The Division of Biology & Biomedical Sciences

what will you discover?

Washington University in St. Louis
Biology & Biomedical Sciences
what will YOU discover?

640 students
more than 447 faculty
37 departments
12 programs
and one YOU.

DBBS
Division of Biology and Biomedical Sciences
Washington University in St. Louis
dbbs.wustl.edu

On the cover: Moshi Song (left), Molecular Cell Biology, and Callie Corsa, Molecular Cell Biology, Longmore lab
This is an exciting and rewarding time to be a biological scientist, especially at Washington University. In the post-genome era, biological science becomes an increasingly integrated enterprise. To meet the exponentially increasing demands of modern science, each scientist needs a thorough knowledge of his or her specialty, but also must possess a familiarity with the information and skills of other disciplines.

The Division of Biology and Biomedical Sciences is ideally positioned to foster the interdisciplinary study and research that brings important scientific breakthroughs; such discoveries often occur at the interfaces of disciplines. For more than 35 years, the PhD programs administered by the Division have operated at those frontiers.

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 the BJC Institute of Health at Washington University School of Medicine, with approximately 215,000 square feet 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 Sciences Center.

I encourage you to explore the programs of study available at Washington University. The depth of the expertise of our faculty and our decades of commitment to a collaborative environment and interdisciplinary scientific education allow us to offer one of the most comprehensive and effective PhD programs available.

John H. Russell, PhD
Associate Dean for Graduate Education
Division of Biology and Biomedical Sciences

As a graduate student at Washington University in St. Louis, you will discover a learning environment like no other. You will enjoy the freedom to explore endless areas of research, the friendship of diverse colleagues, and the mentorship of world-renowned faculty. In the end, you will not only earn a degree. You will also become an outstanding scientist.
The Division of Biology and Biomedical Sciences at Washington University in St. Louis offers exceptional doctoral training at one of the nation’s preeminent biomedical research centers. The Division offers 12 doctoral training programs, 10 of which are ranked among the nation’s top 10.*

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 640 graduate students and more than 447 faculty members from 37 university-wide departments.

Graduate students in the Division are part of an elite research environment that includes one of the country’s top medical schools,** world-renowned researchers and the legacy of 17 Nobel laureates. In this exciting atmosphere of inquiry, students explore many areas of research before choosing their thesis project. The course of study is customized to each student’s interests. As a result, they gain a broad foundation of knowledge along with their areas of concentration and learn the critical skills to conceive, evaluate and test the scientific ideas that expand our understanding of living systems.

*Academic Analytics’ Faculty Scholarly Productivity Index
**U.S. News & World Report graduate program rankings

A TRADITION OF EXCELLENCE
Washington University has historically been a national leader in biomedical research. Among the Nobelists: Joseph Erlanger and Herbert Gasser, pioneers of neurophysiology; Carl and Gerty Cori, who explored enzyme regulation and whose lab trained seven other eventual Nobelists; Arthur Kornberg, leader in understanding DNA replication, and Rita Levi-Montalcini and Viktor Hamburger, discoverers of nerve growth factor.

Examples of groundbreaking work at Washington University include the first faithful in vitro eukaryotic gene transcription; the use of transgenic plants to combat viral diseases; investigations into neural development and brain mapping, including the creation of the first positron emission tomography (PET) scanner; and pioneering large-scale genome mapping and sequencing.
**PROGRAM FEATURES**

Prospective students apply to the Division rather than to an individual department. Students are admitted into a specific Program but may change their Program affiliation as their interests develop. Each Program has its own steering committee, which provides students with guidance, addresses their needs and monitors 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. The PhD degree is granted by Washington University’s Graduate School of Arts & Sciences.

**the programs**

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>Using concepts and approaches of chemistry to understand the molecular basis of biological processes</td>
</tr>
<tr>
<td>Computational and Molecular Biophysics</td>
<td>Fusing the systems and processes of biochemistry and molecular biology with the theory and practice of physical chemistry, mathematics and physics</td>
</tr>
<tr>
<td>Computational and Systems Biology</td>
<td>Bridging the gap between biological data and the computational methods needed to maximize its utility</td>
</tr>
<tr>
<td>Developmental, Regenerative and Stem Cell Biology</td>
<td>Elucidating how single fertilized eggs produce complex adult organisms</td>
</tr>
<tr>
<td>Evolution, Ecology and Population Biology</td>
<td>Applying population genetics, phylogenetic and ecological perspectives to study the origins and maintenance of biodiversity</td>
</tr>
<tr>
<td>Human and Statistical Genetics</td>
<td>Studying the molecular basis of normal and disease phenotypes in humans</td>
</tr>
<tr>
<td>Immunology</td>
<td>Examining how the mechanisms of host defense protect against pathogenic agents</td>
</tr>
<tr>
<td>Molecular Cell Biology</td>
<td>Elucidating essential cellular processes and the mechanisms that control them</td>
</tr>
<tr>
<td>Molecular Genetics and Genomics</td>
<td>Determining how genes are inherited, modified, expressed and regulated in normal and diseased states</td>
</tr>
<tr>
<td>Molecular Microbiology and Microbial Pathogenesis</td>
<td>Understanding comprehensive and modern approaches to microbes and the diseases they cause</td>
</tr>
<tr>
<td>Neurosciences</td>
<td>Understanding how the brain works, how it develops and how it malfunctions in disease</td>
</tr>
<tr>
<td>Plant Biology</td>
<td>Training students in the molecular biology, physiology, biochemistry, genetics, development and cell biology of plants, algae and microbial organisms</td>
</tr>
</tbody>
</table>

"Picking a lab is a big deal, and I did a fourth rotation to make sure I had as many options as possible. With 400-plus faculty to choose from, you’re essentially limitless."

**Paige Cooper**
Molecular Cell Biology, Nichols Lab
Undergraduate Institution: Spelman College
Grand Prairie, Texas

Laura Duvall, Neurosciences, Taghert lab

[dbbs.wustl.edu/divprograms](dbbs.wustl.edu/divprograms)
SPECIAL-EMPHASIS PATHWAYS

The Division of Biology and Biomedical Sciences offers Special Emphasis Pathways to provide supplemental, specialized training undertaken as part of the student’s regular course work. This training further exposes students to interdisciplinary and translational aspects of their fields. Some pathways are available by open enrollment, but some require an application process. More information is available at dbbs.wustl.edu under Current Students.

Cancer Biology Pathway
Provides students with an integrated view of current cancer biology from the clinic to the lab bench and back.

Cognitive, Computational and Systems Neuroscience Pathway
Trains graduate students to become leaders in interdisciplinary brain-related research in psychology, biology and engineering.

Imaging Sciences Pathway
Prepares graduates to specialize in one or more areas of imaging science, including technology development, chemistry and use of novel contrast agents, visualization/manipulation of macromolecular complexes and visualization of human disease states.

Infectious Diseases Scholars Program
Trains doctoral students and postdoctoral fellows to explore issues at the interface between patient care, public health and basic research in microbial pathogenesis.

Interface of Psychology, Neuroscience and Genetics Training Program
Designed for select students wishing to train for a research career at the interface of behavioral science and relevant biomedical science (neuroscience and/or genetics). ipng.wustl.edu

Kauffman Fellowship Pathway in Life Sciences Entrepreneurship
Teaches entrepreneurship and business skills — a unique opportunity to learn how scientific discoveries are translated into successful commercial ventures. Taught in collaboration with the School of Engineering and Applied Science and the Olin School of Business.

Lucille P. Markey Special Emphasis Pathway in Human Pathobiology
Introduces graduate students and research postdoctoral trainees to human disease states not generally covered in graduate courses to foster a more direct connection between basic science and clinical application.

Maria Praggastis, Molecular Cell Biology, Ory lab

"The best part of being at Wash U is having the freedom and resources to pursue many different disciplines — not only those in biomedical sciences but also business and economics. Faculty are approachable and support my diverse interests."

Maximiliaan Schillebeeckx
Molecular Genetics and Genomics, Mitra Lab
Undergraduate Institution: Saint Louis University
Labadie, Missouri
The course of study consists of five distinct parts.

**COURSE WORK**
Course work generally requires two to five semesters. It 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 just before or early in their second year.

**QUALIFYING EXAM**
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.

**THEESIS 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 during the third year, students present their thesis proposals to the thesis committee. Upon successful approval of the thesis proposal, the student officially becomes a candidate for the PhD. For the rest of the student’s program of study, this committee monitors progress and provides analysis and advice; it 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.

**TYPICAL SCHEDULE**

<table>
<thead>
<tr>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Fourth Year &amp; Beyond</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Rotations</td>
<td>Thesis Research</td>
<td>Core Courses</td>
<td>Thesis Proposal</td>
</tr>
<tr>
<td>Core Courses</td>
<td>Thesis Lab</td>
<td>Advanced Courses</td>
<td>Thesis Updates</td>
</tr>
<tr>
<td>Advanced Courses</td>
<td>Qualifying Exam</td>
<td>Thesis Proposal</td>
<td>Thesis Defense</td>
</tr>
</tbody>
</table>

**DBBS Student Publications 2009–2011**

- **STUDENT CONTRIBUTING AUTHOR**: 409
- **STUDENT FIRST AUTHOR**: 409
- **TOTAL PUBLICATIONS**: 898

Students are an integral component of the Division’s research enterprise. From 2009 to 2011, Division students published 898 papers.
Washington University in St. Louis and the Division of Biology and Biomedical Sciences are committed to building a diverse, dynamic community of scholars. Our students come to the Division from 43 states and 29 countries, and from undergraduate institutions of all sizes, both public and private. As a group, they are diverse in their races, talents and backgrounds, but they have in common a love of science and the ability and desire to excel. Camaraderie is an overriding quality of the Division; students provide a built-in source of personal support and friendship for each other.

The Division is committed to providing an ideal learning environment for every student. With the freedom to explore many areas of research and so many outstanding mentors to choose from, finding the perfect match is virtually assured. The Division’s student-to-faculty ratio is less than two to one, which means every student gets hands-on attention and effective mentorship.

Washington University prides itself on providing a friendly, supportive learning environment. Although rigorous, the educational experience is collegial, not competitive. Faculty are accessible and are focused on helping you achieve your highest goals. That support continues all the way through graduation. As students complete their degrees, the Career Center assists them in building employment skills and exploring career options.

The Association of Black Biomedical Graduate Students (ABBGS) enhances the graduate student experience through promoting diversity and encouraging cultural awareness. ABBGS hosts social events and seminars and provides opportunities and information for outreach in the St. Louis community.

Graduate Association of Latin American Students (GALAS) represents the Hispanic/Latin community in the division. GALAS promotes diversity through maintenance of a Hispanic/Latin resources network and organizes educational and cultural activities. Students from all backgrounds are welcome.

OUTgrads is an LGBTQIA group dedicated to developing community among Washington University graduate and professional students, faculty and staff of all genders and sexual orientations, promoting awareness of the issues that affect our communities, and facilitating community involvement by its membership. The organization is open to any member of the Washington University community. outgrads.wustl.edu

The Office of Diversity Programs of the School of Medicine and the Division’s Diversity Steering Committee assist current medical and graduate students in programming multicultural events. The role of the Office of Diversity Programs is to create an inclusive environment for students, staff and faculty within the Division of Biology and Biomedical Sciences and the Washington University community. The office supports cultural and educational programs, including the DBBS Diversity Lecture Series and the annual Minority Research Scholars Symposium. In addition, it works to deepen understanding across various groups and to provide support to the Association of Black Biomedical Graduate Students and the Graduate Association of Latin American Students.
Students’ educational experiences are enriched by the university’s leading-edge research facilities and partnerships with local institutions.

**Washington University**

- **Core laboratories** support collaborative research university-wide for all areas of clinical and basic research.
  - Morphology/Imaging/Spectroscopy
  - DNA Sequencing/Genetic Analysis
  - Transgenic Support
  - Protein/Lipid Analysis
  - Cells and Tissue Culture
  - Animal Studies/Clinical Studies
  - Biostatistics/Bioinformatics
  - Genomics/Proteomics/Lipidomics

- **The Genome Institute**, a world leader in large-scale genome sequencing, gives students unparalleled experience in genetics and genomics research training.
  - genome.wustl.edu

- **The BJC Institute of Health at Washington University School of Medicine** houses five interdisciplinary Research Centers focusing on:
  - cancer
  - cardiovascular disease
  - neurodegenerative disease
  - infectious disease
  - membrane excitability disease

  Each center brings together researchers from different scientific disciplines and academic departments to work together in designated laboratory space. This cross-fertilization of disciplines and the close interactions among scientists provide new inspiration for endeavors that can transform scientific discoveries into bedside medicine.

**Affiliated Institutions**

- **Donald Danforth Plant Science Center**
  - DBBS students conduct research at this not-for-profit research institute, which focuses on improving the world’s food supply and the nutritional content of plants.
  - danforthcenter.org

- **Missouri Botanical Garden**
  - DBBS students have full access to the staff, facilities, and laboratory and research opportunities of this world-class botanical research institution. It offers outstanding field-oriented tropical research opportunities and one of the globe’s leading collections of botanical samples.
  - missouribotanicalgarden.org

Since the Division of Biology and Biomedical Sciences’ first graduation in 1977, graduates have gone on to practice science or pursue related endeavors with the training they received at Washington University. A graduate career-development specialist is available to DBBS students to assist them in building employment skills and exploring career options. After graduation, 80 percent of students go directly into a postdoctoral fellowship. Many DBBS alums currently hold academic faculty positions, while others occupy senior positions in industry and government. A good number of our graduates pursue an eclectic and imaginative assortment of endeavors ranging from museum curator to science journal editor to intellectual property attorney to venture capital consultant. PhD training in the DBBS can open a variety of career possibilities. dbbs.wustl.edu/alumni
Students in the Division of Biology and Biomedical Sciences experience rewarding lives outside the laboratory. They possess many talents and interests beyond science and find time to relax and have fun, often with each other. The university’s graduate student community is social and cohesive, even across Schools. Students come together to enjoy activities of all kinds, from intramural sports to museum visits to float trips.

STUDENT ORGANIZATIONS

Students' commitment to university and community service is strong. Students regularly join forces to find outlets for self-expression and to devise practical solutions to important problems.

The **Association for Women in Science (AWIS)** regional chapter promotes a positive environment for women in science through education, advocacy and outreach. AWIS offers mentoring and networking resources and works to increase recognition for the accomplishments of female scientists.

**BioEntrepreneurship Core (BEC)** is open to all Washington University affiliates (students, postdocs, staff, faculty) who share an interest in the interface between biomedical research and entrepreneurship. BEC organizes events to educate the community about entrepreneurial principles, forge connections between researchers and local entrepreneur/businesses and raise awareness about resources available to startups. Many BEC activities also provide information for those considering alternative career paths outside of academia. Above all, BEC seeks to foster a spirit of innovation at the university that inspires researchers to pursue opportunities for their discoveries beyond the lab.

**Future Educators** is a student-run group including graduate students and postdocs who are interested in teaching and mentoring. Members are not necessarily committed to pursuing a teaching-focused career but share the opinion that learning and thinking about teaching will have positive effects on their current and future careers. The group meets regularly to discuss ideas related to teaching and mentoring in a research-based setting. It also serves as a resource for locating teaching opportunities in the St. Louis area and around the country.

**Student Advisory Committee (SAC)** is made up of students from the Division. SAC serves as the students’ advocate on issues of concern to the student body, represents the Division in the university community, organizes orientation activities and sponsors informational and social events.

**The Young Scientist Program**, run by students and postdocs from the Division, School of Medicine and Graduate School of Arts & Sciences, encourages high school students from disadvantaged backgrounds to consider careers in science through activities that emphasize hands-on research. Division students also participate in science education in the local community by giving a variety of classes at local junior and senior high schools.

**International Graduate Students Association for Career Development and Networking (ICAN)** is designed to help international students improve communication skills, build networks and learn leadership skills by working on group projects with other members in an English-speaking and multicultural environment, thereby enhancing individual member’s professional development and job marketability.

“*I feel like my class bonded really well within the first couple months of school. We were coming from different parts of the country and different schools, but we were starting fresh in grad school, so it was easy to find friends.*”

Elizabeth Danka
Molecular Cell Biology, Hunstad Lab
Undergraduate Institution: University of Richmond
Baton Rouge, Louisiana
Situated at the confluence of two great North American rivers — the Mississippi and the Missouri — the St. Louis region has been a favored destination since Lewis and Clark began their historic westward “Corps of Discovery” here in 1804.

Today, the pioneers of St. Louis are the engineers, scientists, business leaders, educators, artists and other innovative and creative professionals who are working at the forefront of a multitude of fields and endeavors. Thanks in large part to Washington University, other regional universities and key Fortune 500 corporations, St. Louis has developed into a national hub for important research and business development, especially in the fields of biotechnology and plant science.

St. Louis’ affordability and friendly character make it an attractive location for graduate students, including those with families. Students find that their stipends go much farther in St. Louis than they would in other metro areas. Many students even buy houses during their stay. The city is large enough to offer quality cultural opportunities, but small enough to be livable.

The Washington University campuses are located in the cosmopolitan neighborhoods of the Central West End, University City and Clayton. Student lifestyles are accommodated by affordable apartments near bookstores, coffee houses and sidewalk cafes. Students also enjoy the amenities of Forest Park, located adjacent to the university.

The Saint Louis Symphony Orchestra is among the country’s best, and several outstanding theater companies practice their art here. The Fox Theatre presents Broadway shows, dance performances and concerts. Blues, jazz and rock bands are hot attractions in local clubs, and a large outdoor venue draws major concerts. Sports fans enjoy the St. Louis Cardinals, St. Louis Blues and St. Louis Rams.

St. Louis’ central location makes exploring nearby cities easy and inexpensive. Outdoor activities can be found within and around the metropolitan area; bike trails line both the Mississippi and Missouri rivers, and the Ozark mountains and river valleys are perfect for backpacking, camping, fishing, canoeing and spelunking in some of Missouri’s more than 6,000 caves.

www.explorestlouis.com
Approximately 80 PhD students matriculate into the Division of Biology and Biomedical Sciences each year. If an application is reviewed favorably, the applicant is invited to visit St. Louis for an interview. The Division pays most travel expenses up front. The interview is an excellent opportunity for the applicant to meet faculty members and current students, see Washington University and experience St. Louis.

dbbs.wustl.edu/prospective/students/PhDAdmissions

**Benefits**

- Health, life and disability coverage are provided.
- Students in the Division enjoy access to all of Washington University’s educational, entertainment and recreational resources.
- The university’s UPass provides all students with free use of MetroLink light rail and Metro buses. MetroLink connects students to all Washington University campuses, downtown, Forest Park, Clayton and Lambert-St. Louis International Airport.

**Stipends and Support**

The Division ensures full funding for all students making satisfactory progress. Washington University has made an uncommon commitment to the Division to provide long-term, stable funding of its doctoral programs. This support, along with that provided by private foundations including the Olin Foundation, the Markey Trust, the Macy Foundation and the Edward Mallinckrodt Jr. Foundation, is supplemented by training grants from the National Institutes of Health (NIH) and the National Science Foundation (NSF).

- Each student accepted into the Division is guaranteed a generous stipend, provided all academic standards are upheld.
- Tuition is provided for all full-time students in the Division for the duration of training, provided all academic standards are upheld.
- Many students hold national fellowship awards, such as those offered by the NSF.

**Admissions Process**

Applications are available online September 1 at dbbs.wustl.edu.

- Review of applications begins November 15, and early application is encouraged.
- Application deadline: 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:
  1. A baccalaureate degree in the natural, mathematical, physical or engineering sciences.
  2. Courses in:
     - calculus,
     - general and organic chemistry,
     - physics,
     - a core sequence of basic courses in biology.
  3. A strong background in quantitative sciences.
  4. Test scores:
     - The general GRE test is required; 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.

- **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 the port of entry in the United States to St. Louis.
what will YOU discover?

a diverse student body
the freedom to explore the disciplines you love
a world-class research enterprise
outstanding mentorship
a friendly, welcoming atmosphere
a fun and affordable city
generous financial support