

2012-2013

MTSU RESEARCH

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Suddenly **Soaring**

Strategic investment propels MTSU's
aerospace program into the stratosphere



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College of Education

It's appropriate that on the 100th anniversary of an institution that started as a teacher training school, MTSU moved its College of Education into a brand-new, state-of-the-art, \$30 million, 87,000-square-foot, wired and sustainable building.

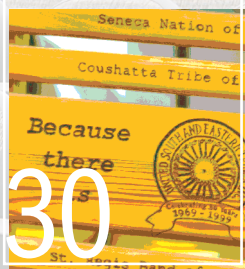
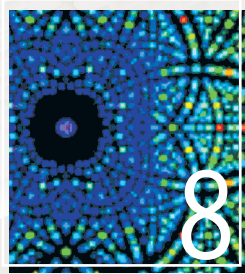
When Middle Tennessee State Normal School opened on September 11, 1911, as one of three teacher training schools established by the Tennessee General Assembly, the 100-acre campus boasted 125 students and a faculty of 19. Today, Middle Tennessee State University occupies more than 500 acres and has 26,500 students and a faculty of 900. In all, the University has graduated more than 100,000 students in the past century.

Some things don't change even with time, though. Still one of the finest teacher preparation institutions in the Southeast, MTSU produces a huge percentage of the certified teachers trained in the Tennessee Board of Regents system.

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Doing our Research



President Sidney A. McPhee

THE COMMITMENT TO FURTHER research and creative activity among our faculty and students is integral to MTSU's mission. Faculty scholarship not only drives innovation and economic progress but also provides the foundation for the University's strong undergraduate and graduate research programs.

Scholarship and research enterprises are at the core of MTSU's academic master plan goals to enhance quality, foster student-centered learning, and develop and sustain partnerships.

Partnerships forged between MTSU researchers and industry are at the heart of MTSU's crucial role in regional economic development. By becoming more strategic in our relationships with major players in economic development in the state

and by creating institutes in partnership with business / industry, primarily supported by extramural funding, we have strengthened interactions in areas as diverse as aviation, construction and manufacturing, biotechnology, STEM education, health and wellness, and entertainment and tourism.

— the future is exceedingly bright for **creation, innovation, and discovery** at MTSU.

This edition of *MTSU Research* magazine shows how MTSU, founded a century ago as a teacher training college and tasked for decades with supplying the middle Tennessee region with top-notch undergraduate education, has in more recent years progressed by leaps and bounds as a center for research. On a purely quantitative basis, the number of articles reporting research from faculty members has increased, as has the dollar amount of extramural funding to support such research. The number of graduate programs increased by three with the introduction of Ph.D. programs in Computational Science, Molecular Biosciences, and Mathematics and Science Education in the last year. The number of participants in undergraduate research programs has also grown along with the number of undergraduate and graduate students receiving national and international recognition for their work.

We hope you enjoy these success stories and will come to believe, as we do, that the future is exceedingly bright for creation, innovation, and discovery at MTSU. [mtsu](http://mtsu.edu)

MTSU RESEARCH

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Building Momentum

Dr. Michael D. Allen, MTSU vice provost for research and dean of the College of Graduate Studies, worked more than 14 years at Sandia National Laboratories in New Mexico, where he spearheaded the study of nuclear reactor accidents similar to what occurred in Japan earlier this year. From using research reactors to melt the core of other reactors to conducting hydrogen explosions at desert test sites, Allen's research background is a colorful one to say the least.

MTSU'S CENTENNIAL IN 2011 ALSO MARKS MY FOURTH YEAR AS VICE provost for research and dean of the College of Graduate Studies. The University has made significant progress during the time I've been here, and I believe that the Office of Research and the College of Graduate Studies have contributed greatly to this success. MTSU is in the process of transitioning from a primarily undergraduate institution to a doctoral research university with high research activity. Only a decade ago, MTSU was attracting less than \$4 million in extramural sponsored awards for research, service, and instruction. Now, the University consistently garners between \$35 million and \$40 million annually.

A boost to the research enterprise was the addition of four new interdisciplinary doctoral programs that enrolled about 80 new doctoral students in their inaugural year—Molecular Biosciences, Computational Science, Mathematics and Science Education, and Literacy Studies. Building upon the initial success of the new Ph.D. programs, the University is developing programs to strengthen the research enterprise. Two newly established strategic centers, related to the Molecular Biosciences and Computational Science Ph.D. programs, are seeking extramural funding to support research in these areas. The most exciting development this fall is the promise of funding for the construction of a 258,000-foot biology and chemistry building that will expand space for laboratory research.

Building on this progress in key areas, I anticipate that the MTSU research enterprise will continue to make great strides in the coming years. [MTSU](#)

An **endangered local ecosystem** stands to benefit from the return of two **problem-solving plant ecologists**

growth EXPERIENCE

Outside garden clubs, co-ops, and farming operations, seeds probably don't figure in daily conversations between average people. Yet, after water and oxygen, seeds are about as crucial to human life as it gets. One need look no further than the so-called "Doomsday" seed vault located in the Norwegian tundra (a repository for the world's food sources should humans, or outside forces, one day need to resow the planet) to see how serious a matter seed preservation can be.

Still, storing a seed does little good if one does not know how to make it germinate. That's where MTSU's own seed experts—Drs. Jeffrey Walck and Siti Hidayati—come in. The husband-wife duo of plant ecologists study seed germination and have cracked the mysteries of hard-to-germinate species around the world.

The pair recently returned to MTSU after a two-year sabbatical working in Australia as part of a collaborative partnership with Kings Park and Botanic Garden in Perth, the University of Western Australia's School of Plant Biology, and the Millennium Seed Bank Project at the Royal Botanic Gardens. (Dramatically named Norwegian seed vaults notwithstanding, this latter project is the world's largest seed conservation initiative for safeguarding plants against extinction.) While in the Land of Oz, the couple solved the problem of germination in Guinea flowers—dominant shrubs in temperate Australia—and also worked on several plants important for mining restoration.

"[Australians] have large mining operations, so they have to reclaim the land but couldn't get the seeds of the native species to germinate," Walck explains. "That was very big for them from both an academic and industrial standpoint."

Success unlocking Australia's seed mysteries garnered attention elsewhere around the globe. Taiwan and South Korea each have the couple working to unlock their own seed germination mysteries. Their work also led to greater notice in the global science



by Drew Ruble

community. Based on additional efforts in Australia reviewing the effects of global climate change on plant regeneration from seeds, Walck recently coauthored an opinion article in *Nature*, one of the world's most prestigious scientific journals, titled "Time to Future-Proof Plants in Storage."

While the couple's global seed germination studies continue to percolate in incubators lining the halls of the Davis Science Building at MTSU, the pair is turning their attention to a problem closer to home—the preservation and restoration of middle Tennessee's signature cedar glades.

Cedar glades, where limestone bedrock occurs near or at the soil surface and makes it impossible for trees to grow, are endangered ecosystems. Globally unique, they are found primarily in middle Tennessee. But because of the rapid growth of Metro Nashville and nearby Murfreesboro and Lebanon, many cedar glades (an estimated 50 percent) have been destroyed by development. Plant communities of highly specialized species, many of which are found nowhere else in the world, have been destroyed along the way.

Walck has focused on restoration ecology—or what to do to "fix" a glade that's been disturbed or destroyed.

"Nothing has ever been done on that question," Walck says. "We have some glades that have been heavily impacted and could probably be restored, but we lack the basic ecological data needed to do it."

Though the rest of the world may miss them, Walck and Hidayati's return to middle Tennessee comes just in time for the cedar glades. [MTSU](#)



The husband-wife duo of plant ecologists study seed germination and have cracked the mysteries of hard-to-germinate species around the world.

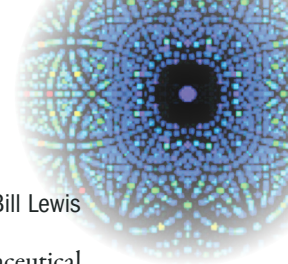
A man with shoulder-length brown hair and glasses, wearing a blue button-down shirt, stands with his arms crossed in front of a vibrant, colorful diffraction pattern. The pattern consists of numerous small, bright spots in shades of blue, green, and yellow, arranged in a complex, grid-like structure. The background is dark, making the diffraction spots stand out prominently.

UPON FURTHER REFLECTION REFLECTION

MTSU teams up with ORNL
to **IMAGINE**
a cutting-edge scientific tool

Scatter-Brained:

MTSU researcher Tibor Koritsansky stands in front of a diffraction image of a protein structure.



by Bill Lewis

IMAGINE being able to see molecules composed of millions of atoms, a technique that could be used to create new designer medicines or technically important materials such as superconductors or shape-memory substances that have military, medical, and robotic applications.

Those are the possibilities of a research project being led by MTSU's Dr. Tibor Koritsanszky, who is collaborating with colleagues at Oak Ridge National Laboratory (ORNL) on a project named, appropriately, IMAGINE.

IMAGINE uses neutrons to peer deep inside molecules. As the materials being studied reflect the neutrons and they scatter "just like a compact disc does when sunlight reflects off it," they form patterns that reveal chemical, physical, and biological structure and function secrets, Koritsanszky says. Another way of describing it is that IMAGINE will identify the "fingerprint" of the molecules, he adds.

IMAGINE will identify the "fingerprint" of the molecules It's actually a bit more complicated than that, which is why Koritsanszky and his colleagues at ORNL submitted a proposal in January 2009 to the National Science Foundation's Major Research Instrumentation (MRI) program to obtain the device they now call IMAGINE, which is a single-crystal neutron diffractometer.

In August of that year, they were awarded \$2.2 million to purchase the device and carry out research at ORNL. Some of the funding came from the American Recovery and Reinvestment Act, popularly known as stimulus funds. The grant is the third MRI for MTSU's Department of Chemistry and by far the largest.

"This diffractometer will fill a gap in U.S. neutron diffraction capabilities, since no similar capability or instrumentation is currently available at a neutron reactor source in the United States," says Koritsanszky, the project's primary investigator.

IMAGINE, which is compact enough to fit into a small office, is under development about 30 or 40 meters from ORNL's High Flux Isotope Reactor (HFIR). Bryan Chakoumakos, ORNL's group leader for single-crystal neutron diffraction, expects it to be operational in January 2012. The speedy timeline is possible because the device combines off-the-shelf hardware with an optical system being developed at ORNL.

Chakoumakos expects researchers from MTSU, pharmaceutical companies, and other industries to use IMAGINE to examine samples that might be as small as one or two millimeters. The reactor will send neutrons speeding down a mirror-lined tube, called a guide, to IMAGINE. There they will strike the millions of atoms that compose the materials being examined and form intricate patterns of spots as they scatter.

"They can be very beautiful—like a snowflake," Chakoumakos says.

IMAGINE will record the patterns on cylindrical image plates that surround the sample and can be thought of as reusable film. That, by the way, is how IMAGINE got its name.

"It's meant to be stimulating and a play on words, since it uses image plates," Chakoumakos says.

Researchers then will use a laser to read the thousands, even tens of thousands, of images on the plates and create a 3-D picture.

That's where Koritsanszky's software tools come in.

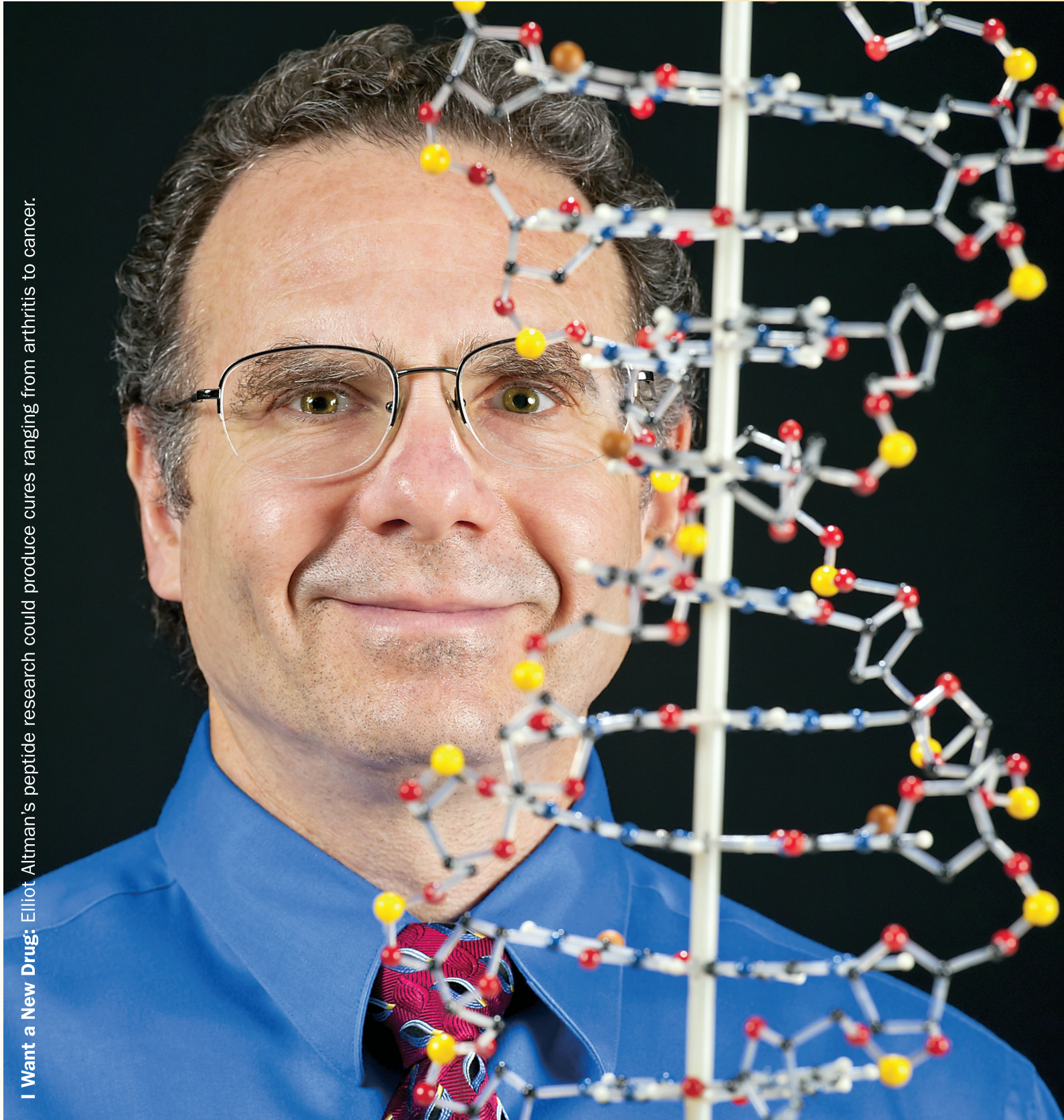
Koritsanszky, an expert in X-ray structural analysis and computational modeling, is writing the software that will help make IMAGINE the most powerful instrument of its kind in the world—more efficient than similar devices in Australia, France, and Japan. (The Japanese facility was untouched by the tsunami that ravaged nearby areas along that country's coastline but was damaged by the earthquake that preceded the onrushing wave.)

IMAGINE will have the power to "collect an unprecedented amount and quality of data on relatively small samples in a short period of time," Koritsanszky says. "Applications of neutron scattering research span the diverse scientific fields of structural biology, pharmacology, chemistry, condensed matter physics, nano-structured materials, [and] environmental and geological science."

Koritsanszky has a longstanding relationship with ORNL, where he also collaborates with the facility's \$1.3 billion Spallation Neutron Scattering laboratory. Building on that relationship with the creation of IMAGINE was a natural outcome, giving MTSU the opportunity to win the National Science Foundation grant, which flows through the University, and provides MTSU faculty and students access to ORNL's world-class facilities.

In return, ORNL is able to tap into the University's talent pool.

"We knew MTSU was starting new Ph.D. programs in computational science, molecular biosciences, and mathematics and science education," Chakoumakos says. "Tibor's goal is to use IMAGINE for research he's interested in and to use it for education at MTSU." [MTSU](#)



I Want a New Drug: Elliot Altman's peptide research could produce cures ranging from arthritis to cancer.

STAYING Power

Dr. Elliot Altman's laboratory **builds a better peptide**, among other things

by Michael Burgin

IN SCIENCE, HOME RUNS ARE THE EXCEPTION, NOT THE rule. It's the rare day in the lab that yields a life-changing vaccine or reveals a new element. (And even those "days" are themselves the result of the weeks, years, and even decades of work that preceded them.)

Instead, the potential advances of most research are incremental—helping scientists understand another step of a metabolic process, verifying something is not possible, or providing a crucial next step for a discovery that is itself still years away.

That doesn't mean there aren't home runs to hit—discoveries that yield practical, even revolutionary, real-world applications within years and even months of being made. And those are precisely the type of advances that appeal most to Dr. Elliot Altman, the head of MTSU's newly established, interdisciplinary Molecular Biosciences Ph.D. program.

When Altman steps up to the plate, he's aiming for the fences.

The Peptide Generation

Altman's laboratory is helping address one common misery of the human condition—arthritis. The key to tackling such a far-reaching problem? Keeping it short. And that's where peptide therapeutics come in.

Peptides are short chains of amino acids. They are so short, in fact, that they often lack an epitope—a marker that helps the

immune system distinguish between what belongs in the body and what is a foreign, potentially harmful invader. Whereas antibodies are large proteins that always contain epitopes—some of which may trigger negative immunogenic responses—most peptide therapies being pursued involve 20 amino acids or fewer, and thus lack an epitope. As such, they also neatly sidestep the host of immunogenic complications that plague antibody drugs.

Though a phrase like "peptide therapeutics" may draw blank stares from the average person, almost everyone knows someone benefiting from the science. Insulin, that mainstay of diabetes treatment, is one of more than 20 peptide drugs currently on the market. (Others include glucagon, calcitonin and oxytocin.)

Although peptide drugs have a substantial advantage over antibody-based drugs, they also carry a pretty significant drawback—they lack staying power.

"Insulin has a half-life on the order of minutes," Altman says. "That's why people who have diabetes who have to take insulin have to take it three times a day."

The human body is very efficient at breaking down and recycling peptides. In fact, most peptides are completely broken down and removed from the bloodstream in a process that can take anywhere from a few minutes to a few hours. From a practical perspective, this means peptide-based medication must be taken

continued on page 12



finding the fast lanes...

Peptide therapeutics is not the only exciting avenue of research going on in MTSU's interdisciplinary Molecular Biosciences Ph.D. program these days. There's also metabolic engineering. While peptide research is all about slowing a process down—specifically the rate at which the peptide degrades—in this arena, it's all about making things go faster. Be it the swifter extraction of sugar from lignocellulosic biomass (to aid in the production of ethanol), or the production of important industrial biochemicals such as succinic, lactic, and pyruvic acids (to name just a few), Dr. Elliot Altman and his team are exploring multiple ways to speed up a host of important biochemical processes. Though the alleviation of metabolic bottlenecks may not seem as thrilling as finding a cure for rheumatoid arthritis, the potential real-world impact is just as impressive. For example, there's the “greening” of numerous industrial biochemicals—taking a biochemical now derived from petroleum and finding a new way to produce it that's petroleum-free. Either way, the research going on in the molecular biosciences program is rife with real-world promise. As a result, prospective grad students pondering which avenue to travel face a win-win-win decision: help save lives, help save the planet, or maybe do a little of both?

much more frequently and in higher doses than traditional antibody drugs.

For Altman and his researchers to make any progress toward providing an attractive peptide-based therapy—be it for arthritis or any other affliction—they first needed either to find or build a hardier peptide.

That's where *E. coli* comes in.

Though the general public associates *Escherichia coli* with food poisoning, for a molecular geneticist like Altman, this common bacterium of the human gut is an invaluable tool in peptide research—for, although the human body swiftly breaks down peptides, *E. coli* does it even faster.

“With a much faster metabolism than humans, *E. coli* replicates and divides in 20 minutes under optimal conditions,” Altman says. “Unstable peptides are destroyed in seconds to minutes.”

But while its metabolism is faster in comparison, *E. coli* and humans are comparable in that each possesses a vast array of enzymes that degrade peptides.

“Thus, conventional wisdom suggests if you tried to produce a recombinant peptide in *E. coli*, you wouldn't find it [it would be degraded too quickly],” Altman says.

After all, with a robust population of protein-devouring enzymes, how could any peptides survive? And why even bother checking? In a tribute to the value—and obstinacy—of the scientific method, Altman and his team did it anyway.

In this instance, scientific method trumped conventional wisdom, as some peptides showed surprising staying power—lasting days instead of minutes.

Establishing Motif

What helped a few peptides stay active and whole while their fellow peptides were being cleaved down to their individual amino acids?

“When we sequenced them, we found a telling answer,” Altman says. “These peptides had developed a protective motif that prevented degradation.” Since the initial discovery, Altman and his team have distinguished two separate motifs—or recurring structures—that yield hardier peptides.

“One protective motif has to do with multiple prolines at the end of the peptide,” Altman explains. “The other involves fusing the peptide to a small stable protein anchor.” Each motif serves as a shield for the peptide to which it is attached, which in turn has yielded dramatic results in terms of peptide half-lives.

“We’ve shown that we can increase the half-lives of these peptides, depending on what motif we use, anywhere from 2- to 100-fold.”

Life after Shelf

Big Pharma is no stranger to the potential of peptide therapeutics. (Nor is small pharma, for that matter.) A number of pharmaceutical companies have invested heavily in the technology, discovering hundreds of peptides that, alone in a test tube, do everything asked of them. These peptides seek out protein targets and block receptors—and in doing so promise effective treatment for everything from arthritis to a host of cancers. But then they are taken out of the test tube and that promise vanishes as quickly as the peptides themselves.

“In an animal model, they don’t work—they are degraded too quickly,” Altman says. The result? “Hundreds of peptides sitting on the shelves of pharmaceutical companies.”

But with the new protective motifs Altman and his team have discovered—and the 2-to-100-fold increase in peptide half-lives that come with the motifs—there is now good reason to return to the shelves and give these orphaned peptides a second look. “We can take a failed peptide and make it a drug,” Altman says.

Peptide Biosciences, headquartered in Thousand Oaks, Calif., was one of the first companies to seek to do just that.

In the case of Peptide Biosciences, the orphaned peptide in question is a potential game-changer in the fight to treat rheumatoid arthritis. In “immune compromised” diseases such

as rheumatoid arthritis, the body attacks itself, causing an immune response that can lead to a corresponding cascade of ill effects—from inflamed and painful joints to potential skin and vision problems, not to mention the emotional and psychological effects of dealing with a chronic condition and the side effects of many of the drugs used to treat it. In fact,

Peptides are short chains of amino acids.

They are so short, in fact, that they often

lack an epitope—a marker that helps the immune system distinguish between

what belongs in the body and

what is a foreign, potentially harmful invader.

ask anyone who suffers from rheumatoid arthritis about the trials and travails of the condition, and they are likely to spend as much time bemoaning the different adverse side effects of treatment medications as they are the affliction itself.

Peptide Biosciences’ particular peptide, currently named NB406, addresses both sides of the treatment equation. First, NB406 disassociates one of the key parts of the initial cascade that leads to full-fledged rheumatoid arthritis, setting the clock back to zero. Then, as a card-carrying non-epitope-bearing treatment, the stabilized peptide passes unremarked by the body’s immune system. So far, so good—NB406 has outperformed Enbrel, one of the most widely used drugs on the market for rheumatoid arthritis in an animal model.

The Tip of the Peptide

As exciting as the development of NB406 might be for sufferers of rheumatoid arthritis, it’s just one of many potential peptide-based applications. There are plenty of orphaned peptides out there, after all, and the motifs discovered by Altman and his team could turn any one of them into an effective treatment for any of a host of other ailments. Altman is particularly interested in the use of peptide antibiotics to battle bacterial infections—autoimmune diseases, such as atherosclerosis, but also of the effort to battle bacterial infections—particularly Methicillin-resistant *Staphylococcus aureus*, better known as MRSA, a virulent superbug that’s the bane of many of a hospital wing.

“Pathogens will always develop resistances,” Altman says. “With peptides, we can develop hundreds of antibiotics and stay well ahead of the curve.”

Thanks to Altman’s research, NB406 is likely just the first of many new drugs to have its home-run potential unleashed. Batter up. [MTSU](#)

Flight of Feet

Research **takes**
the **stage** at MTSU

by Gina K. Logue

WITH *EXODUS*, THE MTSU DANCE PROGRAM takes flight, not due to oppression as the title implies, but toward an emotionally gripping expression of experiential learning and academic research at its most artistic.

Exodus is a concert of modern dance and ballet that examines departures from a variety of cultural and historical perspectives. Its subject matter includes the Underground Railroad, the Holocaust, and Mexican border crossings.

“Every culture has its own exodus story that redefined who they were but also help define who we are currently in the United States,” says Kim Neal Nofsinger, director of the dance program and originator of two pieces of *Exodus*.

Thorough research into diverse ethnic identities is key to the creation of the work.

“We expect the students to be very immersed in the cultural studies side of this as well as the performance studies side of the work,” Nofsinger says.

Several guest artists will contribute to the production, which is slated to debut in its entirety in January and go on tour throughout the spring semester.

Students will audition for the privilege of being part of the company, and only 12–16 will make the cut.

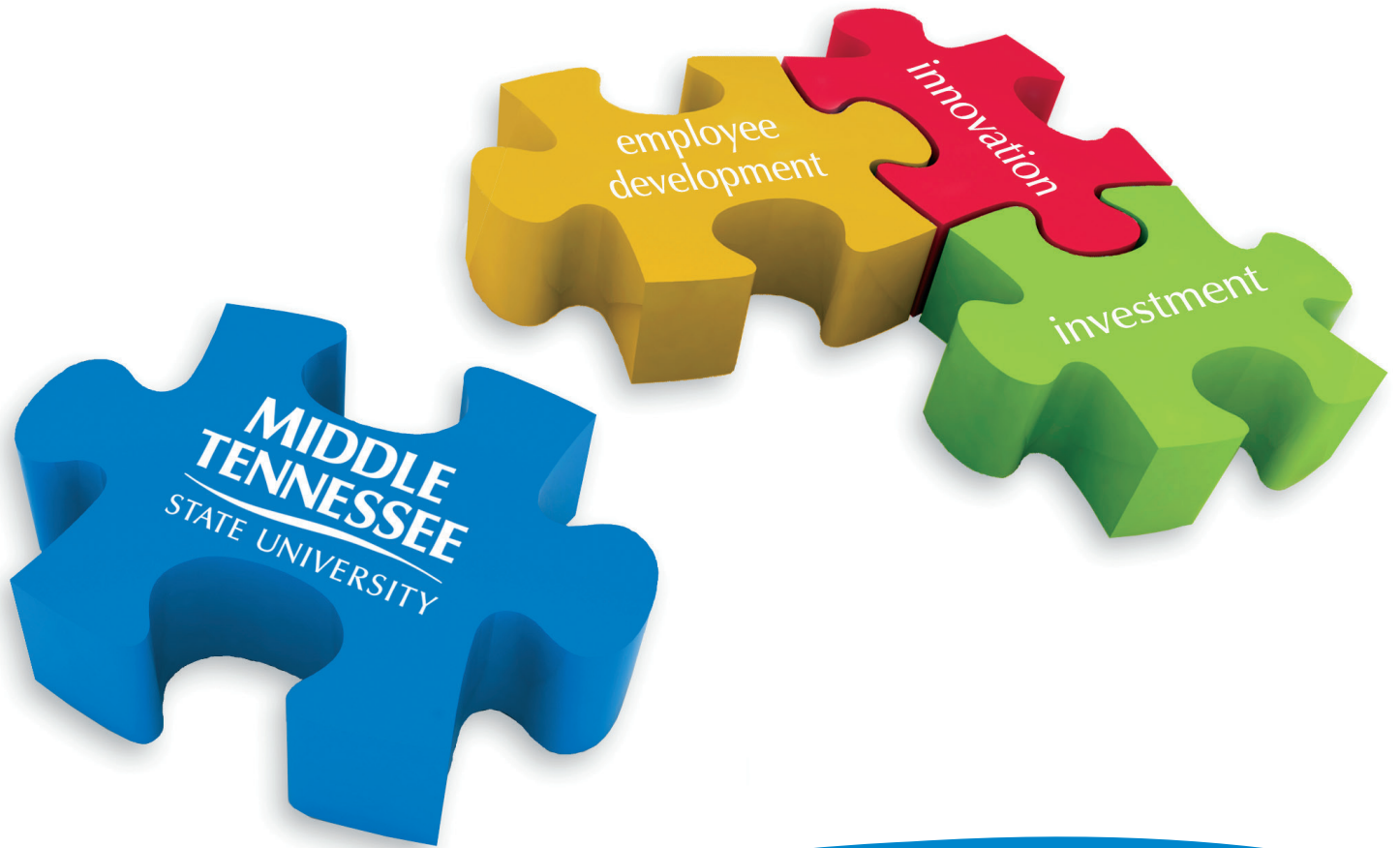
“This is experiential learning at its highest form because it really is about synthesis,” says Nofsinger.

“The students have to take all this information, put it together, have their own interpretation of what the content is, and be able to dialogue about that verbally.”

Nofsinger hopes to parlay this contrast of delicacy and power into the creation of an annual or biennial academic dance conference. Ultimately, the goal is to transform MTSU’s dance minor into a major leading to a baccalaureate degree suitable for propelling the dancers’ own exodus into performing and/or teaching. **MTSU**

En pointe: This image, depicting “migration,” tells part of the story in the MTSU dance program’s forthcoming ballet, *Exodus*.

Photo:
Martin E. O'Connor



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Suddenly Soaring

Years of strategic investment propel MTSU's aerospace program into the stratosphere

by Allison Gorman

TROY RATH ADMITS HE DIDN'T REALLY WANT TO MAKE the trip to Murfreesboro.

Rath is general manager of ITT Corp., a Fortune 500 engineering and manufacturing company based in Washington, D.C. ITT has a \$1.4 billion contract with the Federal Aviation Administration to help shape the future of flight in the United States.

MTSU was part of the interdisciplinary team working with ITT on the project. It was March 2011 and the University's Department of Aerospace had invited Rath to a ribbon-cutting for the new technology it would be using in the collaborative research.

"I was a little reluctant to go," Rath says. "I mean, Tennessee? Middle Tennessee State? At the time, we didn't associate that with avionics or really anything to do with aircraft."

He made the trip to MTSU nevertheless, and he wasn't prepared for what he found there. That newly unveiled technology?

A custom-made air traffic control tower simulator, the most sophisticated in the world. On the floor above was a duplicate of the Nashville ramp tower, linked to a replicated flight operations

A custom-made air traffic control tower simulator, the most sophisticated in the world. This was a "hidden gem"

center. At the nearby Murfreesboro Airport there was a collection of flight simulators, a Boeing 727, and a fleet of state-of-the-art airplanes—one of the largest and most



advanced fleets at any American university. And there were 700 students for whom this technological banquet was, simply, “lab.” “This was a hidden gem,” Rath says.

Reaching new heights

Over the past eight years, MTSU’s aerospace program—one with a long history and one of only 31 accredited programs in the country—quietly graduated from “well-regarded” to “world-class.”

MTSU’s aerospace program has long been known for turning out eminently hireable graduates, but in recent years, former department chair Dr. Paul Craig, his successor, Dr. Wayne Dornan, and other aerospace faculty have made a strategic push to raise the

national profile of the program. They’ve done it in chronically lean economic times, securing funds from NASA and other outside sources, and their sweat equity is now paying off. They have built a technological marvel that is not only a cutting-edge learning environment for students but also an unmatched training, testing, and research facility for industry and government.

Craig says he knew the program had made it to the next level when, in his travels to Washington, D.C., he began hearing MTSU mentioned in the same breath as Embry-Riddle Aeronautical University. “To me, that’s when we started to turn the corner,” he says, “when we started being involved in the national conversation.”

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Photo courtesy of ScanEagle UAS produced by Insitu, Inc. and ISR Group

a timely Launch

Unmanned aircraft systems (UAS) are already big business for the military, but the commercial side of UAS is ready for takeoff, too. More law enforcement agencies are using drones for surveillance, and, as technology advances, UAS could be used for search-and-rescue operations or even to monitor crops on large farms.

The launch of a UAS program at MTSU could not have come at a better time for students, says program director Kyle Snyder. Those who study UAS now will be ready to go into business selling and operating the systems just as the commercial market emerges.

The program will benefit the government sector and Tennessee's economy as well, says Snyder.

The Federal Aviation Administration has seen the UAS trend coming, but it needs solid research to determine how to integrate drones into the nation's airspace.

ISR Group, located in Savannah, Tenn., is a business specializing in UAS field service operations and training for military applications. It wants to tap into the fledgling commercial UAS market, but the FAA currently won't allow drones in the national airspace unless they are used for law enforcement or research.

A multiyear partnership agreement between MTSU and ISR, signed in February, has something for everyone, Snyder says. MTSU gains access to ISR's expertise and facilities and gets corporate funding to establish a UAS curriculum. ISR wins entrée into the commercial market through its research with MTSU. And the FAA captures rare data because (unlike UAS programs at most universities, which tend to be located near military bases) MTSU is in unrestricted airspace.

“The program will benefit the government sector and Tennessee's economy as well”

In short, MTSU is uniquely positioned to help develop the commercial side of UAS.

And Snyder, who worked for years in aerospace product development, is uniquely positioned to leverage that experience. “I can take my knowledge, all those connections, and say, ‘Hey, you at John Deere, you're wondering if we can provide an application that tells you when you need to apply nitrogen. Well, we can go do that research. We can fly to MTSU farms and do exactly that.”

Since his hire, Snyder has been busy building a curriculum along with lucrative business partnerships. The Department of Aerospace began offering an introductory UAS course this fall. [MTSU](#)

Dornan says he's still waiting to hear that conversation at home.

“People don't realize they've got one of the best aviation programs—I would argue *the* best—in the entire country, right here in Murfreesboro,” he says. “It bothers me a little to be the best-kept secret in the United States. It bothers me a lot to be the best-kept secret in Tennessee. And it drives me crazy to be the best-kept secret in Rutherford County.”

Super sim

That secret may not be safe for long. In MTSU's \$3.4 million ATC lab, the new facility that Rath toured, students learn air

traffic control in a simulated environment that has never been possible before—even at the FAA's own simulator in Atlantic City, N.J. “I've been to the FAA tech center,” Rath says, “and the tower simulator is just two big flat-screen TVs. It covers about 100 degrees of visibility. It really pales in comparison.”

The full-scale tower at MTSU is a quiet, darkened, circular room, 30 feet in diameter, where students direct landings and takeoffs while checking radar screens, watching runways, and scanning the horizon for arrivals. That horizon is a 360-degree screen onto which a seamless vista is generated by 10 high-definition digital projectors. On the panoramic screen are interactive scenarios written by aerospace faculty; they can specify traffic patterns and

aircraft, build in emergencies, and incorporate changing daylight or weather, from dense fog to fast-moving storms.

Outside the tower, there are stations for 12 “pseudo-pilots” who follow the controllers’ commands, as well as radar stations for the controllers who monitor the regional airspace beyond the tower and for others who monitor the national airspace. All the students work together to manage air traffic in real time.

Gail Zlotky, an associate professor of aerospace who directs ATC simulator testing and training, says instructors can adjust the speed of the scenarios as students become more adept, although all students start out the old-fashioned way: holding model airplanes, walking plywood runways. “Honestly, this [simulator] goes too fast for them,” she says.

By the time an MTSU air traffic control student graduates, he or she will have experienced the closest thing possible to on-the-job training—invaluable in a profession in which the learning curve is long, the mandatory retirement age is 56, and a bad decision can have fatal consequences.

“That’s the good thing about the simulation room,” says DeMarco Cason, 21, a senior aerospace major. “That’s where you mess up.”

Training with a boost

The ATC simulator gives MTSU students another critical edge: they can practice where they’ll train if accepted into the FAA Academy. That’s because Virginia-based CSC, the company that built the simulator, can design software replicating any airport in the world.

So far, MTSU has software for six airports, including Memphis, Nashville, and the FAA Academy airport in Oklahoma City. Atlanta is next, Zlotky says.

The simulator is a lab for the Air Traffic Collegiate Training Initiative (AT-CTI)—a two-year, FAA-approved program for colleges and universities in which MTSU is a participant. The aim is to teach students the fundamentals of air traffic control before they apply for admission to the academy. Zlotky got the University in on the ground floor of the program in 1997 with a single enrollee. Now she oversees about 100 AT-CTI students—one of the largest university enrollments in the country—and Zlotky says that number could triple.

Students who take the extra CTI coursework have an advantage going into FAA training, she says, because they’re not “cramming two years of knowledge” into a few months of academy study. Given the FAA’s rigorous testing and screening, however, “there is no guarantee that they will get hired,” Zlotky warns. “Absolutely none.”

Nevertheless, if there’s an aerospace position to be filled, put your money on the Blue Raider. Ninety-nine percent of MTSU students who enter the academy are ultimately hired.

MTSU president Sidney A. McPhee says he sees that pattern of success across the University’s five aerospace concentrations: administration, technology, maintenance management, professional pilot, and flight dispatch.

“I travel the country quite a bit,” he says, “and anytime I’m in a major airport and I’m wearing something that identifies me with the University, I will have someone come up to me—a pilot, an aviation mechanic—to say, ‘I’m a graduate of MTSU aerospace.’ Always. That is not an exaggeration.”

Even before they graduate, MTSU students edge out the competition for aerospace internships. Dornan recalls that last year hundreds of students from across the country applied for just a few internships with Southwest Airlines. Two MTSU students applied; both were hired.

Between the program’s hiring rates and its new technology, enrollment in aerospace is growing quickly. “We’re on the verge of an explosion in this department,” Dornan says.

Laying the groundwork

What is now one of MTSU’s largest departments began as a military-run, campus-based flight training program during World War II. Aerospace became a stand-alone department in 1971 but didn’t offer pilot training until 1993, when Craig, a graduate of the program, returned to establish a self-sustaining departmental flight school. “If we ever lost any money,” he says, “the experiment would be over with.”

Craig rounded up the department’s few sturdy-but-aging aircraft, which had been leased out, and charged students a fee for flight training and plane rental. Those meager profits were sown back into the program; every year from 1994 to 2000, Craig added one or two used planes to the fleet. Nationally accredited its second year of operation, MTSU’s flight school still “doesn’t cost the University a dime,” he says.

Technically, Craig had succeeded with his mission, but when he became department chair in 2001, he knew that hand-to-mouth was no way to run a competitive program in such a high-tech field. In 2003, he made that case to McPhee, who asked him what it would take to elevate the stature of the Department of Aerospace.

New planes, Craig said. The planes they had were safe, but they were antiquated. He recalls the conversation:

“I said, ‘What if you went into a computer lab on campus, and it was filled with computers built in the ’70s and ’80s?’ Dr. McPhee

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staying in Focus

The airline industry is like an orchestra, says Dr. Paul Craig. “When all the instruments are on the same beat and into it, it sounds great. But if one section gets off, it all falls apart.”

It seems intuitive, then, that in aviation, all those “instruments” should practice together before they perform on stage. But at universities across the country, full rehearsal is not part of the aerospace curriculum—except at MTSU.

Yet another first for the University’s aerospace program is its Flight Operations Center–Unified Simulation (FOCUS) Lab, which Craig launched in January with NASA grant funding. In the lab, students majoring in all areas of aerospace, from piloting to dispatch to maintenance, spend a weekly three-hour shift working together in real-time scenarios.

The lab teaches time and stress management—skills that can’t be taught



“An airline’s operation center is a place where all the aerospace disciplines intersect.”

in the classroom, where problems are theoretical and students don’t have to resolve them under pressure or in an interdisciplinary way. “And if you can’t manage it well,” Craig says, “it’s just a train wreck.”

He developed the lab with input from his former students and their employers.

“The feedback we got was that this was a missing piece from our curriculum,” he says. “The 20 or so best aviation programs across the United States, including MTSU, . . . all

have one thing in common: we do a pretty good job of training our students in their specialty areas. But we never really showed them how all those pieces fit together.”

The Flight Operations Center includes control stations for plane maintenance, crews and flight scheduling as well as a simulator of the Nashville airport ramp tower, which oversees plane traffic at gates and on the concourse. Craig says the lab will connect to the department’s new jet flight

said, ‘You’d be a laughingstock.’ And I said, ‘There you go. It’s a technology thing. It’s not a safety thing.’”

McPhee nominated the fleet upgrade as his annual bond request to the Tennessee legislature.

“All of a sudden, I was shopping for airplanes,” Craig says.

Fleet of wing

What followed was the first in a series of firsts. Craig ordered 25 new planes, then used a NASA grant to upgrade them from the standard round-dial controls to computerized, or “glass cockpit,” technology—the first collegiate fleet of its kind. (The fleet has since been further upgraded; the school’s newest planes have state-of-the-art “synthetic vision”—another university first.)

Craig had one plane made into a simulator, convincing manufacturer Frasca to absorb all but \$300,000, the remaining grant money, for the privilege of building the first glass cockpit training device.

The department now has five simulators, Dornan says, including the ATC lab—the first of its kind in the world—and a new \$1 million jet simulator, which will connect to the ATC lab. “That’s never been done before,” Zlotky says.

The newest simulator was purchased in anticipation of new safety regulations expected to be handed down by the FAA that will award extra flight credit hours to students with jet simulator training. It’s all part of the FAA–Industry Training Standards (FITS), which encourage pilot training based on proficiency rather than time spent in the cockpit.

MTSU already uses proficiency-based training, Dornan notes; the University has worked with the FAA since 2003 to pioneer the FITS program.

“I’d say 75 percent of the articles on the FAA website that support the efficacy of the FITS program were published here at MTSU,” he says. “We have been at the forefront of that training format. We’re the first school to implement it.”



simulator and, eventually, to the air traffic control simulator, located a floor below in the Business and Aerospace Building.

Now a required seminar for all aerospace majors, the FOCUS Lab gives “a big leg up” to MTSU grads, Craig says.

It also gives Craig the opportunity to extend his study of scenario-based training, which he began with previous NASA-funded projects in 2003. The Federal Aviation

Administration used his research to develop new standards for pilot training that emphasize proficiency rather than an arbitrary number of flight hours.

“I wanted to bring scenario-based training across the entire curriculum,” says Craig. “An airline’s operation center is a place where all the aerospace disciplines intersect.” By building a replica of such a center, MTSU offers all its aerospace

students the scenario-based teaching the University pioneered with its pilots.

Although the FOCUS Lab is unique among aerospace programs right now, Craig says that the FAA has indicated it will mandate just this sort of interdisciplinary training in the future. That’s good news for the U.S. economy, for which the cost of flight delays alone is \$33 billion a year. [MTSU](#)

All these firsts happened in “really tough budget times,” McPhee notes. What Craig estimates is \$10 million in technological investment since 2003 came from bond or grant money, not the department’s budget.

“Obviously, nothing much gets done without the administration’s blessing,” Craig says, “but if I’d gone in and said, ‘Hey, I’d like to have the best aerospace program in the country, but I’ll need \$10 million, once they stopped laughing, I’d be out in the hall. I mean, every other department would have the same request, right?’”

The **fruits** of flight

Now that \$10 million investment is paying dividends.

In July 2010, the new ATC simulator was still on order, but the research and testing opportunities that it promised to deliver were enough to win MTSU a coveted place in a \$6.4 billion research and engineering project called System Engineering

2020 (SE-2020). The project is part of the FAA’s NextGen program, an ambitious plan to modernize the nation’s airspace. SE-2020 involves six industry teams, each led by a major player in aerospace. ITT Corp. leads one team, which includes MTSU—one of only two universities on ITT’s 33-member team and one of just a few universities named to the SE-2020 project overall. (Among other participants are Lockheed Martin, Northrop Grumman, and, yes, Embry-Riddle.)

Under Troy Rath’s direction, the ITT team will share \$1.4 billion in FAA-approved contracts over 10 years. By the end of last year, MTSU had been asked to submit three contracts for approval.

MTSU’s air traffic control simulator will be critical to NextGen research as aviation moves from radar- to GPS-based technology, Dornan says. “You can’t just start using these GPS-based systems,” he explains. “Someone’s got to test them under a controlled and safe environment. Because of the sophistication of our control tower, we’re going to be the site

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that can validate these new concepts. Over the next decade, air traffic control is going to change in the U.S., and MTSU is going to play a pivotal part in that.”

Dornan expects the simulator to attract lucrative contract opportunities independent of SE-2020, including a possible partnership with the FAA, whose Atlantic City tower simulator is not only less sophisticated than MTSU’s but also overscheduled. “I’m hoping to meet with FAA officials to show them what our capabilities are—not to compete with them, but to help them because they’re backlogged,” Dornan says. “I hope that once they get an idea of what we have to offer, we’ll have some significant partnerships with them in the future.”

Rath says he’s begun recommending MTSU to others within the aerospace industry who need to conduct ATC testing or training. The FAA facility “is just not agile,” he says. “There are a lot more meetings to talk about what you’re going to do rather than doing it. There’s less red tape at Middle Tennessee State.”

MTSU aerospace is piquing international interest, as well.

This year the University signed a nonbinding agreement with China to conduct pilot training. The agreement stemmed from

scenarios incorporating the hazards and unpredictable air traffic of a war zone has “huge business implications,” Dornan says.

“If we had success with the Tennessee National Guard,” Allen says, “why not the Alabama or Kentucky or, for that matter, the Minnesota National Guard?”

MTSU signed a multiyear agreement with another neighbor, ISR Group of Savannah, Tenn., for collaborative research on drones, or unmanned aircraft systems (UAS). ISR, which conducts flight training and testing for those systems, has provided funding to help the University establish a UAS program. (See sidebar 1, page 18)

In doing so, MTSU is once again ahead of the curve because the vast commercial applications of UAS are just being developed, says Kyle Snyder, who was hired as program director.

Military use of UAS, meanwhile, has grown exponentially, notes Tim Owings, deputy project manager for the Army’s UAS Program Office in Huntsville, Ala. “[As of 9/11], we were doing maybe \$150 million worth of work in unmanned aircraft systems; today it’s about \$2.5 billion. Just in combat alone, we’ve flown over 1.2 million flight hours. That is a remarkable tribute to the success that these systems have had.”

“But the real **cherry** inside this chocolate is to have a facility like that, turning out high-quality students who are going to be the next generation manning the system—because it is just a system.”

a first-of-its-kind conference that the Aerospace Department hosted last December, when aviation experts from China and the U.S. convened on campus to discuss the challenges of opening previously restricted Chinese airspace to general aviation.

If successful, the partnership could open more doors with the notoriously cautious Chinese government, says Dr. Mike Allen, MTSU’s vice provost for research and dean of the College of Graduate Studies. “We would start with pilots, and as they became more comfortable training with us, we would offer training for air traffic controllers, too,” Allen says, adding that the proposed pilot-training agreement could be worth \$3 million to \$5 million a year for 15 years, he says.

Broadening horizons

McPhee says the conference heralded a new era of lucrative business deals, international and domestic, for MTSU’s aerospace program. “Over a couple of years, everything came together. After the international conference that we had—it just exploded from that,” he says.

Opportunity knocked closer to home in June, when the University hosted ATC training for a battalion of the Tennessee Army National Guard, based in Smyrna. The tower simulator’s unique ability to replicate airports in other countries and to create

Snyder and Owings have now forged an education partnership: MTSU will provide testing and research of UAS, and the Army will supply drone technology to the University’s UAS program, which in fall 2012 is expected to become the department’s sixth concentration. Most university aerospace departments have two or three, Dornan says.

Such expansion provides yet more evidence of the waxing of the aerospace program’s fortunes over the past 18 months. Indeed, a decade of strategic investment by MTSU’s aerospace faculty has culminated in a series of high-profile successes, and at some schools, those successes might outshine the students.

Not to worry.

“When I was there on campus and visiting, I was pretty impressed,” Troy Rath says. “But the real cherry inside this chocolate is to have a facility like that, turning out high-quality students who are going to be the next generation manning the system—because it is just a system. There have to be quality people with the burning desire to make it happen if it’s going to be successful. And I think you have them at MTSU.”

In aerospace, a business in which the smartest technology still relies on the human touch, its graduates remain MTSU’s biggest return on investment. [MTSU](#)



by Drew Ruble

those who can, Teach

An **outside-the-box** teacher licensure program helps recruit future **STEM** teachers

EBONI EATON, A JUNIOR FROM COVINGTON, Tenn., came from a family of teachers. She decided early in her college career not to follow in their footsteps.

“I didn’t want to be like everybody else,” she says. “Science is my thing. It’s something I’m really good at. So I was pre-medicine. I wanted to be a pediatrician because I love being around kids.”

A flyer detailing MTSU’s new MTEACH program—one of only 21 nationally*—altered Eaton’s chosen professional path. The program simply asks math and science majors to try out a one-credit teaching course free of charge to experience what it’s like to be a classroom teacher.

Eaton decided to give it a try. Within five weeks of starting the course, she was trained on lesson plans and getting experience teaching in a local classroom. She liked it so much that she switched her concentration to secondary education.

Eaton is not alone in making that decision. According to MTSU MTEACH program coordinator Leigh Gostowski, the program has been “radically successful.” Just one year into the program, MTEACH has increased by 222 percent the number of MTSU math and science majors now committed to becoming teachers. Going into the second full year of the program, more than 70 students are enrolled.

Those participation and conversion rates are filling a desperate need for teachers in math and science across the nation. Improving STEM (Science, Technology, Engineering, and Mathematics) education is key to maintaining American economic competitiveness because so many of the technologies we depend on today are rooted in math and science theory.

The situation is particularly acute in Tennessee. Students are required to take chemistry and physics to graduate from high school in Tennessee; however, the state hasn’t been able to meet

the need for teachers in those subjects. Just a few years ago, the whole state produced only one physics teacher.

That’s a crisis—so much so that MTSU was willing to reach into the Tennessee public school system and recruit one of its brightest science teachers to work instead in the MTEACH program. MTEACH master teacher Sally Millsap received the 2008 Tennessee Academy of Science Distinguished Secondary Science Teacher Award while working as a chemistry teacher at Blackman High School in Murfreesboro. She says her decision to leave the classroom was the hardest she’s ever made but worth it given the potential impact of MTEACH.

“I had worked with new teachers in the field, and I didn’t feel like we were producing the quality graduates that we needed from our higher education system,” Millsap says. “I also knew from my administrator that we weren’t producing the quantity, either. I knew I could go in and get college students excited about teaching. Instead of teaching chemistry to one kid or 150 kids every year, I could teach 100 college students how to be good teachers, then they could go out and teach 100 students. So I knew my impact could be exponentially greater here.”

Millsap says teacher education programs like MTEACH are also rich with research opportunities. Combined with MTSU’s recently launched Mathematics and Science Education Ph.D. program, as well as its Learning, Teaching, and Innovative Technologies Center (the focal point for faculty development at MTSU), the University is well positioned to ask tough questions about what really works in the classroom, how students really learn, and what are the best practices in teacher education and in the field. The answers have the potential to be crucial findings at a time when math and science education is a matter of global competitiveness. [MTSU](#)

[*MTSU received a five-year, \$1.925 million grant to help launch MTEACH in late 2009.]

Teaching the Teacher: MTEACH master teacher Sally Millsap, a former Tennessee Academy of Science Distinguished Secondary Science Teacher Award winner, works with three recruited MTEACH students on tactile lesson plans.

Photo: Andy Heit

Photo: J. Intintoli

An aquatic treadmill provides a **path** to **greater mobility** for its users

Walking on Water

Not So Run of the Mill: Sandra Stevens, seen here with her patient Janette Rodgers, has made national waves with her underwater spinal cord injury research at MTSU.

THE RESULT OF RESEARCH OFTEN IS SHOWN IN HARD and fast metrics. For Janette Rodgers, the only metric she cares about is that her wheelchair, once her prison day in and day out, now sits empty 90 percent of the time—in large part because of the hours she spent in 270 gallons of water.

After suffering a broken neck and spinal cord damage in a car accident in 2007, Rodgers, 53, was nearly taken off life support. Later, doctors told her she would never walk again. A year later, she was a participant in Dr. Sandra Stevens's underwater treadmill study at MTSU, where she gradually managed to take a few steps with assistance.

Today, Rodgers's husband, Terry, watches as his wife walks 500 feet every day to the mailbox at their home in Rockvale, Tenn.

"She pretty much does all the housework now—dishes, laundry, cleaning floors—and she keeps up with the shopping a lot better. There's a big improvement in her outlook," says Terry Rodgers,

In the four years since my accident, my doctor says he has never seen such improvement.

as he glances over at his wife going through her underwater paces. "I used to do most of it, and I didn't care for it," he adds with a grin.

"When I first started therapy, I was out of my power chair maybe 10 percent of the time," Janette Rodgers adds

without breaking her rhythm. "Today, I'm out of it 90 percent of the time. It has really made a difference in my mental outlook. In the four years since my accident, my doctor says he has never seen such improvement."

"If you quit trying, you'll quit improving," Stevens yells over the whirring of the treadmill.

Dr. Don Morgan, MTSU health and human performance professor, brought the treadmill to the University a few years ago. He describes the therapy as "relatively new technology." Morgan and his graduate students, including Stevens, began their initial work with the treadmill using funding from the National Institutes of Health.

Stevens graduated from MTSU in December of 2010 with a doctorate in human performance. She recently accepted a postdoctoral position at MTSU and is now testing participants for a new study of people with spinal cord injuries (SCI) who have no ability to move their legs whatsoever. Throughout 2009, she worked with 12 people, including Rodgers, who had severe SCI, utilizing the underwater treadmill. She found that, as a group, they demonstrated a 57 percent increase in leg strength,

39 percent improvement in balance, 34 percent improvement in preferred walking speed, 61 percent improvement in rapid-walking speed, 82 percent improvement in a six-minute walking distance, and a 121 percent increase in the number of steps they took in their own environment. "Everybody had some measure of improvement," Stevens says.

Participants also demonstrated greater than typical cardiac responses to training. So the more training increased, the more muscles worked to increase blood flow to the heart and the more signals sent to the brain by nerves in the muscles triggered the appropriate cardiac response to exercise.

Almost all participants reported improvement in mobility, greater independence, better general health, and improved mental well-being. Some said they could climb stairs without assistance, and others said they could reach over and pick up something off the floor, including themselves, if they fell. One participant who had leg braces said he stopped wearing them because he had built up so much muscle in his legs, the braces no longer fit.

"Then he realized he didn't need them," Stevens says excitedly.

That a researcher could show such excitement and compassion about a patient's recovery perhaps in part derives from a horrific personal experience Stevens suffered while she was a Fulbright scholar in Africa in 1998. During that trip, a bus Stevens was on hit another bus head on, fell off a bridge, and plunged into a river below. Five passengers died. Stevens was pulled from the wreckage by a Guinness beer truck driver who had been following her bus. She lay on the riverbank for hours before she was airlifted to Geneva, Switzerland, for treatment. She wondered if her injured left arm would have to be amputated or if it might become diseased and cause her death. Stevens also lost part of her right hand in the accident. It is an experience she says helps her identify somewhat with the personal suffering her patients have experienced in the loss of the use of a limb.

Stevens' research has garnered significant interest from media outlets and occupational health professionals alike. MTSU's resulting brand as a leader in underwater treadmill research has even attracted potential investors with designs on building an aquatic research facility at MTSU—one that would expand spinal cord therapy research but also potentially allow MTSU to become a leading research voice for the use of aquatic exercise to reduce the national cost of big-dollar diseases such as diabetes and obesity.

As such, MTSU is poised not only to help those who need therapy but also to provide hard-and-fast metrics on other positive outcomes of aquatic therapy. [MTSU](#)

Cementing a Reputation

MTSU's first-of-its-kind Concrete Industry Management Department keeps its grads in the mix

Set in Concrete: MTSU Concrete Industry Management director Heather Brown demonstrates how pervious concrete allows water to seep through it.

IN THE FUTURE, YOU MAY WANT TO TIP YOUR CAP TO THE driver of any ready-mix truck you see making a delivery at a construction site. He or she may be a graduate of what is to be MTSU's first-of-a-kind M.B.A. program with a specialization in Concrete Industry Management (CIM).

Students and professors in one of the University's newest graduate degree programs will live and work a long way from any academic ivory towers. Successful students are expected to have active careers in the concrete industry, where even managers might be found behind the wheel of a truck.

Faculty members in the Jennings A. Jones College of Business who have volunteered to teach graduate-level CIM classes are getting hands-on experience as well. Each will spend one to two weeks in the field as a faculty intern, learning the science and unique management practices behind the industry.

"Those willing to get their hands dirty fare better" in concrete industry careers, says Mike Schneider, chair of the industry's National Steering Committee (NSC), which worked with CIM director Heather Brown and others at MTSU to develop the yet-to-be-approved M.B.A. program, which is recruiting its initial class of 25 students and aiming for a fall 2012 launch. Each participant must have at least five years of industry experience.

The NSC collaborated with MTSU to begin the University's then-unique undergraduate CIM program in 1996. Earlier this year, CIM was established as the tenth department in the College of Basic and Applied Sciences under Brown's leadership.

It's all part of an effort to foster sustainability and a deeper institutional memory in an industry crucial to the global economy but in which skills have traditionally been passed from one generation of workers to another—even among those with advanced degrees—through on-the-job experience, not university classrooms.

The business "is still a good-old-boy industry on a local level, but the ready-mix truck is a small part of the end product," Brown says. "The cement industry is an international powerhouse."

MTSU's program is a powerhouse as well, especially when it comes to research. The program is working with a few companies on projects that include determining if a Tennessee-mined kaolin clay is suitable for concrete once mined, burned, and crushed into metakaolin; investigating the long-term durability and bond strength of thin overlay systems for bridge decks and highway applications; comparing different curing methods and products for pervious concrete to determine

if plastic sheeting can be eliminated; conducting testing on three manufactured fibers and one recycled fiber for use in pervious concrete to increase freeze/thaw resistance and abrasion resistance; and validating strength and absorption benefits of a colloidal silicate densifier for interior polished floors (just to name a few).

Armed with such cutting-edge study and research, the 500 graduates of MTSU's undergraduate CIM program fill industry positions in 30 states, where they work as contractors and managers of production facilities and in sales and other positions.

"It's not an industry people historically thought of as glamorous or something they wanted to spend a lifetime doing," Brown says. "The industry is changing its image."

Indeed, 80 percent of the graduates of MTSU's program are still in the industry despite the recession, which left innumerable construction projects on the drawing board and, says the NSC's Schneider, cut in half the amount of concrete produced in the U.S. from 450 million cubic yards in 2007 to just 225 million last year.

Ironically, the industry's troubles are expected to create opportunities for MTSU's CIM graduates, says the NSC's David Vickers, who chairs the committee organizing the M.B.A. program. Many "old hands" have retired or left the industry, and those positions will need to be filled when economic recovery arrives.

"The importance of the [CIM] program to the industry will be as the recovery takes place. They'll have undergraduates in place and high-level M.B.A. [participants] to rely on," Vickers says. "The opportunities for graduates are going to be spectacular."

Many of the M.B.A. classes are expected to be offered through distance learning with occasional visits to the University. While on campus, M.B.A. participants eventually will be able to join the 350 undergraduates in the CIM Department's own building, which is in the early planning stage. Fundraising for the building's projected \$7 million price tag is in progress, with naming rights being offered in return for a \$2 million contribution.

Understandably, the 22,000-square-foot, two-story building will showcase different types of concrete construction. One room may have a stained and polished floor while another may have a floor stamped with a design. Windows will expose the interiors of the walls so students can see how they were built. The driveway and walkways will be made of concrete. Care will be taken to ensure that the building complements the campus, where most buildings are brick.

"It will look like brick to match the campus, but it will be concrete," Brown says. "The idea is to show what we can do."

What CIM can do, it turns out, is both greatly benefit the concrete industry and also cement the professional prospects of the graduates it produces. [MTSU](#)

ROOT CAUSE

The Apostle Paul wrote it, and we've all heard it. Now a professor of management at MTSU has reached a conclusion about it:

"The love of money is the root of all evil"
— at least in the workplace.



Illustration: Tim Williams

Q&A

by Allison Gorman

In 1999, Dr. Thomas Tang began researching what would become his academic specialty—the love of money as a measurable human quality, with foreseeable effects. His Love of Money Scale (LOMS) has become a standard measure in management research.

Tang has applied LOMS in scores of studies in office and university settings worldwide, finding empirical evidence that love of money makes people behave in predictable ways. And Tang says he’s consistently found that common wisdom about wealth—for better or worse—holds true.

Tang recently led a collaborative research project across six continents to explore how the love of money relates to corrupt intent among business managers in 31 countries. A condensed version of that report, named for Paul’s admonition, was selected for publication in the *Best Paper Proceedings of the 2011 Academy of Management Meeting*.

Your research begins with the premise that money itself is not inherently good or bad. Correct?

Tang: Yes. The question is, “What do you do with it?” If you earned your money ethically, you feel happy. I have published a paper on it: in a sense, if you have a lot of talent and a lot of money, chances are you will give more and you will receive more. And if you use it wisely, chances are more money will come to you. So, “To those who have, it shall be given in abundance, and for those who don’t have, even what they have will be taken away.”

You published a 2008 study focusing on college business majors. What were your findings?

Tang: I found that the love of money is somewhat related

to Machiavellianism, which is related to unethical behavior and that [correlation] will be there for business students but not for psychology students. It’s there for male students but not for female students, and for male business students but not female business students. Male business students are more manipulative, and they’re more likely to engage in unethical behavior.

What conclusion do you draw from that?

Tang: Girls are more ethical; they seek other people’s approval. Boys sometimes venture out and do something really bad. That’s why I have a paper called “The Lost Sheep.”

So this is learned behavior that can be undone?

Tang: To some extent, yes,

but it’s a matter of self selection. People who want to make more money may choose a business discipline because of the environment where everyone is competitive and sometimes ethical issues are ignored.

Has your research turned up anything counterintuitive?

Tang: A paper I’m working on now shows that people with a high love of money actually have low corruption for this particular sample in Macedonia—and I have a cross-culture study showing the same thing. That is, in poor countries, those people who want to have a lot of money move to the top, where they have the most opportunities to be corrupt—to take bribes and kickbacks, for example. After they’ve been corrupted for a long time, they have lots of

money. And if they have lots of money, their love of money will go down somewhat. In other words, if you have everything you need, having extra money won’t be very helpful to you.

So in poor countries, the mentality is, “Let me get as much as I can get now because I may not be here next year.” It’s the same mentality as some of those executives at Enron and other places. Most executives survive for seven years as a CEO; they want to get as much as they can in those seven years because after that, they’ll be retiring.

Basically, I think it’s very true that the love of money is the root of all evil; however, the *level* of the love of money may change over time.

Thank you for your time, Dr. Tang.



The health of the country's **Native American** populations may depend in part on MTSU **research**

NATIVE TRUTH

by Bill Lewis

WHEN THE UNITED SOUTH AND EASTERN TRIBES INC. (USET) wanted to learn the true cost of providing health care to members of 26 American Indian tribes in 12 states—and whether adequate resources were being allocated—they turned to Dr. Murat Arik, associate director of MTSU's Business and Economic Research Center (BERC).

Meanwhile, Dr. Jo Edwards and researchers at the University's Center for Health and Human Services (which Edwards directs) were asked to craft culturally appropriate communications to assist USET in confronting an epidemic of diabetes among members of its tribes.

"We went to Dr. Arik and BERC because of the outstanding work they do in economic analysis," says John Mosely Hayes, senior epidemiologist at the USET Tribal Epidemiology Center. He noted that this latest collaboration builds on a longstanding

relationship between Nashville-based USET, a nonprofit intertribal organization, and the University.

Knowing the true cost of providing services is crucial since that can tell officials whether resources are being directed where they can do the most good—toward preventive care for diabetes, for example. But that information is hard to determine, Hayes says.

When American Indians and Alaska Natives receive health services in the federal Indian Health Service (IHS) system, a bill for each procedure or test is not presented the way it is in the private insurance industry. Instead, the cost is covered by a fixed budget, similar in setup to the military's health care system.

A complex process of tribal negotiations and formulas are applied to determine how much federal funding each tribe's independently operated health delivery system receives. Many tribes supplement that with their own government funding,

Tribal Quest: Economic researcher Murat Arik, who is documenting Native American health nationwide, stands in front of the flags of all USET member tribes in the lobby of USET's headquarters building in Nashville.

although there are vast differences in the tribes' financial resources. Complicating matters even further, USET's member tribes are spread across a wide geographic area and have wide array of health concerns.

"The study will provide useful information by clearly showing tribal health care delivery system costs, including treating diabetes," Hayes says. "We hope the study will help define a standardized methodology for costing out each [tribe's] system."

Now two years into the project, Arik is reviewing eight million "patient encounters" within the IHS electronic patient record management system, some of which involve multiple procedures or visits to a doctor. All the work is being done within strict guidelines that protect patient confidentiality.

"You don't know how much the services you are providing actually cost. That information will help them plan for the future," Arik says. "These questions are also valid in the private sector. What are the costs of controlling diabetes versus uncontrolled diabetes? If it's significant, the argument is you need preventive care."

There's a reason diabetes comes up in conversations with Hayes and Arik. According to Hayes, the disease is at epidemic levels among American Indians and Alaska Natives. A 2010 study found that 59 percent of that population age 65 and up in the IHS Nashville Area (a 12-state region) had diabetes, compared with 25 percent of people 60 and older in the general population.

That's why USET asked Edwards to assist its staff in developing culturally appropriate messages about the importance of preventing and controlling diabetes.

Edwards's team tailored messages for physicians, clinic managers, and others with an eye toward providing useful information "so there aren't going to be volumes of data that sit on a shelf," she says. "They wanted us to look at the data from the perspective of those individuals and how they might use it. It was a very interesting project."

BERC's study has taken on new urgency with the passage of President Obama's health care reform legislation and a federal court ruling in Florida that could, if upheld, strike down the law as unconstitutional.

The health care reforms include permanent reauthorization of the Indian Health Care Improvement Act. A wide range of tribes and tribal organizations have expressed concern that if the courts throw out health reform, the act could be lost, as well. A total of 349 tribes have filed a friend of the court brief arguing that Indian-specific provisions are legally separate from the rest of the health reform law.

USET president Brian Patterson said that the group signed on to the brief because "it is critical that Indian country unite to preserve the Indian Health Care Improvement Act amendments." He noted that it took several years of dedication and leadership to get the legislation passed. "It would be a major setback for the overall health and well-being of Indian country if they were struck down."

Arik's study will provide information that should help the tribes make that argument, and Arik is working diligently to make sure every detail is exactly right.

"Some people call me a perfectionist, [with my] need to understand all issues," he says. "I call myself a lifelong learner." [MTSU](#)

Impact Tracker

Who determined that Nashville's health care industry contributes nearly \$30 billion and 210,000 jobs to the local economy and that 10,000 green jobs may be created in Tennessee between now and 2014?

Who reported that Williamson County—Tennessee's richest—had program and funding gaps for issues such as affordable housing; transportation; alcoholism, drug abuse, and mental illness treatment; and access to available services for rural parts of the county? **Who analyzed** the compensation structure for manufacturing employees in Coffee, Franklin, and Lincoln counties in an effort to help economic development officials understand their markets when assisting prospective businesses in their relocation to the region? **Who revealed** that the Bonnaroo music festival is a cash cow for middle Tennessee, pumping about \$14 million in revenue into Coffee County each year? And **who conducted a study** that led to federal funding for a \$20 million northwest Tennessee slack water port? **The experts at the Business and Economic Research Center, housed in the Jennings A. Jones College of Business—that's who.**

The center, led by director David A. Penn, is often cited in newspapers statewide for its astute analyses of Tennessee economic issues. [MTSU](#)

Doctor of Evidence

by Allison Gorman

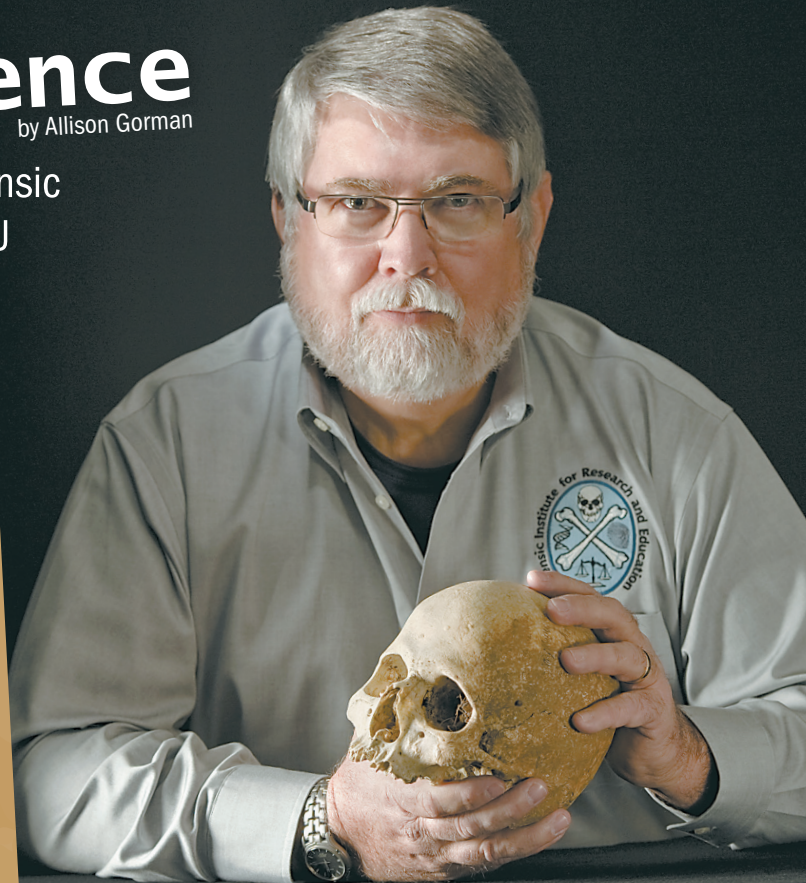
An internationally recognized expert in forensic science **builds a powerhouse program** at MTSU

his research goes by titles such as “Common Household Rope and an Outdoor Hanging,” “Cervical Vertebrae Entrapment in the Noose,” and “Evidence of Prehistoric Violent Trauma from a Cave in Middle Tennessee.”

Such scholarly, albeit gruesome, work in the field of trauma has earned MTSU professor Dr. Hugh Berryman a reputation as one of the nation’s foremost forensic anthropologists; Berryman will receive the 2012 award for lifetime achievement in physical anthropology from the American Academy for Forensic Sciences. The T. Dale Stewart Award, given annually to a single recipient, is the highest honor bestowed upon a forensic anthropologist in the United States.

Venerable institutions like the Smithsonian Institution regularly tap Berryman’s expertise on bones and bone trauma. In 2005, the Smithsonian invited him to join an elite scientific research team examining the 9,300-year-old skeleton dubbed “Kennewick Man.” He is also part of the effort to exhume the body of Meriwether Lewis to determine whether his shooting death was a suicide, as originally reported, or murder.

Berryman also provides consultation and regular testing and review for the Joint POW/MIA Accounting Command Central Identification Laboratory in



Dem Bones: Nationally recognized forensic anthropologist Hugh Berryman is helping build a powerhouse forensics program at MTSU.

Standing Out Among the Masses

by Tom Tozer

in the wake of natural catastrophes like the recent earthquake and tsunami in Japan, one of the unhappy tasks first responders face is finding, identifying, and properly handling large numbers of the deceased.

Given that grim reality, it’s no wonder recent MTSU graduate Jeannie Stubblefield’s undergraduate research on alternatives for managing deceased human and animal remains in mass fatalities has piqued the interest of the Department of Homeland Security (DHS).

Earlier this year, Stubblefield won first place for her poster research at the Fifth Annual U.S. Department of Homeland Security University Network Summit, held in Washington, D.C.

Her research was conducted under an MTSU FIRE grant of \$161,000 (principal investigator, Hugh Berryman), funded by DHS and managed through Oak Ridge National Laboratory’s Southeast Region Research Initiative. The official title of Stubblefield’s research was “Potential Use of Chlorine Dioxide to Decontaminate Skin Surfaces in an Animal Mass Casualty Response.”

Stubblefield recently enrolled in MTSU’s new Ph.D. program in Molecular Biosciences, but she also has an appointment to keep. Officials at Homeland Security were so impressed with Stubblefield’s presentation that they have asked to meet with her privately. **MTSU**

Photo: J. Intintoli

Recent MTSU graduate
Jeannie Stubblefield
garners national attention
for her research

He is also part of the effort to exhume the body of Meriwether Lewis to determine whether his shooting death was a suicide, as originally reported, or murder.

Photo: J. Intintoli

Certainly the glamorization of forensics on television and in fiction has inflamed student interest across the U.S., but at MTSU, Berryman has turned forensics into a flagship program that benefits students and community alike. It operates as an invaluable regional resource while turning out graduates who are several steps ahead of their competition.

He founded MTSU's Forensic Institute for Research and Education (FIRE), which offers extensive training for local law enforcement. Last fall, building on the momentum Berryman created, MTSU introduced a bachelor's-level program in forensic science—the only one in Tennessee, one of only three in the Southeast, and expected

Hawaii, which identifies soldiers from as far back as the Civil War. (It's one of the world's most technologically advanced forensic labs.) And since moving to the Nashville area in 2000, he's made himself available to regional law enforcement and other agencies that deal with death and homicide. As MTSU provost Brad Bartel notes, "Hugh Berryman is probably on speed dial for a lot of counties in Middle Tennessee."

to be one of fewer than 20 accredited programs of its kind in the country. Berryman also created FASR, the Forensic Anthropology Search and Recovery Team, to give MTSU students practical experience at the undergraduate level. FASR students accompany and assist him at crime and accident scenes.

Such hands-on training makes FASR students highly employable once they graduate, says Tennessee Bureau of Investigation director Mark Gwyn, a 1985 MTSU grad.

"If you can get someone who already has knowledge and understanding of that particular venue, then it makes the training easier and shorter, and it puts that person to work a lot quicker. We're always looking for that," Gwyn says.

Bartel says this confluence of talent and opportunity in forensics will give the university national name recognition.

"As a provost, you want all of your programs to be as good as they can be," Bartel says. "But some, by the nature of the quality faculty you have, and maybe just the uniqueness of the program, rise to a higher level nationally. I view the forensic program as one of those signature, reputational programs for MTSU." [MTSU](#)



With a Bullet **Alicja Kutyla Lanfear takes a winding path to success in the forensics field**

after earning a bachelor's degree in biology, Alicja Kutyla Lanfear set her sights on a new goal: a Ph.D. in the competitive field of forensic anthropology. In 2006, she landed at the office of Dr. Hugh Berryman, MTSU's world-recognized forensic anthropologist. Impressed by Lanfear's drive, Berryman accepted her as a master's student, setting her on an intensive, two-year path to the top of her chosen field.

That path took her to morgues and crime scenes across middle Tennessee, forensic collections at the Smithsonian, and the American Academy of Forensic Science meeting in Washington, D.C., where she and Berryman won the prestigious Ellis R. Kerley

Award for their collaborative research on the detection of gunshot residue on bone and the potential for bullet direction and range estimation. In 2008, Lanfear enrolled in UT-Knoxville's highly selective doctoral program in anthropology, Berryman's old stomping grounds.

With her Ph.D. now in hand, Lanfear is still going places. Last summer, she traveled back to our nation's capital, where the National Holocaust Museum granted her access to rare anthropological data from Nazi-occupied Poland. (Lanfear holds Polish citizenship.) Meanwhile, she began a new job teaching anatomy and conducting research at Lincoln Memorial University in Harrogate, Tenn. Lanfear and Berryman continue their collaborative research.

With her hard work and Berryman's good guidance, it turns out Lanfear can go anywhere she wants. [MTSU](#)



Photo: J. Intintoli

Photo: J. Intintoli



Unto Others

by Tom Tozer

Colby Jubenville does his part to make the **Golden Rule** an **MVP** on the courts and playing fields of the **Sun Belt Conference**

of the Center for Sport Policy and Research at MTSU. Jubenville, himself a former college athlete, met Shulman in 2007.

"I told Brian I thought his platforms were good, but I could make them better," Jubenville says. Focusing on the coach-athlete relationship, Jubenville created Real Sportsmanship, an online program platform especially for the collegiate level.

When Brian Shulman, former all-SEC punter for Auburn University in the 1980s and successful entrepreneur, developed Learning Through Sports 12 years ago, he wanted to help youngsters make the connection between the Golden Rule and competitive sports. The results of his Internet programs for K-12 athletics have been remarkably successful.

"In Alabama at the high school level, we have seen a 78 percent reduction in ejections," Shulman says, as a result of efforts in promoting sportsmanship and fair play.

"In Mississippi, we have seen a 68 percent reduction."

Enter Dr. Colby Jubenville, professor in the department of Health and Human Performance and director

The Sun Belt Conference has concluded its first year of utilizing the Real Sportsmanship program.

Findings released from the Center for Sport Policy and Research at MTSU are based on data collected from 478 SBC coaches and 3,476 SBC athletes. The results indicate that the platform "significantly impacted several perceptual and behavioral aspects of coaches and student-athletes regarding sportsmanship."

Wright Waters, Sun Belt commissioner, agrees.

"We have seen a decline in the number of incidents of bad behavior, particularly on the part of the student-athletes," Waters says.

Such results are drawing greater attention from other funding sources interested in backing Jubenville's research. At press time, the John Templeton Foundation was showing significant interest in funding Jubenville's effort to take his research to all NAIA schools

Champions of Character an interactive, reality-based assessment of the **impact of five core values**—integrity, respect, responsibility, sportsmanship, and servant leadership

Real Sportsmanship asks questions and administers a pretest, then follows up with more questions and a post-test. The issues discussed include the realities that both student-athletes and coaches face, which include drinking, partying, sexual activity, cheating, and gambling. Participants are asked to reflect on their experiences and decisions as they relate to those issues. Jubenville says participants should better understand how to handle new situations and assume leadership roles on their teams and in life.

Shulman and Jubenville were excited when the Sun Belt Conference (SBC) called and wanted to implement the platform for a five-year period, starting in 2010.

"Not only the commissioner but also the presidents and athletic directors from all the institutions got on board," Shulman says. "They said this was something they had to try to get a handle on."

in a program called Champions of Character, an interactive, reality-based assessment of the impact of five core values—integrity, respect, responsibility, sportsmanship, and servant leadership—on student-athletes and coaches.

Jubenville notes that his research has uncovered an important sportsmanship paradox—as the skill level increases, the ability to understand and implement sportsmanship decreases. It is a paradox that "each athlete is exposed to as he or she engages the learning platform," Jubenville says.

Fortunately, the Real Sportsmanship program provides a means by which coaches and athletes can bridge this divide between skill and behavior before it grows too wide. [MTSU](#)

Gentleman's Game: In a day and age marked by bad behavior among athletes, Colby Jubenville is pioneering research on collegiate sportsmanship.



Photo: J. Intintoli

Though it might seem humorous to imagine Lady Gaga or U2 recorded on a cylinder, it's really no laughing matter.

PHOTO KEY

1 Songster, a lyrics-only songbook, *Harrigan & Hart's Mulcahey Twins Songster*, 1872

2 Songbook, *Slave Songs of the United States*, the earliest published songbook of African American spirituals, 1867

3 Edison Cylinder, precursor to recorded discs, "Casey Jones," artist Billy Murray, 1910

4 Sheet music, "Hound Dog," written by Jerry Lieber and Mike Stoller, performed by Elvis Presley, 1956

5 Handwritten music, "The Treble to Pilgrims Farwell," Luzon Nichols, 1820

6 Song broadside, "The Captain of the Provost" with panorama of Nashville, 1863

7 Cabinet card of String Trio, unknown musicians, ca. 1880

8 Gospel songbook, *Singers Glory*, publisher James D. Vaughan, Lawrenceburg, Tenn., 1951

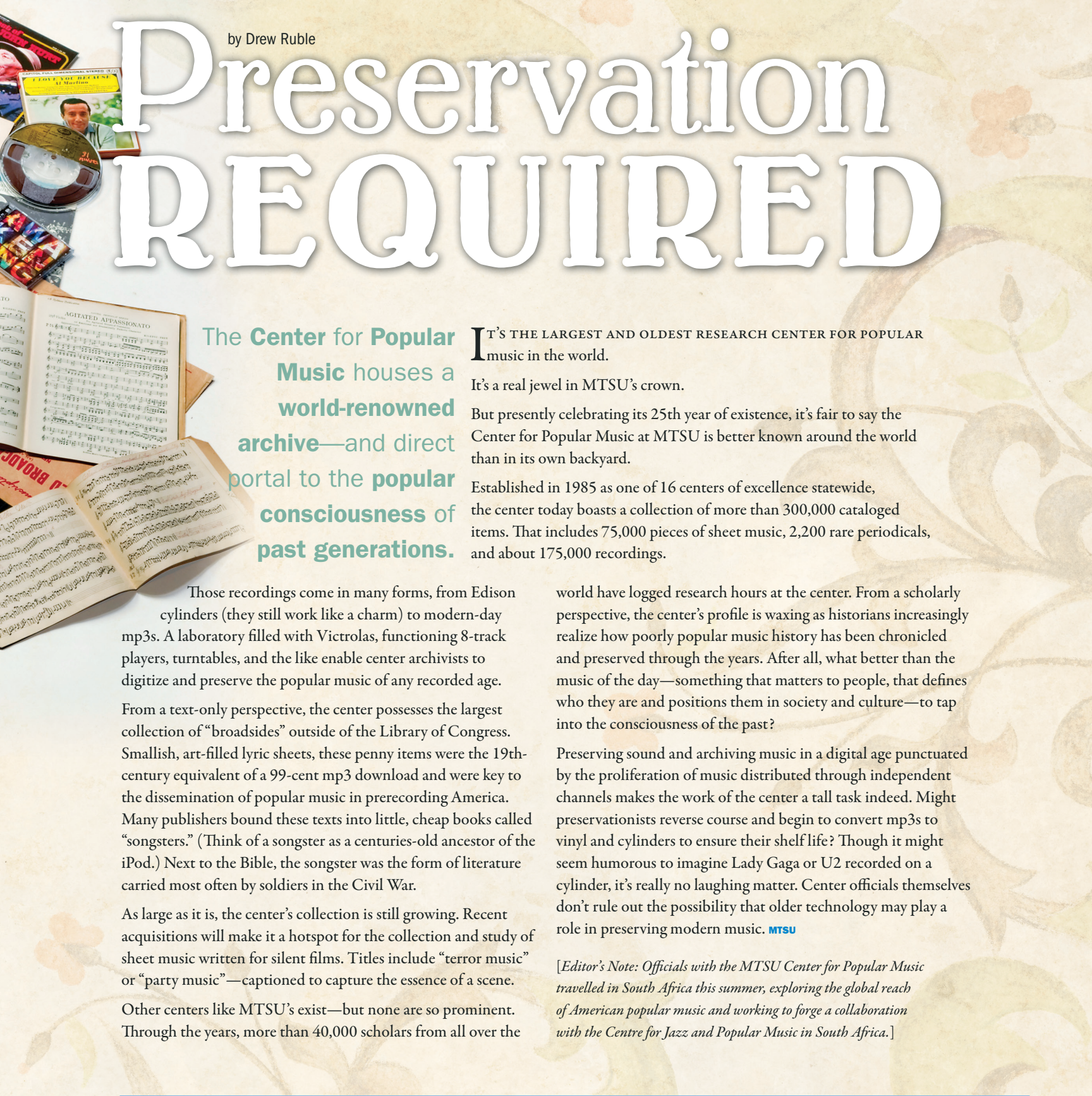
9 Reel-to-reel stereo tape (3"), "Lullaby of Birdland," *Ella and Duke at the Cote D'Azur*, composer George Shearing, performer Ella Fitzgerald, 1967

10 Transcription disc of a recorded radio program (not sold commercially), 1940

11 Sheet music, "Flag of the South," C. D. Bensen & Co., a Confederate imprint, Nashville, Tenn., 1862

12 Music for the Silent Movies, "Agitated Apassionato; For agitated themes of commotion of emotional and dramatically pathetic character," Robbins Music Corp., 1927

13 Flute and violin tune book, *The Musical Miscellany*, the oldest item in the center's collection, 1729



by Drew Ruble

Preservation REQUIRED

The **Center for Popular Music** houses a **world-renowned archive**—and direct portal to the **popular consciousness of past generations.**

IT'S THE LARGEST AND OLDEST RESEARCH CENTER FOR POPULAR music in the world.

It's a real jewel in MTSU's crown.

But presently celebrating its 25th year of existence, it's fair to say the Center for Popular Music at MTSU is better known around the world than in its own backyard.

Established in 1985 as one of 16 centers of excellence statewide, the center today boasts a collection of more than 300,000 cataloged items. That includes 75,000 pieces of sheet music, 2,200 rare periodicals, and about 175,000 recordings.

Those recordings come in many forms, from Edison cylinders (they still work like a charm) to modern-day mp3s. A laboratory filled with Victorolas, functioning 8-track players, turntables, and the like enable center archivists to digitize and preserve the popular music of any recorded age.

From a text-only perspective, the center possesses the largest collection of "broadsides" outside of the Library of Congress. Smallish, art-filled lyric sheets, these penny items were the 19th-century equivalent of a 99-cent mp3 download and were key to the dissemination of popular music in prerecording America. Many publishers bound these texts into little, cheap books called "songsters." (Think of a songster as a centuries-old ancestor of the iPod.) Next to the Bible, the songster was the form of literature carried most often by soldiers in the Civil War.

As large as it is, the center's collection is still growing. Recent acquisitions will make it a hotspot for the collection and study of sheet music written for silent films. Titles include "terror music" or "party music"—captioned to capture the essence of a scene.

Other centers like MTSU's exist—but none are so prominent. Through the years, more than 40,000 scholars from all over the

world have logged research hours at the center. From a scholarly perspective, the center's profile is waxing as historians increasingly realize how poorly popular music history has been chronicled and preserved through the years. After all, what better than the music of the day—something that matters to people, that defines who they are and positions them in society and culture—to tap into the consciousness of the past?

Preserving sound and archiving music in a digital age punctuated by the proliferation of music distributed through independent channels makes the work of the center a tall task indeed. Might preservationists reverse course and begin to convert mp3s to vinyl and cylinders to ensure their shelf life? Though it might seem humorous to imagine Lady Gaga or U2 recorded on a cylinder, it's really no laughing matter. Center officials themselves don't rule out the possibility that older technology may play a role in preserving modern music. [MTSU](#)

[Editor's Note: Officials with the MTSU Center for Popular Music travelled in South Africa this summer, exploring the global reach of American popular music and working to forge a collaboration with the Centre for Jazz and Popular Music in South Africa.]



by Drew Ruble

Across the Zooniverse

Dr. John Wallin hones and harnesses the **computing power** of scientists and citizens alike

An astrophysicist who studies interacting galaxies and the gravitational force of objects at the edge of our solar system, Dr. John Wallin has a passion for applying the power of computing to astronomy.

The director of MTSU's new Ph.D. program in Computational Science, Wallin also serves a pivotal role in the study of an online suite of citizen-science projects, called Zooniverse, intended to help determine the implications of public involvement in large-scale scientific activities.

Zooniverse projects range from an effort to track solar explosions to work on understanding how galaxies merge—a Wallin specialty. Essentially, as technology has increased the flow of new information in fields like astronomy, Wallin has embraced the opportunity to use “citizen scientists” to unlock the data.

According to Wallin, the goal is to “build a partnership between machine analysis and human volunteers.” And it's working. To date, Zooniverse has over a half-million volunteers who have contributed nearly 60 million classifications. Such data is used to help train computers to make the same detailed observations and categorizations.

Citizen science has already led to the development of two new classes of astronomical objects, including the new galaxy classification known as “green peas,” or clusters of stars that resemble fuzzy, bright green spheres.

Wallin spent the 2011 spring semester at Oxford, splitting time between being a visiting scientist in the Department of Astronomy and being a Visiting Fellow at Mansfield College, the nexus of the Zooniverse project. A new project he began work on while there (and later at the University of Minnesota) is the “Ancient Lives” project, created to decode a set of Greek papyri by enlisting volunteers from around the world to help transcribe ancient Greek manuscripts from the Oxyrhincus collection of the Ashmolean Library. These ancient papyri were recovered by British archeologists in the early 1900s and date back to between AD 300 and 700. Since they were recovered, only about 15 percent of the manuscripts have been transcribed. However, in this collection, papyrologists have found early copies of books of the Bible, ancient Greek plays, and even mathematical texts.

Photo: J. Intintoli

Wallin is involved in creating the analysis software that will be used to help identify these newly transcribed manuscripts. He's simultaneously working with collaborators (including NASA) on a challenge project to determine how effectively citizen science data can be used to train computers.

Computational Science is a rapidly evolving field. As the design of computers changes and their power increases, new kinds of computer simulations and analyses become possible. That means opportunities abound for MTSU students and faculty as the field of computational science continues to grow. This growth potential has led to the establishment of the Center for Computational Science at MTSU to help promote research on campus in scientific computing. Faculty members in the center will remain in their own departments as teachers but collaborate through the center on their research. The faculty in the center will be working on both scientific simulation and on data-intensive science.

Currently, MTSU has students and faculty working on projects that include automatic identification of tumors using medical imaging; improving the simulation methods used to test new drug design; and "text mining" the scientific literature to find new connections between different areas of research, among others. One of the goals of the program is to form research partnerships with other departments, with local industry, and with government laboratories like Oak Ridge National Laboratory in east Tennessee.

Though the new Computational Science degree may target a different population than the Zooniverse project, both endeavors—and the man in the midst of them—share a common goal: to further scientific knowledge through increased computing efficiency and mastery. **MTSU**

As the design of computers changes and their power increases, new kinds of computer simulations and analyses become possible.

Eye in the Sky: John Wallin, seen here with MTSU's telescope, harnesses the power of students and citizens alike to map galaxies.

Computational Science is one of three new Ph.D. science programs launched during the fall 2010 semester at MTSU. The other two are **Molecular Biosciences** and **Mathematics and Science Education**.

A close-up photograph of a motor's internal components, showing several copper windings on a stator core. The windings are arranged in a circular pattern, and the metal parts are silver and grey. The lighting is bright, highlighting the texture of the copper and the precision of the engineering.

Hybrid Thinkers

by Randy Weiler

Two MTSU professors take different paths to the same gasoline-free conclusion

A RetroFit Future

Dr. Charles Perry and his Engineering Technology team invent a way to make every car a hybrid

Prolific patent recipient Dr. Charles Perry's latest invention, the Plug-In Hybrid RetroFit Kit, could save America 120 million gallons of fuel daily.

Perry (B.S. Chemistry '66 and M.S. '69) is the holder of the Robert E. and Georgianna West Russell Chair of Manufacturing Excellence in the Department of Engineering Technology at MTSU. He spearheads an eight-member team collaborating on this patent-pending, wheel-hub motor project. The team includes Paul Martin III, an automotive engineering technology expert, co-patent holder, and the grandson of Paul W. Martin Sr., for whom MTSU's University Honors College is named.

Perry says that 80 percent of U.S. drivers make daily trips of 30 miles or less driving 40 mph or less. Those trips can be made with his 10- to 15-horsepower electric motors powered by extra batteries installed in the car's trunk. The hybrid retrofit kit is installed in the space between the brake mechanism and the hub, generating more electricity while the vehicle is driven.

Photo: J. Intintoli

A former IBM electrical engineer who was awarded 40 patents during his career there, Perry says he believes the kits could be developed into a product selling for between \$3,000 and \$5,000.

the **Plug-In Hybrid RetroFit Kit**, could **save America 120 million gallons of fuel daily.**

Under Martin's mechanical guidance, a prototype vehicle recently hit the streets, allowing the Perry team the opportunity to prove its fuel mileage savings and system reliability. The next step will be to fund a fleet of independently manufactured cars that will be retrofitted with the kit and which will fully enable Perry and crew to test the product's efficiency and durability.

The Tennessee Technology Development Council (TTDC), a state agency that offers grants designed to help Tennessee inventors take their innovations from the lab to the marketplace, awarded the kit first place in a recent competition that included applications from Vanderbilt University, St. Jude Children's Research Hospital in Memphis, and Oak Ridge National Lab. It's the latest proof that the right infusion of capital is just the thing to make Perry and crew's kit a significant tech transfer success story at MTSU, a success that will no doubt pave the way for future successes coming out of the University's Department of Engineering Technology.



Photo: Andy Heidt

Drive to Succeed

Dr. Cliff Ricketts embarks on a 2,800-mile road trip on 1.87 gallons of gas. Last fall, Dr. Cliff Ricketts made national headlines when he drove the length of the state of Tennessee using only sun and water to power his vehicle.

The latest step in Ricketts's lifetime of alternative fuel research was a planned 2,800-mile cross-country drive in October using less than two gallons of gas.

At press time, the longtime MTSU School of Agribusiness and Agriscience faculty member was in final preparations for his proposed drive in a modified 2008 Toyota Prius from Wilmington, N.C., to a Pacific Ocean beach near Los Angeles. Besides a few drops of gas, his fuel consisted of various hybrid sources, including sunlight and hydrogen from water.

The journey required about 3.75 tanks to achieve 750 miles per

fill-up or charge (100 miles with solar electric, 250 miles with hydrogen, 350 miles with 95 percent switchgrass ethanol and 5 percent gas, and 100 miles with on-board regeneration, a unit similar in theory to the device created by MTSU professor Charles Perry. See companion story on opposite page.

Ricketts planned to make the drive using only 1.87 gallons of gas. The only reason gas was involved at all is because federal regulations mandate ethanol fuel have at least 5 percent gasoline in it.

"My whole passion is sun and water," says Ricketts, who considers himself a modern-day Davy Crockett, "a frontiersman with energy" who has "blazed a trail with ethanol, blazed a trail with hydrogen, and blazed a trail with sun and water."

Will he make it? He says he's 95 percent sure he will. "This is research, after all," he cautions.

And what's next for Ricketts? He's planning a coast-to-coast trip powered exclusively by sun and water in the fall of 2012. [MTSU](#)



It Takes a Very Steady Hand: Daniel Erenso wields tweezers in the fight against sickle cell anemia.

A Fine Grasp

Daniel Erenso **tackles** sickle cell diseases **one cell** at a **time**

by Drew Ruble

Photo: J. Intintoli

DR. DANIEL ERENDO, ASSOCIATE PROFESSOR OF PHYSICS and astronomy at MTSU, uses an experimental technique that enables him to “grasp” individual cells with a laser beam to study the morphology and elasticity of red blood cells (RBCs) by measuring their responses to linear and rotational deformations. What’s the upside? Abnormalities in RBC shape or flexibility, which are caused by genetic mutation, can result in sickle cell (SC) diseases.

The prevalence of these diseases in the United States is approximately one in 5,000. Worldwide, an estimated 300,000 affected individuals are born each year. SC affects mostly people (or their descendants) from parts of tropical and subtropical regions since the gene mutation is caused by frequent exposure to malaria, which is common there. According to an article published in the *New England Journal of Medicine*, the average life expectancy of individuals with SC diseases is 42 for males and 48 for females.

Though several treatments have been developed to treat these diseases, the most promising technique is stem cell–targeted gene therapy. Recently, a clinical trial conducted in mouse models by a group led by Dr. Derek Persons at St. Jude Children’s Research

Hospital in Memphis corrected two common types of sickle cell diseases: sickle cell anemia and beta-thalassemia.

Future human clinical trials of such stem cell–targeted gene therapy will require a different approach to measure the efficacy of the treatment in mice. One method is to conduct a comparative study on the elasto-mechanical properties of the normal, the sickle, and the genetically corrected RBCs of the mouse model using laser tweezers. In 2010, Erenso teamed up with Persons to conduct this study. Erenso and coworkers found that new blood cells generated through the gene therapy technique have properties resembling those of healthy cells, a breakthrough for the scientists and good news for those with sickle cell diseases.

More recently, Erenso has been busy building a new device: a “magnetic” tweezer that will eventually allow him to study red blood cells at the molecular level—an even smaller dimension. Given Erenso’s cutting-edge approach to SC research, it comes as no surprise that another higher education institution in Middle Tennessee, Meharry Medical College, home of a sickle cell center, has recently reached out to collaborate with the MTSU professor. [MTSU](#)

The Wright Chair

by Gina K. Logue

For Doug Tatum, the **key** to job creation is a **matter of scale**

It's the ultimate question in political circles. What's the best way to create jobs?

Research conducted by Doug Tatum, holder of the Wright Chair of Entrepreneurship at MTSU, suggests that the most net jobs are created by second-stage entrepreneurs. Sadly, that's a fact not well understood by many policymakers in Washington. But Tatum's leadership of a major national business research initiative is changing that.

As appointed head of the Institute for Exceptional Growth Companies (IEGC), Tatum's role is to investigate the performance of exceptional growth companies (EGCs) through economic cycles and how they contribute to job creation and economic prosperity. The institute was established by the Edward Lowe Foundation, a nonprofit organization that supports entrepreneurship. The venture was funded by a \$730,000 grant from the NASDAQ OMX Educational Foundation, a nonprofit supported exclusively by the world's largest exchange company.

Under the auspices of the IEGC, Tatum is probing the relationship between equity-funding sources and fast-growing companies. His work has a special emphasis on high-growth companies in the second and third stages of development, including companies with 10 to 99 employees and 100 to 499 employees, respectively. "We believe the research will yield enormous insight into the dynamics of EGCs, how they interact

supporting entrepreneurship is the right path to increasing America's jobs and prosperity

with capital markets, and, ultimately, their impact on job growth," Tatum says.

The institute will leverage the National Establishment Time Series, a database that

tracks the performance of more than 41 million businesses from 1990 to 2009, to better understand the impact of EGCs on community and economic development.

"We're at [a] historic economic inflection point in the United States," Tatum says. "It's important that we gain an appreciation of how companies transition to financial scale and how we capitalize that growth. We are in a phase in which our only unique advantage may be our entrepreneurs."

The author of *No Man's Land: What to Do When Your Company Is Too Big to Be Small and Too Small to Be Big*, Tatum was chair and CEO of Tatum LLC for more than 17 years. He grew the company into the largest executive-services consulting firm in the U.S., with more than 1,000 employees and professionals in 30 offices. He later served on the firm's board and as chair emeritus

until the company merged with Spherion Corp. in early 2010.

Tatum's chair at MTSU was made possible by a \$1.25 million commitment from MTSU alum Pam Wright, founder and CEO of Nashville-based Wright Travel, Tennessee's largest travel agency. Wright says she endowed the chair in an effort to better engage the economic fight that America has on its hands competing with the rest of the developing world.

"The exposure [of this chairholder], the informal instruction and teaching, the national recognition—it makes people think about what entrepreneurship is all about and whether or not it might be right for them," Wright says.

There's no question—according to Tatum's research—that supporting entrepreneurship is the right path to increasing America's jobs and prosperity. **MTSU**



Start Me Up: Entrepreneurship researcher Doug Tatum (*above right*), whose position at MTSU is funded by travel company CEO Pam Wright's (*above left*) seven-figure gift, is leading a national analysis of the impact of high-growth companies.

Photo: J. Intintoli

Mission Centrals

A diverse array of centers and institutes focus the talents and attention of the MTSU community on problems that affect us all The various Middle Tennessee State University academic centers not only enrich the lives of those on campus, the surrounding community, the state and beyond; collectively, their academic, government, and business partnerships bring millions of dollars to fund cutting-edge research and community service offerings. From helping a student struggling with dyslexia to assisting iconic WSM-AM place its historic radio broadcasting tower on the National Register of Historic Places, the work of MTSU's diverse group of centers results in far-reaching, positive effects. Here, then, is a brief look at some of MTSU's most conspicuous centers and institutes as well as a sampling of their efforts.

Center for Historic Preservation

www.mtsuhistpres.org

The Center for Historic Preservation works across Tennessee to identify, preserve, interpret, sensitively promote, and sustain our historic environment.

Work Samples: The Tennessee Century Farms Program recognizes and documents Tennessee farms owned by the same family and in continuous production for at least 100 years. The statewide program includes more than 1,400 farms.

The Tennessee Civil War National Heritage Area, operated in partnership with the National Park Service, is the nation's only heritage area to encompass an entire state.

The Tennessee Rural African American Church Project is an ongoing survey of rural African American churches that date from 1850 to 1970. The project collects the history of significant events, people, and architecture associated with the various places of worship.

Did you know? Center director Dr. Carroll Van West cochaired the state of Tennessee's Civil War Sesquicentennial Commission, the body created to lead the state's efforts in commemorating the 150th anniversary of the start of the Civil War.

Vision: "To support and sustain meaningful field projects, public-service efforts and student training."
—Carroll Van West, director

Tennessee Center for the Study and Treatment of Dyslexia

<http://dyslexia.mtsu.edu>

The center is dedicated to unraveling the puzzle of dyslexia. It is a model for the organization and delivery of professional services to students with dyslexia, to psychologists and teachers who identify and instruct them, and to schools that must orchestrate a broad range of services to enable these students to achieve their potential.

Work Samples: Training services and workshops are offered statewide, as are specialized in-service school programs. Teachers, school psychologists, speech and language therapists, and administrators are taught how to assess and assist students.

Improving Instruction for Students with Dyslexia is an online, on-demand course offered through MTSU's University College.

Did you know? The center is the only nonprofit center for the study and treatment of dyslexia in the state established by the Tennessee General Assembly.

Vision: "To bring awareness of what dyslexia is and what schools can do for the students, following identification, to assist them in reaching their full learning abilities."
—Erin Alexander, assistant director for clinical services

Tennessee Small Business Development Center

www.tsbdc.org

The Tennessee Small Business Development Center (TSBDC), headquartered at MTSU, consists of 14 subcenters, 7 affiliate offices, and an online service center located at universities and community colleges across the state. The center is a network of professional business consultants providing expert business advice to all types of businesses. It also maintains an international trade center.

Work Samples: The most recent economic impact study data revealed that TSBDC clients generated \$4.88 million in additional state and federal tax revenue.

TSBDC created 631 new jobs and saved 338 existing jobs.

Over \$9.1 million in additional capital was raised by clients as a direct result of the assistance of the TSBDC.

Did you know? More than 100,000 businesses have received TSBDC's expert counsel.

Vision: "The strength of Tennessee's economic growth is based in part on the small business community and its ability to get products to market. TSBDC is here to help every step of the way."
—Patrick Geho, director

Albert Gore Research Center

www.gorecenter.mtsu.edu

Named for Albert Gore Sr., a former U.S. representative and senator from Tennessee (1939–1970), the center collects and makes available archival materials about the history of middle Tennessee to the public and the campus community.

Work Samples: The Margaret Lindsley Warden Library for Equine Studies is a nationally recognized collection donated by Warden, who for 52 years reported on horse events for the Tennessean, Nashville's daily newspaper.

The Gore Center contains more than 2,500 bound volumes, some dating to the 16th century. Also, more than 750 oral history projects/interviews have been conducted about middle Tennessee history topics, MTSU campus life, and other subjects.

Also included are 400 interviews of veterans, conducted in partnership with the Library of Congress Veterans History Project.

Did you know? The University's original 1911 payroll ledger is at the center. The book contains the signatures of the first president, R. L. Jones, and members of the campus staff from professors to janitor, all of whom had to sign for their paychecks.

Vision: "To serve the MTSU community as the University's formal institutional archive and continue to expand our holdings, which help students and others understand the American democratic process."
—Jim Williams, director

Center For Organizational and Human Resource Effectiveness (Cohre)

www.cohre.net

The center helps organizations meet their human resource and organizational development needs by providing a wide range of management consulting services, translating state-of-the-art research into practical strategies and solutions for clients.

Work Sample: The center's expertise has assisted numerous University colleges and departments—including the Office of the President and the Department of Aerospace's NASA-funded air traffic control simulation lab.

Did you know? In addition to its work on campus, COHRE has custom designed programs to assist Rutherford County government, State Farm, the Tennessee Supreme Court, Gaylord Entertainment, United Way, Comdata, and Nissan North America, among others.

Vision: "COHRE partnerships continue to have a growing influence on our community's economic development while simultaneously providing our faculty and students with applied opportunities to sharpen their professional skills."
—Michael Hein, director

Center for Health and Human Services

www.mtsu.edu/achcs/about.shtml

The center initiates and strengthens programs in health and human services to support workforce development and promote healthy communities in Tennessee.

Work Samples: The Death Scene Investigation/SIDS Project is a statewide training program for investigating sudden infant death, with the goal of creating evidence-based programs to reduce these tragedies.

Did you know? Collaboration with the Tennessee Cancer Coalition educates daycare/preschool providers on healthy lifestyles to

decrease the risk of developing cancer and other lifestyle-associated diseases and conditions.

Vision: "As we strive to monitor health status to identify and solve community health problems; inform, educate, and empower people about health issues; mobilize community health partnerships; and attract highly capable students into the health professions, we will continue to improve the health of the citizens of Tennessee."
—M. Jo Edwards, director

Middle East Center

www.mtsu.edu/~mideastctr

The center's focus is to promote an understanding of the various populations and cultures of the Middle East among the student body as well as in the surrounding communities. It also encourages faculty research and seeks to serve and respond to the needs of Middle Eastern students on campus.

Work Sample: MTSU is one of just a few universities nationwide that offers Kurdish language instruction. Why is that significant? As a result of Saddam Hussein's regime, which for years forced Kurds to learn Arabic, the Kurdish language is actually endangered. Middle Tennessee is home to the largest Kurdish community in the nation.

Did you know? The center is the first of its kind established in Tennessee.

Vision: "Current events and continued U.S. involvement in various parts of the Middle East remind us how important the region is and how important it is for us to learn more about its rich and diverse cultures."
—Allen Hibbard, director

Interdisciplinary Microanalysis and Imaging Center (MIMIC)

<http://frank.mtsu.edu/~mimic/about.html>

MIMIC is a core facility for microscopy and other characterization equipment used by a broad range of diverse disciplines, from Concrete Industry Management to Forensic Science.

Work Sample: Hitachi Scanning Electron and Transmission Electron microscopes aid faculty and students in diverse research projects such as "Quantum-Dot Sensitized Solar Cells Using Copper (I) Oxide as the Hole Transport Layer."

Did you know? MTSU is the first U.S. customer for the new TESCAN focused ion beam-scanning electron microscope system.

Vision: "MIMIC strives to provide consultation, services, training and equipment usage pertaining to microscopy and microanalysis for both MTSU and off-campus clients. MIMIC also collaborates with industrial and academic partners in solving problems in which nanoscale or microscale characterization plays a key role."
—Ngee Sing Chong, director

Center for Environmental Education (CEE)

www.mtsu.edu/mtsucee/index.shtml

The center is dedicated to improving environmental education in middle Tennessee and statewide, inspiring commitment about our environment and its inhabitants.

Work Sample: The Tennessee Amphibian Monitoring Program (TAMP) is an all-volunteer effort to assess the abundance of breeding populations of frogs and toads in Tennessee.

Did you know? The center's "Whale Man," Dr. Padgett Kelly, brings a 50-foot long, life-sized adult humpback whale model to middle Tennessee elementary schools in his "Whale of a Tale" program to teach landlocked students about life in the ocean.

Vision: "Environmental topics are gaining higher visibility in the media and in daily conversations of the general public. We hope that the CEE will continue to move people from awareness about the environment to action for the environment."
—Cindi Smith-Walters, codirector

Tennessee Center for Child Welfare (TCCW)

www.tccw.org

As the agency responsible for training the Tennessee Department of Children's Services (DCS) workforce and resource parents, TCCW and its partners bear a great deal of responsibility for the quality of child welfare practice in Tennessee.

Work Sample: One recent project involved evaluation of a new statewide effort called "multiple response" or "differential response," which retrains protective services employees to better determine the exact nature of abuse or neglect calls (many of which can be remedied by simply aligning families with helping agencies) before automatically sending investigators to homes.

Did you know? TCCW is the recipient of the largest grant awarded to MTSU, funded by the DCS.

Confucius Institute

www.mtsu.edu/cimtsu

The institute exists to enhance the understanding of Chinese language and culture, facilitate engagement with China, and create opportunities for exchange and collaboration between communities in Tennessee and China.

Work Sample: The institute provides teaching resources and offers assistance to interested K-12 schools developing Chinese language programs. It organizes summer camps, forges collaborations between schools in middle Tennessee and in China, and even recruits volunteer Chinese language teachers from China to teach at K-12 schools.

Did you know? MTSU's center was established in partnership with Hangzhou Normal University of China.

Vision: "The institute seeks to become a hub for China-related activities and a resource center for Chinese language, history, contemporary society, and culture."
—Guanping Zheng, director

MTSU

Mirror, Mirror

The MTSU Poll provides a semiannual glimpse into *who we are*

Ken Blake, Director of the Twice-Yearly

MTSU Poll, remembers an interesting call from the BBC in Great Britain, prompted by the dead-heat Senate race between Bob Corker and Harold Ford Jr. in 2006. “The whole world covered that race,” recalls Blake, who describes the independent, nonpartisan telephone poll conducted by MTSU College of Mass Communication students as “a mirror we hold up to the population—our goal is to make sure the mirror is accurate.”

Not every state is fortunate enough to have such a “mirror,” especially on a regular basis. Starting in fall 1998, the University’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

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.

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.”

Issues such as teacher tenure, illegal immigration, Muslims’ religious rights, and closing the budget gap were part of the spring 2011 poll. Results (available for view at www.mtsusurveygroup.org) based on calls made between February 14 and 26 to 589 adults chosen at random made headlines across the state. Blake and Reineke send out a press release after each poll, but the website also has the questions, responses, analyses, and raw data.

“We are very transparent and go for full disclosure. We consider that the data we collect is owned by the public,” Blake explains. Media across the state eagerly report on the findings, often doing follow-up stories as issues move into the forefront.

The availability of data over more than a decade fosters considerable research among faculty and graduate students. Two recent projects



by Suma Clark

illustrate the depth of information. Heather Duggin reported her work in her thesis last year: “Birthers and Belief Gaps: Ideology’s Influence on Knowledge of Barack Obama.” During Scholars Week 2011, Misa Culley presented initial findings about political affiliation and opinions on the economy in “Polarized Lenses: Party Identification and Ratings of the National Economy, 2001–2011” and took first place among Mass Communication graduate students. (She plans to complete her thesis in fall 2011.)

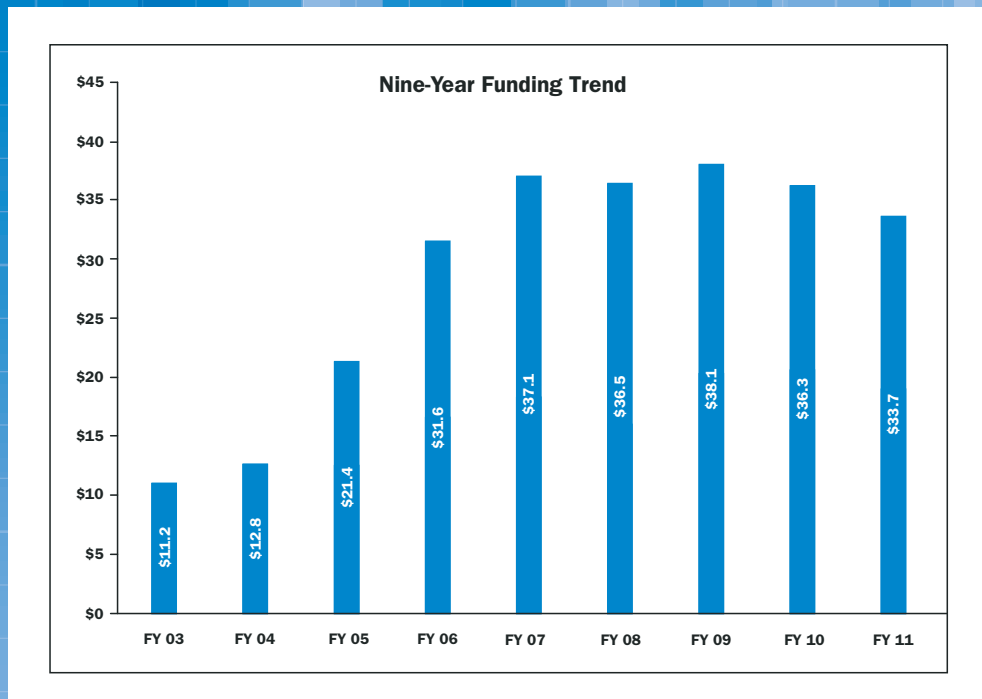
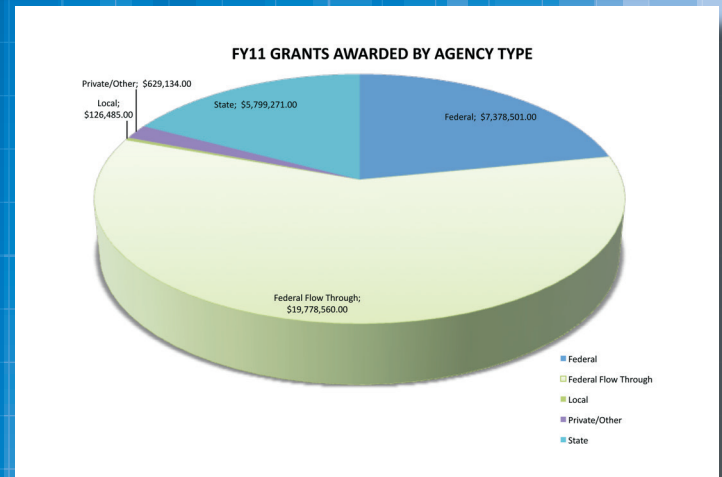
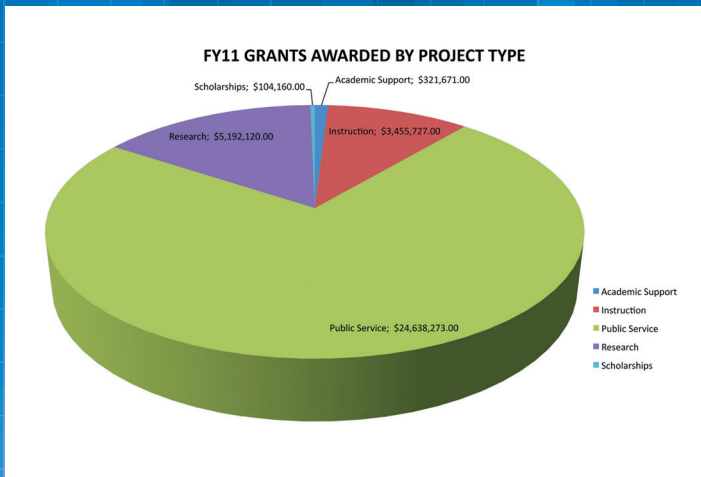
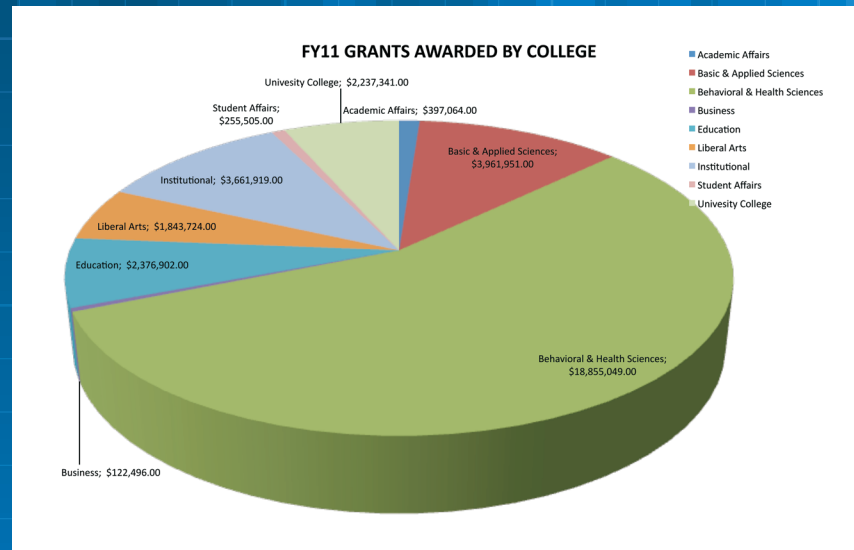
Planning and executing the polls is a year-round process that Blake and Reineke fit in around classes and research. “Things really get going at the first of each semester. We visit classes [such as Journalism 1020, American Media and Social Institutions] and explain to students what they will be doing. There is online registration for them to sign up for specific times to call,” says Blake, adding that close to 1,500 students participate each year. Callers—26 at a time—converge on a room in the Business and Aerospace Building shared with Management and Marketing. The computer gives them a number to call, and they follow a script that adapts to responses through the code Blake writes. He hopes the students “come away with the sense that they did something important.”

After the data is collected, Blake and Reineke analyze it and prepare a release. Blake, who started the poll with Bob Wyatt, says with a smile, “There’s a 12–24 hour period when we know things no one else in Tennessee knows.”

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](http://www.mtsu.edu)

By the Numbers

The financial landscape of MTSU research



MIDDLE TENNESSEE

STATE UNIVERSITY

1301 E. Main Street
Murfreesboro TN 37132

Non-profit
Organization
U. S. Postage
PAID
Permit 893
Nashville, TN

the proposal

for a new **MTSU science building** is at the **top** of the state of Tennessee's capital projects priorities list. Building it will **assist our entire regional economy** in its push to improve science education and **steer us ever closer to our goal of attracting more jobs of tomorrow** to middle Tennessee.



MTSU Science Building