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Dear Reader:

It is my distinct pleasure as the new Vice President of Research to introduce the 2014 issue of UT Discovers. This issue differs from past years in that it does not have a particular focus on any single research area. Rather, we provide some insights on the myriad areas of research, scholarship and creative activity undertaken by scholars of The University of Toledo.

UT scholarship and research are dynamic, exciting and fascinating. These efforts include innovative approaches in many disciplines, encompassing such topics as art, theater, biology, environment, astronomy, nursing, pharmacy and law. UT researchers and scholars are a diverse crew, with varied interests both within and outside the academy. As you read about their efforts, you may be surprised by the scope of the work, pleased that our university has such a devoted group of faculty scholars and intrigued by the opportunities we have to make a difference in our community.

I also would like to emphasize the impact that research and scholarship have on the educational mission of The University of Toledo. Faculty members actively engaged in research and scholarship bring their discoveries into the classroom so students can hear about the emerging technologies and listen to the latest ideas as part of their formal educations. In addition, faculty research and scholarship provide learning opportunities in research laboratory settings and through participation in scholarship and the creative process.

We hope you enjoy learning about the creative efforts of our scholars. If you have any questions about their work or would like additional information, I would be happy to make inquiries for you.

Sincerely yours,

William S. Messer, Jr.
Vice President of Research
## Table of Contents

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>STARRY SKIES</td>
<td>Michael Cushing</td>
</tr>
<tr>
<td>10</td>
<td>MOVING ON</td>
<td>Maria Diakonova</td>
</tr>
<tr>
<td>12</td>
<td>SPIT HAPPENS</td>
<td>David Giovannucci</td>
</tr>
<tr>
<td>15</td>
<td>MEN SEEKING MEN</td>
<td>Wendi Goodlin-Fahncke</td>
</tr>
<tr>
<td>18</td>
<td>IT’S JUST A SPRAIN</td>
<td>Phillip Gribble</td>
</tr>
</tbody>
</table>
21 EXPANDING HORIZONS
RESEARCHER:
Paul Hong

24 ZOMBIES, GUNS AND PROPAGANDA
RESEARCHER:
Brian Anse Patrick

28 ALL TOGETHER NOW
RESEARCHER:
Song Qian

31 LAW AND BEHAVIOR
SCHOLAR:
Geoffrey Rapp

33 TO SERVE OR NOT
RESEARCHER:
Jami Taylor
36 THROUGH THICK AND THIN
RESEARCHER: Guillermo Vazquez

39 SURVIVORS
RESEARCHER: Eileen Walsh

42 CONNECTIONS
ARTIST: Barry Whittaker

46 CONVERSION EFFICIENCY
RESEARCHER: Yanfa Yan

49 POW! WHAM!
SCHOLAR: Matt Yockey
Starry Skies
Stars are born; they live, and then they die. But some stars don’t quite make the grade to become real energy-producing astronomical bodies that emit visible light. These failed “stars” are called brown dwarfs.

The reason stars like our sun shine is nuclear fusion, explains Michael Cushing. The recipe is four hydrogen atoms subjected to extreme temperature and pressure; the end product is one helium atom and a tiny bit of energy. But since the sun is composed almost entirely of hydrogen atoms, and 600 million tons of hydrogen are converted to helium every second, that tiny bit of energy is multiplied enormously.

“However, if you take away some mass from a star, you also lower the pressure and temperature in the core where the fusion reactions occur,” explains Cushing. “When you get down to 8 percent the mass of the sun, the core temperatures and pressures are too low to create fusion reactions. At this point you get a brown dwarf that fails to produce its own energy.”

But if no energy is being generated, how do we see these objects? Cushing explains that, the leftover heat from when a brown dwarf forms leaks slowly to the surface and can be detected by infrared cameras on space telescopes, such as NASA’s Wide-field Infrared Survey Explorer (WISE). “We have infrared images of the whole sky,” Cushing notes. “And,” he adds, “we know what a brown dwarf looks like at different infrared wavelengths, so we can pick them out against a background of stars and galaxies.”

Why look for these objects in the first place? For starters, astronomers just want to know where the sun’s nearest neighbors are. Cushing says that we have already identified all of our stellar neighbors, so now we are trying to find all of the nearby brown dwarfs. “If you draw a sphere around our sun with a radius of about 15 light years (nearly 100 trillion miles), scientists have added five new objects to the list of brown dwarfs in the past year alone. These are places we could actually go to some day,” he remarks.

Another goal astronomers have is to find colder and colder brown dwarfs, Cushing notes. The colder a brown dwarf is, the less star-like and the more planet-like it is. “Planets are obviously very interesting,” he says, “and astronomers are finding lots of big, Jupiter-like planets around other stars.” However, they are hard to study in detail because they are often lost in the glare of their parent stars. “Since brown dwarfs have properties similar to these Jupiter-like planets but float isolated in space,” Cushing adds, “they are much easier to observe and thus are ideal stand-ins for testing our theories of gas-giant planets like Jupiter and Saturn.”

One of the outstanding problems in astronomy is a complete theory of how stars form. Although a great deal is known about this, there are still holes in our knowledge. One major blank is the lack of a theory to explain why there are so many stars with lower mass than our sun and so few with larger mass. “Any theory to explain how stars form has to explain that fact,” Cushing notes. Measuring the number of brown dwarfs in that 15-light-year volume around our sun is a quantity that any successful theory of star formation must be able to predict. So far, scientists have discovered about 1,000 brown dwarfs. Of those, there are six, known as Y dwarfs – two of which Cushing and his team found; these are very cool, with atmospheric temperatures of only about 80 degrees Fahrenheit.

But Cushing and his colleagues do not rely just on data from NASA’s WISE satellite. They use the Hubble Space Telescope and Spitzer Space Telescope to obtain even more data. These telescopes can measure the intensity of light at different wavelengths and can tell them the temperature of the brown dwarf, what it is composed of, and even how far away it is. The ultimate goal, Cushing says, is to locate and measure all the brown dwarfs in a given volume of space and use that information to develop an overarching theory of star formation.

Michael Cushing is an assistant professor in the Department of Physics and Astronomy. His research interests focus on star formation, with special interest in the characteristics of brown dwarfs and a special class of brown dwarfs called Y dwarfs. When not poring over infrared photographs and massive amounts of data, Cushing enjoys playing tennis and spending time with his wife and one-year-old daughter.
The ultimate goal, Cushing says, is to locate and measure all the brown dwarfs in a given volume of space and use that information to develop an overarching theory of star formation.
Metastasis, or the spread of cancer from the primary tumor to other regions of the body, is the real reason that cancer is such a killer. The primary tumor can be removed surgically, but if cancer cells have started to move, there is no way to track, find and remove them. Several years ago, researchers found that the hormone prolactin, which normally regulates mammary tissue development and milk production, was responsible for breast cancer cell division (proliferation). They thought that if prolactin in the blood could be corralled, they could stop breast cancer. When they tried inhibiting its production in the pituitary, however, the cancer was not halted. The research community then lost interest.

Tumor cells that start migrating must move through solid tissue. To do this, they must somehow dissolve or plow through tissue. Diakonova and her students have determined that cancer cells produce proteins that dissolve tissue and allow invasion.
More recently, the scientific community has discovered that prolactin is produced locally by breast cancer cells in addition to its production in the pituitary. Maria Diakonova, associate professor in the Department of Biological Sciences, was studying growth hormones and found that a protein called JAK2 can activate another protein called PAK1. JAK2 and PAK1 are part of a family of proteins known as kinases. These kinases function by attaching phosphate molecules to other proteins. The connection between these two proteins led her to look at the role of prolactin in different cell functions. Furthermore, Diakonova began to see that PAK1 is implicated in cell motility, which is important in cancer metastasis.

Inhibiting prolactin generally is too global an aim, says Diakonova, because other cells in the body—such as cells in the blood and fibroblasts essential to wound healing—depend on prolactin to carry out their function. What Diakonova wants to know is which proteins in the breast cancer tissue can be biomarkers for cancer metastasis. In other words, if she can determine whether PAK1 has been activated by JAK2-prolactin, then that analysis can be a kind of Delphic oracle predicting the future behavior of the cancer cells.

“When prolactin binds to a site on the cell surface,” Diakonova explains, “it activates a protein called JAK2. JAK2 in turn targets another protein called PAK1.” Diakonova has found that JAK2 provides a phosphate group to three of the tyrosine molecules in the PAK1 strand. When that happens, cell motility is enhanced.

It took six years, but Diakonova can now measure the level of activated PAK1 using a special antibody she developed. Each antibody recognizes only one from the three phosphorylated tyrosines. Using cancerous tissue provided by the pathology department, she is testing the correlation between breast cancer stage and the antibody signal. Ultimately she hopes to be able to use the antibody as a predictive marker.

But prolactin and its substrates don’t act in isolation. Tumor cells that start migrating must move through solid tissue. To do this, they must somehow dissolve or plow through tissue. Diakonova and her students have determined that cancer cells produce proteins that dissolve tissue and allow invasion. Prolactin is involved in this process as well, she says. When PAK1 is activated by prolactin through JAK2, it stimulates secretion of several proteins from a large family of proteins called metalloproteinases. These are proteins that incorporate a metal, usually zinc, and degrade the collagen that is a major component of the extracellular matrix. This process occurs simultaneously with enhanced motility.

Because cancer cells divide and multiply prolifically, Diakonova also wanted to determine if prolactin was implicated in this process. It turns out that Cyclin D, which controls cell division, also responds to prolactin, JAK2 and PAK1 to promote cell division and proliferation. This is yet another protein that can regulate cell proliferation during tumor growth and cancer progression.

Her research has led Diakonova from looking at a growth hormone to related proteins and their intracellular interactions. She has gone from determining how prolactin activates proteins that control cell motility to being able to determine how prolactin activates other cellular processes simultaneously. Without enabling cells to dissolve tissue, mobile cancer cells would be able to go nowhere. Without cell proliferation, there would be no need for enhanced cell motility or the production of metalloproteinases and invasion. It is prolactin acting on cellular proteins that promotes all these behaviors. And ultimately, Diakonova seeks to develop an antibody test that will predict metastatic potential of breast cancer cells.

The National Institutes of Health has funded the research reported here.
Spit Happens
The element calcium is in every living cell. It is a ubiquitous signal messenger and controls processes from fertility to cell death and everything in between.

David Giovannucci and his lab are especially interested in the calcium signaling that regulates calcium-activated ion channels and proteins involved in the release of neurotransmitters. This process is important in understanding how nerve cells communicate, how endocrine cells release regulatory hormones and how fluid and protein secretion are controlled in the gastrointestinal tract. Moreover, Giovannucci says that many human disease processes are associated with a dysregulation of calcium signaling and what it controls.

Salivary glands historically have been used as a model to study the intricacies of calcium signaling, Giovannucci explains. He and his colleagues are examining the cellular machinery that creates calcium signals in order to develop a better understanding of how calcium controls a battery of different processes.

Saliva is important in chewing, swallowing and digesting food; it has antibacterial properties that help preserve oral health. Normal humans produce one to two liters of saliva a day. Giovannucci explains that the autonomic nervous system controls most saliva production from two sets of glands: the submandibular gland located at the back of the lower jaw and the parotid gland located just under the ear. These glands produce saliva in response to the neurotransmitters adrenaline and acetylcholine, which normally have opposite (although complementary) effects, but in salivary glands both contribute to saliva production.
In response to neural input, the calcium that controls saliva production is released from an intracellular site, an organelle called the endoplasmic reticulum. The increased concentration of calcium in the cytoplasm of the cell activates calcium-sensitive ion channels in the cell membrane. These ion channels secrete salt and then water follows. The rise in cytosolic calcium also induces salivary cells to secrete digestive enzyme and antibacterial proteins. Calcium, however, is actually toxic to cells over prolonged periods and causes cell death, so there are compensatory mechanisms that subsequently reduce the calcium concentration in the cytoplasm, which then closes the ion channels and terminates secretion.

Giovannucci explains that failure to produce sufficient saliva occurs in patients with an autoimmune disease called Sjogren’s syndrome or those undergoing radiation therapy for head and neck cancers. In this case, the saliva glands produce so little saliva that it evaporates and patients experience dry mouth, oral pain and diminished oral health. Understanding how intracellular calcium release channels function can help devise treatments for this debilitating illness. Using a mouse model of Sjogren’s syndrome and tissue from patients, Giovannucci is examining calcium signal regulation that is altered in the disease. “Can we exploit that pathway to identify a target for enhancing saliva production?” he asks. “The problem is that the pathway no longer provides adequate control. We need to repair or augment what remains so that the body can effectively restore saliva production.”

Furthermore, Giovannucci notes that the process of making saliva is a result of salt secretion that then produces water movement. The fluid in saliva originates in the vascular system so that saliva mirrors many of the compounds found in blood serum. Since it is much easier to collect saliva than blood, Giovannucci thinks that saliva can be a diagnostic tool for what is going on in the body as a whole. Looking to the future, he believes that assays can be developed to detect specific chemicals or “biomarkers” in saliva that would indicate a particular disease state. Miniaturization of these assays can create a “lab on a chip” enabling large-scale screens for many diseases at one time. But he cautions that this vision will be many years in the making: “We are just at the beginning of being able to establish if saliva will be a useful source for biomarker detection.”

David Giovannucci, an associate professor in the Department of Neurosciences and director of the Raymond and Beverly Sackler Laboratory for Neuroendocrine Tumor Research, graduated from Wayne State University in 1993. He was a postdoctoral fellow at the University of Michigan Medical School and a researcher at the University of Rochester Medical Center in New York before coming to UT. Work in his lab has been funded by the National Institutes of Health, the American Heart Association, the Raymond and Beverly Sackler Foundation and the Air Force Office of Scientific Research. When he is not in the lab, he leads a 10-piece acoustic orchestra called “The Luddites.” Composed of scientists and artists, this small orchestra plays gigs in the Detroit area. Check them out online at http://www.theluddites.org.
In the 1970s Laud Humphreys published his dissertation and a book (Tearoom Trade) about men seeking homosexual encounters in public places. He claimed that these men came from diverse social and cultural backgrounds, had different motives for their activities, and variously considered themselves as straight, bisexual or gay. Humphreys demonstrated (controversially) that many of these men were married and lived otherwise respected and “normal” lives.
At a university in the South, Wendi Goodlin-Fahncke (now in the UT College of Social Justice and Human Service) had been conducting research on prostitution. She also taught a course that had a number of law enforcement officers as students. One day she and a colleague were talking about sting operations; they went to Craigslist to investigate and stumbled on a link for men seeking men. “This is a topic that is not studied much,” Goodlin-Fahncke says, “and we were curious to see what has changed in 40 years.”

Initially men would go to public bathrooms for random chance encounters. The culture has changed radically since then, Goodlin-Fahncke says. With the advent of the Internet and sites like Craigslist, participants in these kinds of activities are posting personal notices online and not hanging around public areas as before. Whereas men once had to ask someone where to go to find a willing accomplice, now they can post a personalized ad and meet any place at any time. The Internet has allowed more people to be involved more discreetly at no cost. Craigslist allows someone to post a personal advertisement looking for a casual sexual encounter once or several times a week and even take it down immediately. Potential partners can respond to the advertisements via email. With the rise of smartphones, individuals can schedule casual sexual encounters at lunch and be home for dinner without anyone knowing.

The Internet is thus an easy way to post anonymous ads and remove them without providing a traceable profile or personal information. In addition, “posters” can emphasize particular selection criterion (e.g., age, race, body type) that is most important to them and easily filter any received responses that are not considered a “suitable match.” Moreover, pictures can be exchanged via email once contact has been made in order to filter out any undesired responses.

“Given the apparent increase in the number of men participating in these activities, public health becomes a major concern,” notes Goodlin-Fahncke, “and understanding who is participating in this behavior, how prevalent it is, and where it occurs is increasingly important.”

In their first studies, Goodlin-Fahncke and her colleague Kelly Cheeseman (now at Messiah College in Pennsylvania) found that some cities had thousands of new Craigslist personal ads every day. If they wanted to study the phenomenon, the primary issue thus became how to whittle down this enormous amount of data to something they could tackle. They decided to select cities representative of different parts of the country: Nashville, Chicago, Los Angeles, Atlanta, Boston and Salt Lake City (chosen to see if religion would have an impact on men seeking men for casual sexual encounters). Furthermore, since so many thousands of ads were available on the site, the researchers picked a number at random and chose every 25th ad for the given day in each city (approximately 700-750 cases per city). They have ended up with more than 3,500 cases.

The next major task was to decide how to code the selected notices. The researchers developed a comprehensive list of 60 variables including whether the poster specified a marital status or not for himself; if the encounter was to be “no strings attached” (NSA, meaning the encounter would be completely casual); the type of sexual activity desired; the sexual orientation, age and race of the poster (and also often the partner); if he was drug- and disease-free (DDF) and if he wanted the other party to also be DDF; and other categories (see the glossary of terms on the right).
Men seeking men are very different from men seeking women or women seeking women, Goodlin-Fahncke explains. Women seeking women are generally looking for a long-term, stable relationship. To the contrary, 95 percent of men seeking men want casual encounters – other men who are interested in “doing the deed” and then going their separate ways, often without even exchanging first names. “Some men do seek long-term relationships with other men on Craigslist,” notes Goodlin-Fahncke, “but these are rare.”

Analysis of the ads on Craigslist allowed the researchers to develop a preliminary description of the men involved. Surprisingly, 37 percent said they were married. This group generally had a limited timeframe of when the casual encounter could occur (for example, when the wife was out of town for a day or at work) and would more often specify the act they were interested in – “probably something the wife would not perform,” adds Goodlin-Fahncke. Less than 10 percent admitted they had a disease; most men said they were drug and disease free. “Of course, you would have to take them at their word,” she comments, which can have implications for public health issues.

The population of men placing these ads is a diverse one, says Goodlin-Fahncke. They are of all ages from college-age to well past 70, although the average age is in the 33-40 range. They are of different sexual orientations including heterosexual, homosexual, and bisexual. Most of the men are either African-American or Caucasian; a few are Hispanic or Latino; very few are Asian. Goodlin-Fahncke suggests that the lack of Asians, Hispanics or Latinos in the population studied may be related to the cities that were examined.

The researchers also found that most men stated in their personal advertisements that they could meet at any time. “This would get a higher response rate to the ad and give them more activity,” notes Goodlin-Fahncke. If the ad gave an open door policy, there could be multiple simultaneous encounters – “the more the merrier?” she asks.

She says that most ads require a response, which would allow the person to specify a time and place. As for place, most men use their own homes (i.e., they were able to “host” the encounter) – even the married men. Hotel rooms are not uncommon, and some still use gyms and public bathrooms as meeting places for the encounters. But the cruising is now set-up online as opposed to years ago.

Now that they have a basic description of who, what, when and where, the researchers are honing in on the health aspects of these activities. “No one has looked at the health aspect for married people,” Goodlin-Fahncke remarks. “And taking people at their word that they are DDF can be dangerous,” she adds. Not only that, she says that some of these men are “bug chasers,” men who are looking for someone carrying a disease. “It’s like Russian roulette with HIV/AIDS.” Future studies will add more cities to the list and further investigate ads posted in cities during times of major events – like the Super Bowl – to see if and how the advertisements have changed. Much remains to be done, Goodlin-Fahncke says, but she and her colleague have made a start.

**Glossary of Terms:**
- Gloryhole: partition for anonymous oral sex
- Twink: a more “feminine” male or a more slender male
- Bear: a larger more masculine male
- DDF: drug and disease free
- NSA: no strings attached
- Top: giver of sexual intercourse
- Bottom: receiver of sexual intercourse
- Versatile: can be the giver or receiver of sexual intercourse
- PNP: party and play
- 420: marijuana
- Cut: uncircumcised
- BB: bareback sex (no condom)
- Host: able to have the encounter at his home, apartment, hotel room, etc.
- Discreet: wants to keep the encounter quiet (i.e., does not want anyone to know about the encounter)

Wendi Goodlin-Fahncke is an assistant professor in the Department of Criminal Justice, Social Work and Human Legal Specialties. Her other research interests include the sexual exploitation of women, the safety and well-being of elderly inmates, and intimate personal violence. She enjoys working with individuals at agencies within the community. When she is not on campus she enjoys spending time with her daughter.
Ankle injuries are not life threatening, but they are the most common injury among physically active people and a multimillion-dollar burden on the health care system. In the short term, people recover—often in just a few days; but in the long term, an ankle injury early in life has serious implications. Ankle injuries put someone at risk of further injury and could initiate a cascade of degenerative disease, reduce the person’s activity level, and increase the risk for obesity and cardiovascular disease.

“If something so minor can have such serious ramifications, we need to stop the degenerative process at its inception,” says Phillip Gribble. Working with student athletes and community volunteers, Gribble seeks to quantify the deficits and disabilities that can occur after an injury. What causes the injury to occur in the first place? he asks. What makes a person at risk?

A major goal for Gribble is to determine the important factors that underlie ankle sprains. “The only strong link that predicts ankle sprains is that someone has already had a sprain. That is not good enough for me,” Gribble states. A phenomenon called chronic ankle instability (CAI for short) is a large part of the picture, and Gribble and his colleagues and students are pursuing research to tease apart the specific contributing factors.
Using laboratory measures, Gribble and his students are looking at physical movement such as balance, strength and neuromuscular control. Gribble has developed several noninvasive, simple tests and is validating them in the lab. He notes that these tests can be administered in just a few minutes and cost almost nothing to implement. “They are ideal for clinical implementation,” he says.

Gribble describes the tests as requiring only a tape measure or a small obstacle. In one test, the person stands on one leg and reaches as far as possible with the other leg and then returns. Another test requires the person to squat without losing his balance. A third has the person step over an obstacle and then return. His group of researchers and clinicians can implement these tests in 10 minutes to assess a person’s balance, strength and range of motion that are indicative of the risk of ankle injury.

But this testing and validating is only phase one of a much larger picture for Gribble. Phase 2 is determining what to do to prevent ankle injuries. In investigating ways to prevent ankle instability, Gribble is seeking to determine what factors can be corrected based on a person’s test performance. The ultimate goal is to keep people injury free and physically active for a longer time. Laboratory tests have helped the research team validate that a combination of balance exercises and restoring ankle range of motion helps keep people active and supple. Gribble notes that a few controlled studies indicate that ankle bracing shows promise, but there is insufficient research on a large scale.

“We’re just beginning to scratch the surface,” Gribble remarks, “in considering that an ankle injury early in life sets that person up for increased risk of additional injury and degenerative joint disease.”

Gribble wants to conduct intervention studies to show scientifically that early injury creates long-term problems. “Convincing people who are at risk to take action is a real issue,” he notes. “But we have had good cooperation from local schools and parents. The tricky part will be to find something that is not time consuming or expensive. We need to find something that has positive cost-benefit ratio. People are much more likely to follow through with an activity or an intervention if the benefit outweighs the cost.”

When he launches Phase 2, Gribble will be sure that exercises and interventions are efficient and effective. He says parents and coaches like the idea and are interested in participating in research that will improve the future health of youngsters. Not only will such studies help improve the health of an aging population, but they will also decrease the economic drain on society that comes with treating long-term chronic disease.

Research reported here has received support from the National Athletic Trainers’ Association and the Great Lakes Athletic Trainers’ Association.

Phillip Gribble is a professor of kinesiology whose research has concentrated on ankle instability. When not teaching or conducting experiments, he plays music on his guitar, banjo and mandolin. He is also heavily involved with his children’s activities and enjoys coaching Little League baseball and soccer.
Companies compete, but they do not compete based on their own capabilities alone. Competition incorporates suppliers, distributors and customers in a large and often complicated and densely networked situation. Competition is thus not merely company vs. company, but network vs. network. As the management of organizations extends beyond national boundaries, the complexity of the network becomes very large.

Studying the phenomena of such complex networks, Paul Hong has closely examined global firms, asking how they compete within global networks. Although his original research focused on company innovation and product development, the concern for the overall success of companies has led him inexorably to a larger view. “Companies, even small and medium ones, can no longer compete in just the regional or national market,” Hong says. “They need to go after the global market.”

As an example, Hong notes that an automobile has about 30,000 component parts. Where do those parts come from and who manufactures them? and How do those parts get to where they are needed? are important questions to consider. Manufacturers of airplanes, lawnmowers, kitchen appliances and smartphones – even retailers like Wal-Mart – maintain huge networks of suppliers worldwide.

“Supply chain practices are essential in new product development and obtaining complex components,” explains Hong. This supply chain network must also be flexible and adaptable to be able to respond to disruptions. In a study of Japanese firms affected by the 2011 earthquake and tsunami, Hong found that robust supply chain strategies allowed firms to recover more quickly. Innovation and transformation in manufacturing thus becomes the next major concern for Hong. This involves taking a component part worth $100 million and doing something to it to transform it to increase its value up to $1 billion. To be successful in today’s marketplace, a company needs to have the ability to create a value-added product based on innovative ideas and processes. “A lot of U.S. companies are at the leading edge of innovation because they have the transformational capability to make a component five to 10 times as valuable as the original part,” Hong adds. Innovative companies tap into resources that exist outside of the firm. This approach has increased the emphasis on working closely with supply chain partners.

Increasingly, customers demand sustainability of firms – social and environmental – beyond economic performance. More and more companies are incorporating the end story from the beginning and planning on recycling designs to build sustainable brand reputation. As firms integrate their global supply chains, complex systems and diverse entities interact and collaborate to deliver their products and services for enormous numbers of customers worldwide. Along with a worldwide supplier network comes concerns of global logistics that use air, land and water transportation to both obtain components and deliver finished products. A major disruption (e.g., the 2011 natural disaster in Japan) may affect the entire system. Firms must be prepared for the challenging reality of “disruptions once in a while and competitiveness requirements for everyday,” Hong states.
Rapid changes occur on a global scale, Hong notes. In 2000, 179 of Fortune’s Global 500 firms were based in the U.S.; by 2013 that number decreased to 132. During that same period, Chinese firms went from 10 to 89. “The competitive landscape is changing and how global firms compete is changing,” says Hong. Markets, infrastructure, networks—nothing is quite as it was 20 or even 10 years ago. Nokia, once a mobile phone global giant, disappeared in 2013. Pearl River of China is now the world’s leading piano maker in terms of sales volume, and K.C. and J.C. Mahindra of India’s Mahindra & Mahindra Limited are positioning the company as a global manufacturer of inexpensive cars beyond India. Thus, global competitive market reality will continue to remain turbulent.

Managing global supply chain complexity involves an information system through which real-time communication can be established, and that enables geographically disparate supply chain partners to see problems in the other plants. Working with information technology thus brings up the question of who will coordinate this larger picture. The supply chain is now more complex than ever. Hong notes that it will be pertinent to determine how companies use technology to establish virtual dual supply chains and allow flexibility when projects do not go as planned, or when disaster strikes.

And to make things more exciting, Hong is taking his research on supply chain management and applying it to making service sectors in general and health care in particular more productive. For example, appointments and operating room schedules are typical operations and supply chain problems, he explains. The service industry also depends on networks, so Hong’s research attempts to make the entire service sector more efficient with respect to customer-oriented values. Additionally, the next level of product development will require companies to go beyond known boundaries and suppliers. They will need to develop relationships with firms that take their products and service development into a more global ecosystem approach. For example, Hong notes that firms – small as well as large in any industry – like Nike, Amazon, Square, Splunk, Google, Target, and Procter & Gamble, do increasingly tap into open networks for innovation resources to expand their domestic and global market boundaries.

Companies look at emerging markets and devise strategies for tapping the enormous potential opportunities. China and India, for example, represent fertile grounds for reaching out to a greater number of people at the base who are yet to gain access to innovative products that they can afford to purchase. As more people increase their individual incomes, their ability to purchase products and services is enhanced. Such a large number of people with modest levels of disposable incomes requires global firms to provide quality goods and services with a reasonable profit per unit on very large economies of scale while sustaining a reputation of being socially responsible. These complex supply chain issues direct researchers to governance of diverse stakeholders, systems, processes, cultures and performance outcomes. Hong concludes, “These are emerging themes and exciting new frontiers for the highly interdisciplinary research endeavor called global supply chain management.”

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Paul Hong is a professor in the Department of Information Operations and Technology Management. His research on supply chain management has led him to collaborate with researchers around the globe. He is also the co-chair of an annual Global Supply Chain Conference that is now in its sixth year. His book, “Building Network Capabilities in Turbulent Competitive Environments: Practices of Global Firms from Korea and Japan,” was published in 2012 and the subsequent book on global supply chain practices in emerging economies is expected to be released by December 2014.
ZOMBIES, GUNS
AND PROPAGANDA
You might ask what zombies, guns and propaganda have in common. According to Brian Anse Patrick, the gun movement and zombies are a response to a collective societal angst; and propaganda promotes, motivates and encourages actions resulting from that angst and builds on pre-existent belief systems.

Propaganda is the scientifically informed art of interpreting the meaning of reality in such a way as to benefit the interpreters, Patrick says. Many people have the naïve idea that propaganda is nothing but lies; more accurately it is simply a statement that can be used to support a particular agenda. Propaganda and bureaucracy are intimately related, he adds. Propaganda is how bureaucracies communicate; it is their primary social management tool. Public relations is propaganda directed outside the organization; human resources is propaganda that is inward looking.

The word propaganda comes from the Catholic Church and its worldwide mission of bringing the heathens into the fold. The Church saw the New World as ripe for conversion and established an administrative unit called the Congregatio de Propaganda Fide (Congregation for Propagating the Faith) to accomplish this goal. Religion and propaganda are two sides of the same coin, Patrick remarks. Religion is a belief system that motivates action. “This kind of stuff fascinates me,” he says, “which is why I’m interested in zombies – because they are the manifestation of a new belief system.”

In the Middle Ages, art was heavily influenced by religion. In fact, most art was religious art. There was very little secular art outside of portraits. Religion was a source of comfort for the mass consciousness – to assuage its fears and anxieties. “Collective anxieties led to sightings of the Virgin Mary,” Patrick notes. That is no longer true. In place of sightings of the Virgin, we can now vanquish the zombies that represent the same type of cultural and societal fears that once induced sightings of the Virgin. Only now the fears aren’t of the Black Death or incursions of infidels. Instead, in the media age, anxieties are over immigration, race, government, guns, the decline of western culture and overpopulation. The zombie mania has invaded everything from games to ammunition packages, as well as the gun models that use that ammunition. Patrick asks what is behind this phenomenon.

Zombies have a relationship to propaganda because they are representative of emergent fears. By preparing for an imagined zombie invasion, we are preparing for these other ills that the pundits and media incessantly say are upon us. The Medieval fears are being recycled in different ways. However, propaganda only works if it substantially echoes what people already believe, Patrick states. Hitler’s anti-Semitism worked precisely because it wasn’t new—it mirrored the racial and stereotyped fears Europeans already believed in. Such fears make people susceptible to influence, says Patrick.

Propaganda can also work to shift perception. The new American gun culture was essentially created out of the ashes of the old, Patrick comments. The old gun aficionados were sportsmen and rifle and pistol target shooters. The new gun culture was created in response to what Patrick calls a “vertical, top-down propaganda campaign” that began about 1970 when America’s social elites tried to implement European-style gun control laws. “They overdid it,” says Patrick, noting for example that the Washington Post once ran anti-gun editorials for 77 days in a row. In a classical social movement-style response, the new gun culture reacted and created its own communication media. This new, politically charged, self-aware gun culture has grown steadily ever since. If it were not for negative mass media coverage, Patrick observes, today’s gun culture would not be in such a position of strength. Gun culture’s “anti-media,” as Patrick calls them, have essentially won the battle of gun control for the National Rifle Association (NRA).
The gun control issue is where multiple lines of propaganda come together.
Today’s political agenda focuses on expanded individual gun rights and personal protection, not restrictions.

Twenty years ago, a police officer told Patrick, “You don’t want no concealed weapon permit” and slammed the phone down in his ear. Today, Patrick notes there are more than 40 states that allow citizens to carry concealed guns as long as they have filled out the paperwork, submitted to background checks and received licenses. Today, around 10 million people have concealed carry permits. Janitors in some schools are now being trained to respond to armed intruders with deadly force; teachers are being trained to use firearms.

The concealed carry permit holders are not the murderous people, Patrick asserts. He notes that the white U.S. homicide rates compare well to European ones. He insists that the problem in the U.S. is cultural – specifically a ghetto culture, which is where most of the gun murders occur. The gun control issue is where multiple lines of propaganda come together.

Patrick compares today’s gun culture to early Christian believers: “they meet in the catacombs of virtual space.” Horizontal linkages at the small, local level create a sustainable movement that can mobilize individuals and small groups on emotional and behavioral levels. “The new gun culture is one of the most remarkable social formations of modern times,” Patrick states. “It has created itself out of reprocessed elements and was the first to effectively use electronic media to push its agenda.” Through efficient use of its own media at multiple levels, this new gun culture has taken center stage in today’s politics.

Because he is interested in how propaganda functions and who uses it for different purposes, Patrick is forging ahead with plans for future books and courses related to communication and propaganda in particular. Currently underway is a volume entitled Aristotle on Business Communication, which applies principles of Aristotelian rhetoric to modern communication. “The problem with Aristotle is density: modern students simply don’t follow it. My version is practical and designed for people who want to be effective, practical communicators rather than scholars.” Patrick is also under contract to deliver a book called PropaGUNda that deals exclusively with pro- and anti-gun propagandas. “It’s a rich field, with many lessons to be drawn in communication,” he says.
Environmental researchers all have their special niche. Some look at specific plants or animals in specific locales; some look at local streams; some specialize in certain watersheds; others examine large regions.

“Many in the field recognize that understanding the interplay between fine- and broad-scale patterns and processes is a key to understanding ecosystem dynamics,” says Song Qian of the Department of Environmental Sciences. “We need to understand the components of an ecosystem and their interrelationships in order to understand the effects of climate change and human activity.” For Qian, integration is the key.

Whereas Qian calls himself a modeler, he is a modeler with a different approach. He says that the missing link in this story is a research method that promotes understanding of how all the components become integrated over scales of time, space and organizational levels. Qian says that understanding the different aspects of a problem allows researchers to integrate them. Moreover, statistics provide a set of tools that can connect different spatial situations. His favorite statistical tool is the Bayesian hierarchical modeling approach.

Qian says that three specific items would showcase the methods he promotes as able to shed light on some intractable problems: (1) understanding when climate change started to have an effect on plant phenology and animal behavior, (2) water quality assessments, and (3) spatial variability and reasonable expectations in setting environmental standards.

Understanding climate change and its effect on different species requires analyzing historical data. For some species, such as the lilac and sea turtles, several decades of data are available. In several states, lilac shrubs are blooming earlier and earlier in the year, and some states have had to alter starting dates for sea turtle nest patrols. Is temperature or daylight the more important factor? Qian says that when he pieced together data on lilac blooming, he found that the years between 1970 and 1980 saw a significant change in lilac first-bloom date. “But feeling climate change depends on where you are geographically,” he says. “Plants and animals in Florida may not see the signal as strongly as the same species in Virginia.”

Studying a single species of plant over a large area provides information on spatial patterns of climate change. “But what about changes in a single location?” Qian asks. To help answer that question, Qian notes that the Smithsonian has extensive data on responses of multiple species in one location. How different species perceive change and how they react can provide clues to an overall pattern that takes natural variation into consideration. Qian looks forward to being able to integrate massive amounts of phenological data for many species in the same location and the same species in many locations.

“All Together Now

Many in the field recognize that understanding the interplay between fine- and broad-scale patterns and processes is a key to understanding ecosystem dynamics.”
Water quality is another topic that needs the kind of integration Qian advocates. The Clean Water Act requires states to set standards based on biological concerns. Since 1972, most states have used the abundance and richness of certain macroinvertebrates (e.g., the stonefly, caddisfly and mayfly) as sentinel species and indicators of water quality. But within those groups, different species respond to pollutants in different ways—some are more tolerant than others. In one study the U.S. Geological Survey (USGS) collected data from nine regions across the country, including information on land use history, urbanization, and water chemistry. Qian notes that the USGS initially looked at water quality and supporting data for one region at a time. In a collaborative effort, Qian and USGS researchers looked at all regions together to determine common characteristics. They discovered that the effects of local disturbances—such as urbanization in a watershed—on stream ecosystems depend both on the intensity of local development and on regional land use history (especially agriculture) and climate conditions. As a result, they propose that regional environmental standards incorporate regional and local conditions. “We should not use one standard for an entire state,” Qian explains. “Once urbanization occurs in a watershed, it is not practical to turn the clock back. We need to know what are reasonable expectations.” Accordingly, and as an expansion of his work with the USGS, Qian and his colleagues in the Department of Environmental Sciences are collecting data in the Great Lakes region to understand the natural variability of pollutants over space and time.

The third major consideration for Qian is the ecosystem-level response to pollution. Ecosystem studies collect data at the taxon/species level and make inference at an ecosystem level. This process allows researchers to the ecosystem level response through integration of the responses of many individual species. In this area, Qian says, the Bayesian hierarchical modeling approach is particularly useful.

Integration is the key to Qian’s research, but how to make it work is for him the most interesting aspect. Management of environmental concerns depends on looking at connections as well as individuality of place. Understanding the issues allows us to combine and group and leads to a better comprehension of system interactions.
Laws are written as guides to human behavior. The framers of our laws generally assume that people will act a certain way. But that is not always the case, says Geoffrey Rapp, whose work examines the connection between law and policy on the one hand and between law and human behavior on the other. Human behavior includes considerations of behavioral psychiatry, brain science and economics. Science often predicts that people will act in ways different from those presumed by the law, thus suggesting that the law is poorly written and needs to be redesigned, Rapp remarks.

A good example of a law that didn’t work as planned is the Sarbanes-Oxley bill enacted in response to the Enron scandal of 2001. The law provided protection for whistleblowers who detected and publicized stock and financial fraud – it allowed whistleblowers to sue an employer for wrongful discharge. The problem was that this law did not encourage employees to report fraud. Why?

“The reason people stay silent is less about the fear of retaliation and more about social bonds, water cooler relationships,” explains Rapp. He suggests that
providing a financial reward to go public would break that tendency to preserve the office social bonds and remain silent. With the financial crisis of 2007, people became more receptive to stronger investor protections. The result was passage of the Dodd-Frank act, which provided that financial reward to whistleblowers who went public.

Rapp’s interest in business and antitrust law led him to start examining sports law because leagues operate as businesses but in unusual ways, with competing economic entities working together to produce a joint product, he explains. However, the further he delved into the topic, the stranger things became. He started seeing weird things happen – such as cases decided one way in one location but similar cases in another locale decided exactly the opposite. “The law didn’t change, the judge did,” Rapp notes. “Judges aren’t machines. They are sports fans just like the rest of the population.”

His interest in brain science and connections to sport decisions then led Rapp to look more closely at why college athletes throw games or take impermissible benefits. Reggie Bush lost the Heisman Trophy amid a long-running scandal of accepting improper gifts and services. “These athletes are not allowed to accept money, so it doesn’t seem rational that they would anyway. Why would a player shave points for a small amount of cash or accept a limo ride to an award ceremony?” he asked. In an answer to that question, Rapp says the youthful brain is not fully developed. “The sections of the brain that process higher-order concepts of right and wrong have not reached full maturity,” he explains. “The brains of these youngsters do not process information as do adult brains. We need to speak to them differently.”

Human behavior is also important in tort law, Rapp notes. Tort law provides relief in civil court for people who have been harmed by actions of others. It is written in such a way as to distinguish between conscious and unconscious decision making and to protect against some kinds of harms (physical and economic) more than against other kinds of harms (emotional and psychic). “What is harm?” asks Rapp. The law has one definition, but brain science paints a more complicated picture he says.

Behavioral psychology can tell us about the tort claims of intentional infliction of emotional distress and recklessness. Science tells us that higher order brain functions (Daniel Kahneman’s “system 2”) take second place to intuitive and automated processes (system 1). Thus, Rapp comments, unconscious brain processing is the default way of making decisions. “Are the courts really set up to determine if a person’s actions are conscious or not?” he questions. “That would require a judge to be able to see into a person’s head. If we can’t really determine if an act falls under system 2 or system 1, maybe we should stop trying. The result would be a more rational and cohesive body of law.”

Rapp has other concerns about tort law. The law allows a person to defend himself from physical violence without being found liable. But Rapp asks if a person can defend himself from emotional violence where there is no physical threat. “The answer in law is ‘no;’ but when you ask why, there is no good answer,” he says. The courts have created a tort called intentional infliction of emotional distress, he comments, “yet we still don’t know what defenses are available when someone is threatened with conduct that might rise to the level of that tort.” In the end, Rapp doesn’t conclude we should allow more violence in self defense against emotional harm. “Instead,” he says, “maybe what we should do is be less tolerant of physical force to defend against violence.”

Most laws are defined by judges at the state level, Rapp explains, and what is of immediate utility to judges is the last supreme court decision on the topic. But Rapp’s scholarship seeks to point out the tensions in this process and the need for reform. He takes insights based on hard science and translates that to the policy level, even though understandings from brain science and human behavior may not have an effect on the law for decades. “I simply want to raise awareness,” he concludes, “to make sure that the laws that affect people’s lives are the best we can have and that these laws do the job they are supposed to be doing.”

Geoffrey Rapp, Harold A. Anderson Professor of Law and Values in the College of Law, has testified before the United States Congress, writes a sports law blog for which he has garnered media attention, and has shared the stage with two Nobelists. He says these things would never have happened without the professional support and opportunities that The University of Toledo has provided, for which he is grateful every day as he heads to his office. He adds that his focus on tort law and writing about it make him a better teacher and allow him to give students better insights. It may not attract the New York Times, but he says it is the most satisfying activity.
TO SERVE

01
RATIONAL
STEP

02
AFFECTIVE
STEP

03
NORMATIVE
STEP

OR NOT
What motivates people to donate or volunteer their time or money to charities, enlist in the armed forces, or become politically active? How are these actions related and what does it mean for the future?

Jami Taylor, along with her research colleagues at North Carolina State University, is finding that a theoretical construct known as public service motivation (PSM for short) is useful in understanding why people choose to do what they do in public settings. As defined by other researchers in the 1990s, PSM consists of three motivators that induce public service: rational (pursuit of policy objectives), affective (emotional attachment to a group or community), and normative (a sense of duty or desire to “give back”).

“Nonprofits increasingly are expected to increase delivery of public services,” Taylor comments, “and must thus increase their organizational capacity to meet a growing demand.” A better understanding of PSM will help nonprofits to recruit, motivate and retain the donors and volunteers who are critical to their operations.

Taylor’s original research on PSM used the construct to examine why undergraduate students at an East Coast university chose to volunteer time or donate money to a charity or cause. Although she admits that this convenience sample was not the equivalent of a random sample of college students, it nevertheless offers insights into why these students elected to donate or volunteer. “As expected,” she says, “PSM has a positive effect on volunteering and donating. However, not all dimensions of PSM influence this choice, and not all are positively related.” The rational driver appears to have a negative relationship, whereas the affective and normative drivers appear to be positively related.

The three postulated drivers are not the only indicators of whether or not a person chooses to volunteer or donate—Taylor finds that personal characteristics are also important. In her sample, men are less likely than women to volunteer. But when it comes to donating, sex is not a predictor, whereas income is. Furthermore, Taylor found that those who attend religious services weekly are less likely to volunteer than those who attend only occasionally—perhaps because of time commitments—“There are only 24 hours in a day,” she adds. Passive (lend a helping hand) and active (get involved) socialization also have a bearing on whether someone chooses to volunteer or donate, with passive predicting a greater likelihood to donate and active predicting a greater likelihood to volunteer. “Interestingly enough, compulsory volunteering leads to weaker impulses,” Taylor explains. “Understanding which dimensions of PSM are related to charitable decisions may give us some insight on how to shape nonprofit campaigns.”
Taylor then wanted to know if PSM could yield insights on why people remain in the military as it, too, is a form of public service. She found that the PSM model provided more nuanced indicators of willingness to remain in the armed forces than the prominent Institutional-Occupational model that pervades much of the literature on military recruitment and retention. “The highly institutionalized context of the Army stresses duty to country,” Taylor notes, “and analysis of PSM indicates that, once someone has decided to make the Army their career, they will continue to make it their career.”

“But PSM is concerned with questions of career selection, job performance, employee retention and reward structures,” Taylor comments, “it might provide new insights to the study of soldier motivation.” However, whereas the PSM dimensions (attraction to public participation, commitment to public values, self-sacrifice and compassion) correlate positively to institutional motivation, it was the self-sacrifice dimension that appeared to drive reenlistment, while the compassion dimension appeared to discourage reenlistment in the sample of mostly male, special forces troops.

In further extension of the PSM construct, Taylor has found that it is also useful when looking at individual decisions to become politically active. “It explains about 5 percent more of the variation in political activity than the variables currently discussed in the literature,” she says. But whereas PSM is statistically and significantly related to the level of individual political involvement, Taylor notes, she wanted to get at precisely what PSM adds to the understanding of political activity. She found in particular that PSM is a strong contributor in the domains of knowledge and attitude, but that the need to be involved in something larger than oneself is a marginally important indicator in undergraduate participation in political activity. “Understanding why undergraduate students engage in different types of political activities is an important first step in politically activating the next generation of voters and participants in the political system,” Taylor concludes.

The findings of Taylor and her colleagues extend the utility of the PSM construct beyond its traditional use in describing the motivational differences between public and private employees. She has expanded the use of PSM to considerations of volunteering and donating, service in the armed forces and political activity. The latter two had not been on the PSM radar. Taylor cautions, however, that her studies are limited in that they have all used convenience samples and so are not directly applicable to other populations. Future work will entail expanding these studies to random samples and other populations so she can generalize the implications of the PSM construct.

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Jami Taylor, an assistant professor in the Department of Political Science and Public Administration, comes to academe from careers as a municipal real estate appraiser and a revenue officer with the U.S. Internal Revenue Service. Having worked in government, she thought that going back to obtain her doctorate in public administration was a good idea. In her spare time, Jami likes to hang out with her teenage daughter. She is a devoted fan of the English soccer club Arsenal. She is a history buff (particularly of colonial-era Virginia) whose favorite places in the world are Jamestown and the Smithsonian. She also travels frequently to the South to visit family and to get proper barbecue, Virginia ham, and chicken biscuits.
THROUGH THICK AND THIN
Communication is essential. Just as we communicate with friends, families and co-workers, so do the cells in our bodies communicate with each other. One way a cell communicates with other cells and its surroundings is through molecular channels embedded in the membrane that surrounds the cell. These channels are portals through which a variety of ions can enter the cell. One important type of ion channels is called Transient Receptor Potential Canonical cation channels (TRPC).

“A cation is a positively charged element such as sodium, potassium or calcium that is essential for all living cells,” explains Guillermo Vazquez. “There are seven types of TRPC, numbered 1 through 7. The distinguishing characteristics of these channels include pharmacological properties and certain functional properties that allow them to regulate specific cellular processes.” In the 1990s researchers were concentrating on exploring the functions of calcium permeable TRPC channels. About the same time other groups of researchers were starting to suggest that these channels were involved in the pathogenesis of human disease.

Having studied calcium signaling and how vitamin D regulates calcium equilibrium in the body, especially in skeletal muscle, Vazquez says he was driven to look at calcium permeable TRPC channels and how they work. After receiving his doctorate in Argentina, he accepted a postdoctoral position with the National Institute of Environmental Health Sciences in North Carolina. He was particularly interested in making connections between calcium permeable TRPC channels and cell-types known to be critical in the development of cardiovascular diseases.

“Cardiovascular disease is a huge concept,” Vazquez warns, so he decided to narrow his focus to the role of TRPC channels in atherosclerosis. “We started to get some very interesting data about the role of one of these channels—TRPC3,” he adds. A key feature of this channel is that it has constitutive, or tonic functions and can work on its own regardless of any external stimulation. Calcium is a potent regulator of such cell functions as gene expression and cell survival. Just by allowing calcium to enter a cell, channels like TRPC3 can induce changes in several calcium-dependent cellular processes.
In atherosclerosis, those cell changes tend not to be beneficial. Atherosclerosis, the number one killer in Western society, is caused by the accumulation of lipids (fat) underneath the endothelial cells that line the lumen (the inside space) of blood vessels. As this deposit builds up, it initiates an inflammatory reaction and over time a lesion develops (the plaque) that may either reduce the vessel lumen (stenosis) – thus reducing blood flow – or rupture and trigger acute, usually fatal events such as stroke or vessel occlusion (thromboembolic syndromes). It turns out, Vazquez comments, that endothelial cells and macrophages are critical in the development of atherosclerosis.

In atherosclerosis, macrophages make an effort to prevent the growth of plaque by taking up the lipids that accumulate under the endothelial cells that line blood vessel walls. As a consequence of this process, lipid-laden macrophages eventually die (apoptosis, or programmed cell death) and other macrophages in the lesion “clean up” or remove the apoptotic bodies. This prevents accumulation of cell debris and helps slow down the growth of the plaque. Whereas this is an efficient process at the early stages of atherosclerosis, in more advanced, complex plaques, dead macrophages are not properly removed from the lesion site. This leads to exacerbation of the inflammation, growth of the plaque and, eventually, plaque instability and rupture.

Working with a special “knockout” mouse, one whose ability to produce TRPC3 calcium channels in macrophages has been blocked, Vazquez’s group has recently found that less TRPC3 in the macrophage reduces the number of apoptotic macrophages in advanced atherosclerotic lesions with a concomitant improvement in indicators of plaque stability.

But, says Vazquez, the macrophage is only part of the picture. His lab has found that TRPC3 also plays an important—and related—function in the endothelium. In these specialized cells, calcium regulates gene expression of a cell surface protein called VCAM1 (vascular cell adhesion molecule-1). VCAM1 is responsible for recruiting monocytes from the blood stream into the subendothelial space, where they later differentiate into macrophages. As part of the endothelium’s response to inflammation, more TRPC3 channels assemble in the endothelial cell membrane and allow calcium to enter the cell, promoting VCAM1 production. The more VCAM1 that is formed and inserted into the membrane, the more monocytes are recruited, which then transform into macrophages in the subendothelial milieu. Blocking TRPC3 in the endothelium would block or at least reduce VCAM1 production, which would in turn reduce monocyte recruitment and macrophage production.

Ultimately, Vazquez says the goal is twofold: first to slow monocyte recruitment, which might have a significant impact at early stages of the disease, and second to reduce macrophage apoptosis in more advanced plaques to improve plaque stability and reduce the probability of thromboembolic events. Vazquez asks, “Can blocking this channel in the endothelium or the macrophage slow the progression of atherosclerosis?” In vivo experiments using the knockout mouse model will be proof of concept, he says. The current in vivo studies will allow him to determine the impact of blocking TRPC3 and really understand its role in atherosclerosis.

The next level is to design a drug that would target this calcium channel in a specific way. From a clinical perspective, Vazquez cautions; in patients with atherosclerosis usually two, three, or more risk factors exist: hypertension, overweight, smoking and dyslipidemias, to name a few. Even if blocking TRPC3 becomes an alternative treatment for atherosclerosis, it will probably be part of a cocktail of drugs.

Guillermo Vazquez received his doctorate from the National University of the South in Argentina and went on to complete postdoctoral work at the Argentinean National Research Council and the National Institute of Environmental Health Sciences in North Carolina. His research focuses on the functions and mechanisms of cation channels. When not in the lab, he enjoys experimenting in the kitchen, preparing some modified South American dishes for his family.

The National Institutes of Health continues to support the research reported here.
Survivors

Cancer strikes an average of about 1.5 million people each year. Almost 1,600 people die each day from cancer, the second most common cause of death in the United States. The American Cancer Society estimated that 232,340 cases of breast cancer in women would be diagnosed in 2013, 9,060 of them in Ohio. When cancer strikes, surgery is often the first treatment modality, followed by radiation and chemotherapy. As if the surgery itself was not insult enough to the body, radiation causes fatigue and skin changes in 80 percent or more of women receiving the therapy.
“Nia can be gentle or demanding, depending on the person’s lifestyle,” the researchers say, “and its adaptive nature may be of enhanced benefit to individuals with cancer.”
Fatigue from radiation therapy is different from “typical” fatigue, says Eileen Walsh, with faster onset, longer duration, more energy draining and unpredictability. Skin changes often cause the skin to feel tight, even painful. When coupled with pain and scarring from surgery, these side effects often cause women to limit arm and shoulder movement; this limitation in turn causes restricted mobility and increased pain. In addition, varying degrees of swelling from lymphedema further compromise a person’s ability to perform normal daily activities.

Walsh, along with Debra Reis and Tisha Jones of ProMedica, knew that several studies have shown that various kinds of exercise have beneficial effects and improve physical function. “Most of these studies have focused on traditional exercise such as walking and resistance exercise,” Walsh says, “but interventions that focus on body, mind and spirit are beginning to appear.” Reis and Walsh turned to Nia, a whole-body exercise regimen that combines movement forms from the martial arts, dance arts and healing arts. “Nia can be gentle or demanding, depending on the person’s lifestyle,” the researchers say, “and its adaptive nature may be of enhanced benefit to individuals with cancer.”

Reis and Walsh determined to see if Nia is truly as effective in promoting flexibility and mobility and decreasing fatigue as other exercise. “The conceptual framework for the study was based on the assumption that the person is a biopsychosocial being who is continually interacting with a changing environment. To cope, the person uses innate and acquired mechanisms that are biological, psychological and social in origin,” Reis explains.

The researchers enrolled 41 women in a randomized, controlled study stratified by age of the participant and stage of the disease. All participants underwent assessments for fatigue, quality of life, aerobic capacity and shoulder flexibility at baseline, six weeks and 12 weeks. Participants also saw the researchers at the beginning of the study and again at six and 12 weeks.

The 22 women in the Nia arm of the study were provided a DVD to practice Nia at home for 20–60 minutes at least three times a week. Those in the control group continued their normal exercise regimen.

Nia is referred to as the Body’s Way – a method of using and listening to one’s own body, which allows the practice to be adaptive to an individual’s unique needs. The nine movement forms, Tai Chi, Tae Kwon Do, Aikido (martial arts), jazz dance, modern dance, Duncan dance (dance arts), Moshe Feldenkrais, Alexander Technique and yoga (healing arts), provide a flexible physical activity framework that allows a person to direct movements according to individual needs. The movement forms provide a comprehensive, holistic exercise approach that is both cardiovascular and whole-body conditioning in nature. The practice is enriched by integrating the five sensations of strength, flexibility, mobility, agility and stability into the movement forms, allowing the participant to become aware of what each sensation feels like and to explore these sensations in their own way.

Both groups kept exercise logs, Walsh explains. “Unfortunately,” she notes, “the logs were not regularly maintained, so we could only approximate the exact level of exercise.” The Nia group reported using Nia twice a week and also participated in other aerobic exercise activities an additional two days a week. The control group reported an average exercise level of almost three days a week.

Although data analysis showed no significant difference between the control and Nia group in improvements in distance walked or shoulder flexion and extension, the Nia group had significant improvement in scores of physical, social and emotional well being and fatigue. “This supports the notion that Nia can positively affect cancer-related fatigue as compared with usual care and standard exercise regimens,” say Walsh and Reis, “even though the data clearly shows that standard exercise is effective in combating cancer-related fatigue.” Not every cancer patient can engage in high-intensity exercise, the researchers comment. Nia is thus a valuable alternative to aerobic and strength-training programs.

Both Walsh and Reis look forward to a larger study with a more diverse population and patients with other types of cancer. They suggest that additional research into the complex nature of fatigue is warranted, along with more studies on arm and shoulder mobility. [2]

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**EILEEN WALSH**

Eileen Walsh is an associate professor of nursing. She received her Master of Science in Nursing from Case Western Reserve University and her doctorate from The University of Toledo. She was the first nurse in the YMCA Morse Center and subsequently helped ProMedica begin its vascular rehab program. For Walsh, nursing is not a job but a calling about which she is passionate. She says she always wanted to be a teacher, and as a “people person,” caring for others comes naturally.
When he was a youngster, Barry Whittaker wanted to be either an astronaut or a musician. When he grew up, he became a musician; but then he went into art. He reasons that art allows him to be anything he wants and also lets him combine his love of both music and space. Art is open-ended and free of the constraints found in earth-bound reality.
Barry Whittaker, "Terra Incognita," 2009 (production still). Filmed in Colorado and Utah, this image was at Sand Dunes National Monument, Colorado.
Whittaker is particularly fascinated by new media and typically works on several projects at once. Moreover, he likes to collaborate, “probably because of being a musician, recording, playing in bands and improvising with other people,” he remarks. Working with different people in different styles and with different purposes is both enjoyable and stimulating for Whittaker.

One recent installation developed in collaboration with Sam Sheffield (who is currently at the Maryland Institute College of Art in Baltimore) is based on a digital form of Japanese and Indonesian puppetry in a video game-like installation. The two artists call themselves SaBa (Sam and Barry). “In Japanese, SaBa means ‘mackerel,’ which we thought was amusing,” Whittaker adds. The video is an interactive program that engages viewers in controlling the arms of the on-screen “puppet” by moving their own arms. “We tried originally using motion-capture cameras to capture leg movement, but people couldn’t get used to using their legs to control the puppets,” Whittaker says. This installation has two incarnations—in one version, multiple people control puppets from separate rooms; in the second version, people interact with puppets on one screen in the same room. The installation uses video game structure and language. “The work creates a game-like experience but no way to win,” he explains.

SaBa has also created an installation that draws its inspiration from the locavore movement and computer glitch aesthetics. In this experimental setting, SaBa uses vegetables to transmit electric signals to the control computer animations. As the vegetables age, their resistance level changes, signaling a transformation and the images on screen start to degrade and break apart. Whittaker says he is also interested in miscommunication and uses his art to represent what happens when misunderstandings or errors in translation occur.

Another ongoing collaboration, this one with Michael Bernhardt of Metro State in Denver, uses humor to spoof monumental public art. “I’m very interested in humor,” Whittaker says. “I feel things are more interesting when approached playfully.” The duo has named its ventures Barchael. Most recently, they used the ideas of graffiti to playfully improve notable public art pieces. One example is a drawing of the Calder dinosaur at the Monroe Street entrance to the Toledo Museum of Art, to which they added a rooster head. In another, hand-made puppets suggest an interruption to any of James Turrell’s “Skyspace” series. The duo created this series as playful suggestions, or proposals, to help “improve” well-known public artworks.

With Don Fodness of the University of Denver, Whittaker and Bernhardt (The DMB Collective) participated in an outdoor exhibition on an LED screen in downtown Denver. Spoofing the bike culture and critical mass rides in that city, Whittaker, Bernhardt, and Fodness set up stationary bikes in various public places and pedaled away, occasionally moving one bike to get ahead of the others. The performance elicited cheers and thumbs up from passing motorists and cyclists alike.

And even his aging dog has been a collaborator. Garbed in an Elizabethan collar and dog coat, Ella runs across a moonscape-like terrain while Whittaker himself, wearing a spacesuit and living his childhood fantasy of being an astronaut, traverses another desert scene on a separate screen. The scenes change depending on where the viewer stands. Strings and flutes herald Whittaker’s appearance, while percussion instruments herald Ella’s scenes. “Dogs preceded us into space,” Whittaker says, “but neither they nor we really understand much about the universe.” His installation plays with those ideas.

Recent solo work also plays with space topics, space travel and multidimensionality.

Taking a wireframe spacesuit that floats in space, Whittaker plays with concepts of space travel and communication. As the isolated figure of an astronaut floats in space, it is occasionally distorted to the point of complete abstraction and at times even looks like a spaceship speeding by.

Whittaker is fascinated by how people communicate and use technology. “In space, communication is the link that holds a person to reality,” he says. His art is the triangulation between people and a technology that occasionally becomes problematic or funny or ridiculous.
Barry Whittaker is an assistant professor in the Department of Art. He was both a musician (he played bass guitar and drums) and a graphic designer in his former incarnation. He has lived and worked in France, the Netherlands, Japan and the West Coast of the U.S. and enjoys travel and experiencing different cultures. Whittaker is currently developing solo and collaborative work for upcoming exhibitions and will be teaching in Shanghai this summer through the university’s study abroad program.

A University Summer Research Fellowship from The University of Toledo provided funding for this scholarship.
There are essentially two ways to achieve low-cost per watt electricity, says Yanfa Yan. One option is to improve the conversion efficiency of the devices — how much power is created from sunlight; another is to make the devices cheaper by using materials that are both sustainable and abundant. The ultimate goal is to combine the two approaches.

Current technologies use cadmium telluride (CdTe) or copper-indium-gallium-diselenide (CIGS) as the base for the solar cells. Although progress has been made, some new technologies still leave much to be desired in the amount of sunlight they are able to convert to electricity. Yan and his colleagues are trying to understand what is limiting the conversion efficiency. “A solar cell has many components,” Yan adds, “and they all have to work right and work right together.” To that end, he seeks a fundamental understanding and characterization of these devices.

But creating an efficient solar cell is not a stand-alone goal. There are environmental and economic concerns that are important to consider during manufacture and deployment of these devices. Yan is thus working with Defne Apul, Jiquan Chen and several other researchers on issues such as water consumption and carbon dioxide production. Once the manufacturing processes have been determined, Yan can describe them to his colleagues who then calculate the environmental impact.

Yan explains that, although it is more common to start with a theoretical approach, his group also examines construction, sustainability and environmental impact of the materials and processes. He and his group have a multi-faceted process that allows them to characterize and understand the materials from different perspectives, each of which feeds information back to the other aspects of the process. “This kind of iterative approach provides input to each separate area and can be validated independently,” Yan explains.
Although a major effort has been underway to understand what factors limit improving voltage from CdTe cells, Yan says they have had only minimal success. “When we characterize solar cells, we look specifically at the defects in the absorber,” he explains. “And defects can be good or bad.” Working with national labs that have the advanced microscopy to examine crystal composition and structure at the atomic scale, he hopes to develop a theoretic understanding of what the limiting factors are. If he can analytically describe where the defects are and what they look like, then he can alter the production process as well as see how the physical aspects match his theoretic description.

Furthermore, Yan says that existing high efficiency thin-film solar cell materials are either toxic (cadmium) or rare (indium, tellurium) and thus expensive. He is thus working with an environmentally friendly material – copper-zinc-tin-sulfide (CZTS) – to understand first why it is not efficient in converting photons and second how to improve its efficiency. “Solar cells don’t operate alone,” Yan remarks. “Even if the cell itself costs nothing, it needs to be manufactured and installed. To be practical, it needs a certain level of efficiency.” He notes that CZTS voltage is not high enough, but he doesn’t know why. “There are some theories,” he adds, “but they are not convincing.”

At the same time, Yan is exploring the characteristics of a crystalline structure called perovskite, discovered in 1839 and named for a Russian mineralogist. The octahedral structure was described in 1926, consisting of six anions surrounding a cation atom. Only certain elements can form these crystals, Yan says. His recent theoretical work on perovskites indicates that their particular kind of symmetry plays an important role in solar cell efficiency. Moreover, the halide group perovskites have what Yan calls outstanding electrical properties well suited for solar cell applications.

Because Yan is intent on creating sustainable energy sources, he is also looking at using sunlight and water as an energy source. Water is a molecule composed of hydrogen and oxygen. Hydrogen stores energy and also releases energy. By using the sun to split water into its component elements, the research seeks to use semiconductors to transform water into energy. The process is similar to a solar cell but more challenging, Yan says. The end result is a process that takes water in, uses it as an energy source and releases water as an end product.

With research like Yan’s, we are looking at future energy sources that are efficient, inexpensive and environmentally benign. Stay tuned.
Superheroes like Batman and Superman are pervasive. They are in comic books, television, radio series, popular songs, blockbuster movies and the Internet, to say nothing of toy action figures.
About the year 2000, Matt Yockey was casting around for a dissertation topic that was understudied. At the same time, Hollywood was producing big-budget, blockbuster superhero movies. His childhood love of the genre resurfaced, and he decided to take a closer look at the superhero films. This led to Yockey publishing several articles in academic journals on the subject, as well as his new monograph on the 1960s Batman television series.

The superhero came on the scene in 1938 with the advent of Superman in the first issue of Action Comics; he was immediately popular and soon the newsstands were flooded with a number of super-powered heroes. “The superhero is a uniquely American product, like jazz,” remarks Yockey. As he explains it, the superhero reflects, challenges and shapes ideas of national identity at multiple levels. And interestingly enough, a superhero like Superman – who stands for truth, justice and the American way – can be exported to other countries and become equally successful. Because these characters have what is in some ways a visceral appeal, Yockey says, they have resonance across national borders.

“Superheroes allow us to resolve the inherent tension in an American identity,” Yockey points out. As he sees it, the idea of the superhero is based on individualism, but that individualism also defines national identity. Yockey notes that the superhero is an excessively individual figure who exists at the margins of society but whose whole purpose is to defend that society. They don’t sit in a cubicle from 9 to 5 every day; they wear weird outfits; they are technically law breakers but do so in order to enforce the law. Superman is the quintessential embodiment of both the superhero and the average “everyman”—when he isn’t being Superman, Clark Kent is an unassuming reporter who stands for the status quo.

Superman was first described as fighting for “truth, justice, and the American way” in the popular Adventures of Superman television series that aired in the 1950s. In this way, the superhero was a cultural tool by which the Cold War was fought. Yockey argues that where Superman embodied the ideal of individualism, national identity and a collective nostalgia, the Batman television show that aired in the ’60s reflected a growing ambivalence and confusion about what it meant to be an American. This was the era of civil rights marches, Vietnam War demonstrations and issues of race, gender and politics. The ideological and moral certainty of the nation during World War II and the 1950s was increasingly called into question, reflected by Batman’s parody of the genre. The tone of the television series allowed adult viewers to express ambivalence about national identity issues. With so much contention in the air, Batman was a nostalgic vehicle for simpler times, for an identifiable good that would always defeat the recognizable evil. At the same time, the series allowed adult viewers to distance themselves from this less critical perspective on the nation.

“Batman was played on two levels,” Yockey comments. Where adults laughed at a middle-aged man in tights and his antics, children saw something magical and miraculous that they could accept uncritically. Yockey says this is illustrated in moments such as when the Riddler throws a bound Robin off the roof of a building. Batman throws his “bat rope,” which Robin catches in his teeth (remember, his hands are tied behind his back). Batman then tells him his life was saved by good dental hygiene.

The movies introduced a new wave of superhero characterizations that took these superheroes further than ever before, remarks Yockey. The potential for the superhero to be treated with some degree of credibility first occurred in the 1978 Superman movie. At the same time, however, Gene Hackman still played Lex Luthor for laughs. But after 2000, films took the material more seriously. Additionally, special effects technologies advanced enough by that time that stunts and sets could be much more organic and realistic. “In the 2008 Dark Knight film, Heath Ledger played The Joker as a serious and realistic villain,” Yockey notes, “which was a very different perspective from, say, Cesar Romero’s campy portrayal on the TV show or Jack Nicholson’s scenery-chewing in the 1989 Batman movie.

“The most successful superhero films, through special effects and character portrayal, actualize for adults the beliefs that the adult viewer had as a kid that a man could fly,” Yockey comments. “The special effects are a way of recovering, even if fleetingly, the childhood subjectivity and uncritical willingness to believe.”

What is the future of the superhero in American culture? Yockey says that he sometimes feels the genre is at the point of exhaustion. “Westerns were ubiquitous in the ’50s,” he points out, “but they fell out of favor by the late ’60s.” Genre films tend to be cyclical, however. Only time will tell if the superhero time has peaked.
Matt Yockey is an assistant professor in the Department of Theatre and Film. When he isn’t reading or writing about superheroes, he is busy honing his tennis skills and traveling.