

OSAC RESEARCH NEEDS ASSESSMENT FORM



Title of research need:

Efficiency, throughput and speed improvements in rapid DNA instrumentation through the development of direct PCR methods

Describe the need:

There are significant benefits to improving the efficiency and speed at which DNA analysis can be performed. Direct to PCR methods are now possible that decrease the time needed for analysis as well as decrease the potential for contamination. In addition, the current generation of rapid PCR instruments require 90 mins to complete an assay. This amount of time may be too long to hold a suspect in locations such as airports and border crossings as well as in other time critical situations. Direct to PCR methods can shorten this time. There is a need to further investigate the use of direct to PCR methods on a diverse array of sample types and to further investigate the use of rapid systems and PCR components, such as high-speed enzymes and microfluidics. Research and development in this area can address short term needs at locations that require high speed processing capabilities but may also impact certain types of casework samples that may benefit from the development of direct PCR approaches.

Keyword(s):

Rapid PCR, direct PCR

Submitting subcommittee(s):

Human Biology

Date Approved:

10/05/2021

(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)

No.

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)?

Not at the present time.

3. Key bibliographic references relating to this research need:

- 1) Martin, Belinda, et al. "Direct PCR of fired shotgun casings: a South Australian evaluation." *Australian Journal of Forensic Sciences* (2020): 1-7.
- 2) Gibson-Daw, Georgiana, Karin Crenshaw, and Bruce McCord. "Optimization of ultrahigh-speed multiplex PCR for forensic analysis." *Analytical and bioanalytical chemistry* 410.1 (2018): 235-245.
- 3) Shrivastava, Pankaj, Toshi Jain, and R. K. Kumawat. "Direct PCR amplification from saliva sample using non-direct multiplex STR kits for forensic DNA typing." *Scientific reports* 11.1 (2021): 1-19.
- 4) Kim, Joo-Young, et al. "DMSO Improves the Ski-Slope Effect in Direct PCR." *Applied Sciences* 11.4 (2021): 1943.

- 5) Boelens, Dide, et al. "The development of miniSTRs as a method for high-speed direct PCR." *Electrophoresis* (2021).
- 6) Martin, Belinda, et al. "Successful STR amplification of post-blast IED samples by fluorescent visualisation and direct PCR." *Forensic Science International: Genetics* 46 (2020): 102256.
- 7) Wu, Hui, et al. "Progress in molecular detection with high-speed nucleic acids thermocyclers." *Journal of Pharmaceutical and Biomedical Analysis* (2020): 113489.
- 8) Dignan, Leah M., et al. "Multiplexed Centrifugal Microfluidic System for Dynamic Solid-Phase Purification of Polynucleic Acids Direct from Buccal Swabs." *Analytical Chemistry* 93.19 (2021): 7300-7309.

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, Better understanding of how to integrate Rapid DNA into lab workflows.

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

Rapid direct PCR minimizes sample transfer, speeds up analysis, and improves recovery of touch DNA.

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

Improve the understanding of enzyme kinetics and amplification of touch DNA.

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

Improve speed and cost of DNA analysis, decrease the potential for contamination events and improve rapid DNA results to nearly real time.

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.