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Pursuit

Summer Research Opportunities Valuable to Science and Engineering Students

By Sarah Russell

The University of Tennessee has systematically sought to increase its focus on research at all levels as it pursues an initiative to become a Top 25 public research university. In addition to focusing on improving our student retention rate, faculty and staff, graduate programs, and finances, one of the main areas targeted by this particular initiative is research, including undergraduate research. Students at the University of Tennessee, regardless of discipline, are privileged to have a vast number of research opportunities available to them, both during the school year and during the summers. In today's climate of rapid changes in science and technology, there is a great deal of funding for students in STEM fields (science, technology, engineering, and mathematics) to participate in a wide variety of research projects.

A highly prominent and well-known opportunity available to undergraduate researchers at UT is the ability of science and engineering majors to work directly with Oak Ridge National Laboratory (ORNL) to perform research. The University of Tennessee has had an interesting relationship with the laboratory, which was initially built in 1943 as part of the Manhattan Project and also housed the world's first experimental nuclear reactor. In 2000, the University of Tennessee joined forces with Battelle Memorial Institute to form a non-profit company called UT-Battelle that manages and operates the Oak Ridge National Laboratory for the U.S. Department of Energy. According to UT-Battelle, the company promotes science education and has donated $4.5 million to educational initiatives in the region, including several programs that provide UT undergraduate students with the opportunity to perform research in the summers. Working through organizations like the Oak Ridge Institute for Science and Education (ORISE) and Oak Ridge Associated Universities (ORAU), many UT students have obtained internships, scholarships, and fellowships to perform research and work for this internationally recognized laboratory.

One of the programs sponsored by the Laboratory, Higher Education Research Experiences (HERE), gives student and faculty researchers at many levels the opportunity to participate in research projects, internships, and fellowships at ORNL. Ethan Cansler,

a junior in aerospace engineering, has worked since June 2010 at the Neutron Facilities Development Division, which is the engineering division of the Spallation Neutron Source and High Flux Isotope Reactor (HFIR). His work primarily consists of mechanical design, which sometimes involves directly interfacing with the relevant science groups. Another engineering student in nuclear engineering, junior Daniel Hamm, received an internship to work through the Nuclear Engineering Science Laboratory Synthesis program under Dr. Gary Bell. Hamm's research required him to create a computer program to model "the rate of rise of power reaction of the HFIR rabbit [a tool for inserting sample materials into a nuclear reactor] to an array of reactivities for a mid-cycle neutron absorber ejection." Both Cansler and Hamm remarked that their time at ORNL allowed them to work directly with scientists and engineers in their fields; and as Cansler noted, "my continuing engineering internship position has been extremely rewarding, as it has given me experience and a measure of confidence in my intended field."

Although many people associate ORNL primarily with its work on nuclear energy, ORNL also offers research opportunities for those in chemistry, physics, and biology. Katie Rush, a sophomore in chemistry, worked in the Environmental Sciences Division as an intern, researching the crystallization of the proteins in the *mer* operon, which are elements in bacteria that help detoxify certain compounds. Rush's research was designed to better understand the structure and function of these currently uncharacterized proteins in the *mer* operon. She is also continuing to work part-time during the school year at ORNL. In addition to the experience of performing hands-on research, Rush emphasized how this opportunity "confirmed my suspicions that research is the life for me." The ability for undergraduates to conduct research at a professional level not only provides practical skills in their field, but it also helps them decide whether or not research could be a potential career path.

ORNL's research programs and internships are well-established opportunities for University of Tennessee students in the STEM disciplines, but there are new opportunities on the rise in the sciences, technology, engineering, and math. One such new program is the Research Experiences for Undergraduates (REU) program funded by the Tennessee Solar Conversion and Storage using Outreach, Research and Education (TN-SCORE) program. Although created in 2003, this research program began funding specific research opportunities for undergraduate students in STEM fields only this past summer. The program immerses these students in a nine- to ten-week long intensive laboratory experience with TN-SCORE researchers in laboratories at UT, Vanderbilt, and Tennessee Tech. Ray Henson, a senior in mechanical engineering, had the opportunity through the TN-SCORE REU program this past summer to work in the Laser Flash Photolysis and Biological Electron Transfer Kinetics Laboratory in UT's Chemical and Biomedical Engineering Department. His research, under the advisement of Dr. Paul Frymier, focused on "the reaction kinetics of photosynthesis" using laser flash photolysis in an effort to generate mutants that exhibit fast kinetics, which can then be used to "produce large amounts of hydrogen for fuel." The goal of the TN-SCORE REU program is to foster undergraduate research with a focus on alternative and renewable energy sources, and Henson commented that his research experience was valuable because "it really sparked my interest in sustainable energy, which is now a field I wish to enter."

The National Science Foundation and the Department of Energy recently funded a program at UT that will provide engineering students the opportunity to research the transmission of electricity over an extremely wide area. This new program, called CURENT, is the newest of the University of Tennessee's Engineering Research Centers and is aimed

at developing a nationwide transmission grid that is cost-effective, efficient, and reliable. Undergraduate students can apply to the CURENT program for the summer of 2012 to perform research in areas such as power systems, alternative energy sources, power transmission, and energy storage. Every student is paired with a graduate mentor under the supervision of a faculty member, providing valuable connections as well as the opportunity to engage in research on a topic as relevant as efficient electricity transmission.

ORNL and the TN-SCORE and CURENT REU programs are only a few examples of the vast number of opportunities for research available to undergraduate students in engineering, mathematics, and the sciences. These opportunities provide invaluable experience working in laboratories with faculty members and professionals in order to produce useful and relevant research and often set students on their future career paths. The results of their research provide a background for many of their senior theses or projects, lead to part-time jobs in working laboratories, and foster lasting relationships with faculty and professionals. Summer research opportunities are just one of many ways for undergraduate students at UT to participate in research, but they are undoubtedly a significant asset to the participating students' scholastic experiences.