

# PENN

## ARTS & SCIENCES

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University of Pennsylvania School of Arts and Sciences

LENAPE HIDING IN  
PLAIN SIGHT

ROBERT GHRIST'S  
PARADISO OF MATH

PHILOSOPHER CRISTINA  
BICCHIERI ON LOSING  
THE TRUST GAME

# THE WORLD WANDERERS

MOLECULAR ANTHROPOLOGIST THEODORE SCHURR  
TRACKS THE GENETIC FOOTPRINTS OF HOMO SAPIENS





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### RESEARCH AND TEACHING

by Dean Rebecca W. Bushnell

My most recent book, *Tragedy: A Short Introduction*, is the fruit of more than 25 years of both thinking and teaching about tragedy. In the acknowledgements, I thank several generations of Penn students for bearing with my classroom musings and for sharing their own thoughts on the subject. We scholars always cite our sources, so I also wanted to credit my students for their contributions to this work, thus recognizing how my teaching informs and enriches the research I do.

One of the great privileges and pleasures of Penn is that you get to bring your research into the classroom. As a scholar, I always want to test new ideas to see if they make sense and if they matter. And my students will always let me know if they work.

If I teach a Greek tragedy that I've been reading and talking about for years, I'll usually pose some question I've been contemplating to get discussion started. Sometimes a student might come back with a different question, one that I never encountered. Other times a student may share a surprising observation about an image, a line or a character that stimulates a whole new way of understanding the text. Those are great moments. They inspire me as a teacher and a scholar.

That kind of unexpected thinking indicates the excellence of the students we recruit, but it also demonstrates the quality of learning that takes place in the School of Arts and Sciences. Our students learn from researchers who are pushing back the frontiers of knowledge in their fields. Students see firsthand the ongoing work of active scientists and scholars, and they have the opportunity to contribute to emerging ideas.

Physics professor Charlie Johnson was advisor to Sujit Datta, C'08, G'08, last year. According to Charlie, working with undergraduate researchers gives faculty the luxury of following up on "crazy" ideas and performing unusual experiments. The payoff came when they published four papers together exploring properties of graphene, one-atom thick sheets of graphite. Sujit was first author for two of the papers and received the LeRoy Apker Award, the

highest honor granted by the American Physical Society for undergraduate research.

Sometimes people complain about college professors who "take time away" from students by doing research. But I find that I'm a better teacher when I'm involved in writing a book, because I'm thinking, I'm asking questions and I'm energized by the adventure of discovery.

Last year Emma Dillon, an associate professor of music, won both the Ira Abrams and Lindback awards for distinguished teaching. Emma believes the line between research and teaching should be "fluid" and makes a point of bringing her scholarly projects into the classroom. She says it's important for students to see teachers struggling with materials, posing questions and wondering out loud about how and where to find the answers. It shows students that knowledge doesn't come prepackaged in a textbook. It comes from constantly asking questions, a habit that will benefit graduates throughout their lives.

David Karpf is a graduate student in political science whose dissertation probes how the Internet is enabling new forms of political association and participation. Jack Nagel, the Steven F. Goldstone Endowed Term Professor of

### I FIND THAT I'M A BETTER TEACHER WHEN I'M INVOLVED IN WRITING A BOOK.

Political Science, is his advisor. David says that close study and long discussions with his mentor have taught him how to be not just a student of politics but a political scientist. As for Jack—who might call himself an old dog who's been teaching since long before the advent of the Internet—he's learned a few new tricks about political blogs and the impact of the Web.

The creation and dissemination of knowledge—research and teaching—is the mission of the School of Arts and Sciences. Each informs the other, and together they make Penn a livelier and more productive place.

## ALL THINGS GREAT AND VERY, VERY SMALL

The field of particle physics was born with the discovery that atoms are not indestructible but rather consist of smaller subunits that may be isolated and controlled individually. Cosmology—the study of the origins of the universe—may be said to have begun with the startling revelation that there are many galaxies other than our own. Particle cosmology, the synthesis of these two fields, recognizes that many aspects of the early universe can be described with models of particle physics and vice versa.

With Penn positioned to be a major force in new interdisciplinary efforts in physics, the establishment of the Center for Particle Cosmology provides a crucial component needed to empower University researchers to advance our understanding of the universe. While a number of other top-flight institutions have strong groups in both physical cosmology and theoretical physics, Penn's recent investment in faculty who connect these two areas sets the University apart from many of its peers.

“The connection between particle physics and cosmology is becoming a deep and lasting one and is expected to be a frontier field in physics for decades to come,” says Mark Trodden, Professor of Physics and Astronomy and co-director of the center.

Recently recruited from Syracuse University, Trodden is an internationally recognized expert whose work includes the development of the modified gravity approach to cosmic acceleration, as well as approaches to dark matter and dark energy. Trodden joins center co-director Bhuvnesh Jain, an associate professor of physics and astronomy and a leading expert in gravitational lensing. The Center for Particle Cosmology's other members include Penn physicists Vijay Balasubramanian, Mirjam Cvetič, Burt Ovrut, Ravi Sheth, and new faculty recruit Justin Khoury.

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*For more information, visit [www.physics.upenn.edu/particlecosmo/](http://www.physics.upenn.edu/particlecosmo/).*

—BDS



BRENDA CASPER

## CLIMATE CHANGE IN MONGOLIA

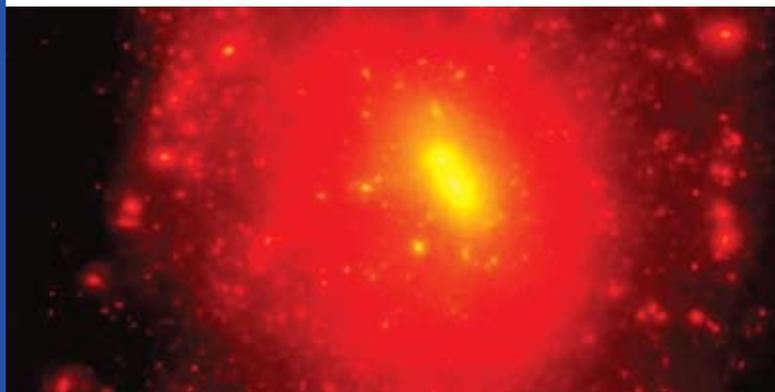
Last summer, a group of College students accompanied Professor of Biology Brenda Casper, Assistant Professor of Biology Brent Helliker, and Assistant Professor of Earth and Environmental Science Alain Plante to northern Mongolia. They went to study the ecological and evolutionary consequences of climate change in the Lake Hövsgöl region.

There, the researchers set up passive warming chambers that trapped infrared radiation and increased the temperature of the air and soil they contained. They also worked with the region's nomadic herders to see how the grazing patterns of livestock were affecting the area. Additionally, Helliker led a study examining oxygen isotopes in tree-core samples to reveal information on past temperatures in the area. Data from the fieldwork will help scientists predict the impact of future climate change on the area's plants and soil.

The excursion was part of a project funded by a \$2.5-million grant from Partnerships for International Research and Education (PIRE), a program of the National Science Foundation, which fosters cultural exchange between U.S. and foreign institutions by establishing models for international collaborative research and education. The field trip—the project's first—also included collaborators from the Academy of Natural Sciences in Philadelphia and faculty and students from the National University of Mongolia.

Biology professor Peter Petraitis, one of the project's principal investigators, says PIRE Mongolia “can help train Mongolian scientists and students to be international players in research, while giving our own undergraduates a firsthand appreciation of both scientific and cross-cultural fieldwork.”

—PR





## RASPUTIN HOMECOMING

Last October, at the Helikon Opera in Moscow, music professor Jay Reise sat with a Russian audience who watched a performance of *Rasputin*, the opera whose score and libretto he had composed. A cast of Russian superstars brought to life the two-act opera about the dramatic rise and fall of Russia’s “mad monk.” *Rasputin* was originally commissioned by Beverly Sills and the New York City Opera in 1988—the *Washington Times* called it “profoundly beautiful”—but the premiere at the Helikon was the composition’s first performance in the Russian language.

“Since high school, I have had an ongoing admiration for the richness and sophistication of Russian culture,” Reise says. “For me, it had a special meaning that the opera was done in Russian for its Moscow premiere, and I must say, I now prefer the Russian-language version.”

One of the sets for the Helikon staging used giant Fabergé eggs to illustrate the delicate world of the tsar and the royal family in contrast to the rough-hewn lives of the peasants and workers who overthrew the aristocracy in the Russian Revolution. The opera is based on historic events, but Reise says he relied more on the legend of Rasputin and his influence on the royal household to tell the story. In the final scene, the murder of the tsar and his family is accompanied by a raging Lenin (hatched from a Fabergé egg), a frenzied crowd and a climactic atonal score.

“History, politics and opera are taken very seriously in Russia,” Reise reports. “Tickets for the remaining four performances were sold out the morning after the premiere.”

—PN



## BEST BRAIN BUILDS BETTER MOLECULE

Associate Professor of Chemistry Jeffrey Bode was named one of *Discover* magazine's "50 Best Brains in Science, 2008" for developing a new way to build peptides—molecules formed by linking amino acids. This finding could improve the production of expensive peptide-based drugs, which include the diabetes medicine Byetta and the HIV treatment Fuzeon.

"In established methods of creating peptides, you have to string individual amino acids together, like pearls on a string," Bode explains. Because the reactions involved in these methods are highly sensitive, it is difficult to manufacture peptides with the length and purity required for use in pharmaceuticals. In addition, the chemicals needed for such reactions result in an enormous amount of waste.

Bode discovered a chemical reaction that creates amide bonds—the key linkage between amino acids—in a way that allows for the synthesis of smaller peptides into larger ones. The reaction is unique because it works in water, isn't sensitive to surrounding compounds and doesn't generate chemical byproducts. Beyond its potential benefits for pharmaceutical production, it may also be applied in the development of new biocompatible materials, with uses ranging from diagnostics to drug delivery to wound healing.

"One reason this finding has generated so much excitement is because it came out of very basic research, but it has immediate practical applications," says Bode, who came to Penn in 2007 from the University of California, Santa Barbara. "We had to take a step back and think about the fundamentals of how amide bonds are made. In the process we discovered something that, in the long run, will be much more powerful than what is out there now."

—PR

## LOOSENING THE SHACKLES OF CASTE

Penn's Center for the Advanced Study of India (CASI) is funding and designing the largest non-government study of economic gains made by India's Dalit caste. Dalits comprise about one-sixth of the country's population and historically have been at the bottom of the complex social hierarchy that constitutes the caste system. The research will help address one of the major challenges facing contemporary India—how to extend the benefits of its economic growth and development to this and other marginalized social groups.

A major component of the study is a qualitative survey, conducted in spring 2008, of 20,000 households in the Indian state of Uttar Pradesh. It was led by Chandra Bhan Prasad, a leading Dalit thinker and political commentator in India today. Prasad began his partnership with the center when he was invited to spend a year at Penn as part of the CASI Visiting Scholar/Fellows Program.

"Chandra Bhan Prasad has been at the forefront challenging conventional wisdom about the economic empowerment of Dalits, which has basically centered on state-led initiatives," says Devesh Kapur, director of CASI and Madan Lal Sobti Associate Professor for the Study of Contemporary India. "He believes modern technologies, capitalism and markets do more than the state to weaken the link between caste and occupation—a key mechanism by which caste is perpetuated."

The survey tests this theory by comparing a host of variables about the lives of Dalits in 1990—the year before India launched major efforts to liberalize its economy—and in 2008. CASI worked with Prasad and other Dalit scholars to design questions, and Prasad enlisted members of the Dalit community to administer the survey on the ground.

CASI researchers are currently analyzing the enormous volume of resulting data, but preliminary results show that Dalits reported significant positive changes in their lives. However, Kapur cautions, "We cannot yet attribute this improvement primarily to economic reforms because there have also been other simultaneous changes, such as major political empowerment of Dalits." And he explains that there is still a long way to go in countering the longtime marginalization of this community. But Kapur says, "From the survey, we can say confidently that the trend is positive."

—PR



CANDACE DI CARLO

## NEW FELS DIRECTOR A CIVIC CONNECTOR

David Thornburgh has been named the new executive director of the Fels Institute of Government. He succeeds Donald Kettl, the Robert A. Fox Leadership Professor of Political Science, who has returned to full-time research and teaching.

“With his deep and rich background in public finance, David Thornburgh stands in the rich tradition of Fels and its 70 years of leadership for results,” says Kettl of his successor. “He’s ideally positioned to help the institute take the next step in its history.”

Boasting a distinguished record of leadership and entrepreneurship in economic development and civic affairs, Thornburgh comes to Fels from the Econsult Corporation, a Philadelphia-based regional economic consulting firm, where he worked as a senior advisor. In 2006 through 2007, Thornburgh served as CEO of the Alliance for Regional Stewardship, a national best-practice network of public- and private-sector leaders committed to building globally competitive regions. He was also executive director of the Pennsylvania Economy League in Philadelphia from 1994

through 2006, and he served as director of the Wharton Small Business Development Center at Penn from 1988 through 1994.

“Fels has built a tremendous legacy of educating effective leaders for public service,” says Thornburgh. “At a time when our economic, environmental and social challenges demand thoughtful and energetic leadership, I expect Fels will play an even greater role in shaping public policy and management at the regional, national and international levels.”

Thornburgh holds a B.A. from Haverford College and a master’s degree in public policy from Harvard’s Kennedy School of Government. He is a frequent commentator on public policy and regional development issues and has been recognized by Leadership Philadelphia as one of the 101 most trusted and respected civic “connectors” in the area.

—BDS

## JUST REPRESENTATION

Established in 2007 with a start-up grant from the Andrew W. Mellon Foundation, the Penn Program on Democracy, Citizenship and Constitutionalism (DCC) kicked off its second year at the National Constitution Center with a panel discussion on this year's highly topical theme, Civic Representation, Elections and Public Opinion. The 2008–09 DCC workshop series and spring conference are dedicated to exploring the challenges facing those striving to achieve just, effective representation in modern electoral systems and representative bodies. Special attention is being paid to the roles of mainstream and emerging media. This year's DCC fellows include scholars pursuing research in multiple disciplinary areas, among them doctoral candidate Phillip Buckley, who for three years served in the U.S. Department of State English Language Fellowship Program teaching at law schools in Ukraine and Serbia. Georgia Kernell, this year's DCC postdoctoral fellow, is working on several projects examining institutions that regulate political-party diversity. In the spring she will teach a freshman seminar on comparative political parties and party systems.

—BDS



## THERAPY VS. MEDS

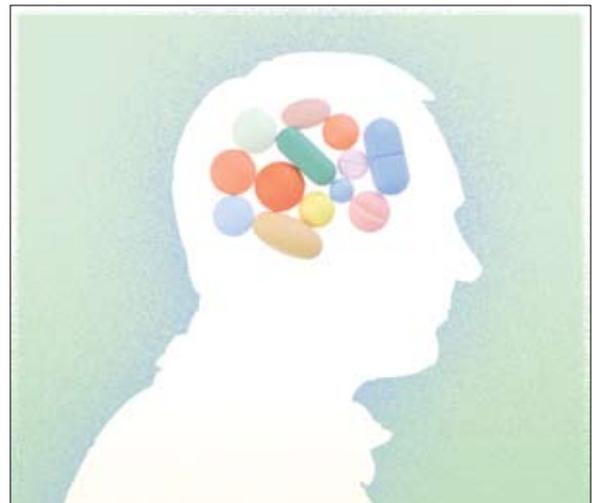
A groundbreaking study on the effects of cognitive therapy by Robert DeRubeis, Professor of Psychology and Associate Dean for the Social Sciences, and Steven Hollon at Vanderbilt University has continued to generate new findings since its initial publication in 2005.

Published in the *Archives of General Psychiatry*, the 2005 paper showed that cognitive therapy worked just as well as antidepressants in treating depression, challenging the American Psychiatric Association's guidelines that antidepressant medications are the only effective treatment for moderately to severely depressed patients. It found also that cognitive therapy was more effective than medication at preventing relapses after the end of treatment.

The study, involving 240 patients with moderate to severe depression, was the largest trial to date on the subject. "Because it was such a big study," DeRubeis says, "we have lots of very interesting data on a range of variables." As a result, several papers have subsequently been published on different aspects of these data.

Penn psychology doctoral student Yan Leykin, along with DeRubeis and a team of researchers, explored the difference in how patients with zero, little or extensive experience with

antidepressant medication responded to cognitive therapy and medication. Their findings, published in 2007 in the *Journal of Consulting and Clinical Psychology*, revealed that although the two treatments are equally effective in patients who have taken medications for little or no time, cognitive therapy is significantly more effective in patients who have tried medications extensively.



In a paper published this year in the *British Journal of Psychiatry*, Jay Fournier, also a Penn psychology doctoral student, and DeRubeis found that medication was more effective for depressed patients with personality disorders and that cognitive therapy was more effective for those with depression alone. And, currently under review for publication at the *Journal of Consulting and Clinical Psychology*, is research that finds that cognitive therapy is more effective than antidepressants for those who are married or cohabiting and for those who are unemployed.

“These findings certainly have practical implications in terms of treatment,” DeRubeis says. “But from a theoretical standpoint, we have to ask ourselves as scientists, what is it about the match between the medication and therapy and these variables that makes them effective or ineffective treatments?”

—PR

More details on DeRubeis’ research can be found at [www.sas.upenn.edu/derubeis](http://www.sas.upenn.edu/derubeis).



## METTLE YIELDS MEDAL

Penn physicist Fay Ajzenberg-Selove was among eight recipients of the 2007 National Medal of Science at a White House ceremony on September 29, 2008. Ajzenberg-Selove, a professor emerita who came to Penn in 1970, spent decades contributing to significant advances in the field of nuclear physics. Her principal work on understanding light nuclei—the elements of stars—is considered a global reference.

Born of Russian ancestry in Berlin, Ajzenberg-Selove fled Europe with her family during World War II, arriving in the United States when she was 15 years old. She received

her bachelor’s degree in engineering physics in 1946 and her doctorate in physics in 1952. A pioneer in a male-dominated field, Ajzenberg-Selove was often the only female in her undergraduate and graduate classes, going on to become the first female physics instructor and researcher many institutions had ever seen, including the California Institute of Technology, Columbia University and Haverford College.

—BDS

# THE UNEASY TRANSITION FROM CAMPAIGNING TO GOVERNING

BY DONALD F. KETTL



MATTHEW LEAKE / PHOTOJASSON

Whew! The presidential-election campaign that seemed like it would never end changed overnight into the most difficult presidential transition since Franklin D. Roosevelt. Barack Obama championed “change,” but he comes to office without having built support in the campaign for the tough policies he’s going to have to manage.

This campaign’s “October surprise” came in September, with the financial meltdown. In the closing weeks of the campaign, the candidate knew—even though he could not admit it—that the promises he had been making for almost two years had been knocked out the window. In fact, the easiest job in Washington in the days after the election was giving the president-elect his first budget briefing: “Congratulations, Mr. President-Elect. Here’s the picture—there’s no money.”

Everyone wants the Iraqi war to end, but the country can’t walk away. Everyone now realizes that the Afghan war is going to prove far more difficult than defense planners had hoped. And most importantly, the financial crisis is going to demand the president’s sustained attention for at least the first two years of the Obama administration.

How can President Obama push aside his campaign’s promises for tax cuts and health reform without breaking voters’ hearts? Voters’ expectations for change are high. They’re sure to get change but maybe not what they had in mind. Righting the economy is job one, but it’s going to be a slow and tough and incredibly complex job.

The financial crisis wasn’t just a Wall Street or even a Main Street problem. As whole countries from Iceland to Pakistan teetered on the edge of bankruptcy, we quickly learned that

the problem was global. The solutions will require redefining government's role in the private sector, and they will need to be international in scope to avoid creating new cracks that further undermine the economy.

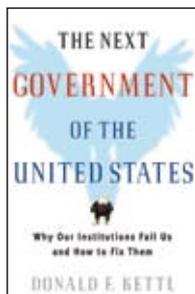
How can President Obama lead the search for a global plan without leaving Main Street Americans feeling neglected? And how can he cobble together a plan to stimulate the economy without turning the federal budget into an ATM on steroids? It cost almost \$150 billion in tax breaks to ram the \$700 billion bailout through Congress. With dollars spilling dizzily out of the treasury, what's a few billion more here or there for everyone's favorite pork? We need a big stimulus plan and we need it fast, but the new president will need to do it in a way that doesn't push the government even deeper into long-term creditcardaholism.

Perhaps most importantly, President Obama promised vision and collaboration, at home and abroad. But crisis management is hard to steer through partnership. How can he allow the important players to share in decisions while maintaining a firm hand on the steering wheel?

The new president never got a chance for a honeymoon. He had to manage the transition without taking a breather or rocking the Bush administration's boat too much. He had to push the campaign promises aside without upsetting his supporters. And now he faces the most fundamental redefinition of government's role in more than 75 years.

Deep down, most Americans knew that neither candidate was going to be able to follow through on all the promises being made. We were really trying on each candidate's style to see how confident we felt about letting him steer a course into a storm of fierce new problems where no one really understands the questions, let alone the answers. We're about to find out whether President Obama can hold a true and steady course in the economic storm that has overtaken us.

*Donald F. Kettl is the Robert A. Fox Leadership Professor of Political Science.*



#### **It's Just Rocket Science**

When they launch rockets, Kettl observes, rocket scientists "figure out what they're trying to accomplish, pull together the people needed to do the job, focus them on the objective, give them what they need, and hold them accountable for the results. And that, it turns out, is the key to effective government."



## HISTORY RISING FROM THE RUINS

A doctoral student in Art and Archaeology of the Mediterranean World, Stephan Zink has spent the past four summers conducting fieldwork on-site at what remains of the Temple of Apollo on Rome's Palatine Hill. Built by Augustus and dedicated in 28 B.C., it is considered by many to be the most personal building project of the Roman Empire's first emperor.

What would become Zink's dissertation topic—an architectural case study of the temple, including a reconstruction of its ground plan and elevation—began with a request from his advisor. Lothar Haselberger, the Morris Russell and Josephine Chidsey Williams Professor of Roman Architecture, asked Zink to measure a single column-drum fragment to resolve contradictory documentation dating from the 1950s and '60s. "Once I was in the field," Zink explains, "things developed their own dynamic. I realized that the temple remains showed much more potential than anyone had thought."

He studied and documented in architectural-scale drawings both the temple's surviving marble fragments and its foundations. Using key measurements he was then able to create a 3-D model. According to Zink, his reconstruction will enable scholars for the first time to conclusively classify the temple's design.

"In comparison with Augustus' other temples in Rome, this building follows a kind of historicizing design," Zink explains. "It was meant to be an ostentatious recourse to earlier architectural traditions."

Having completed documenting the temple's surviving marble fragments, Zink has secured permission to produce a plan of the entire ruin, which he expects will generate new information on the temple's interior organization.

*To view a slide-show essay on Zink's research, visit [www.sas.upenn.edu/zink](http://www.sas.upenn.edu/zink).*

A close-up portrait of a woman with short, curly, light brown hair. She is wearing a dark, high-necked turtleneck sweater. The lighting is dramatic, coming from the side, highlighting her face and hair against a dark background. She has a serious, contemplative expression.

# LOSING THE TRUST

*Cristina Bicchieri is the Carol and Michael Lowenstein Endowed Term Professor of Philosophy and Legal Studies and director of the Philosophy, Politics and Economics program.*



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## PHILOSOPHER CRISTINA BICCHIERI WEIGHS IN ON AMERICA'S CRISIS OF CONFIDENCE

BY B. DAVIN STENGEL

PHOTOS BY JON PERLMUTTER

At the blurred borders between philosophy, game theory and psychology, Professor Cristina Bicchieri conducts experiments to better understand how individuals behave with regard to social norms that promote collective benefits over personal gains. “Fairness, trustworthiness, cooperation—these are all pro-social norms,” she explains. “The big question is, what makes people follow them?”

Based on a theory developed in her recent book, *The Grammar of Society: The Nature and Dynamics of Social Norms*, Bicchieri has been testing several hypotheses about how expectations affect behavior. One conclusion she has drawn is that there are no stable character dispositions to be fair or cooperative. Rather, Bicchieri has found that manipulating expectations can cause major behavioral changes—from fair to unfair choices or from cooperation to defection. “Most subjects have conditional preferences for following pro-social norms,” she says. “Policymakers who want to induce pro-social behavior have to work on changing people’s expectations.”

Having studied the dynamics that underlie social crises, Bicchieri is well equipped to analyze the crisis of confidence that has dominated headlines since Lehman Brothers declared bankruptcy in September. In her view, the extent to which a society is characterized by trusting behaviors hinges in large part on expectations of conformity to reciprocity norms. “When you deposit your money in a bank, you trust the bank not to fail. When you vote, you trust the system to be fair and efficient. This is what we call ‘impersonal trust,’” she explains. “Reciprocating trust means doing what you are expected to do—following the agreed upon rules.” When these implicit agreements fail, she warns, societies may face systemic collapse.

# GAME?

**Q: As the likelihood of a long recession increases, Americans are experiencing a serious crisis of confidence—in financial institutions especially, but also in government and leadership. When trust is lost on such a large scale, how can it be re-established?**

**Bicchieri:** One very interesting question that social scientists have asked over and over is how can impersonal trust be created? Some have said that impersonal trust is an extension of personal trust, that when you have a society in which there is strong social capital and a lot of personal trust among individuals, this trust is then transferred to the public sphere. But we have much evidence that this is not the case.

There was a wonderful book written by Edward Banfield in 1958 called *The Moral Basis of a Backward Society*, about a small village in Southern Italy. What the book showed was that there was a lot of trust within small groups, mainly immediate family and close relatives, but this did not translate into public trust. In fact, citizen involvement in public life was nonexistent. These villagers had a complete mistrust in public institutions. This is an extreme example,

**PUBLIC TRUST IS A CULTURAL PHENOMENON THAT TAKES A LONG TIME TO EMERGE, AND AS WE'RE SEEING NOW, IT CAN BE VERY FRAGILE.**

of course, but there is no reason to believe that close-knit relationships can export trust to the public sphere. Public trust is a cultural phenomenon that takes a long time to emerge, and as we're seeing now, it can be very fragile.

I have done several computer simulations of the evolution of impersonal trust, and what they show is that impersonal trust can only survive in a society of punishers; that is, if a society includes a majority of people who punish those who do not reciprocate, then trust and reciprocation will be quite common. In terms of what's happening now in the United States, the lesson may be that people must be sure that somebody will be punished. Americans who are facing foreclosures or shrinking 401(k)s feel very bad when they hear their government saying that they don't really know what happened, that they are bailing everybody out and so on. There is a lot of fear and anger, and I think in cases like

this a good way to rebuild confidence is through a big show of punishment of those individuals who violated public trust.

**Q: So when politicians and others talk about ushering in a new era of accountability, they should also be talking about ushering in a new era of punishment?**

**Bicchieri:** Well, accountability certainly means that you have to be responsible and transparent in your choices, and if you make a wrong choice, you pay for that. This happens in many areas of life, and I don't see why it shouldn't happen in managing money—especially other people's money. So I think that the connection is there.

What I show in a joint paper called "Trust Among Strangers" is that a minority of purely moral people who always trust and always reciprocate can only survive if there are a lot of punishers around. These good souls would be wiped out otherwise. So, for trust to survive, you need a majority of punishers, and in many situations where trust is violated, somebody has to pay a price.

**Q: Regarding the government bailout of the financial system, many Americans have been saying that it's not fair—this idea of Wall Street investors privatizing gains and socializing losses. How does fairness factor into rebuilding impersonal trust?**

**Bicchieri:** Fairness, or at least an aversion to unfair outcomes, is a very common motive. People care about fair outcomes and fair procedures, at least when focused on them. You see this experimentally. When people get focused on fairness norms, they behave in a fair, equitable way and expect others to be fair as well. However, manipulating the information subjects receive changes behavior quite radically. If people get focused away from fairness, they care much less.

What's happening now is we're all focusing on fairness because we see these major financial institutions falling down. Workers are getting laid off; they see their retirement savings dwindling. This is dire news for all of us. People are worried, and when you are dominated by anger and fear, it is very important that you find a culprit. Who's the bad guy? It's very easy now to find a bad guy, because you can say that the top managers of these big firms were living a lavish lifestyle, getting huge bonuses and so on. This was well known five years ago, but people were not focusing on it then.



You have to understand that fear and anger immediately lead people to focus on how unfair the system is. They may forget all of this in good times. You see something similar happening experimentally. For example, if participants in an experiment are in a position where they have to share money, but there is no retaliation for not giving away much of it—or if it is felt that the receivers do not expect

the right course again.’ It is important that change comes from below. And while the demand for more transparency, for regulation, is an important one, there is always a balance between regulation and efficiency. Certain over-regulated markets may not function as well, but this is a balance that we expect our politicians and top economists to understand. I think that a demand for greater accountability and transparency must come from the public, and the political system should respond to it.

## FOR TRUST TO SURVIVE, YOU NEED A MAJORITY OF PUNISHERS, AND IN MANY SITUATIONS WHERE TRUST IS VIOLATED, SOMEBODY HAS TO PAY A PRICE.

much—the participants will be more reluctant to share in a fair way. Moreover, receivers who are treated unfairly will not care much if they expected little, or if they are focused away from a fair share. This is not to say that government should lie or manipulate information. What government should urgently do now is strengthen the rules and rebuild trust in the system.

**Q: Do you see what’s happening now as being “game-changing” in terms of how Americans think about transparency and regulation of financial institutions?**

**Bicchieri:** For something to really change, people have to push for change. There is a lot of sluggishness in any system, and once things resume functioning reasonably well, people may forget and say, ‘Okay, it was a blip, but now we are on

**Q: Do you think that a demand for greater accountability and transparency entails a public responsibility to better understand economic issues?**

**Bicchieri:** I certainly think it’s the public’s responsibility to be informed. But many derivatives, such as credit-default swaps, are very difficult to understand, even for the people who trade them. These are very complex financial instruments. So the problem is, if an investing firm has difficulty, say, disentangling big packages of mortgages where each mortgage may be cut in many pieces and sold in different packages, you don’t expect the ordinary investor to be able to do that.

What the public should be demanding is better regulation, for example, of hedge funds, trading, investment banks, et cetera. What’s happening now is that many investment banks like Goldman Sachs are merging with commercial banks, and thus they will be regulated by default. But I don’t think that the average American is going to spend much time trying to understand these things. What they should do is demand their government to be watchful. Greater transparency just may mean that whoever wants to be informed may have more information at hand, but I doubt that there will be many people who will take advantage of that. ♦



*A Lenape fan made of beads, deerskin and feathers rests in the hands of Shelley DePaul, director of the Language Program for the Lenape Nation of Pennsylvania and a co-curator of the new exhibition Fulfilling a Prophecy: The Past and Present of the Lenape in Pennsylvania. The fan, a recent gift to Ms. DePaul, is rich in Lenape symbolism. It is one of about 60 objects borrowed from local Lenape people for the new exhibition, which opened at the Penn Museum with a public celebration on September 13, 2008.*

# HIDING IN PLAIN SIGHT

## SENIOR ABIGAIL SELDIN TELLS THE UNTOLD HISTORY OF THE PENNSYLVANIA LENAPE

BY PRIYA RATNESHWAR

PHOTOS BY LAUREN HANSEN-FLASCHEN

Conshohocken, Manayunk, Wissahickon—these and many other appellations throughout Philadelphia mark the city’s location in Lenapehocking, the Lenape homelands. Members of this Native American tribe once inhabited an area stretching from Delaware to Connecticut until colonists pushed them off their lands and drove them westward. Conventional histories of Pennsylvania claim that all but a few elderly Lenape people left the state by the beginning of the 19th century, but anthropology major and recent Rhodes Scholarship winner Abigail Seldin, C’09, G’09, has devoted nearly three years of her Penn experience to correcting this “official” story.

Seldin’s research culminated in *Fulfilling a Prophecy: The Past and the Present of the Lenape in Pennsylvania*—the first exhibition at the Penn Museum to be curated by an undergraduate. The genesis of the exhibition, which opened last fall and will run through September, was a project Seldin undertook as a sophomore in a National Science Foundation undergraduate research program operated by the Penn Museum. She initially planned to develop a small exhibition that broadly treated the trek of the Lenape from Pennsylvania to their current locations in a number of Western and Midwestern states and in Canada. But Seldin’s plans changed drastically when her advisor, anthropology professor and Penn Museum curator Robert Preucel, invited her to accompany museum personnel in lending a traditional paddle to the Lenape Nation of Pennsylvania at a

maple ceremony in the Pocono Mountains. The opportunity revealed to her a community—and a history—she had not known existed.

Facing persecution, Seldin learned, Lenape who did not leave the region “hid in plain sight.” Many married European settlers and appeared to assimilate, but in private they maintained their language, as well as their cultural and religious practices. For the past 200 years, successive generations have been upholding these traditions in secret, fearing discrimination. Seldin found that in the past two decades, however, the community has been moving toward making its existence public, motivated in part by a strong commitment to promoting better environmental stewardship of the Lenapehocking.



*Traditional Lenape corn husk dolls. Dolls play an important role in Lenape culture, both as children's toys and ceremonial objects.*

“Meeting these people and hearing their story, which is a magnificent story of cultural survival in the face of unconquerable odds, really made me want to redirect the project to being about the Lenape in Pennsylvania in particular,” Seldin says.

Seldin invited Chief Robert Red Hawk Ruth of the Lenape Nation of Pennsylvania and former tribal secretary Shelley DePaul to co-curate the exhibit. Their participation, Seldin explains, puts *Fulfilling a Prophecy* on the cutting

edge of museum practices in anthropology. “This level of collaboration between an anthropologist and Native American representatives is really unusual in the United States,” she says. “I think it points to the progressiveness of Penn and the museum. They’re willing to make a stand that we will not perpetuate colonialist structures that treat people as unworthy of telling their own histories.”

In the process of learning about Lenape culture from her co-curators, Seldin wound up sharing her own. For her first meeting with Ruth and DePaul, which took place just before the Jewish holiday of Purim, she baked hamantaschen. “It was an all-day meeting, and it occurred to me that it would be really good to have some snacks around,” she says. “But it turned out beautifully because after talking about symbolism in the collections for three hours, Shelley started nibbling on a hamantasch and asked if there was significance to the triangular shape. So, I told them about Purim and how I’d grown up with this story and how this was part of my culture. I think the fact that I had such a strong cultural identity made it much easier for them to trust that I would be respectful of theirs, rather than if I were looking at it like a scientist through a microscope.”

This trust, Seldin believes, helped foster Lenape participation in the exhibition. Fulfilling a Prophecy draws not only from archaeological, historical and ethnographic research but also relies on oral histories, photographs and a number of family heirlooms—rich with hidden symbolism—

## RHODES SCHOLAR



This fall, Abigail Seldin will continue the research inspired by her work on *Fulfilling a Prophecy* as a Rhodes Scholar at the University of Oxford. One of just 32 students from across the nation to receive a prestigious 2009 Rhodes Scholarship, Seldin plans to study

anthropology at Oxford’s Institute of Social and Cultural Anthropology.

Harriet Joseph, director of the Center for Undergraduate Research and Fellowships (CURF) at Penn, encouraged Seldin to apply for the scholarship. “Abby has a knack for the practice of research,” Joseph says. “She is a spectacularly intelligent young woman, and I am certain that the Rhodes will be only the first step in her career after Penn.”

Seldin became involved with CURF during her freshman year, when she successfully became a University Scholar. She says the University Scholars

program, which mentors and helps fund undergraduate research, is one of many opportunities she received from Penn to pursue her passion for anthropology. “The Lenape exhibit is a project I could only have done at Penn because of all of the support that’s given to undergraduate research here,” she says. “It has defined my student experience and given me a mission.”

At Oxford, Seldin hopes to further her mission by exploring “how museums can be venues for civic discourse, and how they can inspire tolerance and become centers for discussions about human rights.”

—PR

# HIDING IN PLAIN SIGHT

to represent a cultural past that is very much “alive and personal.” One display, for example, is a handmade quilt with one square missing—seemingly a simple mistake. But to the Lenape, who embed an ‘error’ in all their crafts, it is a purposeful sign of spiritual humility.

Seldin was especially gratified that those who contributed objects were able to benefit from the museum’s preservation practices. “Many of these pieces had been kept for 200 years in a closet or under a bed,” she says. “The museum’s conservation department has to stabilize everything that goes on display, and lots of people were ready to give us their entire collections to be stabilized because these things are so precious.”

Such personal contributions, Seldin explains, are essential to *Fulfilling a Prophecy’s* goal of reintroducing the Lenape to the local community and recognizing their place in it. The exhibition’s title refers to the Lenape Prophecy of the Fourth Crow, which they believe represents their history from pre-contact with colonists to the present day. Ruth summarizes, “We now know that the First Crow was the Lenape before the coming of the Europeans. The Second Crow symbolized the death and destruction of our culture. The Third Crow was our people going underground and hiding. The Fourth Crow was the Lenape becoming caretakers again and working with everybody to restore this land.” Seldin says that many Pennsylvania Lenape view the exhibition as an important step toward fulfilling the final part of this prophecy.

In addition to serving as a case study for involving Native Americans in the curatorial process, another primary academic goal of the exhibition is to ensure that the story of the Lenape in Pennsylvania is written into history. To that end Seldin and Ruth are co-authoring a companion book that will be published by Penn Museum Publications. “It’s really important that this book will be published by a respected academic publisher,” Seldin says. “It’ll be a really nice counterpoint to the last 200 years of written history, which says that this community doesn’t exist.”

The public’s embrace of *Fulfilling a Prophecy* has far exceeded Seldin’s expectations. More than a thousand visitors attended the exhibition’s opening, and Seldin learned that a *Philadelphia Inquirer* piece on the exhibition received hundreds of responses within a few hours of publication.



*Chief Robert Red Hawk Ruth, Shelley DePaul and Abigail Seldin take a look at some of the Lenape objects in the Penn Museum’s collections storage.*

A wall at the exhibition is covered in notes bearing departing thoughts from visitors, and Seldin has memorized her favorite. It reads, “When I was a child in Reading [PA], I had always hoped to meet a Lenape Indian. Maybe I did, and I never knew.”

Seldin comments, “I think this kind of response shows that people really understand that this is a history of their land—the land that they’ve been living on.” ♦





# ROBERT GHRIST'S PARADISO OF MATH

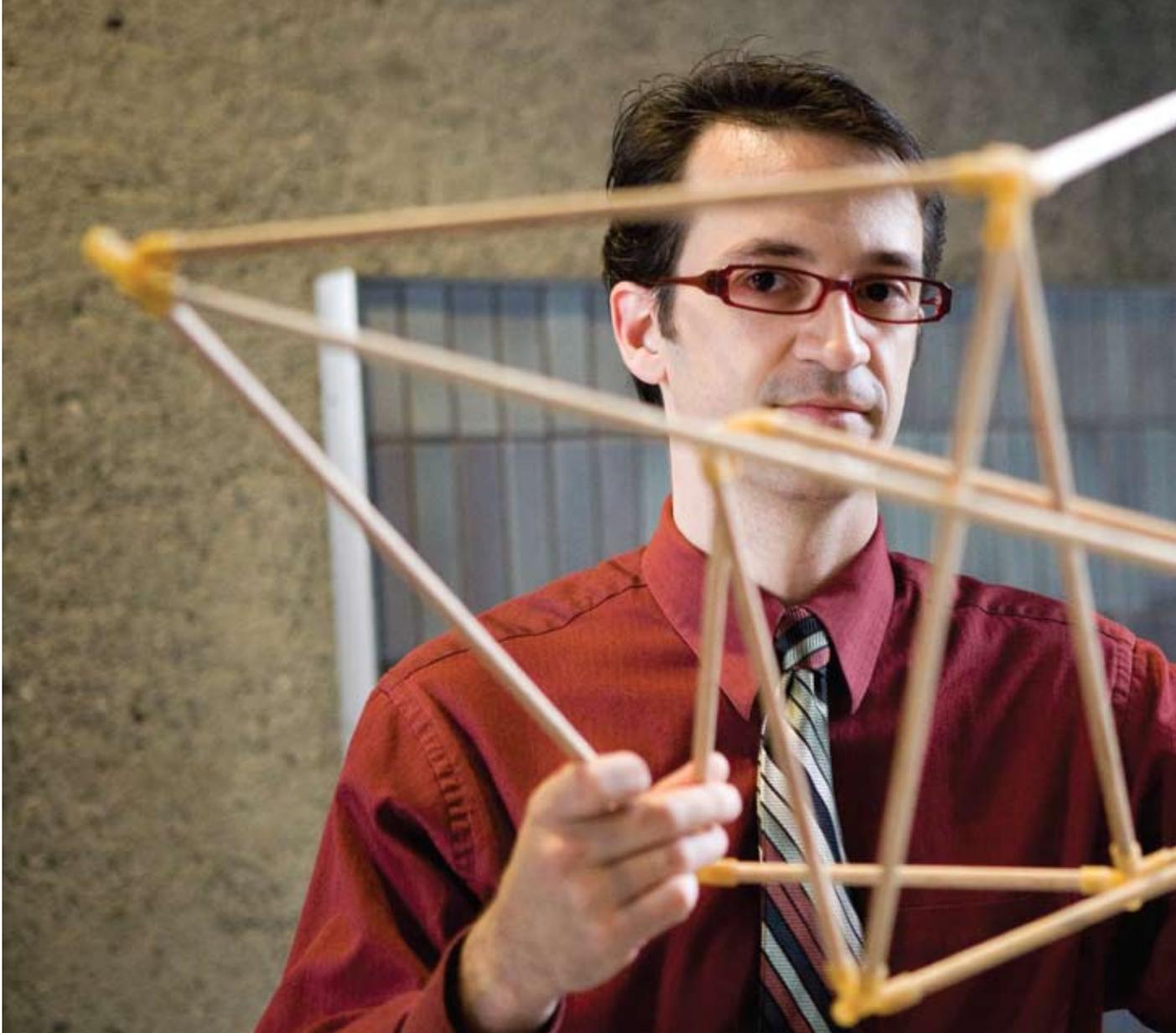
MAPPING OUT DIMENSIONS  
OF ABSTRACT SPACES

BY ANGELA CONNER

PHOTOS BY GREGORY BENSON

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Scientists often talk about the elegance of formulas and equations. If you're not a scientist, you're likely to meet that particular enthusiasm with a blank stare. Yet you don't have to play a musical instrument or read a musical score to appreciate the beauty of a Beethoven sonata. This is one thing Robert Ghrist might like you to remember.



Ghrist joined Penn last summer as the Andrea Mitchell University Professor—the seventh Penn Integrates Knowledge Professor—and holds a joint appointment in the Department of Mathematics in the School of Arts and Sciences and in the School of Engineering and Applied Science. He’s also a self-described amateur medievalist and is particularly fond of—some might say inspired by—Dante’s *Divine Comedy*.

Let’s talk about that for a moment. Most of us read Dante in college, perhaps even in high school, and were no doubt titillated by the *Inferno*’s creatively gory punishments, meted out to fit various sins. If we were so inclined, we may have enjoyed the poetry of the piece, and with a good guide we may have glimpsed the structure of the thing as a whole. But to truly appreciate the cosmology of Dante’s world, one has to not only take apart the meticulous scaffolding that holds the whole thing together, but also delve into the complex allegories behind each image, the layering of meanings

added together like a set of equations to represent what can’t be easily represented.

This is not unlike the work Ghrist undertakes. “A mathematician is an engine for finding patterns,” he says, and much of his current work is aimed at mapping out patterns in multi-dimensional abstract spaces that are much more difficult for us to visualize than Dante’s concentric spheres. It’s not hard to think in three dimensions, but fifteen, say, proves impossible. Not for a mathematician.

Suppose you were a bug living on the surface of a cardboard box. Locally, you would have two dimensions in which to move. But suppose you are an ambitious bug, and you want to know the shape of your cardboard cosmos. Is it a simple six-sided box? Or something more complex, a box with smaller boxes attached and a hole or two to crawl around in. You would have to make long excursions along your “globe,” experiencing more dimensions than you’re capable of keeping in your head, and return to your starting point to try to make sense of it all.



## PARADISO OF MATH

his neighborhood, but how can he and his friends be sure they're covering the entire box? Similarly, think about a group of robots working to assemble a car. The path of a robot's arm as it completes a task maps out an abstract many-dimensional space. Each sensor in its arm keeps track of local movements, but all the sensors in every robot need to coordinate globally to keep them from crashing into each other.

These are the problems Ghrist is solving. Using topology, a branch of math that grew out of geometry a hundred years ago, Ghrist is taking apart the complex shapes these networks form, "visualizing" with algebra and calculus what we can't see with our eyes, and putting them back together again to form a global picture of an environment. Once the global rendering is complete, engineers can use that information to discern if there are holes in a sensor network and where they are. They can keep robots from colliding.

**"MATHEMATICIANS HAVE DONE AN AMAZING JOB OF BUILDING VERY RARIFIED MACHINERY THAT'S EVEN HARDER TO READ THAN THE *DIVINE COMEDY*."**

Ghrist is evangelical about the utility of mathematics. He believes that the tools that have been around for 100 years to study abstract objects and spaces have a surprising amount of relevance to solving very practical, contemporary problems. Opening a math book full of topology tools called sheaf-theory equations, most of us would groan at the seeming senselessness of what's on the page. Even those with quite a bit of education in engineering or applied science might have the same reaction, since, as Ghrist says, "mathematicians have done an amazing job of building very rarified machinery that's even harder to read than the *Divine Comedy*." But in these books, he finds tools that he can translate into a real-world engineering language. "I'm really optimistic," he says, "when I see how many math books there are that are hard to read because that means there's valuable stuff there that hasn't yet been converted to a language that's more useful."

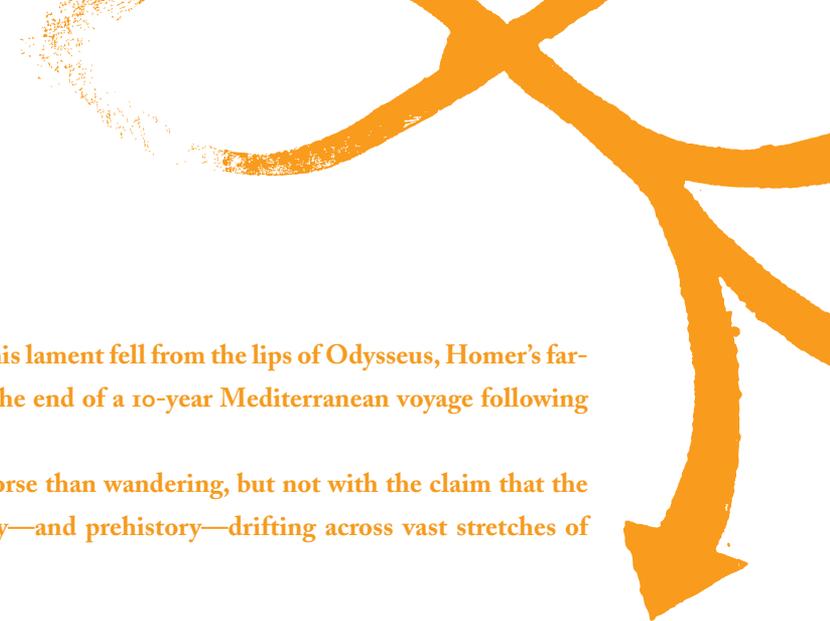
Some of today's most pressing problems in engineering are being solved because Ghrist enjoys delving into the hard books. "I think if Dante were around today," he says, "he'd be delighted to know all the things that we've discovered about life and about the universe. And it would be delightful to see what kind of structure he would append to his cosmology, given our increased understanding of the world." You can bet Ghrist would like to map out that structure. ♦

Increasingly, we are navigating similarly complex spaces. Think about when you surf the Internet. You begin at a specific site and move from site to site, hopping all over cyberspace. What does the shape of that space look like?

Ghrist thinks about these complex spaces, but his work is not just theoretical. As an applied mathematician, he says, "the particular style of what I try to do is take mathematical ideas that haven't found much application in the past and find a use for them." A lot of tools have been developed to study these abstract sorts of objects and Ghrist is finding them relevant to very practical problems in today's world.

Much of his current work involves sensors and their networks. Increasingly, our world is populated with these sensors: as a means to monitor security, to track forest fires or wildlife, to control the movements of robots on a factory floor. It's these moving sensors that Ghrist focuses on. Imagine them as many bugs on that complicated cardboard box. Each little bug gathers his local data while moving about





**“[F]or mortals, nothing is worse than wandering.” This lament fell from the lips of Odysseus, Homer’s far-wandering, homeward-yearning hero who was near the end of a 10-year Mediterranean voyage following the Trojan War.**

**One could perhaps argue about what might be worse than wandering, but not with the claim that the human species has spent much of its restless history—and prehistory—drifting across vast stretches of forests and seas, treeless plains and blue ice fields.**

Wandering is a basic motif of the human condition and a fact, well-established by science, of the human adventure. *Homo sapiens* as *Homo viator*. For better or for worse, the long-term, big-picture view is that we are a tribe of nomads—at home nowhere and ceaselessly on the way to someplace else. It’s even written in our genes.

Genetics is usually thought of as a future-gazing science, a body of knowledge that holds the promise of wonder drugs and miracle cures to come. But DNA is also a book of history. Our DNA tells us that today’s humans are the descendants of ancestors who set out from Africa 70,000 years ago on a long migration that spanned the Earth. No matter where we call home today, all 6.7 billion of us are the children of primeval parents who—2,000 generations back—wandered out of Africa. As groups of humans moved into different corners and continents of the globe, distinct mutations accumulated in the DNA of different populations. For those who know how to read it, the genetic alphabet tells the story of humankind’s long wanderings.

Theodore Schurr is a molecular anthropologist, one of a new breed of cross-disciplinary scholar-scientists who combine ethnographic and archeological fieldwork with laboratory research. An associate professor of anthropology, Schurr is consulting curator in the Physical Anthropology and American Sections at Penn’s Museum of Archaeology and Anthropology. He also directs the Laboratory of Molecular Biology, housed in the biology department’s Goddard Labs, where DNA samples he collects in the field are analyzed. Schurr is in the business of tracing back in time the migrations of existing and extinct peoples and the links among various tribes, clans and other groupings by interpreting inherited genetic “markers,” combined with archaeological clues left behind by a community’s culture.

“Molecular anthropology emerged maybe 20 years ago,” he explains, “with the realization that researchers could use genetics to understand kinship, migration and even the origins of primates and humans.” It’s a science of movement and ancestry and connection.

Every time a human is conceived, the genetic alphabet of parents and all their forebears gets copied, shuffled and recombined to create a new and unique person. The transaction involves billions of moving molecular parts. When genes replicate, ‘mistakes’ or random mutations—the variation that drives evolution—sometimes go uncorrected. These additions, deletions or repeats in the gene code get replicated and transmitted down a lineage of descendants. The genetic stuff in the Y chromosome, which sons inherit from fathers, and mitochondrial DNA, which all children inherit from their mothers, does not get recombined with the genes of the other parent but is passed down almost unchanged. That base of stability makes these paternal or maternal lineages ideal for following markers in the code as they move along the genealogical forks and branches of a family tree.

“By looking at genetic markers in the mitochondrial DNA and the Y chromosome,” Schurr explains, “we’re able to track the historical changes in the branches of the genealogies that connect all women and all men in the world.” Finding common biological markers in seemingly unrelated populations on different continents, for instance, points to an earlier connection between the two groups. And the appearance and transmission of new markers in a lineage can pinpoint a period of time in a population’s history. Many mutations in mitochondrial DNA correlate with geographic regions where they first occurred, providing clues for the reconstruction of ancient migration patterns based on the distribution of these mutations in a population.

As often happens, new technologies give scientists innovative tools to answer old questions. “The stories molecular anthropologists tell are ones that are very, very old,” Schurr comments. “They’re part of the narrative we all share but talk about in non-genetic ways: Where do I come from? Who am I related to? What do I share with people across the valley?” He is currently working to answer these and other questions regarding the peoples of North America. Where did the original settlers, whom we call “indigenous,”

come from? How long ago did they arrive? And how did they spread across the continent? The answers, in order, are southern Siberia and Mongolia about 15,000 to 20,000 years ago by crossing the Bering Land Bridge and wandering down the American continents along coastal migration routes.

Schurr has the answers at his fingertips because he's been studying genetic variations in Asian, Siberian and Native American populations for the last 20 years. He currently heads up the North American Regional Center

**FOR BETTER OR FOR WORSE, THE LONG-TERM, BIG-PICTURE VIEW IS THAT WE ARE A TRIBE OF NOMADS—AT HOME NOWHERE AND CEASELESSLY ON THE WAY TO SOMEPLACE ELSE.**

of the Genographic Project. The five-year, \$40-million undertaking, begun in 2005, is an ambitious voyage of discovery, encompassing 11 regions, hundreds of thousands of DNA samples (mostly cheek swabs) and thousands of scientists from around the world. Primary funding comes

from National Geographic and IBM. The research venture uses front-line gene-science technology and computational equipment to analyze historical patterns of DNA collected from the world's population, with a strong emphasis on indigenous and traditional peoples.

Populations that have remained relatively isolated for long periods provide a clear geographic context for making more reliable inferences about the genetic patterns of ancestry and inheritance. If a group remains in one place, so does its genes, whose unique markers can be identified and tracked when they get passed on to other groups. Once these closed-off tribes enter into the world's genetic melting pot, the geographic context and genetic trail become muddled, so the project has prioritized collection of DNA from these scattering and disappearing peoples.

From these explorations, the Genographic Project hopes to build up a data set that captures a genetic profile of our species at this moment in time. "We're attempting to put together the story of humankind—its migration out of Africa and its expansion across the world over the past 70 millennia," says Schurr. "We have some broad brush-stroke pictures of this migration history, but the details that we will obtain through this study will give us much greater clarity on the timing, the migratory routes and settlement patterns."



*Kids from Voyampolia Village in Kamchatka, Russia, where Schurr worked with researchers on a study of Koryak and Itel'men people.*

# THE WORLD WANDERERS



*Schurr (left) working with villagers on the Anatolia Genetic History Project in the Cankiri Region, near Ankara, Turkey.*

Schurr has been painting in the details of that larger portrait in several parts of the world ever since he was a grad student taking biological samples and family genealogies in remote villages on the Kamchatka Peninsula in northeastern Russia. Molecular anthropologists look at genetic data in light of cultural, geographic and other information to reconstruct a population's history. Biological and anthropological findings together paint a more complete picture, each approach informing or supporting the other, filling in gaps, providing context, adding evidence like pigment to a canvas. "Comparing the genetic analysis with the narrative that comes from the fieldwork allows us to test hypotheses about history, about origins and about connections between people," he stresses. "Without the anthropology, we don't have nearly as much power to interpret our genetic evidence."

In Schurr's informal characterization, fieldwork amounts to "hanging out and collecting the facts on the ground." Those facts can include historical and trade records, oral histories, genealogical data, tribal histories, lists of languages spoken by relatives and ancestors, as well as local archival information on births, deaths and marriages. In Tymlat, a coastal fishing village

in Kamchatka, Schurr was part of a research team that came to investigate the history and pre-history of the Koryaks and Itel'men who lived there. The team went with villagers on their daily rounds to fishing huts, cemeteries, administrative offices and local museums. The researchers also hung out in homes and the *bany* (public bathhouse).

"You need to see things from the local perspective to really understand the bigger pattern," he asserts. "Until you actually work in these communities and talk to the people about their history and their own genealogies and so forth, you don't really understand exactly what you have."

Analyzing the genes of Koryaks and Itel'men revealed that they are not closely related to Native Americans but have stronger genetic affinities with eastern Siberian and East Asian populations. These findings support the view that Paleosian tribes originating in mainland Siberia expanded into the Kamchatka peninsula 6,000 to 8,000 years ago, while the genetic traces of earlier groups that gave rise to Eskimos and Aleuts had been absorbed by the ancestral Koryaks and Itel'men.

In addition to research in Kamchatka and North America, Schurr has carried out work on populations in Turkey,

Mongolia, Siberia, Melanesia, Nepal, South Africa, India, Central America, Europe, Lebanon and elsewhere. He's been a consultant for the genetic interpretation of Vietnam War MIA remains, and he's advised the genetic genealogy company Family Tree DNA in developing genetic tests for people interested in tracing their biological ancestry. In a legal fight between scientists and Native American groups over Kennewick Man, one of the oldest fossil skeletons found in the U.S., Schurr gave expert testimony on the limits of what genetic information can reveal about individual ancestry without the context of cultural data, which was entirely absent in this case.

The Genographic Project's growing files on gene variation among groups of people maps and chronicles with increasing clarity the great odyssey of the human race. After meandering in Africa for 130,000 years, *Homo sapiens*, impelled perhaps by climate change, embarked upon its outward journey. Schurr speculates that humans moved out in two migrations. One snaked along the southern coast of Asia through India and on to Australia, having colonized much of East Asia by 60,000 years ago. The second migration headed into Western and Central Asia and peopled the Eurasian land mass about 43,000 years ago. Even after these regions were settled, transient bands of humans continued roaming the globe, crossing oceans and mountain ranges, trekking

across continents and leaving behind genetic markers before moving on again. The last part of the Earth to be colonized was the New World, although its earliest settlers came, not from Europe to the east, but from the west.

"The big picture for the Americas has changed a number of times in the last two decades," Schurr remarks, "and will continue to change with the accumulation of new archeological and genetic evidence." Current thinking holds that westward-moving Old World migrations halted somewhere in northeastern Asia, perhaps on the Beringian land mass, for several thousand years. These ancestral Native Americans then moved south at the peak of the last ice age, using watercraft to navigate around the ice sheets to unglaciated regions in North America. "We have defined the founding maternal and paternal lineages that were brought in this major expansion event," Schurr maintains, "and we are tracing their spread in North and South America, which while sharing a common migration history, have become genetically distinctive from each other over the past 10,000 years."

By the end of Homer's epic poem, long-suffering Odysseus finally made his way home to the kingdom of Ithaca. But if the story told by molecular anthropology is any guide, the fate of homeless humanity appears to be a never-ending pilgrimage that has but one final resting place. It might be, as some have warned, that the whole

## DNA COLLECTOR



*Sarah Tishkoff (standing) and workers collecting blood samples in the Arusha region of Tanzania.*

Sarah Tishkoff collects human DNA the way old-time naturalists like Darwin gathered up beetles and bird skins. Both collectors use their specimens to support big theories about how life came to be as it is now.

Darwin saw in his assortment of life forms the story of how life evolved. In her genetic database, Tishkoff sees the continuing migratory and evolutionary saga of *Homo sapiens*.

Tishkoff is the David and Lyn Silfen University Associate Professor, one of the University's Penn Integrates Knowledge faculty members. She has a joint appointment in the biology department of the School of Arts and Sciences and the genetics department of the School of Medicine.

Tishkoff travels deep into Africa's bush country to draw blood from diverse tribes and peoples—more than 7,000 DNA samples from 100-plus ethnic groups. The white blood cells are extracted in the field using a portable centrifuge hooked up to her Land Rover's battery, and the material is preserved in pellets, which are carried back to her campus lab for analysis. Slight variations in DNA sequences among the groups provide clues about when and where

Earth is our home, and we should take good care of it. Still, the big money being poured into space travel and the tales told by science fiction writers suggest a future that imagines humanity blasting off to wander far among the stars.

Schurr ponders a different future. DNA is called the “code of life,” the blueprint for building and maintaining an organism. It also tells molecular anthropologists about the interwoven meetings and departures and ceaseless peregrinations of our ancestors. But Schurr describes connections of another sort, inscribed deep within the human genome, written perhaps between the lines of data that tell the story of long-wandering humanity. It’s a code to live by, a lesson on how humans might find their way on the journey.

“We are remarkable in our diversity,” he observes, “what we say, what we do, how we look, how we behave. Despite our differences, we’re all part of the same family tree. Our branch, *Homo sapiens*, is relatively recent, which makes us very similar to each other—99.9 percent of our DNA is the same. It’s a profound thing to find out through this kind of research, and it suggests to me the possibility of developing a mutual understanding, a shared empathy and a concern for all the members of our species.” ♦



*Accordianist and boy in Guanajuato, Mexico, where Schurr's group plans to conduct research on indigenous peoples in the near future.*

our species arose in Africa, how populations differentiated and spread across the continent and beyond, and what ways evolution continues to shape discrete populations in different ways.

“We found very old mitochondrial DNA lineages, among the oldest in Africa, in several groups we sampled,” Tishkoff reports. The genetic material was from peoples in East Africa. The DNA samples showed an accumulation of many mutations, which is a rough measure of the time since a lineage first appeared. Analysis suggests that the ‘African Eve’ who gave rise to this line of descendants (mitochondrial DNA is inherited from the mother) lived 170,000 years ago, a timeline that corresponds to the oldest human fossils found there.

Tishkoff’s DNA research also uncovered the genetic signature of recent evolution in humans. In most mammals, the gene that allows them to digest lactose, the sugar in milk, gets turned off after weaning. Many European peoples are known to be lactose tolerant—cattle herding emerged there some 8,000 years ago. Tishkoff discovered three separate mutations in African groups, all independent from the European mutation, that keep the lactose-digesting gene active in adults. The principle mutation was found in groups from Kenya and Tanzania, who, DNA scrutiny shows, arose around 4,000 years ago, the time when pastoral peoples arrived on the scene. The adaptation attunes the human organism in these tribes more perfectly to the environment of their culture.

Tishkoff is also at work on a project that looks at variations in the human genome across a large set of African peoples. That collection of genetic data will give her the evidence to make further inferences about the movements of African populations and might even help to identify the genetic basis of diseases like diabetes and hypertension, which are widespread among Africans and African Americans.

—PN

WITH CLASS

# SCIENCE AND MEDITATION

## COMPARING NOTES FROM COGNITIVE NEUROSCIENCE AND THE LABORATORY OF THE SELF

BY PETER NICHOLS

PHOTOS BY GREGORY BENSON

Assistant psychology professor Amishi Jha and co-instructor Michael Baime, M'81, were discussing the week's homework with a dozen students around a seminar table.

"I just can't do it!" exclaimed a stymied student.

Another recalled, "I kept thinking, when is it going to end? I have way too much to do!"

The assignment was for the Cognitive Neuroscience of Meditation, a psychology course that probes ancient meditation practice with the data and ideas of a new science. The task seemed simple enough: sit still for at least 10 minutes each day and pay attention to the in-and-out flow of the breath.



*Assistant psychology professor Amishi Jha.*

"I have to have something to think about," protested an annoyed undergrad. "I can't do nothing!"

"Before I did meditation practice," another revealed, "I never realized how wordy my brain was."

To Baime, a clinical associate professor of medicine and director of the Penn Program for Stress Management, the cascade of complaint was clear proof that students had indeed

been doing their homework. Baime teaches mindfulness meditation as a way of coping with stress. At each class, he leads the students through a mindfulness practice, and by week seven the exercises were yielding the expected results.

"We walk around feeling awkward and out of balance all the time," he told the class, "but we're usually not aware of it. When we sit down and do nothing, we really feel it. This is the human condition you're looking at, and although it's not always comfortable, it's the only place where you can know beauty or joy or love."

The course has no religious agenda but takes a rigorous scientific look at how meditation can change the brain. The students read and talk about current research papers on the cognitive neuroscience of compassion, depression, mind wandering, intrusive thoughts and other mental phenomena. They also practice a variety of meditation techniques, introduced by Baime and usually tied to the weekly academic content.

Jha leads the theoretical part of the course. In her lab, she carries out research on the brain's ability to focus and remember. "We've started investigating how mental training may enhance the functioning of attention and working memory using various protocols," Jha says. "The neuroscience of meditation has become a more central strand of my research." Last year she and Baime published "Mindfulness Training Modifies Subsystems of Attention," a series of experiments that showed how meditation improves certain aspects of mental focus and awareness. Other joint projects are in the pipeline.

Meditation cultivates awareness by turning attention, for example, to the breath, returning again and again to breath sensations every time practitioners notice they've wandered down some other thought trail. "Meditation practice makes students intimately familiar with the functioning of attention and memory in a way that doesn't come from just reading about it," Jha observes. "In this course, the mindfulness-training piece is the subjective laboratory that complements objective learning."

During the seminars, each student takes a turn leading discussion on one of the assigned neuroscience papers. Jha



(From left) Co-instructor Michael Baime, Anish Mehta, Nina Rostrup, David Hynes, and Amber Calloway.

punctuates their slide presentations with critiques, caveats, clarifications, contexts, and questions. She has found that the practice of meditation—the close-up, concrete experience of one’s own mind—gives students a more nuanced insight for picking apart unwarranted assumptions about brain events as well as the subtleties and complexities of conducting neuroscience research on this topic. “It adds a richness to the conversation,” she comments. Psychology major David Hynes, C’09, explains, “Meditation helps me understand

critical of other research, as well as my own.” Hynes adds that “the neuroscience part” supplies the vocabulary for “a better understanding of what’s going on inside my head when I’m trying to meditate.”

Following a student presentation on compassion, Baime invited the class to sit quietly—eyes closed, attention on the breath. He struck a tiny bell to mark the break from discussion. The students sat up in their chairs around the table. “Let your breath just flow around all those thoughts and distractions,” he told them. The wall clock ticked off the time. An overhead fan clicked on and blew above the silence in the room. “See if you can be fully present with your mind wide open to what’s happening,” Baime instructed. “It might be hard and it might not be what you want, but it’s real.”

## “IT ADDS A RICHNESS TO THE CONVERSATION.”

some of the more-difficult-to-grasp concepts discussed in the scientific articles we read.” Minjoo Kweon, C’09, another psychology major, reports, “Knowing the complexity of my own life experience in my own brain makes me far more

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Watch senior Anish Mehta talk about his research on the neural effects of meditation for adults with ADD at [www.sas.upenn.edu/mehta](http://www.sas.upenn.edu/mehta).



MATTHEW LEAKE

## FELLOWSHIPS FOR FUTURE FACULTY

Graduate students are a linchpin in the School's academic community. Faculty are invigorated by working with the brightest up-and-coming scholars, and undergraduates benefit from the teaching and laboratory assistance they provide. Competition for these rising stars is intense, and financial support is crucial in attracting and retaining the best scholars of the next generation.

In 2007, The Pew Charitable Trusts awarded a generous grant to the School to support graduate students in sociology, English, economics, history and political science. That funding is providing dozens of full-year and summer fellowships that give the School the flexibility to meet the needs of top students.

A Pew fellowship gave Ryan Grauer, a doctoral candidate in the Department of Political Science, the opportunity to carry out research that is crucial to his scholarship. Grauer was also the recipient of a 2008 Dean's Award for Distinguished Teaching.

Grauer's dissertation—currently in progress and titled *The Military as an Organization: A New Theory on the Sources of Military Power*—recognizes that most existing measures of power look at the material capabilities of adversaries, which are often unreliable predictors of outcomes in a military struggle. Using the rich insights and concepts of organization theory, Grauer looks at *how* resources are used.

He argues that command structures and hierarchies have important implications for the effectiveness of militaries on the battlefield. Understanding the organization of armed forces worldwide, he says, can help us to better appreciate the distribution and consequences of power in the international environment.

This summer, Grauer's Pew fellowship helped fund a trip to Fort Leavenworth, where he examined archival material relating to American military structure at the Command and General Staff College. "The trip was highly productive," he says, "and helped me to sharpen both my questions and my focus, while allowing me the time to uncover important materials that shed light on the training of perhaps the most decentralized military force in the world."

Avery Goldstein, professor and chair of the political science department and chair of Grauer's dissertation committee, notes that "the practical implications for great powers who are sometimes stymied by weak adversaries—the American and Soviet experiences in Afghanistan, for example—are clear. But there are implications in Grauer's research as well for thinking about the way great powers today address current deficiencies through military modernization, as in the case of China, or plan for potentially devastating clashes with other powers in diverse and increasingly complex battle spaces."

—AC

*"When you're finished changing,  
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*Benj. Franklin*

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### FORTISSIMO

A cacophony of clanking and roaring and pounding is underway at the site of the Music Building. The top-rated department has moved out; the interior is gutted; the windows are boarded up; and the heavy construction machinery has moved in. There's a big hole in the ground—and in the exterior wall—behind the 100-plus-year-old building. The \$15.3-million project will restore, expand and modernize the existing structure using green strategies that emphasize energy efficiency, sustainability, and environmentally friendly practices and materials. The new construction will nearly double the size of the existing facility, adding new practice rooms, better-equipped rehearsal spaces, improved soundproofing, and technological upgrades for computer-assisted teaching and learning that are integral to music instruction today. The renovations are scheduled for completion by the end of 2009.

*For more information on restoring the home of music at Penn, visit [www.sas.upenn.edu/musicbuilding](http://www.sas.upenn.edu/musicbuilding).*

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ELIZABETH STORM

*Penn mathematician Peter Storm in Jerusalem's Old City.*

## COME TOGETHER

Although separated by almost 7,000 miles, Penn and the Hebrew University of Jerusalem share the distinction of a longtime benefaction from Stanley Bogen, W'58. Among his many gifts are two chairs at HU and a visiting lecture series here at Penn.

Even more than generosity, Bogen is committed to the belief that scholars and their students benefit most when they share their unique perspectives with other academic communities. In 2003, Bogen's wife, Roberta, raised the idea of an exchange program between professors at Penn and Hebrew University, capitalizing on the strongest programs and most stellar faculty from each institution. That same year Bogen and his wife established the Roberta and Stanley Bogen Family Visiting Professor Exchange Program in the School of Arts and Sciences.

In 2004, Avihu Zakai, a professor of history and American studies at HU, became the inaugural Bogen visiting professor. The next year, Penn was visited by Ayal Kimhi, an agricultural economist, who represented a subfield not currently covered in Penn's economics department.

Last year, Larry Silver, the James and Nan Farquhar Professor of the History of Art, spent a semester at HU. Besides teaching at the university, Silver taught the history of prints directly from the Israel Museum's print-room collection, the first time that courtesy was extended for pedagogical purposes. Silver also met with colleagues from

Tel Aviv, Haifa and Ben Gurion universities. While Silver was in Israel, Yitzhak Brudny, whose research includes the former Soviet Union, nationalism and ethnic conflict, was teaching in the political science department at Penn.

This year, HU is hosting Peter Storm, the Roberta and Stanley Bogen Family Visiting Assistant Professor of Mathematics. His visit captures the spirit of the exchange program most fully.

Storm has been collaborating long-distance with Tsachik Gelernder since they met when Gelernder was a postdoc at Yale. Gelernder is currently on the faculty at HU's Einstein Institute of Mathematics. The two had already published one paper together, but Storm's yearlong visit is giving the two mathematicians the opportunity and the time to delve deeply into challenging problems in a more personal way. And Storm is finding the teaching just as rewarding. From Israel he writes, "The students here are very quick, and I'm forced to think carefully through topics I thought I understood well. I expect to learn at least as much as the students."

Because of Stanley Bogen's generosity and spirit of engagement, the intellectual communities of both Penn and the Hebrew University of Jerusalem benefit from the invigorating dialogue that ensues when scholars separated by distance come together and fully share their experience and expertise.

—AC

# THE SOCIETY OF ARTS AND SCIENCES

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*List current as of June 30, 2008*

# WITH HERODOTUS IN IRAQ

BY JUSTIN MAROZZI

When, in 2003, I started researching a travel history of Herodotus, the fifth century B.C. Greek historian, I had no idea he would take me to war in Iraq.

Turkey's Aegean coast was on the itinerary, not least because this was where the Father of History, as Cicero dubbed him, was born, in what is now the resort town of Bodrum. Greece was required travel as well to immerse myself in his cultural homeland: from the island of Samos to which he was likely exiled, via Athens, Delphi and Thermopylae to Olympia, Corinth, Sparta, Mycenae, Macedonia and beyond. Egypt was a given too because this was the country that most fascinated him on his pioneering travels. No wonder he devoted almost a third of *The Histories*, his one-volume masterpiece, to his travels and discoveries there.

## READING HERODOTUS, A VOICE OF MODERATION, TOLERANCE AND PROFOUND HUMANITY, WAS ALWAYS A RELIEF AND A REFUGE.

Iraq was very different. Initially it was not Baghdad but Babylon, the ancient desert city Herodotus described with such exuberance that attracted me to the war zone. Under a pitiless sun, a Polish archaeologist took me on a guided tour around the ruins, charting the latest round of damage inflicted on the city. She told me terrible stories of troops filling sandbags with earth containing archaeological fragments, of armoured vehicles crushing sixth-century-B.C. bricks, of looters gouging out pieces of dragons from the original foundations of the Ishtar Gate, and of digging, leveling and graveling for helipads on this unique historical site. For anyone who cares about history, it was profoundly dispiriting.

I wasn't expecting to find much Herodotus in Baghdad. After all, the city didn't exist in his time. Yet during 18 months working as a consultant for a British security company operating across Iraq, I discovered extraordinary parallels between the Persian Wars that Herodotus recounted and the

Iraq War two-and-a-half millennia later. The most pithy? Hubris, as Herodotus warned so eloquently, tends to lead to nemesis. I think he would have been aghast at the adventure in the Middle East and the terrible loss of life it entails. In his own words, "No one is fool enough to choose war instead of peace—in peace sons bury fathers, but in war fathers bury sons."

Herodotus provided constant—and often heartening—company in Iraq. Just as he depicted a seismic clash of civilisations during the Persian Wars, the world's first encounter between dictatorship and democracy, so I witnessed an often disturbing confrontation among the different cultures in Iraq. Iraqis, Americans and the British all had high—perhaps unrealistically high—hopes of each other. When these expectations were disappointed, there was a widespread tendency to dismiss the other side and take refuge in stereotypes. Depending on who you were with, the talk was of lazy Iraqis, backward Muslims, arrogant Americans or imperial Brits.

None of this would have surprised Herodotus. "Everyone without exception believes his own native customs, and the religion he was brought up in, to be the best," he wrote. It was—and is—human nature. Hence, the desire, for example, to spread democracy, practise jihad—and, in the case of evangelical Christian leaflets that sprouted up around Saddam Hussein's former republican palace—denigrate Islam. Reading Herodotus, a voice of moderation, tolerance and profound humanity, was always a relief and a refuge from the ugly stereotypes that war brings. He was a multiculturalist ahead of his time.

Now, after the best part of five years on the road clutching a battered Penguin edition of *The Histories* wherever I have traveled, from sunlit Greek islands to snow-dusted Baghdad, my Herodotus journey has come to an end. Strange as it may seem to say of someone who has been dead 2,500 years, he has become something of a friend. I'll miss him enormously.

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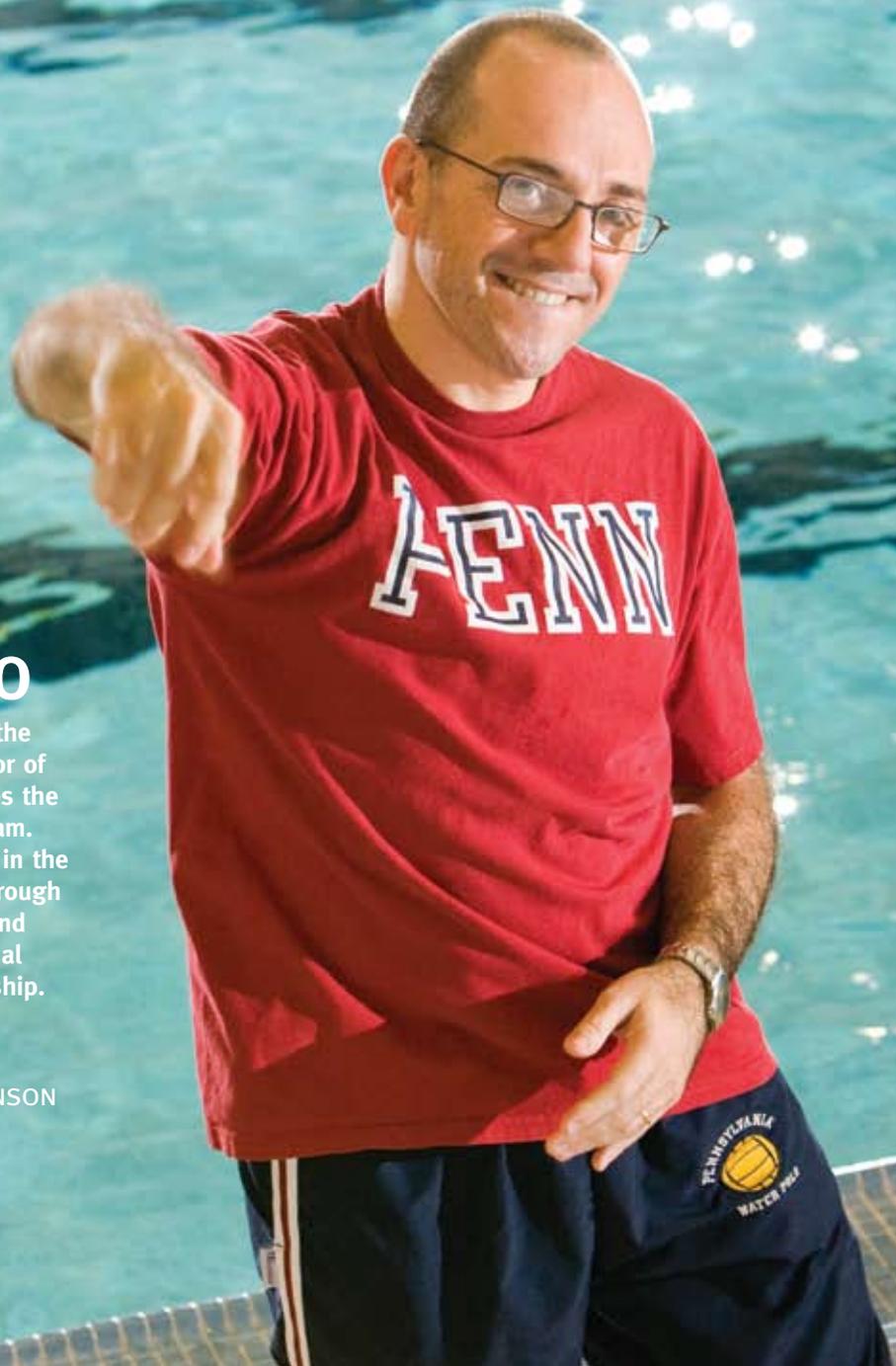
*Justin Marozzi, G'95, is travel writer, historian and journalist who lives in London. His most recent book is The Way of Herodotus: Travels with the Man Who Invented History.*



## MERLO POLO

Antonio Merlo is not only the Lawrence R. Klein Professor of Economics, he also coaches the Penn Men's Water Polo Team. The club went undefeated in the regular season, cruised through the Mid-Atlantic Division and finished 10th in the National Collegiate Club Championship.

PHOTO BY GREGORY BENSON



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