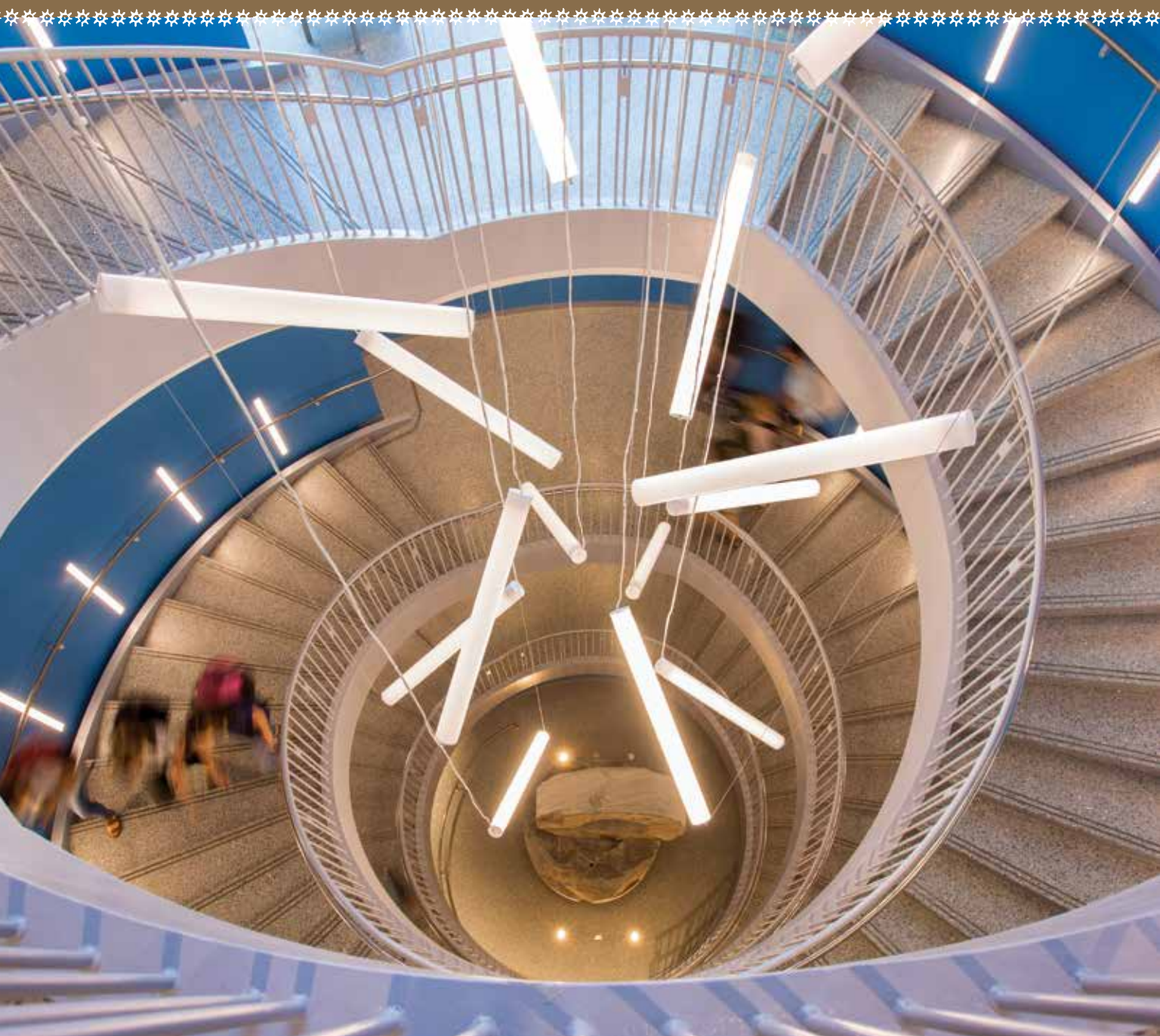
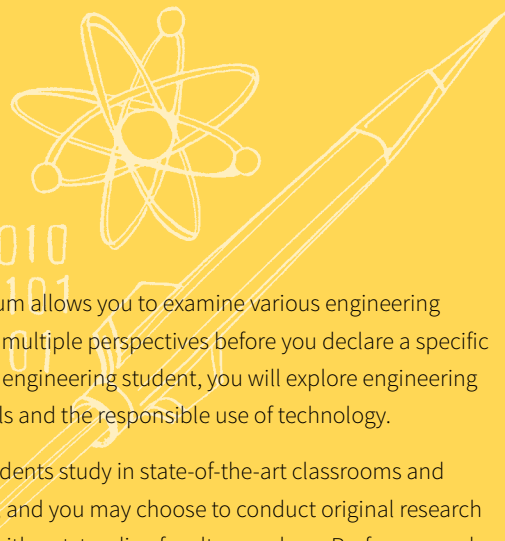


VANDERBILT

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 degree at Vanderbilt are accredited by the Engineering Accreditation Commission of ABET, abet.org. The bachelor of science degree 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 Commission on Colleges of the Southern Association of Colleges and Schools and is a member of the Association of American Universities.

On the cover: The Ed and Sue Clark Grand Stair circles through four levels of the Engineering and Science Building, symbolizing the connectivity at the heart of this trans-institutional facility.



**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 degree in biomedical, chemical, civil, computer, electrical, and mechanical engineering and the bachelor of science degree 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.



95%
OF SENIORS
GRADUATING FROM VANDERBILT ARE
SATISFIED WITH THE
QUALITY OF INSTRUCTION

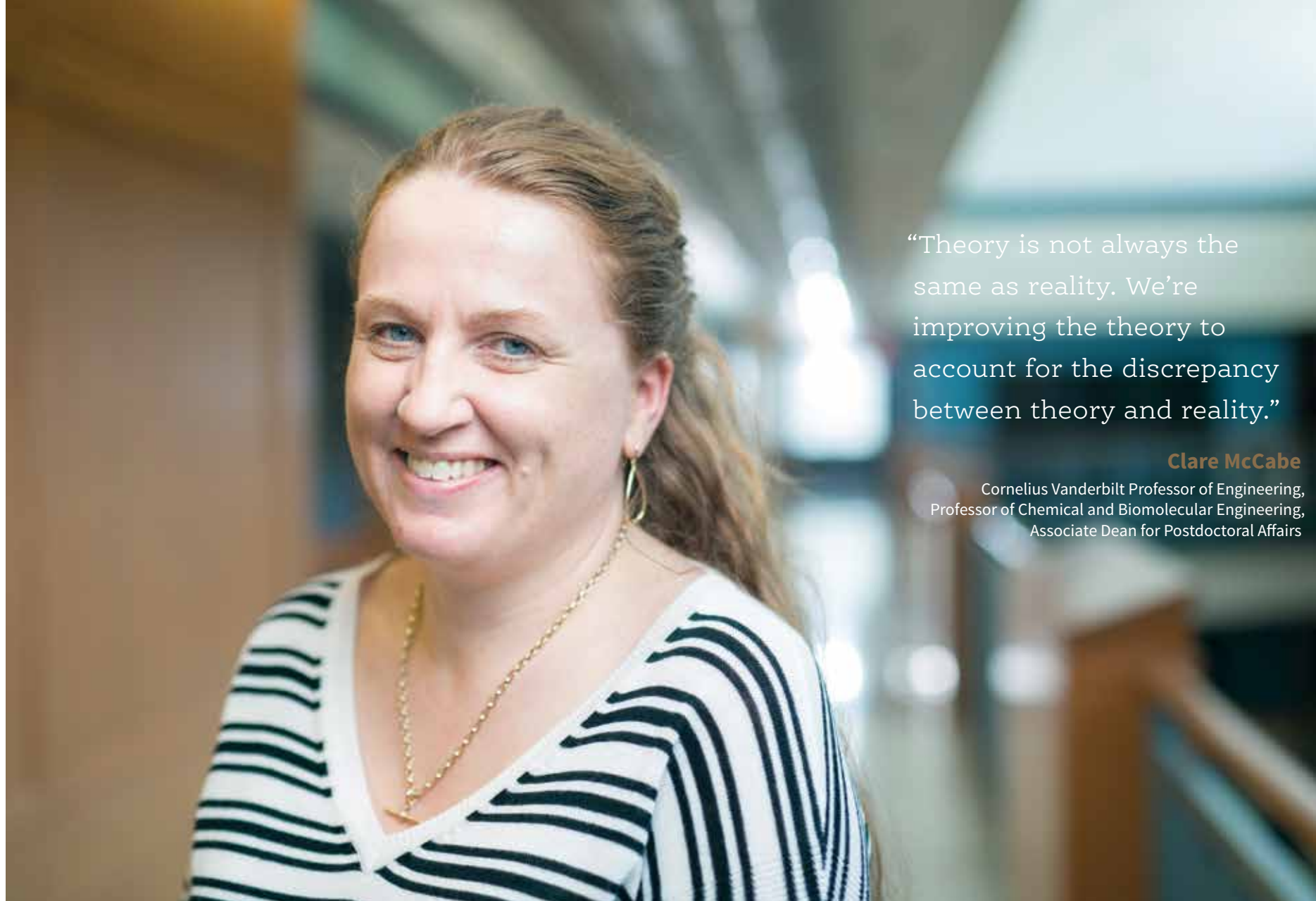


New in 2016, the 230,000-square-foot Engineering and Science Building is specifically designed to foster teamwork and includes an Innovation Pavilion that connects students and faculty with industry mentors.



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 50 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.



“Theory is not always the same as reality. We’re improving the theory to account for the discrepancy between theory and reality.”

Clare McCabe

Cornelius Vanderbilt Professor of Engineering,
Professor of Chemical and Biomolecular Engineering,
Associate Dean for Postdoctoral Affairs

ONE-ON-ONE WITH

Clare McCabe

While Professor Clare McCabe’s research focus brings the virtual world of molecular modeling into the nano-world of real-life molecules, she is a highly acclaimed professor of undergraduate students. In 2011, she was awarded the Madison Sarratt Prize for Excellence in Undergraduate Teaching, which recognizes outstanding efforts in classroom presentation, concern for student learning, and clarity and fairness in the criteria used for awarding grades. Her student ratings are among the highest in the School of Engineering, and she serves as an adviser for the Vanderbilt chapter of the Society of Women Engineers.

Professor McCabe is interested in how molecules operate at the nanoscale, because that’s an area where neither classical theory nor quantum mechanics are sufficiently predicting the true behavior of molecules. “Theory is not always the same as reality,” McCabe points out. “We’re improving the theory to account for the discrepancy between theory and reality.”

McCabe is particularly interested in accurately depicting the behavior of organic molecules. And in the process, she’s come up with new mathematical theories for other engineers and chemists to use in designing chemical processes.

Physics can tell us what a handful of atoms might do together, but when you throw in the hundreds of molecules interacting at the nanoscale, quantum mechanics becomes difficult to do. “Experimental measurements can be very costly and time consuming,” McCabe says. “Computer modeling and simulation are proving to be attractive and valuable means with which to fill in the gaps in experimental literature and obtain important information.”

Computer modeling and simulation are particularly useful in determining how materials will behave at extreme conditions, such as very high pressures and temperatures. “Even conditions encountered in practical applications such as automobile engines can be very difficult to achieve and study experimentally in a consistent way, but pose fewer difficulties to a computer simulation,” she says.

Professor McCabe’s recent work focuses on understanding the self-assembly behavior of skin lipids. The outermost layer of the skin is composed of ceramides, cholesterol, and free fatty acids, with phospholipids, which are the major components of most biological membranes, being completely absent. This unique composition enables the lipids of the outer layer of skin to form highly organized membranes, which in turn are believed to control the barrier function of the skin.

While much is known about the nature of the skin lipids from extensive experimental studies, a clear understanding of how and why these molecules assemble into the structures observed through microscopy and biophysical measurements does not yet exist. “We need molecular simulations in order to probe lipid-phase behavior and molecular-level arrangement of the stratum corneum lipids and provide insight into the lamellar organization that cannot be provided by experiments,” McCabe says.

In addition, McCabe’s National Science Foundation-funded research promises to make important contributions to understanding friction and wear in nanoconfined systems. In collaboration with researchers in the School of Engineering’s Department of Chemical and Biomolecular Engineering and the Institute for Software Integrated Systems, she is also developing tools that will enable other researchers to easily perform molecular simulations of lubrication systems.



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.

engineering.vanderbilt.edu / academics / Undergraduate

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.



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.

30% FEMALE
ENGINEERING UNDERGRADUATES
(vs. national average of 19%)



Engineering Research

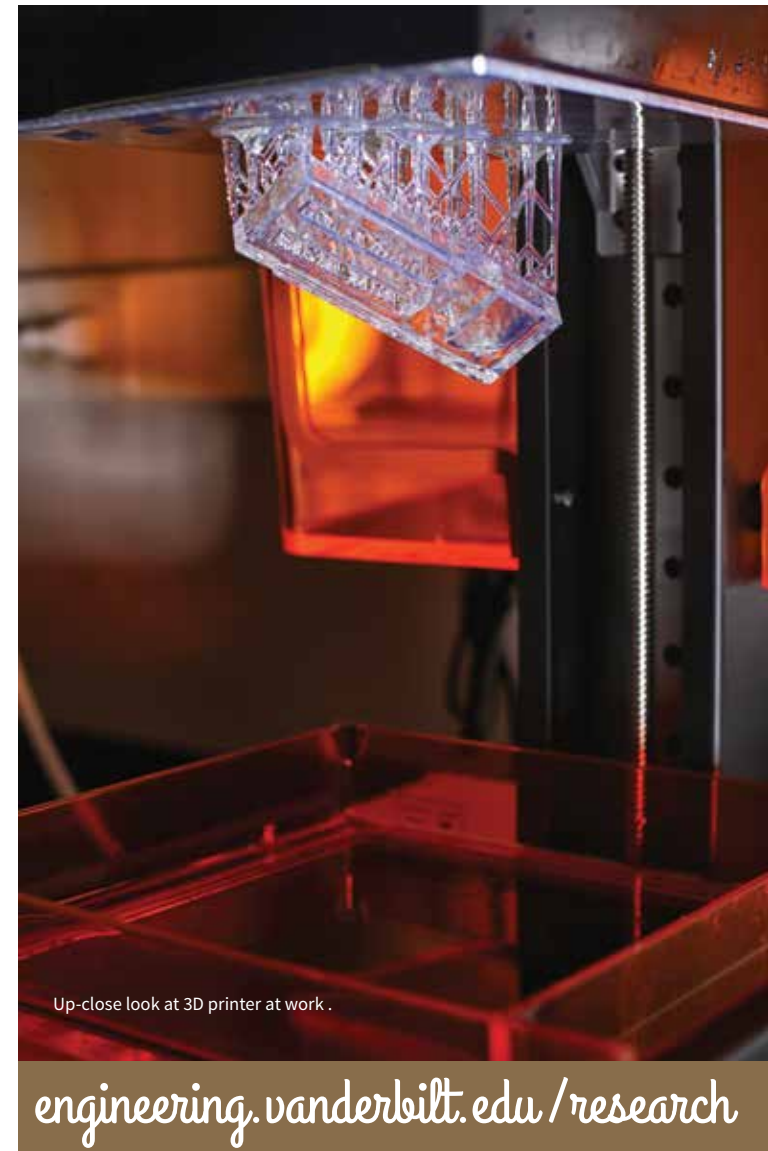
Engineering faculty members are engaged in a diverse collection of research projects, and students are highly encouraged to participate in research activities with faculty mentors.



\$67
MILLION
SPENT ANNUALLY BY THE SCHOOL OF
ENGINEERING FROM SPONSORED
RESEARCH GRANTS

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**—integration of 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**—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**—replace, engineer, and heal 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





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 utilizing 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 **72% of students have completed at least one internship experience during their time at Vanderbilt.** Our students take advantage of internship opportunities posted in the Center for Student Professional Development as well as utilizing 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 application, many internships provide an entrée into professional engineering positions.

Centers and Institutes

- Biophotonics Center at Vanderbilt
- Center for Intelligent Mechatronics
- 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 in 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 for 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, plus summer stipends for study abroad, research, service projects, and/or an 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, 2017.

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, 2017.

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.

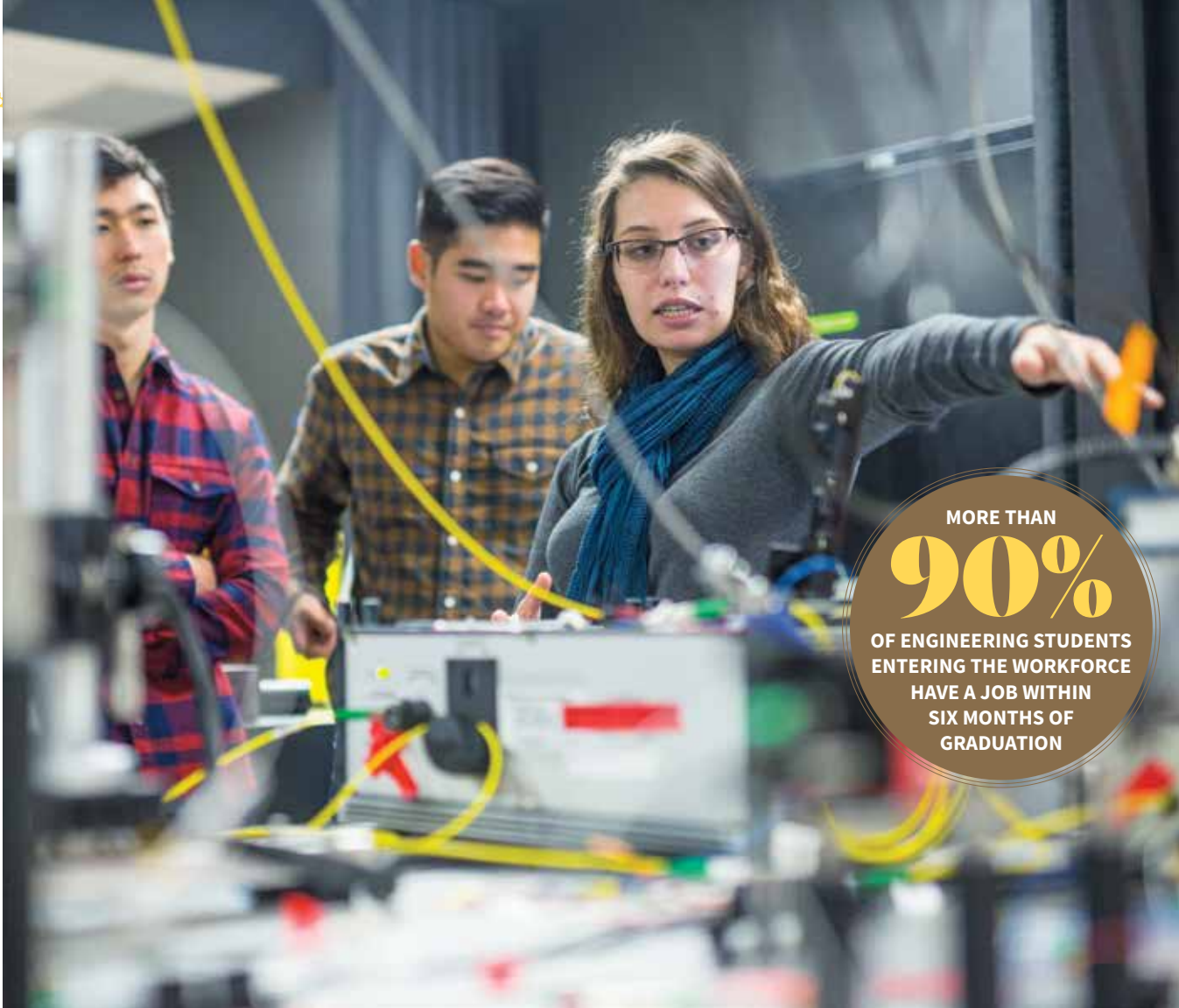
Study Abroad

Qualified engineering students may study abroad during the summer or academic year at universities in England, France, Germany, Israel, Scotland, Spain, South Africa, Ireland, Australia, and New Zealand, 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 2017
STUDIED OR
INTERNEED ABROAD

Engineering students work on a redesigned football helmet that limits mild brain injuries by dissipating impact through shock-absorbing material inside.



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.

B.S. Engineering/M.S. Finance

Computer science students interested in a career in business and finance may opt for this track. With judicious planning, computer science majors are able within four years to earn a B.S. in computer science, an optional minor in engineering management or math, and they may participate in a study abroad experience and/or a senior design experience. During the fifth year, students take all courses in the Owen Graduate School of Management and may obtain a master of science in finance after the fifth year.

Dual Degree with Fisk University

Students may earn an A.B. degree in biology, chemistry, physics, or mathematics from Fisk and a B.E. or B.S. in engineering from Vanderbilt, generally within five years.

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.



ONE-ON-ONE WITH Karl Zelik

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 prosthetic users.

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

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Email: admissions@vanderbilt.edu
Web: admissions.vanderbilt.edu

**Office of Student Financial
Aid and Scholarships**
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Email: finaid@vanderbilt.edu
Web: vanderbilt.edu/financialaid

Accreditation
All programs leading to the bachelor of engineering degree at Vanderbilt are accredited by the Engineering Accreditation Commission of ABET, abet.org. The bachelor of science degree in computer science is accredited by the Computing Accreditation Commission of ABET, abet.org. Vanderbilt University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award bachelor's, master's, education specialist's, professional, and doctoral degrees and is a member of the Association of American Universities.

In compliance with federal law, including the provisions of Title VII of the Civil Rights Act of 1964, Title IX of the Education Amendment of 1972, Sections 503 and 504 of the Rehabilitation Act of 1973, the Americans with Disabilities Act (ADA) of 1990, the ADA Amendments Act of 2008, Executive Order 11246, the Uniformed Services Employment and Reemployment Rights Act, as amended, and the Genetic Information Nondiscrimination Act of 2008, Vanderbilt University does not discriminate against individuals on the basis of their race, sex, religion, color, national or ethnic origin, age, disability, military service, or genetic information in its administration of educational policies, programs, or activities; admissions policies; scholarship and loan programs; athletic or other university-administered programs; or employment. In addition, the university does not discriminate against individuals on the basis of their sexual orientation, gender identity, or gender expression consistent with the university's nondiscrimination policy. Inquiries or complaints should be directed to the Equal Opportunity, Affirmative Action, and Disability Services Department, Baker Building, PMB 401809, 2301 Vanderbilt Place, Nashville, TN 37240-1809. Telephone (615) 322-4705 (V/TDD); Fax (615) 343-4969.

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As part of a trans-institutional collaboration, computer science major Nolan Michael Smith created an app full of rewarding sounds and incentives to help researchers at Peabody College collect data on how preschoolers interact with touch screens.



Dates to Remember 2017/2018

- July/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
- December 15** 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
- February 15** Decision notification for Early Decision II
 - April 1** Decision notification for Regular Decision
 - May 1** Deadline for matriculation deposit

*For international students, priority filing deadline for CSS PROFILE is January 2, 2018.

VISIT US
admissions.vanderbilt.edu/visit



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UNIVERSITY

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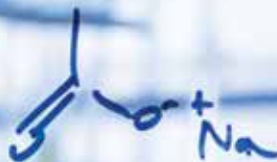


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vanderbilt

PPAA + DMSO
(stock)
5000 µm



→ stops at NaOH
dilute w/ H₂O

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