

Defending against Biological Threats

How PNNL supports pandemic response and preparedness through science, technology, and data analytics



Biological incidents, whether in the form of natural outbreaks, accidents, or deliberate attacks, pose complex and growing threats to our nation. Leveraging advanced experimental facilities (including biosafety containment), unique instrumentation, and staff that work at the interface of biomedical science and field intelligence, PNNL supports the Administration's agenda to rebuild and expand defenses **to predict, prevent, and mitigate biological threats including pandemics.**

PREDICTING THE IMPACTS OF CHANGE ON BIOLOGICAL SYSTEMS

With over 350 staff working in biosciences, PNNL discovers molecular signals (markers) that describe how microorganisms interact with their environment and provide insights into ecosystem sustainability. PNNL's research for DOE's Biological and Environmental Research program and its Bioenergy Technology Office deciphers **mechanisms of plant, microbial, and algal system interactions** and develops strategies for the **secure design of engineered microbe and plant systems** to support DOE's science, energy, and environment missions. The Environmental Molecular Sciences Laboratory, a DOE user facility on the PNNL campus, provides expertise in chemistry, advanced computing resources, and world-class instrumentation to researchers around the world to gain a **molecular understanding of biological and ecosystem functions.**

ADVANCING THE SCIENCE OF DISEASE DIAGNOSTICS AND TREATMENT

PNNL's research for the U.S. Department of Health and Human Services provides new insights into the **mechanisms of cancer and other diseases, the role of the microbiome in human health, and how our bodies respond to stressors** such as sleep disorders, environmental toxins, drug use, and exercise. The Proteomics Research Resource for Integrative Biology brings advanced technologies for the **precise and comprehensive measurement of proteins and their modifications** down to single numbers of cells. The bioscience program at PNNL delivers solutions to problems such as identification of blood-based markers of survival in Ebola patients, validation of prognostic signals for early cancer detection, and identification of new therapeutic targets to combat diabetes. Through the Precision Medicine Innovation Co-Laboratory with the Oregon Health Sciences University, PNNL is also enhancing the **integration of advanced measurement and imaging technologies with clinical research** to understand disease and develop innovative therapies.

TRANSFORMING BIODETECTION AND BIOSURVEILLANCE

PNNL performs R&D to support national security challenges in biodefense, developing and applying characterization and surveillance tools to detect, track, and assess biothreats, and address technical intelligence questions. PNNL provides **assay validation, testing and evaluation of detection tools, surveillance platforms, and forensics support** to DHS and other

government agencies. PNNL's strengths in finding molecular markers and data analytics are assisting DoD in developing new approaches to **biothreat assessment**. For example, in a DARPA-funded Friend or Foe program, PNNL is developing assays to identify whether bacteria present in a complex sample are pathogenic (threat) or beneficial organisms (friend). Using all of its fundamental and applied research strengths, PNNL is **transforming the detection and characterization paradigm** to assess threats beyond the current select agent list of pathogens and toxins to reduce surprise and address the growing threat of emerging biological agents.

MISSION-READY CAPABILITIES ENABLING RAPID COVID RESPONSE

PNNL's biodefense capabilities were deployed in support of DOE's National Virtual Biotechnology Laboratory for the validation of **alternative assays, medical therapeutics, and the study of viral transmission, fate, and transport**. Leveraging deep expertise in biodetection and assay evaluation, PNNL expedited the establishment of a Clinical Laboratory Improvement Amendments (CLIA)-**certified high complexity virology laboratory** in a few weeks. The laboratory processes COVID-19 specimens from PNNL employees, most of whom have released their specimens to PNNL for future research.

PNNL's biosafety level 3 laboratory allowed for **rapid evaluation of SARS-CoV-2 test kits** to provide the U.S. Food and Drug Administration with data to remove a faulty kit from the supply chain as well as approve two additional test kits, which increased the testing supply chain across the nation. PNNL also is using its viral research expertise to help DoD understand the differences between highly pathogenic (SARS and SARS-CoV-2) and benign (common cold) coronaviruses to enable **future risk assessment and identify potential therapeutics**. PNNL's Environmental Molecular Sciences Laboratory was mobilized to provide structural determination of SARS-CoV-2 proteins as vaccine and therapeutic targets. Likewise, coordinated experiments in configurable facilities and computational simulations are providing **robust and quantitative information about behavioral, environmental, and operational conditions** that impact the risk of airborne transmission to enable a safe return to work.

In summary, PNNL is effectively maintaining and developing the workforce necessary to meet the biothreat challenges of the future. PNNL leverages the close collaboration between basic and applied research organizations to bring the latest scientific breakthroughs to bear on the difficult challenges the national faces in emerging and evolving biological threats.

ABOUT PNNL

Pacific Northwest National Laboratory advances the frontiers of knowledge, taking on some of the world's greatest science and technology challenges. Distinctive strengths in chemistry, Earth sciences, biology, and data science are central to our scientific discovery mission. PNNL's research lays a foundation for innovations that advance sustainable energy through decarbonization and energy storage and enhance national security through nuclear materials and threat analyses.

CONTACT

Malin Young, Associate Laboratory Director, Earth and Biological Sciences
(509) 375-6616 | malin.young@pnnl.gov | www.pnnl.gov/biology,
www.pnnl.gov/chemical-biological-signatures-science