OSAC Research Needs Assessment Form

Title of research need: Proficiency testing for complex data interpretation and biostatistical evaluations

Keywords: DNA mixtures, proficiency testing, statistics, probabilistic genotyping , reliability, consistency

Submitting subcommittee(s): BDRIC **Date Approved:** 8/25/16

(If SAC review identifies additional subcommittees, add them to the box above.)

Background information:

1. Description of research need:

Proficiency tests are an essential part of a forensic DNA laboratory's quality assurance program and the current FBI QAS document specifies that analysts, technical reviewers and technicians shall undergo semi-annual external proficiency testing in each technology performed. This is a valuable system for monitoring in-house competency and performance and identifying intra- and inter-laboratory differences. Current proficiency tests target the complete forensic biology workflow starting with body fluid determination. Because there has to be a known consistent outcome for the analysis these tests cannot be based on compromised or complex samples that could potentially fail to yield a result even if handled properly. There is no current commercially available proficiency test addressing complex data interpretation, except tests for kinship laboratories that may include a paper challenge for complex pedigrees. Several collaborative studies dealing with mixtures or population database searches have shown the benefits of comparing intra- and inter-laboratory performance. Several US laboratories have implemented internal competency monitoring for mixture interpretation and statistical evaluations, e.g. by assigning complex data sets to specific analysts. Research should explore the appropriate design for these types of data sets, and how to set ground truth expectations for statistical evaluations, especially if probabilistic tools, with data simulation steps are involved.

2. Key bibliographic references relating to this research need:

National Commission on Forensic Science (2016) Proficiency testing in forensic science. Views document on https://www.justice.gov/ncfs/work-products
Federal Bureau of Investigation (2000) Quality Assurance Standards for Forensic DNA Testing Laboratories. Forensic Science Communications, July 2000, Volume 2, Number 3.
JWDe Keijser, M Malsch, ET Luining, et al, (2016) Differential reporting of mixed DNA profiles and its impact on jurists' evaluation of evidence. An international analysis. Forensic Science International: Genetics http://dx.doi.org/10.1016/j.fsigen.2016.03.006
L Prieto, C Alves, B Zimmermann et al (2013) GHEP-ISFG proficiency test 2011: paper challenge on evaluation of mitochondrial DNA results. Forensic Science International: Genetics 7:10-15
M Crespillo, PA Barrio, JA Luque et al (2014) GHEP-ISFG collaborative exercise on mixture profiles of autosomal STRs (GHEP-MIX01, GHEP-MIX02 and GHEP-MIX03): Results and evaluation. Forensic Science International: Genetics 10:64-72.

3a. In what ways would the research results improve current laboratory capabilities?

Complex data interpretation and biostatistical evaluations are amongst the most challenging aspects of forensic DNA testing. External proficiency tests to be used by a variety of laboratories would allow technical leaders to identify performance issues not only on an individual analyst's level but also for the system as a whole. Internal competency monitoring may not catch problematic polices and threshold decisions that affect conclusions and weight of the evidence.

3b. In what ways would the research results improve understanding of the scientific basis for the subcommittee(s)?

Laboratories have been compiling internal data sets and designing competency tests for mixture interpretation and statistics. The BDRIC is poised to issue a best practice recommendation encouraging this quality measure. It would be helpful to get professional proficiency test designers involved and be able to recommend this for inter-laboratory monitoring as well.

3c. In what ways would the research results improve services to the criminal justice system?

External proficiency tests for complex data interpretation and biostatistical evaluations would result in improved quality monitoring across different laboratories. Legal community stakeholders would have a mechanism to view the results for their local forensic science provider service and can identify their adherence to generally accepted interpretation and calculation principles. This will improve the overall reliability of conclusions and statistical weight presented in court.

4. Status assessment (I, II, III, or IV): I

	Major gap in current knowledge	**Minor** gap in current knowledge
No or limited current research is being conducted	**I**	**III**
Existing current research is being conducted	**II**	**IV**

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.

Subcommittee Approval date: 04/29/2016

(Approval is by majority vote of subcommittee. Once approved, forward to SAC.)

SAC

1. Does the SAC agree with the research need? Yes ⓧ No ◯

2. Does the SAC agree with the status assessment? Yes ⓧ No ◯

If no, what is the status assessment of the SAC:

Approval date: 08/24/2016

(Approval is by majority vote of SAC. Once approved, forward to NIST for posting.)