# IDAHO NATIONAL LABORATORY INTERNSHIP PROGRAM

Idaho National Laboratory (INL) has a long history of supporting university-level internships. The primary objective of INL's Internship Program is to provide strategic leadership in educational and laboratory-directed research activities.

Hosting ~ 240 students each summer, from all over the US and several foreign countries, INL Internship Program helps to ensure a future work force that will carry on the long-term mission of INL.

INL provides a housing allowance of $100.00 per week and provides a list of available housing, ranging from furnished apartments to rooms for rent from INL employees. Public transportation is limited; however INL provides bus transportation to Site Facilities.

Facility tours, technical presentations and seminars are provided for the interns throughout the summer. A technical poster session highlighting each intern's project closes out the summer internship program.

INL sponsors a "Get to know the Interns" picnic at the beginning of the summer. Close to Yellowstone and Teton National Parks, the area offers great outdoor recreation activities from camping, hiking, and whitewater rafting.

INL provides a website where students can post messages, upcoming events and activities.

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## Real-time PCR assays for Pathogen Detection and Discrimination

*Brief description of the project:*
This research will provide reagents and assays applicable to the detection and forensic analysis of *Brucella* spp., which are animal and human pathogens responsible for disease in a broad spectrum of hosts. The project will generate a unique set of validated (against real world diagnostic and environmental samples) DNA signatures for the closely related Category B select agents, *Brucella abortus, B. melitensis,* and *B. suis*. The signatures will be evaluated for cross-reactivity against near neighbors such as *Agrobacterium tumefaciens*, *Rhizobium leguminosarum*, and *Ochrobactrum anthropi*, as well as other closely related microorganisms. The work will also contribute to understanding the potential for transmission of brucellosis among domesticated animals (cattle) and wildlife (bison and elk) in the greater Yellowstone ecosystem. The reagents developed and refined in our work will have value not only to national biodefense, but also to national and to regional animal husbandry, and wildlife management issues that impact U.S. agricultural security.

In addition the same approach will be employed to addresses the development of improved TaqMan assays for another DHS pathogen of interest.

*Specific aims:*

- Assist in the development and validation of a real-time PCR assay targeting *B. abortus*, *B. melitensis*, and *B. suis*. PCR as a platform for rapid *Brucella* spp. detection through the development and validation of assays designed at the INL. *In silico* results will be confirmed experimentally by screening with collections of isolates and type strains, against known nearest neighbors, and in background samples from relevant environments that serve as natural reservoirs of the pathogen *Brucella.*
- Assist in the optimization and validation of real-time PCR assays targeting another pathogen isolates.

***Note:*** Students will only be allowed to work with *Brucella* DNA which can be handled safely at Biosafety Level-1.

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# Idaho National Laboratory Research Projects

**Infrastructure Protection:**

The INL offers comprehensive end-to-end cyber security testing of process control systems, cyber vulnerability analysis, technology development, and industry training to enhance and improve the resiliency of the nation's critical infrastructure systems. INL cyber security research personnel have provided scenario development expertise for national level exercises, red team assessments of industry deployed networks and conducted both attack and defense training for a variety of customers in the telecommunications and command and control network environments. INL cyber security personnel have developed several unique solutions centric to the analysis of extremely large data flows across disparate networks, protocols and sensor platforms. The laboratory supports DHS's National Cyber Security Division by managing the Control Systems Security Program which aims to increase industry awareness about cyber vulnerabilities, develop standards, conduct assessments and provide training to industry organizations and major control system vendors.

**Explosives Detection and Testing:**

INL scientists are experts in ion mobility, secondary ion mass spectroscopy, and active neutron interrogation for trace and bulk explosives detection. Researchers perform explosive forensic analysis, design improved sensors, and develop detection testing protocols and standards. The laboratory also has the capabilities to detect and test a wide range of explosives threats, measure their effects on structures and protective barriers, evaluate the effectiveness of potential counter-measures, and conduct in-depth vulnerability assessments of critical infrastructure facilities. Engineers have developed and deployed the Idaho Explosives Detection System which scans cargo trucks for smuggled explosives, and provided support to the Federal Aviation Administration and U.S. Army by analyzing numerous explosive detection technologies and sensors. Additionally, INL is the only national laboratory with a comprehensive explosives test range and expert staff. In 2007, INL constructed a full-scale explosives test range capable of handling 20,000 pounds TNT, inert projectiles with a maximum flight of 8,000 meters and shoulder-fired rockets. The range is used to measure the effects of improvised explosive devices on infrastructure and security systems.

**Natural Disasters and Related Geophysical Studies:**

As a compliment to the INL's efforts in Critical Infrastructure Protection, engineers and researchers have developed and operate several advanced modeling and simulation technologies to assist first responders in dealing with natural disasters. The INL owns and operates a Real Time Digital Simulator for modeling real-time effects of natural disasters or terrorist attacks on the nation's electric power grid. This system allows operators and emergency planner to run multiple scenarios to predict cascading effects on the electric power grid following a catastrophic event. The INL system is the only RTDS system in the United States certified for government projects. Similarly, the INL has developed two distinct modeling programs that allow emergency planners to run disaster scenarios and visualize the impacts to infrastructures and utility systems in a real-time 3-D environment. The INL recently

submitted several proposals to the DHS Science and Technology directorate to assess infrastructure damage and develop countermeasures to rapidly advancing wild land fires.

**Communications and Interoperability:**

INL engineers and researchers own and operate numerous industry-scale telecommunications, cellular, microwave, fiber optic, and land mobile radio systems in order to improve communication efficiency and operability during emergency situations. Researcher have the ability to perform vulnerability and risk assessments, tool development, and interdependency modeling and simulation for improving security and restricting access to proprietary data in communication systems. Through programs funded by the Departments of Energy and Homeland Security, the laboratory's communications infrastructures is available to government and commercial customers for research and development work within the wireless and telecommunications sector. Capabilities also exist to examine the interdependencies that exist between communications equipment and other critical infrastructure sectors such as electrical, Internet and computing, and manufacturing and industrial control systems. INL is also authorized by the National Telecommunications and Information Administration to operate as an experimental radio station. Combined with its geographic isolation, INL can test a wide variety of existing and emerging wireless systems. Recently, the INL began a research initiative aimed at developing airborne cellular nodes that could be attached to manned or unmanned aircraft and used to provide cellular communication during an emergency or natural disaster event.