A SHOT of INNOVATION

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Binghamton University researchers attack some of society’s most pressing concerns every day in our labs, our libraries and around the world. Linda Spear’s pioneering work focuses on the effect of adolescent alcohol consumption on the brain. David Campbell developed a unique snapshot of the relief agencies that sprang up in the months after the Sept. 11 attacks. And Lijun Yin’s algorithms may make it easier to tell if a criminal is lying.

These faculty members and their colleagues contribute to a rich intellectual environment that’s poised for growth. We recently broke ground for the new home of our New York State Center of Excellence in Small Scale Systems Integration and Packaging (S$^3$IP). This summer, we’ll open the Engineering and Science Building at the Innovative Technologies Complex.

We’re growing in other ways, too. A grant designed to get more undergraduates involved in multidisciplinary research has led to promising new collaborations. The Entrepreneurship Across the Curriculum program promises to give more students an entrepreneurial mindset. And a faculty team is exploring ways to expand and strengthen our research connected to healthcare.

In this issue of *Binghamton Research*, you’ll see what’s possible with a shot of innovation.
GUGGENHEIM FELLOW
Historian to delve into cancer therapies’ development

With a new book, Gerald Kutcher aims to illuminate the effort behind even small advances in medicine.

Gerald Kutcher brings a unique perspective to his work as a historian of science: He was a radiation oncology physicist before he earned a PhD in history from Cambridge.

Now he’s bringing that background to bear in a book project with the working title High Expectations: A History of Cancer Therapies.

“One of the themes of the book is that the expectations are very high for cancer research and the reality is not what is expected,” says Kutcher, a professor of history at Binghamton. “Advances in medicine are very grudging.”

Kutcher’s research for the book will be supported by a $35,000 grant he received as a Guggenheim Fellow. The award, endowed by the John Simon Guggenheim Memorial Foundation, is given to up to 220 people nationwide each year out of a pool of some 3,000 applicants.

Kutcher is the author of Contested Medicine: Cancer Research and the Military, a monograph about the notorious Cold War clinical trials run by Dr. Eugene Saenger.

This year, Kutcher will travel to archives in England and Texas, to Stanford University and Varian Medical Systems in California, and to a source on the development of breast cancer therapy in Chicago. From this archival research, he hopes to gather enough information to document a modern history of cancer treatments.

But rather than being a social history on the subject, the new book will focus on the practices and research efforts of the practitioners who are treating patients firsthand.

“I’d like to convey an appreciation to the reader about what those things are like, rather than to write an intellectual history,” Kutcher says. “This is a history of science in the making.”
Filmmaker to develop a pair of experimental videos

Vincent Grenier, who relishes the process of discovery, strives to surprise and engage his audience.

Experimental filmmaker Vincent Grenier explores the limits of the digital medium, paying particular attention to color and light. His work often takes the mundane—chairs, for instance, or a hillside in full autumn glory—and tweaks it until it reveals itself in an entirely new way.

“I try to do things that would not be expected,” he says. “I like the sense that you don’t know where I’m going to go. It demands that the viewer engage with the film.”

Grenier, a professor of cinema at Binghamton, was honored as a recipient of a Guggenheim Fellowship last year. The prestigious midcareer award, which supports creative research and art projects, is given to up to 220 people nationwide each year. Grenier received $33,000 for the development of two experimental short videos.

“I’m hoping to do work that’s on a larger scale,” Grenier says. The fellowship has also resulted in opportunities to travel to Los Angeles and Toronto to deliver lectures and attend screenings of his films.

Since 1974, Grenier has created more than 40 noncommercial films, videos and installations, which have been shown at festivals across North America and showcases including the Museum of Modern Art. One of his recent works, Burning Bush, takes the relatively common shrub of the same name and explores its color, as seen in nature and far beyond. “I like to play with this idea that it’s normal to see the colors change in the fall,” Grenier says. Seen after digital editing, “this notion has expanded to include other references, some having to do with the medium, others having to do with our cultural ideas about nature and the world we live in.”

“There are many dimensions to color,” he says, noting that red can call to mind different impressions in different contexts, perhaps fire, a red leaf, a red car or blood. Blood, for example, can then be a metaphor for many things, including childbirth. “I am interested in exploring these references in a way that changes them. Red can be horrifying, an object of passion and power, but also festive and enchanting.”

Visit go.binghamton.edu/grenier to watch a short film by Vincent Grenier titled Color Study.
Scholar seeks understanding of America’s rise to power

Political scientist Benjamin Fordham hopes to gain new insights about U.S. foreign policy in the early 1900s.

While researching American foreign policy during World War I and the Cold War, Benjamin Fordham grew curious about the roots of the nation’s status as a superpower.

“I’m interested in the ways that domestic, political and economic considerations influence foreign policy decisions,” Fordham says. “I want to do research on the rise of the United States as a world power and the politics of that process — who supported this expansion of American foreign policy interests and who opposed it and why.”

Fordham, a professor of political science who joined Binghamton’s faculty in 2004, is a Henry Kissinger Scholar in Foreign Policy and International Relations this year. The government-sponsored position, awarded to one person annually, will support Fordham as he spends 10 months at the Library of Congress in Washington, D.C.

Fordham will first analyze manuscripts, books and periodicals written between 1890 and 1945 to get a feel for the public policy of the time period.

“I want to look at the papers of some of the people involved in this process to get a sense of how they understood the expanding economic interests of the U.S. and the rest of the world,” he says.

He will then gather data about the United States during that period — key imports and exports, congressional support and opposition, and overseas economic interests — to obtain an understanding of the country’s past economies.

“The rise of the U.S. as a world power is a puzzle in some ways, because the U.S. became very powerful economically before it took on an expanded role in the world,” says Fordham, author of Building the Cold War Consensus. “Their foreign policy decisions lagged far behind the material power that was necessary to implement them.”
A hot breakthrough
Michael Lawler recently took an important step in solving one of physics’ most interesting problems. Using a new method to analyze data that has been available for years, he and his colleagues made a breakthrough that could lead to advances in superconductors.

Lawler, a theoretical physicist at Binghamton, worked with physicists at Cornell University, Brookhaven National Laboratory and laboratories in Japan and Korea. They found what may be the key to unlocking the secrets of the so-called “pseudogap phenomenon” in superconductors.

“The pattern looked so mysterious and interesting,” Lawler says, sketching it on the blackboard in his office. “It’s so different from any other material we’ve ever looked at. Trying to understand what this data is really trying to tell us has been one of our big ambitions, and we think we have captured one of its essential ingredients.”

The “pseudogap phenomenon” is the remarkable vanishing of the low-energy electronic excitations in high-temperature superconductors. A material experiencing this rare phenomenon becomes mostly insulating but otherwise behaves like a superconductor. And because this can happen at room temperature, scientists believe it may be possible for superconductivity to exist at these temperatures.

Steve Kivelson, a professor of physics at Stanford University, has been interested in this topic for years. He said Lawler’s findings, which were published last year in the British journal Nature, confirmed what he had suspected about the pseudogap. To many physicists, however, this paper was a “shock,” Kivelson says. “This took ideas that seemed nutty and far out and showed that they’re part of physical reality.”

Superconductors are materials — often but not always metals — that conduct
electricity without resistance below a certain temperature. For decades, it was thought that these materials could conduct electricity only at temperatures far below freezing. In the past 20 years, however, scientists have discovered several compounds that superconduct at much higher temperatures.

In principle, a room-temperature superconductor could allow:

- Electricity to travel with zero energy loss from power plants to houses
- High-speed trains to float on top of the superconductor
- Cell phone towers to handle many cell phone carriers in high-population areas

High-temperature superconductors, therefore, are both intrinsically interesting to physicists and potentially of tremendous practical value.

These superconductors have been one of the most intensely studied puzzles in physics since they were discovered. “Despite this heroic effort of the community, we have yet to understand them satisfactorily, either by creating a room-temperature superconductor or proving it is impossible,” Lawler says.

Lawler and his colleagues found that the electronic states of two neighboring oxygen atoms in these superconductors are different from each other. Looking at the electronic structure, then, the physicists were able to observe a broken symmetry. “It is like the electronic states were stretched along the X-direction compared to the Y-direction,” Lawler says. “That the pseudogap phase has this order allows us to make the bold claim that it is actually a distinct phase of electronic matter.”

To understand this observation better, consider the phases of rod-like objects. Rod-like polymers have many more phases than the solid, liquid and gas phases of more ordinary atoms. At high temperatures, they are in a gas phase like ordinary atoms. However, at lower temperatures, all the rods can point in one direction while still moving around freely like a gas or liquid. Physicists call this a “nematic phase.” The organization of the rods in this phase is similar to what the researchers observed in the electronic states associated with the pseudogap phenomenon.

More phases of rod-like objects exist at lower temperatures until eventually the rods freeze into a crystal. Physicists call these intermediate phases “liquid-crystal phases.” They are responsible for the liquid crystal displays commonly used in watches and televisions. Lawler, whose PhD thesis focused on liquid crystals, has thought for a long time that that paradigm might prove useful in examining exotic behavior in electron systems.

A self-described “pencil-and-paper theorist,” Lawler is open to discovery in
unexpected places. That was certainly the case with this project, as the inspiration for the data analysis came to him while he was shopping at Home Depot with his wife, who is one of the collaborators in his research. Six months of discussion and work followed that day’s insight, Lawler says. The collaboration of theoretical and experimental physicists included additional experiments and repeated reviews of the data analysis.

“An experiment is never truly done,” he says. “A proof is never entirely complete. But this is too simple an observation to dispute. The result is very clear.”

Lawler says he owes his success to both the unusual data analysis — which is derived from radio technology — and the unique capabilities of his Cornell colleagues, who have a scanning tunneling microscope that enables them to look at single atoms while maintaining a large field of view.

“Michael suggested a new way of analyzing these experiments to bring out aspects of the data that were previously unclear,” Kivelson says. “He has made a notable contribution to the question of identifying what this pseudogap phase is. This is a puzzle that has been around almost as long as high-temperature superconductivity itself. Michael’s work doesn’t completely solve it, but it gives some very important and very concrete information about what’s going on in this pseudogap phase.”

— Rachel Coker

Unlocking the key to room-temperature superconductors could lead to remarkable advances useful in transportation, electronics and the nation’s power grid.
LASTING RELIEF
David Campbell was in his office at the Community Service Society in Manhattan on the morning of Sept. 11, 2001, when a co-worker delivered the news: The World Trade Center was burning.

“I looked out my window and could see all of the smoke,” he says, recalling the view from the eighth floor of his building on 22nd Street and Park Avenue. “But we weren’t sure what was going on. I remember e-mailing a friend: ‘There’s some crazy accident at the World Trade Center.’ But then we realized that something was seriously wrong.”

Community Service Society, one of the oldest nonprofit organizations in New York City, closed for the day. Campbell, then the group’s vice president for programs, made the slow trek home and watched the horror unfolding just miles away.

Two days later, Campbell returned to work and received an edict from David Jones, head of the Community Service Society: No New York organization will be relevant if it is not engaged in some way in meeting the community’s needs after 9/11.

“That idea always stayed with me,” Campbell says. “At first, it was strange: We don’t do that kind of work. His point was that nonprofits have to respond when there is a crisis in the community. He was right.”

The Community Service Society helped new nonprofit organizations distribute millions of dollars during the years that followed. And this post-9/11 work continued to resonate with Campbell even after he became an assistant professor of public administration at Binghamton University in 2005. He is still lending a hand to future and current nonprofit organizations. Campbell has studied and written papers on the formation of disaster-response agencies, using one such organization — Windows of Hope Relief Fund — as a case study.

“I had the unique experience of being in New York on 9/11,” he says. “That experience changed my professional life in unexpected and dramatic ways.”

The collaboration

Shortly after deciding to help new nonprofit groups, Campbell and Community Service Society learned of hospitality-industry professionals who had already raised money for families of Windows on the World employees.

Windows on the World was a restaurant complex on the top floors of the World Trade Center’s North Tower. More than 160 employees and patrons were killed when the first plane hit the tower or during the ensuing collapse of the building.

Campbell and Jones met with Windows on the World owner David Emil and chef Waldy Malouf and learned how they and their co-founder, restaurant owner and chef Tom Valenti, hoped to use the Windows of Hope Family Relief Fund to provide financial aid, health insurance and educational help to the families of hospitality-industry workers killed in the World Trade Center attack. The founders of the fund were especially concerned that existing assistance systems would overlook or overwhelm the late workers’ relatives, many of whom were low-income immigrants.

Windows of Hope had already held an Oct. 11, 2001, fundraiser called “Dine Out” in which restaurant owners around the world donated 10 percent of that day’s income. That event, coupled with other donations, netted Windows of Hope more than $6 million. Emil and Malouf admitted needing help using those funds.

“They said, ‘We’re chefs. We have this money and these ideas about how to give it away. But we have no knowledge of social services. We need a partner. Will you work with us?’” Campbell says. “We had to figure out a way to distribute millions of dollars to families fairly.”

Campbell spent four years working with Windows of Hope, providing guidance to an organization that has now raised more than $22 million.

“It was very satisfying work,” Campbell says. “I liked the people I worked with. They were really committed.”
Understanding why nonprofits spring up after a disaster, and how they perform once they’re established, may help in future crises. This research may also lead to improved coordination between new and existing relief agencies.

In 2005, Campbell, who had previously taught as an adjunct at Columbia University, left the nonprofit world behind so he could teach full time, and he found what he was looking for upstate.

“Binghamton valued my experience as a practitioner and the importance of working in the community,” Campbell says. “If I had the opportunity to pursue some ideas that interested me, maybe they could shape the world of practice in an important way.”

That opportunity arose when Campbell reflected on his 9/11 work and the formation of so many nonprofit organizations. He learned that more than 250 new nonprofit groups developed after the attacks and generated nearly $700 million in the first two years of operation.

“I didn’t understand it,” he says. “Why are all of these people giving to Windows of Hope? Why do people need to start new organizations? Here was my organization, which had been providing assistance to New Yorkers in need since 1843. Why didn’t David or Waldy come first to Community Service Society or to an existing organization that had a track record? That piqued my interest for the research agenda.”

Campbell’s examination, “Stand by Me: Organization Founding in the Aftermath of Disaster,” was published by The American Review of Public Administration.

In “Stand by Me,” Campbell studies the motivations of the people who
created nonprofit organizations and the roles they played after 9/11. He read tax-exemption applications the groups submitted to the IRS and identified the “defining characteristics” of each. For example, some groups may be geographically based, while others might be affiliated with a fire company or, like Windows of Hope, a 9/11 employer.

“All of the categories represent where people’s passions lie in making a difference in the community,” he says.

But some organizations lacked direction. Campbell pointed to an application from two people in the Midwest who planned to start a nonprofit that would provide foster care for orphans.

“They had no connection to New York City,” he says. “They had no funding source. I think people have a lot of positive energy and they are not sure where to direct it.”

Campbell found that most of the new post-9/11 organizations ceased operation within two years. Once the money was raised, the group disbanded. Those that continued likely had strong ties to the families of victims.

Campbell’s second research project, “Organic and Sustainable: The Emergence, Formalization and Performance of a September 11th Disaster Relief Organization,” examined one such group: Windows of Hope. The case study was published in Nonprofit Management and Leadership last year.

The study was a logical extension of the research; it also gave Campbell an opportunity to reflect on the factors that contributed to the group’s success.

“There was a shared sense of identity among this group of hospitality-industry workers,” he says. “We have to take care of our own: That’s what brought them together. But it wouldn’t have mattered if they hadn’t been able to bring in resources. If you look at the hospitality industry, it has resources and knows how to leverage them.”

Windows of Hope leaders also understood the need for collaboration and knew when to ask for help, Campbell says. “Their willingness to acknowledge what they did not know and to use Community Service Society allowed them to be responsive quickly,” he says.

**The lessons**

Campbell’s unique research has drawn praise from nonprofit leaders.

“He builds on his practical experience in the sector and his considerable knowledge of theoretical and managerial issues,” says Susan Chambré, a professor of sociology at Baruch College who has written about nonprofit groups formed in response to the AIDS epidemic. “His study of new organizations responding to 9/11 is the only study I know about that looked at the creation of a new set of nonprofits in response to that event.”

Both “Stand by Me” and “Organic and Sustainable” offer lessons to post-disaster organization founders and advisors, Campbell says. The projects, in particular, can help a new organization get off — or even stay on — the ground by providing some key questions to address.

“What is the life cycle of an organization founded in response to a disaster?” Campbell says. “Are you looking to go out of business after a year, which is fine but unusual? What is it you are trying to accomplish?”

Perhaps most important, Campbell would like to see closer coordination between new groups and the nonprofit infrastructure. The IRS can help make that happen when nonprofit applications are approved, Campbell says, and produce more success stories.

“These organizations need a connection to the existing service-delivery infrastructure,” he says. “I want to make sure these people talk to each other.”

— Eric Coker

### A Katrina comparison

David Campbell will next turn his research attention to a second U.S. disaster: Hurricane Katrina.

More than 400 new nonprofit organizations received approval for charitable activities in response to the 2005 storm, which devastated New Orleans and other parts of the Gulf coast. Campbell will analyze the groups and see how their life cycles compare to the 9/11 organizations.

“One of the things I heard about my research is: ‘Well, New York is New York. You can’t generalize from a case study of New York. Can you compare Katrina?’

“Katrina was a different kind of extreme event from 9/11,” Campbell says. “It did a lot more damage to property and created a different set of challenges than 9/11.”
THE FACE of the future

Computer scientist's lab offers glimpse of advances to come in medicine, entertainment, security
Stopping by Lijun Yin’s Binghamton University lab is like taking a field trip to the future. And there’s always something new to see.

One day, Yin describes how facial-recognition software could be used to treat children with autism. Another time, he builds a digital 3D likeness of himself from just two photographs. During a third visit, a graduate student advances the slides in a PowerPoint presentation using only his eyes. When children come by, Yin shows them how to create a brief animated clip using his software just by speaking into a microphone.
“Can we find a more comfortable, intuitive and intelligent way to use the computer? It should feel like you’re talking to a friend.”

— Lijun Yin

Some researchers focus on one topic, probing deeper and deeper over a period of decades until they have an exhaustive knowledge of the challenges and solutions related to it. Yin, on the other hand, constantly finds new applications for what he knows. His ideas may one day advance fields as diverse as education, healthcare, entertainment and homeland security.

“Our research is motivated,” he says, “by a desire to improve computers to provide something good for our society. I try to use my sophisticated technology to make computers easier to use by the nontechnical person.”

Yin, a computer scientist who also studied electrical engineering, says his fundamentally interdisciplinary work relies on psychology and mathematics as well. He speaks about the possibilities for technology to improve robotics and plastic surgery as though they’re intrinsically related. That’s because, to his mind at least, they are.

**Human computing**

Yin wants to enable computers to understand inputs from humans that go beyond the traditional keyboard and mouse.

“Our research in computer graphics and computer vision tries to make using computers easier,” he says. “Can we find a more comfortable, intuitive and intelligent way to use the computer? It should feel like you’re talking to a friend. This could also help disabled people use computers the way everyone else does.”

Yin’s team has developed ways to provide information to the computer based on where a user is looking as well as through gestures or speech. One of the basic challenges in this area is “computer vision.” That is, how can a simple webcam work more like the human eye? Can camera-captured data understand a real-world object? Can this data be used to “see” the user and “understand” what the user wants to do?

To some extent, that’s already possible. Witness one of Yin’s graduate students giving a PowerPoint presentation and using only his eyes to highlight content on various slides. When Yin demonstrated this technology for Air Force experts last year, the only hardware he brought was a webcam attached to a laptop computer.

Yin says the next step would be enabling the computer to recognize a user’s emotional state. He works with a well-established set of six basic emotions — anger, disgust, fear, joy, sadness and surprise — and is
These 3D wireframe images of computer scientist Lijun Yin were created in his lab from just two photographs.
Lijun Yin’s research in computer science could shake up fields as diverse as education, healthcare, entertainment and homeland security.

Lijun Yin develops algorithms that enable computers to recognize six basic human emotions: anger, disgust, fear, joy, sadness and surprise.

experimenting with different ways the computer can distinguish among them. Is there enough data in the way the lines around the eyes change? Could focusing on the user’s mouth provide sufficient clues? What happens if the user’s face is only partially visible, perhaps turned to one side?

“Computers only understand zeroes and ones,” Yin says. “Everything is about patterns. We want to find out how to recognize each emotion using only the most important features.”

He’s partnering with Binghamton University psychologist Peter Gerhardstein to explore ways this work could benefit children with autism. Many people with autism have difficulty interpreting others’ emotions; therapists sometimes use photographs of people to teach children how to understand when someone is happy or sad and so forth. Yin could produce not just photographs, but three-dimensional avatars that are able to display a range of emotions. Given the right pictures, Yin could even produce avatars of a child’s family members for use in this type of therapy.

Yin and Gerhardstein’s previous collaboration led to the creation of a 3D facial expression database, which includes 100 subjects with 2,500 facial expression models. The database is available at no cost to the nonprofit research community and has become a worldwide testbed for those working on related projects in fields such as biomedicine, law enforcement and computer science.

Artificial intelligence

Once Yin became more interested in human-computer interaction, he naturally grew more excited about the possibilities for artificial intelligence.

“We want not only to create a virtual-person model, we want to understand a real person’s emotions and feelings,” Yin says. “We want the computer to be able to understand how you feel, too. That’s hard, even harder than my other work.”

Imagine if a computer could understand when people are in pain. Some people’s gestures and facial expressions may change. Some may ask a doctor for help. But others — young children, for instance — cannot express themselves or are unable to speak for some reason. Yin wants to develop an algorithm that would enable a computer to determine when someone is in pain based only on a photograph.

Yin describes that healthcare application and, almost in the next breath,
About Lijun Yin

Lijun Yin, associate professor of computer science and director of the Graphics and Image Computing Laboratory, joined the Binghamton University faculty in 2001. He earned a doctorate from the University of Alberta in 2000, after receiving undergraduate and master's degrees from schools in China. His research has been sponsored by the National Science Foundation, the Air Force Research Laboratory and the New York State Office of Science, Technology and Academic Research.

A pragmatic approach

Yin may dream big, but he's also mindful of the limitations imposed by the real world when it comes to his ideas.

His pragmatic approach to the challenges of computing in everyday life was critical to his role in developing the MPEG-4 standards now used in digital video when he was still in graduate school. The goal there was to save bandwidth by compressing raw data as much as possible without losing information or quality.

These days, he hopes to make it easier to identify suspects passing through security checkpoints at airports. But he knows that for such a security algorithm to be useful, a low-resolution camera must be able to do advanced detection work. There's no way to bring his laboratory's elaborate six-camera setup into every airport. And there's no way to have each passenger pose at exactly the right distance from the camera to be identified.

Yin's goal is to create a facial-recognition algorithm that would be able to pick a person out of a crowd, given only front and side photographs of the individual. And it has to work even if he or she passes a camera at another angle.

“Our current work,” he says, “uses a regular camera system to do this challenging job.”

— Rachel Coker

points out that the same system that could identify pain might also be used to figure out when someone is lying. Perhaps a computer could offer insights like the ones provided by Tim Roth's character, Dr. Cal Lightman, on the television show Lie to Me. The fictional character is a psychologist with an expertise in tracking deception who often partners with law-enforcement agencies.

“This technology,” Yin says, “could help us to train the computer to do facial-recognition analysis in place of experts.”

— Rachel Coker

Lijun Yin speaks about the possibilities of facial-recognition software. Visit go.binghamton.edu/yin or scan this code to see the video.
Many of the newest weapons in the war on cancer come in the form of targeted therapies. These drugs disrupt molecular processes in tumor cells and, as a result, keep the tumor from growing and spreading.

In order to develop targeted therapies, scientists need to understand the activities these drugs disturb. If a compound seems to shrink tumors, for example, they need to define what’s going on inside the cells to produce that result.

Binghamton University researchers are helping to advance this work, which may pave the way for better cancer treatments.
Biologist Susannah Gal, left, collaborates with chemist Susan Bane on research that may one day lead to personalized approaches to cancer treatment.
Tracking an enzyme

Susan Bane, professor of organic and biological chemistry, and Susannah Gal, associate professor of biological sciences, deploy a novel tool in their study of an enzyme called tubulin tyrosine ligase, or TTL. Many cancer cells contain less-than-normal levels of this substance.

Bane and Gal are conducting their project with funding from the National Institute of General Medical Sciences. Their work focuses on microtubules, structures that provide part of the scaffolding that gives a cell its structure and also help chromosomes line up correctly during mitosis, or cell division.

Microtubules are made of proteins called tubulin. During the course of a cell’s life, an enzyme called carboxypeptidase clips an amino acid called tyrosine off the end of some of these proteins. Later, TTL puts tyrosine back on the tubulin. No one knows the purpose of this cycle, Bane says. “But we do know that if you don’t have that enzyme, you’ll die.”

In certain cancer cells, the cycle of removing and reattaching tyrosine has fallen out of balance: Too many tubulins lack tyrosine. “Patients who have that characteristic in their tumor have a poor prognosis,” Bane says. Those tumors tend to grow more aggressively.

Hoping to learn more about the role of TTL in cancer, Bane and Gal are studying the removal and reattachment of tyrosine in live cells. Bane has developed a way to mark tubulin with a fluorescent molecule, allowing the researchers to observe those molecules in action under a fluorescent microscope. The technique will help them explore questions such as what conditions allow tyrosine to reattach to tubulin and what conditions keep that from happening.

Marking tubulin isn’t easy. Most fluorescent markers will bond with any protein in a cell; they don’t distinguish between tubulin and other protein molecules. To mark just the tubulin, Bane and Gal essentially put a “hat” on that protein and then add a marker to that.

The hat is a special derivative of tyrosine that Bane created for the project. The researchers introduce this tyrosine derivative into a cell. They then add a fluorescent molecule that lights up when it bonds with the special tyrosine, but not with any other substance. In effect, they pin a glowing badge to the tyrosine hat.

TTL in the cell may pick up that hat and clamp it on the “head” of a tubulin molecule. Once the tubulin is wearing its luminous headgear, the researchers can tell it apart from other objects in the cell and watch how it behaves.

Other methods exist for adding a fluorescent marker to a protein in a cell. The most common technique, using a fluorescent protein, presents certain disadvantages, says Dan Sackett, a biophysical cell biologist at the National Institute of Child Health and Human Development.

The scientist becomes a patient

Susannah Gal’s work on cancer cell biology provided a special perspective after she was diagnosed with breast cancer in May 2009.

Gal wondered about the genetics of her tumor and how that profile helped her doctors determine her treatment. “I called the company that tested the tumor and asked them to give me a list of the genes,” she says. “I recognized a bunch of them.”

Before her surgery, Gal arranged to send the tumor to a repository where other scientists could access it for research. She wanted to obtain some of the cells herself, but she didn’t have time to go through the necessary protocols before her operation.

In the future, though, Gal may put in a request and take advantage of the chance to study the cells that attacked her body. “I was working with breast cancer cells before I got breast cancer,” she says. “So I’m interested, potentially, in bringing my cells back into the lab.”
“The down side is that it’s a very large molecule, as big as the protein we’re trying to track,” says Sackett, who collaborates with Bane and Gal on their project. The marker may actually block the observer’s view of the protein under study.

The new technique, using a smaller molecule, provides an easier way to watch the behavior of microtubules as cells divide, Sackett says. “And since a lot of anti-cancer drugs target the mitotic spindle — the array of microtubules that moves chromosomes apart at mitosis — being able to observe that easily in multiple cell types is really an advantage.”

Cancer cells are often undergoing mitosis at a much faster rate than normal cells, making cell division a major target of cancer research.

Although Bane and Gal aren’t trying to develop a new cancer treatment, their efforts to learn the role of TTL in tumor growth could someday make it easier to choose a treatment for a specific case of the disease.

“Potentially, someone could send us their tumor sample, and we could put it in our labeling system and say, ‘Yes, that has a problem with the TTL system, and therefore you should be more aggressive with it,’” Gal says. “Or we could say, ‘That’s probably OK, so you can treat it with normal chemotherapy.’”

**Can painkillers kill cancer cells?**

While Bane and Gal focus on microtubules, Yulong Chen strives to understand the role that opioids might play in cancer therapies. His work hinges on the fact that an opioid — the key ingredient in painkillers such as morphine — can block a crucial reaction in certain cancer cells.

Chen, an assistant professor of biology at Binghamton, investigates how the transmission of chemical signals within cells turns genes on and off. Most of his research focuses on neurons, the cells that make up the nervous system. Some neurons have something interesting in common with certain cancer cells: They both carry molecules called opioid receptors that send signals into the cell when they touch opioid molecules.

In the nervous system, that signal blocks the sensation of pain. Unfortunately, the reaction also may cause side effects such as respiratory depression.

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**GLOSSARY**

- Amino acid: A set of 20 molecules used to build proteins. Proteins consist of one or more chains of amino acids.
- Chromosome: An organized package of DNA found in the nucleus of the cell.
- Enzyme: A biological catalyst that is almost always a protein. It speeds up the rate of a specific chemical reaction in the cell.
- Microtubules: Tube-like strands of proteins that give shape to many cells. They participate in cell division as well as cell movement.
- Mitosis: The process during which duplicate chromosomes are prepared for division into two cells, which is completed during a phase called cytokinesis.
- Neuron: The basic cell of the nervous system.
- Opioids: Compounds found in or derived from opium that are often used as painkillers.
- Phosphorylation: A chemical process that activates or deactivates many protein enzymes, causing or preventing the mechanisms of diseases such as cancer and diabetes.

Sources: National Institutes of Health, Encyclopedia Britannica
and constipation, and it may cause opiate addiction.

In a cancer cell, contact with an opioid may cause either of two reactions: Sometimes, an opioid kills cancer cells; sometimes, it stimulates tumor growth.

Since doctors often give opiates to cancer patients, it’s crucial to know what effect a painkiller might have on the cancer. “If the opioid will stimulate cancer cell growth, that’s a big problem,” Chen says.

Before joining Binghamton’s faculty in 2007, Chen worked in the Department of Pharmacology at the University of Minnesota Medical School. There, he identified an opioid antagonist compound that kills small cell lung cancer. It does this by blocking the transmission of a signal that is crucial for cell survival.

He also found that this compound doesn’t always produce the same results. When Chen introduced the same opioid antagonist to cells taken from three different individuals with small cell lung cancer, the compound killed 20 to 30 percent of the cells in one sample, 40 to 50 percent in the second and 90 percent in the third.

The difference depended on the strength of a reaction called phosphorylation at the critical survival molecule Akt when the compound binds to a molecule at the cancer cell surface. “Our study shows that if the level of phosphorylation at Akt is high, then you block the pathway using this compound, and the cancer cell dies,” Chen says. “If the level of phosphorylation at Akt is not so high, the cell doesn’t respond well when you block it.” Different phosphorylation levels in different cancer cells from different individuals show a stronger or weaker reaction to the opioid antagonist.

“This observation,” Chen says, “also provides one more reason for personalized medicine in cancer treatment.”

Chen’s study has enhanced scientific understanding of how an opioid may kill cancer, says Kalpna Gupta, assistant professor in the Department of Medicine at the University of Minnesota. It’s significant that Chen focuses on how opioids may kill cancer cells, rather than on how they may promote cell growth, as earlier researchers have done, she says.

“This is more appropriate, from a therapeutic point of view,” says Gupta, who studies opioid-mediated cancer-cell growth. “That is why his study is very important. It not only provides a basic understanding, but an understanding of — once the monster is there — how do we get rid of it?”

Since coming to Binghamton, Chen has been laying plans to further explore the mechanism that allows an opioid to kill cancer cells. “I still don’t know what molecule it’s targeting,” he says. His next goal is to identify the key receptor on the cancer cell. “If I can identify this molecule,” he says, “then I can study whether it’s valid as a target for an anti-cancer drug.”

In the long run, Chen’s research on molecular signals in neurons and his research on cancer cells may lead toward a common goal. He hopes to find an opioid that reduces pain in cancer patients, doesn’t cause side effects or addiction and kills tumors.

“If the compound that we develop to kill the cancer cells also can block drug tolerance and dependence, that will be one drug that does two things,” Chen says. “That would be wonderful.”

— Merrill Douglas

Binghamton researchers are contributing to a body of knowledge that may one day lead to targeted cancer treatments.
Engineer puts DNA to the test

Understanding molecule’s mechanical properties could lead to medical advances

Some of today’s most innovative science happens at the places where one field of inquiry meets another. That’s precisely where you’ll find Changhong Ke, a Binghamton University mechanical engineer whose interests extend to biology and physics.

“We are able to observe the morphology — the structure — of each individual molecule,” Ke says. “DNA is a very stable molecule, but it can experience damage. Some is from the cell and some is from radiation, mostly ultraviolet light.”

“Interdisciplinary work is of particular importance for discovery at the micro and nano scale,” he says. “This is because the properties and behaviors of small-scale structures that are building blocks of large-scale systems are typically influenced by a variety of physical forces.”

This so-called “multi-physics phenomenon” often involves linkages among mechanical, electrical and chemical forces and opens doors to many technological possibilities.

Ke, who has developed unique ways of examining nanomaterials, brings this background to his work on DNA. He uses an atomic force microscope to observe DNA damage and repair at the molecular level.

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Nearly 60 years ago, scientists created the first model of the shape of DNA. And while that double helix structure — a twisted ladder — has since become famous, scientists are still teasing apart the mechanical properties of DNA.

That’s where Ke comes in.

“The mechanical property of DNA molecules is important to their biological function,” Ke says. “We want to understand the molecular level properties of DNA molecules.”

Understanding DNA
A post-doctoral fellowship at Duke University provided Ke with an introduction to biophysics. At the time, he says, he had a high school-level understanding of DNA. These days, he can offer a brief refresher course along these lines:

DNA, or deoxyribonucleic acid, is found in every cell in the human body. Each strand contains all of a person’s hereditary information. These strands are packaged into chromosomes. One tiny variation in the DNA sequence can have dramatic results: giving someone a different eye color, for example, or putting someone at risk of developing a certain disease.

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to measure the force that stabilizes the double helix.”

He and several colleagues used atomic force microscopy to measure interactions in DNA at the single molecular level. The paper they published on the topic in *Physical Review Letters* in 2007 was named one of the most exciting projects in physics by the American Physical Society’s *APS News*.

“DNA is so important to us that any findings in this area can have a big impact,” Ke says.

**Key collaborations**

Ke’s DNA research is moving forward with help from two key collaborations:

With Jie (Jayne) Wu, an electrical engineer at the University of Tennessee who’s an expert in small-scale electrokinetics, he’s incorporating microfluidics into his study of DNA damage. They will use an electrical field to separate DNA based on the damage it has experienced, a method that’s potentially faster and more accurate than using an atomic force microscope to do the job.

With Binghamton mechanical engineering colleague Peter Huang, Ke is studying hybrid structures that combine DNA and carbon nanotubes. The two have a unique method of directly measuring the binding force between the DNA and the nanotube, Ke says.

While it’s difficult to separate carbon nanotubes, DNA carries a negative charge, which means individual strands repel each other. Combining them, Ke says, will make it easier to separate the carbon nanotubes.

Other researchers have demonstrated that carbon nanotubes can penetrate cell walls. If this binding interaction can interrupt the mechanical behaviors of DNA molecules so that the DNA no longer performs well — perhaps even killing the cell — it may be possible to use this technique in gene therapy.

Ke is also interested in the environmental and health impacts of these carbon nanostructures. They’re widely used in a variety of consumer products, he notes, but it’s not well understood what happens once they come into contact with human tissues.

— Rachel Coker

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**GLOSSARY**

**Nanometer**: A nanometer is a billionth of a meter. A sheet of paper is about 100,000 nanometers thick. Dimensions between 1 and 100 nanometers are known as the nanoscale. Unusual physical, chemical and biological properties can emerge in materials at the nanoscale.

**Atomic force microscope**: A high-resolution microscope that enables observations at the nanoscale. Information is gathered by touching the surface of a specimen with a mechanical probe. Such microscopes have been available for about 20 years.

*Source: National Science Foundation*
Changhong Ke was among just 43 researchers nationwide chosen for the Air Force’s Young Investigator Research Program in 2010. Ke’s project will focus on low-density, high-strength materials that could allow the Air Force to reduce the weight of vehicles such as fighter planes and spacecraft. His studies involve two materials, both of which have hollow, tube-like structures. One is made of carbon and the other is made of boron nitride, which is far less common. Both are called nanotubes because their wall thickness and diameter can be measured in nanometers. Several thousand of these tubes put together would still be thinner than a single strand of hair.

“They are both light and strong,” Ke says. “They have similar mechanical properties but different electrical properties. The carbon nanotubes can be conductors or semiconductors, while the boron nitride tubes are insulators. Both dissipate heat quickly, which is good for aerospace applications.”

Ke plans to investigate not only how carbon nanotubes and boron nitride nanotubes perform individually, but also what happens when small bundles are made from the two. What happens at the places where they touch? How strong is the interface between them?

The Air Force program supports scientists and engineers who received a PhD in the last five years and show exceptional ability and promise for conducting basic research. Grants of $120,000 annually for three years fund creative basic research, enhance early career development and increase opportunities for the researchers to recognize the Air Force mission and related challenges in science and engineering. Competition for the awards is stiff, with fewer than 20 percent of applicants receiving funding.

Ke, who joined the mechanical engineering department at Binghamton in 2007, earned his doctorate from Northwestern University, where he received his first patent. He did his undergraduate work at Beijing Institute of Technology.
Imagine never having seen a car before and trying to determine what makes the vehicle run. That’s how Christof Grewer begins to explain his research on tiny proteins in the brain.

“We would be interested in seeing what happens when the car is moving, and we’d take pictures of that,” he says. “We’d see the pistons moving, and that would be the beginning of understanding.”

Grewer, a biophysical chemist at Binghamton University, studies glutamate transport proteins, miniscule components of our brains that move glutamate among cells. Glutamate, an important molecule in cellular metabolism, is also a neurotransmitter.

Scientists know the transport proteins are important, and they know they move glutamate in and out of cells through a sort of door in the cell wall, known as a glutamate transporter. But exactly how the proteins trigger those doors in the cell wall, and what makes them move glutamate to the inside or outside of a cell, is unknown.

Learning how those triggers function could have major implications for human health. For example, during a stroke, when blood and oxygen to the brain are restricted, brain cells release glutamate into the space surrounding them. That starts a toxic chain that can kill brain cells and harm certain brain functions.

Knowing how the glutamate molecules are transported through cell walls could one day lead to drugs that help or halt the transport.

Grewer — one of perhaps two dozen researchers in the world who work on this problem — switches analogies as he continues describing the way these proteins move. Now he’s talking about a tall building.

“People are transported in an elevator,” he says. “So in order for that to work, the door of the elevator has to open, and then the person has to step into the elevator. And then the elevator brings you to a higher floor, and then the door has to open, and the person has to walk out.”

In this case, glutamate molecules are the people. The elevator cars are the glutamate transporters. And the electricity and wires that move elevator doors are — well, that’s what he’s trying to figure out.
Chemist Christof Grewer has pioneered the use of lasers to study tiny proteins in the brain.
Grewer’s brainstorm was to create a method that uses lasers to trigger the transports’ action. By controlling when the movement happens, he can document it.

It all goes back to his analogy of photographing a car’s pistons. Taking snapshots may illuminate how the transporters and glutamate molecules work together.

**Scientific serendipity**

Grewer stumbled onto the glutamate transporters.

When he was a graduate student in physical chemistry at Johann Wolfgang Goethe-University in Frankfurt, Germany, his research focused on chemistry and light. His introduction to biochemistry — and to glutamate receptors — came during a post-doctoral fellowship at Cornell University.

“We were trying to activate these receptors on a very fast time scale,” he says. “It’s not that easy to do.”

His background in chemistry and physics brought fresh insight to the lab. What if, he thought, a flash of light could help trigger the transport process? By timing the reactions, the researchers could better capture what happens during the glutamate transfer.

“They were so interesting to me that I just had to stay with them,” Grewer says of glutamate transporters. “I thought, that is just the most amazing thing to study.”

Most biochemical research on the brain focuses on possible cures, says Peter Larsson of the University of Miami. Many researchers experiment with known drugs to judge their effect on brain function.

“In most proteins, and in biology these days, we know the genetic code, and we know what the DNA looks like, and we know how many proteins you have in your body,” Larsson says. “But we don’t really know how these proteins work, how they function.”

What sets Grewer apart in this small community of researchers? “He’s pioneering using lasers,” Larsson says. “It had been used on other types of proteins, but nobody has used it in this type of study.”

**Blending research, teaching**

Grewer took his studies back to Germany for a few years before accepting a post at the University of Miami School of Medicine.

“In the medical school community, there is more interest in the neuroscience,” Grewer says of his time in Miami. But he didn’t teach much, and he missed working with undergraduates.

At Binghamton, Grewer teaches every semester.

Donald Nieman, dean of the Harpur College of Arts and Sciences at Binghamton, says Grewer’s arrival in 2008 also created opportunities for interdisciplinary collaborations in biology and chemistry. “While the research Christof does is very specific and doesn’t replicate what others are doing,” Nieman says, “the basic science and techniques he is using mesh nicely with the work of several faculty members.”

Grewer’s research, which is supported by the National Institutes of Health, is painstaking and full of dead ends. Results are years, and possibly decades, in the making. Frustration comes easily.

But teaching tempers that frustration, Grewer says.

“With the teaching, you see the outcome much more quickly,” he says. “When you give a lecture and have a student later come to you with a question and say, ‘This is the first time I’ve ever really understood that’ — that’s a very gratifying feeling that you don’t often have in the research.”

“Teaching gives you the strength to keep going with the research.”

— Anne Miller
It’s no secret that many young people gain a taste for alcohol before they reach the legal drinking age. Often, parents decide that it’s impossible to keep their underage children from drinking. So they preach responsible consumption, serving alcohol at home so they can supervise or offering rides home at all hours to keep the kids off the road.

Linda Spear understands what motivates these parents. But she and her colleagues who study the effects of alcohol on brain development say that this bow-to-the-inevitable strategy is wrong. The dangers of youthful drinking extend beyond the risk of auto accidents. Science shows that alcohol changes the young brain in ways that may cause problems throughout a person’s life.

“We’re trying to convince policy makers that adolescents are responding differently to alcohol than adults,” says Spear, distinguished professor of psychology at Binghamton University. “We shouldn’t be providing alcohol at these younger ages, or condoning it.”

Spear, a noted expert on the adolescent brain, is author of The Behavioral Neuroscience of Adolescence, published by W.W. Norton in 2010. She’s an authority on the effects of alcohol on the adolescent. Among her major interests is how the adolescent brain responds differently to alcohol than the adult brain.

Dr. Jay Giedd, chief of the unit on brain imaging in the child psychiatry branch at the National Institute of Mental Health, calls Spear a pioneer in charting the biology of adolescence. Spear, he says, has helped to ground the debate about teen drinking in solid science.

“Apart from the cultural and social, there are biological reasons that the
Binghamton research demonstrates that the adolescent brain responds differently to alcohol than the adult brain, and in ways that seem to promote “binge” drinking.

adolescent brain is particularly vulnerable to alcohol, down to the chemical and molecular and cellular levels,” Giedd says. Spear’s opinions on this hot-button issue are especially credible, he adds, because she argues directly from her data.

According to that data, some of the danger in youthful drinking stems from the fact that the typical adolescent can drink the typical adult under the table. “Adolescents are very insensitive to many of the cues that normally help you figure out that you’ve had enough to drink,” Spear says. Without signals to warn that they’ve gone way beyond tipsy, adolescents tend to drink more. “And that’s a problem, because high levels of alcohol are toxic.”

**Stamping tolerance on the brain**

It’s also a problem because the more you consume, the less you feel alcohol’s effects. In young drinkers, this tolerance may become stamped upon the brain, possibly creating the conditions for alcohol addiction, Spear says. “It’s not always the case,” she says, “but it does seem that there are a number of circumstances in which you may be ‘adolescentizing’ the alcohol response into adulthood with this chronic exposure to alcohol during adolescence.”

Hoping to better understand how youthful drinking might shape the adult brain, Spear has joined a consortium of scientists from throughout the United States to examine long-term effects on the brain and behavior of adolescent rats exposed to a great deal of alcohol — levels resembling repeated binge exposures. As part of the consortium, Spear and her colleague Elena Varlinskaya, a research professor at Binghamton, will focus on long-term effects on social anxiety after adolescent alcohol consumption.

“We’ve found that shortly after termination of alcohol exposure, the adolescent animals are socially anxious, and they’re unusually sensitive to the restoration of social behavior by alcohol,” Spear says. She and Varlinskaya hypothesize that, when the adolescent drinkers become adults, they will still grow anxious quickly as alcohol leaves their systems. When they drink again, they will relax and start to socialize, finding alcohol especially effective for reducing social anxiety.

Previous researchers have examined long-term effects of alcohol exposure by injecting rats with alcohol. Spear and her colleagues want to see if the effects are different when rats ingest the alcohol themselves.

As the consortium plans these experiments, Spear also is investigating alcohol and brain development through another initiative. In 2010, the National Institute on Alcohol Abuse and Alcoholism awarded a five-year, $8.5 million grant to fund the Developmental Exposure Alcohol Research Center, or DEARC. Spear serves as its scientific director. DEARC is a joint venture of Binghamton University and SUNY Upstate Medical Center. Researchers at SUNY Cortland are participating with a pilot project, and DEARC is considering project proposals from several other universities.

DEARC is the only research center today to focus on how alcohol affects brain development, Spear says. “We’re also unique in that we’re the only
“Adolescents are very insensitive to many of the cues that normally help you figure out that you’ve had enough to drink. And that’s a problem, because high levels of alcohol are toxic.”

— Linda Spear

center that was ever put together to focus on both prenatal and adolescent exposures,” she adds.

Spear’s own project within DEARC explores the chemistry behind adolescent drinking patterns. “We’re keying in on some of the chemical systems that undergo change during adolescence, to try to see if those are associated with certain of the alcohol insensitivities,” she says.

Taking science to the street
Since it’s illegal and unethical to get teenagers drunk in the name of science, most research on alcohol and the brain uses laboratory rats. Spear’s work is no exception. That’s one reason she’s excited about a new project in Binghamton.

Working with Stephen Lisman, distinguished teaching professor of psychology, Gerard Johansen, senior counselor at the University Counseling Center, two graduate students and a cadre of undergraduate assistants, Spear is taking her research to the streets. Specifically, she’s taking it to State Street, the center of nightlife in downtown Binghamton.

Since spring 2010, the group has been surveying young drinkers outside bars, collecting information on their consumption habits and problems with alcohol. Some subjects are then invited to blow into a breathalyzer, complete simple cognitive and motor tasks and then take the breathalyzer test again. The subjects, who range in age from 16 to 30, do not give their names.

The study’s main goal is to learn whether younger human drinkers perform better on the tasks than older drinkers with the same blood-alcohol levels. “It is the only study I know of that’s currently able to look at that in the United States,” Spear says.

Through studies such as these, Spear helps to expand knowledge of how the brain may “sculpt” itself, and to what extent youthful experience shapes the brain in adulthood.

Ultimately, scientists in her field want to learn how to make the most of adolescence, Spear says. Young people need to understand that their choices have a serious impact. The message is: “You’re different from the adults,” she says. “And that’s kind of cool, because you may be able to build the brain the way you want. So, what do you want?”

— Merrill Douglas
One applies the rigors of the scientific method to the study of human rights, quantifying for the world and its leaders what it means to be free.

Another, a pioneer in the study of women in German history, details in her latest book how advancements in social justice spring from a deep well of hope among average citizens.

A third won a Pulitzer Prize for his page-turning look at Japan’s World War II Emperor Hirohito, exploring in new ways the ethical dimensions of his reign.

Binghamton professors David Cingranelli, Jean Quataert and Herbert Bix embrace the role of history and political science in understanding human rights. The quest for justice is informed by the historical or political themes they coax into modern relevancy every day.

**Measuring social change**

Cingranelli’s brainchild, the Cingranelli-Richards (CIRI) Human Rights Data Project with David L. Richards of the University of Connecticut, has become the gold standard for quantifying human rights.

His inspiration was former President Jimmy Carter’s articulation of the responsibility of the United States to advance human rights around the world, but the connection to his own work came after he read a senior scholar’s assertions that U.S. international aid regularly flowed to draconian regimes.

“I was stunned by that,” Cingranelli says.
So he dug deeper, found flaws in the methodology, and knew he could do better. “It’s impossible to engage in meaningful social change without measuring what it is you want to change,” he says. “Otherwise, you can’t tell if you are being successful or not. I want to do something that theoretical scholars can use that also might help policy makers make the world a better place.”

Some bristle at Cingranelli’s application of statistical analysis to such a human cause, or at state leaders’ acceptance of his data. He notes that coming up with reasonable definitions about what constitutes rights can be challenging. But relying on self-appointed arbiters of what is worthy of quantification means missing a major avenue toward change.

The data set describes a wide variety of government human rights concerns, including torture, workers’ rights and women’s rights, over a more than 25-year span.

Consider some of the more challenging definitions in the project: While it might be culturally sound in some countries to limit the movement of women in relation to their husbands or families, Cingranelli doesn’t buy such exceptions.

“If you can’t get a visa because you are a woman or unless your husband agrees or your father agrees, well, we decided that if half the population can’t move, we’d say that wasn’t good,” he says. “There is no international court (to decide these things), so we have to come up with measures. There are things we never would have thought of until we got into this.”

Todd Landman, director of the Institute for Democracy and Conflict Resolution at the University of Essex in England, says the CIREF data set is the leading resource for cross-national and time-series, standards-based measures of human rights. When asked about Cingranelli, Landman says simply: “His work has had a tremendous impact on human rights scholars and practitioners over the last 30 years.”

Exploring the personal
If Cingranelli hopes to find truth from a view above the political and cultural fray, colleague Quataert wades deeply into all human complexity can offer.

In her latest book, *Advocating Dignity: Human Rights Mobilizations in Global Politics* (University of Pennsylvania Press, 2009), readers learn how 14 middle-aged, mostly working-class mothers in Argentina transformed the cases of their “disappeared” loved ones into a matter of national urgency. She also describes how the work of one South African woman brought her struggles against apartheid to an emerging global feminist mission.

Quataert’s internationally recognized scholarship relies on the personal. In the book, she recounts how one of the Argentinian mothers describes her missing son: “Everything was important about him, his studies, his work,
“It’s impossible to engage in meaningful social change without measuring what it is you want to change. Otherwise, you can’t tell if you are being successful or not. I want to do something that theoretical scholars can use that also might help policy makers make the world a better place.”

— David Cingranelli
“I’m always delighted to have students in the class who are critical because it helps us have great debates,” Cingranelli says.

Quataert, who oversees a minor field in the history of human rights, says she hopes her students come to understand just how dynamic and global the human rights system is as it confronts abuses and violations.

“Much of the literature on human rights is written from the perspective of the present, so I offer an historical account of the emergence of the human rights system,” she says. “It was created through the post-World War II collective system of the United Nations, and I stress the many complex factors and human actions that led to its formal emergence between 1945 and 1949: changes in the international system with the codification of international law, emerging international organizations, transnational advocacy groups, new intergovernmental agencies, growing literacy, and print and media circulation.”

Students read early international humanitarian law for its values of common humanity and shared fate and examine the notions and ideas behind the many transnational movements for justice emerging after the middle of the 19th century. Then Quataert has them examine the way human rights principles were incorporated into the U.N. Charter and the creation of the U.N. institutions for human rights oversight, including the Commission on Human Rights and the Commission on the Status of Women. “My view is that the whole U.N. system is shaped from below,” she says, “by people caught in real-life crisis.”

A comparative approach

Bix, whose current research centers on Japanese and American wars of the 20th century, brings to his work a focus on human frailty and susceptibility to political and religious illusions and dogmas.

The author of Hirohito and the Making of Modern Japan continues to explore...
the war crimes for which Japanese defendants in post-World War II international criminal trials were punished. He also compares them to the war crimes perpetrated by U.S. military and civilian personnel in recent years.

“As a historian of modern Japan and its wars, I tend to think in comparative terms, contrasting U.S. and Japanese behavior in different phases of their imperialist expansion, in different regions of the world,” he says.

Indeed, Bix goes so far as to call this an “age of oligarchy.”

“We easily demonize the Taliban who resist us, and we commit war crimes against the civilian populations of Afghanistan, Pakistan and Iraq,” he says. “Yet we do not view ourselves as fighting wars of choice that destroy their societies and harm ourselves. Aren’t these contradictions worth thinking about?”

Bix says his aim is to bring historical knowledge to bear on the study of important contemporary issues. “Why, for example, are legal benchmarks for punishing war criminals ignored whenever American forces or friends of America such as Israel are involved?” he asks. “Who is the enemy and who gets to define him? What light does a nation’s way of waging war shed on its institutional structure and military decision-making?”

— Kathleen Ryan O’Connor

Herbert Bix, a Pulitzer Prize-winning historian, says we are living in an ‘age of oligarchy.’
THE LADY VANISHES

Too often, gender stereotypes push women away from entrepreneurship
Vishal Gupta believes the way that entrepreneurship is presented, discussed and taught must change — especially for women.

“Where are the role models for women?” asks Gupta, an assistant professor of strategy at Binghamton University. “Pick up any book on entrepreneurship: It’s all about men. Switch on the TV, and when it comes to entrepreneurs, it is Bill Gates and Steve Jobs. Where are the women entrepreneurs? They’re not being talked about.”

Of course, there have been many high-profile female entrepreneurs over the past half-century. The accomplishments of Oprah Winfrey, Estée Lauder, Mary Kay Ash and Debbi Fields are easily as impressive as those of Gates, Jobs, Richard Branson and Vidal Sassoon. But the failure to highlight the work of female entrepreneurs is exacerbated by societal stereotypes that often link entrepreneurship to masculine characteristics.

Gupta, who has devoted much of his research career to entrepreneurship, finds that gender stereotypes can discourage women from starting their own businesses, while gender-neutral messages prove most appealing to them.

“Some people say that the question of gender difference is timeless: It has always been there with us,” he says. “My research goes deeper into the question: Do men and women differ when it comes to entrepreneurship?”

Questions and answers
To help answer the question, Gupta and colleagues Daniel Turban at the University of Missouri and Nachiket Bhave from the University of Minnesota distributed articles about attributes of entrepreneurs to more than 465 undergraduate business students who were divided into random groups.

“A lot of what we know about gender differences tends to be anecdotal or based on archival data, such as the Census,” Gupta says. “What we did was bring in the random-experiment approach, which is popular in fields like biology, medicine and agriculture. The nice thing about random experiments is that they take the guesswork from your analysis,” he says. “What if you gave a certain treatment to men and women who are randomly distributed in groups? What kinds of differences would you see based on the readings of the articles?”

In the study, one group’s article simply said entrepreneurship could be best taught through business education. Another group was told that stereotypical male characteristics such as risk-taking and aggressiveness produce the best entrepreneurs. A third group received the female stereotype, reading that characteristics such as social skills and networking are key for entrepreneurship. Another group learned that the best entrepreneurs have characteristics of both men and women, such as creativity.

“Women also showed little ambition for entrepreneurism after reading the female-stereotype article. Women shared equal entrepreneurial aspirations with men only when the gender-neutral attributes were presented. The study, “The Effect of Gender Stereotype Activation on Entrepreneurial Intentions,” was published in 2008 in The Journal of Applied Psychology.

“We were surprised by how clear our results were about the effects of exposing people to those societal beliefs in subconscious ways,” he says.

An entrepreneurial upbringing
Entrepreneurship has had an impact on Gupta’s life since he was a young boy living in India.

“In many cases, entrepreneurship professors grew up around an entrepreneur who had a substantial influence in their life,” he says. “In my case, that someone was my father.”

Gupta and his colleagues determined that both men and women assimilated to the subtle reminders about social beliefs and entrepreneurship.

“When men and women were told that entrepreneurship is about male characteristics, men were more interested in becoming entrepreneurs,” he says. “Women were less interested in entrepreneurship. … It shows the power of the societal beliefs we have. When we are subconsciously exposed to them, it can affect the way we think.”

Women also showed little ambition for entrepreneurism after reading the female-stereotype article.

“When we presented the feminine information, nothing happened. Why? Because it is not consistent with what students are seeing and hearing in society about entrepreneurs,” Gupta says.

Gupta and his colleagues determined that both men and women assimilated to the subtle reminders about social beliefs and entrepreneurship.
Gupta’s father started as an entrepreneur at age 16, working in the machinery business in India.

“When the family got together for dinner or lunch, you heard entrepreneurial ideas and new ways to create value,” Gupta says. “That ends up having a lot of influence on your thinking.”

Gupta earned a degree in mechanical engineering from Punjab Technical University and was pursuing a master’s degree in industrial engineering in the United States when he met business professors at Penn State’s Smeal College of Business. “It gave me a new way of thinking about ideas, he says. “That was the first important influence on me in the U.S.”

The business classes motivated Gupta to earn a doctorate in strategic management from the University of Missouri.

Gupta began entrepreneurial research while pursuing his doctorate and soon became the driving force for incorporating gender issues, says Turban, chair of the Department of Management at the University of Missouri.

“He brings a lot of creativity, hard work and effort,” Turban says. “He is good at thinking about what to investigate and how to frame it. ... Some of the attributes that are particularly important are that he has a lot of drive and motivation that are coupled with ability and curiosity.”

Gupta joined Binghamton University’s faculty in 2008.

“When I first joined academia, my father said, ‘What are you doing? Do something useful with your life,’” Gupta says. “For him, academia wasn’t practical. Now he sees that I haven’t lost my practical orientation. He realizes that academia doesn’t take you away from being practical. You can do both.”

**Making the changes**

Changing the way entrepreneurship is discussed starts not only with reaching young people, but also by always presenting it as an option for men and women.

“We never explicitly say that (entrepreneurship) is for men and not women,” Gupta says. “But implicitly, that’s what we are signaling. How? By emphasizing masculine characteristics.”

Gupta points to arguably the most popular television show with an entrepreneurial focus, Donald Trump’s *The Apprentice*.

“What that show is doing is turning women away from being entrepreneurs because they’re looking at it and think-
One place where that can be seen is in Gupta’s home country of India, where 14 percent of women are entrepreneurs, compared to 8 percent in the United States.

Gupta and his colleagues conducted a similar gender-entrepreneurship study in India in 2009. Unlike in the United States, emphasizing female characteristics had a positive influence on Indian women’s views of entrepreneurship. While India has greater perceived gender differences and barriers to women in business, it has had female heads of state and the female characteristics are consistent with successful business leaders in the Indian culture.

But Gupta worries that the expanding popularity of Western television shows could eventually affect Indian women’s attitudes toward entrepreneurship.

“If you saw that movie, you would not want your daughter to be an entrepreneur,” Gupta says. “They show Martha Stewart as selfish and only looking out for herself at an early age. That’s a big problem. You have to emphasize that entrepreneurs are people who contribute positively to the economy and society.”

Gupta also would like to see the stories of female entrepreneurs “front and center” in textbooks with an emphasis on success “while retaining their feminine identity.”

“Maybe as our TV shows diffuse through their society, they will end up in the same position as us,” he says. “The power of TV shows such as Friends is such that Indian kids would rather watch the show than actually be with their friends. It’s unfortunate that the media can have so much power over how we think and act.”

Gupta plans to further analyze Hollywood’s role in entrepreneurship. He has identified movies that deal with the subject and hopes to answer the question: Can movies with female entrepreneurs reduce some of the differences in men’s and women’s interest in becoming entrepreneurs?

Educators, scholars and activists can all learn lessons from the gender-entrepreneurship research, Gupta says, ranging from the need to promote role models to the power of random experiments in examining the challenges that lie ahead.

“Social beliefs, especially about gender roles and professions, are very entrenched in society,” he says. “They can change, but they take a long time to change. If we want to change the gender image of entrepreneurship, it won’t be an easy job.”

— Eric Coker

Infusing the curriculum with entrepreneurship

A new initiative aims to bring entrepreneurship to the academic forefront at Binghamton University.

Through Entrepreneurship Across the Curriculum (ExC), small stipends have been offered to faculty members who offer an entrepreneurship component on a continuing basis in their classes.

“Every discipline has the opportunity to have a component of entrepreneurship added to a syllabus — be it nursing, arts, science or engineering,” says Eugene Krentsel, assistant vice president for technology transfer and innovation partnerships. “If you are a sculptor, you may eventually open your own gallery. If you are pre-med, you may run your own clinic at some point.”

Krentsel’s office is spearheading Entrepreneurship Across the Curriculum with the Small Scale Systems Integration and Packaging Center (S^3IP), the University’s New York State Center of Excellence.

“This is unique to Binghamton,” Krentsel says. “There are other schools that have done this with engineering and business students, but we are going to expose students across a huge variety of disciplines to ideas about entrepreneurship and what it means to be entrepreneurial.”

In the first year, ExC classes are spread across fields ranging from nursing to computer science and from engineering design to nonprofit management.

The initiative is a small but key step in helping to revitalize the economy, says Ken McLeod, a bioengineering professor. “You have to start small and let this grow,” he says. “It’s not going to happen overnight, but hopefully over the next 10 to 20 years, we’ll see the revitalization of the upstate economy through hundreds, maybe thousands of ventures started by our graduates.”
Q: What gave you your start in entrepreneurship?
A: I have been a rebel all my life, and the reason is that I have found fault with the system all my life. I had to learn how to deal with the system because I couldn’t fight it. The answer was to learn how to be entrepreneurial — a creative problem-solver. I was entrepreneurial long before I became an entrepreneur.

My problem was finding an organization that would allow me to do this and not restrict me. I had one boss who did this, but once he left, my career was in jeopardy. The answer was to buy my own business. This doesn’t have to be the answer, though. It would be better if more organizations learned how to give their people freedom and maintain some control.

The best thing about entrepreneurship is the ability to create commerce or new solutions. That’s being entrepreneurial. As for being an entrepreneur, anyone can do it. It is especially easy if you inherit the business or money to buy it. I know a lot of entrepreneurs who are not very entrepreneurial.

But being entrepreneurial is not enough, nor is creating an organization that thrives on allowing people to be entrepreneurial. Effective personal leadership is also essential. In fact, I’d go so far as to say that entrepreneurship and entrepreneurs are not the answer. They are just the latest silver bullet.

Q: Why do you see personal leadership as so vital?
A: The underlying cause of many problems we face in our society is the Big Bad Bureaucracy. Bureaucracy’s weakness is that it focuses on professional leadership with little attention given to personal leadership.

In my experience, bureaucracy exists in companies and organizations of all sizes. It exists where it is next to impossible to get to the decision-makers. It exists where rules and layers of management confine people.

Q: Can you give an example?
A: Years ago, I worked for a large company. What I found most surprising was how many rules there were — and how everyone knew how to break them. In fact, your boss would tell you how to break them. For example, I had to make an unexpected trip, and I needed some cash. I needed $150, but the rule was that to get more than $100 you had to submit a request to headquarters and wait about a week to get it. My boss told me to make out two requests for $75, and they gave me the money on the spot.

The rules were more important than doing the right thing. Actually, it was difficult to know what the right thing was. There was no discussion about mission and vision, customers or employee welfare, just rules. This method of operating has destroyed a lot of once-successful companies.

When I returned to school as a graduate student, I was amazed at how much the university and that company had in common. That’s when I realized that the problem was bureaucracy and not business, government or the size of an organization.
Q: **How can these issues of bureaucracy be overcome?**

A: The real solution lies in freedom with reasonable control. Give people the freedom to create but do not allow them to take advantage of the system, a system that has to have some moral structure. And this is the difficult part of good leadership: allowing freedom but maintaining overall control.

I have always said that I could never control our people at Adirondack Beverages, regardless of how hard I tried or which methods I employed. My partner used to say, “No one has enough money to watch their people all the time.” I would add that I don’t want to, nor do I have the time to do so.

Q: **If people really can’t be controlled, how can a leader maintain order?**

A: The key is buy-in. The way to get it is a win-win philosophy with a moral basis. The people win — financially and otherwise — when the organization wins and operates ethically and morally. What we did was focus on the right thing to do — our mission, vision, ethics, morals and our budget in time and money — and we gave our people a lot of leeway in the process. That’s the opposite of what so many large organizations do.

Business writer Tom Peters calls this “hard and soft” leadership. It’s hard on the organization’s values and soft on the process. The large organizations are soft on the values and hard on the process, which is what led to the recent disaster on Wall Street.

What we have right now in the United States, both in politics and in the corporate world, is a focus on doing things right with short-term goals and not on doing the right thing. All of this leads to a sort of reverse anarchy. We have a society in which the leaders are out of control and out of touch, and not the people. Effective personal leadership is the missing link.

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**Mastrangelo’s Opportunity Model of Entrepreneurship**

*The key to making a problem an opportunity is to find a commercially viable problem. This five-step process developed by Angelo Mastrangelo will help you find and develop an opportunity.*

1. Find a “commercially viable problem” (one that needs to be solved and is ready to be solved).
2. Create a solution to this commercially viable problem: a product and/or service that is unique (a strong competitive advantage). It must also include an effective method of distribution (the selection of a distribution channel is second in importance to positioning the product and or service) and creating awareness (making your potential customers aware of your product and or service and why it is special is critical and can be expensive and challenging).
3. The solution must be sustainable (patents, trademarks and first-mover advantage are all helpful).
4. The solution must be profitable (in the long term).
5. Build an effective team.
Cathy Hao is a veteran of three laboratories. She has researched colon cancer, counted nanoparticles and conducted experiments related to cognition. She’s also just 19 years old.
Hao needs no lectures about the value of scientific research. “I’m able to be a more critical scientist because of my lab work,” says the Binghamton University sophomore. “I’m able to picture the experiments in my head when I’m learning in the classroom.”

She’s in good company at Binghamton, where undergraduates in a variety of disciplines balance school work and research every day. A new grant from the Howard Hughes Medical Institute (HHMI) promises to extend these experiences to additional students. The $1.4 million, four-year grant will provide summer research placements for undergraduates involved in interdisciplinary projects.

“Undergraduates come to college and expect to be given information,” says Wayne Jones, a professor and chair of the chemistry department at Binghamton. “Research provides an opportunity to create the next generation of knowledge. And that’s when you become engaged: when it’s a part of you. What we know as educators is that the process of discovering that new knowledge is more important than the knowledge itself.”

**Educational benefits**

Hao, who pursued her first research experiences while in high school, says she has already had opportunities to use information from chemistry, math and biology classes in the lab. “I’ve always been a kinesthetic learner,” she says. “I can take what I learned from the classroom and use it.”

Mohamed G. Mohamed can identify with that. He came to Binghamton through the Bridges to the Baccalaureate program, which was established to increase the number of underrepresented minority students pursuing degrees in the biomedical sciences. After working full time in a psychology lab for about a month, Mohamed decided to transfer from a community college to Binghamton.
He’s still working with the same faculty member.

“Part of my life, I’m in school learning things, but there’s no application for them,” he says. “This is all application. What you do has implications.”

Mohamed, an 18-year-old sophomore, says he especially enjoys the lab’s weekly meetings. “It broadens our knowledge,” he says. “I love it.”

Hao spent the summer of 2010 at the University of Michigan, where she was free to focus on lab work without having to juggle homework and other responsibilities. “Even though I made mistakes, I learned from them a lot more than if I were reading a paper,” she says. “In those 10 weeks, I learned more than in a year of school.”

**Career implications**

Anna Tan-Wilson, a distinguished teaching professor of biological sciences and HHMI program director

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**IMPACT**

A new $1.4 million grant from the Howard Hughes Medical Institute will expand interdisciplinary research opportunities for undergraduates. Binghamton is one of 50 research-focused universities that received grants; Harvard, Yale, Cornell and the College of William and Mary are also participating.

At Binghamton, teams will begin their research projects in summer 2011 and will continue working together the following academic year. Along the way, they will be trained in how to work effectively across disciplines.

Through this program, graduate students will receive special training as mentors, says Nancy Stamp, dean of the Graduate School. They’ll do hands-on work with the undergraduates as well as provide vital peer-to-peer interactions. The graduate students may also help faculty researchers and undergraduates alike build a common vocabulary and wade through discipline-specific jargon.

Organizers of the project at Binghamton are interested in understanding how students in the program will develop. Krishnaswami (Hari) Sridhi, distinguished professor of systems science and industrial engineering and dean of the Thomas J. Watson School of Engineering and Applied Science, will observe the students as they work and use data to model the social interactions of the interdisciplinary teams. Working with Sean McKitrick, assistant provost and director of the Office of Institutional Research and Assessment, he hopes to determine what factors help interdisciplinary students grow into independent scholars and better match students to faculty mentors.
“It’s not really your knowledge until you have used it. Undergraduates, even ones with average performance, can become very fired up by research experiences.”

— Biochemist Anna Tan-Wilson

at Binghamton, says she’s excited to see more Binghamton undergraduates get that sort of intensive experience. There’s value in introducing students to the patterns of life in a research setting, including irregular hours and the reality that not every question has a black-and-white answer, she says.

“It’s not really your knowledge until you have used it,” she says. “Undergraduates, even ones with average performance, can become very fired up by research experiences. Even though they’re spending more time in the lab, their grades can go up. They have a goal and they shoot for that.”

Lisa Greenpope says her undergraduate research experience changed her career plans. Greenpope, who graduated from Binghamton in 2010 with a degree in nursing, chose to pursue a master’s in public health at SUNY Albany.

One summer at Binghamton, she worked in a psychology lab. She set up an experiment, collected data, analyzed the results and delivered a poster presentation. Later, she had an opportunity to work at the National Institutes of Health for a summer. “You can see what it’s like to be working in research,” she says. “You can see what it’s like before choosing a field.”

She decided she liked it even more than working in a clinical setting, and turned down a hospital job so she could go to graduate school.

Hao’s not sure yet whether she’ll go to medical school or pursue a research career. “At times, research can be frustrating because you don’t get the results you expect,” she says. “But it also teaches you perseverance and patience and trouble shooting.”

**Building a common vocabulary**

Tan-Wilson, a biochemist, knows firsthand how important it is to be able to communicate well with researchers from other disciplines. Interdisciplinary
work is at the forefront of several fields now, and will likely be a staple of them in the future, she says. Students need to know what questions to ask, have an idea of what the possibilities may be and also understand a variety of methods.

“It’s like speaking another language,” she says. “It makes sense to start young.”

Since she received news of the HHMI grant, Tan-Wilson has been acting as a matchmaker between faculty members in the life sciences and those in engineering, mathematics and other fields. The goal is to boost the number of multidisciplinary projects and ensure that she’ll be able to place 30 undergraduate researchers in summer fellowships.

Too often, students don’t get opportunities like that. Nor do they receive training that would help them have conversations across the disciplines, Jones says. Even many PhD-level researchers lack the common vocabulary necessary to build bridges to other fields.

“Really exciting discoveries right now are at the edges and interfaces of disciplines,” Jones says. “This is fertile ground for new discoveries that are going to be valuable for students going forward, as well as for society as a whole.”

— Rachel Coker
Ancient minerals may reveal clues about history of climate change

Though he’s no fortuneteller, doctoral student Elliot Jagniecki can predict the future of climate change by analyzing rock samples. Jagniecki studies two related minerals. Nahcolite, which is essentially baking soda, is found in deposits from ancient salty lakes in the western United States and eastern China. Trona, nahcolite’s chalky chemical cousin, is often found nearby. Nahcolite and trona form under such similar conditions that, in nature, only one or the other forms at a given time and place. Which one forms is determined by carbon dioxide (CO2) levels in the Earth’s atmosphere: Trona forms when CO2 is low; nahcolite when CO2 is high. The catch? Trona can also form under high CO2 if temperatures are very high.

Comparing these minerals’ abundance provides a way to determine past levels of CO2 and link them to hotter or colder climates. “It’s a more clear-cut approach than has been used in the past,” Jagniecki says. “The minerals can give you a better connection between CO2 and temperature because they’re either going to form or not, depending on conditions.”

Jagniecki grows nahcolite and trona in the lab under varying CO2 concentrations to clarify the conditions under which each mineral forms. Tim Lowenstein, professor of geology at Binghamton, works with Jagniecki. “Elliot is applying modern geochemical techniques to an old problem,” he says. “It’s a really good experimental approach.”

Understanding how greenhouse gases affect the global climate may allow scientists to predict what to expect as the Earth’s temperature climbs. “We’re making this environment that has a lot of CO2, and it’s probably going to get warmer,” Jagniecki says. “Now we can start asking, ‘What else is going to happen? What do we really need to start focusing on?’”

— Sarah Fecht
Anjali Chauhan’s research may one day have a place in your pocket. She works on simulations of advanced cooling solutions for high-powered microelectronic devices. If that sounds a tad abstract, consider that everything from your cell phone to your car relies on microprocessors, which generate tremendous heat as they work. Better cooling will ultimately mean better performance and even smaller devices.

Chauhan, a doctoral student in mechanical engineering, studied metallurgy as an undergraduate in India. An interest in electronics packaging research brought her to Binghamton. “Most people don’t know how electronics work,” she says. “I’ve become excited by learning more and more about them. It’s amazing to see what goes inside a chip.”

Chauhan studies with Kanad Ghose, professor of computer science, and Bahgat Sammakia, director of Binghamton’s Small Scale Systems Integration and Packaging Center and interim vice president for research. They have an interdisciplinary group focused on different aspects of chip-cooling research.

Chauhan is studying new three-dimensional chip designs that can operate at high speeds for applications that require the highest performance.

“Such designs are difficult to manage from a thermal perspective since they dissipate very high power and are also packaged compactly,” Sammakia says. “In some cases the only way to cool them is to use liquid cooling in tiny micro channels that circulate cold water right in the middle of the devices.”

Chauhan, who has already earned a master’s degree from Binghamton and published a couple of papers, expects to go into industry after completing her degree. She says she likes the idea that she’s contributing at the “ground level” to ideas that may reach the marketplace in the next 10 years.

“It feels good to be doing something new, something that no one else is doing,” she says. “It’s creative. The electronics industry is looking for cooling solutions for high-powered electronic devices, and that’s where my research can play a distinctive role.”

— Rachel Coker
Book urges new approach to science education

Lay a wooden ruler on a table with one end hanging off, and cover the other end with two sheets of newspaper. Now smack the hanging end of the ruler. What happened? If you did it correctly, the stick broke apart without so much as lifting or tearing the newspaper. How is that possible?

In his book *Brain-Powered Science: Teaching and Learning with Discrepant Events*, Thomas O’Brien, director of Binghamton’s Center for Science, Mathematics and Technology Education, uses this counterintuitive event to illustrate that air has weight, even if we don’t normally feel it.

*Brain-Powered Science* (National Science Teachers Association, 2010) features demonstrations that science teachers can use to grab students’ attention.

Janice Crowley, a high school chemistry teacher and former instructor at Wichita State University, is enthusiastic about the book. “What makes it exceptional in my opinion,” she says, “is that it breaks away from the typical text and uses lab activities that get our kids hooked on science.”

The book’s simple demonstrations can also save time. “Most teachers spend a lot of time reviewing at the end of the year,” O’Brien says. “And why do they need to review? Because the students forgot so much of the content. They forgot it because they never learned it well in the first place.”

Author charts course for schizophrenia research

About 1 in 10 people have the potential to develop schizophrenia, but only 1 in 100 actually end up with this devastating illness. The challenge is in knowing why some do and some don’t.

Mark F. Lenzenweger, a distinguished professor of clinical science, neuroscience and cognitive psychology at Binghamton University, says he has a good response to this troubling question and ideas about how to find those answers. In his latest book, *Schizotypy and Schizophrenia: The View from Experimental Psychopathology* (Guilford Press, 2010), Lenzenweger explores lessons he has learned in the psychological science laboratory while probing the broader questions of how to think about and conduct psychopathology research.

“The liability for schizophrenia is relatively prevalent and common in our population,” Lenzenweger says. “Therefore, understanding why someone goes on to develop the illness is a high-priority research question. I firmly believe that those who harbor this liability but do not develop the full-blown illness of schizophrenia may hold the key to this puzzle.”

Lenzenweger expects that advancing understanding of the causes and development of schizophrenia will be difficult. “There will be no simple solution or discovery that remedies the entire problem,” he says. “But I hope that my book will chart the course for the field as it stands and show the way forward for the generation to come.”
Research aims to improve speech recognition software

Anyone who has used an automated airline reservation system has experienced the promise — and the frustration — inherent in today’s automatic speech recognition technology. When it works, the computer “understands” that you want to book a flight to Austin rather than Boston, for example.

Research conducted by Binghamton’s Stephen Zahorian with support from the Air Force aims to improve the accuracy of such programs.

Zahorian, a professor of electrical and computer engineering, is developing a database that will be available for spoken-language processing research. His team will gather recordings of several hundred speakers each in English, Spanish and Mandarin Chinese.

“The challenge,” he says, “is to get speech recognition working better in real-life situations.” That’s why the samples in his database will come from sources such as YouTube.

Zahorian’s team will annotate each sample, creating a more detailed version of closed captioning, including time stamps and descriptions of background sounds. Once the human listener has finished with the transcription, automatic speech recognition algorithms will be used to align the recording with the captions. Next, software will verify and correct errors in the time alignment.

“Speech-recognition algorithms begin by mimicking what your ear does,” Zahorian says. “But we want the algorithms to extract just the most useful characteristics of the speech, not all of the possible data. That’s because more detail can actually hurt performance, past a certain point.”

When researchers test an algorithm, they rely on a set of databases held by the Linguistic Data Consortium. The database Zahorian develops will join these others, offering researchers a new way to test their theories with samples of real-life speech.

Journal focuses on children’s folklore

It’s a common scene at a sleepover: Four children crouch around a fifth, who is lying on the floor with arms across his chest. The light is dim; the children are intent. In unison, they chant “Light as a feather, stiff as a board. Light as a feather, stiff as a board,” and, as if by magic, they lift their friend using nothing but two fingers on each hand!

Children’s folklorist Libby Tucker studies games, stories, songs, jokes and other aspects of children’s culture. Many of these, like the levitation game, have been passed from child to child for centuries.

Tucker, a professor of English at Binghamton University, has served as editor of the Children’s Folklore Review since 2008. Published by the American Folklore Society with support of the dean of Binghamton’s Harpur College of Arts and Sciences, the publication is the only peer-reviewed journal that focuses on children’s folklore.

“The articles have varying styles and theoretical orientations,” she says, “but what they all share is a strong interest in children’s culture and a wish to understand it.” The journal highlights the work of anthropologists, historians, sociologists and literary scholars.

“We need to understand how kids have fun, how they learn from each other, how they grow,” Tucker says. “These are important aspects of creativity, self-discovery and, eventually, self-sufficiency.”
The Small Scale Systems Integration and Packaging Center (S³IP), a New York State Center of Excellence at Binghamton University, reports annually on its economic impact on New York state. Figures are provided by industry partners to the New York State Foundation for Science, Technology and Innovation (NYSTAR) and Empire State Development (ESD).

S³IP partners with government, academia and industry to advance the frontiers of microelectronics research and development. The center will move into a $30 million, 114,000-square-foot facility at Binghamton’s Innovative Technologies Complex in 2013. Scan this QR code or visit go.binghamton.edu/architect to see a rendering of S³IP's future home, now under construction.
Binghamton’s new Engineering and Science Building will open this year. The $66 million facility, which includes this rotunda, boasts 120,000 square feet to be used for academic, research and administrative purposes.

Also this year: Binghamton Research will begin publishing twice annually. Look for another edition this fall.