Los Alamos
NATIONAL LABORATORY

Tech Snapshot
Biology
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FEVER

Optimized design of molecular probes for the detection of viral infectious diseases

SUMMARY

Researchers at Los Alamos National Laboratory have developed the FEVER diagnostic algorithm for the Fast Evaluation of Variable Emerging Risks based on a theoretical design used in the successful HIV Mosaic vaccine to create high-coverage DNA probes that accurately detect viruses. In diseases like Flu or COVID-19 where millions of people are tested, a 1% improvement in sensitivity equates to thousands more patients that are accurately diagnosed, treated, and isolated quickly. Los Alamos National Laboratory's FEVER designed probes provide greater virus coverage while employing fewer probes than the current state of the art; thereby reducing complexity, errors, and costs for assay developers. The probes consistently demonstrate high sensitivity and specificity. Several of these probes can be combined to detect coronaviruses and influenza in a single test, allowing rapid diagnosis and triage. Los Alamos National Laboratory is continuing to develop a portfolio for detecting new and emerging viruses and is seeking a commercial partner to collaborate with and license probes in a commercial assay.

MARKET APPLICATION

The market for molecular diagnostics is a rapidly growing field, driven by the need for improved disease monitoring. FEVER-designed probes have broad applicability in a variety of nucleic acid-based testing such as PCR, isothermal nucleic acid amplification, in situ hybridization, next-generation sequencing, and CRISPR to improve diagnostic assays. FEVER designs highly optimized diagnostics that enable multi-level biosurveillance with simultaneous monitoring of virus families, strains, and variants of interest. By developing optimized diagnostics that are future-proofed and bolstered against viral mutation, FEVER provides a foundational capability to mitigate future pandemics. Potential audiences include public health officials and decision makers, academic, industry, and government labs that monitor infectious disease threats, as well as clinical labs for patient testing.
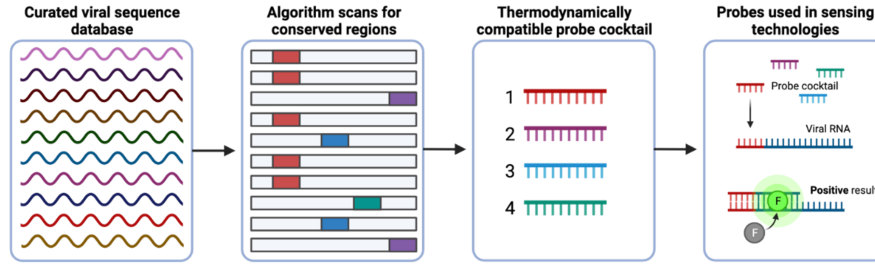
BENEFITS

FEVER provides high coverage for sensitive and accurate diagnosis of Covid-19 that can be used universally against current and future SARS-like virus outbreaks.

- High coverage
- Extremely sensitive through detection in saliva sample
- Reduction in number of probes necessary to cover virus
- Capable of detecting a specific virus or large family of viruses
- Ability to multiplex in which all probes work at the same temperature

CONTACT

Hannah Mazur
hmazur@lanl.gov

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Curated viral sequence database · Algorithm scans for conserved regions · Thermodynamically compatible probe cocktail · Probes used in sensing technologies

WHY WE ARE BUILDING FEVER

Los Alamos researchers originally developed this FEVER algorithm for use in creating diagnostic probes for SARS-CoV-2 (COVID-19) and influenza viruses but the tool is readily applicable for other viruses as well. This work can be extended to applications in threat reduction, global health security, and surveillance.

WHAT'S BEHIND OUR TECHNOLOGY

The FEVER diagnostic algorithm applies sequence-based bioinformatics and heuristic addition to design optimal DNA probes. These probes are compatible with existing diagnostic instruments (PCR) that have a global installed base and can be used in validated biosensors. FEVER probes target viral pathogens that are highly diverse and rapidly mutagenic in a highly sensitive and cost-effective tool that can be easily expanded to other pathogens for both diagnostics and surveillance.

OUR COMPETITIVE ADVANTAGES

Several rapid, low-cost, point-of-care tests exist, but with sub-optimal sensitivities. Low sensitivity results in a high rate of undiagnosed infections. Thus, there is an urgent need for improved DNA probes that we can address. Using FEVER designed probes, a 5 to 15% increase in sensitivity can be achieved compared to identified commercial probes. This translates into over a million more cases accurately diagnosed that are currently being misdiagnosed.

OUR TECHNOLOGY STATUS

Los Alamos researchers have designed probes to detect SARS-CoV-2 (COVID-19) and influenza viruses and have tested them experimentally in a PCR assay, in our validated benchtop sensor, and against clinical samples. Los Alamos National Laboratory is continuing to develop a portfolio for detecting new and emerging viruses and is seeking a commercial partner to collaborate with and license probes in a commercial assay.

PUBLICATIONS AND IP

Zachary R. Stromberg, J. T., Brian T. Foley, Adán Myers y Gutiérrez, Attelia Hollander, Samantha J. Courtney, Jason Gans, Alina Deshpande, Ebany J. Martinez-Finley, Jason Mitchell, Harshini Mukundan, Karina Yusim, Jessica Z. Kubicek-Sutherland Fast Evaluation of Viral Emerging Risks (FEVER): A computational tool for biosurveillance, diagnostics, and mutation typing of emerging viral pathogens. PLOS Global Public Health (2022).

Patent pending. Internal reference number S133916.001

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