

Request for Information (RFI): RaDNAS

Rapid Detection Nucleic Acid Signatures

IARPA-RFI-17-06

The Intelligence Advanced Research Projects Activity (IARPA) is seeking information on the use of nanopore sequencing for human identification and/or environmental pathogen characterization. This request for information (RFI) is issued solely for information gathering and planning purposes; this RFI does not constitute a formal solicitation for proposals. The following sections of this announcement contain details of the scope of technical efforts of interest, along with instructions for the submission of responses.

Background & Scope

DNA sequencing may be used to identify individuals for forensic or investigative purposes and to characterize organisms of concern, such as viruses and bacteria, for biosurveillance and biosecurity applications. While many next-generation sequencing methods are not feasible for field use, nanopore-based sequencing possesses desirable characteristics including label-free sample preparation, lower DNA quantity requirements, and the capacity for technology miniaturization. Long sequence reads of at least 50 kb generated by nanopore sequencing also allow for the resolution of complex or large loci for genotyping and profiling analysis. IARPA is interested in exploring nanopore-based approaches for DNA sequencing that include both benchtop and hand-held “sample-to-answer” device solutions for DNA-based identification and characterization. Specific areas of interest include:

- Methods for preparation of unknown human or environmental samples for nanopore-based sequencing of specific loci
- Multiplexed assays based on short tandem repeats (STR), single nucleotide polymorphisms (SNP), or other analysis type for accurate human identification and pathogen characterization
- Methods to reduce nanopore sequencing base-calling error rates, such as machine learning, advanced statistical analyses, and modeling
- Functionalization or modification of nanopores to optimize characteristics and performance for DNA profiling or pathogen characterization applications
- Approaches for processing and analyzing raw sequence data for human identification and pathogen characterization (e.g., taxonomy, drug/treatment susceptibility, virulence, source attribution)
- Approaches for processing and analyzing modified nucleobases, nucleobase analogues, and unnatural nucleobases

Responses to this RFI may address any or all of the following questions:

1. Compare and contrast the leading approaches and assays for human identification based on STR or SNP analysis. Are commercially available kits amenable or convertible to nanopore-based systems?
2. What standards would be required to enable practical use of nanopore sequencing for STR- or SNP-based DNA profiling? What challenges exist toward developing such standards?
3. Compare and contrast the leading approaches and assays for pathogen characterization based on nucleic acid sequencing and analysis. Are there other approaches currently under development?

4. How can sample preparation steps, sequencing, and a data processing pipeline be integrated most effectively for a field-appropriate workflow? Consider scenarios in which cloud-based software or databases may not be accessible.
5. What are the advantages and disadvantages of biological, solid-state, and hybrid nanopores for the described field-based applications? What are the tradeoffs of 1D and 2D sequencing for this application?
6. What types of features in DNA sequences create challenges for accurate reads? What methods and approaches can reduce nanopore sequencing base-calling error rates? How might these methods be incorporated into workflows in the requested application space?
7. How can nanopore functionalization be used to improve sequencing accuracy or be used for pathogen characterization?

Preparation Instructions to Respondents

IARPA requests that respondents submit ideas related to this topic for use by the Government in formulating a potential program. IARPA requests that submittals briefly and clearly describe the potential approach or concept, outline critical technical issues/obstacles, describe how the approach may address those issues/obstacles and comment on the expected performance and robustness of the proposed approach. If appropriate, respondents may also choose to provide a non-proprietary rough order of magnitude (ROM) estimate regarding what such approaches might require in terms of funding and other resources for one or more years. This announcement contains all of the information required to submit a response. No additional forms, kits, or other materials are needed.

IARPA appreciates responses from all capable and qualified sources from within and outside of the US. Because IARPA is interested in an integrated approach, responses from teams with complementary areas of expertise are encouraged.

Responses have the following formatting requirements:

1. A one page cover sheet that identifies the title, organization(s), respondent's technical and administrative points of contact - including names, addresses, phone and fax numbers, and email addresses of all co-authors, and clearly indicating its association with RFI-17-06;
2. A substantive, focused, one-half page executive summary;
3. A description (limited to 6 pages in minimum 11 point Times New Roman font, appropriate for single-sided, single-spaced 8.5 by 11 inch paper, with 1-inch margins) of the technical challenges and suggested approach(es);
4. A list of citations (any significant claims or reports of success must be accompanied by citations);
5. Optionally, a single overview briefing chart graphically depicting the key ideas.

Submission Instructions to Respondents

Responses to this RFI are due no later than 5:00 p.m., Eastern Time, on 22 September 2017. All submissions must be electronically submitted to dni-iarpa-rfi-17-06@iarpa.gov as a PDF document. Inquiries to this RFI must be submitted to dni-iarpa-rfi-17-06@iarpa.gov. Do not send questions with proprietary content. No telephone inquiries will be accepted.

Disclaimers and Important Notes

This is an RFI issued solely for information and planning purposes and does not constitute a solicitation. Respondents are advised that IARPA is under no obligation to acknowledge receipt of the information received, or provide feedback to respondents with respect to any information submitted under this RFI.

Responses to this notice are not offers and cannot be accepted by the Government to form a binding contract. Respondents are solely responsible for all expenses associated with responding to this RFI. IARPA will not provide reimbursement for costs incurred in responding to this RFI. It is the respondent's responsibility to ensure that the submitted material has been approved for public release by the information owner.

The Government does not intend to award a contract on the basis of this RFI or to otherwise pay for the information solicited, nor is the Government obligated to issue a solicitation based on responses received. Neither proprietary nor classified concepts or information should be included in the submittal. Input on technical aspects of the responses may be solicited by IARPA from non-Government consultants/experts who are bound by appropriate non-disclosure requirements.

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