



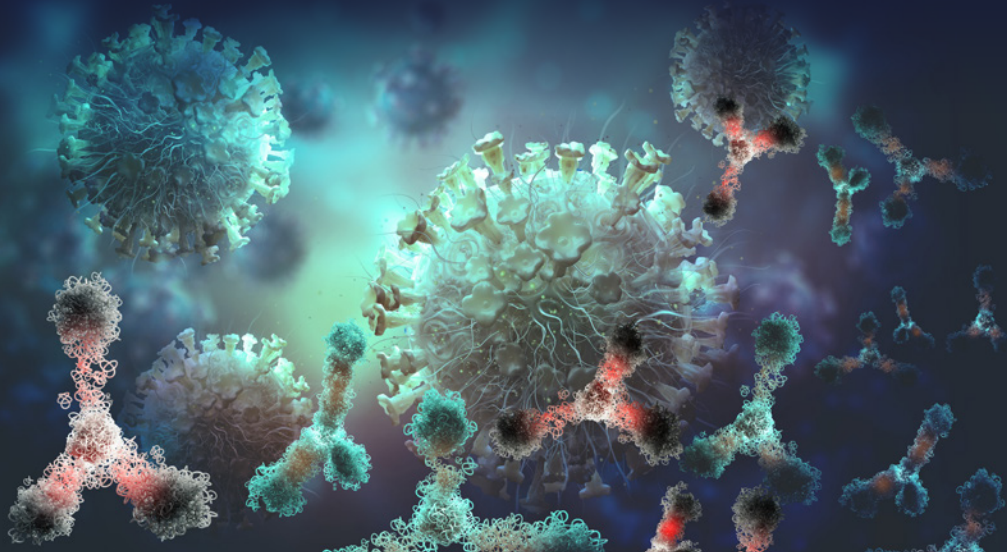
Bioscience and biotechnology research at LLNL

Innovative biological research
to address the nation's most
critical challenges



Lawrence Livermore
National Laboratory

In the **Biosciences and Biotechnology Division (BBTD)** at Lawrence Livermore National Laboratory (LLNL), we integrate biological and physical sciences with engineering to deliver transformative solutions that safeguard health, strengthen national security, and advance energy and environmental resilience.



Our bioscience research spans multiple areas, including:

- Rapidly assessing biological and chemical threats to inform response strategies and mitigate risks.
- Studying host–pathogen interactions and immune mechanisms with experimental and computational approaches to accelerate the development of vaccines, therapeutics, and other broad-spectrum countermeasures.
- Engineering microorganisms and biomolecules to enable advances in biomanufacturing and biomaterials development.



Browse the following pages to learn more about the exciting, team-based research taking place in BBTD:

HUMAN HEALTH

- Genomics
- Microbiology and immunology
- Human health sciences
- Translational immunology

BIOSECURITY AND DRUG DEVELOPMENT

- Biochemical and biophysical systems
- Advanced biotechnologies integration
- Biosecurity, assessments, and materials
- Biophysics and nanomaterials

BIOMANUFACTURING AND BIOMATERIALS

- Microbial systems biology
- Synthetic biology

We are recognized leaders in genomics, bioanalytics, microbiology, infectious diseases, therapeutic design, and synthetic biology. We invite you to connect with us to explore research opportunities in our division, especially in growth areas, such as computational biology, synthetic biology, neurobiology, and cellular biology.



HUMAN HEALTH

The **Genomics Group** develops innovative bioassays to rapidly detect infectious agents and other pathogens to support public health, food safety, and drug safety. We apply expertise in genomics, bioinformatics, virology, and molecular biology to characterize pathogens and identify novel biomarkers and mechanisms for diseases.



BBTD scientist loads sequencing libraries for a high-throughput DNA sequencing experiment.

HUMAN HEALTH

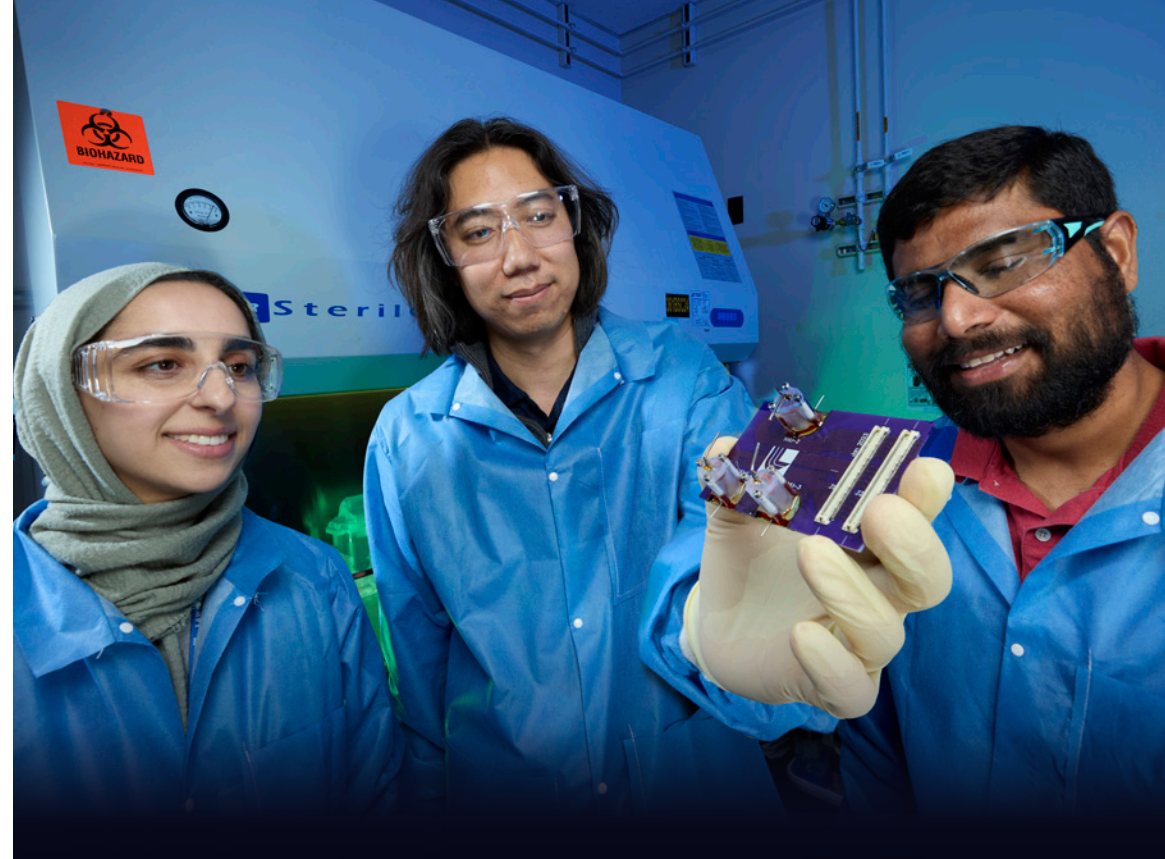
The **Microbiology and Immunology Group** studies clinical and environmental host–pathogen interactions, vaccine and therapeutic design, viral evolution, immune functions, and microbiomes. We prioritize mission-critical efforts, including countering biothreat viruses and bacteria, developing rapid responses to emerging disease, and conducting research aimed at improving military health and readiness.



BBTD scientists use flow cytometry to develop research solutions that support the nation's health and security.

HUMAN HEALTH

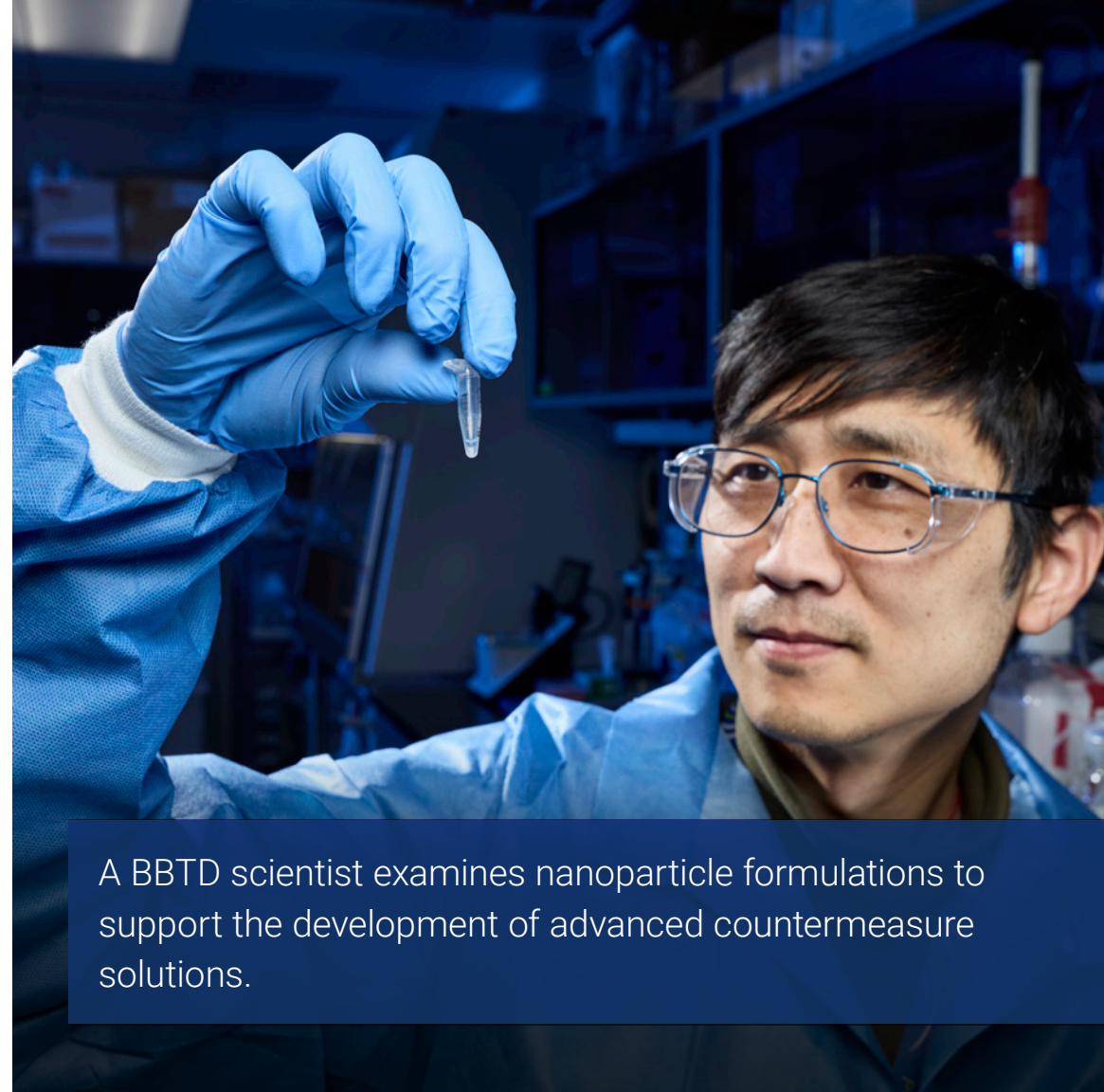
The **Human Health Sciences Group** investigates brain function, drug metabolism, and tissue responses to potential chemical and biological threats. Using LLNL's advanced tools—including brain microphysiological systems, neural network modeling, and 'omics—we examine how drugs, chemicals, toxins, pathogens, and injury affect biological systems. This work expands our understanding of neurotoxicity and host-pathogen interactions, driving innovations in precision medicine and safer medical countermeasures.



BBTD scientists examine LLNL's neurovascular unit, an organ-on-chip experimental model that enables non-invasive assessment of human brain function.

HUMAN HEALTH

The **Translational Immunology Group** focuses on immunology, cellular biology, biotechnology, and nanotechnology. For example, we develop vaccines and study inflammatory diseases. We also create nanotechnology tools to synthesize, formulate, and characterize immunomodulatory proteins, nucleic acids, and small molecules for biosecurity applications.



A BBTD scientist examines nanoparticle formulations to support the development of advanced countermeasure solutions.

BIOSECURITY AND DRUG DEVELOPMENT

The **Biochemical and Biophysical Systems Group** leverages LLNL's high-performance computing resources to develop new computational tools that help scientists understand and predict the behavior of biological systems. For example, our work enables better predictions of protein-mediated activities that are essential to cellular function and interactions in living systems—supporting the design of safe and effective therapeutics.



BBTD scientists use high-performance computing to predict and understand small molecules, proteins, and lipid bilayers, as well as their interactions.

BIOSECURITY AND DRUG DEVELOPMENT

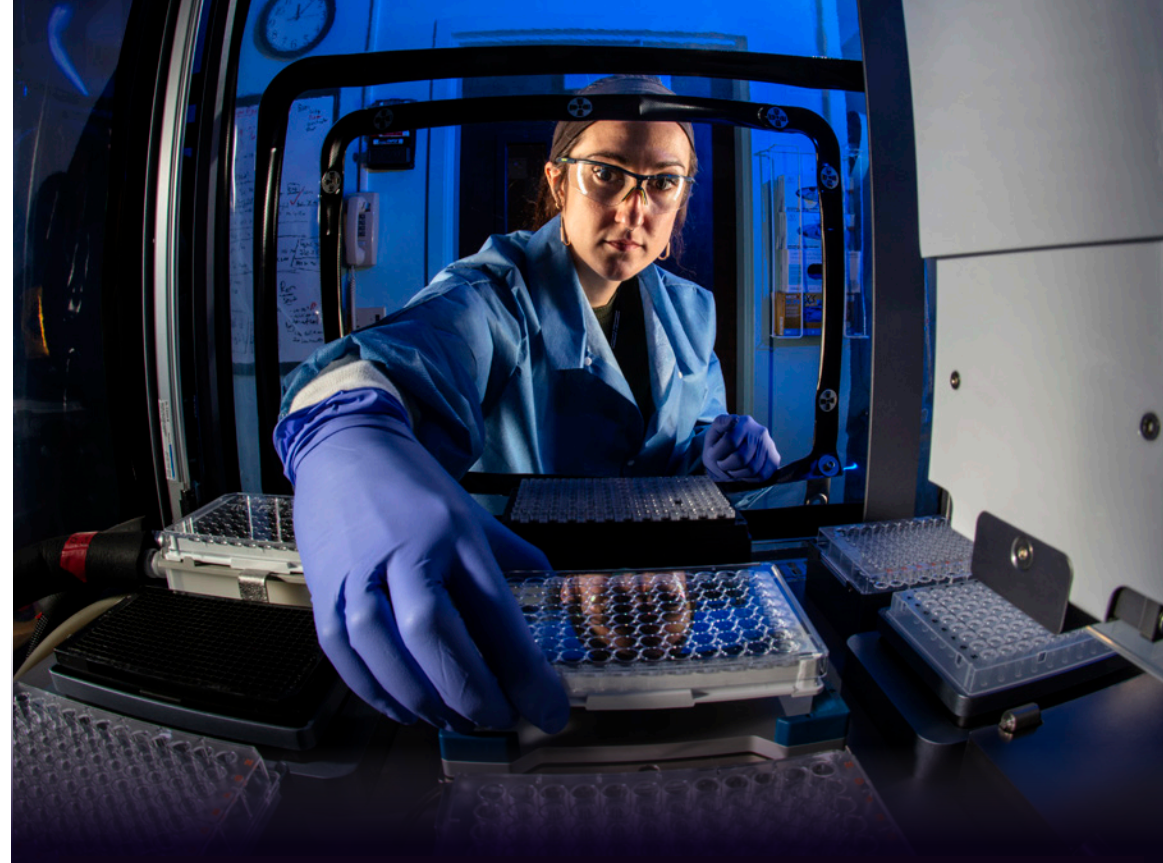
The **Advanced Biotechnologies Integration Group** develops cutting-edge biotechnologies to address critical challenges in national security, public health, and environmental sustainability. We integrate advances in synthetic biology, bioengineering, and computational modeling to create innovative solutions for detecting, mitigating, and responding to biothreats. Through multidisciplinary collaborations, we accelerate efforts to translate this research into beneficial technologies.



A BBTD scientist configures an automated liquid handler for high-throughput experiments.

BIOSECURITY AND DRUG DEVELOPMENT

The **Biosecurity, Assessments, and Materials Group** uses nucleic acid sequencing, bioinformatics, and analytical tools to protect the warfighter and the environment. We partner with programs across the DOE complex on bioremediation projects, and we provide technical assessments on new and emerging biotechnologies to policymakers.



BBTD scientist loads an automated liquid handler to run high-throughput gene-editing screenings aimed at discovering new anti-viral targets.

BIOSECURITY AND DRUG DEVELOPMENT

The **Biophysics and Nanomaterials Group** applies our expertise in biochemistry, biophysics, additive manufacturing, and materials science to address LLNL's national security missions. Our work includes imaging live cells to advance infectious disease research; developing thin-film coatings that protect against chemical and biological threats; leveraging the Lab's additive manufacturing capabilities to create microenvironments for life science studies; and using structural biology to uncover the function of biomolecules.



BBTD scientist loads cells onto an automated liquid handling system to produce candidate therapeutic antibodies to be tested as countermeasures against infectious disease agents.

BIOMANUFACTURING AND BIOMATERIALS

The **Microbial Systems Biology Group** probes the fundamental systems biology of microbes and microbial communities to gain a mechanistic understanding of complex biological interactions and system phenotypes. We harness this fundamental science to design systems at the protein, cellular, and community levels for applications in environmental biotechnology, biomanufacturing, and human health.



BBTD scientists study algae to unlock their biotechnological and biomanufacturing potential, and to predict how interactions with their microbiome can improve their growth.

BIOMANUFACTURING AND BIOMATERIALS

The **Synthetic Biology Group** designs proteins, microbes, and microbial communities for applications in biofuel, advanced manufacturing, and human health. For example, we employ computational, synthetic biology, and biochemical approaches to redesign proteins and microbial pathways that can extract and purify critical metals, resist mutational inactivation, and generate strategically important products. Using our engineering and materials science expertise, we translate these discoveries into technologies that strengthen our national security.



BBTD scientists use automated high-throughput screening platforms to probe genotype–phenotype relationships in biological systems and identify targets with desirable traits.

FACILITIES

The **National User Resource for Biological Accelerator Mass Spectrometry (bioAMS)** at LLNL supports researchers as they explore ways to combat emerging pathogens and environmental toxins; speed development of safe, effective therapeutics; and address other biomedical research challenges. Since 1999, the bioAMS resource has served the biomedical research community, and we continue to enhance AMS technology with expanded analytical capabilities.

Learn more: bioams.llnl.gov

BBTD scientists use Biological Accelerator Mass Spectrometry (BioAMS) to conduct ultra-sensitive analyses of radioisotopes and determine the quantity of biomarkers present in samples.



FACILITIES

The **Aerosol Inhalation Research Laboratory (AIRLAB)** at LLNL is a state-of-the-art facility used to test and analyze airborne particles in small animal models. In the facility's controlled environment, researchers study inhalation exposure to pharmaceuticals, chemicals, and environmental pollutants, while maintaining the highest safety standards.



FACILITIES

LLNL's **High Containment Facility (HCF)** provides cutting-edge research capabilities that are used to study high-consequence pathogens, helping to protect the nation from emerging biothreats and pandemics. It also supports data integration across the national security enterprise and serves the needs of national security and public health sponsors.

The HCF houses three CDC-registered Biosafety Level 3 and Animal Biosafety Level 3 labs. Its biosecurity infrastructure enables research regarding select agents, toxins, and Risk Group 2 and 3 pathogens.

LLNL's High Containment Facility supports cutting-edge research with high-consequence pathogens to protect against known and emerging biothreats.



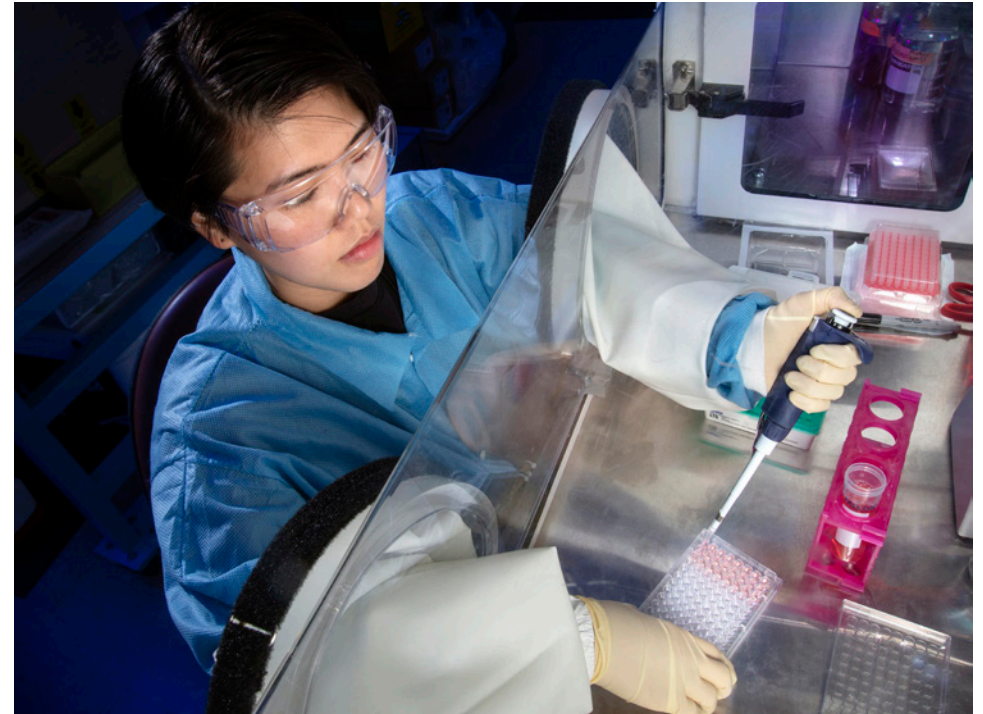
LLNL offers exciting research opportunities for **postdoctoral scholars** and **student interns**.

Postdoctoral appointments are typically two-year assignments, with many extended to a third year. We offer competitive salaries, a collaborative research environment that values innovation, and pathways to staff positions.

Learn more: pls.llnl.gov/careers/postdoctoral-program

Each year, we welcome undergraduate and graduate students to LLNL who participate in paid internships. Interns work alongside mentors, gain hands-on research experience, and engage in enriching learning activities.

Learn more: pls.llnl.gov/careers/internships



Postdocs and interns at LLNL have opportunities to access world-class bioscience research instruments and make meaningful contributions to basic and applied research projects.

Learn more about BBTD's highly collaborative team environment and our innovative research:

pls.llnl.gov/bbtd

Email us: biosciences@llnl.gov

We're hiring!

Learn more about research opportunities at LLNL for interns, postdocs, and staff positions:

pls.llnl.gov/careers



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Antoine Snijders
Division Leader,
BBTD



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Lawrence Livermore National Laboratory is operated by Lawrence Livermore National Security, LLC, for the U.S. Department of Energy, National Nuclear Security Administration under Contract DE-AC52-07NA27344.

LLNL-BR-2010296