OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need: Genetic Ancestry, Proteomics, and Hair Morphology

Describe the need: An assessment of the different aspects of ancestry that can be determined by microscopy, DNA, and proteomics and how a combined approach could work

Keyword(s): microscopy, genetic ancestry, proteomics, hair

Submitting subcommittee(s): Trace Materials **Date Approved:** September 19, 2023

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)

In typical casework, assessments of ancestry are based on hair morphology and microstructure, which are imprecise; however, the information gained from non-destructive microscopical analysis can be informative for determining which hairs to move forward for DNA or proteomic analyses. Exploring hair microstructure and morphology related to genetic ancestry and proteomic genotype would help to update current methods and aid microscopists in understanding the specificity and limitations to using hair microstructure and morphology for estimating ancestry. Currently, DNA and/or proteomic analyses of hairs are not typically used to make ancestry assessments in forensic casework. Proteomic analysis is of great interest for an additional analytical method for hair evidence as hairs may not yield sufficiently high quantities of DNA and/or may not produce usable DNA profiles. Proteomic profiles may be obtained more readily in hairs than DNA profiles. The goal of this research request is to 1) increase the precision of ancestry assessments made using microscopy and 2) assess the ancestry information gained from microscopical analysis, DNA analysis, and proteomic analysis to determine the best testing scheme for hairs in casework. Research on hair phenotypes and the role that human ancestry and genetics play in hair traits, and the variability in hair microstructure can help elucidate potential relationships between hair traits, genetic profiles and proteomic genotype that can be useful for differentiating samples in forensic casework.

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)?

Research has been published within disparate fields, but an interdisciplinary study is needed to combine the microscopical analysis of hairs for the phenotypic traits potentially related to genetic ancestry with proteomic genotyping to determine the best way to make biogeographic ancestry assessments in forensic casework.

3. Key bibliographic references relating to this research need: (ex.: Toll, L., Standifer, K. M., Massotte, D., eds. (2019). Current Topics in Opioid Research. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88963-180-3)

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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?

No.

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

This research could increase the forensic community's understanding of microscopical traits related to ancestry and increase the accuracy of ancestry assessments with the addition of DNA and/or proteomic genotyping.

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

This interdisciplinary study would improve the understanding of the morphological traits of hairs and provide the link between observed hair traits and genetic ancestry (DNA and/or proteomic genotype).

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

Hair evidence is becoming an underutilized type of evidence in forensic laboratories because fewer samples are collected by SANE/SART personnel, fewer labs are maintaining expertise in microscopical analysis, and there has often been limited success developing probative DNA profiles from hairs. With this interdisciplinary analysis, the different disciplines can better understand the information that can be gained from each other and how to best work toward a combined approach to the forensic analysis of hair evidence instead of a scattershot analysis of random hairs by one method alone.

8. Status assessment (I, II, III, or IV): 1

	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.