Biology & Biomedical Sciences

The Division of Biology & Biomedical Sciences at Washington University offers exceptional doctoral training at one of the nation's preeminent biomedical research centers. The Division includes 12 doctoral programs:

- Biochemistry
- Computational & Molecular Biophysics
- Computational & Systems Biology
- Developmental, Regenerative & Stem Cell Biology
- Evolution, Ecology & Population Biology
- Human & Statistical Genetics
- Immunology
- Molecular Cell Biology
- Molecular Genetics & Genomics
- Molecular Microbiology & Microbial Pathogenesis
- Neurosciences
- Plant & Microbial Biosciences

A collaborative, interdisciplinary approach to research and education is a hallmark of Washington University and the Division. As a university-wide consortium, the Division transcends departmental lines and removes traditional boundaries of scientific fields. Faculty and graduate students regularly cross disciplines, devising novel questions and approaches that might otherwise go unexplored. The Division currently consists of 650 graduate students and 475 faculty members from 34 departments.

Washington University in St. Louis provides unique opportunities in translating basic science to practical application. The university's BioMed 21 initiative provides $300 million to support research that bridges the gap from bench to bedside; the project included construction of a 215,000 square-foot building dedicated to such research. In addition, the Division's associations with internationally prominent local institutions provide exciting opportunities: students in the biomedical sciences enrich their work with the clinical perspective of our outstanding medical school; students in plant, population, evolutionary and ecological sciences benefit from our close affiliation with the internationally renowned Missouri Botanical Garden and the Danforth Plant Science Center. To help prepare graduates for a career in academia, government, industry, or another field of their choice, educational opportunities are offered for skills development and career exploration. Through our Career Talks program, professionals from a variety of fields, such as biotech start-ups and patent law, provide presentations and Q & A sessions to students throughout the year. In addition, through partnerships with groups such as the Teaching Center, the BALSA Group and ProSPER, students have additional opportunities to develop experiences relevant to future career goals.

Phone: (314) 362-3365 or (800) 852-9074
E-mail: DBBS-info@wusm.wustl.edu
Departmental website: http://dbbs.wustl.edu

Program Information

Biochemistry

*Areas of study*: metabolic regulation, signal transduction, receptors, membrane channels and transporters, membrane structure and dynamics, membrane trafficking, cholesterol and lipid metabolism, nucleic acid-protein structure interactions and function, DNA replication and repair, recombination, transcription, translation, enzyme kinetics, cancer biology, cell cycle regulation, apoptosis, cell motility, cytoskeleton, cell division, extracellular matrix, vascular biology, aging, senescence, telomere biology, heat-shock proteins, prion proteins, gene expression, RNA editing and binding proteins, microbial pathogenesis, parasitology, virology, drug design and metabolism, plant natural products, photosynthesis and plant energy production, molecular imaging in cells and tissues, carbohydrate metabolism, proteases

Program Faculty Members

Computational and Molecular Biophysics

*Areas of study*: structural biology, protein and nucleic acid kinetics and thermodynamics, single-molecule enzymology, protein design, nanoscience, ion channels and lipid membranes, computational biophysics

Program Faculty Members

Computational and Systems Biology

*Areas of study*: systems biology, genomics, sequence analysis, regulatory networks, synthetic biology, metagenomics, metabolomics, proteomics, single cell dynamics, high-throughput technology development, applied math and mathematical models of biological processes, computational biology, comparative genomics, personalized medicine, next generation sequencing and its applications, bioinformatics

Program Faculty Members

Developmental, Regenerative, and Stem Cell Biology

*Areas of study*: development, stem cell biology, regenerative biology, cell biology, genetics, cell signaling, the biology of cancer, epigenetics, circadian rhythms, systems biology
Program Faculty Members

**Evolution, Ecology and Population Biology**

*Areas of study:* population ecology, community ecology, plant and animal evolution; microbial evolution, evolution of behavior, phylogenetics, systematics, theoretical and experimental population genetics

Program Faculty Members

**Human and Statistical Genetics**

*Areas of study:* human genetics, statistical genetics, functional genomics, molecular genetics, Mendelian disease, complex disease, Mammalian genetics, systems biology

Program Faculty Members

**Immunology**

*Areas of Study:* cellular immunology, molecular immunology, lineage development, autoimmunity, cancer immunotherapy, transcription factors, epigenomics, mucosal immunity, innate immunity, bacterial, viral, and parasite immunity, immune evasion, antigen processing and presentation, dendritic cells, T cell signaling, antigen receptor diversification

Program Faculty Members

**Molecular Cell Biology**

*Areas of study:* cell adhesion, protein trafficking and organelle biogenesis, cell cycle, receptors, signal transduction, gene expression, metabolism, cytoskeleton and motility, membrane excitability, molecular basis of diseases

Program Faculty Members

**Molecular Genetics and Genomics**

*Areas of study:* genetics, genetic basis of disease, genomics, epigenetics, genetic engineering, genome editing, model organism genetics, development, cell biology, molecular biology, complex traits, bioinformatics, systems biology

Program Faculty Members

**Molecular Microbiology and Microbial Pathogenesis**

*Areas of study:* Host-pathogen interactions, cellular microbiology, molecular microbiology, microbiological pathogenesis, pathogen discovery, emerging infectious diseases, microbial physiology, comparative genomics, microbiome and host interactions, virology, bacteriology, mycology, parasitology

Program Faculty Members

**Neurosciences**

*Areas of study:* neurobiology, neurology, functional imaging, behavior, cognition, computational neuroscience, electrophysiology, sensory systems, motor systems, neuroglia, neuronal development, learning, memory, language, synaptic plasticity, mind, consciousness, neurodegeneration, diseases of the nervous system, neuronal injury, clinical neuroscience, motor control, biological rhythms, connectivity mapping

Program Faculty Members

**Plant and Microbial Biosciences**

*Areas of study:* cell biology; development; physiology, signaling, development, metabolic regulation, photosynthesis, bioenergy, protein structure-function, synthetic biology, biogeochemistry, environmental microbiology, ecology, population genetics and molecular evolution

Program Faculty Members

**Course of Study**

Each program has its own steering committee, which provides students with guidance, addresses their needs, and monitors their progress. The committee also helps each student customize the course of study to match his or her individual needs. Each of the 12 programs establishes its own degree requirements.

Across all the programs, the course of study consists of five distinct parts:

**Course Work**

This generally requires two to five semesters and usually consists of four to nine courses in areas fundamental to the student's program. Students are expected to maintain a "B" average in graduate courses.

**Laboratory Rotations**

Selecting a thesis adviser is the most important decision a student makes in graduate school. To help each student make an informed, thoughtful choice, the Division builds in flexibility to explore options. Students usually participate in three lab rotations during their first year. Additional rotations can be arranged, and rotation lengths are flexible. Students usually begin their thesis research by the end of their first year.

**Qualifying Examination**

After required course work is completed, each student takes a preliminary, or qualifying, examination to assess mastery of the field and the ability to integrate information across fields. Upon successful completion of the qualifying exam, the student concentrates on thesis research.
Thesis Research

Thesis research begins once the student has chosen a laboratory in which to work. With his or her mentor — the laboratory's principal investigator — the student devises a thesis project and chooses an advisory committee. Typically between the end of their second year and middle of their third year, students present their thesis proposals to the thesis committee. Upon successful approval of the thesis proposal, the student officially becomes a doctoral candidate. For the rest of the student's program of study, the thesis committee monitors progress and meets at least once a year to provide analysis and advice. It also serves as the thesis defense committee when the thesis is ready for presentation. Most students complete and defend their dissertations by the end of their sixth year.

Scientific Scholarship

Keeping abreast of scientific developments is critical for faculty and students alike. The Division offers many ways to stay current. More than 15 weekly biology seminars provide excellent opportunities to meet outstanding scientists from outside Washington University. Several annual symposia bring internationally recognized speakers to campus. Journal clubs meet weekly for students, postdoctoral fellows, and faculty to present and discuss current scientific literature. Program retreats allow for informal interaction among students and faculty. The Division also provides funds for each student to defray the costs of attending a national scientific meeting.

Admissions

Prospective students apply to the Division as a whole. Students are admitted into a specific degree program but may change their program affiliation as their interests develop. Applications are available online during the first week in September at http://dbbs.wustl.edu. Review of applications begins November 15, and early application is encouraged. Deadline to apply is December 1. In general, students are admitted only for the fall semester of each year.

Requirements for admission to the doctoral programs of the Division include the following:

- A baccalaureate degree in the natural, mathematical, physical, engineering sciences or psychology.
- Courses in calculus, general and organic chemistry, physics, and a core sequence of basic courses in biology.
- A strong background in quantitative sciences.
- Test scores: the general GRE test is required, earned within the past five years; the subject test is optional. International students must submit scores from the Test of English as a Foreign Language (TOEFL) earned within the past two years. Applicants with scores of 100 or higher on the TOEFL IBT will be considered.

- At least one year of undergraduate or postgraduate research experience is required. Letters of recommendation concerning research experience and accomplishments are particularly important.

There is no application fee.

Qualified applicants are invited to an interview in St. Louis. The Division pays travel expenses, up front, within the United States and Canada. International applicants will be reimbursed for travel from their U.S. port of entry to St. Louis.