Department of Energy

VANDERBILT UNIVERSITY®

$4.3 MILLION

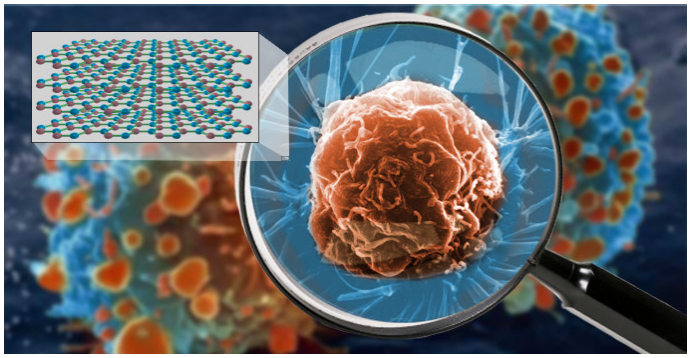
DOE Funding at Vanderbilt in FY 2018

Vanderbilt research is helping to shape the future of American manufacturing

Vanderbilt is playing a key part in the multistate, $259-million Institute for Advanced Composites Manufacturing Innovation that is led by the University of Tennessee-Knoxville. The DOE-funded institute is developing cost- and energy-efficient composite materials and technologies for high-volume production industries, such as automotive manufacturing. Much of Vanderbilt's work for the institute is taking place at the Laboratory for Systems Integrity and Reliability. The goal of Vanderbilt's work is to develop systems that automatically diagnose and fix quality control issues in composites manufacturing processes, including 3D printing, recyclable composites, and carbon fiber production. Vanderbilt has designed and deployed a Mobile Lab comprised of state-of-the-art instrumentation and data analytics tools to address the needs in manufacturing quality control of its composites institute's partners across the country.

Consortium for Risk Evaluation with Stakeholder Participation (CRESP)

CRESP is one of the nation's leading independent, interdisciplinary research groups focused on the waste management and environmental legacy from production of defense nuclear materials and nuclear energy. Vanderbilt is leading this multi-university consortium of engineers, scientists, and legal and policy experts who have contributed over the past 25 years to the progress being made in addressing the nation's largest environmental liability. With the support of DOE, these nuclear waste experts leverage their knowledge to help the U.S. find safe ways to effectively manage nuclear waste from both civilian and defense nuclear power sources. They see this as a critical component of environmental responsibility related to expanded nuclear power generating



New hyperlens crystal is capable of resolving details as small as a virus on the surface of living cells. The atomic structure of the hexagonal boron nitride crystal is shown in the cutout. (Photo: Ken Wood/Vanderbilt University)

capabilities. The work at CRESP requires engineers and scientists to understand the complete life cycle of nuclear power generation, weapons production, and environmental impacts from nuclear weapons tests. Academic research through CRESP educates undergraduate and graduate students while carrying out foundational research needed to improve the efficiency and effectiveness of the cleanup program.

Partnering with Oak Ridge National Laboratory (ORNL)

ORNL is the largest national laboratory in DOE's system. Vanderbilt is one of the UT–Battelle Core University Partners, a select group of seven Southeastern universities that work closely with ORNL to jointly appoint faculty with common scientific interests, support collaborative research, train graduate students, and provide regional support for ORNL in the state of TN. Dr. Padma Raghavan, Vice Provost for Research, serves as Vanderbilt's representative on the UT–Battelle Board of Governors, which oversees management of ORNL, and works closely with ORNL leadership to promote collaborations. Dr. Carlos F. Lopez, assistant professor of biochemistry, serves as the core University Liaison with ORNL. Vanderbilt and ORNL are strongly committed to this ongoing research partnership. Current activities by Vanderbilt researchers at ORNL include use of the Spallation Neutron Source, the nanotechnology laboratories, and the TITAN and SUMMIT supercomputers for engineering, chemistry, physics, and biochemistry research. Scientists and leadership are designing experiments and planning the

next steps that will combine ORNL's analytical and computational capabilities with Vanderbilt's cell biology expertise to explore uncharted areas. These growing collaborative opportunities have the potential to drive innovation and address issues of national importance.

Engineering lab part of $10.7M DOE-funded study of diatoms for next-gen biofuels

Phaeodactylum tricornutum is a microscopic, single-celled algae with outsized potential. It is a leading contender to improve sustainable production of biodiesel and other products using seawater and carbon dioxide as raw materials. Yet how these diatoms do what they do is not well understood - and that's where a team in the chemical and biomolecular engineering departments come in. The team received a five-year, $10.7 million grant from DOE's Office of Science, Biological and Environmental Research, Genomic Science Program to optimize metabolic networks in photosynthetic microalgae. The new research effort is expected to develop technologies needed to achieve sustainable production of biochemicals from photosynthetic microbes within the next 10 to 15 years.

Vanderbilt engineers' smart grid platform joins Linux Foundation

Vanderbilt University is the first academic partner to join a new effort by The Linux Foundation to advance open source innovation in the energy and electricity sectors, contributing both deep expertise and a platform for smart grid applications. The initiative will showcase Vanderbilt's leadership in cyber-physical systems and the Internet of Things. That expertise includes The Resilient Information Architecture Platform for Smart Grid (RIAPS), which provides core services for building effective, secure, and powerful distributed software applications and enables smart grid control software to run reliably. Vanderbilt researchers developed RIAPS with funding from DOE's Advanced Research Projects Agency for Energy (ARPA-E).

Hyperlens crystal capable of viewing living cells in unprecedented detail

Imagine an optical lens so powerful that it lets you view features the size of a small virus on the surface of a living cell in its natural environment. This used to not be possible because the instruments either operate under a high vacuum, expose samples to harmful levels of radiation, require lethal sample preparation techniques like freeze drying, or remove samples from their natural, solution-based environment. Researchers at Vanderbilt, supported by DOE, have made a fundamental advancement in the quality of an optical material used in hyperlensing, which means that instruments can be built that provide highly detailed images of living cells in their natural environments using low-energy light that does not harm them.

Vanderbilt engineers to help enhance Chattanooga transit system

Chattanooga is the test city for a new DOE-funded project that leverages the expertise of Vanderbilt engineers and widespread availability of 1-gigabyte Internet connection to revolutionize the energy efficiency of transit providers. Advancements in data sensors, data collection, and machine learning will fuel the project, which aims to optimize schedules of bus routes, decrease stop-and-go bus driving, and reduce energy consumption at a system-wide level. Creating reusable tools that can benefit other mid-size cities is a key goal of the two-year project with the Chattanooga Area Regional Transportation Authority. Vanderbilt's team, along with its collaborators, will provide context-specific, high-definition energy consumption maps for the transit agency.

Vanderbilt engineers are working with CARTA in Chattanooga to put sensors on buses and train neural networks for reduction of system-wide energy use. (Photo: Vanderbilt University)

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