

## 1. General Description of PNNL

[www.pnl.gov](http://www.pnl.gov)

Pacific Northwest National Laboratory (PNNL) is located in Richland, on the sunny eastern side of Washington state. PNNL is one of the U.S. Department of Energy's (DOE's) ten national laboratories, managed by DOE's Office of Science. PNNL also performs research for other DOE offices as well as government agencies, universities, and industry to deliver breakthrough science and technology to meet today's key national needs.

The Laboratory focuses on providing the facilities, unique scientific equipment, and world-renowned scientists/engineers to strengthen U.S. scientific foundations for fundamental research and innovation; strives to prevent and counter acts of terrorism through applied research in information analysis, cyber security, and the non-proliferation of weapons of mass destruction; helps increase U.S. energy capacity and reduce dependence on imported oil through research of hydrogen and biomass-based fuels; strives to reduce the effects of energy generation and use on the environment.

PNNL currently has approximately 4,000 staff members and a business volume of \$760 million. The William R. Wiley Environmental Molecular Sciences Laboratory, a DOE Office of Science national scientific user facility, is located on PNNL's Richland campus. PNNL operates a marine research facility in Sequim, and has satellite offices in Seattle and Tacoma, Washington; Portland, Oregon; and Washington, D.C. Battelle has operated PNNL for DOE and its predecessors since 1965.

## 2. Description of homeland security expertise for PNNL.

<http://www.pnl.gov/research/nsd.asp>

Scientists and engineers at the Pacific Northwest National Laboratory are drawing upon its fundamental science base to develop the next generation of technologies brought to bear on homeland security issues. Achieving greater levels of security needed to safeguard the homeland from terrorism without adverse impacts on the economy or individual rights poses enormous scientific and technical challenges. PNNL is harnessing the Lab's capabilities in advanced chemical, nuclear and biological detection, analysis and visualization of massive data streams, high performance computing and simulation and modeling of complex systems to tackle the most daunting homeland security issues.

PNNL is investing its own funds to advance science for the next generation of information analysis tools for radiation, chemical and biological detection. PNNL's capabilities most relevant to protecting the homeland include atmospheric monitoring; sensors for explosives, chemical biological and nuclear threats; and information analytics.

PNNL is a world leader in atmospheric monitoring of ultra-trace and low-level radionuclides for detecting proliferation of weapons of mass destruction. The Radiological and Chemical Sciences group within the National Security Directorate has had the mission of radiation detection technology development and deployment for more than 50 years. Instruments incorporating PNNL radiation detection technology have been deployed in an array of "field" locations, including: outer space, deep undersea, within the core of both naval and civilian reactors, international border crossings, international test detection network sites, high altitude aircraft, nuclear accident sites such as Three Mile Island and Chernobyl, nuclear complex sites such as PNNL is deploying radiation portal monitors at U.S. ports of entry for the Department of Homeland Security to detect smuggling of WMD onto American soil.

Electronics experts provide scientific and technology development to meet a broad range of sensor, measurement technology, electronic (including controls), and system integration application requirements to detect chemical, nuclear and biological weapons proliferation. PNNL's expertise is tailored to meet client and project needs and includes: scientific investigations and analysis; feasibility studies; measurement and data analysis; method development; validation and application; laboratory testing; prototype equipment development and evaluation; and development and deployment of field hardened equipment and methods.

PNNL mathematicians and computer scientists have been developing the science behind innovative tools that will help analysts look for trends in a vast amount of information. One of these tools is Starlight, an innovative visualization tool that recently won a R&D 100 Award from *R&D Magazine*. Starlight, which was originally developed for defense purposes, enables an analyst to look for trends in various media including structured and unstructured text, maps, digital data, video and even satellite imagery.

PNNL's William R. Wiley Environmental Molecular Sciences Laboratory (EMSL) provides world-class capabilities for enabling fundamental research on physical, chemical, and biological processes, laying a foundation for new solutions

to environmental challenges and other critical issues. With instruments ranging from state-of-the-art nuclear magnetic resonance spectrometers, mass spectrometers, and one of the most powerful supercomputers in the world, to suites of surface characterization, complex systems, environmental spectroscopy and trace detection tools, EMSL has the resources needed to address a multitude of research topics.

### **3. Brief project descriptions and contact information.**

#### **Improved Non-immune Library for Rapid Antibody Development**

*DHS Research Area: Social, Behavioral and Economic Sciences*

Pacific Northwest National Laboratory (PNNL) has built a strong foundation in the development of protein affinity reagents using yeast surface display (YSD) and a library of more than one billion synthetic human antibodies. With this non-immune library, antibody selection is done entirely *in vitro*, without the costly and time consuming need to immunize animals and produce hybridomas. There have been many advances since this library was first constructed, and PNNL is interested using these advances to develop a new and improved non-immune library.

Contact: Cheryl Baird, PhD, 509-372-6760, [cheryl.baird@pnl.gov](mailto:cheryl.baird@pnl.gov)

Co-mentor: Keith Miller, PhD, 509-375-3965, [keith.miller@pnl.gov](mailto:keith.miller@pnl.gov)

#### **Modeling and Simulations of Security Screening Processes for Radiation Screening in the Puget Sound**

*DHS Research Areas: Explosives Detection, Risk and Decision Sciences, Transportation Security, Border Security, and Maritime and Port Security.*

Pacific Northwest National Laboratory (PNNL) has two primary research projects that a DHS post doc would support. These are the DNDO Maritime Small Vessel Pilot Project for Rad/Nuc detection and the security screening/tool development for Washington State Ferries. The thrust of post doc support would be related to modeling, simulation and subsequent analyses on these projects. Experience in mathematics or operations research/industrial engineering or related disciplines is desired. Goals are to model and simulate security screening process and evaluate overall effectiveness for the small vessel radiation screening in Puget Sound; and optimization of security screening processes for vehicles and passengers boarding Washington State Ferries vessels. Candidate would need to be able to obtain security clearance commensurate with handling OOU and SSI data/documents.

Contact: Robert Brigantic, 509-375-3675, [robert.brigantic@pnl.gov](mailto:robert.brigantic@pnl.gov)

### **4. Terms of postdoctoral appointments at PNNL**

PNNL is flexible with appointment start/end dates in order to work with the individual's calendar, but dates are sometimes dependent on the schedule of the research project. If a security clearance is required, it is noted in each individual research project description.

### **5. Community integration**

The Office of Science and Engineering Education (SEE) at PNNL is committed to providing the programs and activities necessary to enhance the Lab's research and development efforts, while providing educational opportunities to students, postdocs, and faculty that will ultimately assist in building, enriching and diversifying the nation's technical workforce.

All educational appointees at PNNL are invited to participate in many social and recreational activities. PNNL hosts sports events/teams, barbecues, regional trips, events for children, and many other special events that appointees are invited to. In addition, there are technical seminars, guest speakers, and other research-related activities that appointees are encouraged to attend.

PNNL has an on-site dormitory, called The Guest House, is extremely well-suited to short- and medium-term visitors (or those needing a place to stay for a few days or weeks while looking for long-term housing) and is located within walking distance to most PNNL facilities. Additionally, SEE also has information on furnished and unfurnished apartments that are available nearby, as well as a list of private homes who offer long- and short-term room and board arrangements. A car is a very good thing to have in the Tri-Cities (Richland, Kennewick, Pasco) as some services are spread out. The SEE office will gladly assist postdocs with the resources needed to find housing, as well as other services (medical care, schools, etc.) The point of contact for these services is Michelle Nichols, [michelle.nichols@pnl.gov](mailto:michelle.nichols@pnl.gov).