Biology & Biomedical Sciences

The Division of Biology & Biomedical Sciences at Washington University offers exceptional doctoral education at one of the nation's preeminent biomedical research centers. The Division includes 11 doctoral programs:

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

A collaborative, interdisciplinary approach to research and education is a hallmark of Washington University and the Division. As a universitywide 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 670 graduate students and over 500 faculty members from 37 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 (http://www.missouribotanicalgarden.org) and the Danforth Plant Science Center (http://www.danforthcenter.org/default.asp).

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.

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**Programs and Faculty**

**Biochemistry, Biophysics and Structural Biology** (http://dbbs.wustl.edu/divprograms/biophysics/Pages/BBSB.aspx)

*Areas of study:* DNA repair, replication and recombination, allostery and enzymology, molecular signaling, cell cycle regulation, biochemistry of host-pathogen interactions, mechanisms of microbial immune invasion, mechanisms of neural degeneration, nucleic acid–protein interactions, nanotechnology and chemical biology, cellular transport and trafficking, computational biophysics.

Visit our website for information about our Biochemistry, Biophysics and Structural Biology faculty (http://dbbs.wustl.edu/divprograms/biophysics/Pages/Faculty.aspx).

**Computational and Systems Biology** (http://dbbs.wustl.edu/programs/CompBio)

*Areas of study:* systems biology, genomics, sequence analysis, regulatory networks, synthetic biology, metagenomics, metabolomics, proteomics, epigenomics, transcriptomics, lipidomics, single cell dynamics, high-throughput technology development, applied math and mathematical models of biological processes, computational biology, comparative genomics, personalized medicine, genome engineering, machine learning, big data science, next generation sequencing and its applications, bioinformatics.

Visit our website for information about our Computational and Systems Biology faculty (http://dbbs.wustl.edu/divprograms/compbio/Pages/Faculty.aspx).

**Developmental, Regenerative and Stem Cell Biology** (http://dbbs.wustl.edu/programs/DevBio)

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

Visit our website for information about our Developmental, Regenerative and Stem Cell Biology faculty (http://dbbs.wustl.edu/divprograms/devbio/Pages/Faculty.aspx).

Areas of study: population ecology, community ecology, plant and animal evolution; microbial evolution, evolution of behavior, phylogenetics, systematics, theoretical and experimental population genetics.
Visit our website for information about our Evolution, Ecology and Population Biology faculty (http://dbbs.wustl.edu/divprograms/eepb/Pages/Faculty.aspx).

Human and Statistical Genetics (http://dbbs.wustl.edu/programs/hsg)

Areas of study: human genetics, statistical genetics, functional genomics, molecular genetics, Mendelian disease, complex disease, human disease models, systems biology.
Visit our website for information about our Human and Statistical Genetics faculty (http://dbbs.wustl.edu/divprograms/hsg/Pages/Faculty.aspx).

Immunology (http://dbbs.wustl.edu/programs/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.
Visit our website for information about our Immunology faculty (http://dbbs.wustl.edu/divprograms/immunology/Pages/Faculty.aspx).

Molecular Cell Biology (http://dbbs.wustl.edu/programs/cellbio)

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.
Visit our website for information about our Molecular Cell Biology faculty (http://dbbs.wustl.edu/divprograms/cellbio/Pages/Faculty.aspx).

Molecular Genetics and Genomics (http://dbbs.wustl.edu/programs/mgg)

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.

Visit our website for information about our Molecular Genetics and Genomics faculty (http://dbbs.wustl.edu/divprograms/genetics/Pages/Faculty.aspx).

Molecular Microbiology and Microbial Pathogenesis (http://dbbs.wustl.edu/programs/micro)

Areas of study: Host-pathogen interactions, cellular microbiology, molecular microbiology, microbial pathogenesis, pathogen discovery, emerging infectious diseases, microbial physiology and biochemistry, comparative genomics, gene expression and regulation, microbiome and host interactions, virology, bacteriology, mycology, parasitology.
Visit our website for information about our Molecular Microbiology and Microbial Pathogenesis faculty (http://dbbs.wustl.edu/divprograms/micro/Pages/Faculty.aspx).

Neurosciences (http://dbbs.wustl.edu/programs/neuro)

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.
Visit our website for information about our Neurosciences faculty (http://dbbs.wustl.edu/divprograms/neuro/Pages/Faculty.aspx).

Plant and Microbial Biosciences (http://dbbs.wustl.edu/programs/plantbio)

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.
Visit our website for information about our Plant and Microbial Biosciences faculty (http://dbbs.wustl.edu/divprograms/PlantMicroBioSci/Pages/Faculty.aspx).

Degree Requirements

PhD Degrees

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 their individual needs. Each of the 11 programs establishes its own degree requirements.
Across all the programs, the course of study consists of five distinct parts:

Courses
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 courses are 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 their 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. A number of Special Emphasis Pathways (http://dbbs.wustl.edu/cursstudents/SpecialEmphasisPathways/Pages/SpecialEmphasisPathways.aspx) allow students to enhance their PhD program. 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.