

Innovations

Basic and Applied Sciences Magazine

Fall 2013 Vol.1, No. 1

THE SCIENCE OF **SPORT**

Ebony Rowe excels
at both sides of the
scholar-athlete
equation.

**MIDDLE
TENNESSEE**
STATE UNIVERSITY

Innovations

Fall 2013 Vol.1, No. 1

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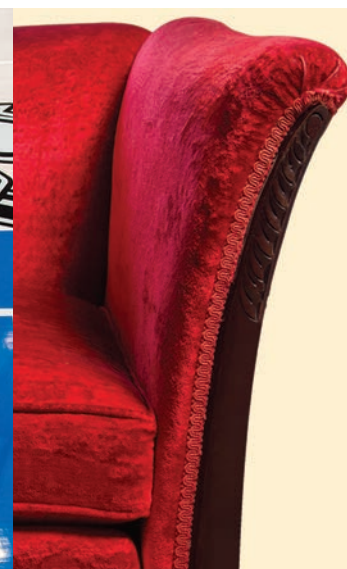
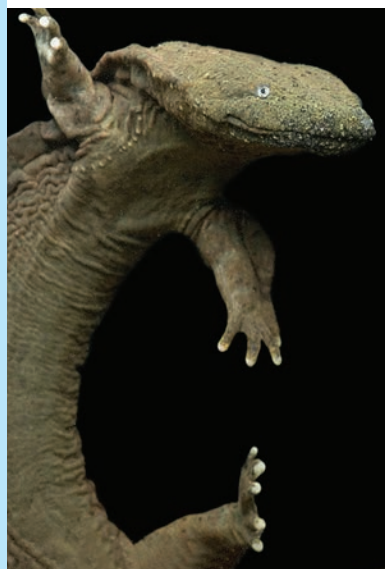
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Getting on Board

A quick Q&A with the new dean of the College of Basic and Applied Sciences at MTSU

by Randy Weiler



Dr. Robert U. “Bud” Fischer became the fifth dean of the College of Basic and Applied Sciences in 2012 following a national search. Fischer, 53, previously served as chair of the biology department at the University of Alabama–Birmingham and as associate chair in biology at Eastern

Illinois University. His research expertise is in the fields of aquatic ecology, evolutionary biology, fisheries biology, and physiological ecology.

Q. What can be accomplished while MTSU’s new \$147 million science building is being built? (see page 28)

A. Fischer: Everything. A building does not make a program or a college. What makes a program or a college is the outstanding faculty and staff in the department or college. Thus, I expect the college to continue to offer our students a high-quality education, opportunities to engage in innovative programs such as study abroad, internships, and undergraduate research and opportunities to engage in service on campus and in the Murfreesboro community. That said, I am incredibly excited about the new building. It will be a state-of-the-art science building that will create an outstanding learning environment for our students, where high-quality teaching and research will be performed by faculty and students.

Q. What are your thoughts about research?

A. Fischer: Research is critical to the mission of the University and is also critical to the economic and social development of society. In addition, research is intertwined with teaching; it may be the best type of teaching, where a student is personally mentored on a research project. It is during these opportunities that we create learning environments that foster creativity, produce strong analytical and leadership skills, and provide the student with valuable

hands-on experiences and an essential skill set for the future—ultimately making alumni productive and influential members of society.

Q. What sold you on MTSU?

A. Fischer: At both EIU and the UAB, my leadership ability, management style, and commitment to shared governance allowed me to work successfully with faculty and staff to develop outstanding undergraduate and graduate programs that are student-centered and offer students a variety of innovative programs. I thought the position of dean of the College of Basic and Applied Sciences at MTSU was a once-in-a-lifetime opportunity to work at an outstanding university with outstanding faculty, staff, and students. Also, the college is poised to grow and expand in the future. With the addition of new undergraduate degree programs, new Ph.D. programs, and a new science facility in the near future, the college will continue to be a first choice for the students of Tennessee. The future of MTSU and the college is bright, and I wanted to be a part of that future.

“With the addition of new undergraduate degree programs, new Ph.D. programs, and a new science facility in the near future, the college will continue to be a first choice for the students of Tennessee.”

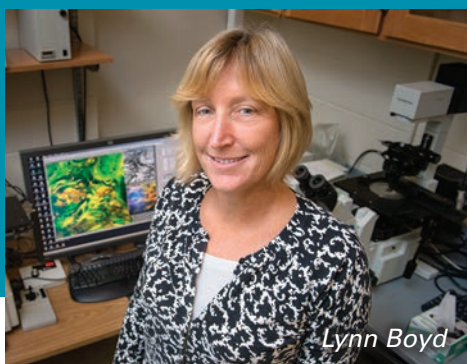
Q. What challenges do you see in fundraising?

A. Fischer: I do not look at development as a challenge but an opportunity. At a time of reduced state support for universities and institutions trying to limit the amount by which tuition is raised each year, development is the one area where an institution can increase funding. Thus, it is imperative for the dean to work with the Development Office to create relationships with alumni and other friends of MTSU that will benefit the students and college. If there is a challenge right now, it is getting out to meet all of the people who are part of the MTSU family and have been strong supporters of the institution.

Thanks, Dean. 🌿



Dean Robert "Bud" Fischer



Lynn Boyd



Greg Van Patten

Three to Get Ready

New hires signal a new era in University research

The hiring of three new, distinguished scholars/administrators signals a shift in direction toward more robust research output in the College of Basic and Applied Sciences. The timing of these hires couldn't be better because a new \$147 million science building is under construction and is scheduled to open in 2015.

Robert U. "Bud" Fischer became the fifth dean of the college last year. He replaced Tom Cheatham, who stepped down to become director of the Tennessee STEM (science, technology, engineering, and mathematics) Education Center on campus. Fischer was previously chair of the biology department at the University of Alabama–Birmingham. His expertise is in aquatic and fisheries biology. (For more, see the interview with Fischer on page 3.)

Also, **Lynn Boyd** and **Paul Gregory "Greg" Van Patten** were named chairs of the Departments of Biology and Chemistry, respectively, after national searches.

Boyd, formerly associate professor of biology at the University of Alabama–Huntsville, has had 13 refereed publications, including one in *Science*, plus three book chapters, dozens of presentations, and 16 funding proposals securing more than \$1.5 million. She earned her doctorate in biology from the University of Utah in 1992 then spent four years as a post-doctoral fellow at Cornell University and a year as a visiting assistant professor at Colgate University before joining the University of Alabama faculty. She replaced George Murphy, who retired from MTSU after 43 years in the Biology Department.

Van Patten came from Ohio University, where he had been a professor of chemistry. He has two patents and two others pending, has published 33 peer-reviewed or refereed articles, and has made 50 professional presentations. He has received 14 grants totaling more than \$3.5 million, mostly from the National Science Foundation and the U.S. Department of Defense. Van Patten served as director of the Center for Condensed Matter and Surface Science at Ohio University. He earned his doctoral degree in physical chemistry from the University of South Carolina in 1996. After postdoctoral work at Los Alamos National Laboratory from 1996 to 1999, he joined the Ohio University faculty. He replaced Earl Pearson, who is retiring after 14 years at MTSU. 🌱



In Addition

The college also has a new development director. **Amy Hardin** formerly served as director of development for libraries at the Kentucky Museum and in and student affairs at Western Kentucky University. Hardin received her B.A. and a master's in public administration

from Western Kentucky and was enrolled in the Ed.D. program with an emphasis on postsecondary leadership while there.



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MIDDLE TENNESSEE STATE UNIVERSITY



Photo © Joel Sartore/joelsartore.com

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 Calkiller Rivers.

Now, after researching almost every foot 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 8)

(continued from page 7)

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.” 🌿

(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.



FLIGHT PLAN

One MTSU freshman's lifelong love of aviation has already placed him on a trajectory of success and job satisfaction

by Jennifer Stone

Four years ago, President Barack Obama stated publicly that he didn't think it was fair that winners of the NCAA basketball championship got to visit the White House each year while young people producing valuable experiments in the fields of math and science did not. In what he described as "leading by example," the president in 2009 instituted the White House Science Fair, annually inviting 100 students from all across the country to 1600 Pennsylvania Avenue to show off America's best science, technology, engineering, and math projects in an effort to prove to young people "how cool science can be."

This year, as an MTSU freshman, Wesley Carter was one of those 100 students selected, along with his high school classmate, Darius Hooker.

The whole experience grew out of an early love for flight. Wesley grew up next to Memphis International Airport and says that from an early age his dad took him to watch the jets take off. "I grew to love airplanes and soon aerospace," he says.

At Wooddale High School in Memphis, Wesley was able to take advantage of an aviation program in which he got to study rocket science and train for a private pilot's license. During his sophomore year, he was asked about building rockets for a competition called the Team America Rocketry Challenge. He calls it a huge

blessing that he was able to begin studying something he loved so much at such a young age.

"The aerospace field is an exciting and amazing field of science," he says. "Just learning new things, creative ideas, and also about the history of the pioneers in aviation makes me love it."

Before meeting President Obama, Wesley, Darius, and the other students presented their projects to military personnel, scientists, and educators. Wesley and Darius were part of a project sending eggs into the air and bringing them back down unbroken. Wesley describes the president as "laid back" and says he showed a lot of interest in their project.

Wesley entered his sophomore year at MTSU this fall. He has a lot of big plans in the works. He's studying aerospace for flight dispatch and is a member of Air Force ROTC.

His future plans will keep him in the air as well. Wesley hopes to become an officer in the U.S. Air Force, flying military jets. Right now, he's working on joining the Air Force Thunderbirds demonstration team to help him get closer to that goal. After retiring

from the military, Wesley says he plans to work as an air traffic controller.

According to Wesley, his White House experience has turbocharged his career plans. There's no doubt about it—this is one young rocket scientist who is remarkably grounded. 🌱



Basic Highlights

A look at recent awards, events, and accomplishments involving the various departments in the College of Basic and Applied Sciences



Chrisila Pettey, chair of the Department of Computer Science, is working to have MTSU supply more talented graduates to the workforce.

Computer Science

Completing the Circuit

Every year, more than 800 technology-related jobs go unfilled in the Nashville area, putting an unwelcome brake on the region's economy. Earlier this year, as reported by *The Tennessean*, the Nashville Area Chamber of Commerce went so far as to launch a recruiting campaign aimed at solving "the nagging and persistent shortage of IT workers." It's no wonder, then, that when students graduate from MTSU's technology programs, they are quickly absorbed by companies hungry for fresh talent. Chrisila Pettey, chair of the Department of Computer Science, is working to have MTSU supply more talented graduates to the workforce. One method is encouraging women to enter STEM fields. While women are the majority at MTSU and many other universities, nationally they earn just over 18 percent of undergraduate degrees in engineering and just slightly over 25 percent of undergraduate degrees in math and computer science. They are missing opportunities to have rewarding careers, says Judith Iriarte-Gross, director of WISTEM (Women in Science, Technology, Engineering, and Mathematics) at MTSU. "In STEM, they can command a higher income, and that means a better economic future for their families," Iriarte-Gross says.

Concrete Industry Management

A Concrete Advantage

Four Concrete Industry Management programs—at Arizona State University, MTSU, Texas State University—San Marcos, and New Jersey Institute of Technology—were named "Excellent Universities" by the American Concrete Institute (ACI) for student and faculty efforts to support the industry.

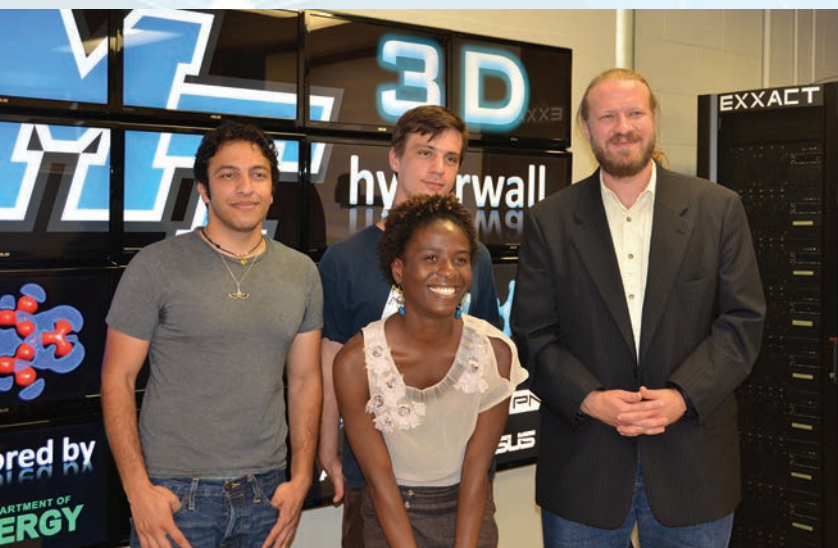


MTSU Concrete Industry Management chair Heather Brown

Chemistry

3D Degree

Technology similar to what people saw in James Cameron's *Avatar* has reached MTSU—and “it brings science to life,” says Anatoliy Volkov, an associate chemistry professor who helped bring it to campus. Student researchers are touting new advanced 3D visualization and GPU-based high-performance computing—affecting medical images such as CT and MRI scans—that is setting MTSU apart from other universities. Such 3D imaging in health care, as an example, could help prepare surgeons for a successful brain tumor removal procedure or help detect the presence of cancer in a scan. The new MT 3D VizLab is equipped with the latest 3D technology available and includes a 16-display 3D hyperwall, or array of liquid crystal display monitors. Particularly since MTSU added doctoral programs in computational sciences and molecular biosciences in recent years, faculty and administrators believed the University also needed high-performance computing and an advanced 3D visualization facility to be competitive in research-intensive scientific disciplines. Preston MacDougall, a chemistry professor and former interim director of the department, inspired the push to get a hyperwall after being introduced to the technology in 1999 while working as part of a summer research fellowship at NASA's Ames Research Center.



MT 3-D hyperwall grand-opening presenters included Julian Harbeband, left, Olukemi “Kemi” Jolayemi, front, and Chris Irwin, who are joined by Dr. Anatoliy Volkov at the VizLab unveiling.

Environmental Science

MTSU student Jonathan Prichard tackles the alternative fuels go-kart challenge.



Fuel for Thought

Most students spend their last day in class taking an exam. Students taking an alternative-fuels class taught by professor Cliff Ricketts ended their class in December 2012 with a go-kart race. Four teams of students competed in races with go-karts powered by various alternative fuels including propane, solar electric, ethanol, and a special hydrogen peroxide-powered vehicle. Senior Jonathan Prichard, a member of the hydrogen-peroxide team along with Dillon Hagewood and Skylar Daniel, called the semester-long class “an experience you cannot get anywhere else.”

Thinking Outside the Classroom

The Harpeth Wetland Bank donated more than 200 acres of rural property in the Rockvale area of Rutherford County to MTSU, providing an unusual “outdoor classroom” for student research. The land, previously known as the Puckett Farm, was donated with the support and encouragement of the property’s previous owners, former MTSU employee Betty Rowland and her sisters, Mary Taylor and Ann Hartmann, in honor of their father, Clarence William Puckett, who was a member of the Middle Tennessee State Teachers College class of 1941. The land will be used as an environmental field laboratory for programs in biology, environmental science, botany, conservation, and other sciences.

(Basic Highlights continued on page 12)

Military Science

Taking Aim

ROTC cadets at MTSU have more opportunities to sharpen their shooting and tactical skills following a recent upgrade at the Military Science program's indoor rifle range simulator (the Engagement Skills Trainer). The University provided funding for an additional five-lane, \$116,000 trainer unit, bringing to 10 the number of lanes available. The simulator uses computers, lasers, projectors, and pneumatic weapons to provide a realistic experience of firing a weapon, including recoil and sound. Master Sgt. Jonathan Bright, a senior military instructor, says the simulator teaches cadets the fundamentals of using and firing the M4 assault rifle. "Everything feels exactly like the [real] rifle," Bright says. "The trigger squeeze, everything that you would do on an actual range is set up in this, except it's with computers and lasers." The U.S. Army funded the initial five-lane trainer unit. "This was a joint effort between the Army and the University to provide us with a complete 10-lane system," says Lt. Col. Joel Miller, professor of military science and department chair.



MTSU ROTC students demonstrate the new indoor rifle range simulator at the open house.

Physics and Astronomy

Physics First

A potential game-changing switch in the sequence in which the sciences are taught in at least 20 Tennessee K-12 school districts was a key topic at the seventh annual STEM Education Research Conference in Murfreesboro in February 2013. The change is called the Physics First Approach, with conceptual physics taught first in the ninth grade and followed in subsequent years by chemistry and molecular biology. Tom Cheatham, director of the Tennessee STEM (science, technology, engineering, and mathematics) Education Center at MTSU, says the Arizona State University researchers who invented Physics First say "physics is a foundational science" and that "chemistry builds on physics, and biology builds on chemistry." Jamie Woodson, president and CEO of Tennessee SCORE (State Collaborative on Reforming Education), a program started by former U.S. Senate majority leader Bill Frist, was among the presenters at the conference.

True Blue Moon

MTSU assistant professor Irina Perevalova acknowledges that her guests at the April 2013 MTSU Star Party were not only some of the coolest she's ever brought to one of the events but also some of the most rare. Lunar samples from Apollo missions 14 through 17, on loan from NASA, were on special display in Wiser-Patten Science Hall. The public was invited to view the display, which was part of both Alumni Weekend and Star Party activities. Perevalova, who teaches in the Department of Physics and Astronomy, called the moon samples "a national treasure."



Agribusiness/Agriscience

Read All About It!

The House Agriculture and Natural Resources Committee presented Pettus Read ('70), a Rockvale resident, with the Outstanding Commitment to Tennessee Agriculture Award. Read, an author, editor, and Tennessee Farm Bureau Federation director of communications,



was recognized for his many years of service covering and promoting the rural way of life in Tennessee. Warren Gill, MTSU School of Agribusiness and Agriscience director, says that Read “is one of the reasons for the unprecedented growth and interest in agriculture for high school students and why enrollments in ag programs in colleges are growing. His [newspaper] column . . . reaches over 400,000 people each week. It’s always good, positive, often funny, poignant, and smart. He’s a great wordsmith. He sells agriculture. And wherever he is, he’s a proud supporter of MTSU and our ag department.” Read is editor of the bimonthly *Tennessee Farm Bureau News* and the quarterly *Tennessee Home & Farm* magazine. He also writes the column “Read All About It,” which appears in more than 55 state newspapers.

Higher Education in Your Backyard!

MTSU has expanded its Agriculture Education program to Shelbyville, giving people there a closer option for taking college courses. Professor Warren Anderson hopes the new program, run by the Middle Tennessee Education Center (MTEC), will help get people focused on farming and agriculture.

Aerospace

Center for Life Flight

Vanderbilt LifeFlight Operations Center and MTSU Aerospace have partnered to establish a national certification program that will create the first national certification of communication specialists within all level 1 and 2 trauma hospital flight operations centers. Once developed and tested, the program will be placed online to make it available nationwide. As part of the special project, a peer-reviewed journal will be established to share best practices and research, leading to national conferences and a national organization to be established and housed at MTSU.

Forging Ahead

MTSU student pilots will benefit from a new bridge program between MTSU and PSA Airways Inc., a wholly owned subsidiary of US Airways headquartered in Dayton, Ohio. The program is designed to give MTSU students the opportunity for more employment options after graduation, with the possibility of entering PSA’s pilot training program. Dean Bud Fischer described the pact as “an excellent example of how industry and universities can work together to solve problems that are out there as we move forward.”

By Land and Air

From facilitating missile strikes on terrorists to keeping soldiers safe from harm’s way by defusing improvised explosive devices in war zones, unmanned aerial and ground vehicles have moved from Hollywood scripts to military necessities. Last year, MTSU formed a historic educational partnership with the U.S. Army and U.S. Marine Corps to study ways robots on the ground can be used in concert with unmanned vehicles in the air. The three-year cooperative effort with the Robotic Systems Joint Project Office, headquartered in Warren, Mich., with a satellite office at the Redstone Arsenal near Huntsville, Ala., is the first of its kind. It comes one year after MTSU and the Army partnered to support educational and research efforts into the Army’s remote-controlled Raven aircraft.



President Sidney A. McPhee (center) chats with Lt. Cols. Nick Kioutas (left) and Robb Walker (right) after a signing ceremony of a partnership agreement between the U.S. Army, Marines, and MTSU involving unmanned vehicles.

(Basic Highlights continued on page 14)

(continued from page 13)

Women in Flight

Two female aerospace majors participated in a cross-country flying competition this past summer. Alison Taylor and Alexis Hutchinson were among 45 teams racing in the 2013 Air Race Classic June 18–21. Women’s air racing started in 1929 when 20 female pilots raced from Santa Monica, California, to Cleveland, Ohio. Taylor graduated in May 2013. She works as an aviation flight instructor in Murfreesboro. Hutchinson, who got college credit for the trip, is scheduled to graduate this winter.



Alexis Hutchinson (left) and Alison Taylor (right) competed in the June 18–21 Air Race Classic against 45 other all-female teams.

Mathematical Sciences

Teaching the Teachers

MTSU graduate students and faculty in math and science education gathered last year to learn more about a teacher evaluation method that could affect classrooms across the state of Tennessee. The Reformed Teaching Observation Protocol, or RTOP, is used to evaluate mathematics and science teaching and is part of a growing movement to reform math and science teaching methods across the country. Angela T. Barlow, director of MTSU’s Mathematics and Science Education Ph.D. program and a professor of math education, says, “With the introduction of the Common Core State Standards for Mathematics and the Next-Generation Science Standards, it is imperative that we work to support teachers in adopting instructional practices that will support their students’ learning.”

Engineering Technology

Best Laid Plans

MTSU’s Land Development/Residential Building Construction Management team finished eighth out of 31 teams in the construction management competition held in January 2013 at the International Builders’ Show in Las Vegas. MTSU’s team placements over the last ten years include finishing in the top ten nine times with seven of the nine being in the top five. In the most recent competition, students were given 118 acres to develop, including an old rock quarry, on the banks of Utah Lake in Saratoga Springs, Utah. The final proposal included market analysis, sales strategy, scheduling, estimating, infrastructure/

house plans, sustainability, cash flow, and a management approach for the project. David L. Hughes, chair of the board of advisors for the Land Development/Residential Building Construction Management concentration, says MTSU ranks “among the elite programs in the nation. The competition . . . is a real-life situation that we do every day in our industry. If this was a nationally recognized sport, MTSU would be in the hall of fame.” MTSU’s program is affiliated with the Rutherford County Home Builders Association, Home Builders Association of Middle Tennessee, Home Builders Association of Tennessee, and the National Association of Home Builders.

Success by Design

The Tennessee Board of Regents approved a mechatronics program for MTSU’s Engineering Technology Department. Mechatronics is a design process that includes a combination of mechanical, electrical, control, and computer engineering. The program is based on a three-level international certification program created by Siemens, a German engineering company. MTSU’s mechatronics program is expected to quickly attract students and, upon graduation, their skills and their bachelor’s degrees should land them jobs in a workforce that’s facing a critical shortage. Motlow State Community College, which started a mechatronics program a few years ago, is assisting the program launch at MTSU by allowing use of its equipment at a Bridgestone facility in La Vergne.

Biology

Imitations in Life

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.”) 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. 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. Brower has secured more than \$1 million in external funding for his research, a component of which was recently profiled in *Science* magazine. Researchers like Brower are playing beat the clock, as thousands of species of plants and animals are threatened with extinction each year.

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



Other News of Note

A New Pathway

The Master of Science in Professional Science is one of the fastest growing master’s programs at MTSU, now serving students in the concentrations of Biostatistics, Health Care Informatics, Biotechnology, Actuarial Sciences, Geosciences, and Engineering Management.

Good Company

Chemistry professor Preston MacDougall helped the Nashville chapter of the American Chemical Society create the first state STEM Education caucus in the United States. Jim Tracy, state senator from Shelbyville, is cochair of the STEM Caucus, which launched with a meeting at the Capitol in spring 2012.

(Basic Highlights continued on page 16)

Towering Figures

Judith Iriarte-Gross's nearly 18 years as a passionate advocate for four areas of science as career possibilities for girls and young women led to special recognition from President Sidney A. McPhee, who earlier this year presented her with the President's Silver Column Award. Iriarte-Gross leads the MTSU Women in STEM Center and is director of the annual Expanding Your Horizons conference and Girls Raised in Tennessee Science (GRITS) workshops that provide girls with more science, technology, engineering, and mathematics education and career awareness. According to McPhee, the award "is designed to recognize employees who go above and beyond the call of duty—extraordinary individuals who really show their commitment to the University." Cliff Ricketts's five decades of alternative-fuels research and exemplary classroom teaching were also recently acknowledged by McPhee, who surprised the 37-year School of Agribusiness and Agriscience faculty member in April with his own President's Silver Column Award. (See article on Ricketts and his alternative fuels research on page 30.)



Dr. Judith Iriarte-Gross serves as a one-woman STEM-ulus package.

Savvy Partnership

MTSU continued to strengthen its credentials as a scientific research institution by becoming one of only 105 universities in the country to gain full membership in Oak Ridge Associated Universities (ORAU). The prestigious designation gives MTSU faculty and students an opportunity to land members-only grants and internships and also provides a gateway to laboratory research at federal facilities. ORAU facilitates access for its member institutions to Oak Ridge National Laboratories, the Y-12 National Security Complex, and the Department of Energy and its programs.

A National Perspective

MTSU welcomed college students from across the country this past May and June for a research experience funded by a National Science Foundation (NSF) grant. Mark Abolins, coordinator of the Geoenvironmental Challenges Research Education for Undergraduates initiative and associate professor of geology, led the program, the first of its kind at MTSU and one of only 21 such programs funded by the NSF. Ten students searched for ancient inactive faults, investigated water and air quality, and explored the ecology of cedar glade habitats, which are rare globally but abundant in middle Tennessee. The research may also lead to a greater appreciation of the role of geology during

the pivotal first day of the Civil War battle of Stones River and should also lead to a greater appreciation of the role of geology and botany in the lives of rural African Americans after the war, Abolins says. The NSF grant of \$368,000 also will enable MTSU to host similar endeavors in 2014 and 2015.

The Good Doctor

MTSU recently hosted the inaugural 1911 Society Luncheon to recognize those who have made financial commitments to the University for the long term. Among those honored at the luncheon was Liz Rhea, who graduated with a science degree in 1958, went on to the University of Tennessee Medical School in Memphis, and became a radiologist. Doing so was quite an accomplishment for a woman in the 1950s. She vividly remembers studying at MTSU. "I was in that Wisner Building day and night more than 50 years ago," she says. Rhea believes the University's new \$147 million science building now under construction will be a sea change. "I think we can attract the brightest and best students—some of the best minds in the country. It'll make it a joy to go over [to the new building] and learn." Rhea says a grade-school principal started her on her career path. "He told me, 'Elizabeth, you're so smart. Why don't you go to medical school?' And I said, 'What?' And he said, 'Just hitch your wagon to a star.' So I always said, when I

grew up, I was going to go to medical school. I don't know what the people of Eagleville thought of a little girl saying that!" Rhea met her future husband, Creighton Rhea, when he taught her radiology class. Married in 1961, they moved the next year to Murfreesboro, where Creighton went to work at Murfreesboro Medical Clinic. The couple moved away from middle Tennessee in 1970, but luckily for Murfreesboro and MTSU, they retired and returned in 1992 to be closer to Liz's mother. Liz's mother died in 2003, and Creighton died in 2004. Rhea's life since her return to Murfreesboro can be characterized in one word: volunteering. A consummate fundraiser, Rhea has campaigned for numerous good causes over the last two decades in Murfreesboro, raising an amount of money that has changed lives and elevated the quality of life in Rutherford County. Rhea remains a tireless, enthusiastic supporter of MTSU and Murfreesboro. "My blood runs blue," Rhea says. "I was a cheerleader in college here, and I'm always cheering on this University. Go MTSU!"

Longtime donor and alumna Dr. Liz Rhea



Grade "A" Students

There have been many stellar accomplishments made by CBAS students in the academic realm in 2012–13.

Daniel Gouger received a 2012–13 Fulbright Scholarship to study biochemistry in Spain.

Jordan Dodson was awarded a 2013 Goldwater Scholarship and also participated in a National Science Foundation–sponsored research experience for undergraduates program at Harvard University's Institute for Applied Computational Science.

MTSU students Robert Daniel Murphy (winner) and Jonathan W. Herlan (honorable mention) received recognition in the Barry Goldwater Scholarship and Excellence in Education Program. Murphy's goal is to get his Ph.D. in atomic physics and research exotic states of matter such as Bose-Einstein condensates and degenerate Fermi gases. Herlan seeks a Ph.D. in physical acoustics and wants to conduct acoustic research and teach at the university level.

Eric Guyes was awarded a Fulbright for 2013–14 and will be conducting research in Israel.

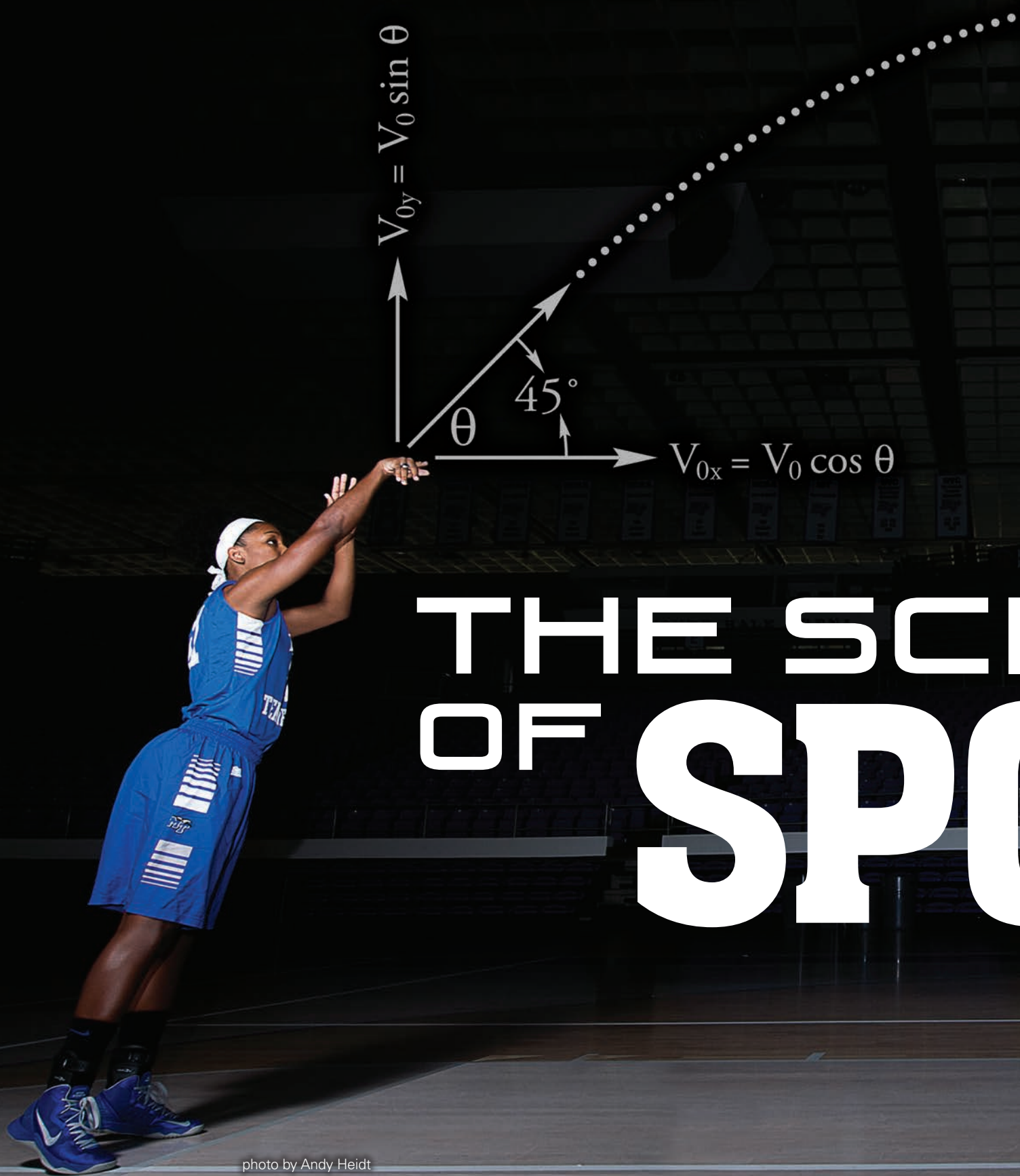
David Owens received a Fulbright to teach in Brazil.

Jacob Basham, who graduated in May with bachelor's degrees in professional mathematics and general science, won a \$5,000 fellowship from The Honor Society of Phi Kappa Phi.

Brett Bornhoft was awarded the German Academic Exchange Service scholarship for an internship in Germany for the summer of 2013.

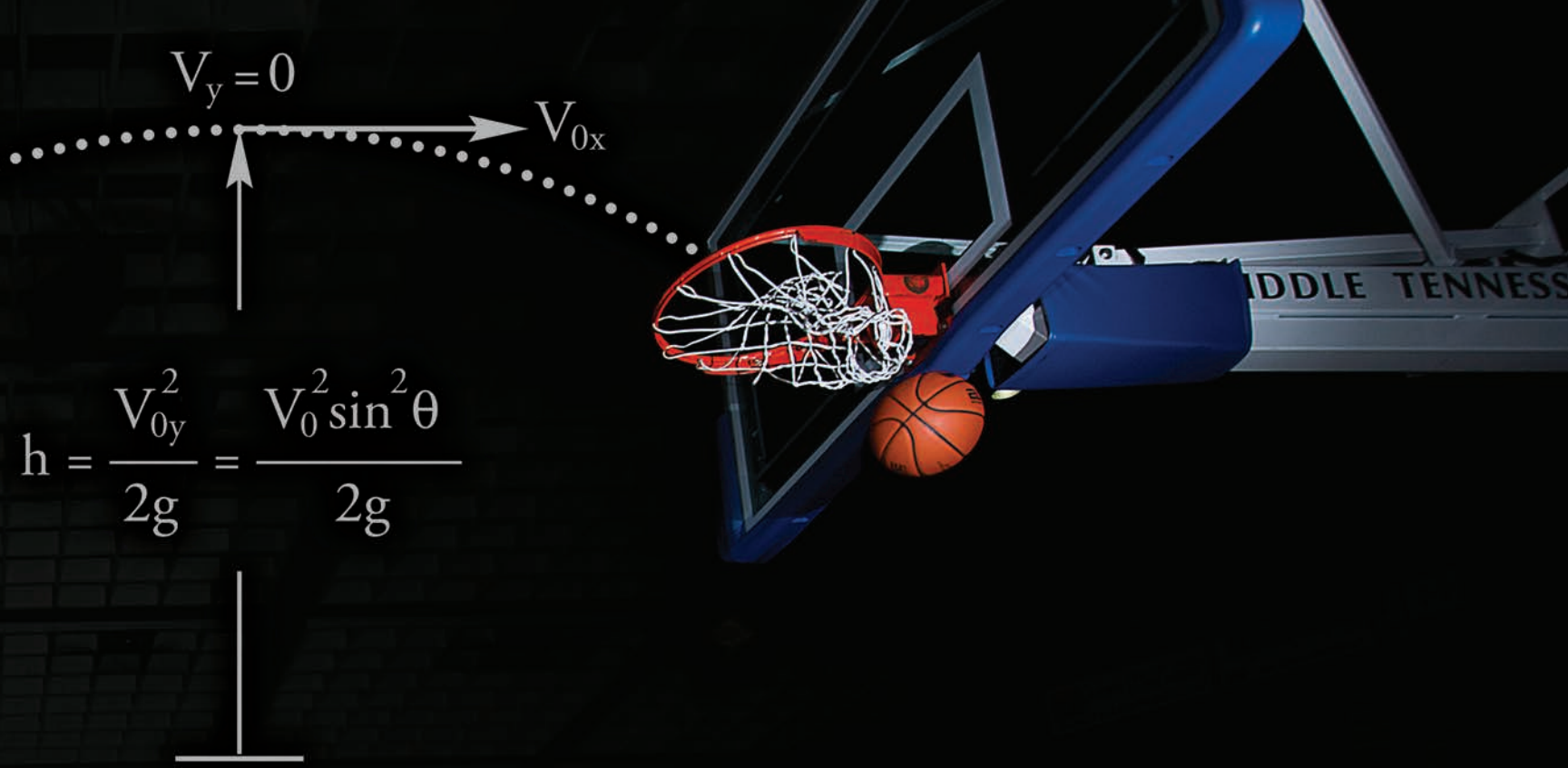


Left to right; Jonathan Herlan, Daniel Murphy, Dean Fischer, Brett Bornhoft, and Eric Guyes



THE SCIENCE OF SPORTS

photo by Andy Heidt



SCIENCE SPORT

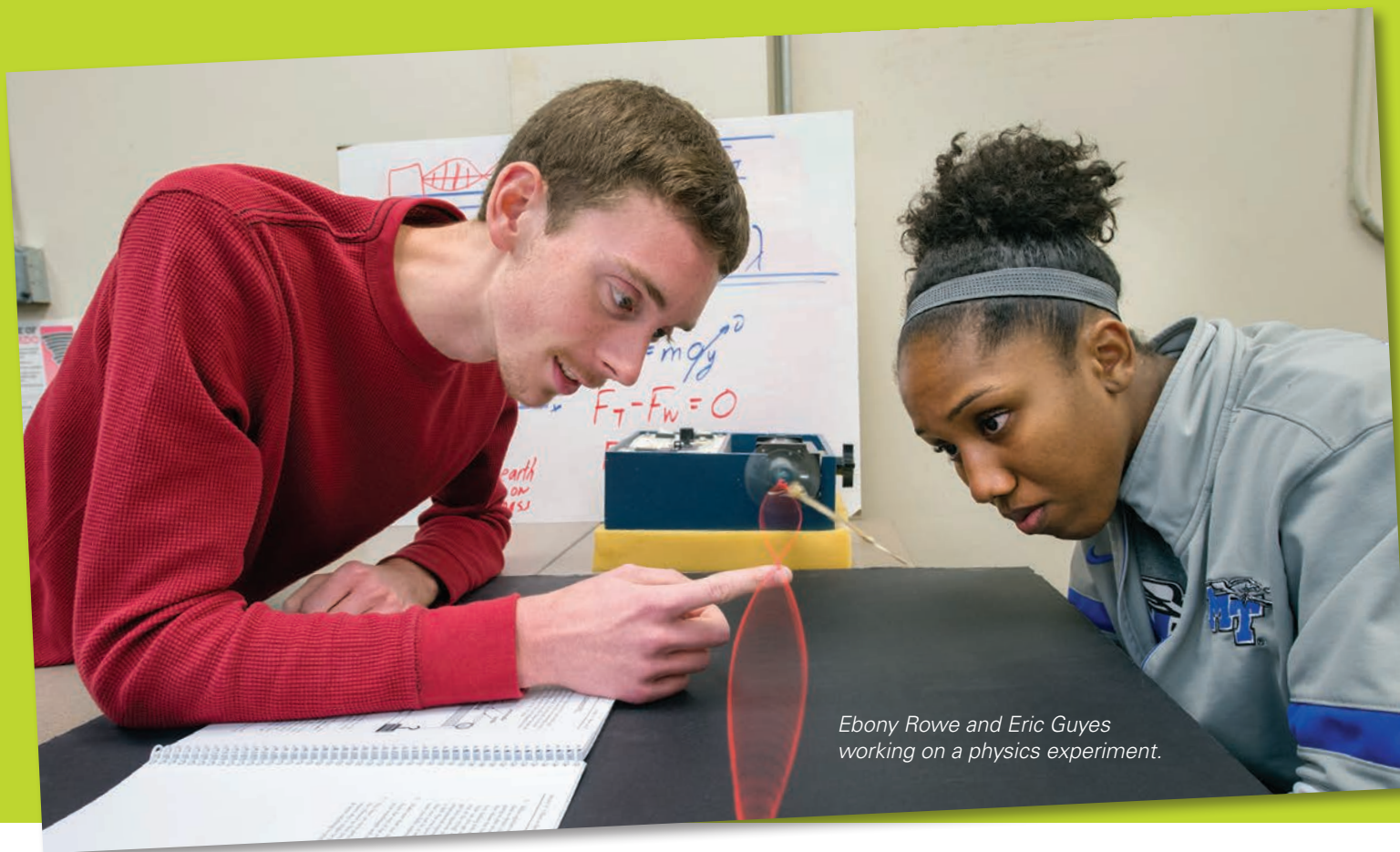
Physics major Ebony Rowe brings her “A” game to both sides of the scholar-athlete equation by Drew Ruble

Lady Raider Ebony Rowe averaged 19.7 points and 11.2 rebounds in 33 games as a junior last year. In three seasons, she’s totaled 1,719 points—ninth most in school history—and is already the program’s leading rebounder. And she still has her senior season ahead of her.

Her athletic prowess garnered Rowe Honorable Mention All-American status by both the Associated Press and the Women’s Basketball Coaches Association. She was also a 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 has racked up an equally impressive portfolio of statistics in the form of academic and personal awards. Notably, she was 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 has earned a 3.58 cumulative GPA as a physics major, which includes a perfect 4.0 last fall.

(continued on page 20)



Ebony Rowe and Eric Guyes working on a physics experiment.

(continued from page 19)

In all likelihood, Rowe will have the opportunity to play women's professional basketball, following in the footsteps of Lady Raider alums like Alysha Clark and Amber Holt. However, Rowe isn't yet committing to a plan to play professional ball. She's as interested, she says, in beginning pursuit of a postgraduate degree or beginning her career in mechanical engineering.

"At this point, I'm just trying to keep all my doors and options open," she says. "Whether that's playing professionally here or overseas or going straight into getting my master's degree in engineering, I'm still undecided."

A Dual Threat

With her high GPA, passionate interest in her studies, and wait-and-see approach to playing pro sports, Rowe bursts the stereotype of the academically disinterested student-athlete. And what makes her even more intriguing is that her major is 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 generations 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 takes classes such as Classical Mechanics, Strength of Materials, and Electricity and Magnetism. Among her recent research projects was a study of the physics of free throw shooting in basketball.

It's an ironic topic for Rowe to tackle given her highly publicized troubles at the free throw line in competition. Even her coach has been publicly critical of Rowe's free throw shooting percentage in years past, which for a time hovered below the 50 percent mark. Rowe has, however, improved dramatically over the past year and is now 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-dling 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.

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Training Mission

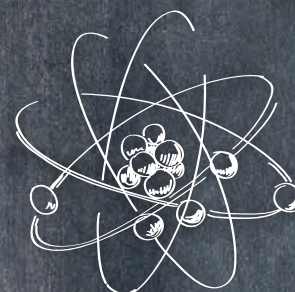
There are only a few of National Science Foundation–approved Physics Teacher Education Coalition (PhysTEC) sites in the nation, and MTSU’s Department of Physics and Astronomy is one of them. (Others include Cornell, UNC–Chapel Hill, Arizona, and Colorado.)

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 during the recent fall faculty meeting, 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.”



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"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.

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.

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 the second straight summer, 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'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 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.



"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." 🌸



Power in

Pairs

Married couples abound in the teaching ranks of the College of Basic and Applied Sciences

by Patsy B. Weiler

Some might think that romance and science go together like orange blossoms and osmosis. At Middle Tennessee State University, Cupid must have his own app—numerous married couples bring their collective and individual talents to the College of Basic and Applied Sciences.

There could be “chemistry” in the air since the largest number work in that department. Others have offices on opposite sides of campus and try to grab an occasional lunch together. Once at home, they say they are like other families but admit that shoptalk about the University does occasionally drift into their conversations.

None of them say they compete with their mates. Often they travel together for work and play, have performed joint

research, rely on their different strengths and interests, and are each other’s best ally and critic.

Collectively, they agree their main goal is to have a positive effect on their students and excite them about learning.

Several of these duos shared a closer a look at their lives on and off campus.

Dan and Liz Troup

Dan: Agribusiness and Agriscience, Crops Unit manager

Liz: Agribusiness and Agriscience, Milk Processing Plant manager

Liz and Dan Troup’s relationship is one that was homegrown at MTSU. After meeting in a genetics lab class as undergraduates, the friendship sparked a long-burning flame. They wed in the chapel at historic Cannonsburgh Village in Murfreesboro and have been married 27 years. Both of their children attend MTSU.

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Together, the Troups are responsible for preparing the good things that go into and come out of the MTSU dairy herd. Dan is a certified crop advisor and oversees equipment maintenance. Since 1981, he has managed the field preparation, planting, and harvesting of crops fed to cows on the University Farm. The milk served on campus, both the white and rich chocolate, is processed at MTSU under Liz's watchful eye.

All the work is performed by students, who, the couple says, are "their real product."

Like bees and honey, their professional and personal lives are entwined. Liz can drive the farm trucks and Dan is just a call away to help make a repair at the plant or do an emergency milk delivery. Both are involved with the Beekeeping and Dairy Science clubs. Dan was a part of the Leadership Rutherford class of 2013, and both are active participants in their church and the Rutherford County Farm Bureau.

"It is just what we do and who we are," Liz says. "It is pretty clear we're married. We're best friends. We're a team."

Dwight and Patricia Patterson

Chemistry Department, professors

When it comes to the study of chemistry, Dwight and Patricia Patterson are in their element. Between them, they have taught in the MTSU Chemistry Department for nearly 40 years. They pursued their advanced degrees together at Case Western Reserve University in Cleveland, and both worked at Dow Chemical and GE Plastics. They have been married for 36 years.

"Working in the same department is not new for us," says Pat, who met her future husband at an American Chemical Society (ACS) meeting when she was president of the Virginia State University student ACS chapter.

However, they have different specialties.

Dwight's expertise is polymer science and research. "The academic environment is a place where one can study this area with greater freedom and train new individuals in a discipline I love and enjoy," he said.

Pat teaches and mentors future science educators and majors. Recently she participated in a five-year National Science Foundation (NSF) grant, serving as a mentor to master teaching fellows in high school math and science.

Both have had extensive involvement with grants from organizations such as NSF and NASA.

When it comes to the **study of chemistry**, Dwight and Patricia Patterson are **in their element**.

Pat has been the MTSU Regional Science Olympiad Tournament director for 11 years, and Dwight is an event coordinator at the high school level. Science Olympiad is an event in which elementary through high school students use team-building and science skills to have fun learning while competing.



"I think the Science Olympiad brings the best of STEM [science, technology, engineering, and math] to students and teachers," Pat says.

When they finally get home, this couple shuts the door on work. They enjoy tennis and spending time with their family.

"When I am at home, I will not log onto my MTSU email," says Dwight. "I leave my work at work."

Ken and Angela Barlow

Ken: Agribusiness and Agriscience, adjunct instructor

Angela: Mathematical Sciences, professor and Ph.D. program in Mathematics and Science Education director

Although they work in two different areas, Ken and Angela Barlow share a mutual passion of engaging their students to be excited about math and science.

He is an adjunct in the School of Agribusiness and Agriscience; she directs the new Ph.D. program in Mathematics and Science Education and teaches graduate courses. Not one to just stand and lecture, Ken often takes his students outdoors to gain firsthand experience at the MTSU Farm. Angela enjoys energizing future and current math educators by emphasizing the importance of being innovative and encouraging the use of fun, hands-on activities in the classroom.

Neither of them **have a memory** of when they **didn't know each other.** . . .

Neither of them have a memory of when they didn't know each other—they grew up together in rural Wilcox County, Ala., southwest of Montgomery. Angela says they "liked" each other in their preteen years, but it wasn't until the two were students at Auburn University that they reconnected at a War Eagle Supper Club dance and soon married. Twenty years later, they are the parents of two children, Lizzy, 17, and Trey, 11.

Mother and daughter share a common interest: this fall, Lizzy, who often videotaped her Mom's workshops, will be

a freshman at UT-Knoxville studying math education. Trey, "who is full of energy" according to his father, now has 4-H on his radar after helping his Dad milk cows and dehorn baby goats during a Maymester class.

At MTSU, the Barlows work on opposite sides of the campus and are rarely seen together. Still, when a random, unexpected encounter happens, Angela says, "It makes me smile when I see him." ❁



Other married couples in the College of Basic and Applied Sciences

Doris Steenland-Gossett and Stephen L. Gossett
(Aerospace)

Jeff Walck and Siti Hidayiti (Biology)

This couple recently went to China to conduct experiments and attend the International Seed Ecology Meeting. While there, Jeff was awarded a Visiting Professorship for Senior International Scientists by the Institute of Botany of the Chinese Academy of Sciences. Siti recently received a Fulbright Scholar Award for spring 2014 to conduct research in Indonesia on Arnold's Rafflesia, a flower with a massive 3-foot diameter.

Beng Guat Ooi and Ngee Sing Chong (Chemistry)

Paul Kline and Tammy Melton (Chemistry)

Jungsoon Yoo and Sung Yoo (Computer Science)

Anthony and Mary Farone (Biology)

Wandi Ding and Donglin Wang (Mathematical Sciences)

Cutting-Edge Technology

One MTSU alum has a direct hand in ensuring we all get a close shave

by Bill Lewis

Have some respect for the humble razor blade you use every day. It might be the result of years of research by Jeffrey Parker, an MTSU-trained physicist who spends his days making possible something that eluded humans for millennia—a close, comfortable shave.

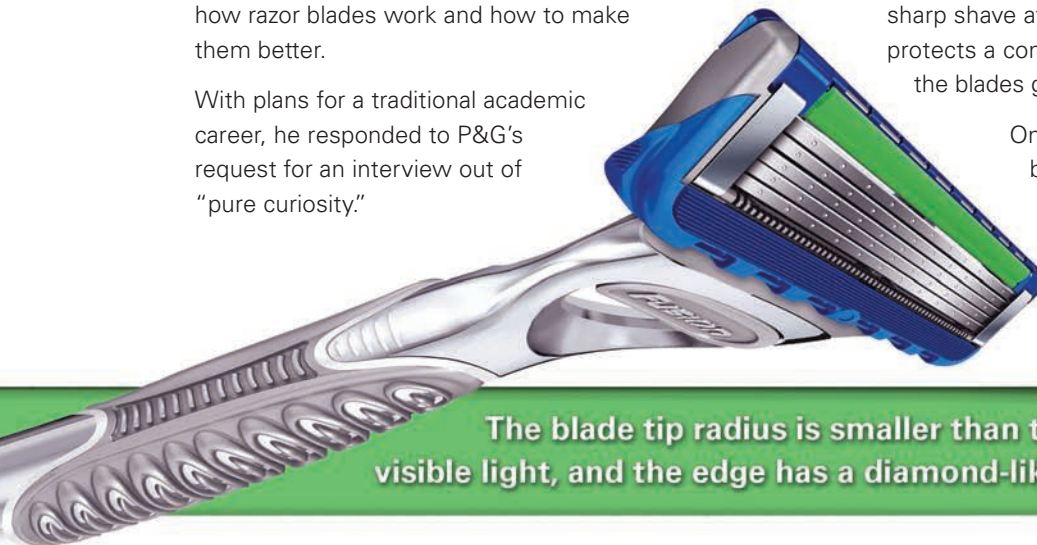
Parker, a 1997 MTSU graduate who received his Ph.D. from Florida State in 2003, is a senior scientist at Procter & Gamble's (P&G) South Boston Innovation Center, where he researches the hidden reality of how razor blades work and how to make them better.

With plans for a traditional academic career, he responded to P&G's request for an interview out of "pure curiosity."

is working on," Parker says. "But it's the nature of the world. It's surprising, the amount of technology in any product."

Parker's work has been instrumental in advancing P&G's Fusion ProGlide products, which use five blades to ensure a smooth shave. Each blade is thinner than a grain of sand. The blade tip radius is smaller than the wavelength of visible light, and the edge has a diamond-like carbon coating ten times harder than the steel beneath, which keeps the blade sharp shave after shave. (It is similar to the coating that protects a computer's hard drive.) Another coating helps the blades glide smoothly over the skin.

One day Parker might be measuring razor blades in the angstrom scale (one ten-billionth of a meter) and the next trying to decipher the responses of consumers participating



The blade tip radius is smaller than the wavelength of visible light, and the edge has a diamond-like carbon coating . . .

What did a consumer products company want with a materials physicist? The answer intrigued him.

The company had acquired Gillette and was building on that company's line of shaving products. For that, it needed scientists.

"None of it, someone would say, is cutting-edge technology, not what someone would think science

in a focus group. What do they mean when they say one blade or shaving lotion is smoother or creamier than the other? He quickly realized that being a physicist for a consumer products company on occasion also means being a psychologist.

"It's hard to define what consumers want. Hard to define a sensation. Physics, psychology, and physiology all come together," he says.

The science of shaving can also be hard to explain to the average consumer. Sometimes, we make fun of what we don't understand. During the first broadcast of *Saturday Night Live* in 1975, a skit starring comedian George Carlin and Al Franken, now a U.S. senator, mocked the then-new idea of a razor with multiple blades.

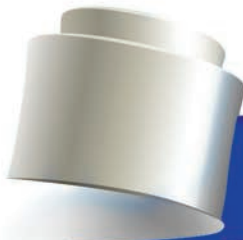
"The first blade grabs at the whisker, tugging it away from your face to protect it from the second blade," an announcer on the show says.

"Blade number two catches and digs into the stubble before it has the chance to snap back and injure you, pulling it farther out so that it is now ready for shearing.

"Triple-Trac's third blade, a finely honed, bonded platinum instrument, cuts cleanly through the whisker at its base, leaving your face as smooth as a billiard ball.

"The Triple-Trac. Because you'll believe anything."

These days, consumers realize they are getting a closer, smoother, and safer shave than ever before. But the underlying science can still be hard to explain.



"How do you explain English to a non-English speaker?" Parker says.

"Some say, 'I don't care how it works. I'm just glad it works.' But a lot of time people want to know. That's the nature of humans. We investigate the world we live in," he says.

That intellectual curiosity led Parker to MTSU after graduation from Brentwood High School. He was attracted by the University's science program and had hopes of becoming a walk-on defensive lineman for the Blue Raiders. He gave up football to concentrate on science.

"It got to be a time requirement," Parker says. "Full study, work, and playing football."

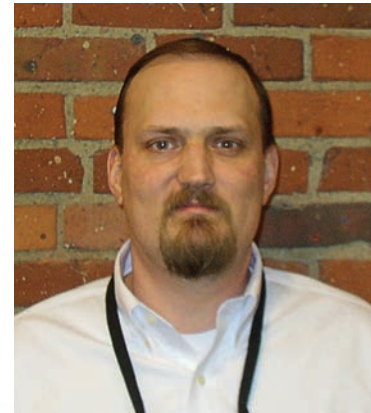
Even after football, the schedule was demanding for an aspiring scientist with dreams of graduate school and a career in academia. One physics class began promptly at 6:30 a.m.

"The professor brought in a percolator. It was an incentive. 'You've got to get up, so I'll give you coffee,'" Parker says.

That's the sort of personal touch that attracted Parker to MTSU.

"At a larger school, you wouldn't get the concentrated knowledge," he says. "At a smaller school, the education is more total. A bigger school can be like a factory churning out people who did well on the entrance exam."

Parker had completed two postdocs, including one at the University of Minnesota's Materials Research and Engineering Center, when he surprised himself by accepting P&G's offer. His career turn from academia to consumer products might have



Science, and physics in particular, is behind much of the everyday conveniences we now take for granted.

been unexpected for Parker, but not for his mentor at Florida State, Peng Xiong.

"Jeff was always a problem solver and favored the practical side of the research," he says. "The career choices such as Jeff's have in fact become more common in physics Ph.Ds.

"Science, and physics in particular, is behind many of the everyday conveniences we now take for granted. Without quantum mechanics, there would be no cellphones and iPads; without relativity, there would be no GPS!"

It's also no surprise to Xiong that becoming one of P&G's top shaving scientists hasn't led Parker to shave his beard.

"He's always had that beard," Xiong says. "It would take much more than a paycheck from Gillette to make him take it off, I think." 🌿

An artist's rendering of MTSU's new science building



A New Catalyst

MTSU's new \$147 million science building promises to take science and research efforts to the next level

By Drew Ruble

With a brand-new, state-of-the-art, \$147 million science building now under construction at MTSU, the institution is preparing to take science and research efforts to the next level. The building is scheduled to open for instruction in 2015.

As anyone familiar with the programs and infrastructure at MTSU will attest, the building is as desperately needed as it is long overdue. And yet, when viewed in the greater context of the other changes sweeping across the campus, the state, and beyond—from an evolving University mission to shifting funding formulas to exploding scientific frontiers—the timing couldn't be better.

The Brass Tacks

The existing Wisner-Patton and Davis Science Buildings (built in 1932 and 1967, respectively) house most of MTSU's science programs in a combined 75,332 square feet. In 1968, just after the Davis building opened, the student population was 6,779; by fall 2011, enrollment was 26,442. That's

an almost fourfold increase with no corresponding expansion of the space for science education.

The new building will provide more than 250,000 square feet of teaching space, faculty and student research laboratories, and collaborative learning spaces for the more than 13,000 students, both majors and nonmajors, who are enrolled annually in biology, chemistry, and physical science courses. Science courses offered in the new building will serve academic programs beyond general education biology and chemistry and include aerospace, agribusiness/agri-science, engineering technology, nursing, physics and astronomy, elementary education, teacher licensure in science education, and wellness and exercise science in health and human performance.

Research space in the new building will accommodate MTSU's needs for many decades. Two upgrades will be particularly transformative. MTSU will for the first time

have an animal facility for conducting research. On the chemistry side, modern ventilation will allow experiments long prohibited in MTSU's aging buildings.

As a result, the new facility will enhance MTSU's abilities to pursue a solid, focused research agenda and ramp up the University's profile as a research institution.

Path to Progress

The creation of three new science Ph.D. tracks (math and science education, molecular biosciences, and computational science) coincides roughly with the laying of the new building's foundation. (The University graduated its first science Ph.D. students in the spring of 2012.)



Construction of the new science building, due to be completed in 2015.

Additionally, the new building is already proving to be a powerful strategic tool for regional, national, and international recruitment of high-achieving students, faculty, and administrators.

When considered together, the construction of a new building, improvements in MTSU's research capacity, new Ph.D. programs, and an influx of new student and faculty talent represent something much more transformative than progress. This is going to be a real game-changer for the University.

Ripple Effects

The impact will be felt beyond the University, and all of Tennessee stands to benefit.

In remarks at the groundbreaking, Gov. Bill Haslam said that the \$147 million in state funding necessary to construct the building had to become a high priority because the facility will affect economic development in the entire state, given MTSU's primary role in workforce development.

During academic year 2009–10, MTSU granted almost 700 degrees in biology, chemistry, and related fields. The University now estimates that number could increase by 25 percent after the new science building is in operation.

The Road Ahead

In a February 2012 speech, Dr. Subra Suresh, director of the National Science Foundation, said, "In today's changing economic landscape, science and technology are the new frontiers of American prosperity. The nation's well-being and global competitiveness depend, more than ever before, on the steady stream of new ideas and the highly skilled science, technology, engineering, and mathematical talent."

MTSU's new science building stands to become the portal by which MTSU enters this realm—and competes for the rewards—for the first time in decades.

Has it been a long time coming? Definitely. But now, as the science and research fetters are being removed, it's just time to get to work. There's a lot of science to be done. 🌱



An artist's rendering of one of the new science building's labs.



Putting GAS IN THE PAST

MTSU's "Davy Crockett of science" travels from ocean to ocean on only sun and water

by Mike Browning

Though the sun is 93 million miles away, its light—solar energy—travels to earth in a mere eight minutes. Most of the earth's surface is another continuously renewed cycle of energy—H₂O.

Sun and water. Both are essential to life. And both are relatively free and abundant.

Dr. Cliff Ricketts, a longtime School of Agribusiness and Agriscience faculty member and an alternative fuels researcher, has a dream that one day people will drive their vehicles using only the natural energies of sun and water. He's worked for 25 years to figure out how to make that dream a reality.

"My whole passion is sun and water," says Ricketts, a farmer who fashions himself a modern-day Davy Crockett of science, or "frontiersman with energy."

In March 2013, Ricketts and a team of current and former students made news nationwide when they successfully drove a modified Toyota Prius from the Atlantic at Tybee Island, Georgia, to a Pacific beach near Los Angeles—a five-day, 2,600-mile driving expedition—powered exclusively by hydrogen made from sun and water.

Two hydrogen storage tanks built and attached underneath the car (alongside tanks added to the backseat and also hauled by a separate trailer) equipped Ricketts and team

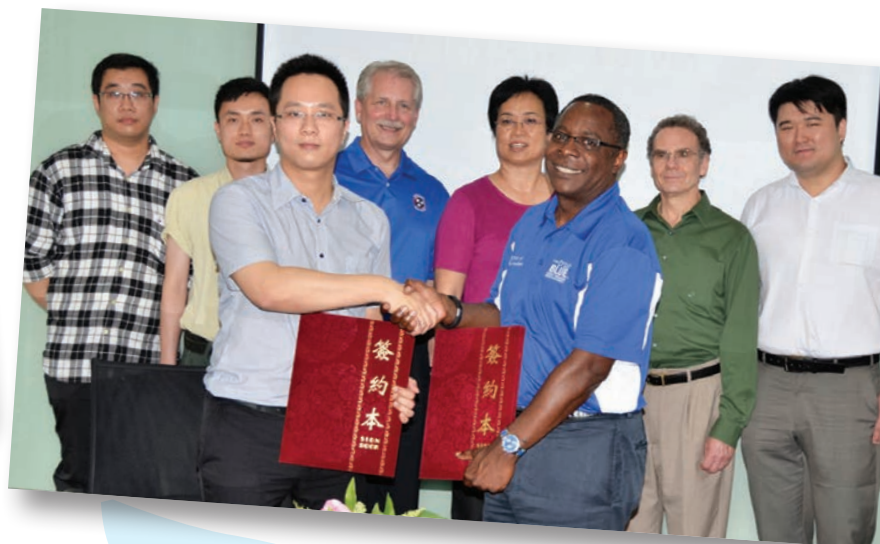
with the fuel necessary to complete the coast-to-coast trip. Ricketts compared his trip with no fueling stations to the plight of two brothers who revolutionized human travel more than a century ago.

"There were no airports when the Wright brothers flew the first airplane," Ricketts says. "And, of course, there weren't any hydrogen fueling stations along the way, so we brought our fueling station with us."

"I believe the government somehow will have to get involved," Ricketts adds. "We're kind of in a chicken-or-egg situation right now. We don't have hydrogen fueling stations because we don't have [hydrogen] cars, and we don't have cars because we don't have hydrogen fueling stations."

The end of the expedition at Long Beach, Calif., was captured on film by MTSU's media team and produced as a documentary. The documentary can be viewed at www.MTSUNews.com, or by searching the MTSU YouTube channel.

"I feel like I've climbed Mt. Everest," Ricketts says in the film. "Putting a man on the moon has more 'wow' factor . . . but as far as helping people for hundreds or maybe thousands of years to come, I think this is planting seeds that will help [hu]mankind." 🌱



The Middle Kingdom

MTSU forges a series of important new ties with China

From staff reports

President Sidney A. McPhee's recent summer trip to China yielded several significant new agreements, each with strong potential to produce significant tech transfer opportunities for MTSU's science-related endeavors.

First, MTSU's partnership in China studying modern uses of ancient herbal remedies has yielded almost 40 results showing promise in the treatment of cancer, viral infections, and other ailments. Those findings were released during an MTSU delegation's visit this summer to the Guangxi Botanical Garden of Medicinal Plants, named in 2011 as the world's largest medicinal herb garden by Guinness World Records. Located in Nanning in southern China, the garden features more than 7,400 medicinal plants.

McPhee and Miao Jianhua, vice president of the Guangxi Academic Science Institute and garden director, celebrated the partnership's progress with the christening of an MTSU-branded Joint Research Center at the garden's new research laboratory and headquarters.

"I am committed to making sure we produce groundbreaking research that will help the people of China, help the people of America, and, perhaps, the people of the world," McPhee said in remarks before the dedication.

The Tennessee Center for Botanical Medicine Research, based at MTSU, and the Guangxi garden are partners in an exclusive collaborative agreement that seeks to accelerate the

development of Western medicines from plant extracts.

The partnership, which began in 2011, plays to the strengths of both institutions. Garden researchers cultivate and prepare extracts. Then, MTSU scientists, led by Professor Elliot Altman, director of the Ph.D. program in molecular biosciences, screen the samples to determine their promise in the treatment of ailments.

McPhee also suggested during the trip that garden researchers assist the University in growing some botanical samples at MTSU's 500-acre agriculture complex at Guy James Farm.

MTSU's delegation was headed by McPhee and included state Senate Majority Caucus chair Bill Ketron (R-Murfreesboro), a 1976 graduate of the University. Ketron emphasized the role MTSU's new \$147 million science building, set to open for instruction in 2015, will play in the collaboration.

A Good Exchange

Next, MTSU established formal ties with a university known as "China's MIT" for its strong science, engineering, and biomedical programs. The agreement between MTSU and Shanghai Jiao Tong University will allow the exchange of faculty and students between the institutions. It will also let professors collaborate and share research.

Founded in 1896, Shanghai Jiao Tong University offers a wide range of academic programs with science as its

foundation. Three of its disciplines—naval architecture and ocean engineering, mechanical engineering, and clinical medicine—are ranked first in China.

Faculty, students, and alumni of Shanghai Jiao Tong have created many firsts in modern Chinese and world history. The university's list of firsts includes China's first internal combustion engine, the first hovercraft, and the first operation that rejoined a severed limb.

Huang Zhen, vice president for teaching and international affairs for the Shanghai university, said one-third of his university's undergraduate students participate in study abroad programs, a point of pride for the institution. McPhee also delivered a lecture to about 100 Shanghai students on how to become a successful international student at an American university, using MTSU as a role model and starting point for his discussions.

A Household Name

MTSU also signed a pact to become the first American university to establish formal ties with an institute in China's leading design center for household appliances and technology—the Research Institute of Industrial Design in the Shunde District in China's Guangdong Province. The pact was signed by McPhee and Xu Xuyan, deputy director of the Education Bureau of Shunde District. It allows the University to develop an exchange program for students to work with the institute. It also allows joint research, giving MTSU a potential outlet to participate in Shunde-based projects.

Shunde, dubbed the “Capital of Home Appliances of the World,” is a leader in the production of electric fans, cookers, microwave ovens, and other household appliances. It is also one of the world's largest producers of furniture.

“Our students can relate to you what our market wants and needs and how to capture consumer attention,” McPhee told Xu. “And you can help them understand the market forces outside of the United States.”

Ketron said the relationship could help innovations developed by MTSU faculty and students reach a global audience.

“In Tennessee, we often miss the link between having the idea and getting to market,” he said. “We must get good ideas to market faster and start putting things on the shelf for sale. That's how we generate money for our economy.”

Expanding Our Reach

Additionally, MTSU opened a student recruitment office at Guangxi University as part of its efforts to bolster international enrollment and strengthen ties in southern China. Founded in 1928, Guangxi University has an enrollment of more than 24,000 students.



The office, MTSU's first overseas representative office, will be operated through the private Canadian Foundation Center for International Education and will help MTSU recruit and assist Guangxi students interested in pursuing master's or doctoral degrees at the Murfreesboro campus. McPhee said the signing of the agreement “is consistent with our strategic plan to internationalize our campus.”

MTSU has an international enrollment of more than 700 full-time, degree-seeking students, a 16.5 percent increase over last year and a jump of almost 30 percent from 2011. McPhee has pursued international enrollment to diversify the MTSU campus and increase revenue for the University.

Wrap Up

The MTSU delegation's visit to China ended with stops at Chongqing University of Posts and Telecommunications (one of the country's top universities for information science and technology) and Communication University of China in Beijing (the country's foremost media education university). The delegation also visited Hanban Confucius Institute's global headquarters in Beijing, which oversees a network of more than 350 Confucius Institutes worldwide (including one at MTSU). ❀

[The character in the background is the traditional Chinese symbol for unity.]



THE DRIVE TO SUCCEED

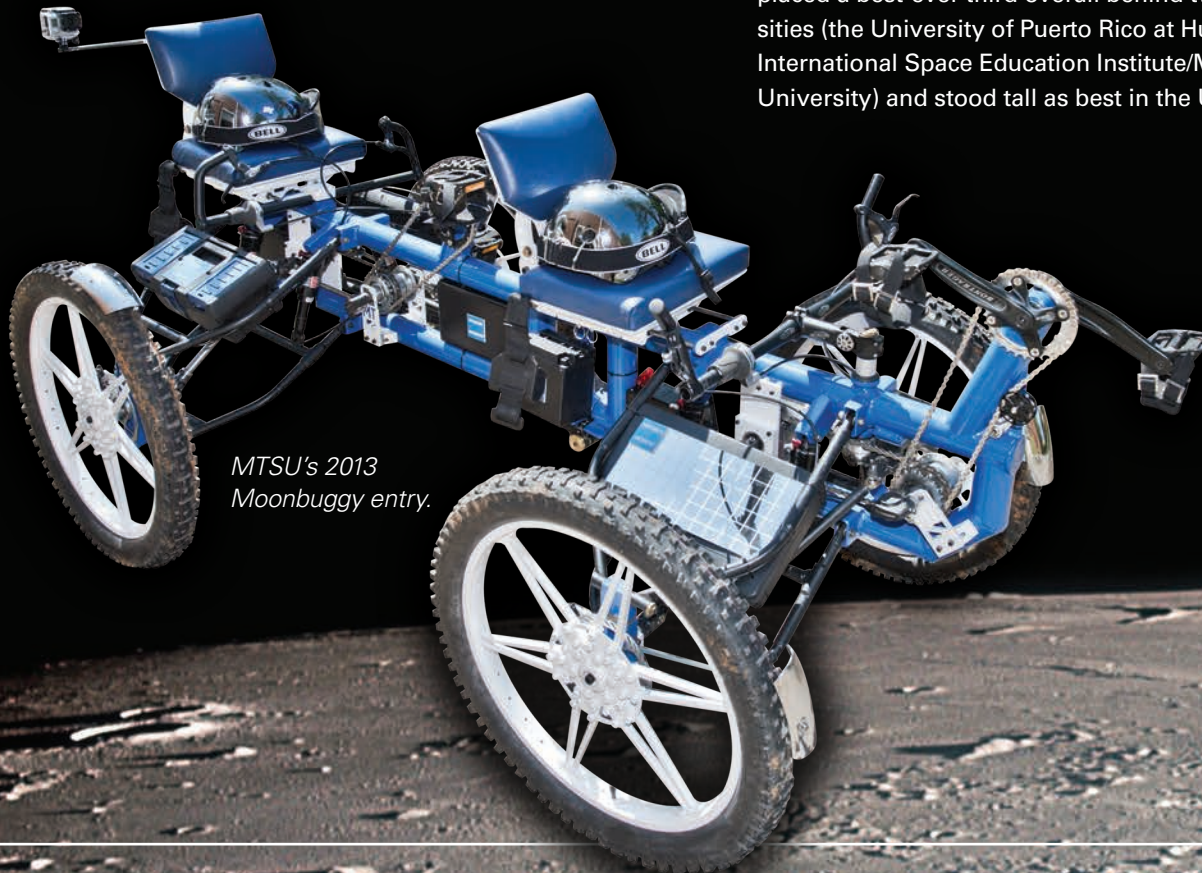
The Experimental Vehicles Program surges ahead of its national competitors in the Great Moonbuggy Race

by Randy Weiler

Imagine that your Experimental Vehicles Program team will be competing against an international field in Huntsville, Ala., at a NASA facility—a benchmark for ultimate success and project completion. Your competition includes students from Auburn, Alabama, Ohio State, and other U.S. universities; foreign entries from Puerto Rico, Russia, and India; and state rivals Tennessee Tech and the University of Tennessee–Knoxville.

So what do you do if you are engineering technology students from Middle Tennessee State University at the Great Moonbuggy Race? You plan, prepare, dress for success, and bring the best doggone moonbuggy you've produced in the 10 years you've been competing in the 20-year-old event.

At the 2013 Great Moonbuggy Race in late April, not only did MTSU earn the Most Improved award but also placed a best-ever third overall behind two foreign universities (the University of Puerto Rico at Humacao and the International Space Education Institute/Moscow Aviation University) and stood tall as best in the United States.



MTSU's 2013 Moonbuggy entry.

"It was a lot of work, but it paid off," says team cocaptain Ryan Miller. "To see the design perform the way we wanted it to and finish first in the nation was the icing on the cake for us. It was a reward for all the hard work."

MTSU drivers Kevin Conner and Devin Raines maneuvered the MTSU moonbuggy to the third-place finish with two solid runs on the course, which includes lunar-like obstacles (craters) and speed bumps, and meanders nearly seven-tenths of a mile around rockets and other space vehicles. Their four-minute, 23-second Day Two run eclipsed the Day One run by 1:07. Other team members included Brian Julian (cocaptain), Sadie Swaney, Joseph Honea, Mike Myers, Stephen Chaput, and Thomas Cox.

Faculty mentor Saeed Foroudastan says he believes MTSU was the only university in the top five to enter written reports for all contest categories at the event including design, safety, telemetry, and best report. MTSU students also had to make verbal presentations and answer judges' questions related to their work.



Members of the MTSU Moonbuggy team, Ryan Miller (senior) and Steven Chaput (junior), making final adjustments to their entry for the 2013 NASA Great Moonbuggy Race in Huntsville, Alabama.

"We were told by the judges we were in the top three in all categories, but they only give awards to the top team," he says. "Our students were very proud. They made my day!"

Team members are eager to share all they've learned with the next generation of moonbuggy builders. The group currently mentors high school students from nearby Central Magnet School, which also fields competitive moonbuggy teams. ☞

Solar Power

MTSU's prowess in the area of engineering technology challenges isn't confined to moonbuggies. An MTSU team recently competed in the annual American Society of Mechanical Engineers Solar Splash—the world championship of intercollegiate solar boating—and garnered five awards at the five-day regatta, which was held on George Wyth Lake in Iowa in mid-June.

The speed of MTSU's solar boat was shown when the boat won second place in the sprint event. MTSU was also honored with the Design Achievement Award for outstanding design, the Outstanding Workmanship Award as the most attractive boat in the entire competition, and the Participation Award. MTSU secured a spot in the coveted top-ten list of the Solar Splash competition, placing seventh overall.

The 2013 MTSU Solar Boat Team included team captain Cary Woodson, Daniel DeBose, Matt Washington, Sadie Swaney, and Kaitlyn Broughton. Addition participants included Nick Cronin, Brian Reyes, Mario Jimenez, Jerome Patterson, Caleb McInturff, and Kevin Conner. The team faculty advisor was Saeed Foroudastan, and Rick Taylor in the machine shop also provided invaluable support.



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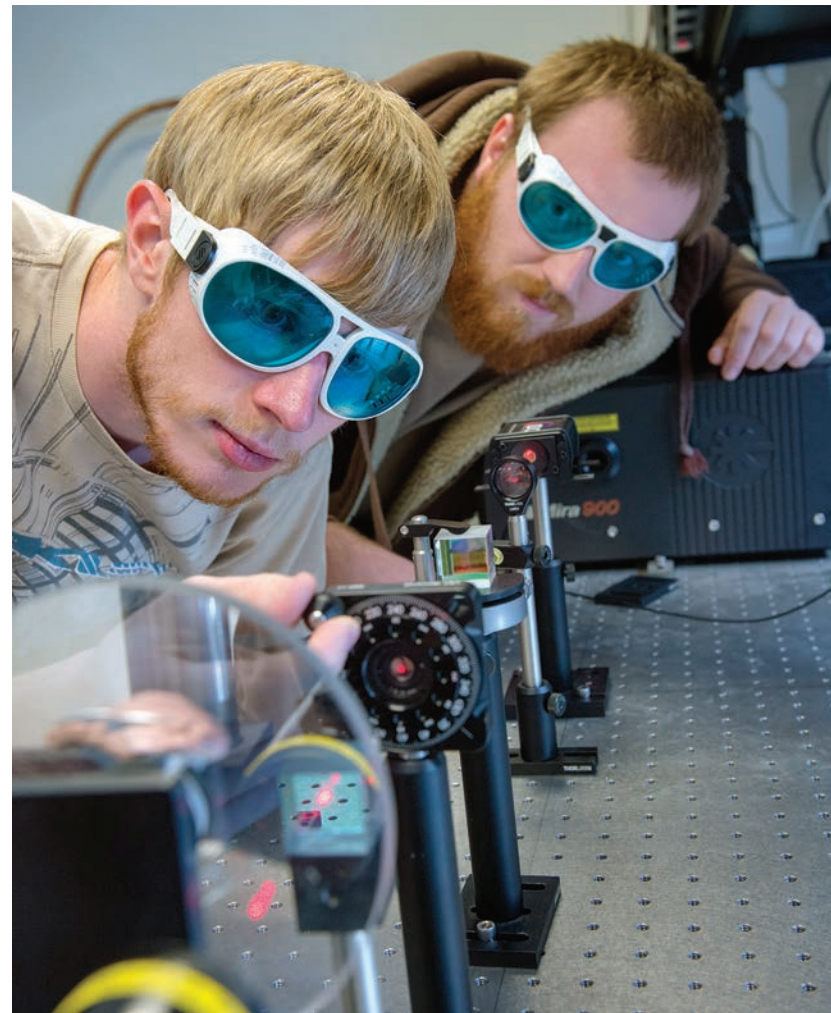
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