

OSAC RESEARCH NEEDS ASSESSMENT FORM

**Title of research need:**

Development of an Integrated and Multidisciplinary Approach for the Advancement of Data Collection, Data Management and Data Analysis to Aid Interpretation of Trace Evidence

Keyword(s):

Databases, statistics, computation, forensic science, interpretation, trace evidence, transfer.

Submitting subcommittee(s):

Trace Materials

Date Approved:

02/24/2021

(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)

See attached file.

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)?

Two projects are listed on the NIJ website (see <https://nij.ojp.gov/topics/articles/forensic-science-research-and-development-technology-working-group-operational#latest>) that contribute to this need:

- 1) Construction of new and updating of existing databases with properties of manufactured materials
- 2) Identification and characterization of nanomaterials in evidentiary materials.

However, due to the multiple aspects that this research need may include, it is important to note that additional research with different perspectives is sought.

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)

See attached file below.

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?

Yes. NIJ recognizes the importance of trace evidence especially in its programs "Research and Development in Forensic Sciences for Criminal Justice Purposes" and "Research and Evaluation in Publicly Funded Forensic Laboratories."

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

The proposed research would help close gaps in knowledge/research that are fundamental to the advancement of the interpretation of trace evidence. The development of reliable, representative, up-to-date databases and their informed use would assist current laboratories with evaluating trace evidence and providing conclusions, including strengths and limitations, that are firmly supported by science. In the light of the latest developments on Conclusion Reporting, research is needed to assist practitioners to address gray areas when identifying the appropriate association type within the range of possible conclusions.

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

The proposed research would provide the scientific basis for a better assessment of the value of trace materials in forensic, investigative and intelligence operations. The overall approach would provide essential information on validation studies, error rates, population studies, information systems, databases, data mining and data management that can be used to support the validity of scientific conclusions.

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

The research would be fundamental in moving trace evidence analysis field towards a more efficient approach for assessing the value of evidence within the criminal justice system. The proposed research is anticipated to add informative value and validity to scientific examinations and interpretations, and provide consistency within the scientific community with regards to the interpretations and conclusions presented to the courts

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.

OSAC Research Need Assessment - Appendix

Title of research need: Development of an Integrated and Multidisciplinary Approach for the Advancement of Data Collection, Data Management and Data Analysis to Aid Interpretation of Trace Evidence.

Background information:

1. Description of research need:

There have been efforts to create collection/reference data sets in trace evidence materials (glass, automotive paint, duct tape, fiber, polymers and pigments). The most comprehensive database in use in trace evidence is the Paint Database Query (PDQ), that permits identifying the make, model and years of vehicles with paints consistent with the evidence. It also permits some assessment of the uniqueness of an association. However, the full potential of databases has received little attention in research and has not been explored beyond traditional investigative queries. As a result, databases are often underutilized in forensic and intelligence investigations.

The application of some interpretation models (i.e. likelihood-based approaches) is restricted in trace evidence due to several factors, including: a) few existing reference collections and databases that fuse multiple sensors for automated interpretation platforms, b) gaps of information/research regarding studies of transfer and persistence of trace materials, c) gaps on updated survey studies and evaluation of error rates, d) gaps of knowledge of forensic practitioners in fundamental and application statistics; d) gaps of knowledge of statisticians/ computer scientists in fundamental and practical scientific/forensic background.

As a result, an integrated and multidisciplinary approach is needed to incorporate: a) strategic collaborations and effective plans for cross-training trace examiners, computer specialists and statisticians, b) updated research efforts for transfer and persistence studies, survey/population studies, inter-laboratory validations and comparisons, c) strong proposals to bring together collaborative knowledge of examiners, researchers, statisticians, computer scientists and manufacturer's organizations to develop and/or update relevant databases, d) development of automated platforms that help the management of different layers of information to assist decision making, e) development of standard methods, dissemination and implementation strategies for the application of integrated solutions for data interpretation.

2. Key bibliographic references relating to this research need:

Note: the following references are provided as an example of relevant references but do not represent an all-inclusive bibliographic review in this field.

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5. Bull PA, Morgan RM, Sagobsky A, Hugher GJA. The transfer and persistence of trace particulates: experimental studies using clothing fabrics. *Sci and Justice* 46, 3, 2006, 185-195.
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13. Mark P, Sandercock L, (2013) 75 Years of Forensic Chemistry in the Royal Canadian Mounted Police. A Timeline for Trace Evidence: 1937–2012. *Canadian Society of Forensic Science Journal* 46:2, pages 120-127.
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15. Neumann C, Margot P. New perspectives in the use of ink evidence in forensic science Part II: development and testing of mathematical algorithms for the automatic comparison of ink samples analysed by HPTLC. *Forensic Sci Int* 2009;185:38-50.
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17. Olivier M.S. On metadata context in database forensics. *Digit Investig*, 5 (3) (2009), pp. 115–123
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19. Siegel JA. Evidence Value of Textile Fiber- transfer and persistence of fibers. *Forensic Sci Review*, 1997, 9,2, 81-96
20. Trejos, T.; Koons, R.; Weis, P.; Becker, S.; Berman, T.; Dalpe, C.; Duecking, M.; Buscaglia, J.; Eckert-Lumsdon, T.; Ernst, T.; Hanlon, C.; Heydon, A.; Mooney, K.; Nelson, R.; Olsson, K.; Schenk, E.; Palenik, C.; Pollock, E. C.; Rudell, D.; Ryland, S.; Tarifa, A.; Valadez, M.; van Es, A.; Zdanowicz, V.; Almirall, J. R. Forensic analysis of glass by μ -XRF, SN-ICP-MS, LA-ICP-MS and LA-ICP-OES: evaluation of the performance of different criteria for comparing elemental composition. *J. Anal. At. Spectrom.* 2013b, 28, 1270-1282.
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