OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need: Improving the recovery of male DNA from sexual assault kits

Describe the need: Traditional serology testing is no longer performed in an historically "routine" fashion, where laboratories are now moving to direct to DNA (DtD) approaches. This is being implemented because of the cost, time and success rates, where it is not uncommon that serology testing yields mixed or ambiguous results, such as negative AP testing, positive p30 testing, negative microscopic search for spermatozoa. The differential extraction permits the identification of male sperm/DNA therefore largely removing the need for serology testing on sexual assault items. Currently, there are many commercial DNA differential extraction chemistries available. However, there is little information as to the nature of the biological source of male DNA in the absence of serology testing or when such testing gives mixed results, yet the male DNA shows an enrichment in the sperm cell fraction. Other means of improving the recovery of male DNA include the swabs used for collection and non-extraction means of separating. A systematic study of these processes and an investigation into new technologies would be beneficial to the community to improve the detection of male DNA, and inform a probabilistic assessment about the nature of the biological material that was the source of the male DNA profile.

Keyword(s): Probabilistic assessment, cell type, differential extraction, sperm

Submitting subcommittee(s): Human DNA **Date Approved:** 10/05/2021

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

Background Information:

1. Does this research need address a gap(s) in a current or planned standard? (ex.: Field identification system for on scene opioid detection and confirmation)

This can fill in gaps for serological training and testing standards as well as best practices for DNA testimony.

2. Are you aware of any ongoing research that may address this research need that has not yet been published (e.g., research presented in conference proceedings, studies that you or a colleague have participated in but have yet to be published)?

NA

3. Key bibliographic references relating to this research need:

1) Alderson G, Gurevitch H, Casimiro T, Reid B, Millman J. Inferring the presence of spermatozoa in forensic samples based on male DNA fractionation following differential extraction. Forensic Sci Int Genet 2018; 36:225–32.

2) Mark D. Timken, Sonja B. Klein, Martin R. Buoncristiani. Improving the efficacy of the standard DNA differential extraction method for sexual assault evidence, Forensic Science International: Genetics,34 (2018)170-177.
3) Sonja B. Klein, Martin R. Buoncristiani. Evaluating the efficacy of DNA differential extraction methods for sexual assault evidence. Forensic Science International: Genetics, 29 (2017) 109-117.
4) Corina C.G. Benschop, Danielle C. Wiebosch, Ate D. Kloosterman, Titia Sijen. Post-coital vaginal sampling with nylon flocked swabs improves DNA typing. Forensic Science International: Genetics. 4(2), (2010), 115-121.
5) Charles P. Clark, Kerui Xu, Orion Scott, Jeffrey Hickey, An-Chi Tsuei, Kimberly Jackson, James P. Landers. Acoustic trapping of sperm cells from mock sexual assault samples. Forensic Science International: Genetics. 41 (2019) 42-49.
6) Victoria R. Williamson, Taylor M. Laris, Rita Romano, Michael A. Marciano. Enhanced DNA mixture deconvolution of sexual offense samples using the DEPArray™ system. Forensic Science International: Genetics. 34 (2018) 265-276.
7) Matthew C. Goldstein, Jordan O. Cox, Lori B. Seman & Tracey Dawson Cruz (2020) Improved resolution of mixed STR profiles using a fully automated differential cell lysis/DNA extraction method, Forensic Sciences Research, 5:2, 106-112, DOI: 10.1080/20961790.2019.1646479.
8) Gerry Alderson, Hanna Gurevitch, Tania Casimiro, Barb Reid, Jonathan Millman. Inferring the presence of spermatozoa in forensic samples based on male DNA fractionation following differential extraction. Forensic Science International: Genetics. 36 (2018) 225-232.
9) Paris Volk, Allison Holt, Angela Chen, Erin Hanson, Jack Ballantyne. Enhancing the sexual assault workflow: Development of a rapid male screening assay incorporating molecular non-microscopic sperm identification. Forensic Science International: Genetics Supplement Series. 7 (1) (2019) 21-22.

4. Review the annual operational/research needs published by the National Institute of Justice (NIJ) at https://nij.ojp.gov/topics/articles/forensic-science-research-and-development-technology-working-group-operational#latest? Is your research need identified by NIJ?

Related areas include "The ability to associate cell type and/or fluid with DNA profile, primarily for mixture DNA profiles"; "The ability to differentiate, physically separate, and selectively analyze DNA and/or cells from multiple donors or multiple tissue/cell types contributing to mixtures, with minimal or no sample loss"

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

This would allow for the recovery of some information that is not obtained in DtD work flows and for a probabilistic evaluation of the evidence given propositions of sperm cells vs. other cell types as the source of the male DNA.

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

This would give a better understanding of the efficacy of differential extraction procedures, collection procedures and cell separation technologies

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

This research would assist the jury when the question at trial involves activity level propositions and improve the detectable quantity of male DNA in sexual assault cases.

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

	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.