Vanderbilt named NSF I-Corps Hub lead institution

Vanderbilt University has been chosen by the National Science Foundation to lead the new Mid-South Innovation Corps Hub, a group of nine universities that make up a regional coalition of diverse, tech-forward institutions to promote inclusive innovation, spur economic development and prosperity and transform Midsouth metro areas into growth, and commercialization centers for STEM-related technologies. As the lead institution for the Mid-South I-Corps Hub, Vanderbilt will receive up to $15 million from NSF over five years to fund participant microgrants, engage consultants with I-Corps experience, train I-Corps instructors, lead National I-Corps cohorts, publish materials resulting from hub work and create positions to support programming and outputs.

The NSF I-Corps program prepares scientists and engineers to explore the potential of their ideas and research beyond the university. I-Corps accelerates the economic and societal benefits of deep technology research and innovation projects that are ready to move toward commercialization.

To date, the Vanderbilt I-Corps site has supported more than 300 teams of researchers and aspiring entrepreneurs in identifying product opportunities for their ideas; 64 percent of the teams have been led by underrepresented minority entrepreneurs. In FY 2021, the Vanderbilt University I-Corps site extended its programming to local historically Black colleges and universities, community colleges and state universities. This led to the first-ever team from Meharry Medical College being accepted into the National I-Corps program.

Teams have worked on ideas ranging from a 3D-printed hand orthosis for stroke victims, to a hemorrhage control device for use during trauma surgeries and a blockchain-based workforce development platform. Since fall 2017, more than 24 teams of Vanderbilt students and faculty have been accepted into the national I-Corps program, each receiving a $50,000 grant to explore the commercial potential of their research. These grantees gain skills in entrepreneurship through training in customer discovery and product market fit, with guidance from established entrepreneurs.

NSF Convergence Accelerator program

The NSF Convergence Accelerator program seeks to test new models for innovation in government, industry and academia. NSF’s convergent approach is designed to speed basic research toward impactful problem-solving with a significant impact by bringing together scientists from different fields, business practitioners and nonprofit leaders to holistically understand problems and craft solutions. As part of the program, NSF awarded researchers at Vanderbilt a highly competitive Phase II $5 million grant to develop technology to detect biological threats and predict disease outbreaks in major U.S. cities. In the first year, the effort focused on monitoring and predicting mosquito-borne diseases, which affect nearly 700 million people globally each year. Vanderbilt also received a Phase I grant to close gaps in scaling and verification of AI technology breakthroughs with streamlined validation, development, assessment and translation of medical imaging AI.

Recent CAREER Awards at Vanderbilt

NSF’s Faculty Early Career Development (CAREER) program offers the foundation’s most prestigious awards in support of early-career faculty who exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research within the context of their organizations.

An assistant professor of psychology received a CAREER award to explore the influence of stressful experiences and supportive caregiving on the developing brain. The research will provide insights that can be used to inform prevention and intervention efforts for children at risk for stress exposure in early life.

An assistant professor of mechanical engineering received a CAREER award to conduct foundational research in mechanically adaptive robotics which will enable the creation of new-generation industrial robots, transportation systems and devices that can assist and augment humans.

An assistant professor of electrical engineering received a CAREER award to associate extracellular vesicles directly to their cell sources, which will address a gap in knowledge that is key to enabling developments of therapeutics and diagnostics. The award also includes education and outreach activities to young scholars in Nashville and in West Africa.

An associate professor of civil and environmental engineering received a CAREER award to develop a novel framework that will improve the ability of power and water systems, the internet and other infrastructure to deal with the intermittent nature of renewables and consumer behavior.

An assistant professor of physics and astronomy received a CAREER award to pioneer gravitational wave search techniques that will help characterize some of the universe’s most mysterious phenomena. The award also will support efforts to increase equity, diversity and inclusion among the researchers and students on the research team.
Understanding history through high-tech archaeology

A Vanderbilt archaeologist and historical anthropologist in the College of Arts and Science is exploring the remains of a 16th-century church high in the Andes Mountains of Peru using virtual reality, artificial intelligence and geospatial technologies to better understand the experience of places and their emplacement in the landscapes of the Andean past. They've brought decades of data and research materials to the site and moved an ancient relic found in a nearby town to its original spot in the church.

$2.5 million NSF grant to establish Climate Leaders Academy

A researcher in the School of Engineering was awarded a $2.5 million NSF grant to establish a Climate Leaders Academy at Vanderbilt that will support students learning about climate change from a range of perspectives and include participation at the annual United Nations climate change conferences, bringing decades of data and research materials to the site and moved an ancient relic found in a nearby town to its original spot in the church.

Non SBIR/STTR funding at Vanderbilt

Four companies with ties to Vanderbilt are recipients of highly competitive Small Business Innovation Research/Small Business Technology Transfer grants from NSF. Those include:

- **Couture Technologies** – an innovative software company that empowers apparel brands to integrate virtual try-on technology.
- **HeroWear LLC** – designs back-assist exosuits to reduce strain on the back while fitting like a comfortable piece of clothing.
- **SkyNano LLC** – a science-based technology company focused on commercializing a free-market solution to carbon pollution.
- **BlueWonder Creative, Inc.** – provides a content-driven mental health and wellness platform coupled with at-home activity boxes and hands-on services at partnered care centers, when fully deployed.

The SBIR/STTR program encourages domestic small businesses to engage in federal research and development with the potential to commercialize and enables small businesses to explore their technological potential and provides the incentive to profit from their commercialization. This program is crucial to the innovation ecosystem at Vanderbilt, especially as it relates to getting research and development off the ground in the early stages of these companies. In 2021, nine startups with roots at Vanderbilt were awarded more than $4.5 million in SBIR/STTR grants and matching funds from Launch Tennessee.

The Wond'ry, Vanderbilt’s Innovation Center, and the Center for Technology Transfer and Commercialization at Vanderbilt University contributed to the startups’ growth in various capacities, from assisting with ideation and R&D to facilitating invention disclosures and commercialization services. Founders of these startups span Vanderbilt faculty, alumni, staff and students.

According to Launch Tennessee, companies awarded their SBIR/STTR matching funds have created more than 505 direct jobs and had an economic impact of $146,125,214 in Tennessee—a return of $11.24 for every public dollar invested in the program.

NSF unveils $20 million AI institute with Vanderbilt and partner institutions

Vanderbilt University engineering and education faculty are part of a new $20 million research institute funded by NSF that aims to create artificial intelligence tools to advance human learning and education. The NSF AI Institute for Engaged Learning is one of 11 new AI institutes as part of a major initiative to advance understanding of AI technologies and how they can drive innovation to address real-world challenges. The researchers will develop narrative-centered AI platforms and characters, or agents, to interact with and support a wide variety of learners. The institute will create a sophisticated framework that analyzes data from interactions to evaluate what works and what needs refinement to make the tools truly interactive and adaptive to the learning needs of individuals and of collaborating groups.

Studying public-private schools in Bogotá, Colombia

Governments of lower- and middle-income countries are increasingly turning to public-private partnership programs to operate schools that deliver education to low-income families as an alternative to traditional public schools. Researchers in the Peabody College of education and human development and the College of Arts and Science received an NSF grant to lead an interdisciplinary study on the quality of these partnership schools in Bogotá, Colombia, and on how families decide whether to send their children to them. This study has the potential to affect educational policy in these countries as low-fee private schools are increasingly viewed as a possible means of improving learning outcomes.

Exploring how wearable tech can ease loneliness in older adults, detect problem behaviors in children with disabilities

With a $2.25 million grant from NSF, researchers in the School of Engineering are exploring ways to transport realistic virtual avatars of families and friends of older adults in their long-term care environment for joint social activities to increase social connection and engagement in the lives of older populations. The lack of social connections in older adults can lead to serious health consequences, including cardiovascular disease, cognitive decline, depression and suicide. In addition to easing loneliness in older populations, this could help broaden the use of augmented reality technologies to include telemedicine, skills training and entertainment.

With support from NSF, Vanderbilt engineering and pediatric researchers will integrate transdisciplinary expertise in cutting-edge wearable sensing, affective computing, machine learning, and behavioral and clinical science to transform existing models of behavioral intervention for problem behaviors in children and adolescents with intellectual and developmental disabilities.

Supporting research on learning math through play

Researchers in the Peabody College of education and human development, with support from NSF, are analyzing the role of play in early elementary math education through a four-year study by connecting research to practice by exploring how children’s mathematical thinking and identities are transformed when mathematics teaching emphasizes exploration and agency. The data collected through this effort will offer insight into children’s participation throughout the first three years of elementary school and provide more information about how student relationships with the discipline of mathematics could be shaped through the learning structure of play.
Graduate Research Fellowships

A record 40 Vanderbilt graduate students and alumni won NSF Graduate Research Fellowships in FY 2022, bringing the total number of graduate student fellows at Vanderbilt to 77. The fellowships provide three years of support and are aimed at aiding individuals who have demonstrated notable potential early in their research careers and at increasing the diversity of the science and engineering workforce.

Frist Center for Autism and Innovation

The Vanderbilt School of Engineering’s Frist Center for Autism and Innovation, inspired by neurodiversity, engineers technologies and transforms the workplace by bringing together engineers, business scholars, disabilities researchers, and experts in neuroscience and education to understand, maximize and promote neurodiverse talent. With NSF support, the Frist Center is:

- Working in partnership with Fisk University, with a $1.9 million NSF grant to create a system of programs to support neurodiverse students in engineering majors and careers.
- Using its unique strengths alongside the Vanderbilt Graduate School to train engineers and scientists engaged in advancing the future of work at the human-technology frontier. Supported by an NSF Research Traineeship grant, Vanderbilt’s Neurodiversity Inspired Science and Engineering program engages students across STEM disciplines in all stages of the development, deployment, and commercialization that support neurodiverse individuals and/or that are inspired by their abilities.

Research Experience for Undergraduates

The Research Experiences for Undergraduates program supports active research participation by undergraduate students in any of the areas of research funded by NSF. At Vanderbilt, the following REU programs have been provided in the areas of Nanoscale Science and Engineering, Chemical Biology, Physics & Astronomy, and Accountability, Behavior, and Conflict in Democratic Politics.

$3M from NSF to launch cutting-edge astronomy graduate program

Vanderbilt researchers from the Departments of Physics and Astronomy, Math, Electrical and Computer Engineering, and History received a $3 million NSF Research Traineeship Award to establish a graduate certificate program in the emerging field of multimessenger astronomy. Over five years, the program will train and educate 300 physics, astronomy, math and engineering graduate students through national summer schools and courses at Vanderbilt and Fisk universities. Students in this program will be among the first pursuing research in this field. The field of MMA collects and harmonizes messages from space in the form of visible light, X-rays, gamma rays, high-energy particles and gravitational waves to learn more about the universe. Trainees will learn the interdisciplinary concepts, research techniques and conduct of research that will advance the field and drive discoveries about MMA. There also will be an emphasis on diversity and inclusion in the program, as it aims to broaden participation in graduate training and expand the STEM workforce.

Research at Vanderbilt Peabody College, in partnership with Fisk University, was among five universities to initiate the program when E4USA launched in high schools across the country. NSF has since awarded partner institutions $4 million over the next three years to broaden the impact of E4USA, which builds engineering literacy in all students and creates a deeper and more diverse pool of engineers. (Vanderbilt University/Brentwood High School)

The program builds on the MMA expertise at Vanderbilt, which includes NSF-funded researchers studying low-frequency gravitational waves from supermassive black holes merging in other galaxies using North American Nanohertz Observatory for Gravitational Waves.

Training diverse students in STEM

Vanderbilt University is committed to increasing the number of underrepresented minority students completing STEM degrees. Partnered with historically Black colleges and universities and funded by NSF, Vanderbilt is working to improve the demographic representation in STEM fields.

Vanderbilt University is a partner in the Tennessee Louis Stokes Alliance for Minority Participation program, an NSF-funded coalition of six colleges and universities in the state of Tennessee that aim to improve the academic success and retention of historically underrepresented minority students in STEM fields statewide, as well as to promote graduate education in STEM.

The Fisk-Vanderbilt Master’s-to-Ph.D. Bridge Program provides students a stepping stone from their master’s degree at Fisk University to a Ph.D. at Vanderbilt. After 18 years, 176 students have enrolled in the program, 126 master’s degrees have been awarded, and 112 students have bridged to Ph.D. programs. Today, 30 students are in a Vanderbilt Ph.D. program, while 25 are in a Fisk master’s program. Overwhelmingly, the student population has been underserved in intersecting ways, with many being first-generation college students, of low socioeconomic status, and/or with disabilities. For African American students in the program, the 10-year STEM Ph.D. completion rate is nearly twice the national average.

Training for teachers

Researchers at Vanderbilt Peabody College, in partnership with Fisk University, will establish a second Robert Noyce Teacher Scholarship Program. Noyce scholarships, funded by NSF, are designed to recruit and prepare high-quality STEM teachers for high-need school districts.