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On the cover: A look inside Living Light, an award-winning, zero-energy house designed by UT students. Page 18

New UT center addresses learning disorders like autism and dyslexia. Page 24

Women’s literature and the Tunisia revolution. Page 10

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Jeffrey Moersch with the Mars rover. Page 02

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Business College #1 in Research Productivity

UT’s College of Business Administration ranks first worldwide in research productivity in the area of supply chain management and logistics according to the International Journal of Physical Distribution and Logistics Management. “The ranking illustrates that the UT faculty and students are unsurpassed as the world’s most productive supply chain management and logistics researchers,” said Ted Stank, Bruce Chair of Excellence in the Department of Marketing and Supply Chain Management. The ranking, which covers the 2008–2010 timeframe, evaluates research published in the discipline’s six leading journals. Also, faculty published two books in 2011, with five more to be printed in 2012.

Life on Mars

Two UT researchers are looking for potential habitats for life on Mars. Jeffrey Moersch (above) and Linda Kah, associate professors of earth and planetary sciences, are integral members of a NASA team working on the Curiosity rover, which launched from the Kennedy Space Center in late 2011. When the rover arrives on the Red Planet, it will search for clues indicating an environment capable of sustaining life, such as liquid or frozen water, organic compounds, and other chemical ingredients related to life. Kah, Moersch, and the rest of the science team will select targets for the rover to investigate each day and choose which instruments will examine modern Martian soils and sedimentary rocks.

Crossing Academic Borders to Improve Medical Education

A joint endeavor between Tami Wyatt and Matt Bell in the College of Nursing and Xueping Li and Yo Indranoi in the College of Engineering has produced a unique educational tool designed to increase the skills of health professionals. DocuCare is a software program that integrates electronic health records commonly used in hospitals and medical offices into a simulated learning environment for students. It puts nursing students into real-world scenarios by supplying fictional “patients” with fictitious medical histories created by the researchers in the form of electronic health records. The system has been purchased by Lippincott Williams & Wilkins, a leading international health care publisher, to be available internationally beginning in the fall of 2012.
Lab on a Chip

Jayne Wu, associate professor of computer science and electrical engineering, and Shigetoshi Eda, associate professor of forestry, wildlife, and fisheries at the UT Institute of Agriculture, have developed a portable device that can be used to quickly detect infectious diseases, pathogens, and physiological conditions in people and animals. All that’s needed is a droplet of blood to place on a microchip within the device. The microchip is treated with disease-specific antigens—a toxin or other foreign substance that induces an immune response—and captures disease-specific antibodies in the blood. If the antigens and antibodies match, the device confirms that the patient or animal is infected. The results are available in a matter of minutes, which can be crucial to stopping an epidemic and saving lives.

XSEDE

UT Joins XSEDE Supercomputing Project

UT’s National Institute for Computational Sciences (NICS) has been awarded $18 million to help create a new generation of linkages among high-performance computers and research facilities across the nation. The new supercomputing grid will create a powerful tool for taking on some of the most complex problems in science. The five-year program, called Extreme Science and Engineering Discovery Environment (XSEDE), will replace the TeraGrid linkage that now connects the country’s supercomputing resources. NICS scientists, specialists, and software developers will participate in the project, partnering with the University of Illinois, the lead institution on XSEDE.

RECENTLY PUBLISHED

Lisi Schoenbach, 
**Pragmatic Modernism. New York: Oxford University Press, 2012.** Challenging the prevailing view that modernism was uniformly oppositional and anti-institutional, Schoenbach traces an alternative strain of modernist thought that grows out of pragmatist philosophy and is characterized by its commitment to gradualism, continuity, and recontextualization.

Jana Morgan, 
**Bankrupt Representation and Party System Collapse. University Park: Penn State University Press, 2011.** In recent decades, Bolivia, Colombia, Italy, and Venezuela have all faced the turmoil and democratic crisis of party system collapse. Morgan examines the causes of such collapse through a detailed examination of Venezuela’s traumatic party system decay, as well as comparative analysis of seven other countries.

Chad Black, 
**The Limits of Gender Domination: Women, the Law, and Political Crisis in Quito, 1765–1830. Albuquerque: University of New Mexico Press, 2011.** This study, based on a vast range of legal sources, examines how women in Quito where able to exploit traditional legal culture, based on practices of consultation, negotiation, and contingency, to resist male domination surprisingly successfully and of how the coming of independence in the early nineteenth century deprived them of this legal culture and left them open to much more aggressive subjugation to male power.

C. Neal Stewart Jr., 
**Research Ethics for Scientists: A Companion for Students. West Sussex: Wiley, 2011.** This book is about best practices in all the major areas of research management and practice that are common to scientific researchers, especially those in academia. Aimed toward the younger scientist, it critically examines the key areas that continue to plague even experienced and well-meaning science professionals.

Flavia Brizio-Skov, ed., 
**Popular Italian Cinema: Culture and Politics in a Postwar Society. London: I.B. Tauris Academic Studies, 2011.** This book shows how popular film genres like horror films, Italian comedy, and spaghetti westerns are interconnected with the political and cultural currents in their moments of history and how they serve as sophisticated instruments for both representing and shaping collective attitudes toward the seismic social changes occurring from the end of World War II to the turmoil of the 1960s and 1970s.

Marvelene C. Moore, 
**Critical Essays in Music Education. London: Ashgate, 2012.** This volume of essays references traditional and contemporary thought on theory and practice in music education for all age groups, from the very young to the elderly. The material spans a broad range of subject areas, from history and philosophy to art and music, and addresses issues such as curriculum, pedagogy, assessment, and evaluation, as well as current issues in technology and performance standards.
It’s difficult—not to mention a bit disconcerting—to imagine Supreme Court Justice Samuel Alito rocking out to “The Promised Land” at Asbury Park or his colleague Antonin Scalia smoking cigarettes while listening to Blood on the Tracks on constant repeat in the small hours of the morning. Yet, according to UT law professor Alex Long, law professionals—from Supreme Court justices to small-town attorneys—have integrated popular music and song lyrics into many judicial decisions and legal writings. How this tactic can bolster or detract from an argument—as well as what the popularity of certain genres and musicians can tell us about the people in the legal profession—are the core of Long’s recent research.

Using popular material to drive home a point in the courtroom or put an artistic flourish on a written opinion is not a new practice. Lawyers have quoted the Bible for centuries, and other works, like Gilbert and Sullivan musicals, have been cited in legal papers.

Long published papers in the Fordham Urban Law and Washington and Lee Law Review journals about the use of song lyrics in legal writing, including cases and scholarly articles. Sometimes songs are used to inject life or humor into an otherwise dry document; sometimes they are more self-serving, inserted to demonstrate that despite being a member of a profession that is synonymous with “bland,” this attorney isn’t at all like the stereotype (no, really!). However, occasionally a judge or lawyer will try to make a point with a lyric that just falls completely flat, Long says.

Some notable examples he discovered were a judge’s opinion that was meant to be sung to the tune of a LeAnn Rimes song and an uncomfortable incident in which a judge had to explain a Ludacris song to a court reporter who had confused her homonyms and peppered the transcript with the word “hoe.”

“I think sometimes lawyers and judges are trying to make connections between lyrics and facts in a case that are just a real stretch,” Long says. “I found an example in which the judge goes to extraordinary lengths to work in Pink Floyd’s ‘Another Brick in the
Wall,” and you read it and think, ‘I don’t need this sort of explanation; I don’t need this sort of connection.’”

Long freely admits to disliking Pink Floyd and thus “probably thinking less” of an argument that used the band’s lyrics to make a point. This brings up another pitfall of using music in legal writing: the wide variety of personal reactions that people have to music and musicians.

“I think there’s a risk when you quote any particular artist because the artist’s identity may trample the meaning the judge or lawyer is trying to convey, or the reader may just be put off by the identity of the songwriter in a way that detracts from the message,” Long says. He declines to even speculate on what would happen if he came across an article quoting Phil Collins. (However, Long acknowledges that others might have a similar reaction to the references he often makes to Guided By Voices, one of his favorite bands).

Music for the Masses?

Bob Dylan, Long says, is by far the most popular songwriter among lawyers and judges, cited 186 times in court filings and law journals. Dylan far surpassed the second most popular source, the Beatles, who appeared seventy-four times. Other favorites include Bruce Springsteen, Paul Simon, and Johnny Cash (there was a disappointing, though not surprising, lack of love for Elvis Presley in the works that Long reviewed). Many of the top musicians are or were folk singers; in contrast, rap and country artists (Cash being the exception) turned up rarely.

A few general characteristics about the legal profession can be inferred from these findings. One is that most lawyers and judges came of age in the 1960s and 1970s, which, given overall population demographics, is to be expected. Another is that they are most likely white and male. This, too, is correct: according to the American Bar Association, in 2004, 73 percent of attorneys were male and 88.8 percent were non-Hispanic white. Such a relatively homogenous group inevitably draws upon the same store of cultural references.

Dylan’s popularity among this demographic is obvious, Long says. “Dylan was the spokesperson for a movement that happened during the youth of many of today’s lawyers and judges, so he’s the first person they think of...Dylan is also a good storyteller, and lawyers are natural storytellers. Dylan is talking about concepts everyone can relate to—justice and fairness—that lend themselves to the law.”

However, the overwhelming preference for folk over country and rap indicates that lawyers and judges may hail from a background different from that of most Americans, particularly most of the criminals they represent, prosecute, or judge. Folk music, Long says, started out as populist, but it soon became the domain of middle- and upper-class intellectuals, with some of its most famous songwriters (for example, Paul Simon and Pete Seeger) coming from these social classes. Arguably, many folk singers are educated, talented storytellers in general, making their lyrics stand out from the rest in terms of quality. Also, folk songs often praise the universal ideal of justice, whereas country and rap songs often speak to the emotions and situations of specific groups of people.

Long says this difference between these genres of music underscores an important disparity in the legal profession. While everyone can comprehend the concepts of justice and fairness in theory, lawyers and judges may not really be able to understand them in relation to people in situations different from their own. Alito, for example, stated at his Senate confirmation hearing that he’s a Springsteen fan. Senator Richard Durbin then pointed out a judicial ruling of Alito’s—a decision regarding the trial of a black man by an all-white jury—that he felt ran counter to Springsteen’s central ethos of fairness. Thus, while the ideals of Springsteen, Cash, and folk singers may represent something for lawyers to aspire to, it’s not clear if they are putting the spirit of their songs into action.

Regardless, Long says the fact that Supreme Court justices are inserting song lyrics into their writing implies that it’s becoming an acceptable practice. He’s interested to see which songwriters the coming generations of lawyers and judges will favor. Will the legal records of the future contain references to R.E.M. and Drive-By Truckers, or will Britney Spears and Justin Bieber dominate?

“Only time will tell.”—Rock supergroup Asia (1982)

Bruce Springsteen is one of the most popular songwriters and performers among lawyers and judges. Bob Dylan is the most popular, cited 186 times in court filings and law journals. Dylan far surpassed the second most popular source, the Beatles, who appeared seventy-four times.
THE BEST
HOW MICHAEL BEST’S AUTOTAXIN
Organic chemists like Michael Best—here with a molecular model of the autotaxin inhibitor he is developing—love the thrill of piecing together molecular puzzles. Yet perhaps the most confounding puzzle remains unsolved: cancer.
People build many things—bridges, buildings, furniture, websites.

Michael Best builds molecules—on paper in elaborate configurations and in the laboratory using chemical synthesis.

“In many ways it is a puzzle,” says the associate professor of organic chemistry. “There are many ways on paper you can make molecules, but only some of the ways are going to work.”

Best says making molecules is an art form. Some organic chemists can make one using ten reactions while it may take others thirty or more. Some organic chemists are skilled, efficient, and creative—while some are lifesavers. They are the ones, like Best, who make molecules that serve as vehicles for stopping or decoding disease.

Organic chemists love the thrill of piecing together these molecular puzzles. Yet perhaps the most confounding puzzle remains unsolved: cancer.

“Cancer is a really difficult target,” Best says. “It is something that’s proven very difficult to control. In many ways, we understand it well. At the same time, it’s such a complicated disease.”

The disease is elusive and not unlike a cockroach. Whereas scientists might think they have exterminated it by blocking its pathway, it finds a way around the barrier to proliferate and emerge in droves.

Best is determined to not only understand cancer, but to try and stop it.

He’s one of the first to dare try and succeed at developing something called an “autotaxin inhibitor.” Autotaxin is a protein that catalyzes a reaction (also called an enzyme) that initiates cell growth. In certain cases, the enzyme gets over-stimulated and produces too much of a lipid called LPA, which promotes abnormal cell growth. This leads to cancer.

In 2007, Best dreamed of developing a molecule that would inhibit autotaxin from producing too much LPA.

“In many ways it is a puzzle. There are many ways on paper you can make molecules, but only some of the ways are going to work.”
by having it instead bind to autotaxin, thus blocking the normal pathway. At the time, this was nothing but unattainable.

“There were no molecules that had the potential to be useful as medicines,” he says. “Inhibitors that were known at the time were other lipids, which would have never worked because they do not possess the pharmacological properties needed to be effective as drugs. Therefore, a new approach was needed to identify inhibitors that could be effective as medicines.”

At a conference, Best met a computational bioorganic chemist from the University of Memphis named Abby Parrill who shared the same goal as him: to develop the elusive autotaxin inhibitor. The two joined forces.

As an organic chemist, Best is skilled at making molecules but was having difficulty developing the target molecule. According to him, he could “sit around and make molecules all day, but waste a lot of time” because he was unable to predict which structures would work. Parrill eradicated this problem by creating computational models that quickly and easily selected the molecules Best wanted.

“The major advancements in technology are allowing us to make significant progress in science these days,” says Best. “It’s a really complicated problem to develop these molecular compounds, and it requires expertise in different areas, but today we can combine expertise to tackle major scientific problems.”

Their plan of action involves using computational models and synthetic organic chemistry to screen and identify effective structures.

First, Parrill’s model screened out random molecules to identify a “lead” molecule as an inhibitor. Then, Best used this lead model as a baseline to map out approximately sixty slightly different molecules that could be even more effective at blocking the enzyme. He then sent his designs to Memphis to run through Parrill’s model to predict the molecules’ behavior.

Based on these predictions, Best synthesized a series of molecules and tested them for potency using an “enzyme assay.” An enzyme is a protein that catalyzes the conversion of a starting material molecule into a product molecule. In the assay, Best combined the protein and its starting material in the presence and absence of the inhibitor, measuring the difference in how much enzyme is left.

Among the variants, 75 percent of the molecules worked well in blocking the enzyme. One was almost 100 percent effective in blocking it—pushing Best and Parrill to the cutting edge of developing a cure for cancer.

“We were among the first to develop an autotaxin inhibitor for therapeutic potential,” Best says. Still, he approaches his discovery with cautious optimism. Drug approvals from the Food and Drug Administration can take nearly a decade and cost millions of dollars to test for items such as bioavailability, metabolic half-life, and side effects.

Best is continuing to evaluate the viability of his inhibitor before talking with pharmaceutical companies about potential licensing opportunities. He is also working to identify which proteins could be responsible for triggering certain diseases, among other projects.

“In science, there is no shortage of challenges,” Best says. There is also no shortage of puzzles to be pieced together to tackle these challenges. However, through interdisciplinary collaboration and technological advancements, Best is working to manipulate the pieces to solve puzzles that will benefit all of society.
It’s understandable why, given its neighbors in North Africa, Tunisia escaped much attention until last year. Its recent history is less bloody and tumultuous than that of Algeria, its leaders lacked the outsized, tabloid-ready personality of Libya’s Muammar Gaddafi, and none of its cities were enshrined in classic Hollywood films like _Casablanca_. In fact, with its largely secular government and a constitution that protects women’s rights and other civil liberties, Tunisia was often perceived as one of the most stable and progressive countries in the region.

So when a sudden series of popular uprisings in January 2011 made Tunisia a focus of international attention, even those with close ties to the country—like Douja Mamelouk, a UT assistant professor of French and Arabic—were shocked.

After following the revolution in real time through social media and engaging in continually evolving discussions on the country with other academics, Mamelouk—who was born and raised in Tunisia—decided to explore the situation further. She expanded her research on Tunisian women’s literature to include an examination of how, prior to the revolution, some of the most published female authors in Tunisia expressed their unhappiness with the country’s political and social systems through their novels.

“Before the revolution, writing by Tunisian women expressed a discontent with masculinity and the state of the country, which were interconnected,” Mamelouk says. “Masculinity is linked to patriarchy, which in turn is linked to dictatorship.”

Decades of Dictatorship
According to Mamelouk, Tunisia’s longstanding reputation as a progressive country is complicated by the gap between the liberal laws laid out in its constitution and the extent to which they are respected and
When the country gained its independence from France in 1956, its new government, headed by Habib Bourguiba, drafted a constitution that included a variety of protections for women, including statutes giving women equal rights during divorce proceedings and a ban on polygamy.

Over the past half-century, Tunisia has developed what is arguably the best educational system in the Arab world, and women have a strong presence in the workforce at all professional levels.

In 1987 Bourguiba was ousted from his position as president. His successor, former military officer Zine el-Abidine Ben Ali, was widely criticized as a dictator who ignored the country’s laws and turned Tunisia into a police state where human rights were frequently disregarded.

“To Ben Ali, Tunisia existed to fulfill his personal needs and the needs of his wife and family,” Mamelouk says. She adds that during Ben Ali’s rule, corruption was rampant, and there was little, if any, objective news reporting to expose or criticize his activities.

Ben Ali’s twenty-three-year autocratic rule—which ended in 2011 when the uprisings prompted him to flee to Saudi Arabia—has spanned most of Mamelouk’s life. Born to a Tunisian father and an American mother, Mamelouk grew up in Tunisia before leaving to attend college at Willamette University in Oregon.

Tunisians might not have been happy with Ben Ali, but it was impossible to imagine the country without him, she says. “To me, the revolution was beyond a surprise—it was a huge shock. When you grow up in a dictatorship, you never think that the country could exist without this leader whose pictures are everywhere.”

Taking a Closer Look

Traditional media outlets in Tunisia were largely silenced during the Ben Ali era, but in the past few years, regular Tunisians have been using social media to tell their stories. Facebook, Twitter, and YouTube became venues for the public to post criticisms of the political system and call for change. Social media sites also helped protesters organize demonstrations and keep up with developments during the revolution.

Online networks also helped Tunisian expatriates like Mamelouk stay informed about the developments in their home country. Before the revolution, Mamelouk did not have much of a presence on social media sites, but when unrest spread in Tunisia, she found Facebook to be a valuable resource for news and discussion.

These conversations and her personal interest in the uprisings spurred Mamelouk to expand her own research, which focuses on the themes of identity and self-expression in novels written by Tunisian women. Having received a bachelor’s degree in political science, Mamelouk drew upon that background to look at how politics also figured into women’s writing.

“Women couldn’t come out and voice their opinions,” she says. “One theme in Tunisian novels is the difference between what women say at home and what they say in public.”

Even before the revolution, female authors were expressing unhappiness with Tunisia’s political system and the expression of masculinity in its society; they wanted Tunisians to rethink their concepts of male identity, Mamelouk says. In the past, it was risky to voice criticisms of the country’s social and political structures, but the recent changes in the government have ushered in an atmosphere of freer speech. Mamelouk believes Tunisian authors will take this opportunity to address these issues more directly.

“We’re going through a period of rehashing the past and saying all the things we couldn’t say before. There will probably be a lot of discontent in the literature with the present, too, because we have a democracy now and everyone has an opinion,” Mamelouk says. “That opinion will be expressed in the literature.”
In a world that increasingly needs clean and secure energy supplies, fuel cells may be a substantial part of the answer.

“A fuel cell is a device that converts the chemical energy inside a fuel into electrical energy,” says Tom Zawodzinski, UT-ORNL Governor’s Chair Professor of Chemical and Biomolecular Engineering. For instance, given a constant source of hydrogen and oxygen, fuel cells will continuously produce electricity. They don’t need slow recharging, like batteries, and they work for long periods without wearing out.

Although most hydrogen is currently derived from natural gas, it can also come from renewable sources. If so, there is no finite, increasingly expensive-to-extract fuel source, like oil; and there is no greenhouse-gas byproduct, like carbon dioxide. Cars powered by fuel cells will have a range of 300 to 400 miles, greater than the 100-mile range of today’s electric cars.

But like many sustainable solutions, there’s a price to pay. Fuel cells are currently much more expensive than conventional engines. However, recent work by the US Department of Energy has lowered the gap between mass production target cost ($35 per kW) and projected cost ($49 per kW).

A fuel cell is gloriously simple: two electrodes sandwiched around an electrolyte. Oxygen passes over one electrode and hydrogen over the other, generating electricity, water, and heat.

Throughout his career, Zawodzinski has worked to make fuel cells more efficient and longer-lasting. He
began basic research on polymer electrolyte membrane fuel cells at Los Alamos National Laboratory. His work focused on real-world applications and engaged several prominent industrial partners.

He later moved to Case Western Reserve University, where he worked with 3M Company to develop polymer electrolytes and electrode structures. Both basic and applied work on fuel cells are part of his Governor’s Chair position with UT and Oak Ridge National Laboratory (ORNL), which he began in 2009.

“We work on the core of fuel cells,” he says. “For example, what are the molecular-level details for the protons and water motion in the membranes? How can we make the reactions occur faster? How can we design materials to make these things happen?”

Zawodzinski examines various combinations of fuel cell technologies, from the fundamental to the applied. “We study how molecules wobble, and we also build devices,” he says. In his labs, researchers are experimenting with fuel cell catalysts to replace expensive platinum. “We’re working with complexes that mimic biological systems, such as enzymes.”

His energy-related work is not limited to automotive fuel cells, however. Zawodzinski is also working on redox flow batteries, which are somewhat similar to large-scale fuel cells. One of these batteries could be the size of a department store and able to supply more than a megawatt of power storage—enough to power several hospitals. These batteries are useful backups for renewable—but intermittent—energies, such as wind or solar energy. Zawodzinski is collaborating on redox flow batteries with mechanical engineer Matthew Mench, who directs UT’s Fuel Cell Dynamics and Diagnostics Laboratory.

“By redesigning the cell—changing the way the active ‘fuel’ is delivered into its electrodes—we’ve improved the peak power density by a factor of ten to twenty,” says Zawodzinski. “Now we’re working for further improvements by changing the materials in the vanadium redox battery. This would translate into greater power at a given efficiency and lower cost. These innovations are transferable to other battery chemistries besides vanadium.”

On still another front, he is working with the Center for Renewable Carbon at the UT Institute of Agriculture. The goal is to use electrochemical technology to convert biomass into more useful fuels or chemical products.

Since coming to Tennessee, Zawodzinski has helped land a $20 million National Science Foundation grant—Tennessee Solar Conversion and Storage using Outreach, Research, and Education (TN-SCORE)—to boost Tennessee’s energy-related research and education efforts. Summer internships have employed students from UT’s “Chem-E Car” team, who design radio-controlled cars that incorporate fuel cell technologies. “We’re designing and building our own fuel cells. This gives students the opportunity to see both research and its practical realization,” he says.

Zawodzinski knows that complex problems are solved not just through brainwork or computer simulations, but also through old-fashioned, hands-on trial and error. He is working to create a 3,000-square-foot laboratory in the Dougherty Engineering Building where students can use research-grade instruments and machines to try things out.

“Tinkerers are wanted,” says Zawodzinski. “This will be a multipurpose lab for research and old-fashioned, hands-on engineering.

“For instance, a box about the size of a microwave oven (or two) will power a car in 2015. The power, though, comes from flexible plastic coated with a catalyst. It doesn’t have to be configured into a box. What if you wanted to put the power source into the arm of a robot or the sleeve of a jacket? Companies donate equipment and materials to us, and we will let people try things out.”

His Governor’s Chair appointment allows Zawodzinski to tap the resources of both ORNL and UT. “This provides the nucleus to help grow the research,” he says. “Every piece adds to what we have. Matthew Mench recently joined UT; his work, together with mine, forms a cluster that keeps expanding. That’s what we’re after.

“We feel we’re world-class. And there’s strength in numbers. We’re going to build something great and extend the research infrastructure across the state.”
Dissecting the Crusades

MACARTHUR FELLOW AND UT PROFESSOR JAY RUBENSTEIN DISCUSSES THE CRUSADES AND MODERN CONFLICT  By Dennis McCarthy

Jay Rubenstein—Rhodes Scholar, history professor, and only the second UT faculty member to have won the prestigious MacArthur Fellowship—published the book *Armies of Heaven: The First Crusade and the Quest for Apocalypse* in late 2011. We recently enjoyed having coffee with Rubenstein, talking mostly about the Crusades and the “Clash of Civilizations.”

**Quest:** You wanted to be a novelist, not a historian, when you were a kid?

**Jay Rubenstein:** That’s right. I started a novel in the fourth grade and wrote about thirty pages before giving up. In high school, I wrote two epic fantasy novels.

**Fantasy novelist . . . historian? I guess there’s a connection.**

In college, I expected to major in English. I also wanted to spend a semester in England, but there were only two programs that allowed you to do that—one in theater and the other in medieval studies. I didn’t think theater would work out, so I went with medieval studies. I took a medieval history class and just kept taking more. It helped that I had an excellent advisor.

So not wanting to be a thespian led you down the history track. What have you learned from that? What has history taught you?

The most common thing people say about history is that if you don’t remember the mistakes of the past, you’re doomed to repeat them. I don’t think that’s true. I think we either make new mistakes or we look at mistakes of the past and say, “Those don’t apply to me this time.” I’m not sure anyone ever learns that much from history. You can’t use history to say with clarity that this is what we should or shouldn’t do. We can use history only to comment on what is already done. That said, there are a few no-brainers that people ought to pay attention to but don’t.

**Such as?**

Sunny and Shia don’t really get along, for one. And not everyone wants to be a Western democratic capitalist. The mistakes of the last ten years happened largely because we assumed that everyone in the world wants to be just like us.
Detail from the Temple Church in London, built by the Knights Templar during the Crusades in the twelfth century
Do you think historians in the future will look back on the current conflict between radical Muslims and the West—what Samuel Huntington called the “Clash of Civilizations”—and see a major historical shift, or will they see only a blip on the radar?

I suspect we’ll look back on this period as a transformative time, with the clash being a part of it. The information revolution, the embrace of globalization as an economic and political philosophy, the clash of ideologies, defined partly on religious and partly on cultural bases—all these factors will be recognized as important. People will look back and say, “Yeah, that was a time when everything changed.

But are we changing for the better? Clearly we have progressed technologically. We’re healthier and have a higher standard of living. For the most part, folks in the West no longer enslave one another. But the twentieth century was a grim period for the West. The level of slaughter was horrific. Are we wiser? Are we more morally advanced? Have we gained any ground ethically and spiritually since the Crusades?

We have more information, and while we’re not dying wholesale as we did in the past, we are killing wholesale. One of the things that attracted me to medieval history was its irrelevance. If you were studying the French Revolution, you were also dealing with the Cold War; but if you were writing about the Middle Ages, you didn’t have to concern yourself with a modern political agenda.

My advisor in college would make the compelling argument that there was no Holocaust during the Middle Ages, no genocide, no atomic bomb, no apartheid, and that we have regressed since then. I’m not as comfortable with that argument today after having researched the underbelly of the Middle Ages. Crusaders committed horrific crimes against the Jews, for instance, although nothing on the scale of what we have done in the modern world.

If the Crusaders had today’s technology, would their crimes have been just as brutal?

Oh, yes. One of the themes of my work has been that the Crusades were genuinely horrific—especially the First Crusade. They weren’t business as usual. They weren’t about acquiring territory or increasing wealth—although some Crusaders did fight with those motives. The ideological basis of the Crusades was to purify the land of unbelief, not to exploit its resources. It’s an ideology that justifies genocide. The mindset that would allow you to cut off an enemy’s head with your sword is very different from the drone warfare mindset of today. With drones, you are disconnected from the act of violence. To make the decision to enter a city like Jerusalem—which was larger than any city the Crusaders had known—and to kill everyone within it requires an ideological commitment.

You once said that after the Crusades, everything was different. What did you mean by that?

The First Crusade is like the end of the Cold War or the French Revolution. It’s one of those moments in history that is truly transformative. After the First Crusade, warfare became a large-scale enterprise, and it was much more brutal. Atrocities happen in a territorial war, but in ideological warfare, atrocities happen as a matter of principle. In an ironic way, the First Crusade also created a sense of shared achievement among the people who stayed in Europe. When the victory was celebrated back home, people said, “Look what we’ve done!”

The Crusade also helped to define Europe as a common people, a common culture—Christendom—in opposition to everything that was Eastern. Christendom was expected to spread out and take over the world, in a Fukuyama-like sense, bringing an end to history.

The First Crusade was also an apocalyptic event. Before the First Crusade, the standard interpretation of the apocalypse was that it would come when it would come and there was nothing anyone could do to affect the timing. God would work his will. The First
Crusade, however, created among contemporary historians and theologians the notion that humans could activate God’s plan. History was no longer just one event following another. Instead, history was leading to the apocalypse, and we had the capacity to bring it about.

**What impact did the Crusades have on the Muslim world?**

Initially, I don’t think Muslims took a lot of notice. Eventually, and to their surprise, however, they saw the Crusaders as religious fanatics intent on conquering Jerusalem. The long-term impact was that the Crusades reinvented the concept of the jihad in the Muslim world. Jerusalem fell to the Crusaders in 1099. Beginning around 1130 or 1140, Muslim leaders adopted the rhetoric of the holy war as an ideological rallying point, much as the Crusaders had. Saladin, the great Muslim leader, effectively used jihad to almost wipe out the Crusader states that had grown up in the century after the First Crusade.

**Do you think Muslims were humiliated by the success of the First Crusade? After all, they were in many ways more sophisticated than Westerners and couldn’t have been happy about these outlanders driving them from their lands.**

I don’t know if it’s right to say they were humiliated. From the Muslim perspective, the Crusaders were just another frontier army that had come through and had some surprising successes, but the locals still expected to take care of these intruders fairly quickly. At the same time, however, the great Sunni and Shia cultures were so internally fragmented that there was no possibility of a concerted response.

**How about today? Do the Crusades have currency among contemporary Muslims? Are Muslim kids who are burning cars in Paris angry about the Crusades?**

Bear in mind that I’m no expert on contemporary Muslim thought, but it’s pretty obvious that the most radical elements in the Muslim world do use the language of Crusade deliberately. It’s no secret that almost all the Muslims in Jerusalem were killed in 1099, and it’s easy to use that as justification to commit atrocities today. For the next several centuries after the Crusades, the Muslim world didn’t talk much about it, however. It wasn’t an open wound for them, in part because they eventually won. The Crusaders were driven out and never returned.

The Muslims at the time were more concerned about driving out the Mongols, which was a much more pressing problem than driving out the Crusaders. It was really not until the nineteenth century—when Europeans began to celebrate the Crusades—that Muslims began to use resistance to Crusade as a metaphor for resistance to colonialism, especially after the fall of the Ottoman Empire and European expansion into the Middle East. When General [Edmund] Allenby marched into Jerusalem, liberating the city from Ottoman control in World War I, he instructed people not to talk about the Crusades. Newspaper headlines the next day, however, read, “Richard the Lionheart Returns,” “Crusaders Are Back in Jerusalem.”

Today, the Crusades are an even more obvious comparison, especially considering the establishment of Israel in 1948 and the 1967 War. The ‘67 War was fought over the same territories as the Crusades were. From the typical American perspective, Israel was returning to the Promised Land. From the Arab perspective, the Jews were the new Crusaders, occupying what had been Muslim or Arab territory for 1,800 years. Whether it’s right or wrong, it’s just hard to avoid the analogies.

My most revelatory moment in understanding the First Crusade happened in Jerusalem a few years ago during a riot. I was at the Temple Mount and could see the Dome of the Rock and Al Aqsa Mosque, two major historic Muslim shrines. As I looked down at the Western Wall and saw all the Orthodox Jews in prayer, I knew that many of them were praying that the buildings on the Mount would be destroyed so that they could rebuild the Temple, which had been razed nearly two millennia before. At that moment, I realized why this conflict really is so intractable.
THE HOUSE OF TOMORROW

Living Light
IN UT’S ZERO ENERGY HOME
By Lola Alapo

Living Light,
UT’s solar-powered home, is a marriage of the past and the present. It’s also a model for the future.

The 750-square-foot house is reminiscent of the region’s cantilever barns of yesteryear—from its overhang to the two wooden support cores.

It integrates modern technologies that enable the “zero-energy” house to produce more power than it consumes.

As a result, future builders and homeowners who incorporate similar technologies could use the surplus energy generated to run an electric vehicle charging system. They also could sell the power back to the grid.
The two-year Living Light project involved more than 200 students and twenty-four faculty members from nine academic disciplines to plan, design, and build the structure that would compete in the US Department of Energy’s 2011 Solar Decathlon. Living Light captured third in engineering, fifth in architecture, and third in the use of energy-efficient appliances. The UT team also tied for first place in the cornerstone area of the competition, the Energy Balance Contest, and wound up placing eighth overall out of the twenty teams invited to compete.

“We were proud of our outcome in DC,” says Professor Edgar Stach, one of the primary leaders of the project. “The high caliber of our faculty and the enthusiasm and dedication of our students allowed us to excel in several of the individual events, placing in the top five in five categories. They took the project from conception to implementation and devised new methodologies for energy-efficient construction and design.”

Project architect Megan Chafin says one of the challenges was to design an energy-efficient glass house. Typically, energy-efficient homes are built with thick walls and few windows.

“We wanted a home that had a lot of natural light and a lot of views to the outside,” Chafin says.

To accomplish this goal, the Living Light team created a double façade system that makes the home’s windows part of its heating and cooling mechanism. The system is composed of a single pane of glass on the outside and insulated, suspended film glass on the inside. Between the layers is an air space.

In the winter, air within the cavity is preheated by the sun on the south side. The warmed air is brought inside the home and then exhausted on the north façade where there usually is heat loss. The system is then reversed in the summer so the house pulls air from the relatively cooler north side and exhausts it out of the south side.

For Living Light’s solar panels, which are positioned over the roof, the team used cylindrical glass tubes that have a thin, photovoltaic film wrapped 360 degrees inside.

“We used off-the-shelf products and made them into new configurations,” project manager Amy Howard says.

“We were striving for new ways to become energy-efficient.”

Typical flat plate solar panels are set at a specific angle and capture direct sunlight during the peak time of the day. Using the cylindrical tubes allows Living Light to capture direct sunlight throughout the day, no matter where the sun is in the sky. It also captures reflected and diffused sunlight. All this produces more power over the course of the day.

Another of the house’s unique features is an intuitive touch pad interface, which controls everything from the blinds and mechanical system to the television and lighting. The touch pad is preset with different “moods.”

“When you leave your house, you can push the ‘day mood’ so everything can change at once,” Chafin says. “Your temperature will be set, and your blinds will all be set the way you want them while you’re away from the home.”

Plus, it has a fun UT mood, “where the orange and white checkerboard lights flash on the floor,” Chafin says.

The interface is able to monitor all the house’s appliances and energy consumption and production. Project engineer Steven Coley says incorporating a similar system into homes can show families how much money they’re spending on laundry, heating, cooling, and cooking, which “can help us start making informed decisions about energy usage.”

The house will continue to be a vehicle for learning as it embarks on a multi-city tour of Tennessee this year.

“We are using the Living Light house as way to directly demonstrate to Tennesseans how to build or retrofit buildings to create sustainable buildings that create energy savings,” says Stach.
The Living Light team created a double façade system that makes the home's windows part of its heating and cooling mechanism. The system is composed of a single pane of glass on the outside and insulated, suspended film glass on the inside.

After a stormy day, the Living Light house shines brightly at night for the Solar Decathlon at West Potomac Park in Washington, DC.
Steven Coley and Colby Jarrett complete the day’s laundry task, part of the Appliances Contest in the 2011 Solar Decathlon.
LEARNING EXPERIENCE

KLASS CENTER RESEARCH FOCUSES ON LEARNING DISORDERS

By Meredith McGroarty
In the past few decades, terms like *autism* and *dyslexia* have become part of our everyday vocabulary.

But even as public awareness grows about these and other learning disorders, questions about how best to identify and treat them remain.

UT recently opened a center designed not only to conduct research on learning disorders and their remedies, but also to treat students affected with these disorders and find ways to help them learn more successfully. The Korn Learning Assessment and Social Skills Center, or the KLASS Center, is part of the Department of Educational Psychology and Counseling in the College of Education, Health, and Human Sciences.

“KLASS provides services to clients who have problems with learning, offers outreach to the community, and conducts research in some areas of learning skills and assessment,” says Director Brian Wilhoit.

The center, which opened in 2009, is the result of a $2 million donation by East Tennessee couple Tom and Pam Korn, who have an adult son who has struggled with learning disorders. After some deliberation, they decided to establish a center that carries personal significance to them.

The term *learning disability* has become a catchall phrase used by the general public that comprises a wide range of mental conditions, from mild dyslexia to autism spectrum disorders. The center focuses on difficulties that, according to Wilhoit, “interfere with or have an impact on a student’s learning.” The treatment of mental illnesses like depression or schizophrenia is not part of its scope, though staff will refer clients to other professionals who can treat those conditions. The center can, however, help address learning difficulties that might result from a condition like depression.

The KLASS Center offers a variety of clinical services directly to individuals, including assessment and diagnostic testing of cognitive abilities, interventions to address learning problems, academic tutoring, some counseling services, and training and consultation for parents, teachers, and other professionals. Students at all educational stages, from pre-K to postsecondary, are welcome; the center’s clients have ranged in age from 2 to 55 years.

“As part of the clinical services we provide, the fourth-year doctoral students spend a year of practicum in the clinic part of the center providing evaluations and other services for kids and college students who have learning disorders,” Wilhoit says. “We also have a few predoctoral interns who have a year of internship after completing their doctoral program, so there’s a significant amount of training conducted here through the program.”

In addition to these direct services, the KLASS Center also partners with schools in the area to conduct research-based work. Wilhoit explains that the center will typically receive a call from a teacher or administrator looking for help with a particular difficulty, either in the classroom in general or with certain students. A graduate student will usually go to the school and speak with the teacher or administrator to assess the situation and then develop and implement an intervention for that difficulty. In the process, the student collects research data about the project that can be used in other research work.

Wilhoit says faculty and students at the center also conduct general research on various technology-based interventions; for example, using a cell phone timer to cue students back on task or using a software program to increase reading and writing skills for children with difficulties.

Dennis Ciancio, a research assistant professor at the center, is one of the faculty members looking at early intervention and treatment methods. He is currently working on a project to develop a vocabulary comprehension writing intervention for children in kindergarten and primary grades.

“We’re looking at instructional strategies that benefit all kids, but primarily kids that are coming from language-impoverished environments—that is, children who don’t spend a lot of time with adults in a high-language environment and who come to kindergarten with some delays in language and vocabulary skills,” Ciancio says.

As research into learning disorders has flourished in the past decade, the importance of early intervention has emerged as a key point for professionals in the field.

“There has been some increase in earlier identification of kids who have particular difficulties,” Wilhoit says. “From my standpoint, there’s been more research that looks at the base development of skills, catching kids earlier and remediating them if needed. Hopefully, we could find ways to circumvent a certain disability; an early intervention might help prevent it from developing.”

Ciancio says that one of the biggest challenges in the field of learning disorders is the fact that interventions need to be individualized; children with the same issues may respond differently to different treatments.

“We’re getting away from the idea that one model will fit everyone,” Ciancio says. “We are getting more nuanced diagnoses that help people target interventions more specifically to the individual. That’s been a big push in the last decade—the ability to diagnose kids earlier and do some prevention work and remediation work and just to be able to hit their needs more specifically.”
He went there not knowing exactly what he was looking for, but when Chris Cherry arrived in Kunming, China, he immediately knew he had found it. It had two wheels, two pedals, and a battery. It was called an electric bicycle, or e-bike.

An e-bike is a bicycle with an attached motor that kicks in when pedaling gets more difficult for the rider, such as navigating up a hill.

When Cherry visited China in 2001 for graduate school research, he had never laid his eyes on one. Streets were congested with cars, buses, and the occasional bicycle. Flash forward to 2005, and the city was buzzing with them.

“In a span of just four years, electric bikes had gone from zero to being ubiquitous on every street in Kunming,” says the assistant professor of civil and environmental engineering. “I was incredibly curious. I started to investigate what made them go and whether they were good or bad.”

A National Science Foundation (NSF) grant returned Cherry to Kunming in 2005. His mission was to find a research topic for his dissertation at the University of California, Berkeley. He found it. In 2006, Cherry began biannual surveys to investigate why e-bikes had become so popular and how they were affecting China’s transportation system. In 2011, he received a Faculty Early Career Development (CAREER) award from the NSF to continue his research through 2016.

Cherry’s initial survey results in Kunming found 60 percent of e-bike users were public transit users. They were attracted to e-bikes for their speed and convenience. His 2006 research also found one in six e-bike riders were would-be car users. Four years later, that number had grown to nearly one in four.

“That means a quarter of all trips are displaced car trips,” says Cherry. “That makes a lot of difference in energy, congestion, local air pollution, and safety.”
Chris Cherry demonstrates the e-bike-sharing system he helped develop for the UT campus. First, Cherry swipes his university ID card to check out a bike at the e-bike station (top). Next, Cherry removes a charged battery from the kiosk (above) and then slides the battery into place on an e-bike (right). Cherry developed the system with Stacy Worley and Dave Smith of the Department of Biosystems Engineering and Soil Science, who built the integrated bike rack/battery station in the university’s civil engineering fabrication shop.
As an environmentally friendly alternative to driving, Cherry immediately saw e-bikes as part of a solution to three related problems in the United States: environmental degradation that impacts public health, quality of life, and economic security; over-reliance on insecure energy; and a health crisis of obesity related to inactivity. Therefore, he wanted to make a difference in the U.S., too.

He decided to launch the nation’s first e-bike sharing system at UT in 2011. It includes two bike sharing stations with ten bikes each—seven e-bikes and three traditional bicycles—and serves as a pilot project to gather information on e-bikes, their impacts, and their users.

“I had a lot of questions I wanted to answer,” Cherry says. “Are e-bikes something someone would adopt? If not, is it an education issue or awareness or technology or pricing issue? Are e-bikes inherently unsafe? Can we make a sharing system work?”

Cherry had the dream. Stacy Worley and Dave Smith in the Department of Biosystems Engineering and Soil Science (and the department’s sensors lab) helped make it a reality. Cherry dreamed of a fully automated sharing station that consisted of an integrated bike rack with a battery-charging kiosk that distributed batteries to those who checked out e-bikes. Users would simply swipe their university ID cards to check out and return bikes to the station when finished. Worley and Smith designed the hardware, software, sensors, and controls, fabricating the entire station in the civil engineering fabrication shop.

The first station launched in fall 2011 and is centrally located in Presidential Court. It utilizes power from the grid to charge the batteries. The other station launched in spring 2012 on the Institute of Agriculture campus and is solar-powered. It’s unique because it does not buy power from a utility company. However, if there’s not enough sunlight, it pulls power off the grid. Conversely, if too much energy is stored, it sends energy back to the grid. The researchers also have the ability to completely cut the grid connection and operate independently.

Cherry’s pilot test involved about fifty volunteers who used bikes and e-bikes. His first modus operandi was to see if e-bike sharing was technically feasible. Because he was blazing a trail, there were some finicky sensors.

It quickly became clear that the system does work. Furthermore, by sharing relatively expensive e-bikes, the cost of the technology can be spread out over many users per day, reducing the average investment per trip.

Cherry was also intrigued by user behavior. “One day I was walking into Earth Fare when I saw a student roll up on one of the e-bikes,” he recalls. “What the project figures out is what mode of transportation did that e-bike replace? Was it a bike, car, public transportation, or no trip at all?”

Preliminary results show that e-bike users travel about one-third farther than their counterparts on regular bikes. Trips on both bicycle types range from short trips around campus to longer trips more than a mile away.

GPS monitoring has been implemented to confirm or debunk the hypothesis that e-bikes are inherently unsafe by tracking bike and e-bike user habits like running red lights and stop signs, speeding, and wrong-way riding. Preliminary data shows a variety of user behaviors. E-bike users’ average top speeds are about 20 percent or 2.5 mph faster than regular bike users. Additional statistical analysis will show differences in behavior at red lights and stop signs, as well as other behaviors.

The system also employs sensors to track its environmental impact. Cherry has found that the entire charging station at Presidential Court only uses ten cents of energy per day.

In a separate study conducted in China, Cherry discovered that e-bikes are the greenest mode of transportation. Using overall emission data and emission rates from literature for five vehicle types—gasoline cars, diesel cars, diesel buses, e-bikes, and e-cars—Cherry and his colleagues calculated the proportion of emissions inhaled by the population and then estimated health impacts. E-bikes were the clear victor.

Interestingly, the research found e-cars—long heralded to be environmentally friendly—actually caused much more overall harmful particulate matter pollution than gasoline cars. This is because the combustion emissions occur where electricity is generated rather than where the vehicle is used. In China, 85 percent of electricity production is from fossil fuels, and about 90 percent of that is from coal. This study caused a firestorm of national media attention and speculation that all e-cars were bad. However, the study’s takeaway is that what matters is where the e-cars are powered and driven. Because China relies mostly on poorly regulated fossil fuels, e-cars emit more fine particles. In the U.S., the power sector is much cleaner, so e-cars are more environmentally friendly.

“Our calculations show that an increase in e-bike usage improves air quality and environmental health by displacing the use of other, more polluting modes of transportation,” Cherry says.

Cherry is also investigating if—and how much—people in the U.S. are willing to pay to use an e-bike. He is experimenting with how to price users effectively—for example, how to charge, how to pay for this, and how to build a business case for something like this. One of the challenges with any shared-vehicle system is managing demand for a finite resource with appropriate price points. That means that the prices might change over the day, depending on how heavily the system is used.

Cherry’s ultimate goal would be to bring something like e-bike sharing to market. But it isn’t about him seeing green—it’s about the earth seeing green.

“If it turns out that e-bikes are a good thing, I would like this thing to spread like wildfire,” says Cherry. “But would I be the CEO? Probably not. My goal is not to strike it rich but to really just see e-bikes improve transportation systems in our cities and campuses and ultimately improve the health of our communities and environment.”
THE SOCIAL SOLUTION for AIDS
When those of us who are mainland Americans think of the US Virgin Islands, we envision their hallmark white beaches, pastel-colored houses, and the charming marine animals that appear in advertisements for snorkeling expeditions.

We almost certainly don’t think about the territory’s shockingly high rate of HIV infection or the widespread poverty that contributes to it—two interrelated problems caused partly by the very tourism industry that drives the islands’ economy.

John Wodarski, professor of social work, recently received a five-year, $2.2 million grant from the Substance Abuse and Mental Health Services Administration (SAMHSA) for a project aimed at preventing HIV infection among young adults in the Virgin Islands. The challenges are many and the need is great, he says.

“Our primary objective is to get young adults tested so they can get the medicine they need,” Wodarski says. “In the Virgin Islands, the service network is extremely fragmented, and it’s hard for people to know where to get tested for HIV or where to get mental health or substance abuse services.”

The Caribbean has the highest incidence of HIV/AIDS in the world outside of sub-Saharan Africa. The US Virgin Islands have significantly lower infection rates than some other Caribbean nations, but they’re still much higher than the rates for the United States as a whole.

By collaborating with various local health agencies and nonprofits, Wodarski seeks to strengthen HIV prevention education, increase participation in voluntary HIV testing efforts, and connect people with available services. The program, which focuses on Virgin Islanders aged 18 to 26 who are at high risk for infection, also sponsors health fairs, distributes condoms, and instructs people on how to properly clean needles.

“The program has been extremely successful thus far,” Wodarski says. “I think we’ve tested about 400 people in the last few years, which is unheard of for HIV. If people test positive, we refer them to the health clinics. If they have any mental health or substance abuse issues, we refer them to the appropriate services.”

For the past decade, Wodarski has been part of a UT project that trains native Virgin Islanders to be social workers. The network created by the program has given Wodarski a strong base of professionals who can more effectively educate members of the local community about HIV prevention and testing.

“They can go on TV and out to schools, bars, and churches—where people hang out,” he says. “And as social workers, they already work with people who have problems or are at risk, and they know how to reach them and others in the same situations.”

The challenges facing HIV prevention and education efforts are significant, and some stem from the islands’ greatest features. The beautiful landscapes draw millions of tourists every year, with tourism accounting for the majority of employment. However, tourism has also created an extremely unequal socioeconomic structure.

“I think there are three classes of people living in the Virgin Islands: the poor, who either can’t find work or have a low-paying job, like as a maid at a resort; professionals like social workers and doctors; and then wealthy people with vacation homes who only stay for a few weeks or months a year,” Wodarski says. “There’s a sliver of very rich people, some professionals, and a lot of very poor people.”

Further hampering prevention and testing efforts is the high mobility of the Caribbean population. The Virgin Islands attract people from all over the region who are looking for work.

“We haven’t seen a real decrease in tourism in the Virgin Islands. The economy there is still fairly good, so many people from other Caribbean nations want to come to work,” Wodarski says.

Another mobile population at high risk for HIV is sex workers, who often come to the Virgin Islands because of the demand presented by the large numbers of short-term employees and tourists. Wodarski says it’s imperative to reach this population. He has instructed social workers to bring materials on HIV testing and counseling to the bars and other areas in which sex workers congregate.

There are significant barriers to stopping the spread of HIV/AIDS in the US Virgin Islands, and it will take a while to see sizable results, but Wodarski says he plans to continue the fight for years to come.

“We don’t intend to leave the islands, even when our grant is up. We’ll get another grant or foundation money or find another way to continue,” he says. “Really, we could be there forever, but at least we’re making a dent.”

“In the Virgin Islands, the service network is extremely fragmented, and it’s hard for people to know where to get tested for HIV or where to get mental health or substance abuse services.”

—John Wodarski
The problem wasn’t simple: Build a laser flash photolysis spectrophotometer (LFPS). Then use it effectively to help scientists explore carbon-neutral ways to create fuel.

Other lab assistants had given up. But Ray Henson took on the task. A senior in mechanical engineering with experience in three other laboratories, Henson was dogged in his pursuit. He actually signed a contract that said, “I will get it working.”

That drive and determination earned him the label “the go-to guy” from Paul Frymier, associate professor of chemical and biomolecular engineering, while Henson was working on summer research in Frymier’s lab.

Henson’s mechanical engineering background made him perfect for the challenge. He started by studying the remnants of previous attempts to build the instrument and deconstructing each component. He examined the laser, the detector, and the amplifier, eventually figuring out how to work the equipment. Throughout the process, he regularly discussed his ideas with his mentor.

“All of the parts were there,” Henson says. “It was just that no one could put it together to measure accurately. It needed tinkering.”

In chemistry, spectrophotometry measures materials’ reflection or transmission properties at different wavelengths of light. In this case, the LFPS will help optimize the production of hydrogen by enabling the lab to study each step of the hydrogen-producing reaction. The spectrophotometer uses a laser to flash the sample, and the materials in the sample absorb the light in a way that can be used to monitor the rate of the reaction.

One of the solutions Henson developed involved filtering the laser light to avoid interference with the sample. His low-tech experiment used a pinhole cut into a piece of cardboard. “The pinhole blocked out stray light so that the sensitive detector could better observe changes in the sample, and it worked surprisingly well,” Henson says.

Frymier compares the challenge Henson faced to building a Mercedes piece by piece from an auto parts store. “Ray has gotten further than anyone else,” Frymier says. “He has the rare quality of always thinking. When he’s working on a problem, he goes home and comes back with a solution. It may be wacky, but he didn’t stop thinking. If you’re smart, with that kind of tenacity, you will solve the problem. Students like that push you as a mentor.”

In their work with the Tennessee Solar Conversion and Storage using Outreach, Research, and Education (TN-SCORE) program, Henson and Frymier are collaborating with other laboratories throughout the state that are also trying to find a sustainable way to make hydrogen as a potential fuel or chemical feedstock.
Barry Bruce, TN-SCORE’s Thrust One leader and a UT professor of biochemistry and cellular and molecular biology, says that Henson’s LFPS will be used by research partners at the University of Memphis.

“With this focus on collaboration and networking, we become relevant to each other, and Tennessee becomes stronger,” Bruce says.

Henson has several LFPS projects under way, including one that focuses on understanding the consumption rate of the electron donor. He explains that this hydrogen-evolving system requires electron donors, which act as a source of electrons for creating hydrogen. Understanding this process will allow engineers to optimize the amount of hydrogen produced.

“My research experiences have added a new dimension to what I’ve picked up in the classroom,” Henson says. “I’ve learned problem-solving methodologies and how to identify parts of the problem and find out more. For example, if I’m studying task X to produce more of Y, then what do I know about the entire process of task X?”

Henson began his first research experience as a freshman in summer 2008, working with Richard Komistek, professor of biomedical engineering and co-director of UT’s Center for Musculoskeletal Research.

The project involved using fluoroscopy and X-ray video to compare the range of motion before and after knee replacement. He then worked on an honors research project titled “Atomic Force Microscopy Characterization of Plant-based Nanoparticles” with Mingjun Zhang, associate professor of biomedical engineering. In summer 2010, he worked with Zhang on a project related to flagella motility, which won an award at UT’s Exhibition of Undergraduate Research and Creative Achievement (EURoCA). His senior design project involved constructing an electric vehicle for the EPA P3 Competition.

Henson is relying on his experiences to help develop his career path. “I plan to pursue an advanced degree in chemical engineering,” he says, noting that he has also applied for several fellowships. “My goal is for a research faculty position or a research position at a company or national laboratory in the sustainable energy field. I’m also considering a PhD and then taking results of my research to the marketplace as an engineer.

“It has been great to work with the professors, grad students, and postdocs,” Henson says. “They’ve honed their problem-solving abilities, and their habits rub off on you. They have given me a new perspective on what life might be like as a researcher.”
Jointly created by UT and Oak Ridge National Laboratory, the Bredesen Center offers two graduate programs that blend the cultures of a comprehensive research university and an outstanding major national laboratory.

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