OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need: Conditions and limitations of testing in proteomic case-type samples

Describe the need:

Proteomics is a powerful tool that can be applied to forensic casework samples to provide information on the species, sex, or tissue of origin of a biological sample. Forensic proteomics can be applied to evidentiary samples that are deteriorated or degraded such that DNA results are not obtainable (i.e., manufactured wildlife products such as leathers), or where DNA alone is insufficient to answer the question (i.e., body fluid or tissue identification). As such, proteomics has the ability to enhance current forensic testing capabilities and can provide valuable investigatory information even with the most challenging or difficult forensic case-type samples. However, validation studies that define the limitations of testing for proteomic case-type samples and conditions are lacking.

Although some case-type samples and conditions have already been tested in research and pilot validation studies (e.g., limits of detection, mixtures, human and non-human fluids, different substrates, commingled samples, aged samples, and environmentally-challenged samples), further work is required. Several topics have been recognized as warranting further study to expand upon SWGDAM guidelines for defining the limitations of case-type sample testing and to ensure standardized methods are used for forensic proteomic casework. Conditions that warrant further examination include limit of detection of common targets, sensitivity of these targets, degree of specificity, ability to distinguish between similar targets, and robustness in both environmental and chemical settings.

Keyword(s): Proteomics, case-type samples, limitations of testing, degraded samples, validation studies

Submitting subcommittee(s): Forensic Proteomics Task Group **Date Approved:** 4/2/2026

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)

Drafting of relevant standards to address this gap are in progress.

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 contributors in degraded or co-mingled samples such as bones, teeth, ivory, food supplements, or cosmetics. Work is also being conducted to identify body fluids or tissues that are present in complex mixtures or that are present in sample-limited amounts. However, no systematic studies to address or to validate the range of limiting factors is known.

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. Sacco, M. A., & Aquila, I. (2023). Proteomics: A New Research Frontier in Forensic Pathology. *International journal of molecular sciences*, *24*(13), 10735. https://doi.org/10.3390/ijms241310735

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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?

This research need would be included under the following Operational Requirements published by the NIJ in February 2024:
Forensic Biology, Scientific Research: Foundational research related to 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?

The ability to accept and test a wider range of source materials encountered in forensic casework would be vastly increased.

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

The limitations of testing encountered in proteomics casework is not known and requires research prior to validation for proteomics casework applications.

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

Being able to provide forensically-informative information on evidentiary sample types where the limitations of testing had not previously been examined or documented would increase the ability to test difficult or degraded samples relevant for casework.

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.