# DISCOVER

MARQUETTE UNIVERSITY RESEARCH AND SCHOLARSHIP 2008

## BLAZING TRAILS

**Advancing the field of fire retardancy**

**Inside:**

RNA breakthrough
Environmental toxins
Animal talk
Fascist fashion

Marquette University owes its name to Rev. Jacques Marquette, S.J., the 17th-century missionary who explored the western Great Lakes and Mississippi River. It's a fitting namesake: The thirst for new knowledge and desire to chart new territory is still alive at Marquette today, and it's in honor of that spirit that we named our third annual research publication *Discover*.

As a Catholic, Jesuit institution, we seek to advance knowledge not just for knowledge's sake, but always with the goal of improving the human condition. That's obvious in the following stories about a breakthrough RNA discovery, innovations in fire-retardant technology, the potentially deadly effects of biotoxins, and research in many other fascinating and critical areas. Marquette faculty also never forget their mission as teachers, and undergraduate and graduate students get valuable hands-on experience and mentorship through the research process.

Despite increased competition for federal research dollars, Marquette faculty continue to win substantial grants from the National Institutes of Health, the Department of Defense, the National Science Foundation and other agencies. We further leverage our resources by engaging industry and forming multi-institutional partnerships with the Medical College of Wisconsin, the University of Wisconsin system and others.

It has also been a banner year for Marquette's private fundraising. In 2007 we raised more than $100 million, much of which will go toward improving our teaching and research resources, including new facilities and more endowed chairs and professorships. During the past five years, we have invested millions of dollars in building and remodeling labs for the dentistry, chemistry, biomedical sciences, exercise science, and speech pathology and audiology departments. Such improvements are key to fostering a culture of discovery.

What's included in the following pages is only part of the Marquette research story. For more, visit *Marquette.edu/research* or come visit us in person.

Wm. Wiener

William Wiener, Ph.D.
Vice Provost for Research and Dean of the Graduate School

# DISCOVER

MARQUETTE UNIVERSITY RESEARCH AND SCHOLARSHIP







## RESEARCH IN BRIEF




*DISCOVER: Marquette University Research and Scholarship* is published annually by the Office of Marketing and Communication.
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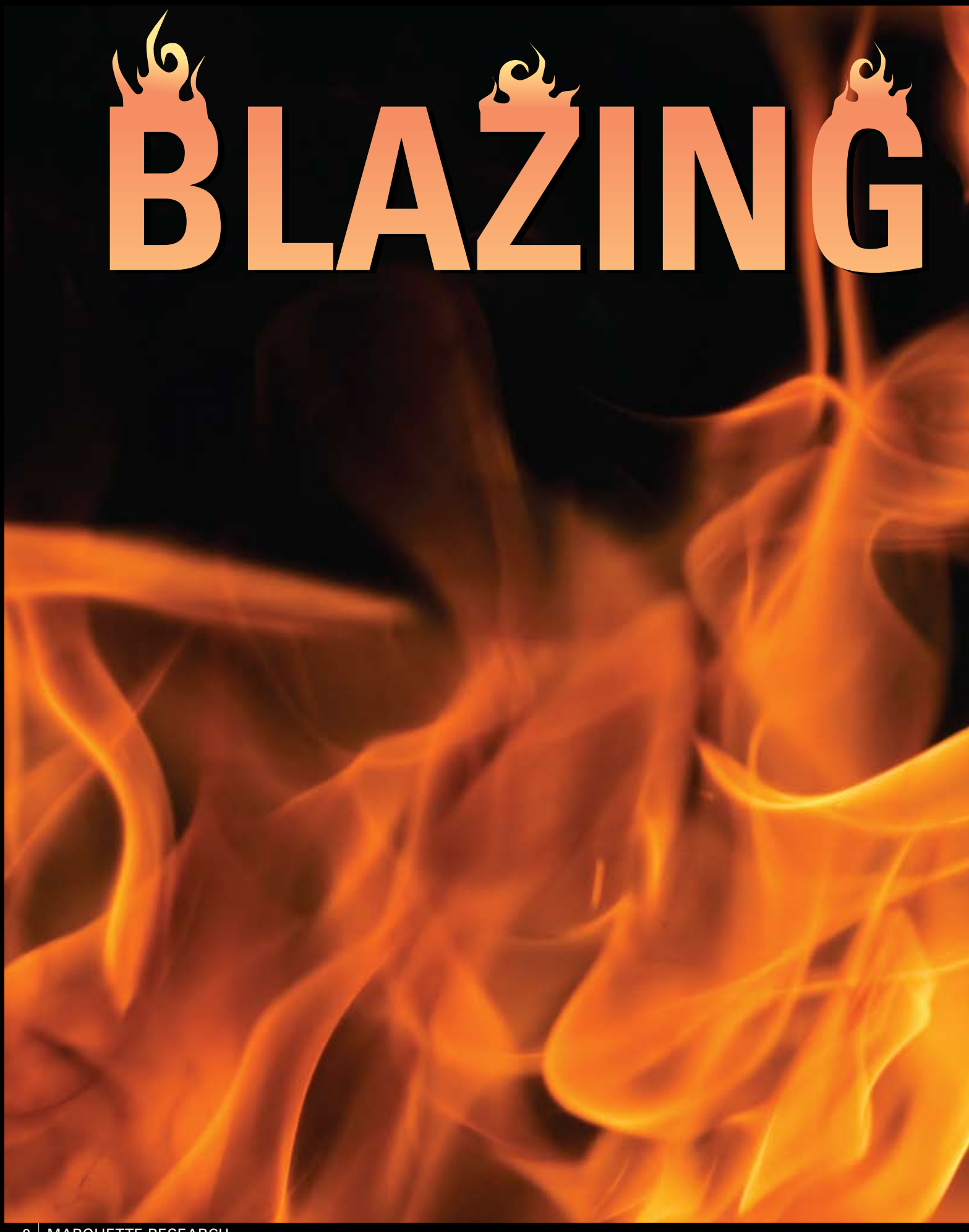

BLAZING

# TRAILS

For 30 years, Dr. Charles Wilkie has studied fire retardancy. Armed with a new federal grant, this leader in his field is heating things up.

If someone told Dr. Charles Wilkie at the onset of his career that he would one day be on the brink of saving countless soldiers' lives by developing a flame-retardant, anti-blast polymer, he would have shaken his head in disbelief. Today, his research on fire retardancy has the potential to revolutionize military defense.

The Pfletschinger-Habermann Professor of Chemistry, Wilkie studies fire retardancy and polymers. He is one of the foremost academic researchers in the field, and his work has been widely published in the United States and abroad. In 2007, he won Marquette's Lawrence G. Haggerty Award for Research Excellence.

Prior to 1978, Wilkie studied organometallic chemicals, which is "about as far away from polymers as you can get," he says.

It was in 1978 — his 10th year at Marquette — that Wilkie switched gears. While on sabbatical, he stumbled across a paper titled "Phosphorous-based Fire Retardants," and his focus forever changed. He published his first paper, "Fire Retardancy of Poly(methyl methacrylate)," in 1981; the research was funded a few years later by a grant from the National Bureau of Standards.

"When I started, I was an inorganic chemist dabbling in polymer science," Wilkie says. "I became a polymer scientist who used to know something about inorganic chemistry. Today I know very little about inorganic chemistry."

Underneath that humility, Wilkie is understandably serious about his research. In addition to improving military defense, it could also help the civilian sector.

"There's a big fire problem in the United States and globally," Wilkie says, underscoring the importance of his life's work. "We need to address the issue of fire-related deaths and the billions of dollars lost each year as a result of fires."

In 2006, there were more than 1.6 million recorded fires in the United States, resulting in more than 3,200 deaths and approximately $11.3 billion lost, according to the U.S. Fire Administration.

While Wilkie hopes his work will reduce those somber statistics at home, his newest undertaking is one with implications stretching far beyond U.S. borders.

Through two separate multimillion-dollar grants in as many years from the Department of Defense, Wilkie and his team have partnered with Boston-based Triton Systems to develop flame-retardant, anti-blast material tiles that can sheath military buildings and vehicles. The result could save innumerable lives among the ranks of American and allied armed services.

"There is an anti-blast material — polyurea — whose elastic properties have made it the most widely used material in military applications,"

Dr. Charles Wilkie's research has earned an international reputation. He has written hundreds of journal articles, and his publications have been cited more than 2,000 times. The associate editor of *Polymers for Advanced Technologies*, he sits on the editorial boards of two other professional journals. His dedication to his field is clear to his students, who range from doctoral candidates to freshmen in Marquette's general chemistry classes. "Chuck is able to convey the excitement that he has for science, frequently inspiring undergraduates to work in his research group and motivating them for further studies in chemistry," says department chair Dr. Jeanne Hossenlopp.

"There's a big fire problem in the United States and globally. We need to address the issue of fire-related deaths and the billions of dollars lost each year as a result of fires."

Wilkie says. "However, polyurea is also highly flammable. What we're going to do is develop a material that maintains the anti-blast properties of polyurea while rendering it flame retardant."

That is no easy task — especially for an academic, according to Wilkie. "My goal has always been to develop knowledge that can be used by others, not to actually make a product," he says. However, that's exactly what he'll be doing during the next few years.

"I'm very fortunate to have some very talented students who will actually be doing the work," the ever self-effacing Wilkie says.

Wilkie's team has already made great strides. Over the span of the project, tests on the team's blast-resistant tiles have shown a 90-percent decrease in heat release rate (HRR) — the single most important variable in describing fire hazard or the "size" of a fire.

Fire is measured quantitatively by its energy output, or heat. Heat is measured in joules, but the rate at which the heat is released is of greater interest to scientists like Wilkie. Thus, HRR is measured as joules per second, or watts.

Tests on the team's first tiles yielded an HRR of 2,000 kilowatts. Wilkie has since improved the material to yield a mere 150 kilowatts, and he would like to see that number drop further.

"Those last 50 kilowatts are the biggest challenge," he says.

It's the challenge that Wilkie enjoys most. He's not motivated by recognition or prestige. It's not even the inherent allure of fire that drives him.

"The field of fire retardancy is simply interesting to me," Wilkie says. "I just feel I have something to contribute."

In fact, Wilkie is thinking beyond this latest project. He also studies nanocomposites, a growing field of inquiry that involves the addition of nano-sized particles to larger polymers to enhance their physical or mechanical properties. "I am very interested in studying the application of nanocomposites in fire retardancy," he says.

Regardless of the outcome of this project or future ones, one thing is certain: Wilkie is blazing a trail in the field of fire retardancy.

## IN THE LAB

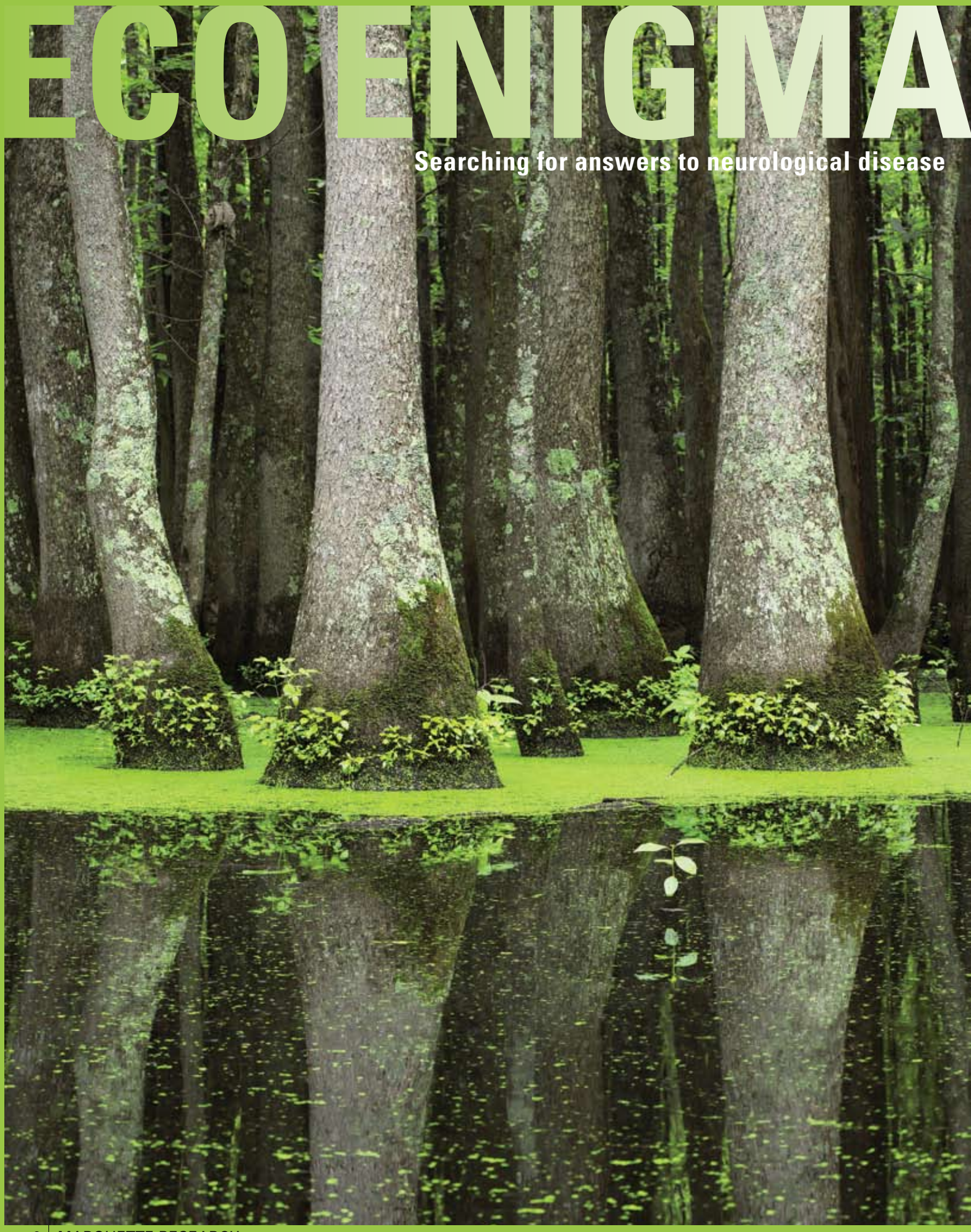
How do polymer chemists like Wilkie determine a material's fire retardancy? They use something called a cone calorimeter, the most significant bench scale instrument in the field of fire testing, which uses a truncated heating element to irradiate the test sample.

The small-scale test uses pieces of material that are approximately 4 inches by 4 inches and 1/8 inch thick. After the sample is weighed, the cone calorimeter heats it to a particular temperature — typically about 1,370 F (730 C) — and degradation begins.

The instrument measures how much oxygen is consumed, which indicates how "large" the fire is. Wilkie also determines how much smoke is produced and how the weight of the sample changes as it degrades. Smoke inhalation causes many fire-related fatalities, so the goal is to reduce both a fire's size and smoke output.

# ECO ENIGMA

## Searching for answers to neurological disease



The mystery started on the Pacific island of Guam in the 1950s. The native Chamorro people developed a deadly neurological disease that caused paralysis, tremors and dementia. Scientists suspected an environmental neurotoxin called BMAA. Formed from bacteria, the toxin jumped up the food chain, from plant seeds to fruit bats, from bats to humans, eventually lodging in the brains of the native islanders.

Over the years, scientists have debated BMAA's role in neurological disease. But one thing remains clear: the bacteria that naturally produce BMAA are found throughout the world, including in the blue-green algae of our lakes and waterways. BMAA has also been found in the brains of Canadians with Alzheimer's disease. Could BMAA or other environmental toxins be the key to stopping devastating neurological conditions such as Alzheimer's, Parkinson's or ALS?

Dr. Douglas Lobner, associate professor of biomedical sciences, is determined to find out.

Lobner studies the death of nerve cells and is known for his research on the neurotoxicity of dental materials (his research team was the first to show that dental amalgam was neurotoxic.) Until recently, his research on neurodegenerative diseases focused on methods that protect neurons, such as drugs that stave off disease. Two years ago, he decided to switch his focus to something more critical: the cause.

Researchers have long known that neurological diseases are caused by a combination of genetic and environmental factors.

"If your mother has Alzheimer's disease, you are more likely to get it," Lobner says. "But you may not. What determines that is almost certainly some environmental agent, and nobody knows what that is. For me, finding the environmental trigger for these diseases is much more important than finding some other drug that delays the disease by a month."

Lobner is studying three suspected environmental villains: BMAA, mercury and pesticides. Because of a process called biomagnification, all three concentrate and become more potent as they travel up the food chain. One of the main criticisms of the BMAA theory is that even with biomagnification, it would be difficult to ingest enough of the toxin to cause neuronal death. Research shows that it takes high levels of BMAA to kill neurons.

But Lobner's research — funded by the National Institutes of Health — revealed something new. In a critical paper published last year in the journal *Neurobiology of Disease*, he showed that BMAA can have a synergistic effect, and thus it takes only low levels of BMAA to kill neurons when combined with other neurological insults that occur in the brains of patients with Alzheimer's and Parkinson's diseases.

That means a single culprit might not be to blame.

"Possibly eating a fish that has high levels of mercury and BMAA, and having a genetic predisposition to the disease might be the exact bad combination that leads to the expression of the disease," Lobner says.

Lobner's team discovered three distinct mechanisms that make BMAA toxic. "One of the mechanisms by which it causes toxicity is through the production of free radicals," he explains. "That's an important mechanism because free radicals are almost certainly involved in the neuronal death that occurs in all of these diseases. That could be how BMAA is able to produce symptoms of all these different diseases."

Like mercury, BMAA isn't easy for the body to eliminate. "It can become incorporated into the protein of the brain and stay there for a long time, which may partially explain the delayed onset of these diseases," he says.

Until now, Lobner's research has used cortical cell cultures from mice. Next, he'd like to test whether low levels of BMAA also hasten the onset of disease in animal models.

"I'm not convinced that BMAA is what causes these diseases, but I think more studies need to be done," he says. "To figure out what is the environmental toxin that causes neurodegenerative diseases is a very important thing to understand."

A design by the Frankfurter Modeamt, a state-sponored fashion school. Courtesy of Luise and Volker-Joachim Stern, Berlin.

Only the German elite could afford such an elegant suit. Courtesy of Staatliche Museen zu Berlin, Kunstbibliothek. On the right, a "Cinderella" shoe. Courtesy of Luise and Volker-Joachim Stern, Berlin.

A "proper" German woman in the traditional dirndl dress. Courtesy of Callwey Verlag, München.

# NAZI CHIC?

## Dr. Irene Guenther unravels the sinister relationship between fashion and fascism

Nazi propaganda posters trumpeted the "ideal" German woman — the Aryan mother wearing a modest peasant dress, a smile beaming from her freshly scrubbed, cosmetic-free face.

In reality, the wives of commanders wore haute couture sewn by Jewish prisoner-seamstresses and bought American makeup. German women who didn't have such connections sewed their clothes using patterns made by *Vogue* or purchased their garments from department stores that offered the same styles that were also popular in England, France and the United States.

"Most women wouldn't have been caught dead in a dirndl dress," says Dr. Irene Guenther, assistant professor of history. "It's really clear that they weren't buying into their government's unrelenting propaganda."

It's just one of the many contradictions that characterized the Third Reich, where the Nazi Party tried unsuccessfully to use even women's fashion as a tool of the state. In Adolf Hitler's Germany, fashion wasn't merely window dressing; it was a politically contentious issue.

Guenther explores Germany's complicated relationship with fashion in her award-winning book, *Nazi Chic? Fashioning Women in the Third Reich*. She's working on a follow-up book that is tentatively titled *Dressing Cold War Berlin: Fashion and Politics, 1945-1961*.

A cultural historian specializing in modern Germany, Guenther's research ranges from post-World War I political art to fashion to the history of the swastika. "It's all cultural," she says. "It all has to do with the way that culture is expressed by people and manipulated by governments — that tension really interests me."

For *Nazi Chic*, Guenther explored a rarely studied aspect of the Nazi regime, which led her to discover previously unexamined historical documents that pertained to Nazi Germany's fashion world. But despite such rich primary sources, Guenther had to battle academia's prejudice against what has been called "the F word." Too often, she says, fashion is dismissed as trivial fluff.

**"It has this very sinister impetus to it — it makes fascism look very elegant and provides a smokescreen that serves to visually detract from the regime's unspeakable cruelty."**

"I had to really fight for this topic," she says. "Clothing speaks volumes to regimes about the importance of controlling culture and about the ways in which people try to express themselves through their appearance. While attitudes are clearly beginning to change, for a long time historians didn't 'get' just how revealing the intersection of fashion and gender really is. I was interested in using fashion as a window into political and cultural issues in Nazi Germany, and what I found was quite remarkable."

While the Nazi state had a clear position on art, music and film, its position on fashion was more ambiguous. Yet Nazi Party officials still saw fashion as a way to promote official gender policies, instill national pride, and "promote a German economic and cultural victory on the fashion runways of Europe," Guenther says.

Berlin already boasted a strong fashion industry throughout the 1920s and, in fact, made more money selling women's clothing during those years than the more-recognized Paris fashion industry. Nonetheless, in 1933, Nazi officials created the German Fashion Institute. "The Berlin women must become the best-dressed women in Europe," Hitler declared only weeks after coming to power. One problem: Many of the country's best designers were Jewish. They were purged from the fashion industry, but later some were forced back to the sewing machine while imprisoned in concentration camps.

The goal of the German Fashion Institute was to conquer France's perceived superiority in the fashion arena. Even French fashion words, such as "chic" and "mannequin," were banned from the German vocabulary. But despite the institute's best efforts and most glamorous designs, German and non-German

Jewish girls from the Lodz ghetto embroidered German military uniforms, a precursor to the forced labor of the concentration camps. Courtesy of Erhard Löcker Verlag.

women preferred the cachet of French clothes simply because "buying French was the hip thing to do," Guenther says. German designs often sold to German women only after they were put under a French label; alternately, French fashion houses often bought beautifully German-designed and sewn garments and then sold them in their shops as French-made.

Wartime rations pushed the state-sponsored Aryan designers in Germany to think innovatively — using Plexiglas from airplane windshields to make "Cinderella" shoes, parachute material for dresses, and dyed fish skins to give a frock extra flair. The sophisticated outfits were modeled in fashion magazines, fashion shows in occupied countries and other propaganda venues as if there was no war, no mass murder and no genocide taking place.

"It has this very sinister impetus to it — it makes fascism look very elegant and provides a smokescreen that serves to visually detract from the regime's unspeakable cruelty," Guenther says.

But as the war raged, such elegance was far from the reach of the average German woman. Because of massive shortages of cloth and shoes, women on the German home front unraveled burlap sacks to make underwear. Thrifty wives turned old military uniforms into new dresses, even using embroidered flowers to camouflage the bullet holes.

Meanwhile, in the Auschwitz concentration camp, nearly two dozen prisoners labored to make fancy, custom-made gowns for the wives and mistresses of Nazi officers and SS guards. Materials often came from "Canada" — actually warehouses filled with the clothing and shoes confiscated from concentration camp inmates upon their arrival.

Ultimately, an exploration of Third Reich fashion reveals intriguing tales of cultural and economic nationalism, of hypocrisy and ambivalence, of contentious French-German relations in the realm of fashion, of vicious anti-Semitism as well as opposition, of female collaboration and resistance, and of Nazism's double countenance, Guenther says. "Fashioning women in the Third Reich," she concludes, "was a serious matter of the most complicated sort."

## WHAT'S IN A SYMBOL?

While riding the subway in London one day, the publishing director of Dr. Irene Guenther's first book noticed an Indian woman wearing a colorful sari. Tiny swastikas marched across the fabric. Her gut reaction was to lean forward and to whisper to the woman that wearing swastikas was inappropriate, at best.

At her publisher's urging, the unusual sight sparked Guenther's latest research project: a book on the cultural history of the swastika. While its connection to Nazi Germany has transformed it into a chilling emblem of evil and hate, the swastika meant something quite different to many cultures for thousands of years, and it's still a commonly used symbol of peace and prosperity in the non-Western world.

In the United States, the swastika motif can be found in pre-World War II architecture. But with the ascent of Adolf Hitler, the swastika suddenly became taboo. Even the Navajo, who had for centuries included the swastika in their art and decorative wares, decided they no longer could use it because of its negative political implications.

The swastika prompts cross-cultural clashes even today. When the European Union recently considered banning the swastika, it caused an outcry among Hindus, who consider it a sacred symbol.

No other political symbol is as instantly recognizable and as controversial as the swastika. "It's interesting to me that this symbol is so powerfully divisive," Guenther says, "and that its use by the Nazis for two decades has loaded it with negative connotations in the West at the same time that two-thirds of the world has viewed it for centuries as an acceptable and positive icon."

# MECHANICAL WONDER

## Dr. James Anderson decodes an RNA process essential for cell survival

He might be examining molecules, but Dr. James Anderson is moving mountains.

The role of ribonucleic acid in protein synthesis is vital to all living things, and while scientists have studied RNA for more than a century, they are still unraveling clues to the mysterious building blocks of life.

Anderson, associate professor of biological sciences, recently discovered a particularly important clue: an RNA process that is essential for cell survival. In what has been lauded as a "landmark discovery" by colleagues around the globe, Anderson's development laid the groundwork for what is sure to be a cascade of follow-up projects by others in his field. It's a critical first step that could lead to breakthroughs in the treatment and prevention of disease.

Anderson has always been passionate about basic science, and he loves when his research becomes the pebble that produces a ripple effect.

"There will certainly be applications to medicine and disease. We just don't know what they are yet," he points out. "What's exciting to me is how that will unfold."

Anderson, whose work is supported by the largest, most prestigious grant program of the National Institutes of Health, was curious about how RNA molecules work together to assemble proteins with the correct sequence of amino acids. When a cell functions properly, transfer RNA (tRNA) molecules do this without fail. If one of the tRNA molecules is faulty, the cell recognizes it and either repairs or destroys the molecule before it synthesizes the proteins incorrectly. In simple terms, cells operate like a factory, with the foreman identifying faulty parts and either fixing or replacing them.

Those exquisitely programmed cellular machines are crucial to sustaining life — after all, improper protein synthesis is the root of many genetic diseases. By understanding how correctly functioning cells identify and then repair or destroy defective tRNA molecules, scientists could better identify and ultimately prevent the earliest stages of disease.

By applying the principles of genetics to bread yeast, Anderson was able to identify the molecular pathway responsible for the degradation of tRNA. "We've known that when RNA is non-functioning, it is recognized in such a way that it becomes a target for elimination," he says. "Until now, though, we didn't know *how* it was recognized."

During normal synthesis, a certain protein group modifies the RNA molecule by adding to it a carbon-hydrogen compound known as a "methyl group." The addition of this methyl group allows RNA to function properly during synthesis; without it, the RNA is defective.

"Genetics revealed that a defective tRNA molecule is recognized by a completely different protein group," Anderson says. "We discovered that a particular protein group adds a 'tail' of nucleotides to the tRNA. It is

that tail that signals to the cell that the tRNA is faulty."

Anderson notes that HIV — the virus that causes AIDS — utilizes RNA to capitalize on cells' own components and compromise the body's immune system. While his discovery in yeast may not provide direct answers for curing this deadly disease in humans, understanding how cells deal with faulty RNA molecules during protein synthesis could ultimately reveal how the virus turns the human body against itself.

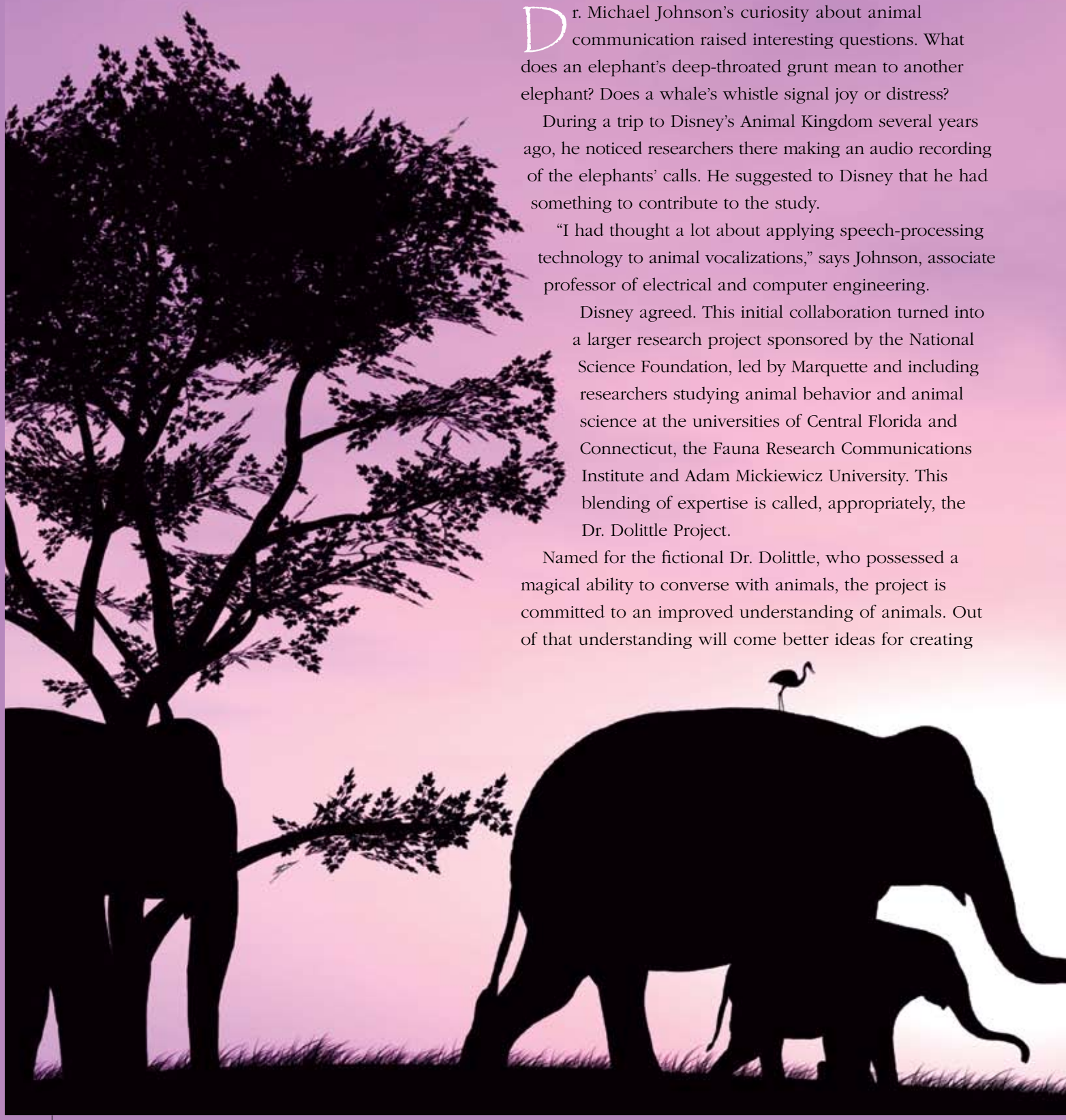
Just as RNA and other genetic materials are the foundation for all living things, basic science like Anderson's work is the cornerstone of practical research and developments in medicine, genetics and other applied sciences.

No one, including Anderson, knows how his research will be ultimately applied. And that's OK with him.

Says Anderson, "I want my research to provide opportunities and resources for other scientists."

Illustration by Tom White

# LISTENING TO THE ANIMAL KINGDOM



Dr. Michael Johnson's curiosity about animal communication raised interesting questions. What does an elephant's deep-throated grunt mean to another elephant? Does a whale's whistle signal joy or distress?

During a trip to Disney's Animal Kingdom several years ago, he noticed researchers there making an audio recording of the elephants' calls. He suggested to Disney that he had something to contribute to the study.

"I had thought a lot about applying speech-processing technology to animal vocalizations," says Johnson, associate professor of electrical and computer engineering.

Disney agreed. This initial collaboration turned into a larger research project sponsored by the National Science Foundation, led by Marquette and including researchers studying animal behavior and animal science at the universities of Central Florida and Connecticut, the Fauna Research Communications Institute and Adam Mickiewicz University. This blending of expertise is called, appropriately, the Dr. Dolittle Project.

Named for the fictional Dr. Dolittle, who possessed a magical ability to converse with animals, the project is committed to an improved understanding of animals. Out of that understanding will come better ideas for creating

habitats and species-survival programs and better technologies for tracking and monitoring animals in their natural habitats. So far, the Dr. Dolittle Project has studied dolphins, African elephants, Beluga whales, Ortolan buntings and domestic species such as poultry, dogs and horses.

Before this, according to Johnson, no one had applied modern speech-processing algorithms to animal vocalizations. Marquette's speech-processing lab became the hub for that portion of the Dolittle Project studies, and the results are enlightening.

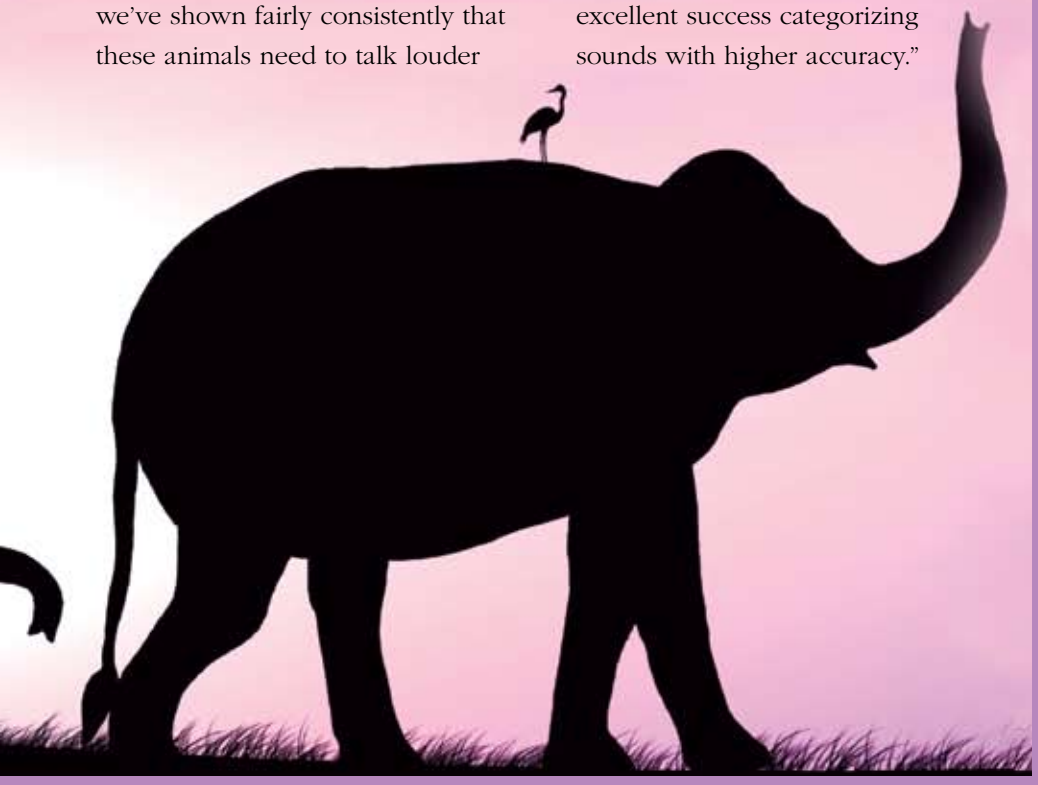
"We have demonstrated that elephants have different vocal patterns at different times of the estrous cycle (the hormonal cycle related to ovulation)," he says. "Knowing that could reduce the need to draw blood to measure hormone levels when breeding. We also have used these techniques to quantify the impact of man-made noise on the Beluga whale population living in the St. Lawrence River Estuary. Specifically, we've shown fairly consistently that these animals need to talk louder when such noise is present. For instance, when the whales are near shipping lanes, it is much harder for them to communicate."

Speech-processing technology and methods make it possible for Johnson to separate and classify sounds, including sounds occurring at frequencies not normally detected by the human ear.

"We can't hear a difference but the computer can," he says. "Elephants often talk at a very low frequency, eight to 14 hertz. We hear it as a rumble, but it is actually a vocalization that they can hear just fine."

The Dolittle Project is working to set benchmarks or starting points that relate a vocal pattern with the animal's activity at a precise moment. Does an elephant make one sound to say "hello" and another to say "let's go?"

"The goal is to identify specific vocalization patterns with specific meaning," Johnson says. "We may not reach 100 percent accuracy, there are so many unknowns, but we are having excellent success categorizing sounds with higher accuracy."



## IN THE NEWS

Whether it's because of the public's perpetual fascination with animals or the catchy title of the Dr. Dolittle Project, Dr. Michael Johnson's research has attracted attention around the world. In the last few years, he and his Dolittle colleagues have been featured in *National Geographic, Wired* magazine, the Discovery Channel and other media outlets. He was most recently profiled in the Milwaukee Journal Sentinel's series "Brainpower: Groundbreaking Thinkers in Wisconsin." In the article by Mark Johnson (no relation), colleagues enthused about the impact of Marquette's Dr. Dolittle. An excerpt:

*By taking techniques used to examine human speech and tailoring them to the study of animals, Johnson "made a major leap," says Michael Darre, a professor of animal and poultry science at the University of Connecticut. Darre, who examined the connections between chicken calls and stress, is now expanding this work to hogs, horses and dairy cattle.*

*"A lot of it," he says, "is because Mike Johnson has spurred us on."*

*"I think it's great work. Insightful," says John R. Buck, who teaches in the department of electrical and computer engineering at the University of Massachusetts Dartmouth. Buck compares Johnson's innovations to "building a better set of binoculars" for animal researchers.*

Go to *www2.jsonline.com:80/features/* to see the Journal Sentinel's complete package on the Dr. Dolittle Project, including an audio quiz and video of Johnson explaining his research in more detail.

# Identity Crisis

## The human side of economics

Who are you? A Social Security number, an American, a spouse, a parent, a child, a co-worker? Or all of these? What makes you *you*?

Economics professor Dr. John Davis thinks a lot about personal identity. In 2003, he published *The Theory of the Individual in Economics*. Now he's working on a follow-up book that examines the individual in light of more recent changes in the economics field.

Those changes include the influence of other sciences. Psychologists were the first to discover that people don't always act the way economists describe. "Psychologists tested such things as whether people behave strictly out of self-interest, and lo and behold, they found that they often don't, destroying all the theories of economics," says Davis, who also teaches at the University of Amsterdam in the Netherlands. "Many of these assumptions we've had for so long are now in jeopardy."

That gives scholars like Davis a chance to re-examine the very foundations of the field. Davis is a prolific researcher who has written or edited 14 books, and the Association for Social Economics recently honored him with a lifetime achievement award. For 18 years, Davis was the editor of *The Review of Social Economy*, and now he is co-editor of the *Journal of Economic Methodology*.

He is used to going against the economic grain. While most economists believe that market values, such as prices and incomes, determine our social values, Davis and other social economists believe differently. They argue that beliefs about family, integrity, poverty, inequality and other social issues underlie our economic decisions.

Classic economic theory doesn't hold up in the modern world, Davis says. "The standard view of the individual in economics explains the person in an asocial way," he explains. "When we talk about personal preferences, they're never things that might be created by advertising or by living in a community or by being the children of certain individuals."

That doesn't make a lot of sense to Davis. Then again, he doesn't think like your average economist. He earned a doctorate in philosophy before earning one in economics, and that gives him a unique perspective in a field that has traditionally emphasized data and models.

The standard mathematical technique that economists use, optimization analysis, assumes that the subject always does what's best for him or herself. Although psychology studies have shown that people don't always act out of self-interest, that's not Davis' only problem with the theory. "The theory doesn't distinguish whether the individual is a single person, a collection of people, an animal or a computer program trading on Wall Street. They can all be treated as 'individuals' and be explained as optimizing," he says. "So it seems to be that the human person has become marginal in importance, and I think that is contrary to our view of the importance of the person."

Davis takes a wider view of personal identity. While traditional economic theory presents humans as completely independent, Davis says our modern reality is more like a web, in which each of us is at the center of multiple social networks. Who we are is often defined by whom we're with, be it family, colleagues, friends or fellow citizens.

"I think one of the fundamental problems in our modern society is what it means to have a personal identity," Davis says. "People have many strong social identities, and as our society becomes more and more complicated, we seem to have more and more of these identities to manage. And because our many social identities are constantly changing, we are constantly in the position of having to re-conceive who we are. I think this social view is a much richer account of what a person is."

Those social relationships, of course, also influence our economic decisions. For example, as parents we might make a decision based not on what's best for ourselves, but what's best for our children.

Davis hopes his scholarship will encourage other economists to see the individual in a new way, but he admits the standard view is well-entrenched.

"The most I can hope for," he says, "is that people will ask themselves where does the rubber hit the road, where is the social, where is the life of ordinary people in economics?"

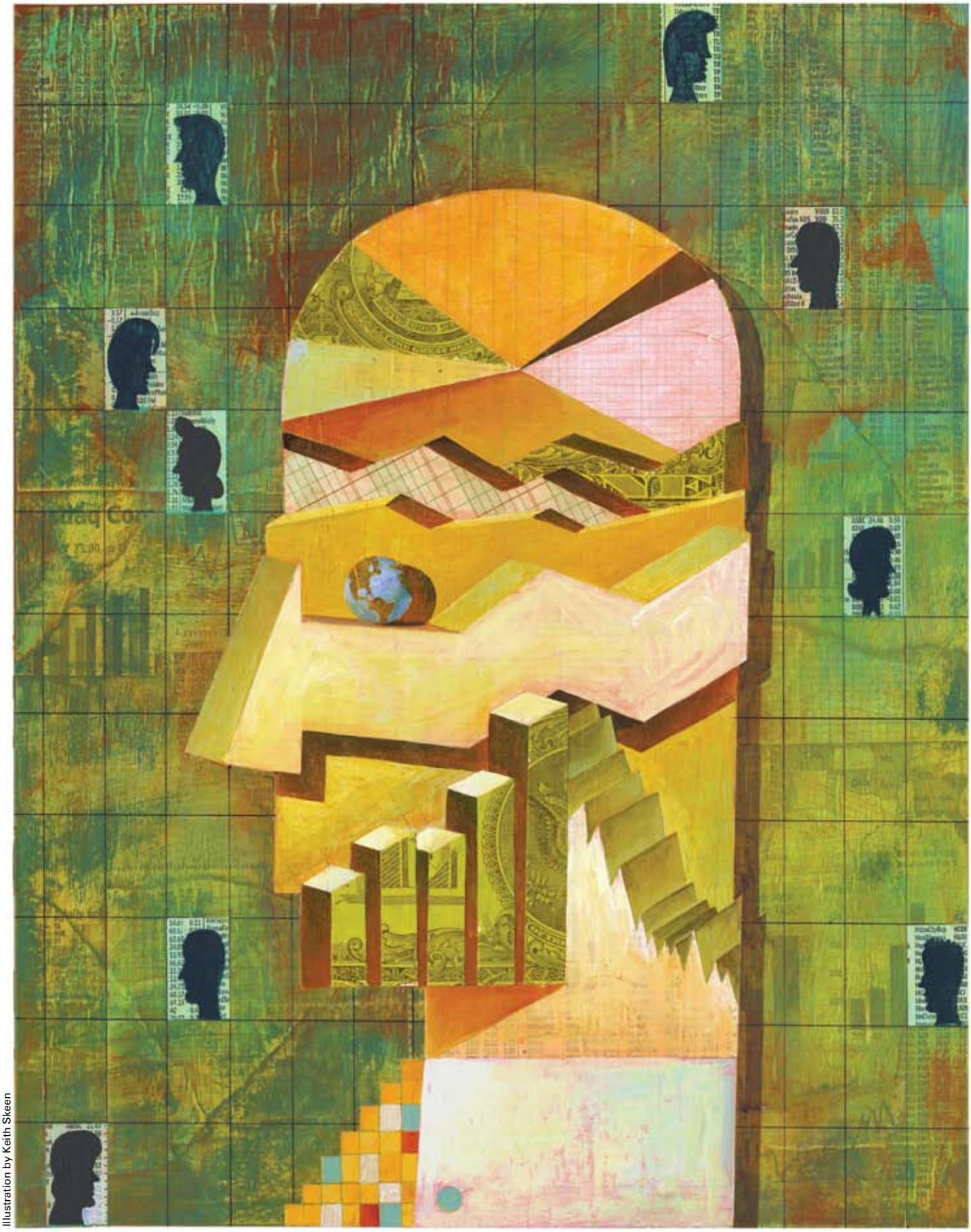


Illustration by Keith Skeen

# TRIAL BY TV: POP CULTURE MEETS LAW

Law professor Dr. David Papke estimates that about one-half of prime-time television depicts lawyers, police and private detectives. He first noticed pop culture's love affair with the law when he was working toward a doctorate in American studies. Intrigued, he took a closer look at the legal themes, characterizations and lessons depicted in movies, television and literature. With these findings, he co-authored the textbook *Law and Popular Culture*, published August 2007, and teaches a corresponding class to law students.

"I saw an interesting shift in the portrayal of lawyers," Papke says, "from hero, the Atticus Finch and Perry Mason type, to everyman types in need of redemption, like Ally McBeal; men and women who have gone astray and have to regain a moral path in their lives."

He also noticed a striking change in the character's role, which flipped from counsel for the defense popularized in the '50s and '60s to prosecutor in the '90s. "I think it's a harder, less-yielding era when people are more inclined to identify with those who crack down on wrong-doing than those representing the unjustly accused," he says.

Papke recognizes the impact such representations have on the public's perception of lawyers and legal practices. He appreciates the dilemma faced by real-life prosecutors, who say they can't measure up when pop culture presents the wheels of justice turning at lightning speed, with a suspect caught, evidence collected, jury impaneled and brilliant prosecution concluded in a 60-minute episode. Add in how easily extraordinary forensic evidence is obtained, as depicted in the television series *CSI*, and the challenges are apparent.

"In real life prosecutors don't have such evidence at their disposal. Yet juries expect it and when they don't see it, they are more likely to think there's a hole in the prosecution's case," Papke says, describing what lawyers call "the *CSI* effect."

Literature hasn't been exempt. John Grisham, the lawyer turned novelist and America's best-selling author in the 1990s, captivated readers with dramatic legal dilemmas.

Papke warns students against underestimating the importance of popular culture in contemporary American life. "For some Americans, what they see on television becomes their entire cultural experience," he says. "It is especially important to law students to reflect on how laymen and women — their future clients — think about lawyers and legal institutions. There's no better measure to alert students to law-related assumptions and expectations than how the law is represented for dramatic purposes."

MPTV.net

**Real-life legal dilemmas don't always play out like a *Perry Mason* episode. Yet over the decades, famous fictional lawyers (such as Mason, played by Raymond Burr, left) have shaped the public's impressions of the legal process. Scholars from around the nation gathered to discuss the issue at the Marquette Law School's Law and Popular Culture Symposium last fall.**

## CRAVING ANSWERS ABOUT APPETITE

The words "eating disorder" usually bring to mind dangerously thin teenagers — not fruit flies.

But understanding the eating habits of those tiny creatures could have huge implications, says Dr. Edward Blumenthal. An assistant professor of biological sciences, he discovered a line of mutant fruit flies that eat and eat and yet still starve to death. By researching these mutant flies, he hopes to identify the genes that are involved in sensing hunger and regulating feeding.

"The exciting possibility is that the problem with these flies lies in the pathways connecting nutritional state and hunger, which would have obvious implications for things like obesity and eating disorders," says Blumenthal, who has a grant from the National Institutes of Health. "Believe it or not, the control of feeding in flies has a lot in common with humans, so it's not that big of a stretch that what we learn could be applicable to human health."

Blumenthal stumbled on the topic by accident. He was studying a fly organ called the Malpighian tubele, which is involved in salt balance, and looking for flies that died on a salty diet. He dubbed the mutants who died "Lot's Wife." Then it got more interesting.

"When I started looking at them more closely I realized that the flies died no matter what I put them on — it wasn't just salty food," he says.

The fruit flies are fed a mixture of cornmeal and molasses that is dyed blue. That allows Blumenthal to track the food, which eventually gets stuck in a food-storage organ called the crop. The hungry flies try to eat more, but unable to digest the food, they deplete their fat stores and die within a few days.

He has already identified the gene that makes Lot's Wife different. Next, he wants to figure out where the gene is turned on, which will help him determine why the flies starve. By doing further genetic screens to create more mutations, he hopes to learn more about appetite control.

Hunger, in humans and in flies, is a very complicated phenomenon, Blumenthal says. "We now have this fly that's really unique because we have uncoupled eating and digestion," he says, "and now we can maybe use this fly to understand how hunger is controlled."

## OH FAVORITE SODA, HOW DO I LOVE THEE?

The power of the Coke and Nike brands crosses borders and transcends cultures. People love them, buy them and believe in them. Why have people built emotional attachments to these brands over others? Dr. Felicia Miller, assistant professor of marketing, hopes to help product owners discover the secret.

After working at Proctor & Gamble for a decade, Miller came to academia eager to test the prevailing theory that consumers form enduring relationships with preferred brands. Her research shows that consumers are less attached to most brands than product marketers would like to believe. Instead most consumers form unique relationships with a small number of the branded products they buy.

"I found the brand/consumer relationship is very idiosyncratic," she says. "It appears that there are some common relationship types that consumers experience, but the brand partner in that relationship varies greatly."

Miller's research defines nine unique relationships consumers form with brands, ranging from adversarial to abusive to fling to communal partner. For an example of the relationship phenomenon, Miller points to the airline industry. Some consumers feel they are in an abusive relationship with brands such as Delta and United that they perceive have failed to treat them as valued customers despite higher prices and fewer services. In contrast, other consumers have formed a communal partnership with brands like Midwest Airlines and Jet Blue that are consistently recognized for customer service and unique on-board experience.

In another stream of work, Miller examined the effect celebrity endorsements can have on a brand. She found that choosing the wrong celebrity could torpedo the consumer relationship altogether. She tested pairing Clinique, a well-respected brand of cosmetics, with celebrity endorsers Paris Hilton, Britney Spears or Jessica Simpson and found the firm could expect negative results. "The celebrity's meaning was in conflict with what the brand Clinique means in the minds of consumers," she explains.

# TEXT MESSAGING: DECIPHERING AN ELECTRONIC BABEL

***"Come, let us go down, and there confound their language, that they may not understand one another's speech."*** — Genesis 11:7

Stroll across any campus in America and you can't help but notice young people intently gazing at mobile phones, thumbs a fury.

For Dr. Robert Shuter, professor of communication studies, the text-messaging phenomenon has not gone unnoticed. To older generations, text messaging is often viewed as a nuisance or the degradation of interpersonal communication. But as someone who has researched communication patterns for four decades, Shuter views things differently.

Shuter recognized an obvious cultural divide between the 18- to 23-year-olds who most commonly use text messaging, and those in Generation X and older who have shied away from the technology.

"For the uninitiated, it looks like the electronic Tower of Babel," Shuter says. "To those in the older generation, it appears confusing, as if there are no rules that guide text message communication."

He added that the uninitiated are even appalled at what they perceive to be an absence of face-to-face communication in favor of numbing electronic encounters.

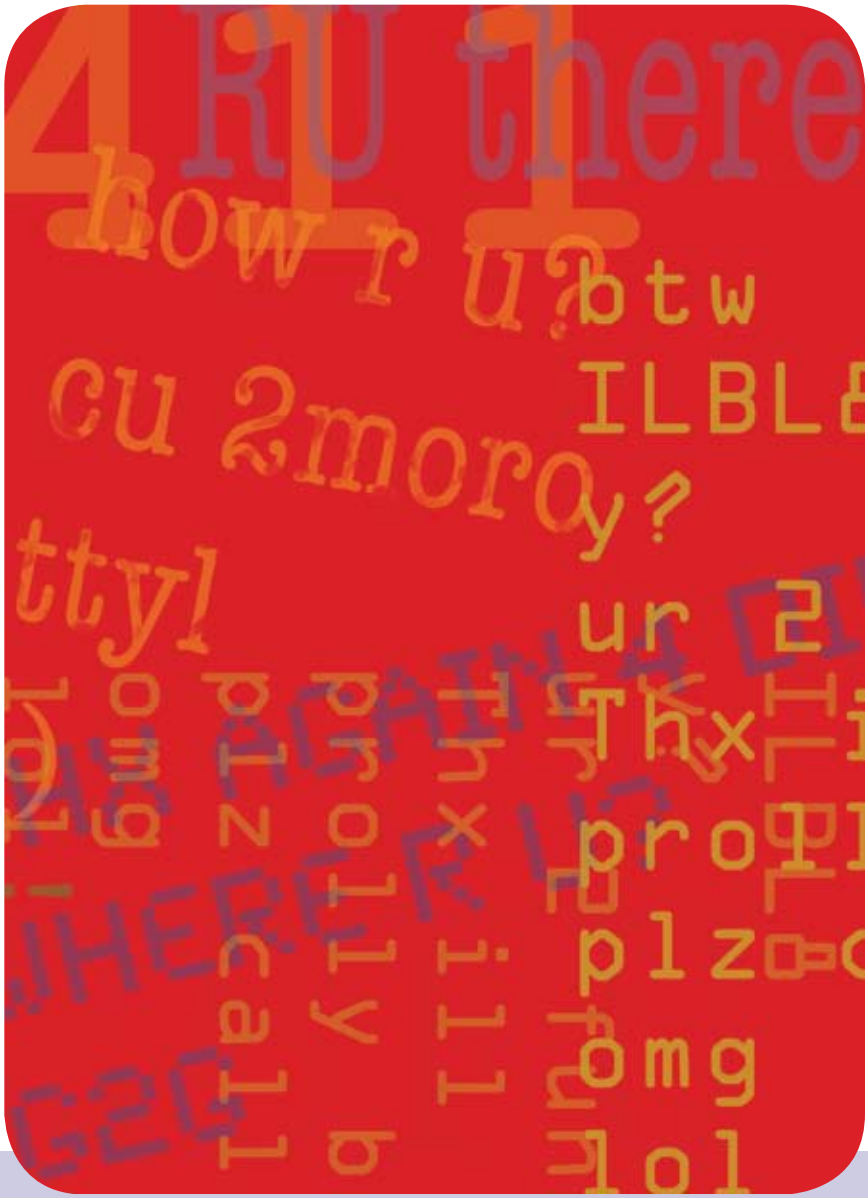
"There really was no research into how people are using this technology," Shuter says. "Existing research was predominantly business focused. I was interested in the behavior; the etiquette."

Using a text-messaging log he developed, Shuter set out to collect data on text message usage among young adults. He distributed the booklets to a statistically significant sample of Marquette students; over a week, each student answered questions about their messaging.

The findings have been counterintuitive. "Contrary to existing perceptions, there's a developing logic to texting," Shuter says. Young people will use texting for short, quick messages — such as "Where r u?" — instead of more personal conversations. "There's a clear etiquette emerging," he says.

Further, this group unequivocally prefers face-to-face communication. Shuter's data show text messaging dead last among preferred media, behind face-to-face conversations, phone calls and e-mails. Now Shuter, a pioneer and leader in the fields of international and co-cultural communication, is conducting a comparison study in India.

While at first glance this emergent technology seems akin to that great tower in ancient Babylon, Shuter's research has shown that text messaging is not as confounding as it might appear.



## GETTING TO THE ROOT OF THE PROBLEM

Teens moan about the two to three years spent wearing dental braces, but they appreciate the reward — dazzling smiles. Dr. Dawei Liu wants those smiles to last a lifetime.

Orthodontics applies degrees of mechanical force to correct dental irregularities, which include everything from crooked teeth to jaw skeletal discrepancies. But there is an unfortunate byproduct to most orthodontic treatments; the continuous force used to move a tooth can cause dental roots to shorten over time.

"We can observe radiographically that after two years of orthodontic treatment part of a root is gone, and you can't regrow it. A tooth with less root will become mobile," says Liu, assistant professor of orthodontics. "It can't bear the functional load of chewing. Eventually, because the tooth is not deeply rooted in the bone, you will lose the normal function or the tooth."

With one-half of the population undergoing orthodontic treatments during their lives, Liu says it is important to anticipate a patient's susceptibility to root resorption. "If we can predict it, we may be able to prevent it," he says.

In clinical trials Liu is evaluating the magnitude, frequency and duration of the orthodontic forces that adversely affect dental roots. "My study deals with the mechanisms of orthodontic tooth movement and its associated root resorption," he explains. "To see how we can move teeth efficiently, we are applying different forces to solve orthodontic problems."

He says solutions may lie in applying a lighter and vibrating force on the tooth and releasing the force immediately when root resorption is observed.

## KANNSCHT DU DEITSCH SCHWETZE?

"Can you speak Pennsylvania German?" Those who can provide fertile field study for Dr. Steven Hartman Keiser, one of the few linguists studying the unique language of the Amish and Old Order Mennonite.

An assistant professor of English, he first heard the language from his Mennonite grandmother. Now he's working on a dialectology of Pennsylvania German, studying the vocabulary, pronunciation and structural differences across regions. He is particularly interested in studying how language changes spread over large, discontinuous space, such as the isolated Amish communities of the Midwest.

A product of colonial Pennsylvania, the language is a "New World" blend that most closely resembles the dialect of the Palatinate region near Frankfurt, Germany, with a bit of Swiss influence mixed in. In the beginning, the Amish and Mennonites were a minority among Pennsylvania German speakers.

**The relatively isolated, rural society of the Amish has helped Pennsylvania German survive.**

"There were once hundreds of thousands of Pennsylvania German speakers in Pennsylvania — Lutherans and Reformed and all sorts of faith traditions — but now the language is all but dead in those groups. The only place where it's still alive, where children are still learning it, is among Old Order Mennonites and the Amish," Hartman Keiser says.

Pennsylvania German speakers are fluid bilinguals, he notes. Although Amish and Old Order Mennonite children speak the native language at home, all of their schooling (which ends in eighth grade) is in English.

Hartman Keiser estimates that there might be 300,000 Pennsylvania German speakers today, down from a peak of nearly a million in the late-1800s. And despite its Pennsylvania roots, the language is now most concentrated in the American Midwest.

Pennsylvania German speakers have defied the pattern of other immigrant populations, who usually drift farther from the native language with every generation. In contrast, the relatively isolated, rural society of the Amish has helped Pennsylvania German survive, he says.

Even more surprising is that the language is on the rise. The Amish population in North America doubles every 20 years, and by 2020, it's likely to reach 400,000. "In all of the Amish communities, you have children learning Pennsylvania German," he says. "So as long as the kids are learning it, it's alive, and it's growing."

## INNOVATIONS IN FAMILY PLANNING

For decades "the rhythm method," basal body temperature and cervical mucus monitoring were the primary tools available to couples interested in natural family planning. Thanks to research undertaken at Marquette's Institute for Natural Family Planning, a modern NFP method called the Marquette Model now guides couples in employing scientific methods and easy-to-use tools such as an electronic hormonal fertility monitor to accurately track fertility.

Using the rhythm method, a woman counts the days of her menstrual cycle, monitors her waking temperature or observes her cervical mucus to determine when she is fertile. With the Marquette Model, a woman measures the levels of two female reproductive hormones — estrogen and luteinizing hormones — in the urine with a hand-held fertility monitor. The two hormonal indicators provide a good estimate of the beginning and end of the fertile phase of the menstrual cycle.

There are six days of fertility in the menstrual cycle, the day of ovulation and the five days before. Dr. Richard Fehring, R.N., professor of nursing, says the Marquette Model provides good indicators to estimate the fertile phase of the menstrual cycle. Couples can use this information to achieve or avoid pregnancy.

When used correctly and consistently, Fehring says the Marquette Model has a 97 to 99 percent effectiveness rating in avoiding pregnancy, which approaches the effectiveness of the birth control pill.

"We want to help couples work with nature, with their natural cycles, as a healthy way of family planning," he says. "This method takes mutual motivation. Couples have to work together, but they tell us the experience improves their communication and fits their moral, ethical and spiritual view of family life."

Since 1998 Marquette has offered the only for-credit courses available to health professionals who want to coach couples on natural family planning and integrate fertility monitoring into enhancing women's health. A new Web site, which will go live later in 2008, will help couples learn how to use natural family planning methods, participate in discussion rooms, and consult with nurses, doctors and moral theologians about natural family planning.

Fehring and his colleagues are also studying the variability of the menstrual cycle and application of fertility monitoring during breastfeeding.

## HEALING PAIN

Pain is a complicated phenomenon. It's the No. 1 reason that people seek medical relief, and yet there's only so much clinicians can do to ease patients' suffering.

That dilemma was what drove Dr. Marie Hoeger Bement to study chronic pain. An assistant professor of physical therapy, she researches the role of exercise in alleviating pain. Her research is supported by the Arthritis Foundation and the American Pain Society.

Acute pain, which is associated with tissue injury, is easy to understand and straight forward to treat. But with chronic pain, the cause isn't so obvious.

"It's hard for the patient as well as the clinician to understand," Bement says. Patients with chronic pain even perceive pain differently, possibly because their central nervous system has become more sensitized, she says.

Although there's no cure for many chronic pain conditions, exercise could help. Exercise-induced analgesia was first identified in long-distance runners, who can become oblivious to their bodies' complaints when experiencing "the runner's high." But high-intensity aerobic exercise isn't feasible for everyone. Bement wants to learn if the same effect can be achieved through low-intensity, isometric exercise, similar to the movements of yoga and Tai Chi.

"A lot of people with pain have a fear of movement, and with isometric exercise people aren't moving; they're just contracting their muscle," Bement says. "It's easy to do, and everyone can do it."

She compares exercise-induced analgesia between healthy individuals and fibromyalgia patients, and also between genders. Although women have lower pain thresholds and higher pain ratings when exposed to a painful stimulus, they may also experience greater pain relief after high-intensity isometric contractions. Now Bement is trying to understand why.

# REVVING UP REHAB THROUGH ROBOTICS

Dr. Michelle Johnson lost her grandmother to a stroke. Now she devotes her career to designing robotic systems to help other stroke survivors do what her grandmother couldn't.

**"It's not just about the science or the engineering; it's about people."**

"I saw someone go from very vibrant and functioning to bedridden and not being able to use her limbs. It affected me," Johnson says. "Then when I started getting into stroke rehab, there was a passion there. I understood this was a real need. It's not just about the science or the engineering; it's about people."

Johnson is an assistant professor and director of the Rehabilitation Robotics Research and Design Lab, a joint effort of Marquette and the Medical College of Wisconsin. With funding support from the American Heart Association and others, Johnson's team is busy creating and testing innovative devices to help stroke survivors. She is also testing whether there are gender differences in robotic-assisted therapy.

One project is a simple video game system that uses joy sticks and steering wheels to help patients exercise an impaired arm. "The goal is to develop low-cost, affordable systems for home therapy," Johnson says.

The researchers can adjust the wheel's height, position and other perimeters to make the exercise more or less difficult. The machine employs both "rote" therapy — for example, using the wheel to chase a moving square across the computer screen — and more fun, commercial video games with a lot of action and flashy graphics.

"The rote therapy is more controlled. The fun therapy is more free form, but people are more willing to stay longer," she says. "So there's a trade-off there. The question is do both result in recovery, or does the engagement factor make a difference?"

The team also built the Activities of Daily Living Exercise Robot, called ADLER for short. By strapping the patient's impaired arm into the device, ADLER helps patients move through three-dimensional space to practice movements such as reaching and drinking from a cup. As the patient recovers, the robot provides less help. One patient needed two-thirds less help after 24 sessions of therapy.

"The caveat is that not everybody sees the same amount of recovery," she says. "It's part of the research to understand who this benefits. Do you have to have a little bit of function and the robot helps you get more? We're still trying to figure that out."

Dr. Michelle Johnson demonstrates her rehab robot.

# THE OTHER SIDE OF THE THERAPY COUCH

What happens when a therapist receives a gift from a client? How does a therapist manage sexual attraction toward a patient? How does a therapist-in-training cope when a patient commits suicide?

In a field focused on emotions, the therapist-patient relationship can be fraught with even further emotional complications. Dr. Sarah Knox, associate professor of counseling and educational psychology, studies psychotherapists and the sometimes sticky issues that can arise in therapy. She recently received the Outstanding Early Career Achievement Award from the Society for Psychotherapy Research.

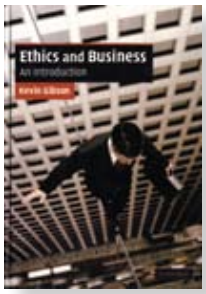
Knox always felt there was an unexplored depth to the therapist-patient relationship. How do therapists create and build relationships, and how does that relationship affect the therapy? "What's going on between these two people? We may never fully understand, but the more we can understand, the better it can be," she says.

Knox is also studying how therapists or therapists-in-training are affected when the roles are reversed — when they're the ones in therapy. Her research shows that it's often a transformational experience that changes the therapist personally and professionally.

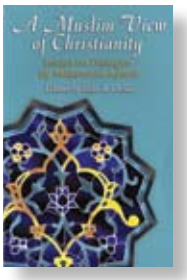
"My hope is that my research informs the work of therapy and helps therapists think about it in new ways," she says.

# MARQUETTE BOOKSHELF

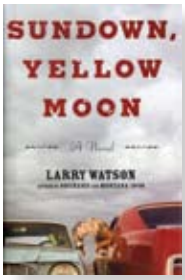
Looking for new reading material? Check out some of the latest works written and edited by Marquette University faculty.




*Ethics and Business: An Introduction*
by Kevin Gibson, associate professor of philosophy (Cambridge University Press, 2007)

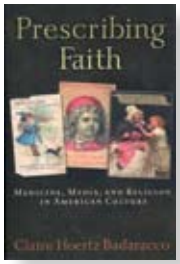



*A Muslim View of Christianity: Essays on Dialogue*
edited by Irfan A. Omar, associate professor of theology (Orbis, 2007)

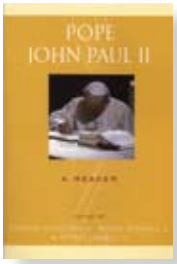



*Sundown, Yellow Moon: A Novel*
by Larry Watson, visiting professor of English (Random House, 2007)

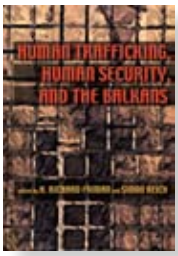

*Foot and Ankle Motion Analysis: Clinical Treatment and Technology*
edited by Gerald F. Harris, professor of biomedical engineering, Peter A. Smith and Richard M. Marks (CRC Press, 2007)



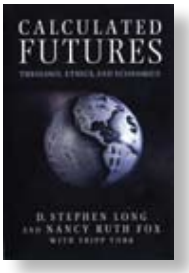

*Prescribing Faith: Medicine, Media, and Religion in American Culture*
by Claire Badaracco, professor of advertising and public relations (Baylor University Press, 2007)




*Pope John Paul II: A Reader*
edited by Jeffrey LaBelle, assistant professor of education, Gerald O'Collins and Daniel Kendall (Paulist Press, 2007)

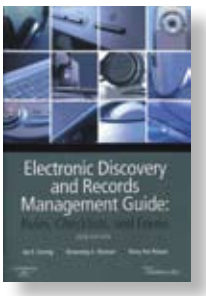



*Human Trafficking, Human Security, and the Balkans*
edited by H. Richard Friman, professor of political science, and Simon Reich (University of Pittsburgh Press, 2007)

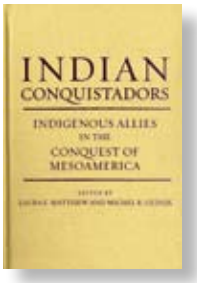



*Calculated Futures: Theology, Ethics and Economics*
by D. Stephen Long, professor of theology, Nancy Ruth Fox and Tripp York (Baylor Press, 2007)

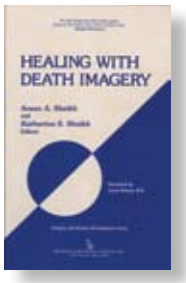
*Seventeenth-Century English Romance: Allegory, Ethics, and Politics*
by Amelia Zurcher, associate professor of English (Palgrave Macmillan, 2007)




*Electronic Discovery and Records Management Guide*
by Jay E. Grenig, professor of law, Browning Marean and Mary Pat Poteet (Thomson West, 2008)




*Indian Conquistadors: Indigenous Allies in the Conquest of Mesoamerica*
edited by Laura Matthew, assistant professor of history, and Michel R. Oudijk (University of Oklahoma Press, 2007)




*Healing with Death Imagery*
edited by Anees A. Sheikh, professor of psychology, and Katharina S. Sheikh (Baywood Pub., 2007)


# RESEARCH AT MARQUETTE

- Marquette faculty significantly increased the number of federal research applications submitted, and externally funded research requests exceeded $26 million for the first time.
- Corporate research dollars increased, with the largest award supporting work on renewable energy.
- More than half of the research awards won by Marquette faculty in fiscal year 2007 included funds for student participation, reflecting Marquette's commitment to the teacher-scholar model.
- The university provides internal support for research through several programs: three-year Way Klingler fellowships, fourth-year sabbaticals for junior faculty, and the Lawrence G. Haggerty Faculty Award for Research Excellence.
- Marquette faculty edit a number of scholarly journals, from the *Journal of Orthopaedic and Sports Physical Therapy* to the *International Journal of Systematic Theology*.
- Marquette's Department of Theology ranked among the nation's top 10 for faculty scholarly productivity, according to Academic Analytics of Chester, Penn.
- The Department of Special Collections and University Archives houses more than 17,000 cubic feet of archival material and 11,000 volumes, including approximately 7,000 titles within the rare book collection. The J.R.R. Tolkien Collection includes many of the author's original manuscripts, including *The Hobbit* and *The Lord of the Rings*.
- Marquette has more than 20 academic centers and institutes that foster research in the areas of end-of-life care, ethics, neuroscience, rehabilitation engineering, transnational justice, water quality, sports law and other areas.

For more, go to *marquette.edu/research*.

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