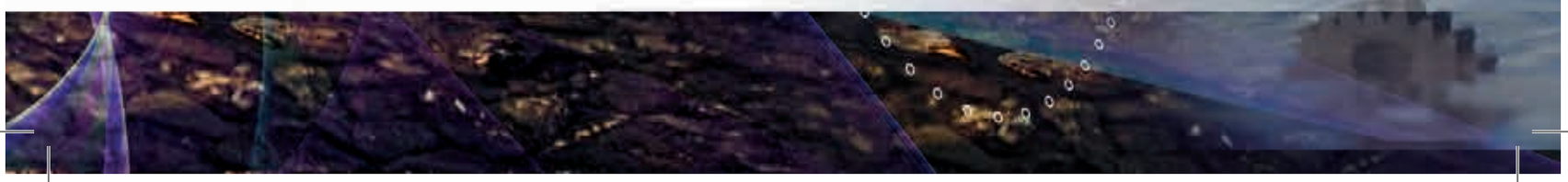
TENNESSEE STATE UNIVERSITY

The Office of Research and Sponsored Programs

2018 Research Horizons



From the President

Greetings,

In this age of electronic global commerce, it is imperative that universities engage in research that serves to expand and deepen the understanding of the immense impact and infinite potential of science, engineering, business, the humanities, and all other areas of international interaction.

Tennessee State University (TSU) faculty eagerly accept the rigors of scientific research with skill, dedication, and limitless creativity. Each year, the research capabilities of TSU, Nashville's only public university, continue to expand and research awards are on an exciting upward path.

Our commitment is to undertake research that is pertinent to addressing global challenges targeted by the research community at large. I commend our faculty and staff for their continued message that Excellence is our Habit!

Sincerely,

Glenda Glover
President

From the Vice President

Greetings,

Research advances discovery and innovation. It is imperative that individuals continue to engage in cutting-edge scholarship that advances society. Research awards received by our faculty at Tennessee State University (TSU) have grown tremendously, with 821 awards totaling more than $202,500,000 over the last four years. This increase in funding for our faculty, staff, and students attests to the exciting, innovative, and high quality work here at TSU. It is also evidence that the research being conducted at TSU is pertinent to addressing global challenges targeted by the research community at large.

The support from the Division of Research and Institutional Advancement and the exciting goals we have set for our future fosters an environment where our faculty can advance their scholarship and research. TSU has a vast portfolio of research programs including: animal science, plant genetics, biotechnology, food safety and security, robotics, autonomous vehicles, physics and astronomy, learning sciences, health disparities, nutrition, mechatronics, advanced materials, cyber security, advanced manufacturing, and renewable energy.

Our commitment is to produce research that will continue to deliver solutions to local, regional, national, and global challenges. We look forward to forging new partnerships and embarking upon new challenges. I commend our faculty, staff, and students for their hard work and continued efforts that dare to inspire, innovate, and impact!

Sincerely,

Lesia Crumpton-Young, Ph.D.
Vice President and Chief Research Officer

TSU AT A GLANCE

77
MAJORS IN EIGHT UNDERGRADUATE AND GRADUATE COLLEGES AND SCHOOLS

405
FULL-TIME ACADEMIC FACULTY

RESEARCH FUNDING PER FISCAL YEAR

2016
$54,400,000

2018
$53,154,942

2015
$51,500,000

2017
$43,500,000

Colleges of the University

COLLEGE OF AGRICULTURE, HUMAN, AND NATURAL SCIENCES

Department of Agriculture and Environmental Sciences
Department of Family and Consumer Sciences

The faculty of the College of Agriculture, Human, and Natural Sciences are engaged in conducting innovative research to solve problems facing our state, nation, and the world. The focus is on finding solutions to challenges faced by socially and economically disadvantaged groups and contribute to the prosperity of all. Research areas include childhood obesity prevention, food safety, climate change, and renewable biofuels.

COLLEGE OF BUSINESS

The College of Business is uniquely poised as a strong, robust, and expanding educational, entrepreneurship and research engine, positively impacting the entrepreneurial and economic tapestry of Nashville, the State of Tennessee, and the world. The faculty are engaged in conducting applied, discipline-based, and pedagogical research in accounting, business management, economics, finance, and information systems and technology.

COLLEGE OF EDUCATION

The College of Education faculty are engaged in research that examines disparities in education and student learning. They strive for the development of innovative models of instruction, such as; the integration of technology to influence student learning outcomes; strategies to increase representation of under-served populations engaged in science, technology, engineering, and mathematics (STEM) education; and more inclusive models of student academic success that are designed to impact student retention.

COLLEGE OF ENGINEERING

The College of Engineering faculty are conducting research in signal and image processing, intelligent control systems, robotics, artificial intelligence tools, bioinformatics, health monitoring, systems engineering, wireless communication, and cybersecurity.

COLLEGE OF HEALTH SCIENCES

The faculty of the College of Health Sciences are engaged in conducting research that includes speech pathology and audiology, behavioral science approaches to reduce health disparities, obesity, diabetes, and breast cancer prevention and treatment.

COLLEGE OF LIBERAL ARTS

The faculty of the College of Liberal Arts are engaged in conducting research in areas that reflect knowledge and potential of new interdisciplinary fields while continuing work in the traditional academic disciplines at the heart of a university. The research includes studies in geosciences and environmental justice; global perspectives on civil rights and justice issues; African American history, literature, and culture; education in music, history, literature, and language; global perspectives in art; and criminal justice.

COLLEGE OF LIFE AND PHYSICAL SCIENCES

Department of Chemistry

Research from the faculty of the Department of Chemistry is focused on environmental science, cancer, viruses, drug design, the synthesis of novel inorganic materials, and the interactions between different biological systems and membrane constituents.

Department of Biological Sciences

The faculty of the Department of Biological Sciences are engaged in research endeavors in the broad area of cellular and molecular biology. Research activities involve studies of plant extracts and the effect of cancer cell growth and function, studies of the role of D3 receptors in neuronal development, studies of collagen assembly and trafficking, and studies of global change ecology.

Department of Mathematical Sciences

Research interests from the faculty of the Department of Mathematical Sciences include applied mathematics, mathematical modeling, functional and numerical analysis, algebra, mathematics education, wavelets, physics, and astronomy.

UNIVERSITY HONORS COLLEGE

The University Honors College (UHC) provides an especially rich and challenging set of academic offerings to talented and highly motivated students at Tennessee State University. Through special courses, a vigorous intellectual community, and emphasis on undergraduate research, the Honors College enables students to reach heights of excellence!

COLLEGE OF PUBLIC SERVICE

The faculty of the College of Public Service are engaged in conducting research specific to leadership; intergovernmental relations, public finance, public policy; policy and economics of education; environmental policy and justice, urban planning and policy, economic development, gentrification, non-profit management and community revitalization; public administration and policy analysis; state lottery policy; health policy; social work; and aging.

RESEARCH CENTERS AND INSTITUTES AT TENNESSEE STATE UNIVERSITY

Center for Advancing Faculty Excellence (CAFÉ)
Center for Aging: Research and Education Services (CARES)
Center for Entrepreneurship and Economic Development
Center for Prevention Research
Center of Excellence for Battlefield Sensor Fusion
Center of Excellence for Learning Sciences
Center of Excellence in Information Systems Engineering and Management
Cooperative Extension Program (CEP)
Institute of Food, Agricultural, and Environmental Research (IFAER)
Institute of Government
Nanoscience and Biotechnology Core Facility
Otis L. Floyd Nursery Research Center at McMinnville
TSU Interdisciplinary Graduate Engineering Research (TIGER) Institute

- Advanced Visualization and Computing
- Bioinformatics
- Cybersecurity
- Mechatronics
- Nano-materials
- Renewable Energy Systems

Tennessee State University Research Capacity

Founded in 1912, Tennessee State University (TSU), a Historically Black College and University (HBCU), fosters scholarly inquiry and research, lifelong learning, and a commitment to service. This 1890 land-grant institution is Nashville's only urban, coeducational, and comprehensive public university, as well as Middle Tennessee's first public Carnegie Doctoral/Research institution. TSU has demonstrated expertise as a strong, robust, expanding educational and entrepreneurial research engine with a continuous positive impact on the economic tapestry of Nashville, the State of Tennessee, region and nation. Through coordination and an interdisciplinary approach, the university offers unparalleled research, produces workforce ready talent, and provides educational and technical assistance services to students, scholars, industries, communities, and business partners around the globe.

Strategic Research, Technical Assistance, and Outreach Priorities

Tennessee State University delivers solutions to local, regional, national, and global challenges through sixteen strategic priority areas.

1. Cybersecurity, Cyber Physical Systems, Bioinformatics, & Interoperability
2. Renewable Energy
3. Big Data Analytics
4. Food Supply Security and Sustainability
5. Critical Incident Preparedness
6. Health Disparities and Chronic Disease Prevention and Treatment
7. Workforce Pipeline Development
8. Early Childhood Education
9. Rural Economic Development and Urban Planning
10. Biotechnology and Nanosciences Advanced Materials
11. Astrophysics
12. Transportation Systems
13. Advanced Manufacturing
14. Autonomous Vehicles
15. Mechatronics
16. STEM Education and Workforce Development

Key Partnerships

The university partners with government agencies, non-profits, private foundations, corporations, and other universities to conduct innovative research and provide technical assistance. Selected partners include: NSF, DOD, ONR, ORNL, Administration for Children and Families, Rolls Royce, Clarkson Aerospace, Boeing, NIH, NIFA, ARL, Vida Labs, TVA, NASA, Vanderbilt University, University of Minnesota, etc.

Research and Technical Assistance Approach

The university offers an array of techniques, approaches, methodologies, and services for solving the world's most pressing issues and providing assistance to communities. Common approaches used include: Feasibility Studies, Economic Impact Modeling, Simulation Testing, Prototype Development, Data Mining, Trend Analysis, Market Analysis, Stress Testing, Automatic Target Recognition Testing, Learning and Behavioral Assessments, Confocal Imaging, Needs Assessments, etc.

Research and Technical Assistance Centers and Laboratories

The university hosts several centers and laboratories that provide cutting edge research and transformative technical assistance to communities.
Center of Excellence for Information Systems and Engineering Management
Center of Excellence for Learning Sciences
Center for Entrepreneurship and Economic Development
Tennessee Small Business Development Center
TIGER Institute
Center for Aging

For more information contact:

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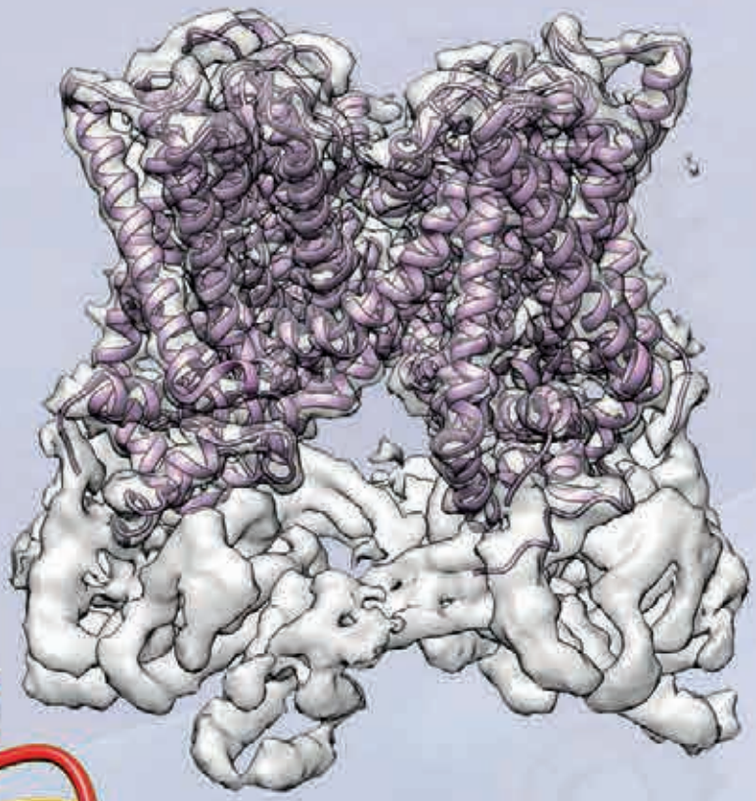
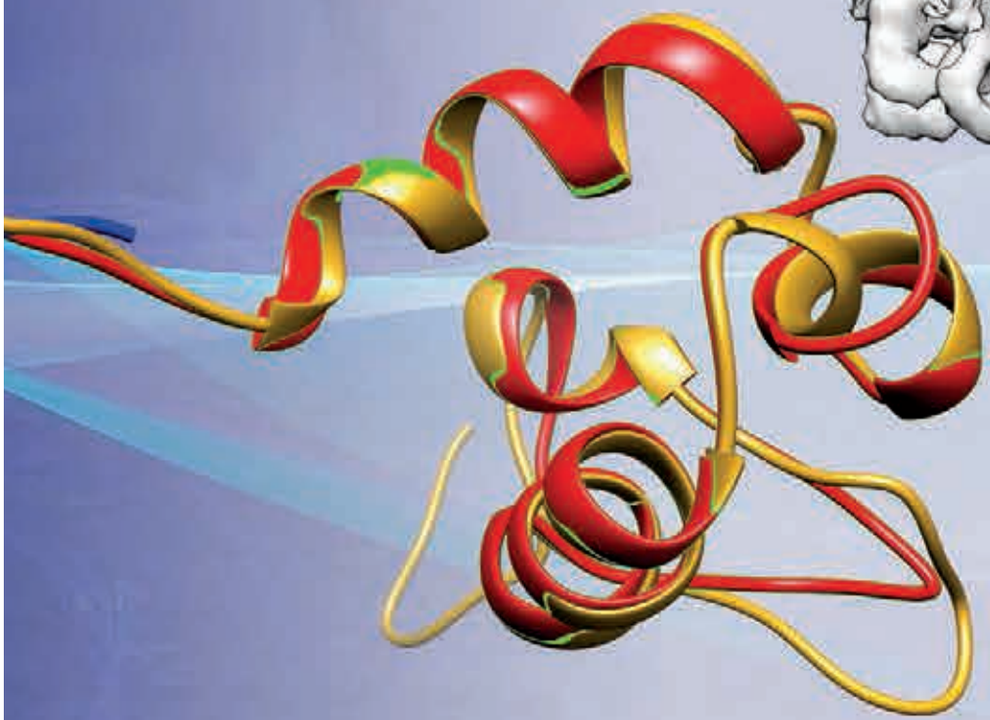
Research Project Highlights

Dr. Kamal Al Nasr

The diverse and dynamic biological functions of proteins are vital to all living organisms. Understanding the biological role of either individual protein molecule or a complex of proteins requires knowledge of their structures. Dr. Kamal Al Nasr, Assistant Professor of Computer Science, was awarded approximately $700K National Science Foundation (NSF) and National Institutes of Health (NIH) grants to develop new and efficient computational methods to model macromolecular proteins. Dr. Al Nasr says, "the funded research will help to develop computational methods that conquer the drawbacks of conventional experimental methods which include the time and cost." The project, "Research Initiation Award: Leveraging Protein Structure Determination: An Efficient Algorithmic Approach" aims at modeling macromolecular and membrane proteins that are part of the contemporary drug targets. Most pharmaceutical and medicinal companies spend an excess of $60 billion each year on developing drugs that target membrane proteins, though there is an insufficient amount of information about the membrane proteins themselves.

Dr. Al Nasr's research aims to improve health and the economy simultaneously. Dr. Al Nasr and his collaborating students analyze 3-D images produced by Cryo-Electron Microscopy (cryo-EM), a biophysics imaging technique that strives towards accurately visualizing and interpreting unstained nanostructure biological complexes such as viruses. However, most of the images are produced at low/medium resolution and, consequently, computational methods are essential to process these images in order to predict the structure of the proteins. This research will help TSU prepare a strong workforce of students ready to engage in various areas of Bioinformatics. Dr. Al Nasr believes his research activities will enhance integration of research and education in Biology and Computer Science with the goal that underrepresented students will be more motivated to pursue career in the STEM fields.

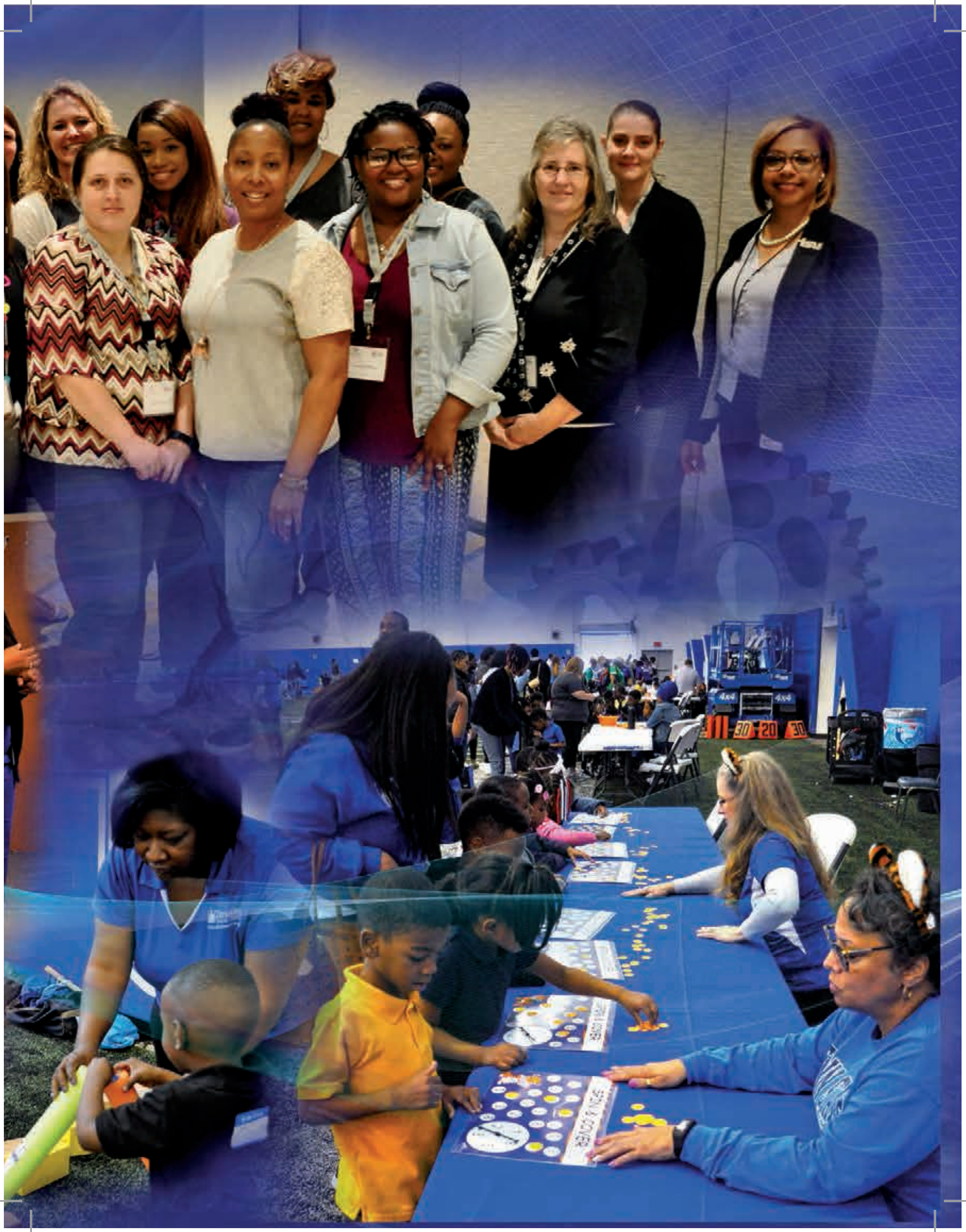




The volumetric image of the structure of the mammalian transient receptor potential channel (TRPV1) at 3.4Å

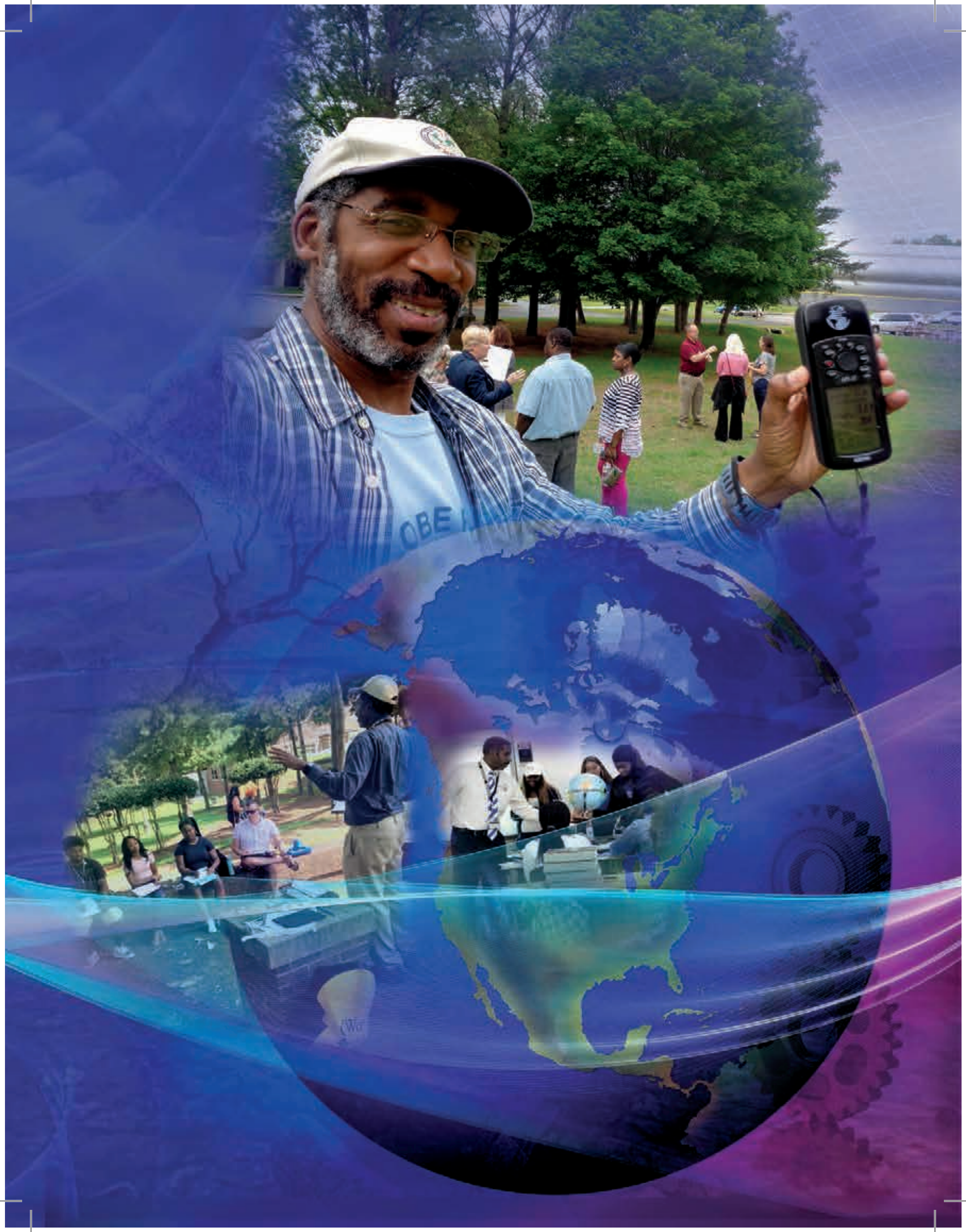
Dr. Kimberly Smith

Dr. Kimberly Smith has made dramatic improvements to the Tennessee Comprehensive Area Resource Efforts (TN CAREs), TSU Early Head Start-Child Care Partnership (EHS-CCP), and Tennessee Early Childhood Training Alliance (TECTA) programs as the Director for the Center of Excellence for Learning Sciences. Dr. Smith was awarded a total of $7,827,169.95 of grant funding in her first year alone. The TN CAREs EHS program focuses on prevention and early intervention with low-income families and provides coordinated comprehensive, intensive, and continuous support services to enable families to attain self-sufficiency, while recognizing the integrity and unique needs of these families and children. The program provides services for 112 children across three counties in Northwest Tennessee. TSUs EHS-CCP is a collaboration between TSU and privately owned childcare centers within the north Nashville area of Davidson County. Through this partnership, the TSU EHS-CCP provides comprehensive child development and family support to 80 children in 10 classrooms via high quality full year, full-day, services for qualified working families. Services include funds for teacher training and professional development, dental screenings, wellness checks, diapers, and baby formula-all for no charge. TECTA is a statewide program that provides free training and academic tuition support to childcare providers and administrators. TECTA provides academic advisement, tuition support and systematic development at 19 higher education institutions statewide. It also offers a High School Course Orientation Equivalency and offers online training for the CDA® Credential Attainment. This year, TSU has also become the administrative headquarters for the Tennessee Family Childcare Association.



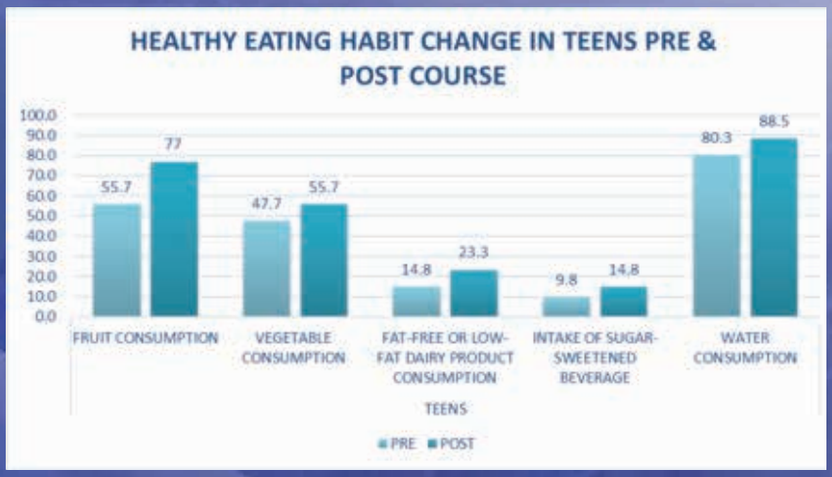
Dr. David A. Padgett

Dr. David A. Padgett, Associate Professor of Geography and Director of the Geographic Information Sciences Laboratory at TSU and TSU's Global Learning and Observations to Benefit the Environment (GLOBE) Partnership Trainer since 2001, is participating in his third year as part of the GLOBE Mission Earth Project, a collaborative of multiple universities and institutions including NASA. The Project is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process, and contribute meaningfully to our understanding of the Earth system and global environment. Dr. Padgett's NASA Assets to Build Systemic Innovation in STEM Education at TSU provides teachers with hands-on science learning strategies and techniques to improve science education from kindergarten through high school. TSU proudly graduates more teachers than any other Historically Black College and University (HBCU). The program is open to pre-service teachers, who may become inspired to teach in a STEM field, and it provides additional professional development for in-service teachers at four Nashville public schools. Alarmingly, many K-12 teachers in science lack proper training or a science background. Dr. Padgett is therefore researching how improvements in teacher training and the placement of quality STEM teachers in Tennessee classrooms affect student achievement.



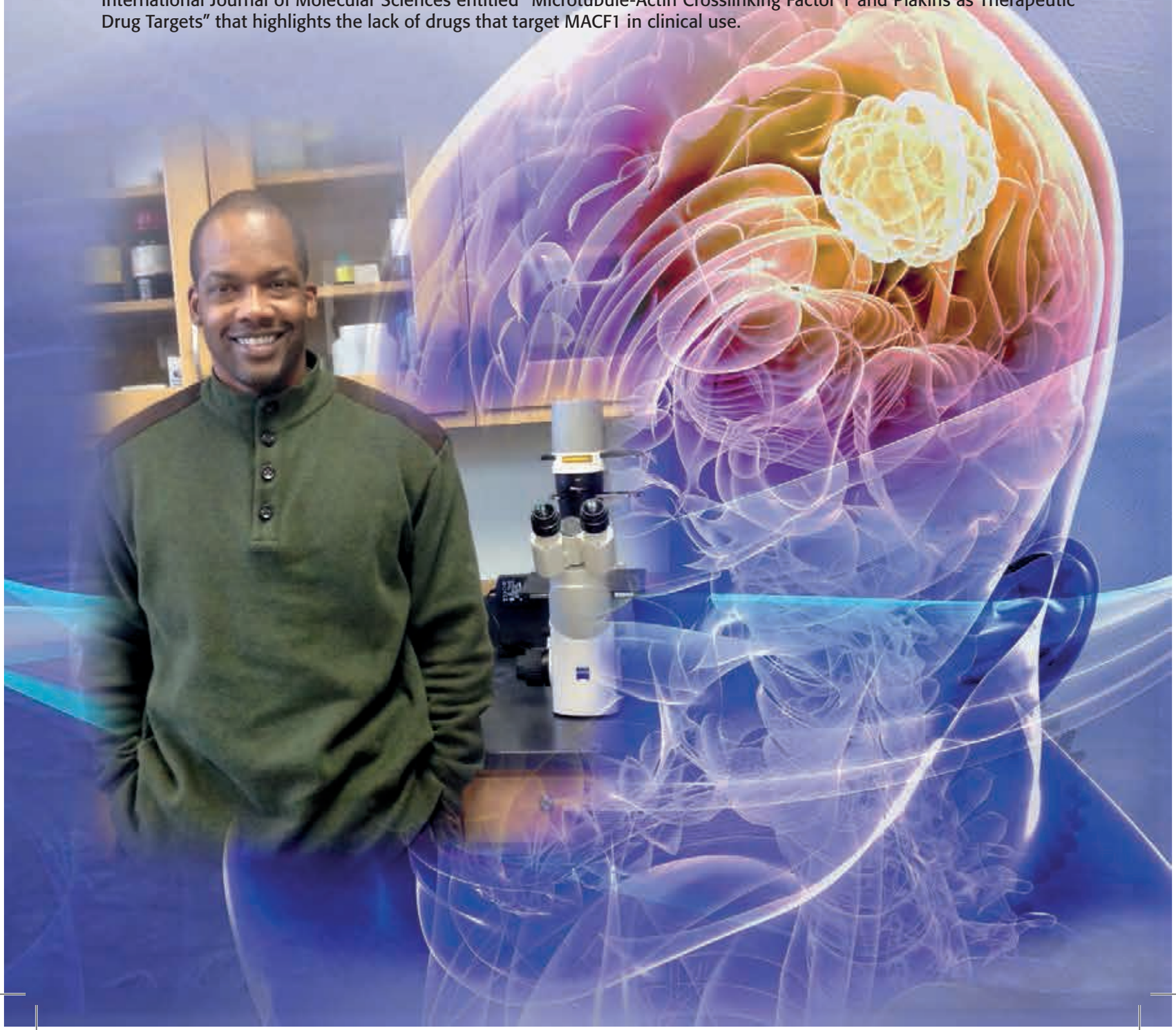
Leslie Speller-Henderson

Dr. Leslie Speller-Henderson, Assistant Professor for the Department of Human Sciences in the College of Agriculture, was awarded almost $2 Million by the United States Department of Agriculture (USDA) for her program, Nutrition Education for SNAP/Food Stamp Program. The program assists SNAP recipients, low income individuals, and individuals residing in communities with a significant low-income population by promoting their awareness, knowledge, and skills related to healthy nutrition. It also promotes an increase in daily physical activity behaviors and obesity prevention through multi-level interventions and community and public health approaches. The program provides individual or group based direct nutrition education to deliver effective, evidence- based and obesity prevention programming to encourage the targeted audiences to adopt the recommendations of the Dietary Guidelines for Americans 2015. The program has demonstrated a significant increase in healthy eating habits in children, as demonstrated by the graph below.



Dr. Quincy Quick

Tennessee has the fifth highest rate of cancer-related deaths in the United States. Dr. Quincy Quick, Associate Professor in the Department of Biological Sciences College of Life & Physical Sciences, is currently heading a research project titled "Targeting Microtubule Actin Crosslinking Factor 1 (MACF1) in Glioblastoma" that is supported by a grant from the National Institutes of Health and conducted in collaboration with scientists at Vanderbilt University and the University of Memphis. Glioblastomas are the deadliest and most difficult brain tumors to treat with a 12 - 18 month median survival and only a 5% survival rate five years post-diagnosis. He has identified MACF1, a cytoskeletal crosslinking protein, as a potential novel diagnostic and prognostic biomarker, which has promise for use as part of the precision medicine approach to for cancer diagnosis and treatment in Tennessee. Using bioinformatics, Dr. Quick has also identified genetic alteration frequencies of MACF1 in a wide range of cancers, not just glioblastomas. These findings suggest that this protein plays a role in the development, progression, and maintenance of different human cancers and consequently may be a clinical target in numerous types of cancers. One limitation to the progression of identifying biomarker cancer targets, such as MACF1, and targeting them clinically is the lack of available drugs. This year, Dr. Quick has published a review article in the International Journal of Molecular Sciences entitled "Microtubule-Actin Crosslinking Factor 1 and Plakins as Therapeutic Drug Targets" that highlights the lack of drugs that target MACF1 in clinical use.



Dr. Tina Smith

Dr. Terrie Gibson

Dr. Tina Smith continues to maintain grant funding for the project entitled, "Provision of Online and On-Campus Course Work Leading to the Master's Degree in Speech-Language Pathology" while she and Dr. Terrie Gibson actively pursue their research goals. The training grant, currently in a five-year cycle, helps students to obtain the Master of Science (MS) degree in Speech and Hearing Science and prepares them to become highly qualified, licensed speech language pathologists (SLPs) who are trained to provide services to individuals with communication disabilities in adherence with federal law.

Since the inception of the training grant program, 100+ graduates have been placed in the Tennessee public school system to help fill the vacancies and reduce the shortage of SLPs working with children who possess speech, language, hearing and swallowing deficits.

This fiscal year, the department was awarded a total of $412,232 for training preparation. However, Dr. Smith and Dr. Gibson have used small research grant funds to address the needs of underserved groups. In partnership with the Knowles Assisted Living and Adult Day Care Facility, Dr. Smith focuses on the efficacy of using impairment-based verses functional-based approaches to treat persons with neurological disabilities due to stroke, traumatic brain injury and/or dementia. The site also serves as a training environment for TSU graduate students in the MS program to perform assessments and group therapy sessions with persons with cognitive and linguistic communication disabilities.

Dr. Gibson collaborates in her research with the Hadley Park Community Center in Nashville. She examines whether a cognitive communication stimulation/intervention program can help improve memory and word-retrieval in elderly persons. This research provides access to opportunities for those individuals who might not have the means to engage in clinical therapy that addresses and tests their mental stimulation capabilities.

Dr. Lonnie Sharpe

Dr. Lonnie Sharpe, Tennessee Louis Stokes Alliance for Minority Participation (TLSAMP) Executive Director, Dean of College of Life & Physical Sciences, and Massie Chair of Excellence, was funded for the 16th year of his Department of Energy (DOE)-community empowerment program. The program has supported the DOE in its effort to build community capacity for meaningful participation in DOE and federal activities since 2002. The program creates technology centers in underrepresented communities in the Mississippi Delta and the Nashville area, and provides these communities with training and technical assistance. These centers give communities access to Federal agencies and a wide range of environmental information on the Internet previously unavailable so that people can more easily make decisions that have environmental impacts within their own communities. To date, the program has refurbished and distributed over 20,000 computers to these communities. They continue to conduct training programs that include computer-based and Internet tools, toxic release, chemical, and risk assessment information, and community economics. They also provide economic development tools, entrepreneurship training, and other resources such as proposal writing and grants management to make the centers economically self-sufficient. The program additionally funds twenty to thirty people annually to attend the Environmental Justice Conference in Washington D.C.

Environmental Justice Technology and Training for Community Capacity

Excellence is our Habit!

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