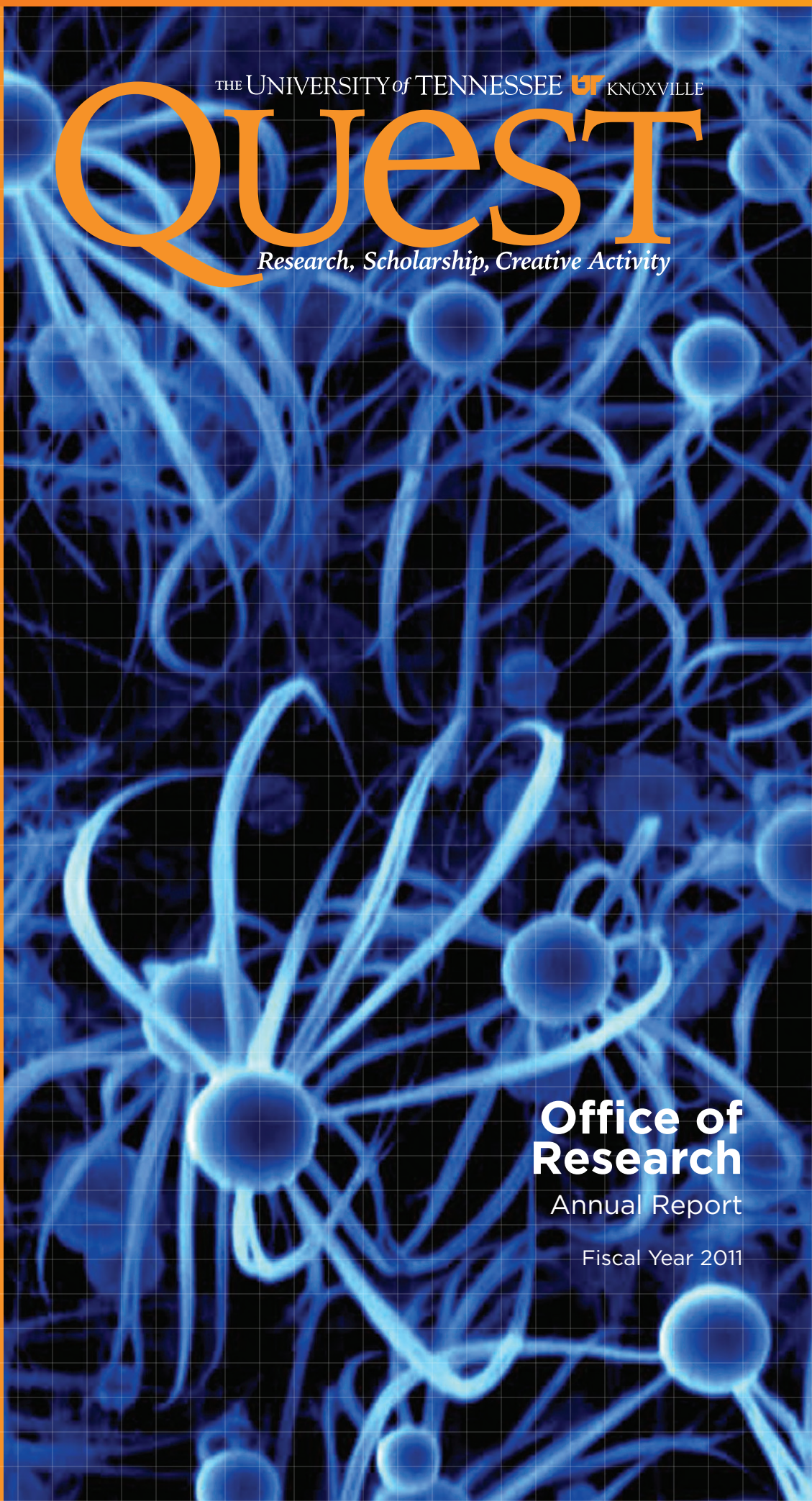
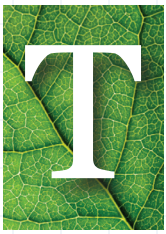

THE UNIVERSITY of TENNESSEE KNOXVILLE
Quest
Research, Scholarship, Creative Activity
Office of Research
Annual Report
Fiscal Year 2011



he veins of a leaf,
carrying moisture and nutrients
to further the life of a tree.

A mesh of spider silk,
efficiently snaring food
for its webmistress.

A watershed,
a riverine network of streams and creeks,
ponds and lakes,
birthed by gravity,
that drains a landmass.

From the earliest moments of culture,
humans have turned those natural models to their own purposes,
knitting baskets, weaving cloth,
knotting twine to catch fish or birds,
developing networks of trails
for transportation and communication.

The grid, the web, the net,
structures of connection and conveyance,
frameworks of capture or communication
a linkage of essential points,
abstracted from the nonessential, the everyday,
to increase strength, harness power, create efficiency.

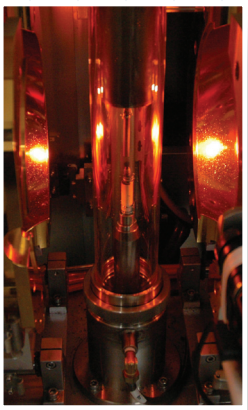
In the twenty-first century, grids and networks have grown
vastly more complex, remarkably more sophisticated,
and unimaginably more vital to the existence and survival
of a global society.

THE UNIVERSITY OF TENNESSEE, KNOXVILLE is engaged in weaving the warp and woof of human knowledge, and in 2011, university researchers focused much more explicitly on grids, creating them and exploring, expanding, improving, and exploiting their fullest promise.

ometimes the growth of grids is haphazard.
Connections develop casually,
as an informal response to immediate needs
for linkages.

A grid can become a snare,
enmeshing efficiencies in structures
that become mazes
instead of links.

The growth in a network builds a complexity
that demands control, requires refinement
to achieve optimal performance
and ensure crucial needs are met.



THE DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE will take the lead role in a new $18 million Engineering Research Center devoted to developing innovative control technologies for the nation's electric power grid. The Center for Ultra-wide-area Resilient Electric Energy Transmission Networks (CURENT) will be directed by **Kevin Tomsovic**. **Yilu Liu,** Governor's Chair for Electrical Engineering and Computer Science, will be co-director for the center, which will develop solutions for a national grid that has been chronically overstretched by rapidly growing electricity use. The center will use wide-area synchronized measurements, large-scale computer simulations, and hardware test beds to develop technologies that will keep the grid resilient in the face of growing continent-wide demand.

Improvements to the existing grid will allow renewable energy sources to be integrated into the network, reducing the nation's use of fossil fuels.

Education will be an important component of CURENT, as the center will develop interdisciplinary opportunities for students at all levels that will enable them to assume leading roles in a new generation of electric power engineering professionals.

The CURENT ERC will find a home in the new Min Kao Electrical Engineering and Computer Science Building. The new facility was made possible by a gift from alumnus Min Kao, co-founder of Garmin Corporation.

Sometimes there is a need to go off the grid,
to minimize the use of common assets,
to lessen the tug of individual
on the fabric of community.

Yet getting away from the grid still requires
a network of knowledge, an awareness of
connections,
an ability to tie together skills and information
from disparate sources
into a result that meets individual needs
while serving the larger good.

CONSTRUCTION OF THE NEW NORRIS HOUSE was completed as the 2011 fiscal year came to an end. The structure and landscape—a collaborative effort led by **Tricia Stuth** and **Robert French** of the School of Architecture—seeks to recapture and update for the twenty-first century the kind of healthy, comfortable, energy-efficient, and environmentally responsible homes pioneered in the 1930s in Norris, a planned community associated with the construction of the Tennessee Valley Authority's Norris Dam.

Drawing on UT expertise in architecture, civil and environmental engineering, planning, landscape, sustainability, and community partnerships, the project combined state-of-the-art knowledge of human, technological, and environmental disciplines into a 768-square-foot structure that embodies the best in sustainable urban living. Clayton Homes provided modular expertise that allowed the shell of the structure to be built in a factory setting and installed on the site. Local government and commercial enterprises contributed materials and support for the effort, which pioneered decreased use of lumber, passive temperature control, and various methods of capturing or reusing water.

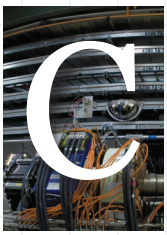
The New Norris House won an Environmental Protection Agency competition in 2008. The National Council of Architectural Registration Boards also honored the project with its 2011 prize for creative integration of practice and education in an academic setting.

The completed dwelling is being occupied and studied for a year and then will be offered for sale to the general public.

Credit: Ken McCown

The grid can be a net, a linkage of discrete points that,
when connected,
captures data and creates a framework
to give meaning to the particular,
to transform facts into knowledge.

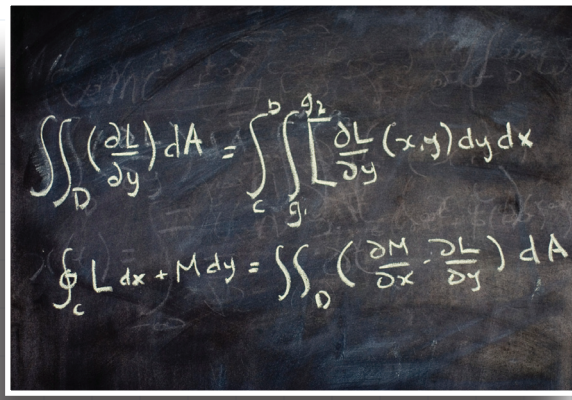
IN THE IMPRECISE WORLD OF INTERPERSONAL RELATIONSHIPS, UT psychologists are creating blueprints of behavior that are at the forefront of efforts to understand intimate human interactions. **Deborah Welsh** studies adolescents' first steps toward intimate relationships. **Kristina Coop** explores the dynamics of infidelity in couples and has developed a model for moving toward reconciliation. **Gregory Stuart** and **Todd Moore** document different facets of the interaction between substance abuse and intimate-partner abuse. **James McNulty** challenges the commonly accepted clinical wisdom about relationships to look for deeper principles of behavior. Together they are recognized nationally for creating a framework that captures essential knowledge about how humans behave in relationships.



reating networks, engineering grids require connecting organizations and linking their programs in ways that bolster existing emphases and expand their reach, bringing separate goals into an overarching initiative.

THE UNIVERSITY STRENGTHENED EXISTING TIES with the Y-12 National Security Complex in a memorandum of understanding that will expand collaborations between the two institutions and encourage the development of joint research projects. The organizations expect to expand ongoing education and training programs that have brought UT MBA students into work settings inside the security complex. The new agreement, similar to one already in place with Oak Ridge National Laboratory, is expected to foster joint faculty and research appointments at both institutions in the immediate future and create the possibility of joint research institutes and centers of excellence in national security and manufacturing-related areas. Y-12, which is operated by a collaboration between Babcock and Wilcox and Bechtel National, is a primary resource for the nation's nuclear and national security needs.

Internally, the Office of Research completed the first iteration of its Research Capacity Catalog, a resource that indexes the major organized research units on campus. The list of more than 200 research groups will allow interested parties both within and outside the university to locate and engage UT scholars working on specific topics. The catalog is expected to be a primary tool in making UT research more accessible to other researchers and to the public. It will be a work in progress, continually revised to reflect current scholarly activities.

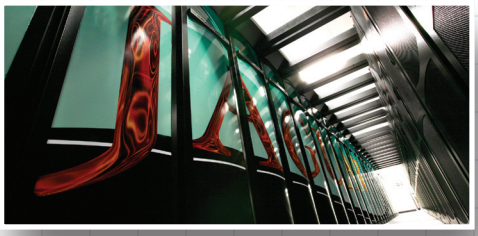


The office also supported the university's initiative to become a Top 25 university. Undergraduate involvement in research was incorporated in the metrics used to measure the university's progress toward the Top 25 goal, and a number of research experiences for undergraduates were offered, including the synthesis and characterization of advanced functional materials by **Veerle Keppens** and **Claudia Rawn** and sensing and signaling in cell biology and genetics by **Cynthia Peterson.** UT Knoxville also had a presence in TN-SCORE, a statewide undergraduate research conference sponsored by the National Science Foundation's Experimental Program to Stimulate Competitive Research and the Council on Undergraduate Research. The **National Institute for Mathematical and Biological Synthesis (NIMBioS)** continues to hold an annual conference that brings together undergraduates working in the mathematical and biological disciplines.

a research world increasingly defined by massive calculating power, linkages are as vital as computational muscle to make effective use of the nation's computer infrastructure. Grids negate space. Networks counteract distance. A computer is only as useful as the connections it can make.

UT will play a major role in creating a new generation of linkages among the nation's high-performance computers and research facilities. The university's National Institute for Computational Sciences (NICS) is receiving $18 million to help create the Extreme Science and Engineering Discovery Environment (XSEDE), a five-year, $121 million project by the National Science Foundation (NSF) that will replace the existing TeraGrid linkage.

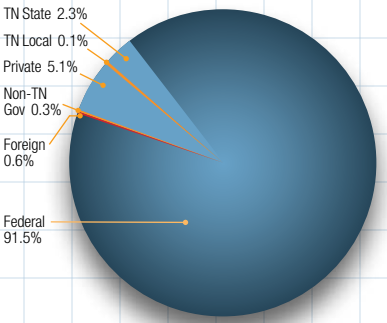
XSEDE
Extreme Science and Engineering Discovery Environment



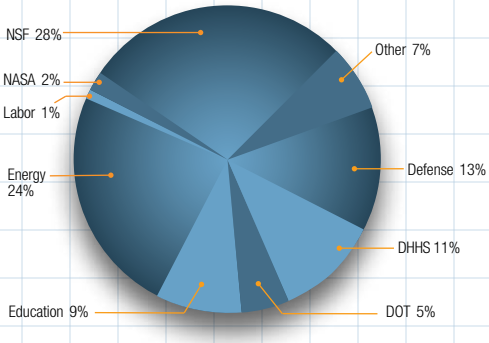
NICS operates the NSF supercomputing complex housed at Oak Ridge National Laboratory that includes Kraken, the world's most powerful academic computer, as well as Nautilus, a massive computer used to analyze and visualize the results drawn from other supercomputers. NICS staff will collect and evaluate the needs and requirements of scientists who use the XSEDE grid. Since 2008, NICS has received nineteen NSF awards totaling more than $111 million.

Patricia Kovatch, interim project director for UT's Joint Institute for Computational Sciences, and **James Ferguson**, director of education outreach for JICS, will have central roles in the project.

Expenditures from Prime Sources (FY 11)

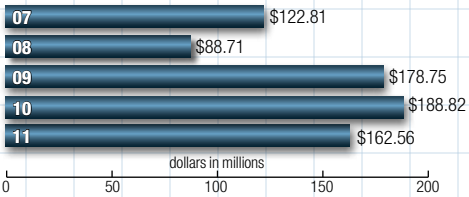


Expenditures from Federal Sources (FY 11)

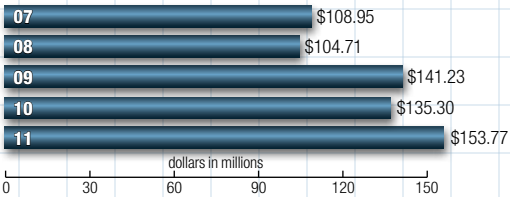


NOTE: Federal expenditures include funds from both sponsored programs and federal flow-through.

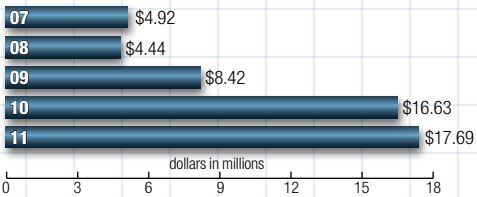
Sponsored Dollars Awarded (FY 07-11)



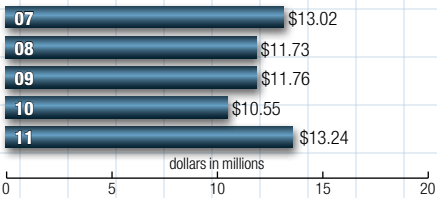
Five-Year Total Sponsored Expenditures (FY 07-11)



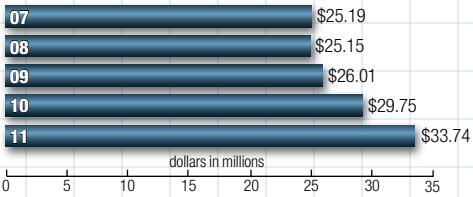
Five-Year Change in Sponsored Expenditures from Defense (FY 07-11)



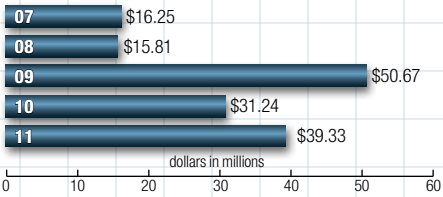
Five-Year Change in Sponsored Expenditures from Education (FY 07-11)



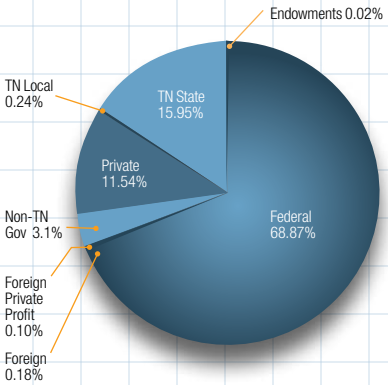
Five-Year Change in Sponsored Expenditures from Energy (FY 07-11)



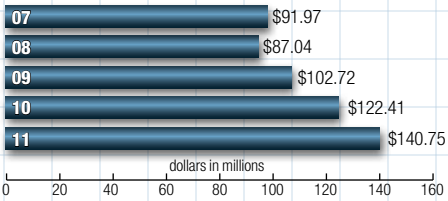
Five-Year Change in Sponsored Expenditures from National Science Foundation (FY 07-11)



UTK Award Amount by Direct Sources (FY 11)

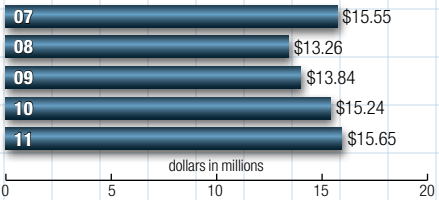


Five-Year Total Sponsored Federal Expenditures (FY 07-11)

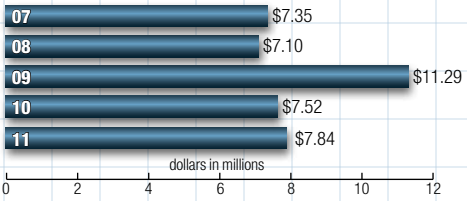


NOTE: Federal = Federal Direct + Federal Flow-through

Five-Year Change in Sponsored Expenditures from Health & Human Services (FY 07-11)



Five-Year Change in Sponsored Expenditures from Industry (FY 07-11)



THE UNIVERSITY of TENNESSEE KNOXVILLE

Office of the Vice Chancellor for Research
Blount Hall, 1534 White Avenue
Knoxville, TN 37996-1529

www.research.utk.edu
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The mission of the Office of Research is to enable all University of Tennessee faculty, investigators, and students to achieve their full potential as scholars.

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Revisions: Project #2940