

Updated 24 June 2020

Title: Rapid, specific disease detection in both symptomatic and asymptomatic individuals

As part of DARPA's ongoing web series highlighting the agency's active programs focused on COVID-19 medical countermeasures, this week we are focusing on supported research in the area of disease diagnosis.

DARPA has five current programs engaged in rapidly **detecting** COVID-19 exposure and/or infection in both symptomatic and asymptomatic individuals:

1. [Epigenetic Characterization and Observation \(ECHO\)](#)- The Epigenetic Characterization and Observation (ECHO) program aims to build a point of service device that analyzes an individual's epigenetic "fingerprint" to potentially reveal a detailed history of that individual's exposure to pathogens, chemicals, or even weapons of mass destruction. DARPA envisions that the same technology could provide rapid diagnostics for individuals who may have been exposed to COVID-19, providing a timely signal to apply effective medical countermeasures.

ECHO performer Fluidigm [recently announced](#) that a consortium of medical schools led by the Icahn School of Medicine at Mount Sinai is utilizing the Fluidigm Biomark HD microfluidics system and technology to create an epigenetic test for early detection of the novel coronavirus that causes COVID-19. This technology has significant potential to increase the speed and capacity of screening efforts, as microfluidics technology generates more data and uses a fraction of expensive testing reagents per precious sample as compared with more traditional, microwell plate-based PCR technology.

The consortium is developing a test using real-time PCR detection for host detection assays targeting epigenome and viral RNA for early-stage host monitoring of potentially infected individuals. Labs will be able to generate more than 6,000 test results per day, with a single system supporting more than 2 million annual tests. An Emergency Use Authorization to the US FDA was submitted in June 2020, and a response is pending.

2. [Prometheus](#)- The Prometheus program is working to develop a molecular test for determining if an individual is likely to spread disease following exposure to an infectious agent and predict within 24 hours of exposure if that individual will become contagious.

Collaborators at the University of California-Irvine who are subcontractors to the University of Maryland Prometheus performer team have [reported the development of an antigen microarray chip](#) allowing for in-depth analysis of the antibody response from infected & recovered COVID-19 patients. The [microarray chip](#) is intended to allow clinicians and scientist to better understand how the body responds to the virus and for serosurveillance activities to detect those who had been infected but are no longer able to be diagnosed by standard PCR based assays. The microarray was originally developed for the study of the contagiousness of influenza and other common cold infections, including common coronavirus infections, under

the DARPA Prometheus program and was redesigned to include COVID-19 proteins in support of rapid diagnostic development efforts.

A separate Prometheus program team at Columbia University was recently featured in [Smithsonian Magazine](#) for their DARPA-funded work on the 'Virome of Manhattan' project. Dr. Jeffrey Shaman and his colleagues have been able to use key learnings from that work as the basis of their now non-DARPA funded efforts focused on COVID-19 surveillance and forecasting.

3. [Friend or Foe](#)- The Friend or Foe program aims to develop biosurveillance technology that can detect bacterial pathogens as, or even before, they threaten the military and homeland. The goal of the program is to quickly determine whether an unknown bacterium is harmless or virulent by directly identifying pathogenic behavior, avoiding conventional strategies that rely on known biomarkers.

Performers are actively working, with one planning to submit initial data for publication this week. Please stay tuned for updates as they become available.

4. [SIGMA+](#)- DARPA SIGMA+—which is developing continuous city-scale real-time monitoring of the full spectrum of chemical, biological, radiological, and explosive (CBRNE) threats—achieved promising preliminary findings from two ongoing studies indicating that influenza can be detected prior to significant symptom onset using COTS wearable technologies. Early results suggest statistically significant changes in various heart rate-derived metrics indicating infection occurring prior (up to one day) to a person having symptoms or being asymptomatic.

Listen to the latest episode of 'Voices from DARPA' for information on this, as well as other critical research being conducted as part of Program Manager Mark Wrobel's portfolio.[INSERT LINK]

5. [PREPARE](#)- program is leveraging prior DARPA investment in the Microphysiological Systems program to establish a human organ-on-a-chip platforms as clinically and physiologically relevant models for in vitro study of viral propagation and countermeasure toxicity and efficacy. The human organ chips more closely recapitulate human physiology than other models, including in vivo animal models. The investment enabled the team to shift focus from flu to SARS-CoV-2 and quickly establish a testing pipeline to evaluate effectiveness of existing FDA approved drugs for treating COVID-19. The work has already identified two drugs that have the potential to treat COVID-19, with additional candidates being pursued.

Some of the groundbreaking work has recently been highlighted in [bioRxiv](#).

In addition to these established programs, DARPA has also provided some initial funding to support Sherlock Biosciences, an Engineering Biology company who received [Emergency Use Authorization](#) (EUA) from the U.S. Food and Drug Administration (FDA) last week for its CRISPR SARS-CoV-2 kit for the

detection of the virus that causes COVID-19, providing results in approximately one hour. For more information on the highlighted programs, we invite you to visit the appropriate program page.

Please continue to follow this space for timely updates on DARPA's portfolio of pandemic prevention efforts, including installments focused on the treatment, prevention, and manufacture of medical countermeasures to combat COVID-19.