



TENNESSEE
STATE UNIVERSITY

Division of Research and Institutional Advancement
Research and Sponsored Programs



RESEARCH HORIZONS

ANNUAL REPORT
FISCAL YEAR 2016

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 in the College of Agriculture, Human, and Natural Sciences (CAHNS) are engaged in conducting research and generating scientific knowledge in a variety of high-demand areas, including childhood obesity prevention; climate change; food safety; global food security; and sustainable bioenergy.

COLLEGE OF BUSINESS

The College of Business is uniquely poised as a strong, robust, and expanding educational, entrepreneurial, and research engine, positively impacting the economic tapestry of Nashville, the State of Tennessee, the country, and the world.

The College of Business faculty are engaged in conducting applied, disciplined-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 involving the development of innovative models in instruction, such as the integration of technology to influence student learning outcomes and strategies to increase representation of under-served populations engaged in science, technology, engineering, and mathematics (STEM) education. In addition, these researchers are building more inclusive models of student academic success designed to impact student retention. Faculty in the experimental psychology program are engaged in psychological science research, addressing cognitive psychology, neuroscience, behavioral psychology, and child development.

COLLEGE OF ENGINEERING

The College of Engineering faculty has been engaged in conducting research in many national and critical technology areas. Areas that are of interest are signal/image processing, bioinformatics, sensor fusion, applied intelligent systems, unmanned mobile robotics, and unmanned air vehicles, decision making processes, health monitoring (prognosis and diagnosis) of air craft engines, wireless communication, robust control systems, cyber-security, renewable energy sources, virtual reality. Additional faculty interests include high performance computing, chemical sensing detection systems.

COLLEGE OF HEALTH SCIENCES

The faculty in the College of Health Sciences are engaged in research endeavors that encompass breast cancer; diabetes; Ebola; HIV prevention; HPV detection among teens; health and housing insecurity of African American women; health disparities; neuro-developmental and related disabilities; obesity, stroke, and communication disorders; and speech pathology

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 SCIENCES

The faculty in the College of Life Sciences are engaged in conducting research through three departments – Biological Sciences, Chemistry, and Mathematics and Physics.

DEPARTMENT OF BIOLOGICAL SCIENCES

The faculty in the Department of Biological Sciences are engaged in research endeavors positioned in the broad area of cell and molecular biology. Faculty research activities involve studies of plant extracts and the effect on cancer cell growth and function, studies of the role of D3 receptors in neuronal development, studies of collagen assembly and trafficking, studies of the role of the spectraplakins protein, MACF1, in maintenance of brain tumors, studies of the use of microorganisms as bioinsecticides and as producers of antimicrobial and anticancer compounds, studies of inflammation cytokines in cancer biology, studies of genome variation in poultry and studies of global change ecology.

DEPARTMENT OF CHEMISTRY

The faculty in the Department of Chemistry are engaged in conducting research activities specific to: cancer, environmental science, nano-science, atmospheric chemistry, synthesis of molecules with biomedical interest, synthetic method development, and polymer science.

DEPARTMENT OF MATHEMATICAL SCIENCES

The faculty in the Department of Mathematical Sciences are engaged in conducting research endeavors that include mathematics, mathematics education, statistics, physics, and astronomy.

COLLEGE OF PUBLIC SERVICE

DEPARTMENT OF PUBLIC ADMINISTRATION
DEPARTMENT OF SOCIAL WORK
DEPARTMENT OF URBAN STUDIES

The faculty in 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, nonprofit management and community revitalization; public administration and policy analysis; state lottery policy; health policy; social work; and aging.

BOVINE RESEARCH RE-ENTERED, HERITAGE DEXTER CATTLE

The Tennessee State University (TSU) Animal Physiology Laboratory embarks on objectively evaluating non-traditional Dexter cattle as a small, but potentially efficient beef producer suitable for small-scale, limited-resource operations.

Dr. Richard Browning, Jr., Professor in the Department of Agricultural and Environmental Sciences, College of Agriculture, Human and Natural Sciences, leads the animal science research at TSU and his research group re-entered the bovine research area in 2015 by establishing a study herd of heritage Dexter cattle. It is the only such institutional herd in the United States. Known as the 'family cow', Dexter cows are half the weight of average commercial cows.

The Lab phased out a fruitful run of traditional research on fescue toxicity in beef cattle in 2002 to evaluate meat goats as an alternative for small-scale ruminant livestock production, yet the research team demonstrated the unrealized production value of heritage Spanish goats.



Dexter research cattle

ERADICATION OF JOHNSON GRASS RHIZOMES FROM FIELDS INTERCROPPED WITH PIGEON PEAS

Tennessee State University (TSU) weed scientist Dr. Fitzroy Bullock, Professor and State Agricultural Program Leader in the College of Agriculture, Human, and Natural Sciences, leads research to provide a new sustainable approach to efficiently manage the notorious and invasive weed Johnson grass that is an impediment to efficient production of food crops in the United States. The innovative USDA-NIFA sponsored project advances research to utilize pigeon peas as the controlling agent in heavily infested rhizome Johnson grass fields. This approach will eliminate the use of synthetic pesticides in organic field production. This work is the first of such kind and will be a breakthrough for TSU in area of natural weed pest control.



Bullock illustrates field research

IMPROVING NITROGEN AND WATER USE EFFICIENCY TO REDUCE GREENHOUSE GASES EMISSION IN CORN CROPLANDS

Tennessee State University (TSU) researchers recently completed an investigation about greenhouse gases (GHGs) in the atmosphere being attributed to anthropogenic activities, also linked to climate change. This U.S. Department of Agriculture Capacity Building Grant award at nearly \$300K embarked upon a three year continuous measurement of N₂O (nitrous oxide) and CO₂ (carbon dioxide) fluxes from a large-scale corn field at a commercial farm using an innovative research technique, the eddy covariance (EC) technique, along with EC equipment.

This research was led by Dr. Sam O. Dennis, Associate Professor, Agricultural and Environmental Sciences, as principal investigator and his team of scientists, co-principal investigators Dr. Dafeng Hui, Associate Professor, Biological Sciences, and Dr. Chandra Reddy, Dean, College of Agriculture, Human, and Natural Sciences; and post-doctoral fellow, Dr. Qui Deng to generate significant research that enhanced the knowledge of greenhouse gas emissions and water conservation conditions in agronomic crop production systems.

DISCOVER THE GREATNESS

RESEARCH EDUCATION PROGRAM TO PREPARE UNDERREPRESENTED STUDENTS FOR CAREERS IN NEUROSCIENCE

Tennessee State University (TSU) is the recipient of an award from the National Institute of Neurological Disorders and Stroke (NINDS), Blueprint Program for Enhancing Neuroscience Diversity through Undergraduate Research Education Experiences (BP-ENDURE) program partnering TSU with international leaders in Neuroscience research, including Vanderbilt University.

The 5-year program, TSU-NERVE (Neuroscience Education and Research Vanderbilt Experience) grants provisions for recruiting 20, talented (primarily African American) STEM majors from TSU with expressed interest in Neuroscience; provides support and scaffolding for these students as they receive paid quality Neuroscience research and didactic experiences at major research institutions; and advances students into doctoral programs in Neuroscience with well-crafted professional development activities, including direct contact with graduate program directors.

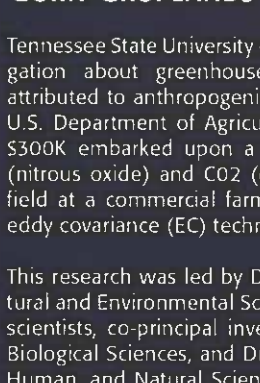
TSU faculty and neuropsychologist, Dr. Kiesa Kelly, Chair and Associate Professor, Department of Psychology, serves as the Principal Investigator (PI). Current and future Co-Project Directors include Drs. Lisa de la Mothe, Quincy Quick, and Hugh Fentress.



Richard Browning, Jr., Ph.D.



Fitzroy Bullock, Ph.D.



Sam O. Dennis, Ph.D.



Dafeng Hui, Ph.D.



Chandra Reddy, Ph.D.



Kiesa Kelly, Ph.D.

SUCCESS OF PARTNERSHIP TO ELIMINATE CANCER HEALTH DISPARITIES LEADS TO NEW 5-YEAR FUNDING

The NIH-U54 Meharry-Vanderbilt-TSU Partnership (MVTCP) to Eliminate Cancer Health Disparities grant has recently been renewed for another 5-year cycle beginning September 2016. Professor Emeritus in the Center for Prevention Research Dr. Baqar Husaini is the principal investigator (PI) and Professor of Chemistry Dr. Margaret Whalen is the co-principal investigator (Co-PI) for this grant sponsored by the National Institutes of Health, U. S. Department of Health and Human Services.

The MVTCP engages in community service, student training, and faculty development as part of an effort to reduce disparities in cancer health care. Based on the success of the previous cycle of grant funding, Tennessee State University (TSU) has expanded the student training component from a Summer Cancer Research program for juniors and seniors at TSU to a year-round program that includes freshmen through senior undergraduates at TSU as well as Nashville area high school juniors and seniors.

Additionally, a basic cancer research project examining the immune footprint in tumor micro-environment following high salt induced breast cancer progression will be funded in the new grant. This research project will be headed by TSU Assistant Professor of Biology Dr. Venkataswarup Tiriveedhi.



Baqar Husaini, Ph.D.



Margaret Whalen, Ph.D.

TENNESSEE STATE UNIVERSITY JOINS CONSORTIUM TO IMPROVE THE NATION'S CYBER SECURITY IN ENERGY DELIVERY SYSTEMS

Tennessee State University (TSU) began participation in a five-year, \$28.1 million U.S. Department of Energy initiative to improve computer/communication networks for energy delivery systems.

TSU researchers joined a consortium of 11 universities and national laboratories led by the University of Illinois at Urbana Champaign to improve the resilience and security of the cyber networks. These networks serve as the backbone of the infrastructure that delivers energy to the nation – known as energy delivery systems – for the electric power, oil, and gas industries.



Sachin Shetty, Ph.D.



L. H. Keel, Ph.D.

The university received \$930,000 to conduct studies in security risk assessment, software-defined networking, robust control systems, and detection and classification of the impact of attacks on cyber-physical systems. TSU researchers will also design controller procedures to protect against specific attack categories.

Dr. Sachin Shetty, Associate Professor of Electrical and Computer Engineering and a cyber security and networking systems expert, led the effort as principal investigator, assisted by Dr. L. H. Keel, Professor of Electrical and Computer Engineering, as co-PI.

“THINK. WORK. SERVE.”

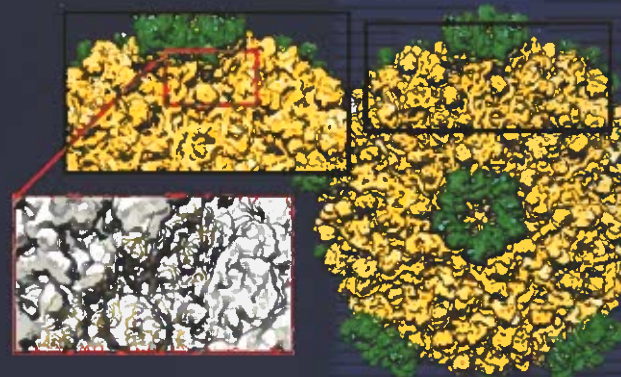
MODELING OF MACROMOLECULAR PROTEINS AT TSU, COMPUTATIONALLY

Tennessee State University (TSU) researcher Dr. Kamal Al Nasr, Assistant Professor of Computer Science, has been awarded a \$300K NSF grant to develop new and efficient computational methods to model macromolecular proteins.



Kamal Al Nasr, Ph.D.

Dr. Al Nasr says, “The knowledge about protein’s tertiary structure has been acquired conventionally, for extended time, from biophysical protein determination techniques such as X ray Crystallography and Nuclear Magnetic Resonance.” He added, “The funded research will help to develop computational methods that conquer the drawbacks of conventional experimental methods which include the time and cost”. It is worth mentioning that the cost and time are not the only negative side about conventional techniques; these are not successful with all types of proteins such as membrane proteins.



The 3D cryo-EM volumetric image of Cytoplasmic Polyhedrosis Virus (CPV) (EMDB ID: 1509; 5.88Å resolution). The Atomic model constructed for one subunit protein (PDB ID: 3CMT) shown the red box. Proteins play an essential role in the viral life cycle. They are found on the outer shell of the virus to protect its genome.

USDA/NIFA AWARD TO INVESTIGATE TICK-BORNE ILLNESS

The Wildlife Ecology Laboratory led by Dr. William Sutton, Assistant Professor in the Department of Agriculture and Environmental Sciences at Tennessee State University (TSU) is currently implementing research to explore how forest management practices impact wildlife and tick populations and how changes in host species and forest conditions influence the prevalence of tick-borne diseases (e.g., Lyme disease, Ehrlichiosis, Babesiosis). The United States Department of Agriculture (USDA)/National Institute of Food Administration (NIFA) awarded this grant for three years of investigation.

Dr. Sutton currently has ongoing research projects that are funded by the Wildlife Management Institute (WMI) and USDA. Referencing the current research project, evaluating the impacts of forest management on wildlife and tick populations, Dr. Sutton says, "It is important for us to understand the potential impacts that habitat disturbance has on not only wildlife, but also parasites that depend on these species as hosts." According to Dr. Sutton this study will have large implications for helping to understand how to better develop 'healthy landscapes', which will benefit both human and wildlife populations.



William Sutton, Ph.D.
Dr. Sutton holding an adult Red-eared Slider (*Trachemys scripta*) turtle captured at the TSU campus wetland.



The Red Salamander (*Pseudotriton ruber*) is a handsome amphibian that lives in springs, seeps, and caves of the northeastern United States. Salamanders play important roles in forest and stream ecosystems as predators of forest floor invertebrates. Due to their sheer abundance, salamanders play important roles in carbon sequestration.

TSU'S MARIE HAMMOND ENGAGES ACTIVITY ON NATIONAL SCIENCE FOUNDATION EHR CORE RESEARCH GRANT

Dr. Marie S. Hammond, Associate Professor, Psychology, Tennessee State University was recently awarded her third National Science Foundation (NSF) grant. Dr. Hammond has been awarded a \$1.42 million NSF EHR Core Research grant to begin to examine the role of professional identity and career management skills on the career development of African American and women STEM students.

"As of 2013, African Americans formed only 5% of the STEM workforce", according to Hammond, "and while approximately 40% of first-year students intending to major in a STEM field, only 9.9% obtained a bachelor's degree in a STEM field in 2014. When students drop out of their STEM field, the world loses the contributions and discoveries that the student would have made. It's critical to our nation that these precious contributions are not lost."

Hammond's most recently completed NSF award developed and tested a culturally-appropriate intervention to increase the retention and commitment of African American STEM students. In addition to receiving the NSF EHR Core Research award, she has also received a second award to further refine this intervention, based upon the results of her previous work.



Marie Hammond, Ph.D.

TSU ASTRONOMER PART OF TEAM THAT DISCOVERS PLANET WITH ECCENTRIC ORBIT

Tennessee State University (TSU) researcher Gregory Henry is part of a team of astronomers who have discovered an extrasolar planet scientists say has the most eccentric orbit ever seen. This new planetary discovery is just one of many involving TSU in the past.

The new planet is referred to as HD 20782 b and is about 117 light-years from Earth. It appears "elliptical or oblong" as it orbits around its star, astronomers say, which is unlike other planets in the solar system that have nearly circular orbits.

The team of astronomers, led by Steven Kane of San Francisco State University, explains that extrasolar planets like HD 20782 b pose "a wealth of questions" for astronomers.



Gregory Henry (right), presents the operation of the world's first fully robotic observatory in collaboration with Fairborn Observatory in Southern Arizona and the significance of TSU's robotic telescopes in the discovery of over 150 extrasolar planets and planetary systems to a visiting astronomer.

CLOSING THE K-12 "STEM GAP" VIA HANDS-ON SCIENTIFIC INQUIRY

Dr. David A. Padgett, Associate Professor of Geography and Director of the Geographic Information Sciences Laboratory within the College of Liberal Arts, at Tennessee State University has been awarded a \$723,000 NASA grant (part of NASA's \$8.0 million "Mission Earth" project) to develop a model for improving science education at the K-12 level.

The five-year project focuses upon the implementation of the Global Learning and Observations to Benefit the Environment (GLOBE) Program at several Nashville partner high schools with the primary mission to enhance learning opportunities for these students from racial and ethnic populations underrepresented in science, technology, engineering and mathematics (STEM) disciplines.

"In order to close the 'STEM achievement gap' for minority and female students, we must expose students at the K-12 level to inquiry based hands-on learning experiences as early and often as possible," Padgett said.



David Padgett, Ph.D.



Samuel Nahashon, Ph.D.

USDA AWARDS RESEARCH FOR ADVANCING BIOTECHNOLOGY THROUGH CAPACITY BUILDING FUND

Dr. Samuel Nahashon, Professor and Interim Chair of the Department of Agricultural and Environmental Sciences, College of Agriculture, Human, and Natural Sciences, received an award as one of four professors who shared the nearly \$1.4 million granted to Tennessee State University through the United States Department of Agriculture (USDA) Capacity Building Fund. Dr. Nahashon's mission is to research new and emerging areas of biotechnology such as transcriptome analysis and computational bioinformatics. He will collaborate with an expert in computational bioinformatics at the University of Georgia to determine the mechanisms and modes of action of probiotics in conferring beneficial effects to poultry.

"This project is also an effort to continue strengthening the biotechnology research and teaching program in the Department of Agricultural and Environmental Sciences at TSU," said Nahashon.

RESEARCH: CELEBRATING EXCELLENCE



Karla Adesso, Ph.D.

ETHANOL IS THE KEY: KNOWLEDGE OF AMBROSIA BEETLE BEHAVIOR LEADS TO NEW MANAGEMENT TOOLS FOR NURSERY GROWERS

Tennessee State University (TSU) researcher Dr. Karla Adesso, Research Assistant Professor, Department of Agriculture and Environmental Sciences, College of Agriculture, Human, and Natural Sciences, has been involved in an industry-wide effort to manage ambrosia beetles in nursery production systems. Together with collaborators from TSU, Central Connecticut State University, USDA-ARS-Wooster, Virginia Tech and North Carolina State University, the Ambrosia Beetle Working Group, has been working to provide the nursery industry with methods to protect high-value trees and shrubs from assault by these beetles.

"The key is ethanol," says Dr. Adesso. "It's the signal that triggers an ambrosia beetle attack. Only stressed trees release ethanol. A tree can look healthy to the human eye, but the beetles can smell the difference."

Dr. Adesso has spent the last few years focusing on ways to better manage ambrosia beetles in nurseries by using the knowledge of this signal as a springboard for new technology development.

Dr. Adesso's research has led to some promising new technologies to help Tennessee nursery producers manage ambrosia beetles. One product developed in collaboration with Dr. Jason Oliver (TSU) is an 'ethanol blocker' treatment that can be applied directly to the trunks of trees with standard spray equipment.

A second tool under development is a simple field method to help growers monitor plant stress.

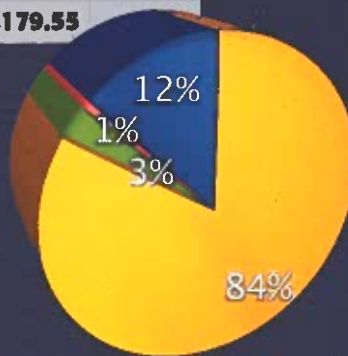


AWARDS BY AGENCY/CORPORATION/FOUNDATION

Agency/Corporation/Foundation Awards	Dollars
National Aeronautics and Space Administration (4)	\$ 1,203,400.00
National Science Foundation (15)	3,373,565.00
U.S. Agency for International Development (2)	254,162.00
U.S. Air Force (8)	469,987.50
U.S. Army (1)	590,544.00
U.S. Department of Agriculture (69)	16,744,508.87
U.S. Department of Defense (1)	149,977.00
U.S. Department of Education (17)	8,371,564.00
U.S. Department of Energy (5)	788,467.00
U.S. Department of Health and Human Services (11)	6,312,730.00
U.S. Department of HHS - National Institutes of Health (5)	5,987,813.00
U.S. Department of Homeland Security(2)	581,080.00
U.S. Department of Transportation (1)	74,560.00
U.S. Department of Veterans Affairs (1)	14,376.00
U.S. Federal Highway Administration (2)	4,000.00
U.S. Navy (2)	663,427.00
U.S. Small Business Administration (2)	323,082.00
United Soybean Board (1)	10,000.00
Private (21)	1,514,429.58
Public (2)	347,278.00
State (28)	6,692,228.60
Total (200)	\$54,471,179.55

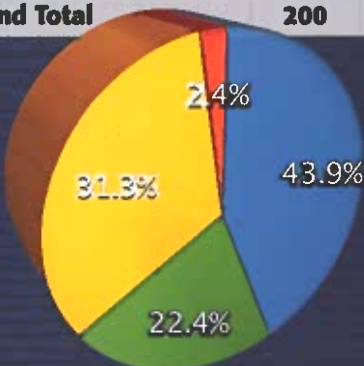
AWARDS BY FUNDING SOURCE

FUNDING SOURCE	AWARDS	DOLLARS	PERCENT
Federal	149	45,917,243.37	84
Private	21	1,514,429.58	3
Public	2	347,278.00	1
State	28	6,692,228.60	12
Grand Total	200	54,471,179.55	



AWARDS BY PROJECT TYPE

PROJECT TYPE	AWARDS	DOLLARS	PERCENT
Research	114	23,928,220.80	43.9
Institution	47	12,192,113.88	22.4
Service	38	17,050,844.87	31.3
Construction Physical Plant	1	1,300,000.00	2.4
Grand Total	200	54,471,179.55	



CHAIRS OF EXCELLENCE AT TENNESSEE STATE UNIVERSITY

Chair of Excellence in Banking and Financial Services
 Frist Chair of Excellence in Business
 Massie Chair of Excellence in Environmental Engineering

RESEARCH AREAS OF INTEREST AT TENNESSEE STATE UNIVERSITY

Advanced Control Systems
 Advancement of Human Capital and Leadership
 Automated Astronomy
 Bio-Security
 Biotechnology
 Breast Cancer
 Climate Change, Weather, and the Environment
 Community Engagement, Enhancement, and Economic Revitalization
 Cybersecurity, Cyber Physical Systems, BioInformatics and Interoperability
 Data Science and Analytics
 Digital Storytelling
 Early Childhood Education
 Energy and Alternative Fuels and Device Storage
 Environmental Sciences
 Food Safety and Security
 Human Health, Nutrition, Obesity, Disease Pathology, and Cultural Disparities
 Leadership Development
 Mechatronics
 Nanotechnology
 Neuroscience
 Personalized Learning Systems
 Plant and Animal Science
 Public Policy and Urban Affairs
 Speech Pathology and Communication Disorders
 STEM Education
 STEM Workforce Development
 Supply Chain Operations Research

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 for Food, Agricultural, and Environmental Research (IFAER)
 Institute of Government
 Otis L. Floyd Nursery Research Center at McMinnville
 Nanoscience and Biotechnology Core Facility
 TSU Interdisciplinary Graduate Engineering Research (T.I.G.E.R.) Institute

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



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Contributing Editor

Cover photography: Dr. Lewis Myles (standing right), Professor and Principal Investigator in the Department of Biological Sciences, College of Life and Physical Sciences, leads the Cancer Cell Tissue Culture Laboratory at Tennessee State University. Undergraduate biology students training in research at Dr. Myles' Laboratory are Aje Walton (standing left) and Avery C. Humphrey-Davis (seated).

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