What if varying the schedule of chemotherapy could have anti-tumor effects and boost the immune system? What if we looked for a link between Massachusetts health care reform and the reduction of racial and ethnic disparities in the use of medical care? What if there were an app to help us count calories? What if we could prove that the falling divorce rate is due to the growing number of “career women” in the U.S. labor force? What if we found out what makes birds sing? What if we were able to fight breast cancer by using gene therapy and designer T-cells? What if we started the first broad-based systematic study of the risks and safety of vaccines and medicines taken by pregnant women? What if we were able to control blood sugar levels in diabetics by developing an artificial pancreas? What if we converted Macedonian folktales into operas? What if we could learn more about society and ourselves by studying the history of cafés in Japan? What if we could help the city protect the environment by measuring its CO₂ and gauging “Boston’s Urban Metabolism”? What if we re-created Captain John Ross’s expedition to find the Northwest Passage? What if a major research university gave its faculty the freedom to dream, explore, succeed, and sometimes even fail?
2010

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Research at Boston University

What if

What if

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What if
Welcome to Research at Boston University 2010. In this issue, you will meet more than 45 faculty members whose work exemplifies the enterprising, interdisciplinary, and international spirit of research at BU. Their diverse projects—on subjects ranging from cancer to the role of calligraphy in 19th-century Chinese political life, epilepsy to the evolution of the Milky Way—offer a glimpse into the vibrant scientific, scholarly, and creative endeavors now engaging our students at the undergraduate and graduate levels, as well as our faculty and research staff across BU’s 17 schools and colleges on two campuses.

The stories in this magazine highlight Boston University’s commitment to supporting scholarly activities and research in all their varied forms, including both individual efforts in particular departments and collaborative projects that stretch across two or more academic disciplines, or even across institutional, national, and international boundaries. Moreover, these efforts cover a broad range of topics in basic and applied sciences, STEM fields, arts, humanities, and social sciences.

What is more difficult to capture within the magazine-story format is the intrinsically dynamic and unpredictable nature of the research process—from the initial idea to the “eureka” moment of discovery to the published results. It is the roller coaster of fits and starts, together with the excitement of uncovering new truths while venturing into uncharted territories, that gives the research process its indescribable sense of exhilaration. This unpredictable process of discovery can be as informative as the final destination, and can often lead researchers in an entirely new and promising direction of inquiry. At BU we aspire to go beyond providing support for and facilitating the end point of research: our goal is to empower our faculty, research staff, and students to dream and take risks at every point of the research process defying the path to discovery, a goal symbolized by the “what if” theme of this year’s Research cover.

All aspects featured in this year’s magazine—the focus on integrating scholarly activities and research with our educational mission; the entrepreneurial, collaborative spirit of our faculty, staff, and students in developing programs within the University and in building partnerships outside of the institution; and a global engagement with industry, government, and academia focused on translating basic ideas into applications for societal good—are a reflection of Boston University’s vitality and its ascending trajectory into the top tier of major research universities.

To learn more, visit www.bu.edu/research.
About half of all men and one third of all women in the United States will get cancer at some point in their lives. The disease kills more than half a million Americans every year, and within two decades it will surpass heart disease as the nation’s leading cause of death, according to the American Cancer Society. Boston University researchers are attacking this disease on many fronts—spreading the word on risk and prevention, finding innovative ways to increase the effectiveness of established therapies, training the next generation of cancer fighters, uncovering new drug targets, and enlisting the body’s immune system as an anti-cancer warrior.
What is needed now, says Wang, is an understanding of what genetic risk information will motivate people to choose healthy behaviors and what risk information, if any, might actually impede those healthier lifestyle choices. For example, a “high” genetic risk could scare some people into fatalism, while a “low” genetic risk might give others a false sense of security. She says that the “rush to market” of direct-to-consumer genetic tests ignores those basic questions about genetic risk interpretation and behavior that public health researchers are only starting to answer.

“There are a lot of people saying, ‘I’m smart enough to make decisions; give me the information and get the doctors out of the way,’” says Wang. “But they’re making some serious decisions about their health after seeing only part of the picture.”

Cracking the Cancer Code

Is same disease risk riskier than the rest?

Last May, under pressure from the Food and Drug Administration, Walgreens postponed its plans to sell a test that claimed to show genetic risk for cancer and other diseases. Those types of direct-to-consumer genetic tests worry many public health experts, including Catharine Wang, an assistant professor of community health sciences in the School of Public Health. Wang studies how the public interprets and acts on disease risk—whether knowing something about their genetic predispositions will make them more or less likely to make the health behavior choices that reduce disease risk.

In a study published last year in the journal Cancer Causes and Control, Wang found that the vast majority of more than 400 healthy women who were surveyed ranked heredity as the most important causal factor for both breast and colon cancer—84 and 78 percent, respectively, despite the fact that prior studies have estimated that 36 percent of breast cancers and 45 percent of colon cancers are preventable through a combination of healthy eating, exercise, and weight management.

Suzanne Miller, director of the psychosocial and behavioral medicine program at the Fox Chase Cancer Center in Philadelphia and one of Wang’s research collaborators, says, “As we learn more and more about cancer and its treatment at the genetic level, Catharine’s work shows us that we need to intervene at the level of the whole person, not just at the level of their molecular genetics.”

“Every day, there are more findings of genetic associations from minor DNA variants, and industry jumps into fatalism, while a ‘low’ genetic risk might give others a false sense of security. She says that the ‘rush to market’ of direct-to-consumer genetic tests ignores those basic questions about genetic risk interpretation and behavior that public health researchers are only starting to answer.

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Tracking a Killer

Muhammad Zaman’s fight against brain cancer in kids began with a wrong turn. A few years ago, while searching for a colleague’s lab in the University of Texas’s M.D. Anderson Cancer Center, he got lost and ended up in the pediatric ward.

“My daughter had recently been born, and it pained me to see how many of those kids were probably not going to make it,” says Zaman, an assistant professor of biomedical engineering. Zaman had been seeking a clinical application for his research into the physical, chemical, and biological details of cancer cell migration in the body, what’s known as metastasis. Partnering with researchers at the Massachusetts Institute of Technology and the University of Manchester (UK), he decided to focus on pediatric brain cancer, which gets much less research attention than the most common childhood cancer, leukemia. Zaman’s goal is to use his intricate computational and experimental models of pediatric brain cancer cell migration to pinpoint the key biochemical mechanisms that support metastasis.

Zaman’s research has been made possible by a $1.5 million grant from the National Institutes of Health. Zaman and his research partners use a laser-scan microscope to track cultured cancer cells moving through three-dimensional ‘‘matrices’’ of a common protein such as collagen, or a synthetic soft-tissue. They then assemble the time-lapse microscopic images into detailed computer simulations of real-time cell movement.

“We’re trying to find out what enables or hinders cancer cell migration and invasion, so that people will be able to develop therapies that specifically target those mechanisms,” says Dewi Harjanto, a biomedical engineer and doctoral student who works with Zaman.

(continued on next page)
“It’s not about looking at a single gene in isolation. It’s about how genes and the environment interact, how one protein influences another, and how those interact with the cellular systems and with the structures inside the body.”

While most studies look at individual cancer cell migration, Harjanto is investigating how clusters of cancer cells, mini-tumors, sometimes migrate away from the main tumor. She is focusing on how the density of the collagen matrix affects this movement.

Another collaborator, Roger Kamm, an MIT professor of mechanical and biological engineering, is using microfluidic systems to see how cancer cell movement is affected by varying the fluid flow through the matrix. Other experiments alter the pH of the matrix or the DNA of the cancer cell. Eventually, says Zaman, they will introduce different drugs to those systems, “to see what happens to those cells and their ability to move, divide, and form tumors.”

No matter what variable is being altered, “this is a systems question,” Zaman stresses. “It is not about looking at a single gene in isolation,” he says. Instead, it’s about how multiple proteins inside the cell interact with the environment of the tumor, how one protein influences another, and how those interact with the cellular systems and with the structures inside the body.

Fundied by a 2009 $5.9 million Impact Award from the Department of Defense’s Breast Cancer Research Program, Junghans is genetically modifying T-cells to recognize cancer cells and kill them.

“These are living drugs, made from the patient’s own cells,” says Junghans, who is currently overseeing Phase I clinical trials of the designer T-cells—which he affectionately calls “nano-to-toots”—to fight metastatic breast cancer.

“Using the immune system is the fourth arm of cancer therapy with the hope of succeeding even when we have a patient whose cancer is growing despite chemotherapy, radiation, and surgery,” he says.

Cancer patients travel to Roger Williams from around the country to receive treatment in the clinical trials. At the Roger Williams Cancer Center, in a building adjacent to Junghans’s office, T-cells are harvested from the patients’ blood. Downstairs, in a classroom, researchers use a genetically engineered virus that cannot reproduce to carry a bit of new genetic code into the T-cell chromosomes, programming a new receptor to recognize a signature molecule, known as carcinoembryonic antigen, or CEA for short, that is present in half of all breast cancers.

These genetically modified T-cells are cultured until about 400 billion are grown per patient. Then, they’re infused through an IV back into the patients in varying amounts, after which patients are observed over several weeks as outpatients. The current trials are using a ‘second generation’ of designer T-cells. The first generation was tested about a decade ago. They were effective in killing cancer cells, but didn’t keep at it for long, because not only do T-cells need to be educated about what to attack, they also need to be activated by signals from other cells in the immune system, called dendritic cells. Junghans’s second-generation T-cells have a special signaling chain—engineered to activate when the T-cells encounter a tumor—built in along with the CEA receptor. This signaling chain should allow the T-cells “to proliferate, and survive, and maintain their active status,” he explains.

Because CEA is also expressed by some healthy tissues, the Phase I trials are using “escalating exposures” to the new T-cells in order to identify what Junghans calls “a window of therapeutic opportunity between anti-tumor effectiveness and patient toxicity.”

The Phase I trials will continue for another year, and Junghans’s research team is continuing to make small modifications to the designer T-cells. Phase II and III clinical trials will follow, with the goal, Junghans says, of curing breast cancer that expresses CEA within the next five years.

Enhanced Chemotherapy

When it comes to killing cancer, sometimes timing is everything. In studies backed by the National Institutes of Health, David Waxman—who is a professor of biology and a professor of medicine, as well as associate director for basic research at the BU Cancer Center—has found that simply altering the scheduling of chemotherapy may enlist the body’s immune system as an additional cancer fighter.

Waxman’s research builds on the idea of “metronomic chemotherapy,” conceived about a decade ago by the late Judah Folkman, the famous cancer researcher of Children’s Hospital Boston. Instead of giving patients several, widely spaced rounds of a “maximum tolerated dose” of chemotherapy, which poisons both cancerous and healthy tissue, Folkman proposed using lower chemotherapy doses more frequently. In his studies, metronomic chemotherapy not only killed cancer directly through toxicity, it also shrank tumors. The theory on the latter effect was that more frequent drug doses did sustained damage to the blood vessels that supply tumors with oxygen and nutrients, a process known as “anti-angiogenesis.”

In Waxman’s own metronomic chemotherapy studies, which involved administering an older drug called cyclophosphamide every six days to mice with induced tumors, he observed tumor regression to an extent “that we had never seen using maximum tolerated doses.” Some tumors even disappeared completely.

But, says Waxman, “we reasoned that there had to be another mechanism,” beyond destroying blood vessels. They based this suspicion partly on the relatively weak tumor-shrinking performance of a new class of anti-cancer drugs that specifically work as anti-angiogenesis therapies, targeting the tumor-feeding blood vessels.

And they were right. When Waxman and his team compared some of the new, anti-angiogenesis drugs directly with metronomic chemotherapy, the anti-angiogenesis drugs were better at knocking out blood vessels, but not nearly as effective in actually shrinking the tumors. In addition, says Waxman, studies carried out by Joshua Doloff, a doctoral student in Waxman’s lab who graduated this May, revealed “lots of immune cells populating the tumors” of the mice receiving metronomic chemotherapy.

That raised the astounding possibility that an older chemotherapy drug not only out-performs a new drug specifically designed to starve tumors of their blood supply, but that this older drug was recruiting a cancer fighter that researchers have been trying to harness for years—the body’s innate immune system.

Unlike the adaptive immune system, which attacks only specific pathogens it identifies as foreign, the innate immune system is a more general defense against infection. Waxman and his collaborators are now trying to determine why metronomic chemotherapy might trigger this response. One hypothesis favored by Doloff is that the repeated damage to cells by metronomic chemotherapy triggers a sustained inflammation response. “In that case,” says Doloff, “the immune system is using basically to clean up the mess.”

The mystery is complicated by the fact that the treatment is remarkably effective against some tumor types but relatively ineffective in shrinking others, including some types of colon, lung, and prostate tumors. “We need to understand more about the mechanism to know whether there’s a way to stimulate this process in humans,” says Waxman.
Cancer is the second leading cause of death in this country, and rising. And about 60 percent of cancer patients will be treated with radiation," says Hirsch. "We need to make sure we’re as prepared as we can be for that."

Being prepared includes understanding the emotional side of patient care, says Hirsch, whose office is decorated with gifts from former patients—a doll from Trinidad, a decorative plate adorned with a Jamaican flag, a wood figurine carved by a Haitian patient. It also means learning about the cutting-edge radiation equipment that sits behind thick, shielded doors down the hallway from Hirsch’s office, such as the “CyberKnife,” installed in 2008, which uses a large, robotic arm to deliver a high dose of radiation from multiple angles, and has image-guided tracking software and a camera that synch the radiation beam to a patient’s breathing cycle for increased accuracy.

Finally, it means exposure to research. Hirsch invites students to collaborate with her in ongoing studies, on topics such as radiation therapy after robot-assisted prostate cancer surgery, and the effects of embedding radiation-emitting radioisotopes in the cement used to reinforce vertebrae and alleviate the pain of malignant compression fractures that result from cancer spreading to the spinal column.

Hirsch also involves students in measuring the effectiveness of the oncology education initiative and in finding ways to improve and expand it, with the ultimate aim, she says, of creating a model for oncology education at other medical schools. One of Hirsch’s advisees, Nick DeNunzio, who is pursuing a joint MD/PhD in physiology and bio-physics, is the lead author on a paper recently accepted by the Journal of the American College of Radiology. The study has caught the attention of policymakers, researchers, and others across the country who are interested in how previously uninsured and underinsured individuals may be benefiting from health care legislation. In particular, Hanachate and Kressin are investigating whether minority populations who did not have access to affordable health insurance before 2006 have started to seek medical attention for referral-sensitive procedures. Hanachate defines these as “inpatient surgical procedures performed at the behest of a health care provider, with the intent to cure, repair, or alleviate the symptoms of a disease, trauma, or condition.”

Hanachate and Kressin are also interested in examining the impact of health care reform on the use of emergency admissions, and in particular, “the changes to inpatient surgical procedures performed between 2004 and 2008—two years before and two years after the health care legislation passed. They used inpatient discharge data on 2,654,554 white patients, 193,841 African American patients, and 172,852 Hispanic patients. The result was striking: “The data showed a marked increase in the use of these procedures across the board, but especially among the minority groups. African American patients, for instance, had a 25 percent increase in heart surgeries after the passage of health care reform. For knee replacement surgeries, there was a 17 percent increase among African Americans, and a 9 percent increase among Hispanics. “We have shown that health care reform has positively impacted minority patients in Massachusetts,” says Hanachate. 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"This was a very important policy change that came into the ER because of complications of asthma or diabetes, we say. In a sense, it is a false sense of failure for poor care.”

There are several problems with this strategy. Emergency room visits are expensive, for one thing, and patients who must afford health insurance can rarely afford to pay thousands of dollars for emergency care. “There is a human cost, too, for the lack of health insurance that goes far beyond the price of a trip to the ER. One response from the patient would be just to delay, and people can delay to such an extent things like knee replacements,” says Hanachate. “This shows that it costs a lot more people to make choices by cutting down on their quality of life and by ‘sick waiting.’ In many cases, the decision to postponed can be life-threatening.

“We have shown that health care reform has positively impacted minority patients in Massachusetts,” says Hanachate. Yet another step in their research will involve taking a closer look at what hospitals are doing to reduce the rate of readmissions. “If people have better access to outpatient care when they come home from the hos- pital, they are less likely to be readmitted than when they come home from needing to be quickly readmitted for something that didn’t get resolved once they were in the hospital.” According to the Centers for Medicare and Medicaid, 20 percent of people who are hospitalized return to a hospital within a month, which could mean that hospitals need to do a better job of explaining patients when and how they need to follow up with their primary care physician for treatment and follow up.

Last year Hanachate and Kressin were selected to share their early findings in a plenary talk at the Society of General Internal Medicine’s annual meeting, reflecting the wide appeal and interest of their work. “The national health reform law that Massachusetts adopted in 2006 has been so significant in many respects, to the Massachusetts reform law,” says Hanachate. “The entire nation is going to be watching how Massachusetts turns out, and any effects that we see here are going to directly get the attention in Washington, DC.”

WEB EXTRA
See more at www.bu.edu/research/magazine

Research
Snapshot
Massachusetts: Health Care Reform’s Guinea Pig?

by Katherine Calver Hawkins

“Cancer is the second leading cause of death in this country, and rising. And about 60 percent of cancer patients will be treated with radiation. We need to make sure we’re as prepared as we can be for that.”

“Is it okay for oncologists to hug their patients?”

“Knowing the Enemy”

Behind the 14 million new cancer cases in America every year are even more stories—about lives before and after the diagnosis and about the ups and downs of treatment. Last April, second-year Boston University School of Medicine students heard one of these stories from a 67-year-old woman who recently completed surgery and radiation for breast cancer.

The students listened, and then they asked questions ranging from, “How did you react to the diagnosis?” to “Is it okay for oncologists to hug their patients?”

“The class is part of the Oncology Education Initiative, spearheaded by Ariel Hirsch, an assistant professor of radiology, and Karen Antman, dean of the School of Medicine. ‘No matter what field they choose, every medical student is going to encounter cancer at some point in their careers,’ says Hirsch, whose education initiative began in 2007 when she arranged to give a single lecture on radiation oncology to all fourth-year medical students during the core radiology rotation.

In 2009, her efforts were helped by an education grant from the Radiological Society of North America, and she became the leader of a new two-week oncology block in the medical school’s second-year curriculum. Previously, few medical students learned about cancer in a piecemeal fashion—covering lung cancer in the pulmonary block and colon cancer when learning about the gastrointestinal system, for instance. In addition, the fourth-year rotation in radiology was expanded to third-year students, giving more students the chance to shadow Hirsch as she treats patients and to collaborate in her research.

Such comprehensive cancer education, particularly the instruction in radiation oncology, is rare in medical schools, says Hirsch. In fact, a 2009 literature review found only seven journal articles in ten years that mentioned teaching radiation oncology to medical students, and two of them were about the efforts at Boston University.
By the end of the 20th century—a century that saw women secure the right to vote, begin to follow educational and professional pathways long blocked to them, and gain control over their fertility—it was easy to think that the “Woman Question” raised by Victorian-era suffragists had at last been resolved. And yet the role of women in global society continues to change and to be contested. Women’s own perceptions of their status—and consequently, their advocacy for their own needs and the needs of their families—ripple out to affect the health and well-being of entire communities. New research from across BU’s two campuses is shedding light on the evolving roles, rights, and responsibilities of women historically and in the present day.
That’s what Davidson Hamer has done for the past 15 years, and that’s what the Bill and Melinda Gates Foundation is doing by funding his latest project, one that looks at the effects on infant survival of a beautifully simple postnatal intervention to improve umbilical cord care in Zambia’s Southern Province.

Hamer, a professor of international health and medicine, has a five-year, $8.4 million grant to study the effectiveness of getting mothers to apply a 4 percent solution of chlorhexidine to her baby’s umbilical cord, in the days immediately following birth. “Chlorhexidine helps to prevent sepsis,” he says. “A severe bacterial infection that probably accounts for between 20 and 40 percent of neonatal deaths, depending on the region,” Hamer says. Sepsis can arise when bacteria get into the bloodstream, either through infection of the umbilical cord stump, treatment of the cord with contaminated substances, or by cutting the cord with an unsterile knife. “The newborn’s immune system has not fully developed,” Hamer says, “and the bacteria can cause it to become very sick, very quickly.” Hamer will be assisted by Katherine Semrau, an assistant professor of international health and epidemiologist who has extensive experience living and conducting research in Zambia.

Very few large-scale neonatal survival interventions have been tried in Africa, due in part to the lack of population density in many regions. Hamer has worked in Zambia before, so navigating through the country’s topographical challenges and complex system of health ministry officials, local chieftains, community health workers, and traditional birth attendants (TBAs)—all of whom he needs to involve—is familiar.

Hamer and colleagues at the Center for Global Health & Development conducted a study in the north-central Lufwanyama District. Hamer’s project trained TBAs—minimally educated women who act as midwives—to treat the most preventable causes of newborn death: sepsis, neonatal asphyxia (respiratory failure), and postpartum hypothermia. The results were so encouraging—with approximately 40 percent fewer neonatal deaths in newborns tended by the trained TBAs—that Save the Children has helped convert the study site into a five-year, community-based program to improve maternal, neonatal, and child health and to serve as a model training center for other organizations interested in carrying out similar work in poor rural populations in Africa.

His current project, Hamer hopes, will have similar long-range impact, especially when assessed alongside another Gates-funded study, also looking at chlorhexidine and umbilical cord care, in Tanzania. “If these two large, well-designed studies show similar impact—a 10, 20, 30 percent reduction in mortality—that, along with recent findings from South Asia, will be enough evidence for the World Health Organization to change global policy,” he says.

Safety in Numbers

When the thalidomide tragedy of the 1960s revolutionized the drug regulatory system in the United States and elsewhere, the only group that did not benefit from the new safety net was the same group devastated by thalidomide’s destructive effects: pregnant women and their babies.

The drug, touted as safe and effective, was given to treat morning sickness in pregnancy; after its dire consequences became apparent, in children born with shortened limbs and other malformations, thalidomide was quickly banned, and stricter testing protocols for medications and pesticides were later mandated. “But when a drug comes onto the market today, it has to go through the same regulatory process,” says Allen Mitchell, professor of epidemiology and pediatrics and director of the Sloane Epidemiology Center. There are good reasons for that, he says—ethical clinical trials would be impossible to construct—“but it means that the only time you can study the safety and risks of a drug in pregnancy is when it’s in the marketplace.”

Since 1996, Mitchell and his colleagues at Sloane have done precisely that, collecting data on prenatal drug exposures in more than 40,000 women through Mitchell’s pioneering Birth Defects Study (BDS). Now the study is being expanded with a significant federal investment and an infrastructure that promises an unprecedentedly comprehensive view of risk and safety. The goal is to provide critical risk and safety data for women and their doctors, with the initial focus on seasonal flu vaccine, antiviral medications used to prevent or treat flu, and commonly prescribed asthma medications. As the study expands, it will also gather data on the wide range of medications used by pregnant women, including over-the-counter headache cures and herbal remedies.

Thus, the study will identify as early as possible which medications are relatively safe and which might pose a risk to the fetus.

BDS is one of two data collection components collaborating with the American Academy of Allergy, Asthma, and Immunology on what is being called the first broad-based, systematic study of the risks of vaccines and medications in pregnancy. The new study—Vaccines and Medication in (continued on next page)
In the history of feminism and the women’s rights movement, one group of key actors in late-19th century Britain has been long overlooked. Mitchell’s group identifies women in four regions of society at large. Some of those women who really saw women’s rights as a social concern that had a lot to say about the health of their own state. They were broadly interested in what it would mean to live in what they called a “perfect state.” This was a moment of revolution, and so we see a lot of utopian ideas circulating. Those ideas, and the passions they engendered, were ecletic. Most of the men shared an opposition to slavery and to the so-called “Test and Corporation Acts,” which barred members of religious dissenters from political office. Many were also “campaigning for their own political representation,” says Chernock, since less than one-fifth of men in Britain could vote at the time. Others championed things like vegetarianism and penal reform, or even argued “that the alphabet should be made more democratic by introducing phonetic spelling.” There is a real range of figures there,” Chernock says.

Their motivations differed widely, too. Some were clearly driven by personal histories, and by a sense of their own status as second-class citizens. Others “embraced women’s rights primarily to be consistent and to avoid hypocrisy,” Chernock says, “especially those who subscribed to the theory of natural rights.”

(continued on page 18)

Building a Better Vaccine

Pregnancy Surveillance System (VAMPS)—was launched in September 2009 with the initial mandate to look at H1N1 vaccine, seasonal flu vaccine, two antiviral flu medications, and asthma drugs. It will combine the strengths of complementarity—but separately implemented—epidemiological techniques, a case-control surveillance method developed by the Slone Center, and pregnancy registries (cohort studies) conducted by a network of specialists who collaborate through the Organization of Teratology Information Specialists. MITCHELL'S GROUP IDENTIFIES WOMEN IN FOUR REGIONS OF

Research

Women & Family

By Cassandra Nelson

The Food and Drug Administration has not only set safety standards, but it has maintained a rigorous scientific review process. “If it’s not conserved across the species, it’s not a good vaccine target,” says Goldstein, “because it leaves nature with a vacuum to fill.” The goal of the common protein strategy is not to allow for that vacuum.”

Goldstein explains: “But the dark cloud is, subset 13 from 91 and what do you get? The others are still out there. The question then becomes, will those other serotypes step in to replace the 13 covered by Prevnar?”

“Prevnar 13 responds to the most prevalent serotypes responsible for invasive pneumococcal disease in North America,” Goldstein explains. “But the dark cloud is, subset 13 from 91 and what do you get? The others are still out there. The question then becomes, will those other serotypes step in to replace the 13 covered by Prevnar?”

The answer appears to be yes. Epidemiological evidence suggests that the highly variable S. pneumoniae is capable of circumventing vaccines, through an increase in infections by non-vaccine serotypes. “But a broadly efficacious 9-valent vaccine is quite unlikely,” says Goldstein. “It’s going to be so complicated to manufacture, and too costly to attempt.” Instead, Goldstein intends to identify and characterize a new category of vaccine target, called a “common surface protein”—that is, an antigenically accessible protein universal to all of the otherwise generally capsular types of S. pneumoniae.

To do so, he is surveying pneumococcal DNA for genes that might code for such common proteins, then determining which of those genes are resistant to mutation, and thus “conserved” throughout the species. “If it’s not conserved across the species, it’s not a good vaccine target,” says Goldstein, “because it leaves nature with a vacuum to fill.” The goal of the common protein strategy is not to allow for that vacuum.”

Goldstein is currently examining what he calls “chromosomal cold spots”—regions of pneumococcal chromosome where variation is tolerated. “Mutations do occur,” says Goldstein, “but those mutations are lethal. Any bacterium with that mutation is naturally purged from the population.” The hope is that one or more of these “cold spots” will prove to encode a highly promising vaccine target.

To test whether a particular cold spot is conserved across the species, Goldstein has sequenced a unique collection of over 1,000 pneumococcal isolates from around the globe and organized them by genetic relationships into a vast phylogenetic tree. The phylogenetic tree serves as a template of S. pneumoniae species evolutionary diversity. The target for the tree, the more accurate a picture of species evolutionary diversity it provides. “This is no one in the world who has the collection I have, and even I can’t be yet not rough enough,” says Goldstein, who recently received hundreds of additional isolates from Africa and South Asia, thanks to collaborations at the Centers for Disease Control and Prevention and in Karachi, Pakistan. “A phylogenetically organized collection, thank the key there.”

The lab before him amounts to a monumental and painstaking process of collation, but Goldstein is eager to take it on, driven by a strong desire to prevent and alleviate suffering caused by S. pneumoniae. “More than two million children die a year of pneumococcal infections,” he says, and those who survive carry life with serious lasting health problems. “Of course children in poor, developing countries suffer the most. But this is a real problem in the United States too, because of serotype replacement.”

Goldstein dreams of recreating Pasteur and Salk. “Any bacterium that can cause pneumonia, even if it’s a host of other invasive infections, resulting in the deaths of between two and three million children each year—is a matter of disquiet. Its outermost surface is covered by a capsule made up of sugars, and can come in any of 91 different capsular variants, or serotypes, depending on the composition of the sugars. The large number of serotypes—and each with a different antigen that must be recognized by the body’s immune system—means for the faster that it is destroyed—has so far thwarted efforts to develop a vaccine effective against all capsular variants of S. pneumoniae,” also called pneumococci.

Professor of Pediatrics Richard Goldstein, who cites Arianne Chernock to the things that, more than a molecular geneticist by training, he is bringing a thorough knowledge of evolutionary mechanisms to bear on the search for a novel pneumococcal vaccine target, with support from the Harvard Foundation and the Slone Center.

The existing vaccines, Prevnar-13, often protect against 13 of the most common and strainable S. pneumoniae serotypes. It is an extraordinary accomplishment, says Goldstein, who cites Arianne Chernock to the things that, more than a molecular geneticist by training, he is bringing a thorough knowledge of evolutionary mechanisms to bear on the search for a novel pneumococcal vaccine target, with support from the Harvard Foundation and the Slone Center.

These reformers were unconventional, nonconformist, and mostly fringe characters, with the exception of Jeremy Bentham, a radical jurist and philosopher best remembered as the founder of utilitarianism. “I don’t claim that they were emblematic of the broader society,” says Chernock, an assistant professor of history. “But these were men who really saw women’s rights as a social concern that had a lot to say about the health of their own state.” They were broadly interested in what it would mean to live in what they called a ‘perfect state.’ This was a moment of revolution, and so we see a lot of utopian ideas circulating.

Those ideas, and the passions they engendered, were ecletic. Most of the men shared an opposition to slavery and to the so-called ‘Test and Corporation Acts,’ which barred members of religious dissenters from political office. Many were also ‘campaigning for their own political representation,’ says Chernock, since less than one-fifth of men in Britain could vote at the time. Others championed things like vegetarianism and penal reform, or even argued ‘that the alphabet should be made more democratic by introducing phonetic spelling.’ There is a real range of figures there,” Chernock says.

Their motivations differed widely, too. Some were clearly driven by personal histories, and by a sense of their own status as second-class citizens. Others ‘embraced women’s rights primarily to be consistent and to avoid hypocrisy.’ Chernock says, ‘especially those who subscribed to the theory of natural rights.’
Freedom of expression. Freedom to travel. Freedom to be an intellectually stimulating, professionally challenging life. That quest for freedom inspired Yan Mazurkevich, professor of music, and his wife, Dana, associate professor of music, to leave the Soviet Union in the mid-1970s and head west. They quickly established themselves as a sought-after recitalist and teacher, and in 1985 founded the School of Music at BU College of Fine Arts. For 25 years, Mazurkevich has helped train a new generation of violinists, many of whom came to Boston initially because they had seen him perform and were eager for the opportunity to study with him.

The School of Music, founded in 1872, holds the distinction of being one of the few music conservatories to be part of a major research university. That, says Mazurkevich, is what makes the experience for students so rich. “They’re given the chance to explore the world in every direction: intellectual, thought, and culture, and politics, and literature. It gives students the incredible opportunity to grow not just as musicians in their own profession, but to be informed and acquainted in so many fields.”

In a recent interview, Mazurkevich said that he is “looking for a personality, for imaginative and lovely expression,” he says, “You can teach technique, but it’s almost impossible to teach musical intuition.” He’ll listen to some music you have to make sense of the notes. And that’s a matter of interpretation. Leaving them to do independent thinking, and present the piece in such a way that it makes sense and you’re happy with it.”

Mazurkevich studied at the Moscow Conservatory with world-renowned violinist David Oistrakh. Upon graduation, he was sent to teach at the Kiev Conservatory. “In his old Soviet Union, it was a rule that when you finished your higher education, you were directed to go wherever they wanted you to go, and you couldn’t refuse. Fortunately, the Ukrainian government asked that three of us from Ukraine be sent there to help with music education.”

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Asia

The world’s largest and most populous continent, Asia may also be the most diverse, with subregions containing vastly different cultures, environments, historical ties, and government systems. For centuries it has captivated the imagination of visitors from around the world. Today, it inspires the research of more than 50 faculty members affiliated with BU’s Center for the Study of Asia.

Together and independently, faculty at BU are exploring the history, economics, values, and art of Asia from a variety of perspectives. With projects focusing on leisure, coffee, and a little-known 19th-century civil servant, it seems that sometimes you have to start small to tackle a subject as large as Asia.

A History of Hobbies

What do modern-day Japanese smokers, Qing imperial hunts, and the art of the Mughal Empire all have in common? That’s what several faculty members in Asian Studies found themselves asking in 2008, shortly after the opening of the BU Center for the Study of Asia, led by William Grimes, an associate professor of international relations and the center’s director until last summer.

In September, Joseph Fewsmith became the new director, and Grimes became chair of the International Relations Department. With more than 50 BU faculty involved, the center’s diversity—in terms of geographic regions of interest and scholarly disciplines, with everything from Turkey to China and economics to art history represented—was overwhelmingly full of possibilities.

“We wanted to know, what kinds of interests do we share? And how can we build on the synergy of all of us being in one place?” says Robert Weller, professor and chair of the Department of Anthropology. “We were looking for a topic that enough people worked on, and found interesting and fun, to pursue.”

The point of convergence turned out to be a surprising one: leisure. The ways that people across Asia have spent their free time over the centuries was a topic that many Asian Studies faculty were already looking at—some without even realizing it. “At first you might think, I’ve got nothing to say about this topic,” says Weller, who is currently looking at the relations between religion and civil life among Chinese communities in Malaysia, China, and Taiwan. “But, key to facilitating collaboration across departments, he says, was encouraging researchers to “rethink what we even mean by leisure.”

“For example, if long ago a member of the Chinese elite painted in the evening, that’s not exactly leisure because we know he had to do it to maintain his political credibility,” says Weller. “So, then, is playing golf today leisure? Leisure turns out to be this loose and sloppy concept. When you talk to other people and think about these things in a new way, it becomes really interesting.”

Weller, together with Catherine Yeh, an associate professor of Chinese, and Eugenio Menegon, an associate professor of Chinese history and world history, both in the College of Arts & Sciences, has launched a three-year project titled “Leisure and Social Change: The Transcultural Flow of Concepts, Institutions and Practices across Asia.” Fifteen faculty members from six departments will meet regularly to present new research and look for areas of collaboration, with visits from invited guest speakers from other academic institutions. Each year, an international workshop is planned on one of three focus areas: Leisure and the State; Leisure and Money; and Leisure, Gender, and the Generation Gap. The first conference will be held at BU, the second in Europe, and the third in Asia.

The goal is to examine leisure from a multidisciplinary perspective, as well as explore how concepts and practices of leisure change—or don’t—across boundaries of geography, time, nationality, culture, and class. Ultimately, project participants hope to collect the scholarship produced over three years in one or two edited books.

(continued on next page)
“Not much has been done on the topic of leisure in Asian Studies,” says Menegon. “So this project will give us not only a comparative perspective, but a space in which to say new things.”

But why study leisure activities—the things that people do in their free time—at all? Aren’t hobbies and pastimes as peripheral as they are pleasurable? Actually, Weller says, the periphery can often serve as a helpful mirror of what’s going on at the center. Leisure—whether it’s playing soccer or practicing calligraphy or watching television—is inevitably more than just leisure: it’s a reflection of everything from politics and economics to culture and human relations. Those connections, as well as the shifting meaning and kinds of leisure over time, make it a fascinating topic.

“We are at the beginning, not the end,” Weller explains. “It never is.”

And the first thing I noticed was that there were white sheets hanging all over the walls,” she says. “Soon after we arrived, we were asked to take off our clothes.” Artists at the café painted White’s body with bright, cobalt blue paint, and then she and the other participants became living pictures, in the café painted White’s body with bright, cobalt blue paint, and then she and the other participants became living pictures, a la Yves Klein, pressing themselves against the white sheets. “This was not the Japan I expected,” she says. “It never is.”

Since that first trip to Japan, White, a professor in the Anthropology Department, has become a leading expert on Japanese culture, publishing multiple books on the country’s education system and popular culture. And that surprising episode at the coffeehouse has always stayed with her, inspiring her forthcoming book with the University of California Press on the role of the urban coffeehouse in Japanese society.

To research her book, White became a regular at 14 cafés in Tokyo, Kyoto, Osaka, and Kobe over four years, and spent hours upon hours interviewing customers as well as coffee masters (the people we know as baristas). She enrolled in a coffeehouse management course, so she could learn more about the logistics that went into running these prolific public institutions. There are often multiple coffeehouses on a single city block in Japan. She also spent time with Japanese coffee roasters and importers and read primary documents from the 1800s when coffee was first brought to Japan, including Dutch journals that recounted Japanese prostitutes trying coffee for the first time.

What White discovered is that coffee, not green tea, is the foremost social beverage in Japan. There have been coffeehouses in Japan since the 1880s, and the country is the third-largest consumer of coffee, after the United States and Germany. The first coffeehouse chain in the world, Paulista, opened in Tokyo in 1908. Japan is also the frequent testing ground for new varieties of coffee before they go on to be marketed throughout the world. “The Japanese have higher coffee standards than anywhere else,” White says. “So if your coffee can pass there, it can pass anywhere.”

Specially coffee in Japan is usually served using a hand pour, rather than brewed by machine. And the Japanese prefer blended coffee. “This preference comes from the sense that a real master can ‘play’ the different notes of different coffees together, making a symphony of flavor,” says White. The whole process, she says, is very handmade, very artisanal—as much a cultural experience as a beverage. Recently, cafés in the United States and Europe have begun to use Japanese techniques to brew and serve coffee. “What interests me is coffee as an industry in Japan, but also this new export of Japanese-style coffee from a place that people really don’t think of as a coffee-drinking country,” she says. And it’s not just this prevailing image of the Japanese as the quintessential tea drinkers that White hopes to change. She also hopes her work will confront other common stereotypes. “We have the idea that the Japanese are all incredibly fastidious people who sleep and work and don’t take time off,” she says. But Japanese cafés show another, more dynamic side of Japanese culture, playing a central role in the country’s arts and cultural scene. And unlike the United States, where you’ll usually find patrons firmly seated on their laptop screens, the coffeehouse in Japan has remained a vibrant social center. That said, Japanese cafés can also serve as a personal time-out space, where an individual can find solitude in public, a rare thing in what White calls a “densely relational society.”

“This was not the Japan I expected. It never is.”

Whether Japanese coffeehouses are used as a place to exchange ideas or a space in which to contemplate alone, White believes cafés provide an illuminating dance at the country as a whole. “There are creative, innovative spaces. Unlike many other institutions in Japanese society where people have their identities given to them, the café is a free, flexible place where there is no operative role that governs you. There are stories in the coffeehouses and cafés of Japan that people wouldn’t expect. There are a lot of surprises,” she says. “And I think these surprises ultimately extend beyond the café environment.”

Surprising Spaces: Café Culture in Japan

Soon after Merry White arrived in Japan in the mid-1960s for the first time, she was invited to a local coffeehouse in Tokyo.

“It was a dark, cavernous, French-style artists’ café. The moment of triumph in Chinese emperor Quianlong’s stag hunting expedition is depicted on a silk scroll by Father Giuseppe Castiglione (1688-1766), left, while MacLaren performs as Meng Yushua in the opera The Pavilion of Royal Monument.

We have the idea that coffee is the national drink of Japan, the country is also home to some of the most discriminating coffee connoisseurs in the world.
These artistic pursuits were not merely idle pastimes; knowledge and mastery of art were expected of government officials. Calligraphy, scholarship, and artistic skill were all a necessary part of the political life," says Bai. "There was an idea that China was ruled by educated men, so self-cultivation became critical." The entrance exam for civil servants contained numerous questions on poetry, art, and literature. If a candidate had poor calligraphy skills, officials would refuse even to look at his test.

But over the course of Wu’s lifetime, this emphasis on artistic self-cultivation dissipated. "China was once ruled by people with a humanities background," explains Bai. "But with modernization and increasing confrontation with the Western world, China was forced to change." Part of that shift was toward a modern education system, with an emphasis on specialty subjects like science, engineering, and the law—subjects previously considered unimportant for the governing class to know. Three years after Wu’s death in 1902, the 1,300-year-old civil examination system was abolished, an official sign of the irreversible decline of the scholar-official class.

Ironically, Wu and many of his contemporaries supported the very modernization and globalization efforts that led to the end of Chinese cultural and political life as they knew it. The resulting, profound implications for the governing class to know. Three years after Wu’s death in 1902, the 1,300-year-old civil examination system was abolished, an official sign of the irreversible decline of the scholar-official class.

Wu Dacheng may be the most interesting Chinese historical figure you’ve never heard of.

The 19th-century government official was a scholar, artist, collector, and patron of the arts, who counted among his friends some of the most important politicians of the day. But for Art History Professor Qianshen Bai, Wu is more than just a colorful member of the Chinese literary—he is also a symbol of its ultimate decline.

Bai has published dozens of articles on Wu and his contemporaries and is currently at work on a book. His research has taken him to places ranging from nearby New Hampshire to distant China, in search of materials—paintings, seals, diaries, and the like—on Wu and his circle. Upcoming trips are planned for Japan and South Korea, where there are many enthusiastic collectors of Wu’s work.

Wu’s life, family, and relationships, as well as his work as both an artist and a civil servant, exemplify some of the major changes happening in China during the 19th century, says Bai. Therein lies the source of the continuing interest in him.

Born in 1835 in Suzhou, then the capital of arts and culture in China, Wu came from a wealthy, well-connected merchant family. In 1868, he passed the civil service examination required of all government officials and went on to become governor of the Guangdong and Hainan provinces. In that time, he also established himself as an important artist and calligrapher and a very prominent collector, compiling a massive assembly of art and antiquities.

Nature Morte, the title of a recent exhibit that included six photogravures by School of Visual Arts Director Lynne Allen, is the French term for still life. But the literal translation is more stark: “dead nature.” For Allen, the two connotations are equally apt. Her photogravures of objects that have lost their original purpose and significance offer a study in obsolescence; both her subjects and her method are remnants of a bygone time.

Several of those images form a link to and reflection on Native American heritage. Allen first saw these images in the 1930s. "They are from the Department of Interior back six generations. But it was only in the last decade that she began exploring this background in her art. ‘I’m the product of assimilation into white society,’ she says. ‘Beginning with my great, great, great, great-grandmother, all the women married white men. I don’t have the reservation life. I grew up an hour outside Philadelphia. I’ve always been very aware and proud of my rich history, but I saw myself as a white person. I didn’t think I should go around telling myself as a Native American. I only started making work about that history after a Navajo friend of mine said, ‘Lynne, come out of the closet.’”

Allen’s art has always dealt with psychological and social issues; the homeless, Alzheimer’s patients, prisoners. “The common denominator in my work is the underdog,” she says. “And I didn’t realize until I was 50 that my passion, my empathy comes from my mother and the women before her.”

Her Nature Morte showed marked the first time Allen created photogravures, using an exciting printmaking technique in which a photo is etched onto a copper plate. “The technique was invented in the 1830s, which is about the time they started teaching Native Americans,” she says. “In 1860, Native Americans were no longer making the claims, but were being made on reservations. So I used a medium from that period when those people were no longer valid, to create images of things that are no longer valid today.”

For instance, she juxtaposed moccasins and shoe forms. “Moccasins are still being made, but Native Americans don’t wear them anymore, except for ceremonies,” she says. “And shoes are no longer made with those forms. I put those pictures next to each other because they represent two sides of me. And they’re objects that no longer carry their utilitarian purpose. They’re artifacts.” A photo of a log cabin with a flamingo in front of it is about progress and change. “We’ve come from the log cabin to people having flamingos in their front yard. But what sort does this that change surfaces or other people’s culture?”

The photogravures challenge people to find their own interpretations. “I tell my students that good art is like a good movie,” says Allen. “When you go to a good movie, you think about it for a week. You want to do it again because you can learn something from it.”

She teaches one class each semester, an artisanal bookmaking class that requires students to produce text as well as images. It is, she says, a course about ideas. “I try to get them to delve inside themselves to find out who they are so that they can make work that is meaningful to them.”

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Allen says that her own work, regardless of the subject, has always been meant “to educate the public about certain issues. Empathy is the power to imagine a world outside your own experience, and although the truth is not always pretty, the hunger for it is.” She is currently making a series of small books, only 2 inches by 2 inches, “reverting the history” of how the west was won. “I want people to understand that the history they learned in school is not the entire history. History is always written by the victor. I want my work to be a book of voices. I also want people to delve deeper into the ‘why’ of what I’m doing. I’ve never done anything for fame. I’ve just done it because I had to satisfy myself.”

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A bold strategic plan in 2007 called for the creation of 100 new faculty positions over the next decade. Boston University is continuing to move forward with this goal today, even as the global economy has slowed. By recruiting talented junior faculty in a range of fields, we are strengthening and expanding a vibrant, diverse community of committed scholar-teachers.

**Old-World Opera**

**BY VICKY WALTZ**

Ketty Nez was only six months old when her family immigrated to the United States from the Former Yugoslav Republic of Macedonia. Nonetheless, the music she composes is rooted in her homeland’s musical traditions.

“My father is an amateur violinist, and my aunt is a pianist,” Nez says. “When I was a child, they would play duets.” A musical prodigy of sorts, she took up the piano at age three, with her father’s encouragement. As a teenager, she practiced upwards of 10 hours a day: Bach, Brahms, Beethoven, Mozart.

Today, Nez is an assistant professor at Boston University’s College of Fine Arts, where she teaches classes in musical composition, theory, orchestration, and analysis. While versed in numerous musical genres including classical, chamber, contemporary, and electronic forms, her most recent compositions explore the music of the cultures surrounding her birthplace.

Mostly an agricultural and pastoral people, Macedonians passed on their folk songs orally through generation after generation of cattle farmers and sheepherders. “Few villagers could read,” Nez says, “so they preserved their histories through spoken stories and song.”

Since the fall of socialism in Eastern Europe, contemporary folk and pop musicians throughout the Balkans have tapped into the region’s time-honored folk songs. Among the most famous earlier projects—and one that particularly inspired Nez—is *Postcards from the 1930s*, a setting for violin and piano that uses transcriptions of Bosnian and Herzegovinan folk songs by renowned Hungarian composer and ethnomusicologist Béla Bartók.

Nez is referencing those traditions in a different medium: opera. “The opera project is a by-product of my everlasting curiosity for the sounds and rhythms of my own ethnic background,” she says, “a mixture of Slovenian and Slavic Macedonian.”

Thanks to generous support from the BU Humanities Foundation, the opera, called *The Fiddler and the Old Women of Rumelia*, will be performed in spring 2011 in collaboration with Xanthos, a young professional ensemble directed by violinist Brenda Van der Merwe. The story begins with the title: “Rumelia is the name of the former Ottoman province which encompassed the Balkan areas whose music I’m studying,” Nez explains. “And the capital was Bitola, my mother’s hometown.”

While most of the opera will be sung in English, Nez may use some of the original language with subtitles. “It depends on how difficult it is for the singers,” she says. At this point, she does not intend to incorporate any traditional folk instruments into the production; instead, Nez plans to imitate their sounds with Western ones. “The violin mimics the sound of the gadulka, a Bulgarian bowed instrument,” she says, “and the oboe and saxophone can fill in for bagpipes.”

At present, Nez is working on the plot. “I’m fleshing out the intriguing stories which the folk songs seem to allude to,” she says. “My cast of characters includes a village ingénue, a dashing and murderous outlaw, a spry card-telling Roma, and a crusty old epic singer. The challenge is to preserve the musical sources as untouched transcriptions—a musical photograph, if you will.”

This is not Nez’s first opera. While a composer-in-residence at the École Nationale de Musique in Montbéliard, France, she wrote *A Devolutionary Opera: Drama in 540 Seconds*, which premiered in 2003 at Munich’s annual A·Devantgarde Festival. A collaboration of seven composers, each of whom contributed a chapter, the opera is about two scientists who study the effects of a viral epidemic among humans. Nez chose in her piece for the virus to cause people to behave like animals, and she incorporated iconic cartoon characters, including Batman, Catwoman, the Pink Panther, and King Kong, into its narrative. “*The Fiddler and the Old Women of Rumelia* will be nothing like that,” she says with a laugh.

**WEB EXTRA**

Listen to some of Ketty Nez’s recordings at www.bu.edu/research/magazine
Secrets of the Stars

BY MARK DWORTZAN

Can the smallest stars in the Milky Way galaxy be the key to understanding the universe? Assistant Professor of Astronomy Andrew West is working on just that mission, and the data he has collected and analyzed so far suggest that he is onto something.

Occurring between one-thousandth and one-twentieth the volume of the Sun, red dwarfs are the smallest stars in the Milky Way. They are also the coolest and least luminous. But what they lack in size, temperature, and brightness, they make up for in number, with red dwarfs accounting for 70 percent of all stars in the galaxy.

“Those stars are very dim but fuel efficient, and on average could burn for trillions of years,” says West, who does red dwarfs the “WV of the Milky Way.” Because they’re so huge in number and last almost forever, large samples of them can allow you to probe the shape, structure, and evolution of our own galaxy like no other stars.

Drawing on the Sloan Digital Sky Survey and other deep, all-sky surveys, West is tracing how the Milky Way has evolved over time. To achieve that objective, he is building a research team that includes BU graduates and undergraduate stipends, astronomy Department colleague Youssef Daniel Clemens, and other astronomers from Cornell, MIT, and the University of Washington.

“By deducing the relative ages of the red dwarfs and obtaining light spectra that reveal information about their physical composition, temperature, and magnetic fields, West is tracing how the Milky Way has evolved over time. To achieve that objective, he is building a research team that includes BU graduates and undergraduate stipends, astronomy Department colleague Youssef Daniel Clemens, and other astronomers from Cornell, MIT, and the University of Washington.

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Secrets of the Stars

BY MARK DWORTZAN

Can the smallest stars in the Milky Way galaxy be the key to understanding the universe? Assistant Professor of Astronomy Andrew West is working on just that mission, and the data he has collected and analyzed so far suggest that he is onto something.

Occurring between one-thousandth and one-twentieth the volume of the Sun, red dwarfs are the smallest stars in the Milky Way. They are also the coolest and least luminous. But what they lack in size, temperature, and brightness, they make up for in number, with red dwarfs accounting for 70 percent of all stars in the galaxy.

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Reverse Engineering Birds

BY MARK DIVORTZAN

A picture may be worth a thousand words, but a single image produced by neuroscientist Tim Gardner can capture as many as 1,500. To his case, though, the “words” in question are the distinct vocalizations of a songbird, represented in visual form.

Gardner, an assistant professor of biology in the College of Arts & Sciences, uses these images to understand how birds build and retain the songs they use to communicate with one another. His work could shed light on how the neural circuits of learning and memory communicate with one another. His work could shed light on how the neural circuits of learning and memory communicate with one another. His work could shed light on how the neural circuits of learning and memory communicate with one another.

In a recent study published in the Journal of the Royal Society of London Interface, Gardner and his colleagues noted the song patterns of juvenile canaries, other canaries. Gardner hopes to learn more about the growth of these processes by introducing small perturbations to the spontaneous activity that occurs during birds’ sleep, and then observing the impact of these perturbations on their neural networks and songs. As the bird grows, it learns to sing upon awakening, a computer detects the sleeping pattern and triggers a stimulating electrode or implanted optical fiber to induce slight changes in neuronal electrical activity at specific locations in the song pathways. A brain-machine interface implant measures the activity.

If we can increase or decrease the neural activity of the bird during sleep, we can see if there’s a change in the sequential order—and creativity—of the songs it produces,” says Gardner, noting that such studies could help us understand how similar neuronal changes in humans might impact our performance during the day.

To home in on these rules, Gardner is now investigating how birds learn these rules. He and his lab recorded every sound the birds uttered through their development. Initially, the subjects mimicked the songs of other canaries, but as they matured, they reverted to species-typical songs, even in the absence of other canaries.

“At the University of California, Berkeley’s program in Applied Science and Technology, Kramer helped develop a mathematical model that describes what happens in the brain during an epileptic seizure. The purpose of the study, published in the March 2005 issue of the Journal of the Royal Society of London Interface, was to help neurologists better understand and treat epilepsy.

When epilepsy patients fail to respond to various drug treatments, Kramer explains, doctors may take an alternative course of action. "They remove the part of the brain that causes the seizures," he says.

While numerous measures are undertaken to ensure patient safety, the surgery is nonetheless invasive, and it is not always successful. According to a 2007 Cleveland Clinic study, 60 percent of patients who have the surgery continue to have seizures.

New an assistant professor of mathematics and statistics, Kramer wants to reverse those numbers. To that end, he is using his background in math and physics to help doctors at Massachusetts General Hospital determine which parts of the brain to target.

"Up until now," he says, "the primary way to analyze data retrieved from the brains of epilepsy patients has been through a painstaking visual inspection. Epileptologists painstakingly analyze the electrical activity and try to determine where in the brain the seizure is starting."

Before surgery, neurologists must map the region where the patient’s seizure originates to ensure that they remove only what is necessary. This involves lifting a section of the skull and putting electrodes directly on the surface of the brain.

"The patients stay in the hospital for about a week," Kramer says, "during which time they may experience a number of seizures."

Kramer and his collaborators study the voltage data collected from the electrodes using sophisticated mathematical techniques. "Rather than looking at individual voltage traces," he says, "we’re examining them collectively. Are there any relationships between those traces? Is there any sort of pattern?"

While the recordings reveal the consequences of abnormal brain activity, they continue, they do not identify the cause. "If we understand why and how seizures progress over the surface of the brain," he says, "eventually we may be able to prevent the seizure by disrupting the activity preemptively with medication or stimulation."

To-date, Kramer’s team has analyzed only a handful of seizures from a small group of patients. It is a miniscule percentage of the 50 million people worldwide who suffer from the disease, but still a strong start. The "scientific process is filled with wrong turns," Kramer says, "but I truly believe we’re on our way."

Representative networks, such as constructed from brain activity a...
The U.S. Surgeon General’s report, Healthy People 2010, lists diabetes mellitus as a major health challenge—and with good reason: as many as a million and a half new cases of diabetes are diagnosed each year, bringing the number of American children and adults with the disorder to 23.6 million.

Millions more are at risk, or already have a pre-diabetes condition. A chronic but treatable disorder, diabetes can strike anyone from the young to the aged, male and female, and in particular, African Americans, Latinos, Asian Americans, and certain other ethnic groups.

To help those living with the disorder and to prevent further cases, Boston University researchers are working on a number of different fronts, from developing an artificial pancreas that automatically controls blood sugar and insulin in type 1 diabetes, to identifying new risk and treatment factors for both type 1 and type 2 diabetes, socioeconomic factors regarding the high-risk population of African American women, and genetic loci that warrant further study.
Taking It Personally

It’s a little bigger than a cell phone and just as smart. A small sensor under the skin monitors blood sugar, a pump delivers a calculated amount of insulin, and a software program tells the first two components what to do.

The device, worn externally, is called an artificial pancreas. It promises to revolutionize the management of type 1 diabetes—an autoimmune disease in which the pancreas does not produce the insulin needed to carry blood sugar into cells—and to improve the quality of life for those who suffer from the disorder.

“Most people currently on pump therapy will use the artificial pancreas,” predicts Edward Damiano, an associate professor of biomedical engineering and a co-principal investigator on the artificial pancreas project, which has received funding from the National Institutes of Health (NIH), Juvenile Diabetes Research Foundation, Leona M. and Harry B. Helmsley Charitable Trust, and Wallace H. Coulter Foundation.

Damiano has done his homework on insulin pump therapy. His 11-year-old son, David, wears two insulin pumps, one just below each hip. The pumps deliver insulin under the skin rapidly, which is more convenient for an active adolescent than the injections that most type 1 diabetes patients need daily. It was David’s condition, diagnosed when he was a baby, that prompted Damiano to seek out a new research direction, one that would benefit his son and diabetes patients everywhere. “I saw a role for myself in diabetes,” he said. “I knew I had a certain skill set that could be brought to bear on the disease.”

Damiano, his former student, Firas El-Khatib, now a BU senior research scientist, and other colleagues designed the “smarts” of the artificial pancreas system—that is, the computer program that regulates the device. They were the first academicians to receive an investigational device exemption from the Food and Drug Administration to test a blood-glucose control algorithm in clinical trials. The positive outcomes of those 2009 clinical trials were published in the journal Science Translational Medicine.

If the second round of clinical trials are as successful as the first, Damiano estimates that the artificial pancreas will be available for commercial production in 2014. He hopes that the device will be approved by the time his son reaches college age.

Damiano is excited about the clinical trials—begun in June at Massachusetts General Hospital, where Damiano’s co-principal investigator Steven Russell is an endocrinologist—because of the younger subjects. Half of the patients in the clinical trial are between 12 and 18 years of age; the rest are 18 and older. The study is twice as long and larger in scope than the previous trial.

However, the real test for the device is scheduled for spring 2011, when a third clinical trial will incorporate exercise into the subjects’ regimen and allow them to consume food as they do at home, rather than in a prescribed format. This trial will also eliminate the IV pole and desktop computer currently used to operate the artificial pancreas; instead, the necessary software will be imbedded on a computer chip built into the unit, paving the way for a portable device ready for commercial production.

Although the artificial pancreas is being tested specifically for patients with type 1 diabetes, Damiano is optimistic about its eventual use for everyone with the condition. “I think it also will work very well with people with type 2 diabetes,” he said. “Anyone on insulin therapy will benefit from this device.”

Edward Damiano and Firas El-Khatib are developing an artificial pancreas that improves on current insulin pump technology, top. Edward Damiano’s son David balances type 1 diabetes with the active lifestyle of an eleven-year-old boy. From left: Damiano encourages exercise, like jumping on the trampoline, since exercise naturally burns excess glucose; a specially prepared smoothie; David’s insulin levels have to be checked at regular intervals around the clock and insulin doses administered as needed by two pumps that David wears on his hips at all times; Damiano’s research carries over into the home, where a large chalkboard is used to plan upcoming clinical trials for 2011.
Location Is Everything

African American women who live in low income neighborhoods have a higher risk of developing type 2 diabetes than do African Americans who live in more advantaged neighborhoods—even if they have high educational levels themselves.

“Where a woman lives, regardless of her own education and income, has an effect,” explains Professor Julie Palmer, senior epidemiologist at the Slone Epidemiology Center and a co-principal investigator of the Black Women’s Health Study, who discovered the correlation between area of residence and diabetes risk. “This finding is important because so many black women continue to live in disadvantaged neighborhoods even while they work in professional jobs and earn adequate incomes. Efforts to reduce the alarming rate of diabetes in African American women need to focus not only on individual lifestyle changes but also on improving conditions in disadvantaged neighborhoods.”

The Black Women’s Health Study—which has been following 50,000 African American women from 17 states since 1995, thanks to more than $30 million in funding—is helping to shed light on why black women are twice as likely to have type 2 diabetes as non-Hispanic white women.

Palmer and colleagues Lynn Rosenberg, associate director of the Slone Epidemiology Center, and Lucille Palmer, of Georgetown University, have hypothesized that the association between neighborhood socioeconomic status and diabetes risk may occur because neighborhoods with a lower socioeconomic status lack access to grocery stores that sell wholesome fruits, vegetables, and other foods, as well as access to safe areas for walking and other exercise. Obesity is one of the primary factors for developing diabetes, so maintaining a healthy weight, eating a nutritious diet, and engaging in regular exercise are key to preventing the disease.

The study found that African American women living in neighborhoods with the lowest socioeconomic status—as determined by the U.S. Census Bureau’s “geo coding”—had a 1.65 times higher risk of contracting diabetes, after factoring for individual risk factors such as education, age, income, and household size. Taking into account physical activity and caloric intake reduced the association, indicating that physical activity and diet explain at least part of the link between type of neighborhood and risk of diabetes.

Palmer said that over 5,000 Black Women’s Health Study participants have developed diabetes since the study began in 1995. Surveys, mailed every two years, track how the women’s health and habits have changed, and gather data on weight, diet, birth control, smoking habits, and the development of disease.

“Our study is powerful because we know about behaviors that occurred before diabetes developed,” says Palmer. “We are particularly interested in social factors and how they influence diabetes.”

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Dupuis and her team evaluated the 22 human chromosomes, depicted here in alternating colors along the graph’s x-axis. Peaks in the graph represent increased subjects had fasted for eight hours or more, so that ingested sequence variation, by scanning the DNA of thousands of European descent affect risk in other ethnic populations, and also to identify the exact genetic variant that increases diabetes risk.

“We don’t have all the pieces yet,” says Dupuis. “That’s why they call diabetes a complex disease. It’s not straight-forward. Diet, exercise, and the environment are involved as well.”

For the philosopher and theologian Wesley Wildman, considering religion while the vA hospital in Boston, for example, led “This field is building bridges across the disciplines, and it’s when you put these disparate subjects together that you get, I think, the deepest insights into the way that religion works,” says wildman, who also directs an interdisciplinary graduate program in religion and science within BU’s Division of Religious and Theological Studies. “To be evolutionarily and biologically conditioned to respond to the universe, to the world we live in, is a very particular way is directly relevant to why you believe what you believe, what you’re willing to do for, what you’re willing to kill for. What you’re willing to save.”

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Here, There, and Everywhere

With a diverse student body on campus, representing more than 135 nations, and well-established study abroad programs in 30 countries on six continents, BU has a strong tradition of global engagement. Today, that tradition continues with new traveling fellowships, an innovative inter-university collaboration, and forward-looking contributions to the international exchange of ideas.

Writing and Wanderlust

Poets, playwrights, and fiction writers set off in search of inspiration, supported by a new fellowship for international travel and study.

The rain pounded relentlessly as Nathan Hogan made his way across the barren Greenland tundra. His backpack—swollen by its waterlogged state—sagged on his shoulders, and he wondered, not for the first time, if trekking 100 miles across the Arctic Circle Trail was such a good idea.

A graduate of the Creative Writing Program, Hogan is writing a novel about the Arctic Ocean in search of the Northwest Passage. By exploring the western coast of Greenland himself, Hogan hoped to gain insight into the country’s people and customs while witnessing firsthand its majestic icebergs and glaciers.

Hogan’s journey was made possible through the Robert Pinsky Global Fellowships in Creative Writing. The program, established in 2009 through a $2 million donation from Robert J. Hildreth, vice chair of the BU Board of Overseers, provides funds for up to four months of international study. Named in honor of former U.S. Poet Laureate and critic Pinsky, a College of Arts & Sciences professor of English, it sent five writers overseas last year. This year, the number of recipients more than doubled, with 12 graduates selected to take part.

The opportunity to experience a foreign culture heightens writers’ skills by exposing them to lifestyles that challenge their thinking, says Pinsky. “The fellowships reinforce the demanding nature of the Creative Writing Program,” he adds. “The more different the experience, the richer the challenge.”

In August, poet Alix Gika, who left her native home of Albania more than 14 years ago, returned to her birthplace to research five female Albanian poets whose work she plans to translate into English.

“Many of my Albanian colleagues see me—and should—see poetry as being abroad. A lot of returnados moved to Canada during the 1970s,” she says. “I hope to gain insight into what life was like back then, what challenges they faced, and what called them home.”

Dynamic Duo

During the 1960s, almost at the same time that former BU President Harold C. Gray began his quest to transform Boston University from a commuter school into a leading national research institution, the United Kingdom announced a government initiative to expand access to higher education. The University of Warwick, widely regarded as one of Britain’s top research schools, is probably the most impressive result of that expansion.

“Boston University and Warwick have striking similarities,” says Graham Wilson, a BU professor of political science. “They’re comparable in size, programs of study, and ambition, and both are renowned as dynamic and entrepreneurial institutions.”

So when Britain’s then-President George Brown proposed more inter-university collaboration between the United Kingdom and the United States, it came as no surprise that Warwick looked to Boston University as a potential partner.

“We are very much like-minded institutions, and have both evolved in parallel into major research universities,” says Ruckenstein. “Our similar trajectories and aspirations, the common mindset in areas in which we have complementary strengths, or emerging disciplines. For the short term, Ruckenstein says, BU and Warwick announced a partnership to leverage the strengths of each institution through research collaborations in new and emerging disciplines. For the short term, Ruckenstein says, “We are focusing on research and educational opportunities in areas in which we have complementary strengths, or in impactful directions—new to both institutions—where we are willing to share risks.”
“This is much more than an exchange program,” says Mark Smith, Warwick’s pro-vice-chancellor of research. “It’s a completely new model that will develop joint strategic thinking over a range of fronts, especially research.”

Over the past several years, the connections between BU and Warwick have strengthened as the result of grassroots efforts, driven by individual or small groups of faculty members whose areas of expertise range from the arts and humanities to business and hard sciences.

“We’re looking to make a big impact by being not just world competitors, but world leaders,” says Kevin Smith, a BU professor of physics.

For example, BU wants to expand its studies of electron microscopy, an area in which Warwick is strong. “Instead of building our own center of excellence in electron microscopy, we can use Warwick’s,” Kevin Smith says. “In exchange, Warwick’s faculty members will have access to our materials and projects.”

Earlier this year, Ruckenstein appointed Kevin Smith to lead a steering committee for the project. Other committee members include Adil Najam, a professor of international relations and director of the BU Frederick S. Pardee Center for the Study of the Longer-Range Future; Alan Cohen, a professor of health policy and management and executive director of the BU Health Policy Institute; and Wilson.

So far, the collaboration has been a success. Researchers in the physics, chemistry, and engineering departments, along with their Warwick counterparts, are currently studying energy materials that are used in storage devices such as solar cells, fuel cells, and batteries. In the political science department, Wilson and his colleagues are studying business and government relations.

“It turns out that both universities have tremendous strengths in these areas,” Wilson says. “So in December we held a joint research session at Warwick. Our topic was the ways in which the economic crisis of the past three years has changed business and government relations. We hope the resulting papers will become a book.”

Kevin Smith expects the partnership to expand significantly within the next year. “We’re putting out a call for new proposals,” he says, “so we expect to see growth into new areas of joint scholarship.”

The next step is to involve students, both graduates and undergraduates. “We envision a system where students will move seamlessly between the two universities,” Smith says. “They’ll regard both BU and Warwick as their homes.”

As director of the Frederick S. Pardee Center for the Study of the Longer-Range Future, Najam has built a career around thinking about the future, but he doesn’t do it through reading tea leaves or gazing into crystal balls. “It’s about research,” he says. “The future is a big puzzle, and to solve it we must look at every individual piece: politics, economics, technology, culture.”

Established in 2000 by Frederick S. Pardee—who received degrees from the BU School of Management and Graduate School of Management, as well as an honorary doctorate in 2006—the center focuses its research on identifying, anticipating, and enhancing the long-term potential for human progress. In recent years the center has been focusing on regional patterns of human progress.

In 2008, an international group of scholars came together to discuss the future of China in terms of politics, religion, law, economics, energy, the environment, and health care.

Organized by Joseph Forssman, a Pardee Center faculty fellow and professor of international relations and political sciences, the conference included 14 leading experts from the United States, China, and Germany, who presented papers that were later compiled into a book, China Today: China Tomorrow: Domestic Politics, Economy, and Society (2010), edited by Forssman.

Although the center’s research focuses on the long-term—that is, between 35 and 200 years ahead—50 appears to be the magic number. “It’s asking our experts to imagine what something will be like in a year, they remain constrained in the shackles of today,” Najam says. “They need a good 50 years—an entire generation—to distance themselves from the present, to envision a world that is entirely different from what they know.”

This year, the center concentrated on South Asia and Africa. While the South Asia 2060 project focuses on scenarios that could occur during the next five decades, Najam says, its research is rooted in steps that can be taken now to move toward a more positive future.

The center hosted a series of South Asia 2060 seminars, including in South Asia itself, and a collection of resulting essays—each focusing on individual aspects of South Asia’s regional futures—will be published as an anthology in 2011.

In April, the center hosted another all-day conference, “The Good News from Africa,” as part of its Africa 2060 program. With discussions on social development, markets and economy, politics and institutions, and society and culture, the conference also served as a launching pad for a number of papers that examine regional development in Africa, the narcotics trade, obesity in sub-Saharan Africa, malaria, and agricultural and climate change.

Although each conference focuses on a different region, Najam has noticed one common trend emerge. “In every instance,” he says, “the solution for the future of these regions includes better governance and institutions. Now we just have to focus on getting there.”
Traffic Cop on the Information Superhighway

There is a good chance you own a zombie. It could have been infected by a website you visited, or a link you clicked in an email. Just because your firewall and anti-virus software are turned on, and you have an up-to-date operating system, you could be the target of an attack by a hacking system called a botnet. These systems are now being used by GÉRMI, a network of thousands, or even millions, of computers that overload and shut down websites.

Researchers are studying botnets to find out how they are able to initiate a widespread and rapid attack on the Internet. The goal is to find ways to stop it from ever reaching your personal computer. Unlike most computer viruses, botnets—networks of thousands, or even millions, of zombies—become part of “botnets”—networks of thousands, or even millions, of zombie computers become part of “botnets”—networks of thousands, or even millions, of zombie computers become part of the Internet. Instead of being killed by anti-virus software by looking for a signature—a unique sequence of code, or something in the content—and then blocking programs with those signatures. For instance, says Crovella, “There are programs that can tell a computer to block email with the word ‘Virus’ in the title.” It can be effective, he says, but only for a little while. “An adversary just has to change one letter in its signature to ‘Virux,’ for example—and they’re in.”

Rather than attempt to define the properties of unwanted traffic, Crovella’s strategy is to paint a picture of what “normal” Internet usage looks like. Using software he and his team designed, they capture and analyze anomalous traffic from five to ten computer networks—information about the amount of data as the flows pass through thousands of routers around the world. Unusual patterns—statistical anomalies in the amount or type of data being transferred—flip off Crovella and his team to potentially malicious activity. How these programs sneak into individual computers can change daily, even hourly, but their patterns of behavior, the ways they interact on the Internet, are nearly always outside the norm. Don’t attack, for instance, generate abnormally large amounts of traffic. Instead, “You can reveal criminal activity. For example, if you see a large variety of Internet Protocol, or IP, addresses—numbers that identify individual computers—coming from one source in a short period of time, that kind of activity is statistically anomalous,” Crovella explains. And anything outside of statistical norm traffic patterns is potentially malicious.

Other researchers and companies have tried similar techniques, but with only one router at a time. The unique multivariate statistical approach developed at BU involves statistical and data mining techniques and a large number of other computers, a sign of potentially malicious behavior.

In the Field

Academic research at major universities—an exciting world of excavations, sediment sampling, and high-level lab tests—is typically reserved for graduate-level work. But at Boston University, a significant number of faculty members are giving undergraduates a key role to play in ongoing research projects—in some cases, as early as freshman year. From archaeological explorations in western Turkey, where civilizations have thrived for millennia at the crossroads of East and West, to methods of dating rocks that provide clues about the Earth’s past and its present-day processes, BU undergraduates are learning firsthand how to gather, analyze, and report data at the forefront of endeavors in their fields of study.

Outdoor Classroom

While studying historic travel journals and other accounts by early explorers for an archaeology-themed section of WP150—a writing seminar required of all undergraduates in the College of Arts & Sciences—Ali Clark had a “eureka” moment.

Clark, an art history major, realized that the plunder and sale of antiquities—a practice dating at least as far back as the Roman period—remains the modus operandi in today’s art world, where it continues to undermine a people’s ability to understand and preserve their cultural past.

“I’ve always been interested in art history, but I had never been exposed to that aspect of it before,” Clark says. “That really focused my studies on what I wanted to pursue at BU.” Toward the end of the semester, she contacted her writing instructor, Christina Luke, who is also a research fellow in the Department of Archaeology, about other opportunities to study looting and its impact on cultural heritage. The exchange sparked Clark’s long-term involvement in the Central Lydia Archaeological Survey, a project Luke co-directs with Christopher Roosevelt, an associate professor of archaeology.

Clark is one of several undergraduates who have been involved in the survey, which explores human activity in western Turkey from the prehistoric age until the present and is partially funded by the Undergraduate Research Opportunities Program (UROP) at BU. Launched in 2005, the survey centers on a 135-square-mile rural area south of Istanbul and east of the Aegean Sea.

Luke and Roosevelt initially chose the site because of its proximity to Sardis, the capital of the Iron Age Lydia civilization, and its role as a vast burial ground for Lydia kings. (Known as Bin Tepes, or “The Thousand Mounds,” the area is the largest tumulus cemetery in Turkey.) But before long, the project expanded in scope, from the Bronze Age through today.

“It began with a focus on the Iron Age and on understanding one of the world’s early empires and its hinterland,” says Roosevelt. “But it quickly grew into something broader because, as we learned very quickly, the remains of the area date to much more than just the Iron Age. There are much older and also much more recent periods of activity.”

In the second millennium BC, for example, when Mycenaean Greeks ruled the Aegean and Hittites had established themselves in Asia Minor, central Lydia saw the rise of a network of fortifications, which might have served as a buffer zone between the two empires. These Bronze Age structures provide exciting support for the existence of a sophisticated indigenous state and also offer clues about how the land was used by early populations.

“System like this, with the complexity that we see at those sites, is unknown anywhere else in western Anatolia right now,” Luke says. (continued on next page)
PhotoCalorie is a free food journal for Apple’s iPhone that calculates a meal’s nutritional information and records eating habits. Istrail started work on the app during a summer 2009 research project with Mark Bajuk, a research associate at Harvard Medical School.

Although nutrition apps are common, Istrail says, PhotoCalorie’s simplicity gives it a competitive edge. “For a lot of other apps,” he says, “you have to search for each item. It’s very tedious, and we wanted to eliminate that.” Users type a meal in one line (“poppy seed bagel, cream cheese, iced coffee”) and the app, which Collins of Engineering alumnus Vince Fusaro helped to program, tallies the meal’s nutrition: calories, protein, fat, and carbs. Rival programs lack PhotoCalorie’s Google-like search component. The photo aspect is also unique.

“You take a picture of the food as a way of personalizing your journal,” says Istrail, who used the U.S. Department of Agriculture’s nutrient database to compile the extensive food list that powers the app. “A lot of people have told us that they just take the pictures, that’s it, and that they have a visual food journal.”

Istrail also runs the PhotoCalorie blog, dispensing timely nutritional news and tips and offering a science major’s take on the latest dietary trends. His interest in seeking out the truth behind ever-changing healthy eating advice was encouraged in a class on nutritional epidemiology taught by Associate Professor of Nutrition Paula Quatromoni. Quatromoni says nutrition is such a hot topic right now that more people are seeing it as a career path.

And she says that students need to understand the truth behind these studies because there is so much confusion. “Any tool that helps people increase their awareness of their personal habits has the potential to shift behaviors,” she says. “The average person has difficulty identifying reputable sources of nutrition information and distinguishing fact from fiction. On the web, in magazines, on TV, and in the aisles of health food stores, it is easy for consumers to be misled and fall prey to false hope.”

Istrail is optimistic the app will make it easier to get nutrition facts into the open and help inform some of the millions of people who suffer from nutrition-related health problems. With the app picking up new users every month, Istrail plans to go to medical school and then focus on research full time. “If you can do a good study that is novel and actually shows something,” he says, “you can change the world; you can influence billions of people.”

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**WEB EXTRA**

Ethan Baxter studies the geological processes affecting the evolution of Earth’s crust and mantle. [www.bu.edu/research/magazines](http://www.bu.edu/research/magazines)
A Breath of Fresh Air

One of the first scientific facts that schoolchildren learn is that human respiration involves the intake of oxygen and the exhalation of carbon dioxide. Scientists have long understood that respiration works in the reverse for vegetation: growing plants take in carbon dioxide—carbon, the dirt—-and release oxygen. Just how much carbon a plant will absorb is one question that researchers from the Department of Geography & Environment are tackling: thanks to a two-year exploratory grant from the National Science Foundation and the U.S. Forest Service known as Urban Long-Term Research Area, or UTLRA.

“Why are we doing it basically a giant carbon footprint analysis of metropolitan Boston?” says Assistant Professor John Phillips, one of the leaders on the project. Except that in addition to measuring CO2 released by humans, Phillips and his team are “also linking it to that a whole other part of Boston that is exchanging carbon as well, and that’s the natural systems.”

“The urban environment is like an experimental treatment. Are plants more or less healthy? Are they growing faster or slower?”

Another aspect of UTLRA is studying the effects of human behaviors on carbon emissions in Boston. Led by Robert Kolttmann, professor and chair of the Department of Geography & Environment, this effort focuses on figuring out why and how people are using certain appliances and is also tracking commuting habits to see how models might be juggled in sustainable directions.

In 2012, BU researchers will compete for the next phase of UTLRA, which would provide funding for a decade. The team is confident that their findings will date to poppin’ interest in future research. “Once we have the core information, we can start to play what it games,” says Hulya. “What if we increase the canopy cover? What if we required new housing developments if we increase the canopy cover?”

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By Katharine Calver Hawkins

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Michael F. Holick (Endocrinology) won the Linus Pauling Prize and the NAMS/Upsher-Smith Laboratories, Inc. Vitamin D Research Award. He also received the DSM Innovation in Nutrition Award and the American Association for Clinical Chemistry’s Outstanding Speaker Award.

Bradford Hudson (Hospitality) was named the 2010–2011 Fullbright Visiting Research Chair in Sustainable Commerce at the University of Guizhou.

Jeffrey Hurtar (Dental Medicine) received the American Association of Endodontists’ Edgar D. Coitlidge Award.

The Institute on Culture, Religion & World Affairs received awards from the Henry Luce Foundation.

The Institute for Geriatric Social Work received an award from The Atlantic Philanthropies.

The Institute for Nonprofit Management & Leadership received an award from the Barr Foundation.

Alice K. Jacobs (Cardiology) won the American Heart Association’s Gold Heart Award.

Gene Jarrett (English) was named a 2010–2011 Radcliffe Institute Fellow at Harvard’s Radcliffe Institute for Advanced Study.

Judith Jones (General Dentistry) won the American Association of Public Health Dentistry Service Award.

Richard Kelish (Family Medicine) received the Health Champions Award and the Community Health Pinnacle Award.

Douglas Katz (Neurology) received the MAB Community Service’s Al Gaygazian Lifetime Achievement Award.

James Kaufman (Medicine) won the David Littman Award.

Leslie Kaufman (Biology) received a Partners in Conservation Award from the U.S. Department of the Interior.

Carine Lenders (Pediatrics) was named America’s Top Pediatrician by the Consumers’ Research Council of America.

Kenneth Latchen (Biomedical Engineering) was elected President of the American Institute for Medical and Biological Engineering and received Case Western Reserve University’s Distinguished Alumni Award for Biomedical Engineering Education.

Jared W. Magnani (Cardiology) received a Fellow-to-Faculty Award from the American Heart Association.

Barry Manuel (Continuing Medical Education) received the Massachusetts Medical Society’s Lifetime Achievement Award.

Robert Manquez (Finance/Economics) was named Extramural Fellow of the Massachusetts Medical Society. He was named an American Dietetic Association National Media Spokesperson.

Elise Morgan (Mechanical Engineering) won the Vernon T. Tulo Basic Science Paper Award.

The Neuroscience program was awarded $1.5 million from the Howard Hughes Medical Institute to enhance undergraduate research opportunities.

Ketty Nez (Music) won the ERMA/Edus film scoring competition for her orchestral score to Thomas Edison’s 1904 film The Manic Chase. She also received an ASCAP/USC Award.

Sandra Nicolucci (Music) was named the Sigma Alpha Iota International Music Fraternity’s Distinguished Woman of the Year.

Rafael Ortega (Anesthesiology) was the Special Award from the New York State Society of Anesthesiologists.

David Ozonoff (Environmental Health) delivered the MacGeorge Memorial Lecture at the University of Alberta Medical Centre.

Harold Park (Mechanical Engineering) received the Gallagher Young Investigator Award from the U.S. Association for Computational Mechanics.

Linda Piewarczyk (Psychiatry) received the Sarah Hakey Memorial Award for Clinical Excellence from the International Society for Traumatic Stress Studies.

Richard Raiselis (Visual Arts) was awarded the National Academy’s Giovanni Martino Prize for Landscape Painting at the 18th Annual Exhibition of Contemporary American Art.

Siddharth Ramachandran (Mechanical Engineering) was named a Member Correspondente of the Real Academia Española.

Ellie Ross (Biomedical Engineering) won the Vernon T. Tulo Basic Science Paper Award.

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Adam J. Rose (Internal Medicine) received the Per M. Mannucci Young Investigator Prize from the Journal of Thrombosis and Haemostasis, and the Milton W. Hamolsky Junior Faculty Award from the Society of General Internal Medicine.

Jennifer E. Rosen (Surgery) won a Center for Integration of Medicine and Innovative Technology (CIMIT) Young Clinician Award.

George Rosenthal (Geriatrics) received the Robert Dawson Evans Outstanding Citizen Award from the Boston Medical Center.

Ronald Boy (Mechanical Engineering) was awarded the Helmholtz-Rayleigh Interdisciplinary Silver Medal from the Acoustical Society of America.

David J. Salant (Nephrology) was named President of the Association of University Technology Managers.

Robert Marquez (Finance/Economics) was named President of the American Association of Governmental Ordinance Makers.

Barry Manuel (Continuing Medical Education) received the Massachusetts Medical Society’s Lifetime Achievement Award.

Joan Salge-Blake (Health Sciences) was named an American Dietetic Association National Media Spokesperson.

Natascha Saunders (Organizational Behavior) was recognized as the 2010 Harvard University WECAN Woman of the Year.

Kitt Shaffer (Radiology) received the 2010 Meera and Shaq D. Mainz Visiting Professor at UCLA and USC.

Joan Salge-Blake (Health Sciences) was named an American Dietetic Association National Media Spokesperson.

Thomas Szabo (Biomedical Engineering) was elected a Fellow of the American Association for the Advancement of Science.

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Jennifer Tong (Vascular Biology) was named a Junior Faculty Award from the American Diabetes Association.

Xiaoyong Tong (Vascular Biology) was named a Junior Faculty Award from the American Diabetes Association.

Benjamin Tong (Vascular Biology) was named a Junior Faculty Award from the American Diabetes Association.

Shuba Sinha (Marketing) received the Google and WPP Marketing Research Award.

Barbara Shinn-Cunningham (Music) received the Special Award from the New York State Society of Anesthesiologists.

Lee Staples (Social Work) won the Beverly Ross Fliegel Award for Social Policy and Change from the Massachusetts Chapter of the National Association of Social Workers.

John H. Wallace (Music) received a Bronze Best Practices Award for Excellence in Distance Learning Teaching from the United States Distance Learning Association.

Alexander Walley (Internal Medicine) won the Clinical Investigator Award from the Society of General Internal Medicine, New England Region.

Joseph Wipfel (International Relations) was awarded the Distinguished Intelligence Medal from the Central Intelligence Agency.

Philip Wolf (Neurology) delivered the Robert Wartenberg Lecture at the American Academy of Neurology.

Jonathan Woodson (Surgery) won the Humanism in Medicine Award from the AAMC’s Arthur P. Gold Foundation.

Donald Wright (Mass Communication) received the Presidential Citation Award from the Public Relations Society of America.

Jeremy Yudkin (Music) received a Certificate of Merit from the Association for Recorded Sound Collections.

Muhammad Zaman (Biomedical Engineering) received the University of Texas’s Regents Outstanding Teaching Award, and was named a Fellow at the University of Melbourne.
Boston University at a Glance

Robert A. Brown, President
David K. Campbell, University Provost
Karen H. Antman, Provost, Medical Campus

Research Centers and Institutes
African Presidential Archives & Research Center
African Studies Center
Alcohol and Drug Institute for Policy, Training & Research
Alzheimer’s Disease Center
American Schools of Oriental Research
Amyloid Treatment & Research Program
Anna Howard Shaw Center
Archaeological Institute of America
Arthritis Center
Biomolecular Engineering Research Center
Cancer Research Center
Cardiovascular Proteomics Center
Center for Adaptive Systems
Center for Addictions Research & Services
Center for Advanced Biotechnology
Center for Anxiety & Related Disorders
Center for Applied Research in Language
Center for BioDynamics
Center for Biomedical Imaging
Center for BioDynamics
Center for Biomedical Imaging
Center for Biomedical Imaging
Center for Character & Social Responsibility
Center for Chemical Methodology & Library Development
Center for Computational Science
Center for Congregational Research & Development
Center for Congregational Research & Development
Center for Computational Science
Center for Ecology & Conservation Biology
Center for Energy & Environmental Studies
Center for Global Health & Development
Center for Human Genetics
Center for Information & Systems Engineering
Center for Integrated Space Weather Modeling
Center for International Relations
Center for Mathematical Physics
Center for Molecular Discovery
Center for Nanoscience & Nanobiotechnology
Center for Neurorehabilitation
Center for Neurorehabilitation
Center for Neuroscience
Center for Philosophy & History of Science
Center for Polymer Studies
Center for Psychiatric Rehabilitation
Center for Reliable Information Systems & Cyber Security
Center for Remote Sensing
Center for Research to Evaluate & Eliminate Dental Disparities
Center for Science & Medical Journalism
Center for Space Physics
Center for Subsurface Sensing & Imaging Systems
Center for the Study of Traumatic Encephalopathy
Center of Excellence for Learning in Education, Science & Technology
Center of Excellence in Sickle Cell Disease
Clinical & Translational Science Institute
Communication Research Center
Danielsen Institute Center for the Study of Religion & Psychology
Elie Wiesel Center for Judaic Studies
Framingham Heart Study
Fraunhofer Center for Manufacturing Innovation
Gerontology Center
Harold Goodglass Aphasia Research Center
Health & Disabilities Research Institute
Health Policy Institute
Hearing Research Center
Howard Gotlieb Archival Research Center
Human Resources Policy Institute
Institute for American Political History
Institute for Astrophysical Research
Institute for Economic Development
Institute for Geriatric Social Work
Institute for Leading in a Dynamic Economy
Institute for Philosophy & Religion
Institute for Sexual Medicine
Institute for Technology Entrepreneurship & Commercialization
Institute for the Advancement of the Social Sciences
Institute for the Classical Tradition
Institute for the Study of Muslim Societies & Civilizations
Institute of Jewish Law
Institute on Culture, Religion & World Affairs
International Center for East Asian Archaeology & Cultural History
International History Institute
Management of Variability Program
Memory Disorders Research Center
Morin Center for Banking & Financial Law
National Emerging Infectious Diseases Laboratories
NeuroMuscular Research Center
Pardee Center for the Study of the Longer-Range Future
Parkinson’s Disease & Movement Disorders Center
Partners in Health & Housing Prevention Research Center
Photonics Center
Prevention Research Center
Pulmonary Center
Science & Mathematics Education Center
Slone Epidemiology Center
Smart Lighting Engineering Research Center
Superfund Basic Research Program
Systems Research Center
Tanglewood Institute
Whitaker Cardiovascular Institute
Women’s Health Interdisciplinary Research Center

Students
16,340 undergraduate; 13,497 graduate; 2,720 non-degree

Faculty and Staff
2,896 full-time faculty; 1,282 part-time faculty; 5,103 full-time staff; 325 part-time staff

Campus
133 acres, 321 buildings; 487 classrooms; 2,022 laboratories; 11,546 total residence capacity

Computing Facilities
Supercomputers
IBM BlueGene/L supercomputer with 1,204 nodes
IBM pSeries 655 with 112 processors
IBM xSeries Linux cluster with 60 processors
IBM Blade Center Linux cluster with 272 processors

Specialized High-Performance Computer Laboratories
Deep Vision Display Wall
Access Grid Conference Facility
Computer Graphics Laboratory
LIVE: Laboratory for Virtual Environments

High-Performance Networking
Fiber Optic Metro Ring interconnecting Boston University, Harvard, and MIT
Northern Crossroads (NoX)
Internet2

Computing Labs
UNIX, Windows, and Macintosh labs
ResNet Computer Labs
More than 30 additional departmental computer laboratories

Libraries
23 libraries and special collections; 2.9 million volumes; 57,755 periodicals; 4.8 million microform units

Research
Sponsored Program Awards FY2010: $407.8 million

Financial Resources
Endowment: $1.02 billion
Total assets: $3.9 billion

Enrollment, staffing, and facilities figures as of Fall 2009.
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Here, There, and Everywhere

Poets, playwrights, and fiction writers set off in search of inspiration, supported by a new fellowship for international travel and study.

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