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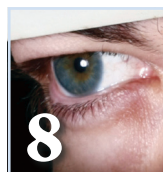
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Photo: J. Intintoli

Committed to Excellence

Dr. Jackie Eller
Interim Vice Provost for Research and
Dean, College of Graduate Studies

EXCELLENCE IN GRADUATE EDUCATION IS FUNDAMENTAL to the quality and reputation of any research university. Middle Tennessee State University has a thriving, innovative research community of graduate scholars supported by faculty experts in a variety of disciplines.

Our research centers are involved in such diverse projects as biomedical research using traditional Chinese medicine, the study of how animal cells align and migrate within tissue and how this might relate to diseases, innovative analyses of gunshot residue, and documentation of the forgotten landmarks of the Trail of Tears. These centers pursue extramural funding for research, service, and instruction. At the undergraduate level, we have expanded the URECA (Undergraduate Research Experience and Creative Activities) internal grant program to support more faculty-mentored individual students and summer teams of students and mentors.

In the College of Graduate Studies, we have been establishing new concentrations and specializations within existing degree programs, recognizing the increased demand for cross-disciplinary graduate curricula. Our interdisciplinary Ph.D. programs in Molecular Biosciences, Computational Science,

and Mathematics and Science Education appeal to STEM students around the world. Signature programs in Recording Arts and Technologies, Aviation Administration, Industrial/Organizational Psychology, and Public History enjoy national reputations.

In our outreach to undergraduates, we have introduced the Accelerated Bachelor's-to-Master's (ABM) program, allowing motivated students to earn both degrees in five years. Seven programs across several colleges have already been established, and more are in development.

MTSU's commitment to excellence includes providing state-of-the-art facilities to support faculty and student research. The new 250,000-square-foot Science Building, opened in fall 2014, houses the Departments of Biology and Chemistry and the Ph.D. program in Molecular Biosciences. James E. Walker Library offers excellent collaborative spaces, professional services, over one million volumes in its collection, and more than 33,000 serial resources.

MTSU is committed to supporting outstanding research, scholarship, and creative activities.

Take a closer look!



Doing Our Research

Dr. Sidney A. McPhee

Photo: J. Intintoli

SCHOLARLY RESEARCH NOT ONLY DRIVES INNOVATION and economic progress but also provides the foundation for MTSU's strong academic programs. Creating a culture of research and inquiry among faculty and students is at the heart of the University's mission and is vital to industry partnerships.

This edition of *MTSU Research* showcases important faculty research in subjects as diverse as butterflies and salamanders, dyslexia, folk music, and Internet privacy. The wide range of subjects presented at Scholars Week in March further demonstrated the strong role of academic research and partnerships at MTSU.

One of the main goals of MTSU's Academic Master Plan is to promote individual student success and responsibility for accomplishments through fostering a student-centered learning environment. The Undergraduate Research Center stimulates student research with application-based funding of research and creative projects throughout the year, and by coordinating efforts with other initiatives such as the Honors College, NSF - First STEP, NSF REU, NSF Tennessee Louis Stokes Alliance for Minority Participation, and other funded research programs for undergraduates.

The partnerships forged between MTSU researchers and industry are central to MTSU's role in regional economic development. Our research centers, supported largely with extramural funding, join with business and industry in areas ranging from historic preservation to environmental education and from small-business development to tracking Tennessee's economic recovery.

MTSU's research impact starts the heart of middle Tennessee and resonates throughout the world. Our partnership in China studying modern uses of ancient herbal remedies has yielded dozens of results showing promise in the treatment of cancer, viral infections, and other ailments. Partnerships such as this have the potential to reap dividends for Tennessee's economy and treat some of the world's worst illnesses.

At MTSU, our commitment to scholarly research is unwavering. We hope you enjoy these stories celebrating the progress, inspiration, and excellence of research at MTSU.

True Blue!

Above: President Sidney A. McPhee, State Representative Jeremy Faison, MTSU researchers Ying Gao and Elliot Altman, and State Senator Bill Ketron take receipt of wild-grown ginseng in east Tennessee.



Our New Catalyst

WITH A NEW \$147-MILLION Science Building now open for business, MTSU prepares to take its science and research efforts to the next level.

Anyone familiar with the programs and infrastructure at MTSU knows that the new building is as desperately needed as it is long overdue. And yet, when viewed in the greater context of other changes happening on campus, in Tennessee, and beyond—from an evolving University mission to the shifting of funding formulas, to the explosion of scientific frontiers—the timing couldn't be better.

This project had been the number-one priority of the University even before President Sidney A. McPhee's arrival 13 years ago. MTSU absolutely requires this building to continue its effort to provide Tennessee with qualified graduates for the workforce. About 80 percent of MTSU students will take classes in the new Science Building. And this building is already helping produce more science graduates to fill high-technology jobs, prepare more

teachers for math and science in K–12 schools, and enhance the economy of our region and state. It immediately makes MTSU more competitive for research projects, science scholarship, and entrepreneurial efforts.

MTSU's enrollment has almost quadrupled in the last 45 years but with no increased space for science education until now. Wisner-Patten Science Hall and Davis Science Building were built in 1932 and 1967, respectively, and have a combined total of nearly 117,000 gross square feet. The new building has more than 250,000 gross square feet for teaching, faculty and student laboratory research, and collaborative learning.

Rest assured, those two older buildings, which hold memories for generations of graduates now working in science fields and those who simply took science courses as undergraduates in them, will be put to good use. They are scheduled for significant renovations to bring them back to usefulness. They are to be emptied in

January 2015 and ready for reopening by May 2016. About \$20 million will be spent to get the job done.

A primary beneficiary will be the Physics and Astronomy Department, which will take over the second and third floors and part of the first floor of Wisner-Patten. The Davis Building will house the Geosciences Department, which recently moved from Liberal Arts to Basic and Applied Sciences. Geosciences' departure from Kirksey Old Main will open space in MTSU's oldest and most beloved building for expansion of the Computer Science Department.

The Davis Building will also house centers that need additional space: the Center for Cedar Glade Studies and the Center for Environmental Studies. Eleven new and a total of 18 advisors for the College of Basic and Applied Sciences will also be in Davis, and other spaces in the building will be used for research labs or future growth. These are just a few of the planned moves.



The new building strengthens MTSU's ability to pursue a solid, focused research agenda, and it significantly raises our profile as a research institution.



Wiser-Patten Science Hall and Davis Science Building are scheduled for significant renovations.

Consistent with our rich tradition of teacher training, the new Science Building is tailor-made for the science of education, designed to make learning and teaching more productive and compelling experiences. It follows ideas put forward by the nation's foremost science and technology experts with regard to what works best for effective science and science education teaching. It includes discovery-based group-learning environments and spaces for informal discussion and collaborative interaction, all vital for establishing and promoting an ultramodern science education and research community.

Speaking of research, space in the new building will meet MTSU's needs for many decades. Certain upgrades will be particularly transformative. In chemistry, for instance, modern fume hoods now

allow experiments that were long prohibited in our older buildings. As a result, the new building strengthens MTSU's ability to pursue a solid, focused research agenda, and it significantly raises the University's profile as a research institution.

MTSU grants about 700 degrees in biology, chemistry, and related fields each year. Now that the new Science Building is in operation, that number is expected to increase significantly.

Science courses generate about 60,000 credit hours annually, and more than 13,000 students, majors and nonmajors,

enroll in biology, chemistry, and physical science courses.

Courses now offered in the new building serve academic programs beyond general education, biology, and chemistry. Nearly all of MTSU's students will benefit from our much-improved science facilities.

MTSU's new Science Building will be the portal through which we enter a new realm of science and research activity and compete for its rewards.

Has it been a long time coming? Definitely. But now the science and research fetters have been broken, and it's time to get to work.

There's a lot of science to be done!





photos: J. Intintoli; photo illustration: Brian Evans



REBUILDING *the* Privacy Fence

Calling on corporations to do the right thing (and not just the legal thing)

by Gina K. Logue

In the classic Alfred Hitchcock thriller *Rear Window*, Jimmy Stewart peers at his neighbors from his apartment window through the lens of an analog camera. Can you imagine what he could have learned about his neighbors in the age of Google? If Stewart were operating in the digital era, would he trade his own privacy rights for the convenience that Google, Facebook, Twitter, and other digital companies afford?

American private businesses have an “innovation policy vacuum” in dealing with the new technology, assert Dr. Leigh Anne Clark, associate professor of management, and her father-in-law and research partner, Dr. W. Jeff Clark, professor of information systems. The Clarks, along with Auburn University doctoral student Daniel Jones, compared privacy laws in the United States and the European Union, particularly Germany. They found that the few restrictions on

the books in the U.S. are very lenient, while Germany has perhaps the toughest privacy laws in the EU.

“They look at personal data as belonging to the person, and a person has to consent to the use of that data,” says Leigh Anne, who also is an attorney. “Even a photograph taken on a public street is my image that you’re using. . . . In Germany, the norm is I should consent to . . . the taking of the picture and the use of that data before it’s ever even used.”

According to Leigh Anne, a recent attempt to conduct a census in Germany came under fire as an invasion of privacy partly because the country’s agonizing Nazi past still looms over today’s public policy decisions.

“They are very, very sensitive to data being collected and to being surveilled,” she says.

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Contrast that with the American model, which can be diametrically different.

“There’s an argument that says an organization, a company, ought to do whatever it can do in order to maximize shareholder wealth,” Jeff says. “There’s even a prevailing sentiment in some sectors in the United States that says that if you can violate the law and increase shareholder wealth—so long as the penalty is not criminal, just civil—then go for it.”

Leigh Anne says Germany’s personal privacy statutes date back to around 1970. In 1995, the European Union passed a law requiring foreign companies working with EU companies to adhere to EU privacy standards. There are court precedents that use privacy as a touchstone. The 1973 *Roe v. Wade* case asserted a woman’s right to privacy. But can a case about abortion be pertinent in other areas of life?

“The spirit of that . . . is that there are things within us that are within our own control and body, and they’re not for someone else to use,” Leigh Anne says. “So I think you can pull from what is out there to help provide guidance.”

The research the Clarks are doing is scholarly, not judgmental. But they do suggest that businesses should take social norms and “hypernorms”—not just the law—into consideration when establishing their policies. They describe a norm as a principle that defines the right thing to do whether it becomes policy or not. A hypernorm is a cultural expectation that is so strong that virtually everyone in society accepts it as the way things ought to be.

Editor’s Note: Leigh Anne Clark (Ph.D., business administration, Southern Illinois University), professor of Management and Marketing at MTSU, has been cited by media outlets for her recent research and commentary on privacy concerns related to Google. The former Georgia attorney (J.D., Emory School of Law), who also focuses on disability and aging issues, previously worked for the Georgia Attorney General’s Office, the AARP, the Georgia Governor’s Council on Developmental Disabilities, and for her own consulting practice.

“Maybe you don’t have to go to jail, or maybe you don’t have to pay a fine,” Jeff says. “But there are people saying, ‘Whoa! That’s not okay.’ So you may suffer some public relations consequences, which may cost you, in the long run, even more than a civil fine.”

“I’m not sure that the average U.S. citizen realizes how far we have already compromised our privacy rights compared to the rest of the world.”

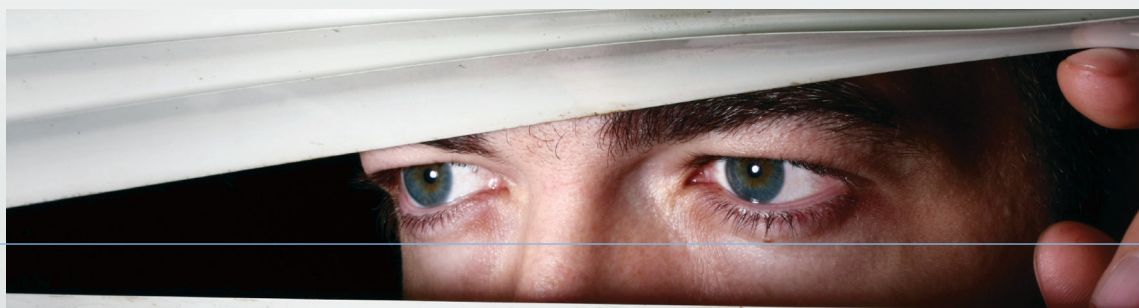
More and more of us are sacrificing privacy rights for personal convenience. For example, all Twitter transmissions are being archived by the Library of Congress. Another example is Google’s method of obtaining photo informa-

tion for its maps, capturing digital images of private property from public streets. Let’s say someone drives down your street in a van with a camera on a pole on top of the van. The pole is tall enough to enable the camera to take photos of you sunbathing in the nude behind a 10-foot-tall fence in your own backyard. The van never trespasses on your property. Do you have recourse?

“I’m not sure that the average U.S. citizen realizes how far we have already compromised our privacy rights compared to the rest of the world,” Jeff says.

The Clarks believe that society has been caught somewhat flatfooted as technology has evolved. After all, Alexander Graham Bell hardly could have anticipated that his revolutionary invention could have led to the obscene phone call.

“There’s no way that we can keep passing laws that will stay ahead of where we’re headed,” says Leigh Anne. “That’s why we strongly said to companies, ‘You’ve got to look at the cultural norms, because they are there. They don’t change very quickly.’” **MTSU**



ReSEARCH for Answers

News from a sample of MTSU's many research centers

THE VARIOUS MIDDLE TENNESSEE STATE UNIVERSITY academic centers not only enrich the lives of those on campus, the surrounding community, the state and beyond but also, collectively, their academic, government, and business partnerships bring millions of dollars to fund cutting-edge research and community service.

From helping a student struggling with dyslexia to assisting WSM-AM radio get its iconic broadcasting tower on the National Register of Historic Places, the work of MTSU's centers has far-reaching, positive effects.

Forensic Institute for Research and Education (FIRE)

Dr. Hugh Berryman, director

The mission of FIRE is to advance forensic sciences through education, research, and community service in collaboration with faculty, students, and community partners.

FIRE recently developed a smartphone app that gives officers a crime-scene checklist, key to preserving the initial scene. Instead of trying to juggle notepads, cameras, and video recorders, officers can immediately document crime scenes—capturing text, photographs, video, audio, GPS, dates, and times—with their smartphones.

A team of seasoned investigators headed by FIRE's director, Dr. Hugh Berryman, developed CASE (Checklist App for Scene Examination) with funding from the Department of Justice's Bureau of Justice Assistance. "Early documentation of evidence can make a difference in bringing justice to both the guilty and the innocent," says Berryman.

For more information on the Forensic Institute for Research and Education and its programs, including CASE, visit www.csimtsu.com.

Middle East Center

Dr. Allen Hibbard, director

The Middle East Center's focus is to promote an understanding of the various populations and cultures of the Middle East among MTSU students and in surrounding communities. It encourages faculty research and seeks to serve and respond to the needs of Middle Eastern students at MTSU.

In addition to supporting an interdisciplinary minor in Middle East Studies, the center has recently partnered with James E. Walker Library to sponsor two public events that were a part of a National Endowment for the Humanities Muslim Journeys Bookshelf grant. Dr. Ron Messier, MTSU history professor emeritus, introduced a showing of the documentary *A Prince Among Slaves* and led a discussion of the film, and Dr. Mustafa Bayoumi, professor of English at Brooklyn College, presented "How Does It Feel to Be a Problem? Arab-American Life and U.S. Foreign Policy."

Visit mtsu.edu/mideastctr for more information.

The Tennessee Small Business Development Center

Mr. Patrick Geho, director

The Tennessee Small Business Development Center (SBDC) is a partnership of MTSU, the Tennessee Board of Regents, and the U.S. Small Business Administration. The SBDC's mission is to enhance economic development in Tennessee by providing quality solutions for existing and potential small businesses through consultation, education, referral, and support services.

The SBDC is celebrating 30 years of delivering counseling, training, and technical assistance in all aspects of small business development. In 2013, the center counseled 3,807 clients, created 1,617 jobs, retained 1,442 jobs, and trained 15,564 people in small business-related subjects.

Visit tsbdc.org for more.



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Center for Cedar Glade Studies

Drs. Kim Cleary Sadler and Jeffrey Walck, codirectors

The Center for Cedar Glade Studies is an outreach effort of the Department of Biology. Its mission is to foster greater appreciation and knowledge of the natural environment. The center provides resources to the public through the use of technology to communicate concepts concerning cedar glades, offers opportunities for scholarly study as part of a research program on the ecology of glades, and provides K-12 and college students with an understanding of the methods of science through basic and applied research.

Recent projects include Kim Cleary Sadler's work with the McFadden Elementary School of Excellence in Murfreesboro to establish a cedar glade garden at the school. Cindy Cliché, second-grade teacher, and her students have "rescued" glade plants from roadsides and transplanted them in the school's cedar glade. Her students learn about scientific inquiry as they observe, map, and collect data about glade garden plants. Students also "adopt" a rare cedar plant to study throughout the year as part

of an integrated curriculum developed by Sadler, Cliché, and former elementary school teacher and math consultant Mary Lasater. The results have been accepted for publication in *Science Children*, in a paper called, "Bringing the outside in: learning ecology through the study of native plants."

Two faculty members are working on National Science Foundation projects with questions related to cedar glades. Chris Herlihy is studying the evolution of self-pollination in the glade

endemic *Leavenworthia alabamica* (Alabama gladecress). Another project is examining flower color polymorphism in *Leavenworthia stylosa* (Cedar or Long-styled gladecress) with M.S. student Julie Folk and Ph.D. student Thilina Fernando. Jeff Walck is part of MTSU's first NSF Research Experiences for Undergraduates grant, which involves preservice science teachers in cedar glade research projects related to soil and plant distribution.

Visit mtsu.edu/gladecenter for more.

Center for Historic Preservation

Dr. Carroll Van West, director

The Center for Historic Preservation (CHP) engages students with communities so that together they can interpret and promote significant heritage assets through education, research, and sustainable development.

One of the center's projects, Forgotten Landmarks along the Trail of Tears, is a collaboration to identify and document the existing buildings and structures along the more than 7,000 miles of the Trail of Tears National Historic Trail. The CHP is traveling every extant trail remnant possible in nine states from North Carolina to Oklahoma to find forgotten landmarks and to enter the documentation into a permanent database with the National Park Service. Amy Kostine, who studied the trail for her MTSU graduate thesis, is the project historian. Amy works closely with CHP director Dr. Van West and fieldwork coordinator Katie Randall to compile the database. Also contributing to the project are graduate students Jenna Stout and Jessica Reeves and alumni Pat Cummins and Robbie Jones. The project's success relies on partnerships between the CHP, property owners, the Cherokee Nation, the Eastern Band of Cherokee, the Trail of Tears Association, and the National Park Service.

Visit mtsubhistpres.org for more information.

Albert Gore Research Center

Dr. Jim Williams, director

The mission of the Albert Gore Research Center is to educate the MTSU community and the public about the histories of MTSU, American Democracy, equine studies, and life in middle Tennessee and to lead in the preservation of materials vital to those histories.

The center also eagerly assists other entities with archival and museum projects. Center director Jim Williams is leading a history project for Cheekwood Botanical Garden and Museum of Art in Nashville. Using Dr. Williams's expertise in oral history and the center's archivists and graduate assistants, interviews are being conducted with family members and others with long associations with Cheekwood and archival material is being gathered from family and public collections. (Joel Cheek founded what would become Maxwell House Coffee in the 1890s.) Cheekwood will use this information as it completes a new family history exhibit in the mansion and returns some rooms to their original appearance.

On campus, the center and a Ph.D. candidate in public history are working closely with the Department of Aerospace to arrange and properly store the manuscript and other materials that make up the Tennessee Aviation Hall of Fame archive.

Visit gorecenter.mtsu.edu.

Business and Economic Research Center

David Penn, director

The mission of the Business and Economic Research Center (BERC) in the Jennings A. Jones College of Business is to produce and distribute information about economic conditions and issues for authorities in middle Tennessee. The center's recent projects include the following.

The nonprofit sector in the Nashville Metropolitan Statistical Area (MSA) (headed by Murat Arik, associate director).

The nonprofit sector is an important part of local and national economies not only because of spending and employment but also through volunteering and civic participation. In this study, the Business and Economic Research Center systematically analyzed the nonprofit sector's contribution to the local economy. Findings show the presence of a vibrant nonprofit sector in the Nashville MSA. The study was sponsored by the Center for Nonprofit Management in Nashville.

Tracking Tennessee's Economic Recovery (headed by David Penn, director).

The Tennessee economy has improved following the Great Recession, but information regarding where new economic activity is happening in the state and the distribution of gains across industrial sectors was not readily available in one place until now. This project designed and updated the Tracking Tennessee's Economic Recovery website. Visitors to the site can discover how Tennessee is progressing through a variety of monthly economic indicators including employment, construction, housing prices, and sales. Data are collected for Tennessee and all ten metropolitan areas in the state. The project was sponsored by the Tennessee Advisory Commission for Intergovernmental Research (TACIR).

Visit mtsu.edu/berc for more.

Photo: J. Intintoli



Dr. Sandra Stevens (far left), seen here with her patient Janette Rodgers, has made national waves with her underwater spinal cord injury research. People who the insurance industry asserts are incapable of making any physical progress for the rest of their lives are making progress on MTSU's underwater treadmills.

Center for Health and Human Services

Dr. Jo Edwards, Adams Chair of Excellence in Health Care Services

The Center for Health and Human Services initiates and strengthens academic programs in health and human services to support workforce development and promote healthy communities. Through collaborative affiliations and partnerships, the center disseminates research and health-related information and conducts education and outreach projects.

The center's current projects include the following:

Death Scene Investigation Project. This initiative partners the center, Distance Education and Nontraditional Learning, and the Center for Educational Media with the state medical examiner, and the Departments of Health and Children's Services to implement a statewide training program for investigating sudden, unexpected infant or child death (SIDS). The program has been developed to train first responders such as EMTs, police officers, and firefighters. The project provides an annual SIDS Update meeting for public health staff and resources for medical examiners to attend a pediatric forensic conference.

Tennessee Comprehensive Cancer Control Project. The center works with the Tennessee Department of Health to aid activities supporting the Tennessee Comprehensive Cancer Control Plan. Working with the Tennessee Cancer Coalition, a volunteer group of citizens and organizations dedicated to reducing the burden of cancer in Tennessee, the center recently helped form six regional Cancer Coalitions that carry out many activities detailed in the plan. The center has provided marketing/media services and evaluation during various phases of the project and coordinates an annual educational Cancer Summit.

Smart Mothers Are Resisting Tobacco (S.M.A.R.T. Moms). This program promotes smoking cessation among pregnant women throughout Tennessee.

Visit mtsu.edu/achcs for more information.

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Discover how **Tennessee is progressing through a variety of monthly economic indicators**

GOOD *as* GOLD

Dr. Charles Chusuei's technology could transform patient care in emergency rooms and health centers worldwide

by Michael Burgin

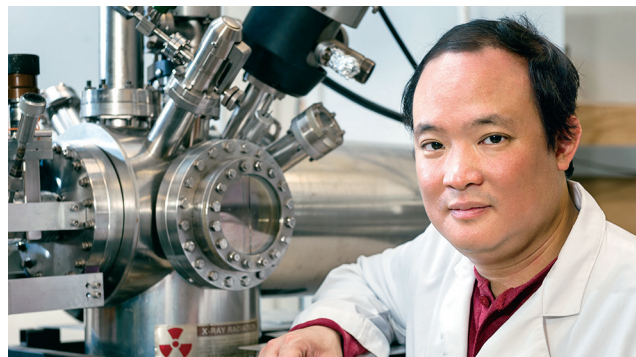
ON THE BOTTOM FLOOR OF WISER-PATTEN SCIENCE Hall, past a lecture hall and a few smaller classrooms and teachers' offices, one can find the home base of Dr. Charles C. Chusuei and his team of student researchers. At first glance, the lab is pretty much what one would expect. A number of small workstations, some whiteboards, and a desk or two populate the periphery of the room. Stacked in one corner, there are a number of large, unopened boxes. A bulky piece of equipment dominates the center. Most scientists and many students in the field would recognize the instrument as an X-ray photoelectron spectrometer, a machine that allows for nondestructive elemental analysis. It's a vital tool in the associate professor of chemistry's current line of research. Of course, give a layperson, someone who doesn't know a spectrometer from a chromatograph, a few moments to look around, and you'll probably hear the following question: "Is that a hand drill?"

It is (a Black and Decker, in fact). It's also a makeshift stepper motor for a homemade ultra-high vacuum sample transfer system. With the assistance of Rick Taylor, lab director in the Department of Engineering Technology, and the machine shop in the Voorhees Engineering Technology Building, Chusuei used the drill, a gearbox, a threaded rod, and machined pieces of aluminum to build a device the components of which would normally cost about \$1,000 to buy new.

There are plenty of other examples of Chusuei's combination of thrift and inventiveness—a fish tank pump substitutes for the Wisser-Patten building's lack of dedicated pipes for chilled water. It's one of many drawbacks to the 46-year-old building—those boxes in the corner are actually equipment with technical and safety specs that bar them from being installed in Wisser-Patten. In a field where research ambitions often far outstrip existing facility technology and available funding, it's not uncommon to find professors who are equal part bargain hunters and MacGyver. Chusuei, who arrived at MTSU in 2010, can count

on one of those variables changing soon—a \$147 million, state-of-the-art science building is scheduled to open for instruction in 2014—but that doesn't mean he's just waiting around. Quite the opposite, Chusuei and his student researchers have been busy developing a technology that could transform patient care in emergency rooms and health centers throughout the world.

As a result, this cluttered room, with its combination of brand-new, unpacked equipment in waiting and cobbled-together scientific apparatuses in use—not to mention the man standing in the middle of it all—represents the exciting present and potential-filled future of science research at MTSU as surely as the new building being built a few hundred yards away.



Not So Common Sense

As with most scientific research, discoveries with big applications often boil down to thinking small. Really small. Yet it also involves the detection of something one can find a bottle of in almost every home—hydrogen peroxide. It turns out that bubbling stalwart of home-based health care is also a natural byproduct of the biochemistry of all living organisms. The ability to monitor hydrogen peroxide on a molecular level has a host of practical applications in fields as diverse as health care (early cancer detection) and food service (spoilage detection). As a result, researchers have developed a variety of nanotech-based sensors. For the most part, those technologies have used sensors dependent on carbon nanotubes (CNT) coated with oxides derived from precious metals—gold, palladium, ruthenium, etc.

As the word “precious” suggests, it’s not cheap to use such metals. But just as with his lab’s ultra-high vacuum sample transfer system, Dr. Chusuei found that the expensive way to do things was hardly the only way. In an effort to establish a cheaper biosensing material, Chusuei turned to zinc.

“A common theme of nanotechnology is determining how material size and shape affects chemical reactivity,” Chusuei explains. “Our research team has shown that zinc oxide (ZnO) shape selection in the nanocomposite formulation (involving carbon nanotubes) dramatically improves its biosensing properties.”

The Goldilocks Standard

An earth-rich element, zinc is much more abundant and, therefore, cheaper than the precious set. But in order to establish it as a viable substitute, Chusuei and his team first needed to control the shape of the ZnO compound itself. (The more complete the coverage by the ZnO of the CNT, the better the sensor.) “It was a lot like the fairy tale *Goldilocks and the Three Bears*,” Chusuei says. In the end, working the ZnO into its ideal shape required many things being “just right.” It required, among other things, finding just the right temperature (90 degrees Celsius) of the solution in which the suspended ZnO nanoparticles were formed and the pH (7.365) for maximum reactivity, as well as establishing just the right amount of time for sonication (the application of sound energy to agitate the solution).

With the bulk of the research completed—and with the right balance struck—it’s actually a rather simple procedure to replicate, but as Chusuei’s patent application shows, it wasn’t an obvious one. The real-world potential of the research has Chusuei and his students excited. The cheaper the materials, the more widespread the possible application of the technology.

“If we can attach this biosensor in a portable electrochemical cell, then people can easily detect the presence of [certain compounds] in their body whenever and wherever they want,” says grad student Anup Deb, who learned of Dr. Chusuei’s research while an undergraduate at the University of Dhaka, in Bangladesh.

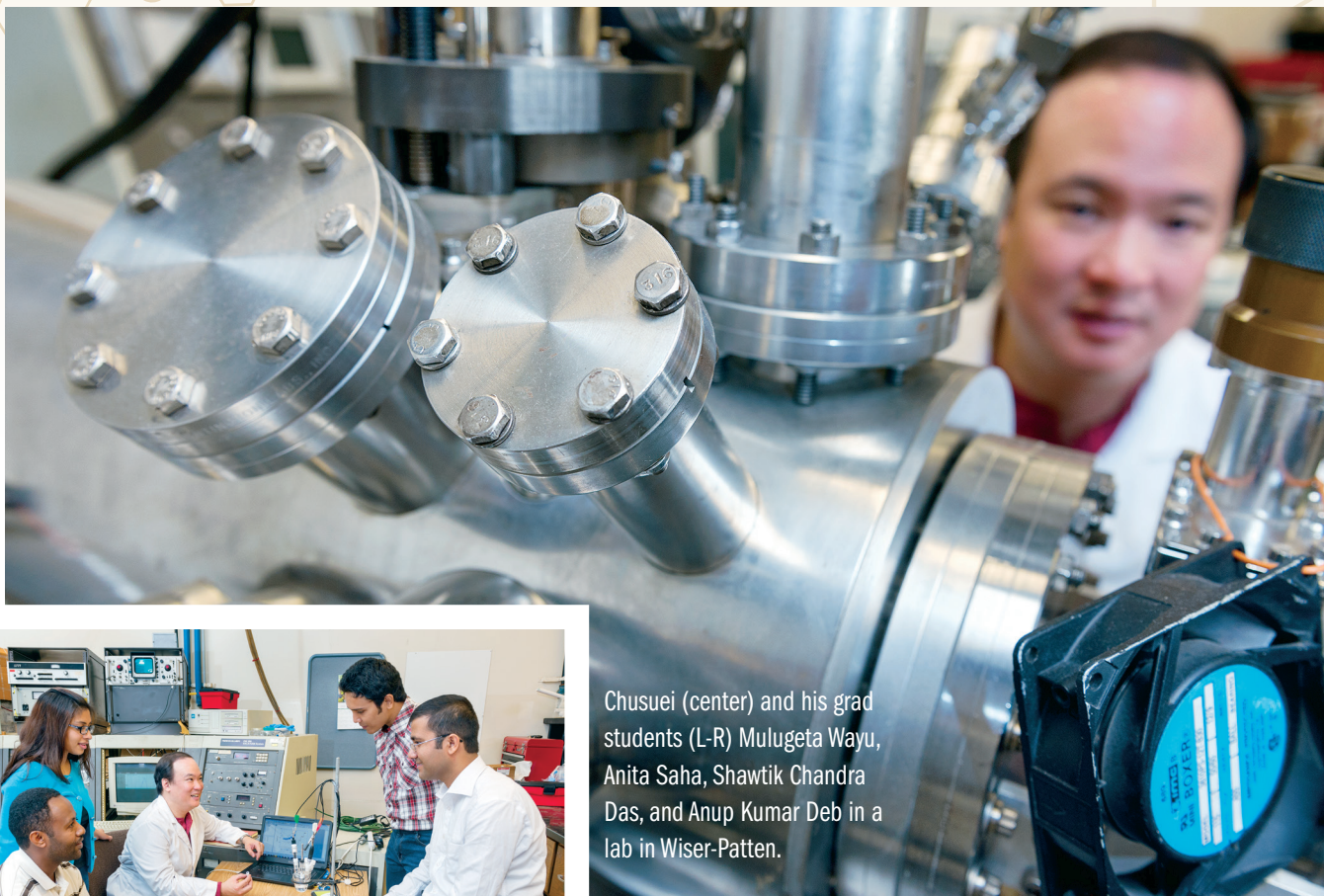
“What I’m doing now contributes to the effort to create a cancer-free community,” says Mulugeta Wayu, a Ph.D. candidate in the University’s Molecular Biosciences program who came

(continued on page 16)



as GOOD as GOLD

(continued from page 15)



Chusuei (center) and his grad students (L-R) Mulugeta Wayu, Anita Saha, Shawtik Chandra Das, and Anup Kumar Deb in a lab in Wisser-Patten.



to the United States after spending years as a research scientist in Ethiopia.

Cancer is not the only affliction potentially addressed by the research of Chusuei and his students, nor is hydrogen peroxide the only substance detectable. Another vein of inquiry includes the detection of lactic acid, a marker for anaerobic respiration (the presence of which can indicate that a patient is not breathing well or getting enough oxygen). Such sensors could detect signs of physical distress that show up well “before changes in heart rate or blood pressure would be registered,” Chusuei points out.

Even with so much established, there remain plenty of practical questions and intriguing pathways for follow-up research. “Now it becomes a question of how low you can go,” Chusuei says. As

with most things nanotech, the smaller one gets, the wider the applications. (There’s also the question of testing and gauging the toxicity of the resulting sensors.) The lab’s success with ZnO has also led to research with other non-precious-metal-based compounds. Anita Saha, a senior biochemistry major, is working with cerium oxide to detect acetaminophen.

In less than a year, Dr. Chusuei’s modest little laboratory will be housed in a shiny new science building. The low-energy electron diffractometer, liquid nitrogen generator, and quadrupole mass analyzer—to name a few of those brand-new pieces of equipment still in boxes—will have been unpacked and put to long-awaited use. It’s exciting to consider, and no doubt the state-of-the-art facility will make a host of scientific processes easier and new discoveries possible. Nonetheless, the most crucial ingredients to the University’s future success as a research institution are already in place in the form of Dr. Chusuei, his colleagues, and all the student researchers under their direction. Oh, and that hand drill masquerading as a stepper motor. [MTSU](#)

SURVEY Says

MTSU POLL

MTSU's statewide poll is second to none in reading the minds of Tennesseans

by Suma Clark and Drew Ruble

NOT EVERY STATE IS FORTUNATE ENOUGH TO HAVE A MIRROR IN THE FORM of a University-led, independent statewide poll that can reliably inform the population—especially on a regular basis. Starting in fall 1998, MTSU's Survey Group has collected public opinion data every spring and fall on major social, political, and ethical issues affecting Tennessee.

Jason Reineke, associate director, whose decision to join the MTSU faculty was swayed by the opportunity to be involved in the poll, says, "I really believe that, after educating residents of Tennessee, the poll is one of the most important services that Middle Tennessee State University provides to the state."

Planning and executing the polls is a year-round process that Reineke and poll director Ken Blake fit in around classes and research. Hundreds of students participate each year. Blake says he hopes the students "come away with the sense that they did something important." The availability of data over more than a decade also fosters considerable research among faculty and graduate students.

Among many other findings, the latest MTSU Poll in 2014 showed that Tennesseans oppose legalizing marijuana generally but appear willing to allow medical marijuana use. (See column at right.) Conducted Jan. 23–26, the scientifically valid poll of 600 randomly selected Tennessee adults has an error margin of plus or minus 4 percentage points at a 95 percent level of confidence.

In 2014, the poll also revealed the following:

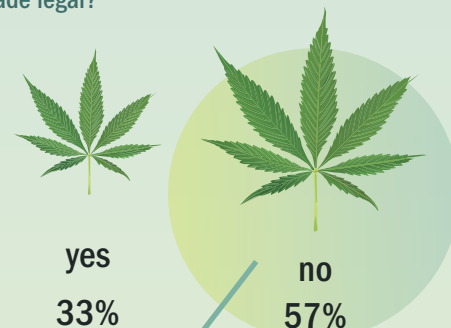
- Sixty-four percent of state residents oppose allowing gay and lesbian couples to marry legally.
- Fifty-two percent support forbidding the enforcement in Tennessee of federal-level firearms laws and having firearms regulated solely by state and local laws.
- Tennesseans give their schools C's on performance.

Just as the queen in *Snow White* was not happy with the truth-telling "mirror on the wall," not everyone is happy with the poll mirror. "Sometimes it's pleasing; sometimes it's not," Blake says. But that doesn't decrease the value of the reflection provided by the MTSU Poll to the citizens of Tennessee. [MTSU](#)

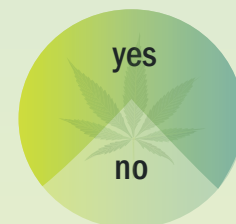
The *Marijuana* Question

Tennesseans were asked:

Do you think the use of marijuana should be made legal?



Should adults be allowed to use doctor-prescribed marijuana for medical purposes?



Conclusion

Do you think the use of marijuana should be made legal?

Only for **medical purposes** 36%

Yes, **legal** 33%

No, not even for medical purposes 18%

Undecided 7%

Undecided about general legality but approval for medical purposes 6%



Imitations in Life

Dr. Andy Brower uses mimicry patterns to
decode the evolutionary history of butterflies

by Allison Gorman

AT AN AGE WHEN MOST KIDS WERE SITTING ON the family room floor watching Captain Kangaroo, Andy Brower was running across the green hills of Trinidad, watching his parents collect butterflies. Both were renowned entomologists: his mother, Jane, conducted groundbreaking research on butterfly mimicry, the protective adaptation by which one species develops the markings of another; his father, Lincoln, built on her research and also received acclaim for his study of the unique migratory pattern of the monarch butterfly. The scientific term “Browerian mimicry” was named for them. (“My parents were high school sweethearts,” Brower says. “Nerdy, bug-collecting sweethearts.”) By age seven, Andy had tagged along on several research trips to Trinidad and, shepherded by graduate assistants, amassed his own “little-kid butterfly collection” of brightly colored tropical species.

Now, Dr. Brower is a renowned entomologist in his own right. A graduate of Yale and Cornell, he conducted postdoctoral research at the Museum of Natural History and the Smithsonian Institution, and he has published more than 60 peer-reviewed articles and become an internationally recognized expert on butterfly evolution. In 2006, he left Oregon State University to join the biology faculty at MTSU, where he recently earned the University’s Distinguished Research Award.

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Brower recently received a rare invitation to speak at the Linnean Society of London, the oldest biological society in the world, at the venue where in 1858 Charles Darwin read his paper introducing the theory of natural selection.

photo: J. Intintoli

The butterfly effect is a term used to describe how small changes to a seemingly unrelated thing or condition can affect large, complex systems.

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One of Brower's advantages over his parents is technology they didn't have that allows him to study butterflies at the chromosomal level. Over the past 20 years, he has been piecing together an evolutionary history of a group of South American butterflies, studying their DNA to figure out how certain mimetic patterns developed over time in that continent's diverse geography. Did those patterns stay essentially the same, he wondered, or did they change—and what role did genetics play in the process? He hypothesized that the butterflies evolved their wing patterns independently and “mimicked” one another many times in different areas. When he began the research, he says, “The access we had to the genome was pretty limited. It's much broader nowadays, but subsequent research has largely borne out what I said.”

Brower has secured more than \$1 million in external funding for his research, and he just received funding from the National Science Foundation to begin new fieldwork in South America. He and several Brazilian scientists will collaborate with the American Museum of Natural History, the New York Botanical Garden, the Field Museum in Chicago, and the Natural History Museum of Los Angeles County to construct a Pleistocene history of the Amazon Basin. “We'll be looking at genetic patterns of variation in a variety of model organisms including birds, monkeys, trees, and then butterflies,” he says. “We're going to try to do some next-generation sequencing, which is something I haven't done before.” He hopes to begin in the spring.

Researchers like Brower are playing beat the clock, because thousands of species of plants and animals are threatened with extinction each year. “There are too many people, the

climate is changing, and it's an ecological catastrophe for most other living things in the world right now,” he says. “And as countries like China and Brazil become more economically advanced, it speeds up the destruction of natural resources—they get whittled down to little national parks and places like that.” The next few decades will be the most critical in history for understanding and preserving biodiversity, Brower says—and that requires coordinated, systematic research.

To promote that collaborative mission, Brower has added his expertise to the Tree of Life Project, a web-based “family tree” charting genetic interconnections among all living things. Scientists and nature enthusiasts around the world have contributed to 10,000 web pages, each devoted to a different group of plant or animal, from tyrannosaurs to fungi. (Thanks to Brower, it includes more than 40 varieties of *Heliconius* butterfly alone.) It is an ambitious undertaking, a blueprint of the evolution of life on earth.

Because Darwinian theory underpins Brower's research—mimicry is evolution by natural selection—he's well aware of the attendant political and religious baggage. While his own fieldwork never crosses the perilous intersection of human and ape, he does teach an evolution course required for biology majors. Brower begins by acknowledging to his students that a majority of Americans reportedly don't believe in evolution—and then he reminds them that for scientific purposes, absolute truths are less important than hypotheses and data, the framework for understanding biology. “You don't have to believe it,” he tells them, “but you've got to understand it.”

To understand. If work like Andy Brower's could be distilled to a single concept, that would be it. Unlike applied science, whose goal is problem solving (often through the development of marketable technology), basic science has no agenda beyond furthering understanding of the natural world. Certainly applied science is built upon that understanding: as Nobel prize-winning astrophysicist George Smoot once noted, “If we only did applied research, we would still be making better spears.”

But as academia pushes the more lucrative applied side, Brower says he feels fortunate to do what he does for a living. “My work is like art, in a sense, and my artistic medium is that I generate stories about the evolutionary history of butterflies.” When he tells those stories well, he doesn't just help people understand biodiversity—he gets them excited about it. Then, perhaps, they'll be motivated to preserve it. [MTSU](#)



From Literary Canon to *Vampire Slaying*

by Candace Moonshower

**DR. DAVID LAVERY IS CRAFTING A
NEW POP CANON, ONE BUFFY AT A TIME**

“I’ve been asked a hundred times why I’m interested in *Buffy, the Vampire Slayer*,” says Dr. David Lavery, director of Graduate Studies in English at MTSU. “I say it’s because it makes me feel like my education wasn’t for nothing.”

Connecting the respected canon of literature to a TV show about vampires and a heroine slayer isn’t the typical self-reflection one might expect from a professor of English literature with curriculum vitae long enough to warrant an ISBN number. But Lavery isn’t typical.

Since 1978, when he earned his Ph.D. in English at the University of Florida, Lavery’s career trajectory, which began with a desire to focus on American literature and specialize in Native American literature, has taken a surprising detour out of the realm of the canon and into the uncharted waters of popular culture, particularly television studies. The first leg of that journey was his dissertation, which came out of a push to see a Federico Fellini film. Then, during an early stint at the University of Memphis as a professor of communication and film studies, Lavery was asked to teach a class called TV and Culture.

“At first, I thought it was ridiculous, but I enjoyed it,” he said. Little did he know, but he was in the first group of scholars engaged in groundbreaking studies about TV and its impact on our culture.

Since arriving at MTSU in 1993, he has continued to break new ground, bridging the gap between pop culture and the canon.

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photo: J. Intintoli

Vampire Slaying

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Lavery created the first scholarly book devoted to an individual TV series



photo: J. Intintoli

“It’s exciting to teach at a school with such a comfort level,” Lavery says. “Here at MTSU, I can teach Wallace Stevens and then Joss Whedon,” the latter being the creator of *Buffy*, the director of recent box-office smash *The Avengers*, and other iconic shows and movies. (Lavery recently published a book titled *Joss Whedon: A Creative Portrait*.)

According to Lavery, the division between low and high culture is not as strong as it once was—or as people thought.

“As a graduate student, I used to hate TV,” he admits. “I thought it was Orwellian and would ruin our souls. I never pictured myself here, in this career. And I’m having fun.”

Lavery adds, “No one has ever invited me to Australia to talk about Wallace Stevens, but they have invited me there to talk about *Buffy*.” (His eyes twinkle as he tries not to smile too broadly.)

One promising aspect of this burgeoning area of study? The need for scholarly articles and books. Lavery created the first scholarly book devoted to an individual TV series, *Twin Peaks*.

“No one had thought of taking on a book about TV—and I certainly never anticipated being that person,” he says. Since that seminal work, Lavery has authored, coauthored, edited or coedited over 20 books and over 150 published essays, chapters, and reviews, including the aforementioned book-length biography of Whedon.

Lavery believes MTSU is a leader in the integration of pop culture and traditional English studies. He acknowledges that while English departments have accepted film studies, many have not yet taken on TV, which he calls misguided.

“TV shows are like novels,” he says. “They cover a long narrative time, and they should be part of the canon. The canon will grow.”

It’s not the first time MTSU has done pioneering scholarly work related to pop culture. Lavery points to former professors Michael and Sara Dunne (also noted pop culture scholars) and the much-celebrated Charles Wolfe, who became, arguably, the most important music scholar in the world writing about country music.

For Lavery, it all starts with *Buffy*.

“I hated the movie, so I didn’t watch the show on TV,” Lavery admits. “Four years in, students wanted me to watch. They said, ‘It’s your kind of show!’ I finally watched it, and it changed my life. Those students changed my life.”

And what about Joss Whedon, around and about whom a good deal of Lavery's work has been centered?

"Whedon is the champion out there for all of us out here who once thought we were losers," he says.

Lavery boldly places Whedon studies as a natural complement to those of a better-known literary icon.

"Shakespeare . . . has kept English teachers busy for 400 years," Lavery says. "Whedon . . . has tapped into how our imaginations work and changed TV. He has reached whole families and spoken in a language we understand. Like Shakespeare in his day, Whedon is one of us."

Lavery is one of us, too. Tori Warenik, a former student of Lavery's who received her master's in English from MTSU in 2013, says she enrolled specifically to study under Lavery.

"I first met Dr. Lavery in 2010 at Slayage, a popular culture conference on Joss Whedon, which convenes every other year. When applying for graduate programs, I contacted Dr. Lavery, who volunteered some advice: 'Go where you feel like you belong.'" (Lavery was a cofounder of the Slayage conference, and the *Slayage Journal*—each outgrowths of the Whedon Studies Association Lavery also cofounded.)

Warenik chose MTSU.

"Many people don't get the opportunity I did to make a connection with someone so plugged in to his area of interest as well as to his legacy: his students," Warenik says. "Though he has written and edited a veritable shelf of books and academic papers, Dr. Lavery wants his students to succeed in their chosen paths as he has, which in academia, is actually extraordinary."

Warenik, now a high school English teacher in Florida, says she is excited to try to make those same types of connections with her own students.

What is next for David Lavery? His ambitions are many and varied. He certainly doesn't want to be pigeonholed. He admits that he has always chafed at the "turf" of academia.

"In my perfect world, the English Department and the Chemistry Department would teach together," he says.

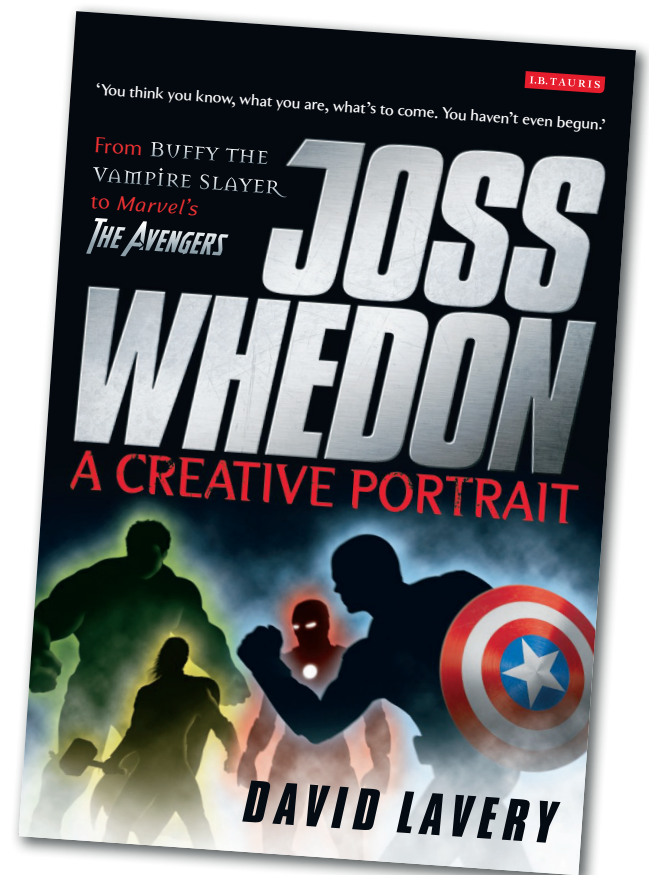
Lavery says he has enjoyed teaching in the Honors College and would like to teach an interdisciplinary course on the topic of creativity.

"Our Honors [program] does an incredible job of giving good students a chance to think outside the box," he says, acknowledging that MTSU is the number-one target for the state's best and brightest students.

In summer 2014, Lavery is teaching Special Topics in Popular Culture: James Tiptree, Jr. and Science Fiction—a graduate class. He is also finishing a book called *Finale* about the great television finales of all time.

And the canon?

"I'd like to write a book on Wallace Stevens," Lavery says with a smile. [MTSU](#)



MTSU is a leader in the integration of pop culture and traditional English studies.



Welcome TO THE FUTURE

James E. Walker Library and its staff deftly ride the digital humanities wave



by Gina K. Logue and Drew Ruble

DATING BACK TO THE THIRD CENTURY BC

and the library of Alexandria, the most famous example of an early library in the ancient world, **the mission of libraries has been simple: to connect people to information.**



In modern times, in a world filled with Web-based media, social networking, and cloud computing, that fact remains true. But today, libraries serve a world extending far beyond bricks and mortar, including anyone with an interest in a particular topic and access to an Internet connection.

MTSU's Walker Library is a sterling example of a modern library that already offers electronic versions of many or most of its periodicals, books, and collections. As library dean Bonnie Allen points out, "We have rows and rows of books on shelves, but that is only about half of our entire collection—the other half is accessed through a keyboard or your smart phone." Significantly, though, that pathway to information isn't limited exclusively to the library's standard collections. Libraries now acquire collections in electronic formats but are also transforming unique collections into digital collections. Beyond digitizing its own materials, Walker Library has also partnered with other academic units to make some of the University's priceless intellectual holdings available electronically.

In doing so, Walker Library has evolved into a true hub for humanities research in a digital age, becoming less a warehouse for books and more of what Allen describes as a "portal to a world of information."

BRAVE NEW WORLD

Matthew G. Kirschenbaum, an associate professor in the Department of English at the University of Maryland (and

associate director of the Maryland Institute for Technology in the Humanities), has written that while science disciplines have always evolved with new technology, and, in fact, depend on technological advancements, the humanities have remained "largely the same in approach and creation, staying rooted in the so-called 'analog humanities,' which consist of printed, physical media."

That's changing. Engulfed by the digital age, the humanities are, in Kirschenbaum's words, rebooting. The defining phrase in the library profession today is "digital humanities." In a recent interview with the *Journal of Education and Information Studies* at UCLA, Johanna Drucker, a UCLA professor of bibliography, described digital humanities as "work done at the intersection of computational technology and the humanities."

"That means that we use a whole suite of methods, tools, and techniques that make humanities materials available to digital processing," Drucker added, specifically citing text analysis, data mining, databases, metadata, geospatial encoding, virtual-world building, network analysis, information visualization, interface design, and imaging, among other approaches. "Most of these techniques come from the empirical sciences, statistics, or business applications and have been adopted for use in the humanities. They require structured or formalized presentations of materials—documents, images, sound—in digital formats, which means migrating analog artifacts into a digital format."

In other words, the digital humanities encompass the use of new technology to study what have been historically nontechnological disciplines. And Walker Library is in step with that transformation.

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FROM STACKS TO CYBERSPACE

Crucial to this new landscape for libraries is collaboration between campus entities—the humanities, computing, and libraries—to take full advantage of digital scholarship. At MTSU, Walker Library serves not only as a catalyst for the creation, management, and delivery of digital content but also as the new focal point for the storage and dissemination of content through a strong and growing web presence of digital text, images, audio, and video.

One major initiative in particular illustrates Walker Library's role as a leader in the digital spectrum—namely, the execution of digitization projects that will preserve the one-of-a-kind, vintage analog materials already in MTSU's possession for future generations of scholars. To coordinate the work, Walker Library is partnering with three highly regarded MTSU research centers—the Center for Popular Music, the Center for Historic Preservation, and the Albert Gore Research Center—to make what are some of Tennessee's most precious collections more accessible worldwide. "This started with a meeting more than a year ago where we looked at synergies among our campus collections, our

expertise, and our space, and realized we had a common mission," Allen says. "I had just joined MTSU as dean of Walker Library and was accustomed to collaboration with a wide range of scholars, as well as libraries. I knew that MTSU archives and Walker Library had this great opportunity to work together. We all seemed to have the same idea at the same time—it was an easy partnership to form!"

Walker Library is less a warehouse for books and more of what Allen describes as a "portal to a world of information."

Named the Digital Partners, the partnership is now publishing in digital form what Allen describes as the "hidden collections of MTSU." Digital Partners marries the technology, expertise, central campus space, and unique collections at MTSU for the electronic benefit of all who are drawn to the collections housed physically on campus. "Each of the partners has been working to establish processes, gather equipment, and initiate training to digitize their most valued collections," Allen says. "So, for instance, CPM and Gore are visited by researchers who travel to use their special collections. Walker has the foundational collection

of published reference materials that provide the historical context and factual verification on nearly every discipline."

"Each of the partners had also spent time in the trenches learning the standards and the technical tools of digital publications," she adds. "All had staffers who had experience in the creation of specific digital collections and had collaborated in the production of Web-accessible portions of our collections, were ready to expand, and eager to do this together."

To support Walker Library's strategic push further into the digital realm, the library has in the past year alone hired various professionals with specializations in metadata or descriptive data for digital publications. It has also expanded its technological staff expertise. Two librarians, Ken Middleton and Mayo Taylor, who had already developed digital collections in recent years, have continued to keep pace with new developments in digital publishing. Behind glass walls on the second floor of the library are the technical tools Middleton and Taylor use to transform images and documents into a rich digital collection used by local schoolchildren, world scholars, and top researchers alike. The Digital Scholarship Lab, which opened in August 2013, includes scanning equipment, computers, and staff and meeting space that encourages and enables more publishing.

James E. Walker Library Dean Bonnie Allen



“One major initiative in particular illustrates Walker Library’s role as a leader in the digital spectrum—namely, the execution of digitization projects that will preserve the one-of-a-kind, vintage analog materials already in MTSU’s possession for future generations of scholars.”

All copies of the student newspaper *Sidelines* through 2011 have been scanned. The digitization of *Midlander* yearbooks was outsourced. These were obvious targets for preservation to chronicle the University’s history and growth. But there’s more to it than that. For example, one project now underway chronicles the effect of Jim Crow laws on the formation of statewide communities in Tennessee. This yearlong project is funded with a diversity grant from the Tennessee Board of Regents and will conclude with both a collection and a website.

The digital collections created by Walker Library, including those achieved through collaboration with the Digital Partners, can be seen on the library’s digital collection website (<http://digital.mtsu.edu/cdm>). Allen says the influence of the collections to date is “strongly toward southern history and MTSU’s history.”

STUDENT SUCCESS

According to Allen, the implications of the Digital Scholarship Lab include positives for graduate students and departments on campus “to apply a variety of technologies in the course of their research and then publishing a digital format or collection.” Allen adds that Walker is evaluating software for the creation of an institutional repository that will virtually house such items as electronic theses and dissertations, articles, reports, photographs, and

research data from undergraduates through faculty. “This repository will be the searchable electronic archive of works as they are created on campus,” Allen says.

Looking to the future, Allen promises that the Digital Scholarship Lab “will be a place for training our students and faculty in the use of technology to better visualize research and publish in electronic media.” Preparing students and faculty in this way, Allen says, is the truest definition of digital humanities in academic circles. UCLA, the recognized leader in the digital humanities in higher education, states on its website that at its core, digital humanities teaches students “to create and critique media content, to develop the necessary skills and abilities to evaluate this content, to manipulate and transform digital technologies, and to develop the requisite literacy across information environments and media forms, including textual, aural, visual, and digital domains.”

One example Allen cites of the future of digital humanities at MTSU is the potential use of geographic information system (GIS) software to better visualize the influence of music across the South and how that is associated with community change or historical events.

“It is so exciting to think of the potential for graduate students in the Historic Preservation program working with the Center for Popular Music and specialists in mapping technologies to work together in creating new scholarship,” Allen says.

“We have models among the leading research institutions like UCLA to guide us, but most importantly, the library and archival partnership bring the necessary talent and the collections to provide a rich and innovative learning environment for our students and faculty.”

BACK TO THE FUTURE

Walker Library’s collaboration with the three MTSU centers is symbolic of the interdisciplinary nature of the digital humanities. The Jim Crow laws project is an example of how libraries can facilitate such research using new technologies and working with multiple databases. The total effort, which emphasizes real-world education in a digital age, ties in seamlessly to MTSU’s focus on student success.

Clearly the role of the university library in the 21st century is not simply to serve as a repository for books. Libraries have been reinterpreted and redesigned to serve as a vibrant resource for a diverse audience looking for multimedia solutions. But whether content is being delivered off the shelf or online, the modern library’s mission remains the same as it was in the third century—to make reading accessible and learning possible, even as it remains a true community resource. Walker Library has deftly changed with the times to maintain that seminal role at MTSU and beyond. [MTSU](http://www.mtsu.edu)



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Vanishing GIANTS

Dr. Brian Miller investigates the disappearance of one of the region's strangest looking animals

by Candace Moonshower

Devil Dog. Ground Puppy. Snot Otter. Tweeg. Hellbender. These are just a few of the nicknames associated with *Cryptobranchus alleganiensis* (the Eastern Hellbender) and *Cryptobranchus alleganiensis bishopi* (the Ozark Hellbender), two subspecies of North American giant salamander, one of the largest amphibians in the world and the specialty of Dr. Brian Miller, MTSU professor of biology.

Miller, who grew up north of St. Louis, has always been a big fan of amphibians and reptiles. Although he was working with snakes at the time, Miller began working with hellbenders in a herpetology class at the University of Missouri, where he was pursuing his bachelor's degree in wildlife. After receiving his master's in biology from the University of Missouri and a Ph.D. in zoology from Washington State University in 1989, Miller came to MTSU to work specifically with hellbenders. "The

habitat looked promising for hellbenders," he says as he recounts how he had no trouble finding the creatures in 1991 in the Duck, Little Duck, Collins, Buffalo, and Calfkiller Rivers.

Now, after searching almost every body of water from the Duck River to the Normandy Reservoir, Miller hasn't been able to find the creatures. "Almost all of the individual hellbenders we collected, marked, and released were older, larger, and sexually mature," Miller says. "We think that in areas where we cannot find young individuals, it is because they aren't reproducing well." The die-off has happened quickly, and alterations in the water quality and stream habitat may account for the changing population. "Pollution, agricultural run-off, or disease may all account for the decreasing populations," Miller says, "and we're just trying to get a better feel about what might be happening."

(continued on page 30)

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According to Miller, hellbenders used to be easy to find, and in the past, people harvested the creatures for pets or for science class dissections. “I had snakes, lizards, and salamanders as pets,” Miller admits. “But it’s a different time now. Since I began my work at MTSU, my views on owning wildlife as pets have changed.” He says if a previously easy-to-find group of animals is disappearing, it should be a cautionary tale. “These are the largest salamanders we have that live in the clear, clean water of streams,” Miller says. “If they’re dying out, there is some kind of environmental problem that we need to investigate.” Miller concedes that when something becomes rare, people automatically want it, and that we might see hellbenders now on the black market. But he doesn’t think that is as big an issue as water quality.

For its size, MTSU has a strong group of students working with everything from plants to salamanders in the area of field biology. “I’ve hired more than 40 students off the grants I’ve obtained,” Miller says. “Within the state of Tennessee, you’re not going to find as large a group working with herps and other diverse animals.” In the 1990s, funding for the hellbender studies came from the University. Recently, the money has come from the Tennessee Wildlife Resources Agency (TWRA) and State Wildlife and Tribal Land Grants.

Several different entities—Lee University, the Nashville Zoo, and MTSU—were each separately awarded money to research and work on species that are in jeopardy of being listed as rare, threatened, or endangered. While each entity was given separate grants, they have worked in a partnership that makes sure activities don’t overlap

and that maximizes the use of the money each group was awarded. Michael Freak at Lee University has conducted genetic analyses of hellbenders from as many watersheds in Tennessee as possible to better determine the genetic relationships of the remaining populations. Dale McGinnity at the Nashville Zoo is primarily interested in the husbandry of hellbenders and refining techniques that will allow the use of frozen sperm on fresh eggs. Miller’s work has been entirely field-oriented—searching streams that he worked 20 years ago and other streams in watersheds with past records of hellbender occurrence.

The partnership stems from the State Wildlife Action Plan Partnership Award that was presented at a “Teaming with Wildlife” convention in Washington, D.C. It is a competitive award given to those groups receiving State Wildlife and Tribal Grants money that exhibit collaborative success. It was presented to Miller, Freak, McGinnity, Bill Reeves (TWRA chief of biodiversity), and Stephen Spear of the Orianna Society, a group dedicated to protecting imperiled snake species.

Miller views hellbenders as part of our natural heritage. “Just as we try to protect our cultural heritage—Stones River Battlefield, Oaklands Mansion—I think it is also important to preserve our natural heritage. Future generations deserve the opportunity to visit local streams and see a diversity of wildlife and not just those species tolerant of more polluted or disturbed waters.” **MTSU**

(below) Dr. Brian Miller, professor of biology, and his team won a national award from the Association of Fish and Wildlife Agencies for their studies on the hellbender salamander in middle Tennessee.



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UNRAVELING DYSLEXIA

An MTSU center helps students and parents recognize and overcome obstacles posed by a common reading disorder

by PATSY WEILER

Envision standing near the entrance to a walled garden. Inside is a fascinating place where letters and words take root and bloom into meaning. People happily come and go at will through the gate, but not you. No matter how many times you try or how hard you push, it won't open. It is embarrassing to have others watch you. You feel discouraged. Eventually, a sense of failure takes root, and you walk away.

While metaphorical, this is a picture of what those with dyslexia regularly experience when trying to read, write, or spell.

Although most of us take it for granted, reading enables us to step outside our own experience, see the world through different eyes, and gain new perspectives that inform our worldview. It isn't any wonder, then, that a person's reading ability can prove to be a significant barometer of success in life, whether in academics, a career, or even one's health.

Dyslexia—which has nothing to do with a child’s intelligence and desire to learn (or even good teaching)—is like the garden wall described above: a barrier to literacy. Failure to clear that barrier can produce negative consequences not just for students but also for society as a whole. Illiteracy often leads to undesirable social outcomes ranging from unemployment to homelessness and poverty.

The good news is, students with dyslexia can learn to read, and they can do so through the types of specialized instructional approaches employed at the Tennessee Center for the Study and Treatment of Dyslexia at MTSU.

A Model Organization

Mention dyslexia and most people have some awareness of the term but no clear understanding of its meaning or its impact. Dyslexia affects 10 to 20 percent of the population.

In 1993, the Tennessee General Assembly established the Tennessee Center for the Study and Treatment of Dyslexia, which is part of the MTSU College of Education, to assist K–12 students and their families, teachers, and other professionals grappling with the problem. The work of the center has touched the lives of thousands of people—helping them find new keys to open the gate—in 94 of the state’s 95 counties.

Dr. James Herman, the center’s director, is enthusiastic about the work being done.

“This is an exciting place,” he says. “We are constantly moving forward. The staff regularly meets to discuss the latest research and cutting-edge technology. We are all working to make dyslexia known for what it is and what it isn’t.”

What it is, according to the International Dyslexia Association, is “a specific learning disability that is neurological in origin, characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities.” Struggling to read hinders vocabulary growth and reading comprehension and can lead to low literacy and poor self-esteem.

It’s important to understand that dyslexia is not a disease; it cannot be cured. Nor does it equate to intelligence; many dyslexics function at an average to above-average level. However, when detected early, dyslexia can be successfully addressed with education, training, and patience.

An example of someone who refuses to let dyslexia define him is Justin Lowe, 22, an MTSU junior from Murfreesboro majoring in anthropology. Lowe’s second-grade teacher at Homer Pittard Campus School recognized his student’s struggle and sent his family to the center for help.

“The people at the center helped me realize I should not focus on my weaknesses but rather my strengths,” he says.

“I can get the same thing achieved by taking a different route, but the outcome is the same. You learn to think outside of the box.”

Lowe remembers being motivated when he learned that celebrated military general George Patton had dyslexia.

“It made me realize that if I put my mind to it, I could do anything I wanted and dyslexia was not going to hold me back,” he says.

Other well-known Americans who have this disability include Jay Leno, Henry Winkler, Tom Cruise, Cher, and Anderson Cooper. Most struggled in school and couldn’t read well and were told they were not living up to their potential or, even worse, that they should quit school.

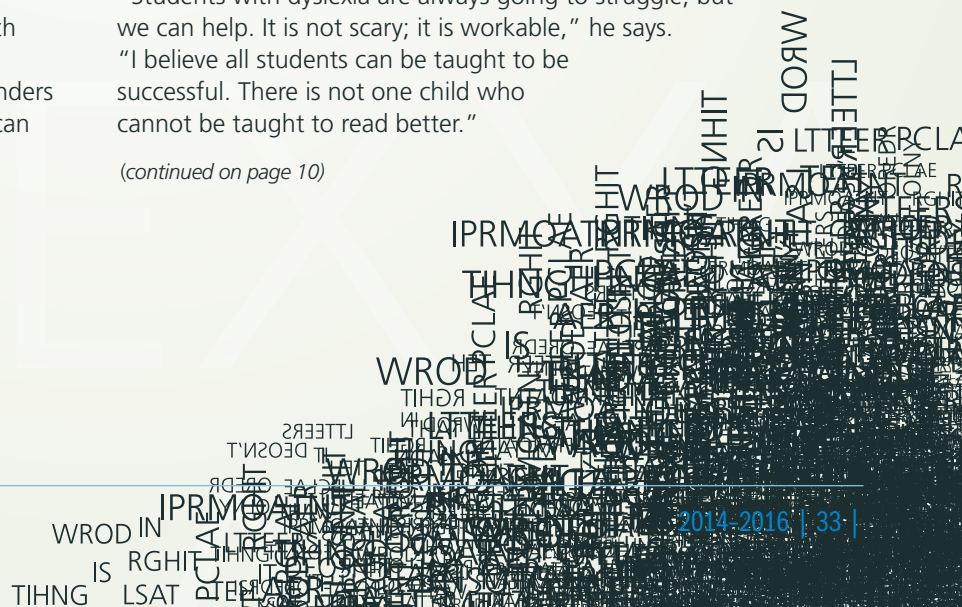
Such thoughts make Herman bristle.

“Students with dyslexia are always going to struggle, but we can help. It is not scary; it is workable,” he says.

“I believe all students can be taught to be successful. There is not one child who cannot be taught to read better.”

(continued on page 10)

It’s important to understand that dyslexia is not a disease; it cannot be cured.





from Flora to Pharma

MTSU's collaboration with a Chinese botanical garden bodes well for the health of a nascent Tennessee industry

By Drew Ruble

Several recent pharmaceutical successes stemming from the use of active chemical ingredients in Chinese herbal medicines to develop conventional Western pharmaceutical agents reveal just **how big a deal** MTSU's new partnership may be.

MIDDLE TENNESSEE STATE UNIVERSITY'S ACADEMIC connections to the Middle Kingdom rival those of any university in America. But it is MTSU's latest collaboration with the Chinese that may hold the greatest potential to yield significant dividends for Tennessee's economy—and cure some of the world's worst illnesses at the same time.

In his ongoing efforts to internationalize MTSU, President Sidney A. McPhee has been forging relationships in China for more than a decade. Over that span, McPhee has gained the trust of many powerful Chinese officials. They include the vice governor of the large province of Guangxi (pronounced Gwan-Chee) and leaders of a unique enterprise located there, the Guangxi Botanical Garden of Medicinal Plants (GBGMP). In its beautifully manicured gardens, GBGMP grows every plant that has ever been used in the healing art of Traditional Chinese Medicine (TCM). And now, as a result of a new collaboration forged by McPhee, MTSU has gained exclusive access to the GBGMP library of extracts, creating the opportunity to develop new Western medicines based on TCM's proven healing powers.

The result is the creation of the Tennessee Center for Botanical Medicine Research at MTSU, where the screening of these TCM extracts takes place.

MTSU professor Dr. Elliot Altman, who came from the University of Georgia to head MTSU's new Molecular Biosciences Ph.D. program, says in partnering with GBGMP, McPhee has unlocked a potentially lucrative research opportunity for MTSU. A lifetime drug developer currently taking another drug he helped develop to phase 1 clinical trials, Altman knows the drug development path from test tube to human trial.

photo: Dr. Sidney A. McPhee

“One thing I know very well from my years of intellectual property development is a good idea when I see one,” says Altman, who is conducting MTSU’s newest research project in concert with Guangxi native and MTSU research assistant professor Iris Gao, a key liason in the project. “This could be an unbelievable opportunity.”

The partnership also represents a perfect marriage of institutions with different strengths. GBGMP has identified and grown plants or herbs that have been shown to have the potential to treat a variety of diseases via TCM. The extracts that have been prepared represent a library of 50,000 to 250,000 individual compounds. MTSU, meanwhile, is expert in screening extracts.

“Clearly, there is great synergy here,” McPhee adds.

Several recent pharmaceutical successes stemming from the use of active chemical ingredients in Chinese herbal medicines to develop conventional Western pharmaceutical agents reveal just how big a deal MTSU’s new partnership may be. The two most prominent examples are Taxol (Paclitaxel), isolated from *Taxus brevifolia* (the yew tree) and used to treat various cancers, and Artemisia, isolated from *Artemisia apiacea* (a herb called sweet wormwood) and used to treat malaria. (It has already saved millions of lives.)

“It’s clear these plants work,” Altman says. “And we’ve just scratched the surface.”

David Windley, industry analyst for Jefferies in Nashville, says the major pharmaceutical companies are always looking for the next drug, and that these success stories stemming from TCM are in fact changing attitudes.

“The proprietary pharma industry in the United States would certainly view anything that’s patentable and provable as an opportunity worth looking at,” he says.

What’s the potential financial impact if a new drug were to emerge from MTSU’s study of TCM extracts? Altman says universities that have developed a drug can get anywhere from \$100 million to \$700 million per year in licensing fees for at least 10 to 15 years. But to get a product to market and create the windfall, universities usually

partner with large pharmaceutical outfits (often based outside their state) to fund the discovery process.

Alternatively, McPhee believes there is a homegrown option that could create big opportunity for Tennessee.

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photo: Andrew Oppmann

According to McPhee, the partnership between MTSU and GBGMP has already yielded about 40 results “showing promise in treating cancer, viral infections and other ailments.”

Looking West: MTSU President Sidney A. McPhee visits the Guangxi Botanical Garden of Medicinal Plants in Nanning, China.



Flora to Pharma

Miao Jianhua, left, vice president of the Guangxi Academic Science Institute and director of its botanical garden, shakes hands with MTSU President Sidney A. McPhee after unveiling a sign outside the Nanning, China, laboratory that brands the Joint Research Center with the university. Also shown are State Sen. Bill Ketron, R-Murfreesboro, center; MTSU professor Elliot Altman and MTSU assistant professor Iris Gao.



Photo: Andrew Oppmann

The TCBMR Team

Dr. Elliot Altman, director of MTSU's new Molecular Biosciences Ph.D. Program, conducts research in metabolic engineering and peptide therapeutics. Altman holds 10 patents and has many others currently pending.

Dr. Ying "Iris" Gao joined MTSU's faculty in 2011. With her expertise in Traditional Chinese Medicine, her relationships with Guangxi officials and her command of English, Gao helped launch the Tennessee Center for Botanical Medicine Research at MTSU.

The TCBMR recently expanded its research efforts and additional MTSU professors are now part of the group:

Anthony Farone, Biology (Immunomodulator screening)

Mary Farone, Biology (Antimicrobial screening)

Anthony Newsome, Biology (Antiprotozoal screening)

Stephen Wright, Biology (Antiviral screening)

William Stewart, Biology (Antidiabetic screening)

Bruce Cahoon, Biology (Ginseng micropropagation)

Scott Handy, Chemistry (Chemical purification)

Norma Dunlap, Chemistry (Chemical purification)

Chengshan Wang, Chemistry (Chemical purification)

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"This could lead to significant jobs, perhaps the establishment of a pharmaceutical company in our state, along with a manufacturing plant where the drugs might be made," McPhee says. "This is one of those significant opportunities to potentially see state dollars to grow industry later. We can own and leverage the final product. So perhaps this is an investment opportunity the state should pursue."

"Clearly, there is great synergy here," McPhee says.

Jump-starting the pharmaceutical industry in Tennessee is certainly an important priority for state economic development officials—in large part because the state doesn't have one to speak of. And it is not unprecedented for the state to fund projects like this at other universities across the state.

"We have biotech supporting pharmaceuticals but we don't have Big Pharma [in Tennessee]," McPhee says. "And Nashville is the perfect place for it."

Windley concurs, stating flatly, "Like Tennessee, most states would like to see at-the-bench discovery work and pharmaceutical development."

MTSU's TCM partnership holds promise for the economy of Tennessee and the health of people well beyond our borders. **MTSU**

Digging In

The roots of a potential economic gold mine for Tennessee may be emerging out of MTSU's own backyard

by Randy Weiler

FIVE MILES EAST OF MTSU IN Lascassas, on a plot of land at the MTSU Farm, researchers are busily cultivating a plant rural folks call 'sang that has untapped potential for the state.

Panax quinquefolius L. is the scientific name for 'sang, or ginseng, which is found mainly in the mountains of the eastern part of the state. If

MTSU-led research receives state funding to proceed, ginseng could become a lucrative new crop for the state. In

November 2013, state and University officials led by President Sidney A. McPhee announced the MTSU Ginseng

Initiative to grow and harvest the plant at the 438-acre School of Agribusiness and Agriscience Experiential Learning and Research Laboratory.

"This is a great opportunity," said alumnus and state senator Bill Ketron (R-Murfreesboro). "It is up to us to take it to the next level. We can make this a statewide cash crop . . . and a world-class facility."

Professor Elliot Altman, director of the Tennessee Center for Botanical Medicine Research, agrees.

"The ginseng market represents a huge opportunity for Tennessee, which has significant acreage that could be devoted to the cultivation of ginseng," Altman said. "This is the most significant opportunity our farmers

have to meet Gov. Haslam's quest to increase the state's agricultural revenues."

"It's one of our gems in Tennessee, and we're not doing enough to take advantage of it," Altman added.

Ginseng is a popular over-the-counter supplement used to boost the immune system. According to Altman, it was one of the first herbs from traditional Chinese medicine to be widely used. Those suffering from colds or flu and those whose immune systems are suppressed, such as cancer patients, are primary users of ginseng.

According to Altman, the annual world market for ginseng is more than \$2 billion, with the average price paid for harvesting ginseng roots ranging from \$500 to \$800 per pound. Kentucky, Tennessee, and North Carolina are the top three states producing Appalachian ginseng. The American variety of the herb was discovered in the 1700s and has long been a part of Appalachian culture. Historians say legendary frontiersmen Davy Crockett and Daniel Boone were ginseng traders.

Altman believes MTSU's future in the ginseng market includes the formation of two companies, one rigidly certifying the quality of Tennessee ginseng and the other specializing in producing ginseng grown in a controlled environment if MTSU's micropropagation (a method speeding up and multiplying the growth process) and tissue culture studies are successful.

"The (certification) company might act as a brokerage house for all the ginseng sold from Tennessee farmers," Altman said. "Our Chinese collaborators really like this idea since most ginseng that is sold is not certified with respect to its ability to act as a dietary supplement. This might lead to a branding opportunity, such as gold-certified ginseng, that would be preferred by consumers because of its guarantee via certification."

MTSU awaits word on state funding for the project. Ketron, who came up with the idea that the University might grow ginseng, is working on an appropriations amendment in the General Assembly to secure funding.

"Whether or not we'll be able to fund it, I don't know yet," he said during a recent campus visit.

Altman said he's "very hopeful" that Sen. Ketron will be successful and that MTSU researchers and the graduate students now assisting them will soon be able to dig in and grow exciting new opportunities for the University and the state. [MTSU](#)

RITE of *Spring*

by Randy Weiler

MTSU students exhibited their best scholarship, research, and creative activity during Scholars Week

MTSU celebrated research and scholarship from March 17 to 21, 2014, during the University's eighth annual Scholars Week. The showcase of research and creativity by graduate and undergraduate students concluded with the university-wide Scholars Day on the 21st, highlighted by nine performances and 180 posters exhibited in the Student Union Ballroom.

Exhibitors included the College of Behavioral and Health Sciences, presenting the work of 14 faculty members in "Building a Student Research Team" at the undergraduate, master's, doctoral, and hybrid levels, to the College of Liberal Arts, offering student/faculty collaborative research. The College of Mass Communication featured a showcase and spring career forum and an appearance by danah boyd, one of the nation's foremost experts on social media. Boyd, author of *It's Complicated: The Social Lives of Networked Teens*, delivered the keynote address and held a question-and-answer session.

Boyd said of her communication objective in academic settings, "Go out and be curious. Try and understand how the world works. What are the different things that will help you explain phenomena you see? Try to question everything. That kind of critical perspective's not owned by any discipline or single methodology."

Scholars Week is the sharing of knowledge and research for only a week, but the work showcased represents countless hours of preparation throughout the year. Walking through the maze of posters and comprehending the research and time invested in the projects is an eye-opening experience for visitors.

"It's an exciting time of year," said Dr. Michael Allen, vice provost for research and dean of the College of Graduate Studies. "Everyone can browse through the poster session and look at all the things MTSU students are interested in."

The work on display included the following:

- The camera used by senior photography student Chanelle Despins in her documentary class can capture small objects with great detail. Her "Macro Photography" poster earned first place in Mass Communication.
- Jeremy Posey oversees the engineering technology experimental vehicles program as a Master of Science in Professional Science student. Vehicles include Formula, Formula Hybrid, Baja, Lunar Rover (Moonbuggy), and Solar Boat.
- A car wreck left Health and Human Performance graduate student Brittany Leedham injured. Her poster and research, "The Invincible Intervention," is a method for improving driver education in high schools.
- Graduate student Tara McCamey is a full-time first-grade teacher with Murfreesboro City Schools. Her study, "Learning Sight Words without Drill Overkill: A Study of First Grade English Language Learners," earned first place in the College of Education division. She got permission from Eric Carle, a well-known children's literature author and illustrator, to include some of his background patterns and drawings in her presentation.

Scholars Day by the Numbers:

- 158 undergraduate participants
- 129 graduate participants
- 62 faculty participants
- 8 centers/departments represented
- 10 faculty posters
- 76 graduate posters
- 74 undergraduate posters
- 9 performances





Center for Environmental Studies (CES)

Dr. Cindi Smith-Walters, codirector

The CES encourages and develops scientists of all ages. Its mission is to improve environmental understanding in middle Tennessee and statewide, educating individuals about our place within the environment and inspiring environmental commitment for the benefit of life on our planet.

Two doctoral candidates recently collaborated with a science museum and a state agency to conduct research and assess programming. Both are in the process of publishing their findings. Heather L. Barker, an interdisciplinary Ph.D. candidate, examined general science interest and understanding of the nature of science in elementary students attending a weeklong day camp at Discovery Center, a children's museum in Murfreesboro. Dave Owens, a biology emphasis Ph.D. candidate, continues to work with the Tennessee Department of Environment and Conservation's Division of State Parks. He is evaluating the effectiveness of the Junior Ranger program at state parks and in select elementary schools. This research will continue as the Junior Ranger program expands and is refined using results from his work.

The CES continues to run the Tennessee Amphibian Monitoring Program (TAMP) through a renewed contract with the Tennessee Wildlife Resources Agency. TAMP was featured in the March/April 2013 issue of *Tennessee Conservationist Magazine*, specifically regarding its discovery of the Pickerel Frog, a new species encountered while TAMP "Frog-loggers" were running their regular TAMP routes. Bob English supervises the TAMP program.

Visit mtsu.edu/mtsucee for more.

Interdisciplinary Microanalysis and Imaging Center (MIMIC)

Dr. Ngee Sing Chong, director

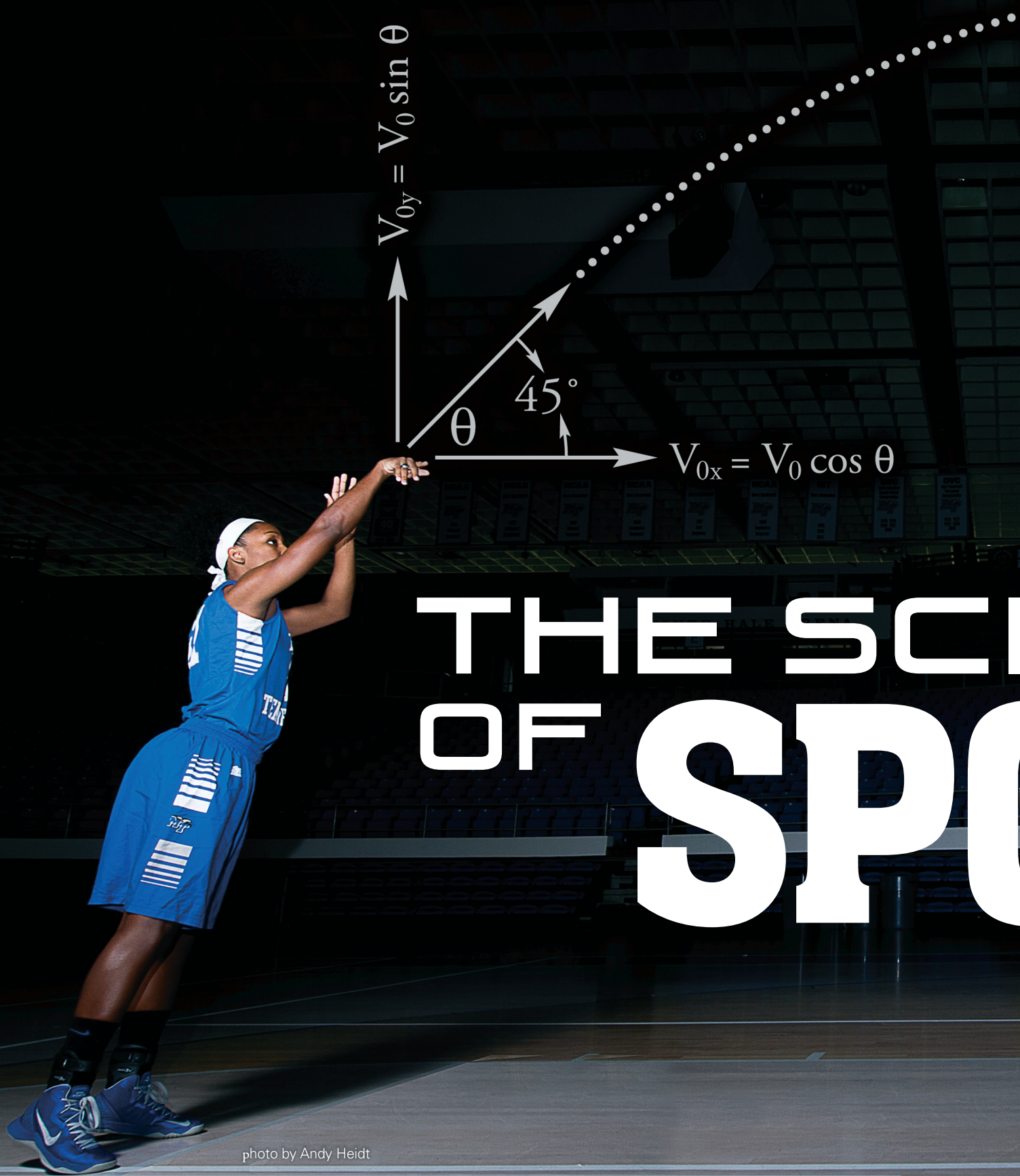
MIMIC is a core facility for microscopy and microanalytical instrumentation used in basic sciences including biology, chemistry, physics, materials science, anthropology, and forensic analysis. It supports the academic goals of scientific training and partnerships with industries in Tennessee.

Focused Ion Beam Scanning Electron Microscopy (FIB-SEM) combines the ability to obtain serial sections of samples and SEM images that can be used to create 3-D renderings with micron-level resolution. FIB-SEM has been applied to the study of cell architecture in the genus *Arabidopsis*. The goal was to determine the efficacy of this technique in plant tissue/cellular studies and demonstrate its usefulness in studying cells and organelles and their architecture and distribution. FIB-SEM has been successfully used to produce SEM micrographs and 3-D renderings of cells using five different tissues from *Arabidopsis*. Organelles such as nuclei and chloroplasts were easily identifiable, and other structures such as endoplasmic

reticulum, lipid bodies, and starch grains were distinguishable in each tissue. FIB-SEM produced 3-D renderings of five plant cell types, offering remarkable views of their shapes and internal content.

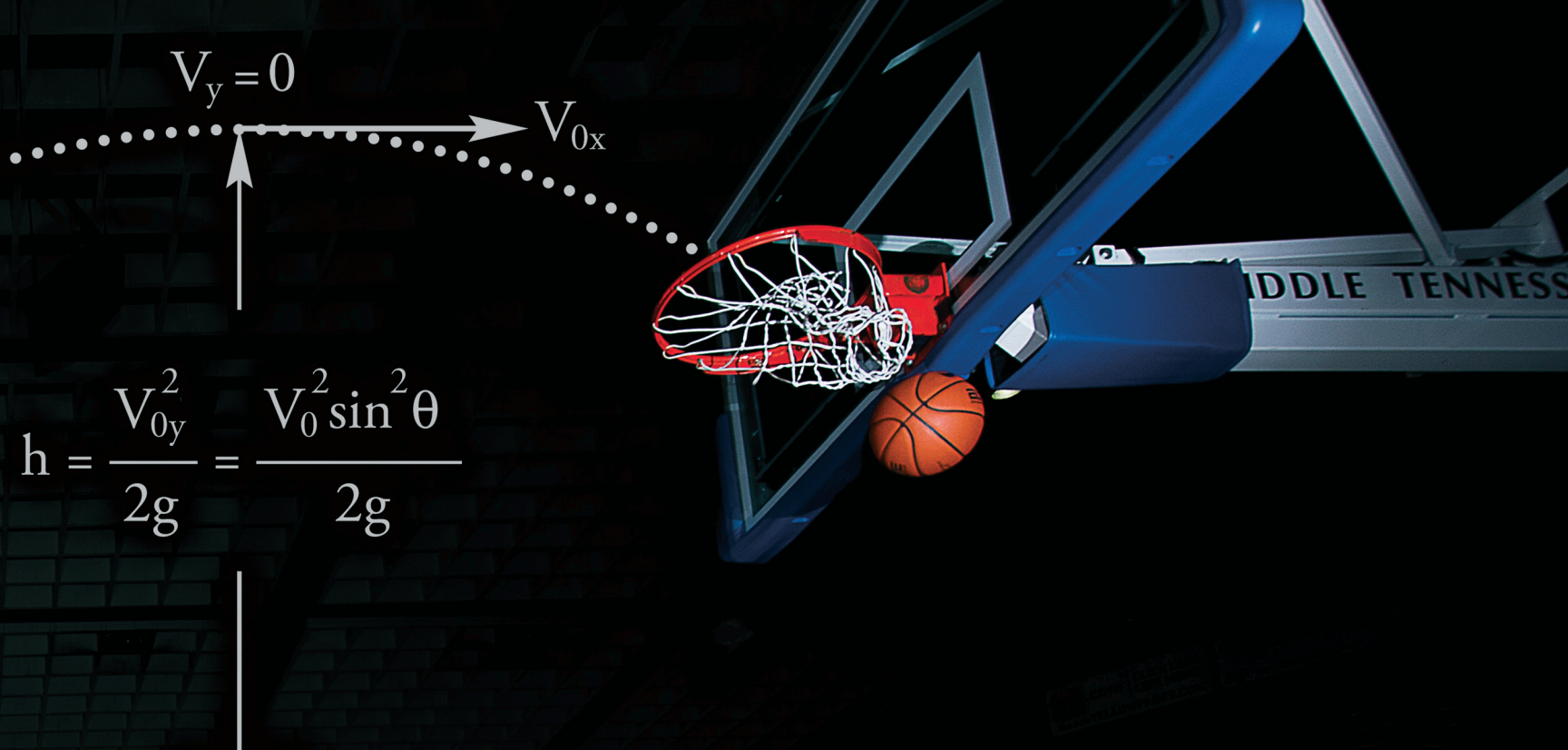
Scanning Electron Microscopic (SEM) Analysis has been used to detect gunshot residue from human hair, collected with a handheld vacuum cleaner with a HEPA filter. This analytical approach makes it possible to analyze particles adhering to the hair of shooters and has the potential of improving on the current practice of swabbing hands for trace metal determination by atomic spectrometry. The sampling based on the HEPA filter allows the screening of particles as small as 0.3–10 μm . Energy-dispersive X-ray analysis (EDX) available with SEM allows the characterization of particles composed of lead, barium, and antimony (Pb-Ba-Sb) that can directly be connected to gunshot residue. The results of this project conducted at MIMIC may be useful in forensic investigation in which a gun is used as a murder weapon.

Visit capone.mtsu.edu/mimic for more.



THE SCIENCE OF SPORTS

photo by Andy Heidt



$$V_y = 0$$
$$V_{0x}$$
$$h = \frac{V_{0y}^2}{2g} = \frac{V_0^2 \sin^2 \theta}{2g}$$

Physics graduate Ebony Rowe brought her “A” game to both sides of the scholar-athlete equation

by Drew Ruble

SCIENCE SPORT

Lady Raider Ebony Rowe recently graduated from MTSU as the most prolific scorer and rebounder in school history. The 2013-14 Conference USA Player of the Year, Rowe’s athletic prowess during her illustrious playing career garnered her such accolades as Honorable Mention All-American status by both the Associated Press and the Women’s Basketball Coaches Association. She was also a multiple-time top-30 finalist for the Naismith Award, given annually to the nation’s best high school and college basketball players and coaches.

Off the court, Rowe racked up an equally impressive portfolio of statistics in the form of academic and personal awards. Notably, she was previously named to the Arthur Ashe Jr. Sports Scholar Women’s Basketball First Team as announced by *Diverse: Issues in Higher Education*. A true student-athlete, Rowe’s GPA as a physics major hovered in the 3.6 to 3.7 range.

Rowe had the opportunity to play women’s professional basketball, following in the footsteps of Lady Raider alums like Alysha Clark and Amber Holt. However, instead of pursuing a playing career in Europe or as a WNBA free agent, she accepted an offer to attend graduate school at Georgia Tech in 2014 to study mechanical engineering.

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SCIENCE OF SPORT



Ebony Rowe and Eric Guyes working on a physics experiment.

(continued from page 43)

"My basketball career has been more than I could have ever imagined," Rowe said in a statement. "But now, it's time to focus on my true passions: my education at Georgia Tech, my career, and my family."

A Dual Threat

With her high GPA, passionate interest in her studies, and her decision not to play pro sports, Rowe bursts the stereotype of the academically disinterested student-athlete. And what makes her even more intriguing is that her major was science-related—a field of study far more dense than the proverbial "basket weaving" coursework the public tends to think about when it paints student-athletes with a broad brush.

Rowe describes perceptions of student-athletes as "dumb" and science majors as "nerds" as "a sad mentality that's just developed and is taken as truth now."

"A lot of people told me you can't be a basketball player and an engineer. But it can be done," she says. "I like to be different and unique, not just for myself but also for genera-

tions behind me. More people need to start showing the younger generation that competing in high-level athletics and excelling in the classroom can be done."

As a physics major, Rowe took classes such as Classical Mechanics, Strength of Materials, and Electricity and Magnetism. Among her research projects was a study of the physics of free throw shooting in basketball.

It was an ironic topic for Rowe to tackle given her highly publicized troubles at the free throw line in competition. Even her coach was publicly critical of Rowe's free throw shooting percentage in years past, which for a time hovered below the 50 percent mark. Rowe, however, improved dramatically over the past year and became one of the best free throw shooters on the Lady Raider squad.

One might think that a shot called a "free throw," when no one is guarding you and you simply step up to a line and take a wide-open shot, would be an easy exercise. But according to Rowe, it's much more complicated than that. Rowe's description of a free throw from a physicist's perspective sounds so dizzyingly difficult that it might even

cause a coach to take it easy on an athlete for a fair-to-mid-ling performance.

Rowe begins her explanation by pointing out that there are an infinite number of speed/angle combinations that can lead to a successful free-throw shot (or an unsuccessful one), but the chances of success are greatly improved by increasing the arc on the shot so that the ball is falling straight down, increasing the relative size of the hoop, as compared to a shot with a flatter trajectory.

“These small calculations applied to a free throw can throw off the whole shot based on the smallest of technicalities . . .”

“Beyond that, there’s so many little mechanics that go into a free throw,” Rowe explains, citing release point, launch angle, ball velocity, shape of path, optimum speed, varying force, and distance, among other variables. “So when you start to break it down piece by piece, if any one of those measurements is off by a certain degree, it can cause you to miss your free throw.”

In her research, Rowe used a simulation program to shoot 10,000 free throws, altering all of these little measurements incrementally to reveal proper and improper mechanics—and outcomes.

“These small calculations applied to a free throw can throw off the whole shot based on the smallest of technicalities,” she says, referencing concepts including forward spin, frictional force, and horizontal motion. Lady Raider fans can no doubt imagine Coach Rick Insell groaning at such an explanation.

So is Rowe’s classroom exercise to be credited for her improvement from the free throw line? She says no.

“It’s so funny, a lot of people asked me, ‘Well, your free throw percentage got a lot better now that you broke it down,’” she says. “And I say, ‘No, I just practice.’”

From the free-throw shot to other staples of the sport including dribbling and hang time, physics permeates the game of basketball. Perhaps the All-American Rowe’s fascination with the two isn’t such an unusual set of interests after all.

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Training Mission

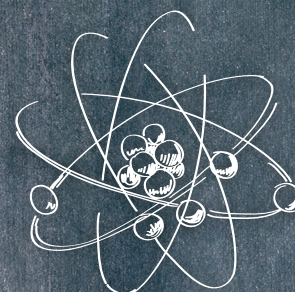
There are only a few National Science Foundation–approved Physics Teacher Education Coalition (PhysTEC) sites in the nation, and MTSU’s Department of Physics and Astronomy is one of them. (Others include Cornell, UNC–Chapel Hill, Arizona, and Colorado.)

The department’s potential to increase the number and quality of physics teachers graduating annually is an important factor in efforts to raise Tennessee’s collective science IQ.

Ron Henderson, Physics Department chair, has written that over the past 15 years, very few students in Tennessee universities have completed a major in physics and become endorsed to teach in high school.

“MTSU is rapidly becoming a leader in physics teacher education,” said Monica Plisch, associate director of education and diversity at the American Physical Society, and PhysTEC project codirector, in an article by Gabriel Popkin published in the APS 2012 newsletter.

President Sidney A. McPhee singled out the department, commending it for meeting his challenge to help students succeed. The department has implemented more student-friendly teaching practices for introductory courses and is using high-achieving undergrads to serve as “learning assistants” for classmates in those courses. The department’s reward—in addition to fewer failing grades, more physics and astronomy majors, and more graduates—was a \$20,000 check as the first “President’s Award for Exceptional Departmental Initiatives for Student Academic Success.”



SCIENCE OF SPORT

(continued from page 45)

The Next Step

In addition to excelling on the court and in the classroom, Rowe is also already making waves in the professional world. For two consecutive summers, Rowe spent her academic break working as an intern with the Fortune 500 software firm Lexmark in her hometown of Lexington, Ky. She worked alongside an electrical hardware engineer and had access to robotics and other types of machinery and testing on what she describes as a “real world product” in “early stages of development.”

Rowe is only too happy to use the power of her celebrity as a high-profile athlete to encourage more girls and young women to pursue science studies and careers.

Rowe’s sister is a chemical engineer at Lexmark. Her dad earned a degree in civil engineering and works in the corporate world. Rowe says math and science was “just something that ran in the family and, I guess, came easier than other subjects. So it’s definitely just been a passion.” (Even as a junior in high school, Rowe conducted research at the University of Kentucky in the Engineering Department, where she built a bilinear spring-mass system that replicated the support system of a NASA project.)

Such interest and involvement in a science discipline is statistically unusual for a woman. A 2010 report by the American Association of University Women found that the number of women in science and engineering is growing, yet men continue to outnumber women, especially at the upper levels of the professions. It doesn’t bode well for research and discovery when half of the human race—for whatever reason—remains outside the arena of science. Nor does it help America fill the STEM jobs increasingly available in this country.

“I think it’s something that’s definitely gotten better, but it’s a little discouraging,” Rowe says. “I mean, I’ve never thought of myself as intimidated in any aspect, but it might be a little intimidating when you walk into a room in a business setting and it’s all men sitting there. They all just look at you like, ‘Are you in the right place?’ So I would definitely say it’s gotten better, and more women are realizing that we do have a lot of brain power and a lot to offer to different fields in science.”

Rowe was only too happy to use the power of her celebrity as a high-profile athlete to encourage more girls and young women to pursue science studies and careers.



“That’s what is so good, especially about being an athlete, because you get to reach out to so many different people,” she says. “So whether it’s young females who are playing sports or whether it’s young African Americans or young African American girls. There also aren’t a lot of African Americans who are choosing the sciences and engineering and physics. I think it’s just the more people start to do it, the more that it’s going to be expected, and it’s not going to be, ‘Oh, you’re a female or an African American in sciences.’ It’s just going to become normal. So I think we just have to take it a step at a time. It’s gotten better, but [we still have] a long way to go.” **MTSU**

UNDERGRADUATE RESEARCH NEWS



Senior BRETT BORNHOFT earned the Deutscher Akademischer Austausch Dienst Research Internship in Science and Engineering (DAAD RISE) fellowship to serve 12 weeks at Universitat des Saarlandes in Germany last summer. Bornhoft's MTSU experience includes serving as research assistant for the Center for Unmanned Systems Operational Advancement and Research and as a research engineer for MTSU's Fifth-Generation Aerial Target Drone program under the office of the Secretary of Defense. Most recently, he worked as a research engineer for MTSU's Unmanned Aircraft Systems program. Bornhoft's dream is to pursue a Ph.D. at Massachusetts Institute of Technology.



Senior DANIEL MURPHY was awarded a Goldwater Scholarship from the Barry M. Goldwater Scholarship and Excellence in Education Program for the 2013-14 academic year. A University Honors College student majoring in physics and philosophy, Murphy was among 272 recipients nationally and five from Tennessee. He has conducted research in optics, most recently a "computational study of a unique dielectric structure capable of dramatically enhancing linear and nonlinear optical effects." Murphy hopes to pursue a doctorate in atomic physics.

Ten MTSU student researchers were among 61 university undergraduate students from across Tennessee participating in the ninth annual POSTERS AT THE CAPITOL in February at the State Capitol in Nashville. The undergraduate researchers not only made their posters and themselves available to the legislators and other visitors that day but they also scheduled individual and group meetings with their state senators and representatives.

MTSU students selected to participate in the event included **Brett Bornhoft**, aerospace; **Martin Moran**, exercise science; **Daniel Murphy**, physics; **Shiloh Siegel**, early childhood education and elementary and special education; **Christie Sanborn**, psychology; **Victoria Harrison**, agribusiness; **Shannon Allen**, chemistry; **Lenzie Howell**, health education; and **Rance Solomon**, physics.

CHELSEA HARMON, a sophomore Buchanan Scholar, worked last summer for the Tennessee Center for Botanical Medicine Research at MTSU. The center works in partnership with a Chinese botanical garden to isolate new medicinal natural products, capitalizing on the effectiveness of traditional Chinese medicine involving a variety of plants that are generally administered as teas, tinctures, and powders. Harmon's research, under the guidance of Chemistry Professor Dr. Norma Dunlap, is involved in identifying compounds responsible for the medicinal properties of certain Chinese herbs. In particular, she has applied

the process of bioassay-guided fractionation to one of the Chinese plants traditionally used to treat fevers and burns that has exhibited antiviral activity against the herpes simplex virus Type 1. Harmon was more recently awarded the DAAD RISE internship fellowship for study in Germany. She aspires to be a chemistry professor and researcher. By pursuing her research in medicinal chemistry, Chelsea says she is "working toward providing future generations with the ability to extend or improve their quality of life."



A past director of MTSU's Center for Popular Music proves not all research and discoveries occur in a laboratory setting

by Drew Ruble

MUSICOLOGIST DALE COCKRELL IS A scholar. He's not used to the bright lights of a major television production. Nor is he used to being surrounded by musical legends like Ronnie Milsap and Randy Travis thanking him for the academic work he did to shed light on the old-time fiddle music ingrained in the American frontier experience.

No, Dale Cockrell is more comfortable digging through volumes of great American music or presenting a paper at a conference. But he couldn't escape the bright lights and celebrity attention he received at the Loveless Café and Loveless Barn in Nashville, site of a PBS concert taping, the roots of which were watered by Cockrell's scholarly sweat.

Cockrell, former director of MTSU's world-renowned Center for Popular Music, is the man behind the Pa's Fiddle Project, an effort to reconnect generations of readers with the rich musical legacy woven into the *Little House* books written by Laura Ingalls Wilder. Cockrell says his idea had a quite innocent beginning—reading at bedtime to his then-eight-year-old son, Sam.

"We read along, and there were songs embedded in the books. We would sing the songs, and if we didn't know one, we would make up a song. Sam and I enjoyed that," Cockrell says. "But after a while, the scholar in me started to crawl into bed with us, and I started thinking about how there was an amazing amount of music in these books."

Inspired, Cockrell sat down one Christmas break and started going through all the books and listing the songs. He then began looking for existing recordings. What he found was that little had been done to chronicle or showcase these song references. Thus was born Pa's Fiddle Project, dedicated to resurrecting and voicing the 127 songs found in the *Little House* books and making some great American music commercially available once again.

Cockrell established a record label, Pa's Fiddle Recordings, to record the music referenced in the books. The label has issued three CDs (out of a projected 10-CD series). The first was picked up by the National Endowment for the Humanities and sent to libraries nationwide as a sample of music making in 19th century American style.

The collections at the Center for Popular Music formed the foundation of the research that led to the music's production. In all, Cockrell has spent 14 years on the project.

"Sometimes, it's felt like we've been pushing that boulder up that hill every day," he reflects. "Now we're finally at the top and get to share this music with everyone."

But how could Cockrell share the music with a broader audience? In June 2010, he attended a conference in Minneapolis called "LauraPalooza," which was dedicated

Now Pa's Fiddle Project is Around

photos:

to all things Laura Ingalls Wilder. There, as scholars do at conferences, he delivered a paper—this one on Pa's Fiddle Project. Afterward, he was approached by actor Dean Butler, who played the role of Almanzo, Laura's husband, in the *Little House* TV series. Butler told Cockrell he thought the project would make a great pledge drive special concert for the Public Broadcasting System. The owner of a California-based production company, Butler successfully pitched the project to PBS in New York.

It all culminated on a winter night in Nashville, when a stellar cast of Music City's all-stars brought Charles "Pa" Ingalls's old-time fiddle music alive for a PBS taping. *Pa's Fiddle: America's Music*, which has aired on PBS stations nationwide, features artists including Travis, Milsap, Ashton Shepherd, The Roys, Natalie

Grant, Randy Scruggs, Rodney Atkins, and NBC's *The Sing-Off* champions, Committed.

Adding to the occasion, MTSU students were behind the scenes to film *Inside Pa's Fiddle*, a look at the inspiration, creation, and execution of the PBS special. The resulting documentary, sponsored by MTSU, is the product of a student crew led by Tom Neff from the Department of Electronic Media Communication in the College of Mass Communication. (Neff happens to be the founder and former CEO of the Documentary Channel and an award-winning producer and director.) Many students were on site for the special, and many others worked in postproduction on editing, graphics, and sound with faculty members Clare Bratten and Matt Foglia.

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Perfect Pitch: Music City All-Stars brought MTSU scholar Dale Cockrell's innovative research about the music embedded in the *Little House* books to life at the Loveless Café Barn during a PBS taping.

Dale Cockrell is more comfortable digging through volumes of great American music or presenting a paper at a conference.



(continued from page 49)

That the national PBS network would show such interest in Cockrell's project indicates the ongoing, high level of fascination with the *Little House* world. Cockrell believes the stories retain their popularity because they are based on real-life experiences and events—not fiction—of a family that homesteaded on the American frontier in the 1860s, '70s, and '80s.

"None of the people in the Ingalls family were superheroes," Cockrell adds. "It goes against the grain of much children's literature today. In fact, the books are pretty dark. Babies die, grasshoppers come and eat the crops, people get kicked off their land, houses burn down—they're not books that are unremittingly cheerful. They are books about real life."

Cockrell argues that the popularity of the books (and the TV series) might never have happened if it hadn't been for the music references.

"To be in a family where you heard live music every day, for probably a couple of hours every day, printed itself upon Laura Ingalls Wilders's brain in a way that's difficult for us to understand today," Cockrell says. "Based on research by neuroscience and cognitive psychologists, my theory is that by remembering the songs that her father played and that she sang along to, it enabled her to unpeel the memories in which those songs [were] embedded. In doing so, she could start to write the stories that are about the memories of her family. Without

Without the music, there may have been no *Little House* books."

the music, there may have been no *Little House* books."

Though he's admittedly a little uneasy about all the public attention he's getting for his project, Cockrell is thankful for what's happened.

"It's enormously gratifying but also daunting, frankly," he says.

"As a musicologist, I'm not trained to get up on a stage in front of a PBS audience and communicate what I do as a scholar. I'm being stretched and challenged in ways that I never expected. But I find it terribly exciting."

Where does his project go from here? Cockrell's goal is to take Pa's Fiddle to grade schools nationwide, where he hopes the impact on kids will serve his even loftier expectations.

"I like to say that my goal is to change the music consciousness of the nation," he says. "It's kind of grand, but if 3rd- and 4th-grade students who come up against these books also learn the music that's embedded in the books—Wilder expected that you'd know the music—then, in fact, you've inculcated a regard for [an] American musical legacy that's not currently present in the consciousness of the nation."

Cockrell is already at work on lesson plans for 3rd- and 4th-grade teachers. It's just the next ripple of the scholarship he hopes will be felt far beyond the comfortable confines of his academic roost.

[Editor's note: The third director of the Center for Popular Music, Gregory N. Reish, joined MTSU in summer 2014.]

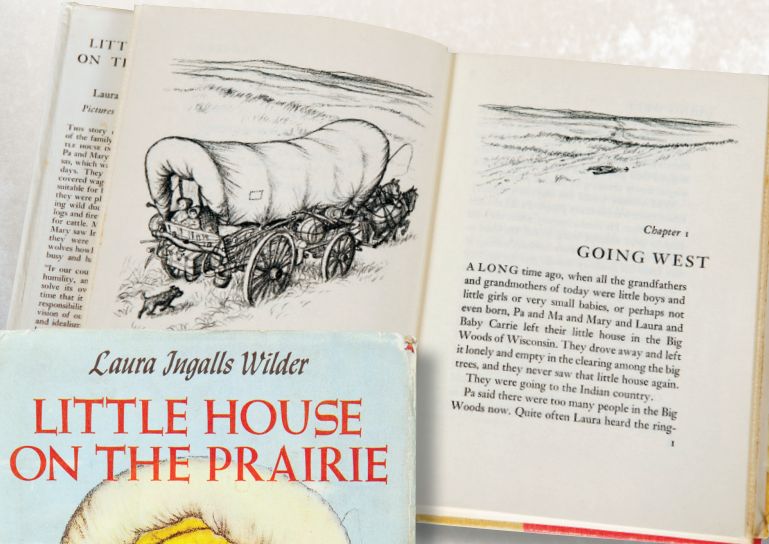
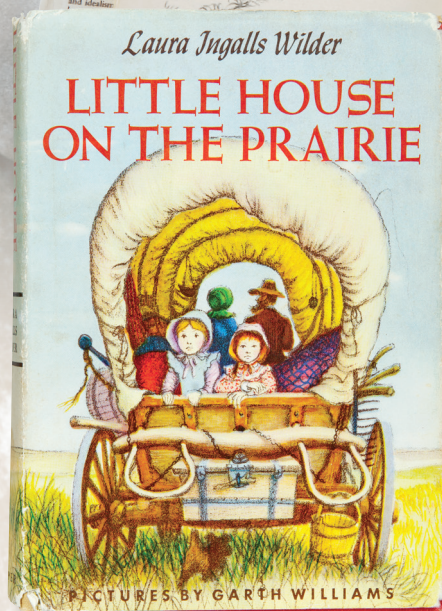
HITTING the RIGHT NOTES

I have been reading the Little House series to my 6-year-old daughter at bedtime. Your music gives a whole new dimension to the stories. What a gift to our family! Well done!

—Peter H. Bouman, M.D.,
to Dale Cockrell, February 22, 2014

The Pa's Fiddle Project continues apace, as evidenced by testimonials such as that from Dr. Bouman. One accomplishment is the recent publication of *The Ingalls Wilder Family Songbook*, a scholarly edition of all 127 songs found in the *Little House* books. The 425-page book is volume 22 in the prestigious *Music of the United States of America* series (eventually to contain 40 volumes) underwritten by the National Endowment for the Humanities that will show the breadth and depth of American music.

The Ingalls Wilder Family Songbook reconstructs “the family songbook,” a collection of Little House music known and loved by Laura Ingalls Wilder. This music likely informed the musical sensibilities of more Americans than almost any other paper-and-binding anthology, because what children and their parents know about America’s musical heritage is often what they learn from the *Little House* books—song titles, song functions, where songs were played and heard, and what they meant. The songbook intends to give new voice to Laura Ingalls Wilder’s music and instill a new understanding about how music functions in families and communities.



Some of the sheet music in the songbook has been lifted and reorganized into paperback anthologies that contain all the music in individual *Little House* books. The seven volumes of *Music from Laura Ingalls Wilder's Books* are intended for those who want to

follow the music and perhaps sing and play it.

In July 2013, Dr. Dale Cockrell gave a presentation of his *Little House* project to a Voices Across Time workshop in Pittsburgh. These events bring selected teachers together from across the nation for an intensive six-week course on how to integrate American music into their classrooms. As a result of Cockrell’s presentation, lesson plans have been developed to bring *Little House* music to children who might not otherwise know of this legacy. As Dr. Cockrell has done for more than a decade, he still regularly visits libraries and classrooms across middle Tennessee to talk about, sing, and dance to the music in the *Little House* books.

Plans for the ongoing project include a deeper integration of the Pa’s Fiddle Project into the catalog of materials on Laura Ingalls Wilder and the *Little House* books maintained and operated by Dean Butler, former *Little House* actor and a champion of the project. **MTSU**



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