



Ascending to New Heights in Research and Sponsored Programs



TENNESSEE
STATE UNIVERSITY

The Office of Research and Sponsored Programs

2019
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

Tennessee State University At A Glance



Achieved High Research
(R2) Carnegie Status



417 Full-time
Academic Faculty



Undergraduate
Student-faculty
Ratio: 12 to 1



77 Majors in Eight
Undergraduate,
Graduate Colleges
And Schools



520 Campus Acres,
275,000 sq. ft.
Downtown Campus,
3 Farms



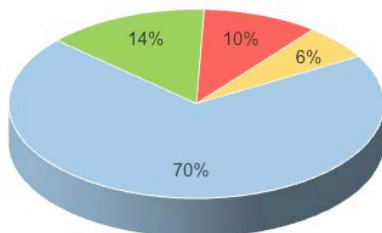
Fall 2018
Undergraduate Student
Enrollment: 6,121



Fall 2018
Graduate Student
Enrollment: 1,653

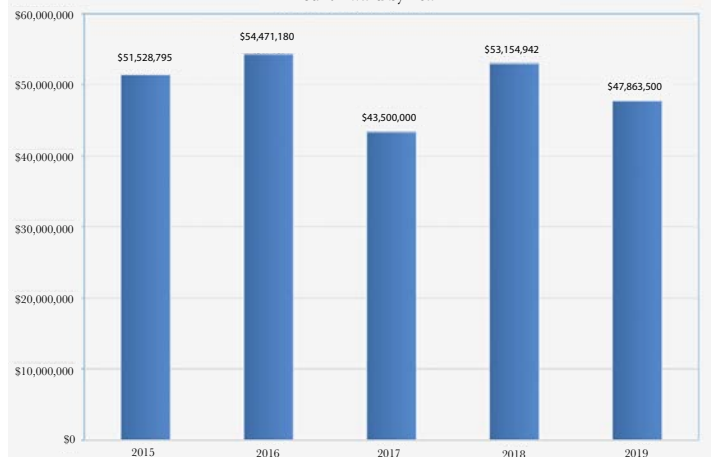
Research Funding per Fiscal Year

Awards By Source



■ Federal (91) ■ State (18) ■ Other (13) ■ Private (8)

Amount Award by Year



DR. FRANCES R. WILLIAMS NAMED ASSOCIATE VICE PRESIDENT FOR RESEARCH AND SPONSORED PROGRAMS

Dr. Frances R. Williams is Tennessee State University's new Associate Vice President for Research and Sponsored Programs and Chief Research Officer. Dr. Williams is currently the associate dean for graduate studies and research in the College of Engineering. In her new role, Dr. Williams will provide oversight of TSU's research enterprise, including management of research grants and contracts, strategic research initiatives and partnerships, proposal development, and TSU's Centers of Excellence.

"I am excited for the opportunity to serve the university in this capacity," said Dr. Williams, who is also a professor of electrical and computer engineering, and director of the Center for Micro-, Nano-, and Biotechnology Research at Tennessee State University. "I look forward to working with the TSU family to expand our research and sponsored activities and to foster strategic partnerships for growth."

A veteran researcher and university administrator, Dr. Williams previously served as the director of the Center for Materials Research at Norfolk State University as well as the director of Norfolk State's Micro- and Nano-technology Cleanroom, a premiere research facility for fabricating micro- and nano-scale devices. Dr. Williams has extensive publications, and holds a patent in the areas of advanced materials and devices, biosensors, and nano- and micro-electromechanical systems processing and devices. She has received grants totaling over \$15 million as a principal investigator or co-principal investigator.



For her contributions in teaching, scholarship, and service, she has received various awards including the 2018 STEM Innovation Award at the 32nd Black Engineer of the Year Awards (BEYA) STEM Global Competitiveness Conference. In 2013, she received the State Council of Higher Education for Virginia (SCHEV) Outstanding Faculty Award (the highest faculty award given out by the state). She was named an "Emerging Scholar" by *Diverse Issues in Higher Education* in 2012. She received Norfolk State's top distinguished faculty award, the University Award of Excellence, in 2010.

Dr. Williams holds B.S. and M.S. degrees in electrical engineering from North Carolina Agricultural and Technical State University, and a Ph.D. in electrical and computer engineering from the Georgia Institute of Technology.

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 global challenges. The focus is on finding solutions to problems faced by socially and economically disadvantaged groups and contribute to the prosperity of all. Research areas include childhood obesity prevention, food safety, climate change, meat and plant genetics, 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 underserved 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 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.

- Cybersecurity, Cyber Physical Systems, Bioinformatics, and Interoperability
- Renewable Energy
- Big Data Analytics
- Food Supply Security and Sustainability
- Critical Incident Preparedness
- Health Disparities and Chronic Disease Prevention and Treatment
- Workforce Pipeline Development
- Early Childhood Education
- Rural Economic Development and Urban Planning
- Biotechnology and Nanosciences Advanced Materials
- Astrophysics
- Transportation Systems
- Advanced Manufacturing
- Autonomous Vehicles
- Mechatronics
- 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 innovative 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:

John Barfield

Director of Engagement and Visibility

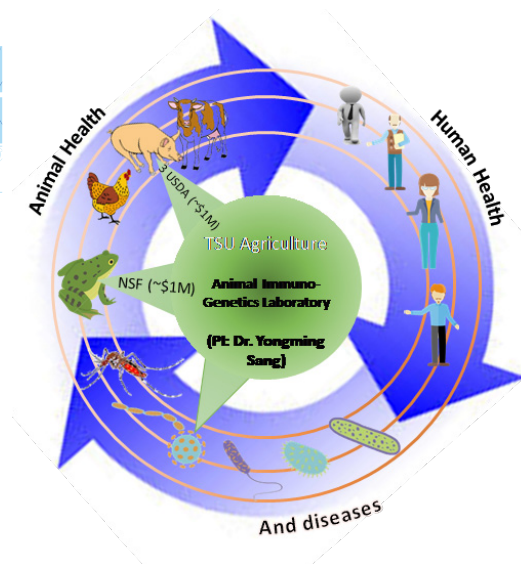
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College of Agriculture, Human, and Natural Sciences



Dr. Yongming Sang is an Associate Professor of Animal Genomics and Immunology for the Department of Agriculture and Environmental Sciences in the College of Agriculture. The NSF and USDA awarded him nearly \$2 million in the past three years and over \$900,000 last year alone. His currently funded research includes:



Animal Immuno-Genetics Study Targeting ONE HEALTH. Animal health and wellbeing is not only essential for livestock production, but also is critical for public health for wild animals and humans. Animal health relies on the regulation of both metabolic and immune gene responses during microbial infections. The research is directed at elucidating, molecularly and functionally, animal immune and metabolic genes, in particular those that have antimicrobial activities and therapeutic potential. The research uses combined approaches at molecular, cellular, and animal levels to elucidate genes or gene families that are potentially important in animal and human health. His current projects are focused on the following three directions: (1) Antimicrobial regulation against several devastating viral and bacterial diseases in livestock; (2) Animal comparative immunome projects, which is aimed to characterize a family or the overall composition of immune genes in an animal species; and in turn (3) To develop novel vaccines and antivirals for mitigating animal diseases.

TSU Organic Agriculture Program



Dr. Dilip Nandwani is a Professor of Organic Agriculture in the Department of Agricultural and Environmental Sciences, in the College of Agriculture. Dr. Nandwani has received grants and agreements of over three million dollars from federal, state, regional and international organizations such as USDA, SCBG, SSARE, and TLSAMP. He has published over two hundred writings in peer-reviewed journals, conference proceedings, book chapters, extension booklets and has been an editor of four books. His currently funded research includes:

Integrating Row Covers into Organic Production Systems for Specialty Leafy Vegetables to Strengthening the Sustainability of Limited Resource Farmers (USDA-SCGB). The Specialty Crop Block Grant program application fits into the overall goal of enhancing food security, community development, rural development and sustainability by providing research based, outreach training, education and technical assistance to Tennessee's transitional and organic grower, beginning and limited resource farmers and their families throughout the State. This preparedness will enhance the short and long-term goals of operating successful, productive farms. The specific objectives are 1) to evaluate row covers into organic production systems of specialty greens to improve growing conditions, yield and productivity; 2) to demonstrate the reduction in pest and disease



incidence; 3) to conduct field days and outreach for dissemination of information to farmers, stakeholders and extension personnel. Specifically military veterans, socially disadvantaged small farmers, and limited-resource small farmers (transitional and organic) and new farmers.

Professional Development In Assessing The Impact On Organically Managed Horticultural Crops To Enhance Research At Tennessee State University (USDA-CBG). Sustainable intensification of the organic vegetable industry involves the utilization of modern technologies to improve profitability, environmental stewardship, and social wellbeing. The purpose of this project is to strengthen the capacity of Tennessee State University organic agriculture program to assist stakeholders throughout the state to provide them non-chemical solutions for insect pests and disease management and improve productivity. Organic fruit and vegetable growers in the South are small scale, highly diversified, and face



insect pest and disease challenge in organic crop production. The specific objectives of this project are to conduct training in evaluation of the effect of plastic covering on arthropod community in high tunnels in high value crops grown organically. Tennessee State University has created a new organic agriculture program that will strengthen expertise in research and education for an interdisciplinary assessment of the potential agro-ecological changes and benefits of integrating plastic coverings into a sustainable production system of vegetable crops.



Tennessee State University's Tennessee Louis Stokes Alliance for Minority Participation (TL-SAMP) Program in STEM Research at Vivekananda Global University, India. Dr. Nandwani received his third grant of this year (TLSAMP) and travelled to India this summer with three undergraduate research students under TLSAMP research program. He also spent four weeks at Vivekananda Global University in Jaipur, India for summer research internship with three STEM students worked with mentors on various research projects e.g. agriculture, biology and engineering.



Career Pathways in Agriculture

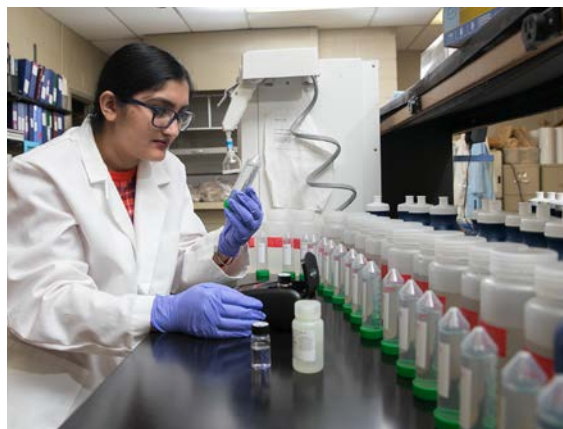


Dr. John C. Ricketts is Professor of Agricultural & Environmental Sciences. He has received two grant awards from the United States Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA). Both projects seek to develop TSU's capacity to develop a greater number of minority and underrepresented populations for the hot career pathways in agriculture. Careers in agriculture are high tech, high paying, and in demand. They are also mostly void of diverse professionals, and the two projects recently awarded to Ricketts will help TSU become even more uniquely positioned to develop a pipeline of highly skilled, diverse professionals to meet these demands.

Higher Education Challenge Grant (HEC) (\$678,136) The objectives of this project are to 1) develop a sustainable pipeline of minority and underrepresented students in Agricultural Sciences, 2) expand and enhance Agricultural sciences curricula through distance education innovations, advanced placement dual credit, and faculty development, and 3) increase student engagement in Agricultural sciences through undergraduate research, experiential learning and leadership education. Ricketts has partnered with Dr. De'Etra Young (Associate Professor, Agriculture) and Dr. Sharon Peters (Executive Director, Community College Initiatives) at TSU, Dr. Evan McHugh (Dean, Health & Natural Sciences) at Southwest Tennessee Community College, and Ms. Kayla Fisher (Agriscience Instructor) with Shelby County Schools in Memphis. Ricketts and his team have worked with Fisher at Bolton High School to deliver high school teacher professional development for the introductory Curriculum for Agricultural Science Education (CASE) course. Eight high school teachers received grant-sponsored scholarships for the CASE training, and Ricketts has begun to work with them on the implementation of advanced dual credit for students who complete the CASE training in their respective high schools.



1890 Capacity Building Grant (CBG) specifically designed for professional development (\$99,990). The objectives of the project were for Ricketts to 1) learn and apply contemporary instructional strategies for teaching in an online environment, and 2) develop online modules that lead faculty through the process of converting their courses for online capability, specifically Virtual Reality (VR)/360° video integration. This fall Ricketts will be developing VR and 360° video content to include in the faculty development modules and selected core courses in his department.



College of Education



Dr. Kiesa Kelly is Department Chair and Associate Professor of Psychology in the College of Education, Department of Psychology. The Tennessee Board of Regents (TBR) and National Institutes of Health (NIH) has awarded her nearly \$1 million in research funding over five years. Her current research includes:

5-year TSU-NERVE R25 training grant from NIH 2015-2020 –Enhancing Neuroscience Diversity with the Tennessee State University – Neuroscience Education and Research Vanderbilt Experience (TSU-NERVE), \$971,560. Since 2015, the TSU Psychology Department has been the home of a NIH-funded R25 training program that aims to prepare underrepresented students for doctoral programs in neuroscience and related fields. This summer, TSU-NERVE students are conducting research in neuroscience labs at Duke, Georgetown, Harvard, and the University of Southern California. All program participants receive funding to present their work at the annual meeting of the Society for Neuroscience (SfN). During the academic year, they work in neuroscience labs at Vanderbilt, and take coursework at Vanderbilt tuition-free. To date, the program has helped two students get accepted into PhD programs, one into medical school, and several others into masters programs.



SERS TBR grant exploring ePortfolios and other high impact practices

2018-19 –Tennessee Board of Regents Student Engagement, Retention, and Success (SERS) Grant: IMPACT Scholars: a pilot program utilizing ePortfolios to increase engagement in High Impact Practices (HIPs) in underrepresented populations at Tennessee State University, \$24,960.00. A growing body of work demonstrates that high impact practices (HIPs), including undergraduate research, work-based learning, honors courses, study abroad, and eportfolios, enhance student success. Research suggests students who participate in four or more HIPs are more likely to graduate, and that underrepresented students benefit the most. Building off this body of work, Dr. Kelly designed a pilot program to stimulate student interest and engagement in HIPs, in part through utilization of an eportfolio, which provides a platform for presenting and synthesizing their HIP experiences.

SOARS Scholars Program



Dr. Andrea L. Tyler (*left*), Director of Graduate Student Services and Research Associate, and **Dr. Sharon D. Peters** (*right*), Executive Director for Community College Initiatives, received as co-Principal Investigators, the Minority Science and Engineering Improvement Program (MSEIP) three-year grant from the U.S. Department of Education.

The MSEIP Student Opportunity for Advancement in Research Skills (SOARS) Scholars program is a Science, Technology, Engineering, and mathematics (STEM) initiative that supports sophomore, juniors, and senior students majoring in Biology, Chemistry, Computer Science, Engineering, Mathematics, and Agriculture. The SOAR Scholars program supports 36 underrepresented ethnic minority students with a monthly stipend to conduct formalized research and participate in professional development and workforce ready activities.

Research suggests that STEM students report greater gains from their coursework if supplemented with participation in legitimate, professional communities of practice. Therefore the SOARS Scholars program incorporates activities such as 1. Increase the number of undergraduate STEM students



engaged in meaningful and relevant research, 2. Prepares students for graduate school and/or for the STEM work force, 3. Participate in Graduate Record Exam (GRE) or Medical College Admission Test (MCAT) preparation courses offered through a partnership with Vanderbilt University and Meharry Medical College. Additionally, to gain workforce readiness skills there are pending partnerships with local companies to support SOARS Scholars through summer internships.

The broader impact of the SOARS Scholars program is to provide meaningful and engaging research opportunities to underrepresented ethnic minorities, particularly minority women, to foster graduate school readiness and expand the STEM workforce pool to improve overall marketability and thus expand the STEM workforce pool.



Tennessee State University

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