

VANDERBILT

School of Engineering



Our curriculum allows you to examine various engineering majors from multiple perspectives before you declare a specific major. As an engineering student, you will explore engineering fundamentals and the responsible use of technology.

All of our students study in state-of-the-art classrooms and laboratories, and you may choose to conduct original research by working with outstanding faculty members. Professors and students collaborate on projects that span the spectrum of engineering from robotics and computer animation to biomedical optics and environmental engineering.

Our engineering graduates are valued for their expertise, intellectual independence, communication skills, and leadership ability. Professional demand for graduates with this background is intense. Graduates are actively recruited, not only for engineering careers, but also for careers as diverse as consulting, medicine, law, and finance.

Vanderbilt's School of Engineering offers the depth and breadth of education required to solve real-world problems. Understanding how to solve these problems will give you an edge in any endeavor.

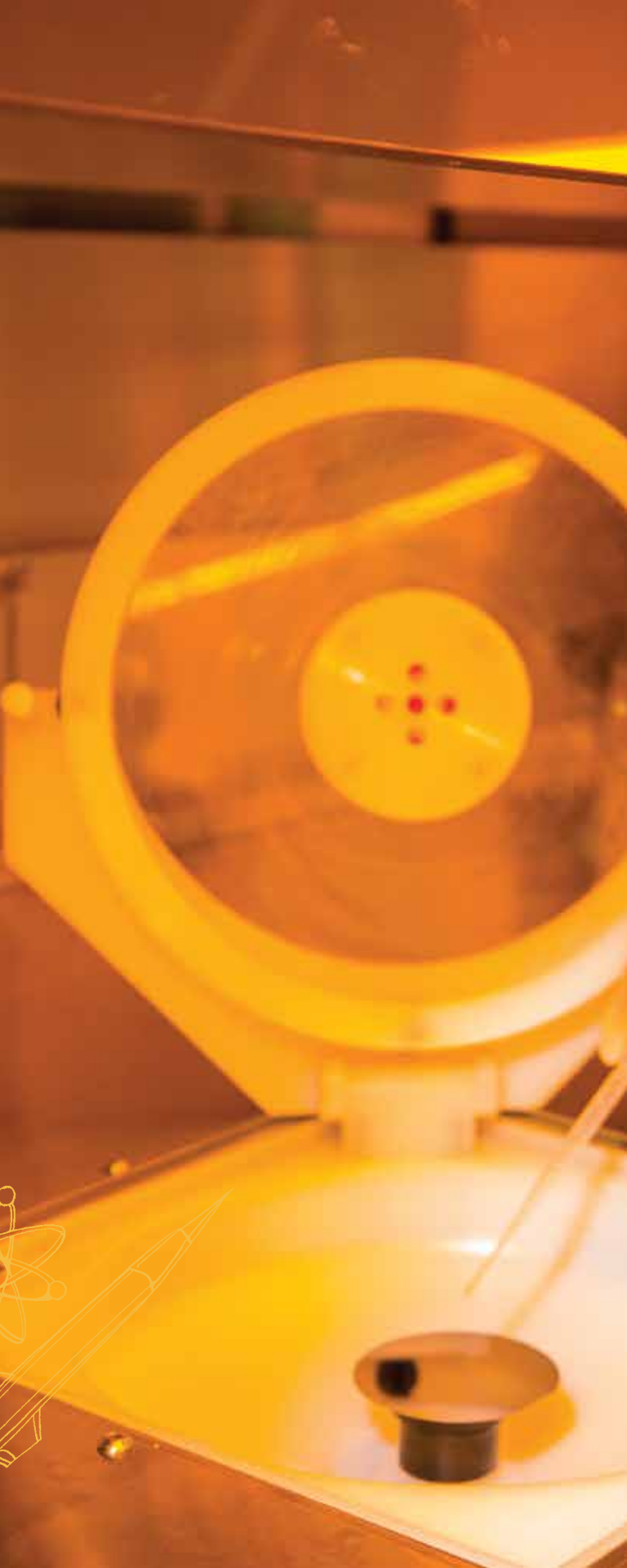
ACADEMIC DEPARTMENTS

- Biomedical Engineering
- Chemical and Biomolecular Engineering
- Civil and Environmental Engineering
- Electrical Engineering and Computer Science
- General Engineering
- Mechanical Engineering

All programs leading to the bachelor of engineering at Vanderbilt are accredited by the Engineering Accreditation Commission of ABET, *abet.org*. The bachelor of science in computer science is accredited by the Computing Accreditation Commission of ABET. Vanderbilt also encourages students to take the Fundamentals of Engineering examinations, coordinated by the Tennessee State Board of Architecture and Engineering Examiners. Vanderbilt University is accredited by the Southern Association of Colleges and Schools Commission on Colleges and is a member of the Association of American Universities.

Cover: New in 2016, the 230,000-square-foot Engineering and Science Building is specifically designed to foster teamwork and includes an Innovation Pavilion that connects students and faculty with industry mentors.

Right: Inside the Vanderbilt Institute of Nanoscale Science and Engineering's commercial-grade cleanroom, used by faculty, researchers, and students in engineering, chemistry, and physics.





INSIGHT, INNOVATION, IMPACT.®

Vanderbilt appeals to engineering students who want to put their careers and lives into a rich context. You will learn creative thinking and problem solving skills that will be valuable throughout your life.



The School of Engineering offers the bachelor of engineering in biomedical, chemical, civil, computer, electrical, and mechanical engineering and the bachelor of science in computer science and engineering science. The school also confers master of engineering, master of science, and doctoral degrees.

All full-time faculty members hold doctorates and teach undergraduate students. Our research centers and labs investigate topics from nanoscale materials, technology-guided surgery, and robotics to environmental management, intracellular engineering, and systems resilience.

Many engineering students choose double majors, minors, or concentrations in complementary disciplines. In addition to training in engineering science, mathematics, physics, and chemistry, you will take liberal arts courses in the College of Arts and Science. You may also choose selected courses from Vanderbilt's other undergraduate or graduate schools or round out your academic experience with an honors program, internship, engineering-based study abroad, or accelerated degree program.



Students launch a NASA weather balloon ahead of the 2018 solar eclipse.

94%
OF SENIORS
GRADUATING FROM VANDERBILT ARE
SATISFIED WITH THE
QUALITY OF INSTRUCTION



Professor Joshua Caldwell, second from left, works with student researchers in his lab, where he explores nano-optics, nanophotonics, infrared optics and imaging, and other related areas.

Our multimillion-dollar engineering complex combines advanced technologies in a student-centered environment. Featheringill Hall features a three-story atrium for student interactions and contains more than fifty teaching and research laboratories brimming with the latest equipment. The design studio, model shop, and project room showcase student ideas from concept to prototype to final product.


Extending the application of our student-centered physical spaces, a new seven-story Engineering and Science Building opened in 2016. This newest addition to the engineering complex is designed to foster project teamwork and offer programs, instrumentation areas, makerspaces, and core research space that will promote interdisciplinary work and allow for even greater collaboration between students and faculty across disciplines.



ONE-ON-ONE WITH

Hiba Baroud, Ph.D.

As a math whiz growing up near Beirut, Lebanon, Professor Hiba Baroud thought she'd be an actuary, working for an insurance company or corporation. Instead, she found a way to combine her risk analysis and statistics skills, her love of teaching, and her passion for helping people in need.



“Vanderbilt offers a nurturing environment and is a great place to advance a career. I have been fortunate to work with amazing colleagues and students in the department as well as across the School of Engineering and the university.”

Hiba Baroud

Assistant Professor of Civil and
Environmental Engineering

In addition to advising undergraduate research interns, Baroud is leading a project funded by the National Science Foundation that looks beyond historical weather patterns and infrastructure reliability to better measure and analyze risk and resilience. The team is focused on using Bayesian statistical modeling to predict outcomes in extreme weather events and models of how communities can best recover from them.

In a world with more frequent extreme weather events, basing new bridges on historical weather data and previous structure wear no longer works. Bayesian modeling is based on more than what happened when, for example, three successive hurricanes hit Florida. It factors in expertise from emergency officials, climate change data, information about materials used in infrastructure, and potentially a hundred other data points.

“Bayesian modeling gives you a probability distribution—a number of possible events and outcomes,” Baroud said. “It allows you to incorporate the stakeholders in the decision-making process. If someone is risk averse, they want to build the most robust bridge that will withstand any potential hazard. They will go with a parameter that is looking at more extreme cases. Others may be geared toward more profit, so they would be risk-taking, valuing a more cost-effective solution.”

Professor Baroud also is collaborating on an NSF project to study the trade-off of allocating water between hydroelectric power generation and crop irrigation to minimize unemployment and maximize food production. She has become part of several new programs at the Vanderbilt Center for Transportation and Operational Resiliency, including a winning proposal in the National Disaster Resilience Competition to study river supply chain dynamics in extreme weather events, with the support of the U.S. Department of Housing and Urban Development. In addition, she is on teams for two Vanderbilt University 2016 research awards—the Vanderbilt Initiative on Smart Cities Operations Research and the Vanderbilt Initiative for Intelligent Resilient Infrastructure Systems.

While her accomplishments continue to grow in numbers, Baroud is quick to share the credit. “Vanderbilt offers a nurturing environment and is a great place to advance a career. I have been fortunate to work with amazing colleagues and students in the department as well as across the School of Engineering and the university.”



Engineering Programs

In addition to foundations in math, chemistry, physics, and the liberal arts, our eight academic majors provide depth of study in a wide variety of traditional engineering disciplines and some that can be customized based on individual interests. Minors, as well as electives, should be selected carefully to fulfill a specific purpose and in consultation with your academic adviser.

Biomedical Engineering

Bachelor of Engineering

Biomedical engineering applies engineering concepts to specific and practical problems in biology, medicine, and health care. It attempts to quantify biological events for the purpose of creating and improving upon diagnostic practices and treatment protocols. The main areas of study in our biomedical engineering program include biophotonics, biomaterials, medical imaging, gene therapy, and technology-guided surgical devices.

Chemical Engineering

Bachelor of Engineering

Chemical and biomolecular engineering play a key role in the development and production of pharmaceuticals and bioengineered materials for medical applications. Chemical engineers are also concerned with process control techniques and production in the development of high-strength composites and specialty polymers, semiconductors and microelectronic devices, and a variety of other products.

Civil Engineering

Bachelor of Engineering

Civil and environmental engineering prepares professionals to repair our nation's decaying infrastructure with the use of engineered materials for stronger, lighter, and more reliable buildings, bridges, and transportation systems. Civil and environmental engineers address problems with land use, sustainability, risk management, increasing population, nuclear waste management, environmental quality, construction management, and systems reliability and resilience.

Computer Engineering

Bachelor of Engineering

Computer engineering acts at the interface of software and hardware and deals with problems related to the organization, design, and application of digital processing systems as general purpose computers or as components of information processing, control, and communications. Computer engineering allows students to specialize in embedded systems, computing systems and networks, or intelligent systems and robotics.

Computer Science

Bachelor of Science

Computer science blends scientific and engineering principles, theoretical analysis, and computing experience. Program emphasis is on computing activities of both practical and intellectual interest and on theoretical studies of efficient algorithms and the limits of computation. Students may major or minor in computer science.



Computer science major Christian Motyczka helped develop a virtual reality program to help addicts stay clean.

Electrical Engineering

Bachelor of Engineering

Electrical engineering focuses on hardware involved in electrical and electronic systems and how electrical components interact with each other. Students study mathematics, physics, and computer science and develop a foundation in circuit analysis and electronics. Students choose an area of further study in computer engineering, microelectronics, signal and image processing, robotics, or networking and communications.

Engineering Science

Bachelor of Science

Engineering science combines engineering fundamentals with specialized knowledge from a student-designed concentration of courses that assist with achieving specific career goals. This interdisciplinary degree program is designed under close advising by faculty members and can include specialties as diverse as engineering mathematics, environmental engineering, teaching, technical communications, and entrepreneurship, among many others.

Mechanical Engineering

Bachelor of Engineering

Mechanical engineering prepares students to become practicing engineers who design systems to control engineered products and solve problems through manufacturing processes, energy management, and hardware design. Strengths of the department include robotics, intelligent mechatronics, combustion and propulsion, nanostructures, fluid physics, and laser diagnostics of combustion and space experimentation.

31% FEMALE

ENGINEERING UNDERGRADUATES
(vs. national average of 19%)



Computer science minor Sami Chiang co-founded Code Ignite at Vanderbilt, which provided free programs in animation, game design, coding, and software design to middle and high school students in the Nashville area.

Minors

Minors in computer science, scientific computing, environmental engineering, energy and environmental systems, and nanoscience and nanotechnology may be combined with engineering majors, as can minors offered by the other three undergraduate schools, including the new business minor.

Engineering Management Minor

This interdisciplinary program links engineering, science, and management. Students study entrepreneurship, management of high-tech enterprises, engineering economics, technology strategy, business psychology, finance, communications, and supply chain management.

Materials Science and Engineering Minor

High-performance materials are in demand throughout the engineering world, and there is equal demand for specialists who understand the relationship between properties and structure, the thermodynamics of materials, and the physics and chemistry of solids and liquids. In specialized laboratories, you'll test the properties of materials and consider new applications of derived information.



Civil engineering professor Doug Adams introduces undergraduate students to the Laboratory for Systems Integrity and Reliability, Vanderbilt's proving ground for new technologies for the energy, security, and manufacturing sectors.



60%

UNDERGRADUATES INVOLVED IN
ENGINEERING RESEARCH EXPERIENCES
SUPERVISED BY PROFESSORS

Engineering Research

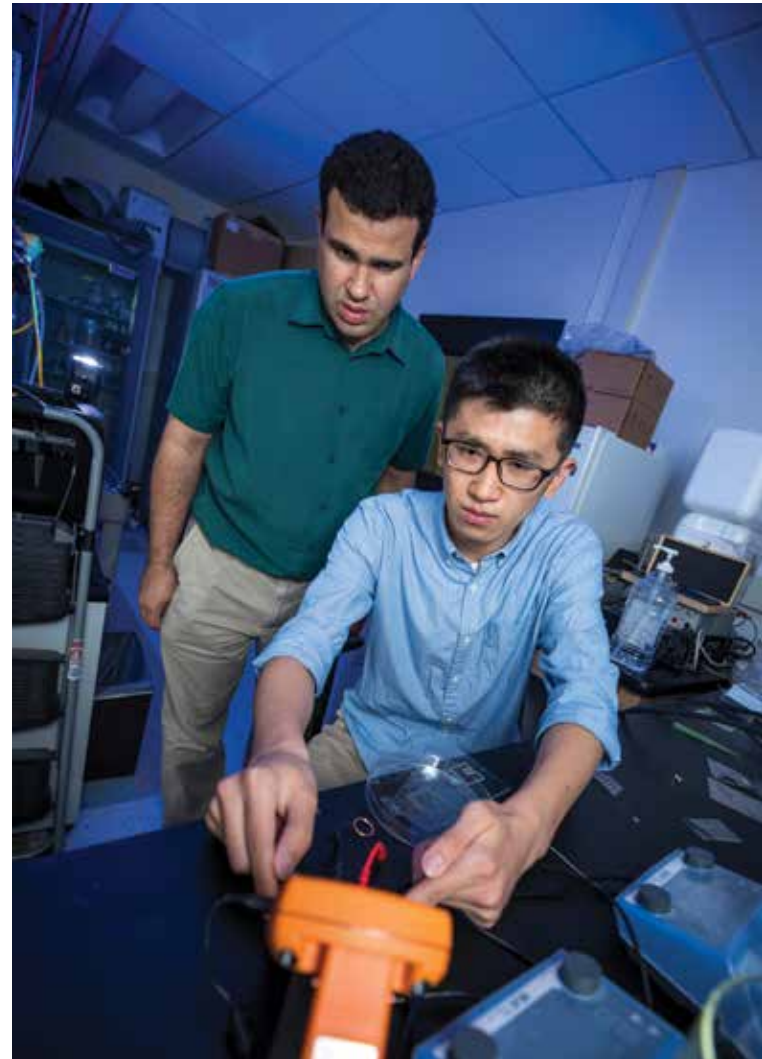
Engineering faculty members are engaged in a diverse collection of research projects, and students are highly encouraged to participate in research activities with faculty mentors.





Research activity in the School of Engineering can be grouped into nine intellectual neighborhoods reflecting major societal and technological problems being addressed globally.

1. **Cyber-physical Systems**—integrating software and hardware
2. **Biomedical Imaging and Biophotonics**—using physical phenomena to diagnose and treat disease
3. **Rehabilitation Engineering**—restoring lost physical and cognitive function
4. **Nanoscience and Nanotechnology**—the science and engineering of materials and processes on the nano scale
5. **Risk, Reliability, and Resilience**—improving predictability of systems, infrastructure, and materials
6. **Big Data Science and Engineering**—harvesting and using knowledge from collections of large data sets
7. **Regenerative Medicine**—replacing, engineering, and healing damaged tissues and organs
8. **Surgery and Engineering**—technology, methods, and tools to improve patient outcomes
9. **Energy and Natural Resources**—enabling sustainable resource and energy conservation, production, and recovery



engineering.vanderbilt.edu/research



Vanderbilt researchers add nanoparticles to clear polymer resin to create a smart material that changes color when it is damaged or about to fail.

Research and Internships

Students have the opportunity to perform independent research with engineering faculty as well as with other professors from across the entire university. Research interests may be identified by using the school's website, working with academic advisers, or talking to course instructors. You may choose to do research for up to six hours of course credit.

You may also apply to participate in one of two paid summer research programs at Vanderbilt: the university-wide summer research program (VUSRP) or the engineering school-sponsored summer research program. Students also may wish to take advantage of National Science Foundation-sponsored Research Experiences for Undergraduates (REU) that are available across the United States.

Internships teach invaluable lessons. Recent graduating senior survey data indicates that **71 percent of students have completed at least one internship experience during their time at Vanderbilt.** Our students take advantage of internship opportunities posted in the Career Center and use their own networks and those of their professors.

Recent student internships include serving as a biomedical industrial intern for Lockheed-Martin at the Johnson Space Center

in Houston; writing user guides for medical test hardware for the International Space Station Alpha; developing web applications for UnumProvident, Inc., in Chattanooga; and creating a website and customer kit for medical applications for National Instruments in Austin. In addition to valuable experience beyond technical applications, many internships provide an entrée into professional engineering positions.

Centers and Institutes

- Biophotonics Center at Vanderbilt
- Center for Rehabilitation Engineering and Assistive Technology
- Consortium for Risk Evaluation with Stakeholder Participation
- Institute for Software Integrated Systems
- Institute for Space and Defense Electronics
- Vanderbilt Center for Environmental Management Studies
- Vanderbilt Institute for Surgery and Engineering
- Vanderbilt Institute for Energy and Environment
- Vanderbilt Institute for Integrative Biosystems Research and Education
- Vanderbilt Institute of Nanoscale Science and Engineering
- Vanderbilt University Institute of Imaging Science



Other Academic Opportunities

Merit Scholarships

vanderbilt.edu/scholarships

The School of Engineering awards Cornelius Vanderbilt Scholarships to incoming first-year students. Awards are made on the basis of academic achievement, intellectual promise, and leadership and contribution outside the classroom. In addition, Vanderbilt awards scholarships through the Ingram Scholarship Program and the Chancellor's Scholarship. Recipients of each of these three signature scholarships receive full-tuition awards that include a stipend for research, study abroad, a creative endeavor, community service, or the required immersive experience. Scholarships are renewed each year as long as the recipient maintains at least a 3.0 GPA.

A separate application is required for the Cornelius Vanderbilt Scholarship; you must apply to be considered. For the Ingram Scholarship Program and the Chancellor's Scholarship, the application is strongly encouraged; preference is given to those who apply. Merit scholarship applications will be available via your MyAppVU portal after you apply for admission. The deadline for merit scholarship applications is December 1, 2018.

In addition, the Clark Scholars Program provides scholarship and programmatic assistance to meritorious engineering undergraduate students with demonstrated financial need who also exhibit business acumen and civic engagement. The Clark Scholars Program awards \$15,000 per year plus assistance for summer immersive experiences. To be considered for a Clark Scholars Program Scholarship, students are encouraged to submit a Cornelius Vanderbilt Scholarship application by December 1, 2018.

First-year Seminars

First-year seminars introduce students to the expectations of the university—a high level of scholarship and a participatory style of learning. Optional seminars through the School of Engineering or through The Martha Rivers Ingram Commons offer first-year students opportunities to work in small groups with seasoned engineering professors. By creatively applying engineering concepts to real-world problems, students improve their communication skills and become more certain in their selection of a specific engineering major.

Honors Programs

Qualified engineering juniors and seniors may participate in departmental honors programs that emphasize independent study and research. Honors students may also take selected graduate courses in Vanderbilt's graduate and professional schools.

Study Abroad

Qualified engineering students may study abroad during the summer or academic year at universities in Australia, England, France, Germany, Ireland, Israel, New Zealand, Scotland, South Africa, and Spain, among others. Exchange programs include National University of Singapore, City University of Hong Kong, Hong Kong University of Science and Technology, Budapest University of Technology, and Politecnico di Torino.



30%
OF THE SCHOOL OF ENGINEERING
CLASS OF 2018
STUDIED OR INTERNED
ABROAD

Biomedical engineering professor Amanda Lowery oversees students as they modify riding toys for children with mobility impairments.



MORE THAN
90%
OF ENGINEERING STUDENTS
ENTERING THE WORKFORCE
HAVE A JOB WITHIN
SIX MONTHS OF
GRADUATION

Integrated Bachelor/ Master of Engineering

Selected engineering undergraduates who have completed at least 75 hours with a B average or higher may be accepted into an integrated engineering program through which both bachelor's and master's degrees are earned. The last two years, generally of five, are planned as a unit. You may earn bachelor's and master's degrees in engineering through this program.

Academic Advising

Each student is assigned a faculty adviser in his or her major department. This adviser remains with the student all four years as long as he or she does not change majors. These advisers guide course selection, direct students toward academic and research opportunities, and provide information on careers after graduation. Advisers meet with students throughout each semester and are readily available for consultation.

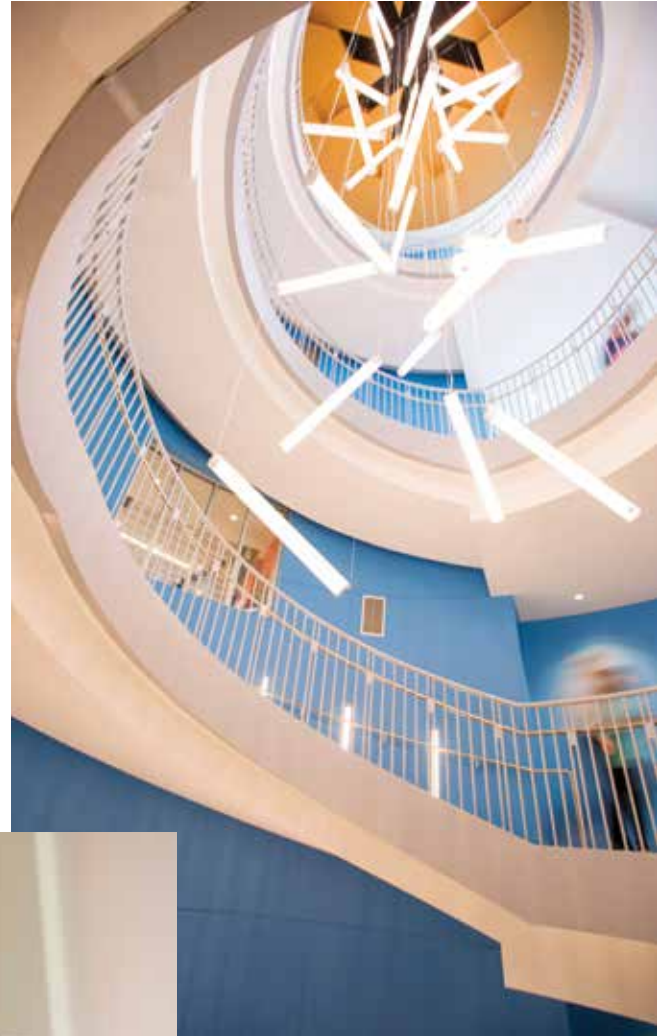


Teacher Licensure

The School of Engineering and Vanderbilt's Peabody College offer a teacher education program that leads to licensure as a secondary school teacher in physics. Students major in engineering science in the School of Engineering and complete a second major in education at Peabody. The Office of Teacher Licensure at Peabody provides guidance and information on this option.

Accelerated Graduate Program

Students who enter with 20 to 30 hours of credit—earned through Advanced Placement tests or in college courses taken during high school—may be eligible for the Accelerated Graduate Program in Engineering. A student may earn a bachelor's degree in four years and an M.S. by completing a master's thesis the following summer.



Students display their engineering solutions to real-life problems to faculty, staff, project sponsors, and fellow students during Senior Design Day.

ONE-ON-ONE WITH

Karl Zelik, Ph.D.

It's no surprise that Professor Karl Zelik was drawn to study motion and force as it applies to biological systems. "Since a young age, I've been testing the limits of the human body—specifically, my own."

Growing up in a family of four boys and active in sports for most of his life, Zelik had many broken bones and stitches. But in college, Zelik discovered biomedical engineering, "which was an academic and much safer way to explore the limits of the human body."

That fascination led him to explore biomechanics and assistive devices, such as prostheses and exoskeletons. While a great deal of research has focused on developing a better prosthetic ankle, Zelik is extending this work by exploring how dynamics within the biological foot—due to muscles, tendons, and ligaments—can also be designed into foot prostheses to enhance walking for individuals with limb loss.

"We don't yet understand how individual properties of the foot, such as toe length or stiffness, affect walking performance. If we did, then we could potentially optimize these features in prosthetic feet to improve health and mobility outcomes for users." Zelik also researches human-exoskeleton dynamics, smart clothing, and how our understanding of multi-joint muscles in the body can inform device design to make walking less fatiguing for users of prosthetic devices.

Undergraduates are heavily involved in his research, often working in the lab for multiple semesters. "I have had quite a few students transition from my classroom into my research lab. I have had students as co-authors on patent applications, research conference submissions, and journal articles. I enjoy this level of personalized interaction and the opportunity to get to know and work with students throughout their time at Vanderbilt," he noted.

Recently two of his undergraduate research assistants were awarded Goldwater Scholarships, the premier undergraduate award for students in science, math, and engineering fields.



They were among only 240 awardees nationwide and three from Vanderbilt.

So what inspires the man who inspires so many others? "The excitement of discovering something new and the humility of realizing how much there is left to discover," he answers. "By developing devices that better interface with the human body, and tools that better quantify human movement performance, we are striving to improve mobility and quality of life for individuals with disabilities and enhance human capabilities beyond their natural biological limits."



“We don’t yet understand how individual properties of the foot, such as toe length or stiffness, affect walking performance. If we did, then we could potentially optimize these features in prosthetic feet to improve health and mobility outcomes for users.”

Karl Zelik

Assistant Professor of Mechanical Engineering
Assistant Professor of Biomedical Engineering

For More Information

Vanderbilt University School of Engineering

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Office of Undergraduate Admissions

Vanderbilt University
2305 West End Avenue
Nashville, Tennessee 37203-1727
(615) 322-2561 or (800) 288-0432
Email: admissions@vanderbilt.edu
Web: admissions.vanderbilt.edu

Office of Student Financial Aid and Scholarships

Vanderbilt University
2309 West End Avenue
Nashville, Tennessee 37203-1725
(615) 322-3591 or (800) 288-0204
Email: finaid@vanderbilt.edu
Web: vanderbilt.edu/financialaid

Accreditation

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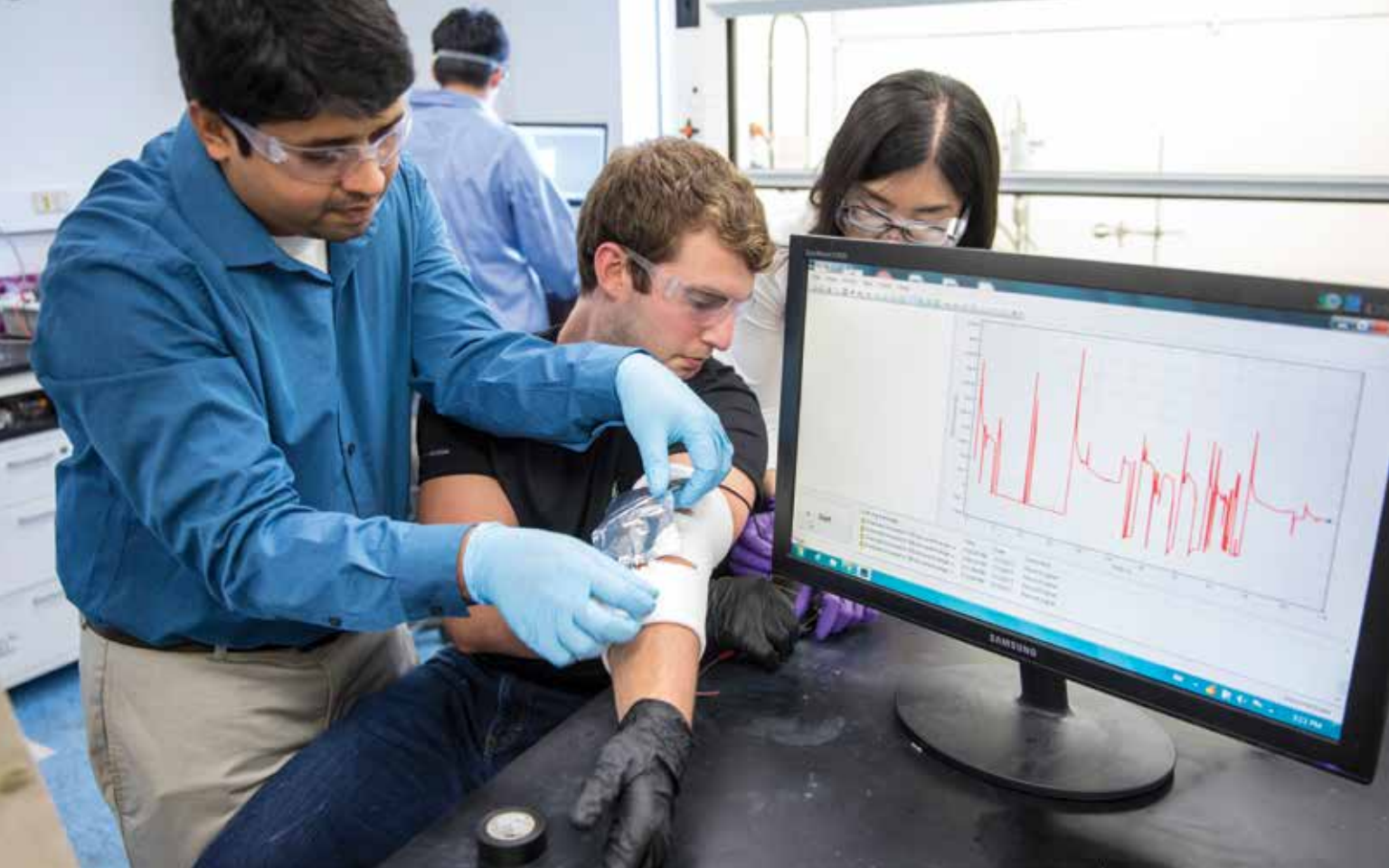
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First day of classes for students at the new Engineering & Science Building.

VISIT US

admissions.vanderbilt.edu/visit



Dates to Remember 2018/2019

August	Applications available
November 1	Application deadline for Early Decision I
November 7	Priority filing deadline for College Scholarship Service (CSS) PROFILE and FAFSA for Early Decision I
December 1	Deadline for merit scholarship applications
Mid-December	Decision notification for Early Decision I
January 1	Application deadline for Early Decision II and Regular Decision
January 2	Priority filing deadline for CSS PROFILE and FAFSA for Early Decision II
February 1	Priority filing deadline for CSS PROFILE* and FAFSA for Regular Decision
Mid-February	Decision notification for Early Decision II
Late March	Decision notification for Regular Decision
May 1	Deadline for matriculation deposit

**For international students, the priority filing deadline for CSS PROFILE is January 2, 2019.*

Back cover: The Vanderbilt Institute of Nanoscale Science and Engineering cleanroom has been the site of laboratories for undergraduate courses from traditional semiconductor materials processing to cutting-edge synthesis of two-dimensional materials.



VANDERBILT
UNIVERSITY

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