

ANNUAL REPORT—FISCAL YEAR 2008 RESEARCH



THE UNIVERSITY of TENNESSEE 
KNOXVILLE

Auspicious.

That's the word that best describes the University of Tennessee's research and scholarly accomplishments in Fiscal 2008.

This year, we have seen some remarkable, even momentous developments in research and scholarship at the university.

And the UT Knoxville Office of Research is responding to those developments with renewed vigor and with practical changes in organization and process that will support an ever-growing research endeavor on campus.

Among the most notable events were two record-setting awards for UT Knoxville for national centers in high-performance computing and computational biology.

Seeing an increasingly research-educated public is just one part of the way university research engages with the state and nation. For example, every day UT Knoxville anthropologists take up archaeological projects for Tennessee towns and churches; social workers design methods that improve day-care centers across the state; and business researchers monitor the state's economy.

This engagement between the university and the people of the state is itself auspicious: it means a richer, more prosperous life for all Tennesseans.

Kraken and NIMBioS

The university stepped into the front ranks of supercomputing when it won a National Science Foundation Track II competition worth \$65 million to build Kraken, a Cray XT4 high-performance computer that is expected to be capable of 170 teraflops (one trillion calculations per second) upon build-out. Before installation was complete, Kraken had become one of the world's 60 fastest computers, according to the *Top500* ranking of the world's supercomputers by speed. When completed it is expected to be among the 10 fastest.

Located in a university joint-use facility at Oak Ridge National Laboratory, the National Institute for Computational Sciences provides academic researchers with computing power massive enough to process the many mathematical variables present in modern scientific problems—from how complex meteorological factors influence weather patterns to how proteins interact with biological membranes in living tissue.

NICS, as part of the state supported UT-ORNL Joint Institute for Computational Sciences, is the product of unique collaborations between the university, the U.S. Department of Energy, and the National Science Foundation, among other partners.

During FY 08 the National Science Foundation chose UT Knoxville as the site for another major national center and awarded the university \$16 million to create it. The National Institute for Mathematical and Biological Synthesis will enable biologists to apply mathematical modeling and computational techniques to biological problems as complex as the movement of species over thousands of acres or evolutionary changes in microorganisms.

The NIMBioS center is expected to draw hundreds of scientists for research collaborations, workshops, and conferences in Knoxville and at the Twin Creeks Science Center in the Great Smoky Mountains National Park, which is partnering with the university. Other institutes involved in NIMBioS are the U.S. departments of Agriculture and Homeland Security, as well as computer-maker IBM and software-maker ESRI.





SCALE-IT

Scalable Computing and
Leading Edge Innovative Technologies

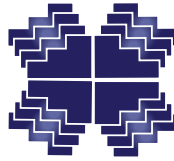
Other auspicious developments

While those big wins stand out, other UT Knoxville researchers continued to bring in awards that are the hallmark of a land-grant institution.

The university's role as an educator of fledgling researchers has been recognized with two recent NSF IGERT awards. Each Integrative Graduate Education and Research Traineeship program will support about 15 graduate students. The SCALE-IT program supports the NIMBioS center by focusing on the role of high-performance computing in biological studies, and the STAIR program explores hydrogen's role in a sustainable energy supply.

The STAIR award is part of the university's response to the global attention

now being paid to energy and sustainability. It was won by an interdisciplinary team working in the new Sustainable Energy Education and Research Center, which was recently formed to create a collaborative environment that advances sustainable energy production. SEERC coordinates the development of interdisciplinary proposals in areas like advanced materials for energy applications, direct solar energy conversion to fuels, and hydrogen fuel cells. The center complements energy initiatives in other parts of the university and at Oak Ridge National Laboratory.



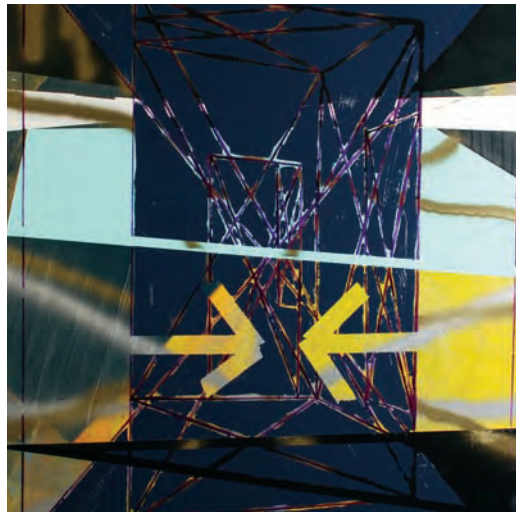
STAIR

Sustainable Technology through
Advanced Interdisciplinary Research

Individual faculty in Knoxville continue to do internationally significant work and garner recognition and honors.

- A book on writer Toni Morrison by English Professor **La Vinia Jennings** was published by Cambridge University Press and won her the Toni Morrison Society Book Prize for the best book on Morrison by a single author.
- **Jay Rubenstein's** work in medieval history added a MacArthur Foundation Fellowship to his already impressive list of honors.
- The paintings of **Jered Sprecher** have been seen in exhibits from New York, Boston, and Santa Monica to Nashville, Chicago, and Dublin, Ireland.
- **Hollie Raynor** is combining psychology and nutrition to study eating regulation and behavioral interventions in childhood obesity.
- Physicist **Pengcheng Dai** was published in *Nature* on high-temperature superconductors—his 35th published paper in three and a half years.
- **Bruce J. MacLennan**, associate professor in the Department of Electrical Engineering & Computer Science, has been appointed founding editor in chief of the *International Journal of Nanotechnology and Molecular Computation* (IJNMC), scheduled to begin publication in January 2009.
- **Jack Dongarra**, University Distinguished Professor in the Department of Electrical Engineering and Computer Science, was selected as the recipient of the first IEEE Medal of Excellence in Scalable Computing for significant contributions to the scalable computing community.
- **George Pharr**, head of the Department of Materials Science & Engineering, received the Alexander von Humboldt Award for Senior U.S. Scientists.

Jered Sprecher, *A Type of Magic*
oil on linen, 60" x 60", 2008



Auspicious Undergraduate Researchers

“Auspicious” also applies to the university’s program to involve undergraduate students in research and scholarship. The Exhibition of Undergraduate Research and Creative Activity—a spring science fair of sorts—is showing healthy growth, both in the number of participants and the quality of the research projects they share with the Knoxville community. EURēCA has grown over the past 12 years to involve 292 undergraduate exhibitors in the 2008 exhibition.

The fair is an indicator not only of the promise of a new generation of researchers and scholars but also of a citizenry educated to the meaning of research and thus better able to decide the complex issues that future research will bring them.

Summer Research and Creative Opportunities

Numerous opportunities exist at UT Knoxville for undergraduate students to become involved in original and innovative study under the direction of a faculty member. Projects may be formalized through honors or senior design requirements of academic majors or may develop as a side interest during a student’s academic career. Research and creative projects give students professional experience in their chosen fields and strongly enhance the educational experiences of talented and motivated students. Below are profiles and comments from some of these students.

Rachael Ainsworth, physics

FACULTY MENTOR: Mike Guidry

PROJECT TITLE: *Galaxy Collision Simulation and Analysis*

“I learned the importance of collaboration, since the completion of my project depended on results from other people. This project has helped me to decide that this is an area of science that I wish to pursue professionally.”

Aaron Tennessee Benson, ceramics

FACULTY MENTOR: Sally Brogden

PROJECT TITLE: *Castable*

“The research program has allowed me to do something that I would never have had the chance to do before graduating.”

Erik Bowman, biomedical engineering

FACULTY MENTOR: Wei He

PROJECT TITLE: *Directionally Guided Neuronal Cell Migration via a Chemotaxic Neurtropic Gradient*

“This has been a great opportunity for me to learn more about the methodology of research and to give me a better insight into what it takes to be a medical scientist.”

Yue Cao, electrical engineering and mathematics

FACULTY MENTOR: Leon Tolbert

PROJECT TITLE: *Multilevel Converters as a Utility Interface for Renewable Energy Systems*

“Before I came to the lab, I underestimated my value because I expected that my work was simply assisting the professor or some graduate students with manual labor; but soon I discovered that I played an important role in this project and that many things would rely on me.”

Chris Fox, civil & environmental engineering

FACULTY MENTOR: Baoshan Huang

PROJECT TITLE: *Development of a Practical Testing Procedure for the Durability of Pervious Concrete*

“This summer I was challenged with the task of developing an effective method to determine the durability of pervious concrete. Pervious concrete has many safety, economical, and environmental benefits. I personally enjoyed the freedom I had with this research and the responsibility of motivating myself to get it finished on schedule.”

Selected Honors

American Academy of Audiology &
American Academy of Audiology Foundation
New Investigator Research Award

Patti Johnstone, audiology and speech pathology

American Council of Learned Societies
Burkhardt Fellowship

Michael Kulikowski, history

American Philosophical Association
Berger Prize

David Reidy, philosophy

American School of Classical Studies Fellowship
Denver Graninger, classics

Beinecke Rare Book & Manuscript Library
Jackson Fellowship

Misty Anderson, English

Can Serrat International Art Center
Artist in Residence

Emily Bivens, School of Art
Patricia Tinajero, School of Art

Environmental and Engineering Geophysical Society
Early Career Award

Greg Baker, earth and planetary sciences

Frans Masereel Center
Artist in Residence

Beauvais Lyons, School of Art

Fulbright Program of the U.S. State Department
Fulbright Research Award

Jon Shefner, sociology

Fulbright Senior Specialist Award
Neal Shover, sociology

Guggenheim Foundation
Guggenheim Fellowship
Sergey Gavrilets, mathematics (joint with EEB)

Guggenheim Award
Sergey Gavrilets, ecology and evolutionary biology

Harland Bartholomew Award
Arun Chatterjee, civil and environmental engineering

Irish Museum of Modern Art
Artist in Residence
Jered Sprecher, School of Art

Kyoto University Museum
Visiting Professorship
Gordon M. Burghardt, ecology and evolutionary biology

Greg Houchin, psychology

FACULTY MENTOR: Jeffrey Fairbrother

PROJECT TITLE: *The effects of self-controlled amount of practice on the performance and learning of a motor skill*

“Becoming involved in research this past summer has strengthened the skills I will need in my future as a graduate student. It has also made me consider research as a career path.”

Pinky Mahbudani, biochemistry & cellular and molecular biology

FACULTY MENTOR: Barry Bruce

PROJECT TITLE: *Develop an optimized transformation and gene replacement protocol for the Thermosynechococcus elongates*

“I was very fortunate to work in Dr. Bruce’s lab and acquire useful laboratory skills. My post-undergraduate aspirations include pursuing a graduate degree, and I feel certain that an experience such as this will help me to actualize this dream.”

Samuel Mortimer, architecture

FACULTY MENTOR: Tracy Moir-McClean

PROJECT TITLE: *An in-depth investigation and planning of the South Knoxville City Sector’s Greenways and Alternative Transportation Routes*

“My research experience reinforces the ambitions that I have for my professional career. Not only have I learned a great deal about modern cartography and urban design, but I also feel better prepared for graduate and post-graduate work.”

Justin Nepa, psychology

FACULTY MENTOR: Sundaresan Venkatachalam

PROJECT TITLE: *Determining the role of chromatin remodeling in DNA damage responses*

“Coming in with no experience and leaving with a vast amount of knowledge, I have learned the fundamental principles of oncological research through this internship.”

Kristen Reeves, social work

FACULTY MENTOR: Sarah Craun

PROJECT TITLE: *Students’ Feelings of School Safety in Regard to Perceptions of Learning and Rules at School*

“Dr. Craun gave me a greater knowledge of how to conduct research. I also gained a new appreciation for research and even found that I enjoyed it.”

Max Trent, materials science

FACULTY MENTOR: Wei He

PROJECT TITLE: *Design and Development of a Polymeric Construct to Promote Nerve Growth Via Continuous Mechanical Tension*

“I plan to continue to work with my mentor through out the year and I honestly feel this experience makes me a better engineer and gives me the experience I will need for graduate school.”

Andy Welton, astrophysics

FACULTY MENTOR: Mike Guidry

PROJECT TITLE: *The Core Collapse Supernova Project at ORNL*

“I have many options for what I want to do in my research career, and this summer has opened many doors of opportunity for me. Research experience is priceless, and I look forward to learning more about the physics of the world we live in!”

Ronda Wright, sculpture

FACULTY MENTOR: Jason Brown

PROJECT TITLE: *A Green Forge*

“My self-directed educational experience and the finished results will be valuable as I graduate and move into a professional career in metal arts.”



MacArthur Foundation
MacArthur Fellowship
Jay Rubenstein, history

National Endowment for the Arts
NEA Fellowship
Margaret Dean, English

National Endowment for the Humanities
Christine Shepardson, religious studies

Social Science Research Council
Fellowship
Robert Stolz, history

Association of Icelandic Visual Artists (SIM)
Artist in Residence
David Wilson, School of Art

United States Department of Energy
Outstanding Junior Investigator Award
Thomas Papenbrock, physics

Yale University
Walpole Fellowship
Misty Anderson, English

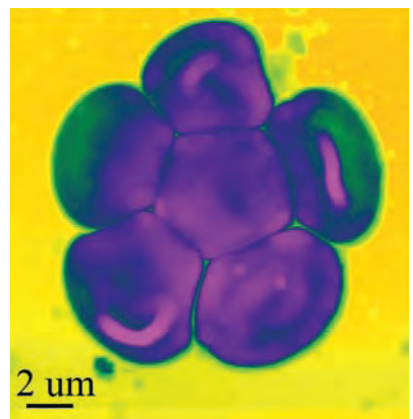
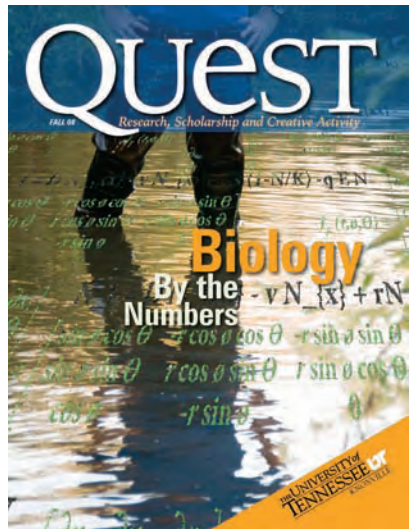


The Start of a Quest

Faculty accomplishments have prompted the Office of Research to look for new ways to get the good news out to the various people who have a stake in the success of UT Knoxville—its faculty and staff, its supporters, and its institutional peers. Thus was born *Quest*.

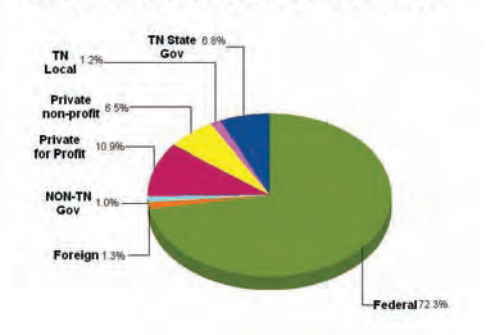
Quest is a unified communications initiative designed to raise the profile of UT Knoxville research and scholarly agendas both inside and outside the university. It involves a focused initiative to increase faculty involvement in funded scholarship and research, a broadening of the Office of Research communication goals, and the use of multiple communication channels to achieve those goals.

A completely redesigned research magazine—named, appropriately, *Quest*—will showcase UT Knoxville research to the general public and UT's peer institutions, while two alternating weekly newsletters provide faculty with the information they need to bring in new research projects. News, information, and opportunities are also presented in a totally redesigned website that features a "Scholar of the Week," highlighting individual scholar's contributions to the university's research environment.

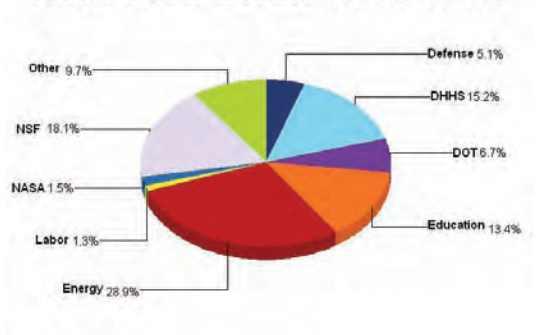


Office of Research Financial Reports

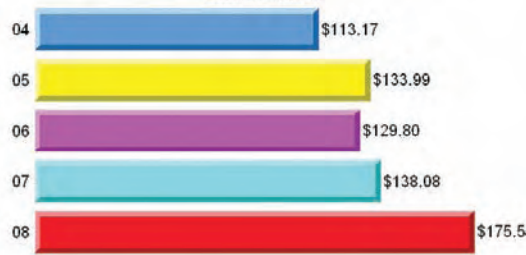
FY 2008 Expenditures from All Sources



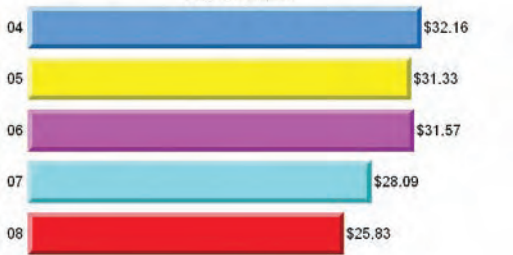
FY 2008 Expenditures from Federal Sources



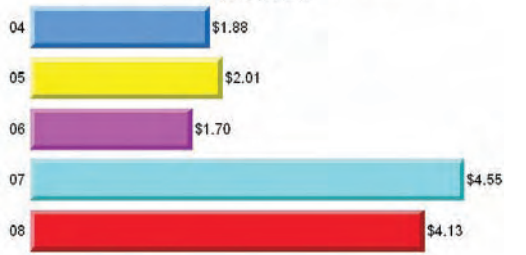
Sponsored Dollars Awarded FY 2004 - FY 2008
Dollars in Millions



Five-Year Change in Sponsored Expenditures from Flow-Thru
Dollars in Millions



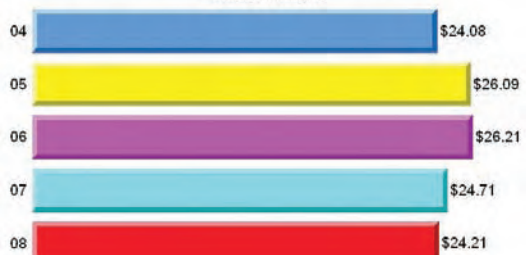
Five-Year Change in Sponsored Expenditures from Defense
Dollars in Millions



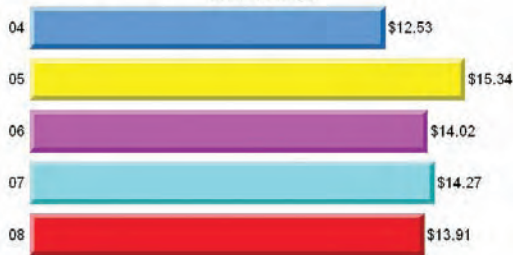
Five-Year Change in Sponsored Expenditures from Education
Dollars in Millions



Five-Year Change in Sponsored Expenditures from Energy
Dollars in Millions



Five-Year Change in Sponsored Expenditures by NSF
Dollars in Millions



Five-Year Change in Sponsored Expenditures by Industry
Dollars in Millions



Five-Year Change in Sponsored Expenditures from State
Dollars in Millions



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