Washington University in St. Louis

Division of Biology & Biomedical Sciences

Email: DBBS-Info@email.wustl.edu
Website: http://dbbs.wustl.edu

Programs

Biochemistry, Biophysics, & Structural Biology (https://dbbs.wustl.edu/programs/biochemistry-biophysics-structural-biology/)

Biochemistry uses the concepts and approaches of chemistry to understand the molecular basis of biological processes. Biochemical studies include enzymology, metabolism, DNA replication, cell signaling, and drug discovery. Insights from these studies may shed light on fundamental biological processes as well as mechanisms of disease, new drug treatments, and new diagnostics.

Biophysics brings together elements of biology, chemistry, physics and mathematics to describe and understand biological processes. It is a fusion of scientific cultures: the systems and processes of biochemistry and computational and molecular biology are joined with the principles and quantitative laws of physical chemistry. The goal is to develop a quantitative and predictive understanding of biology at a detailed molecular level.

Structural Biology seeks a mechanistic understanding of macromolecular function through molecular structure and dynamics. X-ray diffraction, cryo-electron microscopy, and nuclear magnetic resonance are among the tools used by structural biologists, whose insights address important questions throughout biology and medicine at Washington University.

Biomedical Informatics & Data Science (https://dbbs.wustl.edu/programs/biomedical-informatics-data-science/)

Biostatistics and Data Science Research Track: The goal of the Biostatistics and Data Science track is to train independent and innovative researchers who will contribute to the development and application of cutting-edge statistical and data science methodologies in health science disciplines. The track provides a balance of theory, methods, and applications of biostatistics and data science that are central to modern interdisciplinary research. Under the supervision of advisors, PhD students participate in the design of clinical studies and are involved in the analysis, inference, and interpretation of these studies.

Biomedical Informatics Research Track: Through the Biomedical Informatics track, students will have training and research opportunities in the five subdisciplines of biomedical informatics as defined by the American Medical Informatics Association (AMIA (https://www.amia.org/)), the largest professional scientific community in the field of biomedical informatics:

- Applied Clinical Informatics (ACI): applying innovative measurement and informatics approaches to inform and improve clinical practice
- Consumer Health Informatics (CHI): investigating consumers' needs and integrating consumers' preferences into health information systems
- Clinical Research Informatics (CRI): managing information related to clinical trials as well as secondary use of clinical data
- Translational Bioinformatics (TBI): developing storage, analytic, and interpretive methods to optimize the transformation of biomedical data
- Population Health Informatics (PopHI): integrating aspects of public health, clinical informatics, and health care delivery

Cancer Biology (https://dbbs.wustl.edu/programs/cancer-biology/)

The graduate program in Cancer Biology spans many disciplines, including cell biology, genetics, biochemistry, microbiology, pharmacology, pathology, epidemiology, bioinformatics, and immunology, to name a few. It represents a unique set of training and educational activities that, taken collectively, expose the student to the full breadth of cancer biology while allowing immersion in a specific dissertation topic of the student's choice. A common theme that unites these diverse endeavors is the desire to push the limits of our understanding of these processes to the highest possible molecular resolution. The program is designed to provide graduate and medical students with the education and training they need to make significant contributions to the field of cancer biology, both in the laboratory and in the clinic.

Computational & Systems Biology (http://dbbs.wustl.edu/divprograms/compbio/Pages/default.aspx)

The graduate program in Computational and Systems Biology trains the next generation of scientists in technology-intensive, quantitative, systems-level approaches to molecular biology. As technological changes generate exponentially larger amounts of data, the scale of the biological questions under investigation grows ever larger. Students in the Computational and Systems Biology program learn to leverage advances in cutting-edge, high-throughput experimental and computational tools. Because of its interdisciplinary nature, the program's curriculum accommodates students with a wide variety of backgrounds, including genetics, biochemistry, molecular biology, mathematics, engineering, physics, chemistry, computer science,

and statistics. The faculty in the program are highly interdisciplinary and specialize in the application of computer science, information technology, biophysics, biochemistry, genetics, applied mathematics, and statistics to problems in molecular biology.

Developmental, Regenerative, & Stem Cell Biology (http://dbbs.wustl.edu/divprograms/devbio/Pages/default.aspx)

A central theme of the Developmental, Regenerative and Stem Cell Biology program is the desire to understand the genetic and molecular basis of specific developmental events and how defects in these events lead to developmental disorders and disease, such as cancer and neurodegeneration. Students and faculty members in the program employ genetics, cell biology, and biochemistry as well as cutting-edge imaging, genomic, and systems-level approaches to dissect key outstanding questions in the fields of development, regeneration, and stem cell biology.

Ecology & Evolutionary Biology (https://dbbs.wustl.edu/programs/ecology-evolutionary-biology/)

The graduate program in Ecology and Evolutionary Biology studies the origins and maintenance of biodiversity on both evolutionary and ecological timescales. The program combines field studies with the technical advances of molecular genetics, statistics, large-scale genomics, quantitative genetics, and mathematical theory to gain an understanding of evolutionary history and environmental biology. Research in the program is extremely diverse. Study organisms include model systems such as yeast, *Drosophila, Arabidopsis,* and *Dictyostelium;* human populations; agricultural species; and various natural plant and animal populations. Students' research opportunities are enriched by the university's partnerships with local institutions. Our Tyson Research Center allows field studies in local natural ecosystems. The Missouri Botanical Garden conducts systematic studies of plant diversity worldwide. The Saint Louis Zoo facilitates studies of the conservation biology of exotic large animals. Our faculty and students also conduct studies on a global scale at field sites in Africa, Asia, and South America.

Immunology (https://dbbs.wustl.edu/programs/immunology/)

The graduate program in Immunology offers an outstanding learning environment in one of the largest and most diverse Immunology programs in the nation and a faculty that is highly committed to graduate education. The Immunology faculty are leaders in their field, developing and employing cutting-edge technologies, including the generation of genetically modified mice by gene targeting, proteomics, intravital microscopy, and high-throughput pathogen discovery. Some of the key questions explored here are specific to the field, while others deal with the immunological versions of more basic phenomena in areas such as developmental biology, signal transduction, and the regulation of gene expression. Because immunology is interdisciplinary and rapidly developing, the program trains students to develop specialty expertise in immunology itself, as well as basic knowledge in a number of general "emphasis" areas with broader applicability.

Molecular Cell Biology (https://dbbs.wustl.edu/programs/molecular-cell-biology/)

The graduate program in Molecular Cell Biology involves a wide array of investigations into many fundamental cell processes and the mechanisms that control them. Among the subjects currently under investigation are gene expression; mechanisms of transcription and tissue-specific transcription regulation; molecular mechanisms involved in cell proliferation; the cell cytoskeleton, motility, and chemotaxis; pathways for the trafficking of molecules into and out of cells; receptor-ligand interactions involved in the regulation of cell growth and the cell phenotype; signal transduction molecules and pathways; lipid metabolism; the assembly of supramolecular structures, including the extracellular matrix; mechanisms of enzyme catalysis and inhibition; and mechanisms of pathogenesis. A common theme uniting these research programs is the desire to understand essential cellular functions at the highest possible level of molecular resolution.

Molecular Genetics & Genomics (https://dbbs.wustl.edu/programs/molecular-genetics-genomics/)

The graduate program in Molecular Genetics and Genomics provides an ideal interdisciplinary training environment for students interested in exploring basic questions in biology. Students and faculty members in the program employ genetic and genomic approaches to investigate questions in genetics, cell biology, development, and physiology. Common themes include research aimed at identifying and characterizing the genes and the genetic and molecular networks that control fundamental genetic and cellular processes; deciphering how defects in gene function disrupt these processes and lead to disease; and devising genetic and molecular methods to identify and treat diseases.

Molecular Microbiology & Microbial Pathogenesis (https://dbbs.wustl.edu/programs/molecular-microbiology-microbial-pathogenesis/)

Molecular Microbiology

Research in molecular microbiology employs genetics, cell biology, biochemistry, and biophysics to investigate fundamental biological problems including environmental sensing and cell-cell signaling, transcriptional and post-transcriptional regulation, secretion,

energy generation, and the bacterial cell cycle. State-of-the-art computational and comparative genomic approaches are used to study commensal, pathogenic, and environmental organisms in their natural environments.

Microbial Pathogenesis and Host Defense

Research in this area involves the molecular biology and biochemistry of pathogenic bacteria, fungi, protozoa, helminths, and viruses, with an emphasis on mechanisms of virulence and host–parasite interactions. By applying a wide range of emerging technologies in molecular genetics and cell biology, this work includes the discovery and analysis of virulence-associated genes, the study of innate and acquired immunity to pathogens, and the identification and exploration of novel targets for chemotherapy.

Neurosciences (https://dbbs.wustl.edu/programs/neurosciences/)

The graduate program in the Neurosciences has a large and interactive faculty drawn from numerous preclinical and clinical departments across two campuses. We study nearly every area of modern neuroscience, from the structural analysis of ion channels to the mapping of the functional connections of the human brain. Students enjoy a challenging and productive environment in which to define and pursue their professional goals. The superb resources and remarkable breadth of research possibilities at Washington University guarantee the student's exposure to the most fundamental issues in the field and the tools to address those issues in depth in a diverse, collaborative, and interdisciplinary scientific community. Active areas of research include cellular, molecular, and developmental neurobiology; systems and integrative neuroscience; and clinical and computational neuroscience.

Plant & Microbial Biosciences (https://dbbs.wustl.edu/programs/plant-microbial-biosciences/)

The graduate program in Plant and Microbial Biosciences provides training in the use of prokaryotes, eukaryotic microbes, mosses, and vascular plants as experimental organisms to address fundamental and applied biological questions. Contemporary research on plant and microbial systems adds to our knowledge of basic biology, informs our understanding of the natural world, and leads to innovations in biomedicine, agriculture, and energy production. Our graduate students have unparalleled opportunities to pursue multidisciplinary training in genetics, biochemistry, cell biology, development, molecular evolution, and physiology, capitalizing on current interest and investment in biological research and fueled by experimental resources found at Washington University and our partnership with the Donald Danforth Plant Sciences Center.