OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need:	Development of proteomic techniques and databases for species and sex identification when forensically useful DNA is not available
Describe the need:	Taxonomic identification of questioned specimens of forensic importance using either morphological- or DNA-based methods is an important component of wildlife forensics. Often, degraded or processed source materials such as leathers, furs, hair, feathers and bones make the recovery of high-quality DNA challenging, thus limiting the ability to accurately identify the taxonomic origin of an evidence sample. When morphological identification is not suitable for a given evidentiary item or genetic material cannot be recovered from the evidentiary source material, an alternative method is required for accurate taxonomic identification. One potential method is proteomics-based identification (1, 2) which uses mass spectrometry (MS)-based techniques to characterize the peptide sequences in a sample (3). In order to apply targeted proteomic assays to wildlife forensics, the creation of reference databases, workflows, and protocols must be conducted for taxonomic groups of forensic interest using suitable source materials. The application of proteomics to wildlife forensics would fill the unmet need for identifying the origin of source materials that cannot otherwise be identified using current laboratory methods.
Keyword(s):	Protein, taxonomic identification, sex identification, forensic, proteomics, databases, targeted assay

Submitting subcommittee(s):	Wildlife Forensic Biology	**Date Approved:**	10/7/2022

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)

No current or planned standard identified.

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)?

Limited pilot studies to identify ancient or degraded archaeological non-human remains, including ivory and hair, using forensic proteomics techniques developed for human forensics.

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)

1. Mooradian, A. D., van der Post, S., Naegle, K. M., & Held, J. M. (2020). ProteoClade: A taxonomic toolkit for multi-species and metaproteomic analysis. PLoS Computational Biology, 16(3), e1007741.
2. Karlsson, R., Gonzales-Siles, L., Boulund, F., Svensson-Stadler, L., Skovbjerg, S., Karlsson, A., Davidson, M., Hulth, S., Kristiansson, E., & Moore, E. R. (2015). Proteotyping: Proteomic characterization, classification and identification of microorganisms--A prospectus. Systematic and Applied Microbiology, 38(4), 246–257.
3. Brandt, L. Ø., Schmidt, A. L., Mannering, U., Sarret, M., Kelstrup, C. D., Olsen, J. V., & Cappellini, E. (2014). Species identification of archaeological skin objects from Danish bogs: comparison between mass spectrometry-based peptide sequencing and microscopy-based methods. PloS One, 9(9), e106875.

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?

Forensic Biology/DNA, Scientific Research, Increased information about the discriminatory power and sensitivity of alternate biological analyses (e.g., proteomics, microbiome, plants, animals) to associate individuals with crime scene evidence.

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

Increase the ability to accept and test a wide range of source materials from various species, sexes, and populations. Also increase communication and dissemination of databases and sharing of materials and databases among wildlife forensic laboratories.

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

The availability and use of protein databases for taxonomic species or sex identification is limited and requires further research to be practical for wildlife forensic casework use. The ability to identify species and other taxonomic groups from evidentiary source materials requiring identification in casework that do not harbor viable DNA is critical.

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

The ability to provide objective, scientific information pertinent to species identification and regulations allows the criminal justice system to determine if a violation has occurred. With this information, true violations can be prosecuted, and non-violations can be dismissed, thus informing effective enforcement of laws and regulations. Without the ability to identify evidentiary materials that are potentially illegal or criminal violations, then these cases cannot be made using scientific- or forensic-based evidence.

8. 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.