# OSAC RESEARCH NEEDS ASSESSMENT FORM

**Title of research need:** DNA transfer, persistence, prevalence and recovery (DNA-TPPR)

**Describe the need:**

Subcategory: collection, classification, and preservation of body fluids/DNA

Forensic scientists are often asked questions about how or when DNA was deposited (or not- in cases of absence/exclusions). This is not specific to "trace" DNA; sexual assault cases, for example, often have questions in dispute related to how/when the DNA was deposited. Different theories (formally, propositions) of the parties may prevent a straightforward evaluation of the value of biological/DNA results, especially for "trace DNA" for which no serology testing was performed. In order to appropriately inform investigators and other criminal justice stakeholders, scientists need to know more about the transfer, persistence, prevalence, and recovery of DNA (DNA-TPPR) including background DNA (unknown DNA due to unknown reasons). Studies are needed that investigate TPPR for both activities that may be related to a charged offense (i.e. a stabbing), as well as background activities that have nothing to do with the events in question (i.e. cutting bread). This research needs to address both cell-bound and extracellular DNA.

Some questions include: how much pre-existing DNA (prevalence and background) can be commonly found on objects; how long DNA might persist on hands or other items serving as transfer vectors; how often detectable DNA transfer can occur; and, what is the likelihood of observing (trace) DNA — affected by collection and processing techniques (recovery). In addition, research in this area would better characterize the quantity, influence, and expectations regarding extra cellular DNA present on evidentiary samples.

Much of the current literature assessing results given activity scenarios has been done using simulated transfer studies performed in highly controlled laboratory environments. Results from these studies prove challenging when informing probabilities of findings in casework. Research studies are needed that better mimic real-world conditions. Research should also address how data on DNA-TPPR should be collected and presented in order to be applicable across different laboratories, and how these data points might be combined to provide useful information in specific cases. Additional research can focus on preferential isolation of extracellular DNAs.

It is highly desirable that the results of TPPR studies be done in conditions that allow for their extrapolations to findings in casework, and especially that the results include probability values that can be used in likelihood ratio calculations.

**Keyword(s):** DNA direct and indirect transfer, background, persistence, activity level propositions, extracellular DNA, cell-free DNA, Bayesian Networks

**Submitting subcommittee(s):** Human Biology **Date Approved:** 05/16/2025

**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)

| Yes |
|---|

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)?

| Yes |
|---|

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?

Yes - Ground truth data sets across a range of evidence types for source and activity level inferences, and implementation guidance and Comprehensive, systematic, well-controlled studies that provide both foundational knowledge and practical data related to DNA transfer (e.g., primary, secondary), prevalence, persistence, and recovery (TPPR) in the real world, as well as best practices for interpretation.

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

This research will add to the capability of laboratories to evaluate DNA evidence when the parties have a dispute about the activities that took place. Research resulting in probability values based on specific types of results (presence/absence of DNA; profile completeness, etc.) will add to the ability of experts to address questions relating to DNA and activity at court. It is important to note that laboratories need to implement proper training and protocols in order to use the TPPR knowledge gained from this research.

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

The evaluation of DNA results given activities that consider direct or indirect transfer of DNA is often based only on subjective criteria such as the forensic scientist's casework experience, or research that does not mirror real crime scene scenarios. A more systematic, scientific approach for evaluating trace DNA results beyond the value of the DNA comparison is needed.

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

DNA results where the expert provides the value of the comparison at the sub-source level (who) but is unable to provide value to the results in light of alleged activities (how) are routinely challenged in court. A robust and wide ranging set of research studies that focus on TPPR for real world activities can help meet these challenges. This can help avoid situations where the lay factfinder is forced to do their own assessment with little to no understanding of TPPR given different activities or the misapplication of the sub-source evaluation to disputed activities.

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

| | **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.*