PhD Programs in Engineering
Engineer your way. Engineer at WashU.

WashU is a top university and world leader in research and education. Here, you will have the opportunity to make an impact and contribute toward solving national and international challenges through our interdisciplinary programs working alongside renowned faculty and collaborating with peers. And you will be prepared to be a leader in your field whether you work in academia, industry or a national lab.

The School of Engineering & Applied Science is ranked among U.S. News & World Report’s top engineering schools, with 88 tenured and tenure-track professors, 40 additional full-time faculty, 1,300 undergraduate students, 844 master’s students, 364 PhD students and more than 20,000 alumni.

Together, faculty and students inspire and motivate each other as an inclusive community of leading scholars to collaborate across disciplines and across the world to develop innovative solutions for the most urgent challenges facing the world, from sustainable energy, to a cleaner environment, to next-generation information technology, improved health care and more.

ENGINEERING GRAND CHALLENGES

With help from experts around the world, the National Academy of Engineering identified “Grand Challenges for Engineering” in the 21st century. From access to clean water and renewable energy sources to better medicine and a safer internet, we highlight a few of those challenges and ways WashU addresses them.

engineeringchallenges.org
PhD program options

Biomedical Engineering
» PhD in Biomedical Engineering
» Combined MD/PhD (jointly with the School of Medicine)

Computer Science & Engineering
» PhD in Computer Science
» PhD in Computer Engineering

Electrical & Systems Engineering
» PhD or DSc in Electrical Engineering
» PhD or DSc in Systems Science & Mathematics

Energy, Environmental & Chemical Engineering
» PhD in Energy, Environmental & Chemical Engineering

Mechanical Engineering & Materials Science
» PhD in Materials Science & Engineering
» PhD in Mechanical Engineering
» PhD in Aerospace Engineering

ABOUT WASHINGTON UNIVERSITY

#9 funding from the NIH — over $377 million in 2015
1,800 doctoral students across the university
65+ countries are represented by PhD students
#1 MD/PhD ranking in U.S. News & World Report
Research with renowned faculty

Our award-winning faculty members are leading innovative discoveries through research in the areas of medicine and health, energy and the environment, big data and security. As you begin working with faculty, you will be directly involved in conducting research and finding new solutions to the world’s greatest challenges.

Research projects at WashU Engineering:

» Discover drugs to treat deadly heart conditions
» Develop efficient algorithms to process large-scale astronomical datasets
» Create device to allow sensations in prosthetic hands
» Providing insight into brain response to stimuli and senses
» Finding less expensive ways to convert carbon dioxide into useful fuels and materials
» Researching elbow stiffness after injury
» Creating gasoline from E. coli
» Using big data to find genetic clues in complex human diseases
» Creating 3-D indoor maps of popular locations around the world
» Developing new sensor to detect tiny individual nanoparticles

engineering.wustl.edu/faculty
World-class partnerships that matter

You will have unique opportunities through our education, research and engagement opportunities that are offered through collaboration with schools and programs across the university. Nearly 60 of the university’s graduate and undergraduate programs hold a top 25 ranking by U.S. News & World Report, including The Brown School, ranked No. 1, and the School of Medicine, ranked No. 6.

Research and university partnerships allow students to reach beyond borders and disciplines to make changes impacting health, energy, environment and climate change, security, hunger, inequality and poverty; and with WashU students from around the globe and faculty who conduct research that touches every corner of the world, WashU engineers understand how you can be a local person but have a global impact.

School of Medicine
WashU’s School of Medicine has been committed to its mission of advancing human health through outstanding clinical care, innovative research and the education of tomorrow’s leaders.

The Brown School
It is recognized for pioneering the development and use of evidence-based approaches in research and in practice, for its interdisciplinary focus, and for its international emphasis.

Olin Business School
Olin is home to a renowned four-year undergraduate business program, one of the top MBA programs in the nation and leading executive education programs.

Institute for Public Health
Improving community and global health through the creation of new knowledge, the application and translation of science, and the training of advanced academic and practice leaders in public health.

Institute of Materials Science & Engineering
Integrating and leveraging the full potential of interdisciplinary materials research by bringing together researchers from engineering, physics, chemistry, and earth and planetary sciences.

McDonnell Academy Global Energy and Environment Partnership
A consortium of 28 universities and corporate partners working together in energy, environmental and sustainability research, education and operations.
Conduct work in state-of-the-art facilities

Realizing the need for new research laboratories and specialized facilities that would support the school’s intellectual vision and plans, Chancellor Mark Wrighton committed the site at the northeast corner of WashU’s Danforth Campus for the School of Engineering & Applied Science.

The university has invested more than $150 million with another $50 million planned in our facilities since 2001 and continues to develop a new, state-of-the-art engineering complex.

With about half of the new engineering complex complete, the school plans to build another 350,000 square feet of space distributed through two or three new buildings. Set to house the Department of Mechanical Engineering & Materials Science (MEMS), the Henry A. and Elvira H. Jubel Hall will offer infrastructure and research facilities that are key to fostering the interdisciplinary nature of engineering.

engineering.wustl.edu/facilities

RESEARCH CENTERS & INITIATIVES

- Cardiac Bioelectricity & Arrhythmia Center (CBAC)
- Center for Biological Systems Engineering (CBSE)
- Center for Biomedical Informatics
- Consortium for Clean Coal Utilization (CCCU)
- Center of Regenerative Medicine
- Center for Sensor Signal & Information Processing
- Institute of Materials Science & Engineering (IMSE)
- International Center for Advanced Renewable Energy & Sustainability (I-CARES)
- The Nano Research Facility (NRF)
- McDonnell Academy Global Energy & Environment Partnership (MAGEEP)
- Photosynthetic Antenna Research Center (PARC)
- U.S.-India Joint Clean Energy Research & Development Center
Biomedical Engineering

The Department of Biomedical Engineering (BME) is committed to educating and training the next generation of biomedical engineers to integrate the analytical, modeling and systems approaches of engineering to the complex, and sometimes overwhelming, descriptive details of biology. You will be uniquely positioned to address new and exciting opportunities.

In BME, you will focus on five overlapping research programs that represent frontier areas of biomedical engineering and leverage the existing strengths of our current faculty and resources. These areas provide exciting training opportunities for students with a variety of backgrounds and interests.

112
PHD students

RESEARCH AREAS
» Biomaterials & tissue engineering
» Cardiovascular engineering
» Imaging technologies
» Molecular, cellular & systems engineering
» Neural engineering

Gabriella Espinosa

HOMETOWN New York, New York
RESEARCH How changing fluid mechanics alters the structure of the developing aorta to uncover potential causes of congenital heart defects
FACULTY MENTORS Professor Larry Taber and Professor Jessica Wagenseil

"I chose WashU because of its strong biomedical engineering and mechanical engineering departments alongside an excellent medical center. It was the ideal place to study biomechanics."

WASHU IS MEETING THE CHALLENGE
Shelly Sakiyama-Elbert, PhD, professor of biomedical engineering, is using novel methods to take a closer look at how nerve cells grow and make new connections to reroute signals between the brain and the body that could restore function and movement in people with debilitating spinal cord injuries.

engineeringschallenges.org
Computer Science & Engineering

Students in the Department of Computer Science & Engineering’s PhD program perform groundbreaking research while exploring creative endeavors, including entrepreneurial activities. The program’s structure encourages students to become creative thinkers and independent researchers in a collaborative environment.

Students have helped expand the Named Data Networking Project (NDN), develop surveillance technology to reduce redundant drone footage and engineer streaming systems for graphics hardware. They have moved on to successful careers in academia, industry and entrepreneurial undertakings.

cse.wustl.edu

65
PhD students

RESEARCH AREAS

» Computational systems biology
» Computer engineering
» Cyber-physical systems & sensing
» Graphics & vision
» Human-computer interaction
» Machine learning & artificial intelligence
» Networked systems
» Parallel computing technology
» Theoretical computer science

Adam Drescher
HOMETOWN Collierville, Tennessee
RESEARCH Networking: measuring the performance of Linux software routers in a variety of contexts
FACULTY MENTOR Professor Patrick Crowley

“The Computer Science department has a unique mix of qualities. Work is demanding, but at the same time, the environment is friendly and relaxed. The professors are very approachable and sincerely want you to succeed.”

Caitlin Kelleher, PhD, has centered her work on the design, development and evaluation of a programming system for middle school girls titled “Storytelling Alice.” This program includes high-level animations to enable users to program social interactions.

engineeringchallenges.org

WASHU IS MEETING THE CHALLENGE

Grand Challenge: Advance personalized learning
Lan Yang, PhD, professor of electrical engineering, has demonstrated the first on-chip micro-resonator-based particle sensors that can achieve not only detection but also size measurement of single nanoparticles one by one. Professor Yang recently received a Presidential Early Career Award for Scientists and Engineers — the highest honor bestowed by the U.S. government on science and engineering professionals in the early stages of their careers.

Electrical & Systems Engineering

The Department of Electrical & Systems Engineering (ESE) has a unique and long tradition of excellence in advancing basic science and solving engineering problems relevant to society. The department is dedicated to providing high-quality education and research in a variety of topics and focus areas, including applied physics and devices, signal analysis and imaging, and systems science and applied mathematics.

Our doctoral programs balance fundamental theoretical concepts with modern applications, allowing students to find ample opportunities for close interactions with faculty members working on cutting-edge research and technology development.

WASHU IS MEETING THE CHALLENGE

Lan Yang, PhD, professor of electrical engineering, has demonstrated the first on-chip micro-resonator-based particle sensors that can achieve not only detection but also size measurement of single nanoparticles one by one. Professor Yang recently received a Presidential Early Career Award for Scientists and Engineers — the highest honor bestowed by the U.S. government on science and engineering professionals in the early stages of their careers.

50

PhD students

RESEARCH AREAS

» Applied physics and devices
» Signal analysis and imaging
» Systems science and applied mathematics

GRAND CHALLENGE:

Engineer the tools of scientific discovery

Linda Wang

HOMETOWN: Beijing, China

RESEARCH: Optimal control problems in various backgrounds, such as cancer chemotherapy and physics

FACULTY MENTORS:

Professors Jr-Shin Li and Heinz Schaettler

“I picked WashU not only because of the wonderful academic atmosphere and faculty members, but the activities and interactions with students and the community. I joined CSSA the moment I settled down in St. Louis.”

ese.wustl.edu
Energy, Environmental & Chemical Engineering

The Department of Energy, Environmental & Chemical Engineering’s PhD program promotes cutting-edge multidisciplinary research and education in the thematic areas of energy, environmental & chemical engineering.

The department builds upon a long, established tradition of excellence and cooperation among many different facets of the university to bring a truly interdisciplinary approach to advancing basic science. Our work is focused on contributing to solutions for the energy and environmental challenges around the world.

ece.wustl.edu

85 PhD students

RESEARCH AREAS
- Aerosol science & engineering
- Aquatic processes
- Metabolic engineering & systems biology
- Multiscale engineering

Adewale Adeosun

HOMETOWN Eruwa, Nigeria
RESEARCH Combustion numerical and experimental study of pressurized oxy-combustion processes for clean coal utilization
FACULTY MENTOR Professor Richard Axelbaum

“The fact that WashU is the first university in the world to create a highly specialized and interdisciplinary Department of Energy, Environmental & Chemical Engineering speaks volumes about the university’s strategic plan for the future of our world.”

WASHU IS MEETING THE CHALLENGE
Daniel Giammar, PhD, professor of energy, environmental & chemical engineering, investigates the removal of arsenic and chromium from drinking water, control of the corrosion of lead pipes, geologic carbon sequestration and biogeochemical processes for remediation of uranium-contaminated sites. He currently teaches courses on environmental engineering and water quality.

engineeringchallenges.org

GRAND CHALLENGE: Provide access to clean water
Mechanical Engineering & Materials Science

The Department of Mechanical Engineering & Materials Science PhD programs provide opportunities for advanced study and research in biomechanics, energy conversion and efficiency, advanced materials, nanotechnology and computational mechanics.

Faculty and students collaborate on interdisciplinary projects with partners in Biomedical Engineering, Energy, Environmental & Chemical Engineering, Chemistry, Physics, Biology and the School of Medicine.

35 PhD students

RESEARCH AREAS

- Biomechanics and biotechnology
- Advanced materials
- Energy and sustainability
- Aerospace systems

Washu is meeting the challenge

Philip Bayly, PhD, professor and chair of mechanical engineering & materials science, develops imaging methods to study biomechanics from cell motility to traumatic brain injury. He uses magnetic resonance imaging (MRI) to investigate the mechanics of brain injury and brain development.

engineeringchallenges.org

Ramin Modarres

HOMETOWN Tabriz, Iran
RESEARCH Optimization of the efficiency of propellers, wind turbines and helicopters
FACULTY MENTORS Professors David Peters

"I chose WashU because of its renowned facilities and faculty. Furthermore, I wanted to work with Professor David Peters, since he is one of the leading minds in the field of vertical flight aerodynamics."

mems.wustl.edu
IDEA Labs is a student-run biotechnology incubator that provides resources, training, and mentorship to teams of students tackling clinical problems by developing innovative solutions. These resources include assistance with business plans, market assessments, prototypes, and patents, which prepare teams to form startups that commercialize their technology.

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select faculty, student & alumni companies:
- 4Design Biosciences
- 825 Basics
- AI Entertainment Service
- Aphiaris
- Answers
- Appistry
- Applied Particle Technology
- CloudCulad
- Datotel
- Ettus Research
- Exergy
- Gateway EDI
- Geokinify
- Global Velocity
- Kwame Building Group
- Mobilante
- Observable Networks
- OsatoVantage
- Red Lion Beef Corporation, Lion’s Choice
- Retectix
- Saikify
- Salesforce.com
- Sanergy
- Savioke
- See3 LLC
- Sparo Labs
- Square Inc.
- Tenjpy
- The Spinning Cook
- Third Rock Ventures
- trueEX
- Venturck Capital Ventures
- WhosHere
- Willow Garage
- Yerdle
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A total of 14 core facilities provide startup and growing companies at CIC@CET with access to equipment and expertise that are critically important to scaling high-growth bioscience ventures.

The largest and oldest innovation center in the State of Missouri, CET is nationally recognized for providing the infrastructure and resources needed for early-stage, high-growth companies in the fields of information technology, bioscience and consumer/manufactured products to innovate and thrive.

**Cortex**

The Cortex Innovation Community (Cortex) announced a unique partnership providing access to “core” research facilities located at Saint Louis University and Washington University in St. Louis for companies residing in The Center for Emerging Technologies (CET), which is now managed by the Cambridge Innovation Center (CIC@CET).

```cortexstl.com```
Living in St. Louis

Centrally located, the WashU campus offers myriad opportunities for enrichment and exploration. St. Louis has also developed into a national hub for important research and business development, especially in the fields of biotechnology and plant science.

Consistently ranked among the nation’s most affordable and best places to live and raise families, the St. Louis region offers many opportunities to watch or participate in a wide range of sports, recreational activities and cultural events.

Adjacent to campus is Forest Park, one of the largest urban parks in the nation at approximately 1,400 acres. In addition to space for tennis, golf, baseball, skating, jogging, rollerblading, bicycling, boating and more, Forest Park includes several of St. Louis’ cultural institutions, including the zoo, science center, art museum, history museum (all with free admission) and the nation’s largest and oldest outdoor theater — The Muny.

Make St. Louis your home

**Neighborhoods**
- Central West End
- Clayton
- Forest Park
- University City (The Loop)

12M
visitors go to Forest Park each year

#7
most affordable city in the U.S. according to Forbes

#1
city for fastest-growing startup scene according to Business Insider
Professional development & careers

Washington University is committed to helping you make the transition into the next phase of your career, whether that means an academic or non-academic position. Searching for employment that is appropriate for your advanced degree requires strategy, thorough research, preparation and practice, and translation of your research experience to your current pursuits.

Survey of postgraduate plans for engineering PhD alumni upon graduation (2013-2015)

49% signed contract or made commitment for a postdoc
16% negotiating with one or more specific organizations

Employer types (survey of postgraduate plans)

<table>
<thead>
<tr>
<th>Employer Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private sector</td>
<td>52%</td>
</tr>
<tr>
<td>Education</td>
<td>34%</td>
</tr>
<tr>
<td>Other</td>
<td>11%</td>
</tr>
<tr>
<td>Government</td>
<td>3%</td>
</tr>
</tbody>
</table>

Graduate community

Graduate student organizations (select)

» Association of Graduate Engineering Students (AGES)
» BioEntrepreneurship Core
» Black Graduate Council
» Chinese Students and Scholars Association
» Graduate Professional Council
» Graduate Student Senate
» International graduate student association for career development and networking

» Korean Graduate Student Association
» Latino Graduate Student Alliance
» OUTgrads
» ProSPER (Students Promoting Science Policy, Education and Research)
» Taiwanese Graduate Student Association
» Indian Graduate Student Association
» WUVETS (Student Veterans Association)

150+ graduate student groups university wide

Career Center

Through individual advising, workshops, and events, the Career Center assists PhD students and postdoctoral appointees with career planning, decision making and job seeking.
careercenter.wustl.edu

Teaching Center

The Teaching Center provides formalized, multi-disciplinary training in pedagogy for graduate students and postdoctoral appointees—in their current work as Teaching Assistants (TAs) or instructors, and as they prepare for future academic positions.
teachingcenter.wustl.edu

Engineering Communication Center

The Engineering Communication Center offers one-on-one assistance to graduate students on the following:
» Journal articles
» Peer reviews and responses
» Proposals
» Theses
» Dissertations
» Resumes and cover letters
» Personal statements
» Oral presentations
» Conference posters
» Invention disclosures
» Grant and scholarship applications
» Research and teaching statements
Evan Scott, PhD
Assistant Professor of Biomedical Engineering, Northwestern University
Evan Scott is a recipient of the 2015 NIH Director’s New Innovator Award, the 2015 National Science Foundation CAREER award and the 2014 American Heart Association Scientist Development Grant. His laboratory investigates the basic inflammatory and immunological processes contributing to diverse pathologies with the goal of developing targeted therapeutic approaches using engineering- and materials-based strategies. They are currently focusing on novel vaccine delivery systems, immunotherapies, and approaches to the treatment and basic understanding of cancer.

Christopher Hogan, PhD
Benjamin Mayhugh Associate Professor, McKnight Land-Grant Professor, and Director of Graduate Studies, University of Minnesota
Christopher Hogan’s research focuses on the design of new instrumentation to produce molecular ions from aerosol nanoparticles and clusters, particle-particle and particle-surface interactions in the gas-phase, high temperature gas-phase synthesis of agglomerated, fractal-like nanoparticles, and the dispersion of fractal agglomerates in liquid suspensions for the preparation of enhanced thermal conductivity nanofluids.

Jessica Ray, PhD
2015 Miller Fellow, Civil and Environmental Engineering, University of California, Berkeley
Jessica Ray’s current research is designing engineered geosolids to treat urban stormwater. In water-stressed areas such as California, harvesting stormwater may become necessary to augment the water table and increase drinking-water supplies. However, due to the large number of impervious surfaces (i.e., buildings, pavement, etc.) in urban areas, there are elevated levels of contaminants in urban stormwater. Therefore, before harvested stormwater can be used, it must be treated to remove harmful compounds. Her research investigates new benign, low-cost materials to add functionality to natural water purification media such as sand and activated carbon.

Matthew MacEwan, MD, PhD
Founder, President of Acura Surgical Inc.
Matthew MacEwan is responsible for research and product development, preclinical/clinical testing, regulatory compliance and clinical/medical affairs at Acura Surgical Inc. Matthew received his PhD in biomedical engineering and MD from the School of Medicine at WashU. He has received multiple awards for his scientific, and entrepreneurial work in the life-science community.

Richard Souvenir, PhD
Associate Professor, College of Computing and Informatics, University of North Carolina at Charlotte
Richard Souvenir’s research involves the application of machine learning techniques to computer vision problems. Specifically, he focuses on medical learning (i.e., applies to images and videos), biomedical image analysis and human activity understanding.

Limei Tian, PhD
Beckman Institute Postdoctoral Fellow, University of Illinois at Urbana-Champaign
Limei Tian completed her PhD from the Department of Mechanical Engineering & Materials Science where she worked with Professor Srikanth Singamaneni on the design, synthesis and hierarchical assembly of plasmonic nanostructures and their applications in chemical/biological sensing, biomanufacturing and nanoanalytics. Her current research is on the design and fabrication of flexible electronic and optoelectronic devices for biomedical applications.

Katherine A. Rink, DSc
Assistant Head of the Air and Missile Defense Technology Division at MIT Lincoln Laboratory
Katherine A. Rink leads research and prototyping in new sensors, technologies and systems at MIT Lincoln Laboratory. In March 2012, she was promoted to the Group Leader of the Advanced Concepts and Technologies Group, developing and integrating advanced air and missile defense capabilities across the Department of Defense and the Armed Services.

Melissa L. Holtmeyer, PhD
AAAS Science and Technology Policy Fellow, U.S. Department of Defense
Using her engineering background, Melissa Holtmeyer advised senators and congressional staffers on energy, environment and climate change legislation. At the DOD, she is helping to develop plans to reduce military fuel use, ensure secure fuel supplies for global operations and provide technical expertise on next-generation ODD technologies to military leaders.

Christine Julien, DSc
Associate Professor, Electrical and Computer Engineering, University of Texas at Austin
Christine Julien’s research focuses on the intersection of software engineering and dynamic, unpredictable networked environments. Her specific focus is on the development of models, abstractions, tools and middleware the goals of which are to ease the software engineering burden associated with building applications for pervasive and mobile computing environments. Her work has been recognized by an NSF CAREER award and an AFOSR Young Investigator Award.
Apply to WashU

The deadline for PhD applicants to submit their applications is January 15. PhD programs have fall semester entry only.

Departments will review all applicants in a timely manner and all admission decisions will be posted by March 15 of each year. An admitted applicant will have only until April 15 to accept the offer.

Financial Support

All full-time PhD applications are reviewed for full financial support.

**Chancellor’s Graduate Fellowship (for engineering PhD diversity applicants)**
The Chancellor’s Graduate Fellowship Program was established in 1991 for the purpose of providing academic and generous financial support to outstanding, diverse students interested in careers as college or university professors.

**InSITE Fellowship**
The InSITE Fellowship is a prestigious fellowship available to graduate students who demonstrate a passion and drive for innovation, entrepreneurship and/or venture capital. A nationally-recognized fellowship, this is an opportunity for grad students to work with local entrepreneurs and venture capitalists on consulting projects.

skandalaris.wustl.edu/training/insite-fellowship

**McDonnell International Scholars Academy (for admitted doctoral students)**
To be eligible to apply to the McDonnell Academy, an individual must be a graduate of one of WashU’s university partners and must also apply to one of a select group of full-time doctoral or master’s degree programs.

mcdonnell.wustl.edu

**Olin Fellowship (for women engineering PhD students)**
The Mr. and Mrs. Spencer T. Olin Fellowships for Women in Graduate Study are co-sponsored by the Monticello Foundation and by Washington University. The Foundation continues the mission of Monticello College, the second-oldest women’s college in the US, to “promote female education.”

Contact WashU Engineering Graduate Admissions

Phone: (314) 935-4446
Fax: (314) 935-5449
Email: engineeringgradadmissions@wustl.edu

Nondiscrimination Policy
Washington University encourages and gives full consideration to all applicants for admission, financial aid and employment. The University does not discriminate in access to, or treatment or employment in, its programs and activities on the basis of race, color, age, religion, sex, sexual orientation, gender identity or expression, national origin, veteran status, disability, or genetic information. Applicants with a prior criminal history will not be automatically disqualified from consideration for admission. Inquiries about compliance should be addressed to the University’s Vice Chancellor for Human Resources, Washington University, Campus Box 1154, One Brookings Drive, St. Louis, MO 63130.