab to invest in expensive capitol equipment that is used only rarely.

Sample collection at a crime scene is of paramount importance. How can this process be improved? Better training? Research on how to better collect samples at crime scenes?

Crime labs can apply to the NIJ for grants to hire a research fellow or to pay overtime required for research. Please contact the NIJ for more information on how to apply.

**Committee's Next Steps**

1. Query ASCLD membership on their current research activities including NIJ grants and internally funded research.
2. Query ASCLD membership on the requirements for a DNA "expert system."