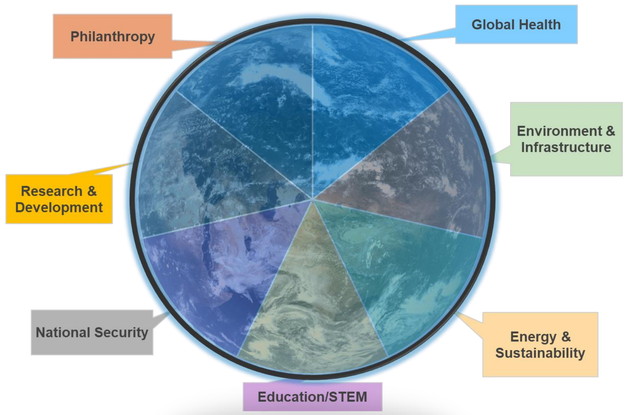
Pathogen Genomic Biosurveillance Tools for Environmental and Clinical Samples

Battelle Memorial Institute

Company Overview

Battelle, founded in 1929, is the world's largest, independent, non-profit, applied science and technology organization. Battelle's headquarters complex is located in Columbus, Ohio.



The Need for Pathogen Biosurveillance

The benefit of biosurveillance for tracking pathogens was demonstrated during the COVID-19 pandemic with wastewater epidemiology to track pathogens in communities around the world. However, most sampling still is conducted using quantitative polymerase chain reaction (qPCR), which only quantifies one target. Sequencing methods provide additional strain information and can identify all pathogens and variants in the sample. Using a validated toolkit of sampling methodologies, targeted metagenomic sequencing of DNA and RNA genomes, Battelle can provide a detailed understanding of pathogen dynamics in the natural or built environment or diagnose infections from clinical samples. This information can be used to determine health risks for entering environments, predict outbreaks in a community, or identify if vaccine or diagnostics need to be adapted to ensure efficacy and enable supply chain planning.

Our Technology

Sampling

Battelle runs the National Ecological Observatory Network and the Arctic Research Support and Logistics Services programs for the National Science Foundation, bringing expertise in environmental sampling.

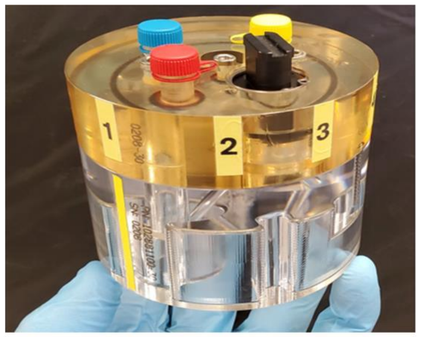


Figure 1. Portable Consumable Culture Unit

Consumable Culture Unit
The portable Consumable Culture Unit (Figure 1) provides sample containment throughout extraction, sample culture, sub-sample collection, neutralization of sub-sample for follow-on analysis, and termination of the entire sample taken from swabs or an aliquot of liquid in austere environments.

Suspended Animation and Viability Encapsulation
Through the DARPA AMPHORA program, Battelle is developing the Suspended Animation and Viability Encapsulation (SAVE) device to prevent sample deterioration during shipment from austere collection sites back to centralized testing facilities in the USA.

Laboratory Analysis

Battelle has developed laboratory, bioinformatics, and data visualization dashboards for infectious disease surveillance.

OutbreakSeq
A targeted hybridization panel covering the virulence factors from 61 viral, bacterial, and fungal pathogens known to cause respiratory or gastrointestinal infections and biothreat agents. This method enables low-cost biosurveillance by selectively sequencing the genetic components that make pathogens harmful to human health.

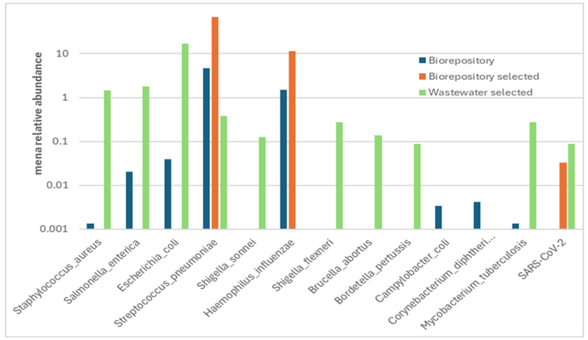


Figure 2. OutbreakSeq identifies SARS-CoV-2 and bacterial pathogens in saliva or wastewater samples.

Subtractive Hybridization Virome Sequencing
This sequencing tool enables specific sequencing of viral pathogens from host-derived samples by removing the host nucleic acid prior to sequencing library preparation. This focuses data on the viruses in the sample, reducing the cost and time needed to sequence and identify viruses in clinical samples or vectors.

Data Interpretation

Wastewater Pathogen Tracking Dashboard
This biosurveillance (Figure 3) tool tracks the incidence and spread of pathogens quantified through wastewater analysis. The tool incorporates both qPCR and sequencing data of wastewater samples collected, allowing users to view information at both the site and regional levels. At the regional level, the dashboard provides an overlay of demographic variables of interest at a census tract resolution, allowing the user to understand the pathogen detections and prevalence in the context of the populations being affected.

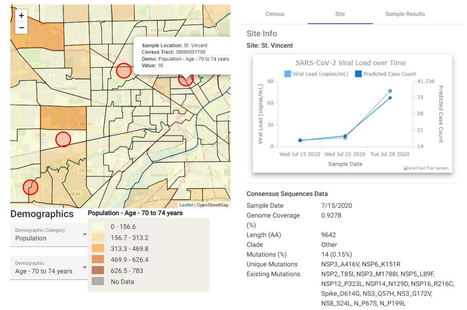


Figure 3. The Wastewater Pathogen Tracking Dashboard enables pathogen surveillance data to be overlaid with demographic and geographic data, incorporating multiple data inputs to enable actionable results.

Benefits of Battelle Genomic Infectious Disease Surveillance

- Cost and time savings by identifying all pathogens via a single sample
- Increased resolution and accuracy when compared to state-of-the-art methods
- Actionable results help identify health risks and mitigations
- Focus on virulence factors to identify pathotypes and novel or emerging infectious diseases.

Contact: Rachel R. Spurbeck, PhD, spurbeck@battelle.org