



Exploring genetics leads to big ideas

KITTA MACPHERSON

As a light rain swept across campus one October evening, 15 freshmen were tucked around a seminar table immersed in a discussion about nature in another form.

With their eyes riveted on their instructor, Princeton president and molecular biology professor Shirley M. Tilghman, they grappled with one of the deepest questions in the natural world: What is at the root of the intricate process that makes us all so different?

In her freshman seminar titled “How the Tabby Cat Got Her Stripes or The Silence of the Genes,” Tilghman, one of the world’s foremost authorities on genetics, is introducing the students to a newer aspect of her subject known as epigenetics. The topic is vast, touching

upon any factor not already predetermined in specific genes that affects the behavior of a living being’s collection of chromosomes. Influences as simple as the parent from which the gene was inherited, the chromosomal neighborhood in which a gene resides and even chance, scientists are learning, influence whether the gene will be expressed. Epi-

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AND INQUIRY
DISCOVERY

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In her freshman seminar “How the Tabby Cat Got Her Stripes or The Silence of the Genes,” Princeton president and molecular biology professor Shirley M. Tilghman (right) introduces students to a newer aspect of her research area known as epigenetics. The complex field examines the extent to which the expression of genes is “hardwired” or preprogrammed, or shaped by circumstance.

Princeton engineers develop sensor derived from frogs to help fight bacteria, save wildlife

CHRIS EMERY

Princeton engineers have developed a sensor that may revolutionize how drugs and medical devices are tested for contamination, and in the process also help ensure the survival of two species of threatened animals.

To be fair, some of the credit goes to an African frog.

In the wild, the African clawed frog produces antibacterial peptides — small chains of amino acids — on its skin to protect it from infection. Princeton researchers have found a way to attach these peptides, which can be synthesized in the laboratory, to a small electronic chip that emits an electrical signal when exposed to harmful bacteria, including pathogenic *E. coli* and salmonella.

“It’s a robust, simple platform,” said Michael McAlpine, an assistant professor of mechanical and aerospace engineering and the lead researcher on the project. “We think these chips could replace the current

method of testing medical devices and drugs.”

McAlpine collaborated on the project with Manu Mannoor, a graduate student who works in his laboratory; James Link, an assistant professor of chemical and biological engineering; and Siyan Zhang, a graduate student who works with Link.

A paper outlining the project was published online Oct. 18 in the Proceedings of the National Academy of Science. The research was funded by the American Asthma Foundation, the Air Force Office of Scientific Research and the National Science Foundation.

The current testing method has a major drawback: It relies on the blood of the horseshoe crab, a species that is roughly 450 million years old. The horseshoe crab population has declined in recent years, and as a result, so too has the population of a bird that feasts on the crab.

The crab became desirable for testing because its immune system has evolved to cope with the constant threat of invasion from its bacteria-rich environment.

Its blood contains antimicrobial cells, known as amebocytes, that defend the crab against bacteria — similar to the way the peptides protect the African frog’s skin.

For almost 40 years, an aqueous extract made from horseshoe crab blood cells, called Limulus amebocyte lysate (LAL), has been used for testing drugs and medical devices for contamination.

In the era before the use of these animal extracts for testing, although drugs and medical devices were sterilized, they would sometimes cause patients to develop fevers due to an immune reaction to endotoxins, which are remnants of bacteria destroyed by the sterilization process. When a sample from a drug or device is added to LAL and the solution hardens into a gel, it indicates the sample is contaminated and not safe for human use.

Potential to save animal populations

To produce LAL, the crabs are captured and roughly 30 percent of their blood drained before they are returned

to the ocean. There is disagreement on how many crabs die as a result of the procedure, but their estimated mortality rate can be as high as 30 percent, according to the United States Geological Survey.

A conservative estimate puts the number of horseshoe crabs on the Atlantic Coast between New Jersey and Virginia at between 2.3 to 4.5 million, according to the Ecological Research and Development Group. In recent years, the populations of the horseshoe crab and shore birds that rely on them for food both have been in decline, with the red knot, a rust-colored species of shore bird, of particular concern.

Each spring the bird migrates 20,000 miles from the islands of Tierra del Fuego, off the southern tip of South America, to the Delaware Bay on the east coast of the United States. From April to May, the bird feasts on horseshoe crab eggs found on beaches, nearly doubling its body weight to sustain its health for the long flight south.

Studies have discovered a precipitous decline in the red knot population. One study by researchers at the University of Toronto found that the Tierra del Fuego population of red

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Five new faculty members appointed

The Board of Trustees has approved the appointments of three new full professors and two assistant professors.

The full professors are: Marc Fleurbaey in the Woodrow Wilson School of Public and International Affairs and the University Center for Human Values, effective Sept. 1, 2011; Alison Isenberg in history, effective Sept. 1, 2010; and Richard Rogerson in economics and public affairs, effective Feb. 1, 2011.

The assistant professors, both appointed for three-year terms, are: Nathan Arrington in art and archaeology, effective July 1, 2010; and Andrew Shephard in economics, effective Sept. 1, 2010.

Fleurbaey, who has been appointed the Laurance S. Rockefeller Professor of Public Affairs and the University Center for Human Values, specializes in ethics and normative economics. He is the author of "Fairness, Responsibility and Welfare" and the editor of "Justice, Political Liberalism and Utilitarianism: Themes From Haranyi and Rawls."

Fleurbaey will join the Princeton faculty from Université Paris Descartes, where he has been a researcher at Le Centre National de la Recherche Scientifique since 2005. Previously he was a professor at Université de Pau and Université de Cergy-Pontoise. A graduate of Ecole Nationale de la Statistique et de l'Administration Economique, Fleurbaey holds a master's degree from Université Paris X and a Ph.D. from Ecole des Hautes Etudes en Sciences Sociales.

Isenberg, a scholar of American urban history, had been a professor at Rutgers University since 2001. She previously taught at the University of North Carolina-Chapel Hill and Florida International University. She is a graduate of Yale University and earned a Ph.D. from the University of Pennsylvania.

Isenberg is the author of "Downtown America: A History of the Place and the People Who Made It," which

received numerous awards including the Ellis Hawley Prize from the Organization of American Historians. She currently is working on two books: "Second-Hand Cities: Antiques, Inheritance and Preservation From the Civil War to Urban Renewal" and "Urban Design Unclothed: Collaborative Landscapes and the Modernist Turn Toward Preservation in the 1950s-1970s."

Rogerson is a macroeconomist who is particularly interested in labor markets. He has published dozens of articles in major journals — including the American Economic Review, the Journal of Political Economy and the Review of Economic Studies — on topics such as business cycle fluctuations, the effects of labor market regulations, and financing of public education and development.

Rogerson will come to Princeton from Arizona State University, where he has taught since 2001. He previously has taught at the University of Pennsylvania, the University of Minnesota, Stanford University, New York University and the University of Rochester. A graduate of the University of Alberta, he holds a Ph.D. from the University of Minnesota.

Arrington, a 2002 Princeton graduate, specializes in classical archaeology. He joined the faculty after receiving his Ph.D. from the University of California-Berkeley. He holds a master's degree from the University of Cambridge.

Shephard, who focuses on public economics, came to Princeton after receiving his Ph.D. from University College London. He holds bachelor's and master's degrees from the London School of Economics. ♥

Board approves five promotions

The Board of Trustees has approved the promotions of five faculty members, all effective July 1, 2010.

The faculty members and their departments, by the academic rank to which they are being promoted, are:

Professor — **Daphne Brooks**, English and African American studies; **Hans Halvorson**, philosophy; **Michael Laffan**, history; and **Christopher Tully**, physics.

Associate professor (with continuing tenure) — **Jason Fleischer**, electrical engineering. ♥

Faculty members submit resignations

The following faculty members have submitted their resignations:

Effective July 1, 2010: **Jonas Pontusson**, professor of politics, to accept a position at the University of Geneva.

Effective Sept. 1, 2010: **Elon Lindentrauss**, professor of mathematics, to accept a position at Hebrew University; **Maryam Mirzakhani**, professor of mathematics, to accept a position at Stanford University; and **Katherine Newman**, professor of sociology and public affairs, to accept a position at Johns Hopkins University. ♥

Employee retirements

Effective Oct. 1: in history, professional specialist **Lin Ferrand**, after 11 years; in the plasma physics lab, senior engineer **Lewis Randerson**, after 33 years; in public safety, head security supervisor **James Thomas**, after 25 years.

Effective Nov. 1: in the fire protection shop, fire protection systems mechanic **Thomas Scully**, after 21 years.

Effective Dec. 1: in information technology, coordinator of institutional communications and outreach **Jon Edwards**, after 24 years.

By the numbers

The Sept. 20 issue of the Bulletin presented a look at Princeton's incoming undergraduate and graduate students based on figures for the pre-registration period. The following are updated figures based on official opening enrollment data issued by the Office of the Registrar.

THE PRINCETON CLASS OF 2014

| | |
|--|---------------|
| Number of students (including readmitted students) | 1,317 |
| Percent on financial aid | 59 |
| Number of applications (record) | 26,247 |
| Percent admitted (record low) | 8.8 |
| Percent men | 50 |
| Percent women | 50 |
| Number of states represented plus Washington, D.C. | 49 |
| Number of countries represented | 61 |
| Percent students of color | 37.4 |
| Percent international students | 10.6 |
| Percent sons/daughters of alumni | 13.7 |
| Total undergraduate enrollment | 5,149 |

Opening enrollment statistics and other data can be found on the registrar's website at <registrar.princeton.edu>.

FALL 2010 NEW GRADUATE STUDENTS

| | |
|--|---------------|
| Number pursuing doctoral degrees | 472 |
| Number seeking master's degrees | 153 |
| Number of visiting and exchange students | 29 |
| Number of applications | 11,124 |
| Percent admitted | 11 |
| Percent men | 62 |
| Percent women | 38 |
| Percent international students | 39 |
| Percent students of color | 12 |
| Percent in humanities | 16 |
| Percent in natural sciences | 25 |
| Percent in School of Architecture | 5 |
| Percent in School of Engineering and Applied Science | 21 |
| Percent in social sciences | 19 |
| Percent in Woodrow Wilson School of Public and International Affairs | 14 |
| Total graduate enrollment | 2,582 |

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Spotlight



Denise Applewhite

Name: Joseph Ramirez

Position: Program coordinator in the Office of the Dean of Undergraduate Students. Working closely with student organizations to help facilitate extracurricular activities. Working with colleagues in the dean's office to plan events for occasions such as freshman orientation, Class Day, Commencement and the Dean's Date deadline for written coursework.

Quote: "I am originally from Nebraska, and attending Princeton on a scholarship changed my life. This is where I met my wife, Aimee, who graduated with me in 2007. I'm very honored to have worked in various capacities at this university. I have worked in admissions and in development, and now with my role in student life I can help make attending Princeton an even better experience for current students by supporting a vibrant, stimulating and transformative extracurricular environment. It's great to give something back to a place that has given me so much."

Other interests: Traveling (he has visited 35 of 50 states). Staying connected to the student dance group Ballet Folklórico, where he met his wife. Serving as an Annual Giving and Reunions volunteer for the class of 2007. Attending games of the New York Red Bulls Major League Soccer team, for which he holds season tickets, and any Princeton athletics event.

Employee obituaries

Current employees

September: **Gerry Johnson**, 52 (1990-2010, Building Services).

Retired employees

May: **John Hidveghi**, 88 (1959-1986, plasma physics lab).

July: **Margaret Ashton**, 78 (1978-1997, admission).

Deadline

In general, the copy deadline for each issue is the Friday 10 days in advance of the Monday cover date.

The deadline for the next issue, which covers Dec. 13-Jan. 16, is Friday, Dec. 3. A complete publication schedule can be found at <www.princeton.edu/bulletin>. Call 258-3601 with questions.

To submit events for consideration for "Nassau notes," go to <www.princeton.edu/main/news/share/submitevents>.

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University endowment earns 14.7 percent annual return

CASS CLIATT

Princeton's endowment earned a 14.7 percent annual return on its investments in the fiscal year that ended June 30, 2010. The Princeton University Investment Co. (PRINCO) manages the University's endowment.

"The strong performance of the endowment contributes significantly to the financial health of the University in what remains a difficult economic climate," said Provost Christopher Eisgruber. "As a result of PRINCO's excellent stewardship of the endowment, the support of the University's alumni and friends, and the budget cuts implemented by units throughout our campus, Princeton has established a new baseline for its budget and avoided the need for additional reductions in spending. The endowment's performance brings us back within our target band for spending, but we will need to demonstrate continuing budget discipline to contend with the effects of the recent financial crisis and persistent economic uncertainty."

As of June 30, 2010, Princeton's endowment was valued at \$14.4 billion. At the end of the previous fiscal year, the endowment stood at \$12.6 billion, following an investment return for that year of -23.5 percent. The return for the 2008 fiscal year was 5.6 percent.

During the economic downturn, the University reduced spending by \$170 million over two years — for the previous fiscal year 2010 and the current 2011 year — but sustained its commitment to world-class teaching and research. The University also protected key programmatic initiatives, such as its generous financial aid program and family-friendly benefits for faculty, staff and students. This year, a budget of more than \$109 million for Princeton's "no-loan" program provides financial aid to roughly 60 percent of undergraduates in the form of grants that do not have to be repaid.

The University's long-term annualized endowment returns remain strong. The average annual return on the endowment over the past 10 years is 7.9 percent. This result is in the top percentile of 428 institutions reporting to the Trust Universe Comparison Service.

In asserting that the endowment's positive performance for 2010 should place the University's spend rate back within its target band, Eisgruber explained that the University currently has a spending policy that aims for spending between 4 percent and 5.75 percent of the market value of the endowment. Last year, the spending rate was 6.04 percent, modestly above the upper level of the policy. This year's favorable returns will reduce the spend rate to 5.1 percent. ♥

Holiday outreach initiatives set

Members of the University community will have the opportunity to share the holiday spirit through a series of community service initiatives and special events planned for December and January.

A "Heros for Heroes" campaign will enable campus community members to send greetings to soldiers who will be away from home this holiday season. Holiday cards or letters can be sent individually or by a team. The team or individual who delivers the most cards and letters to the Frist Campus Center by 2 p.m. Thursday, Dec. 2, will receive lunch from Hoagie Haven (up to \$100 value). Cards and stationery will be available for anyone who needs supplies between 11 a.m. and 2 p.m. Wednesday and Thursday, Dec. 1 and 2, at the 100 level of Frist. Each card and letter collected will be included in a care package sent to soldiers overseas by the nonprofit organization Operation Gratitude.

A holiday "A Cappella Jam and Toy Drive" featuring several student performance groups will be held at 6:30 p.m. Friday, Dec. 10, on the Palmer Square Green. The event is free and open to the public, and attendees are encouraged to bring a new, unwrapped toy to be donated to the YWCA Princeton St. Nicholas Project.

A "Holiday Hoops" food drive will provide a \$4 voucher off the price of a game-day ticket with the donation of a nonperishable food item when the Princeton men's basketball team takes on St. Joseph's at 5 p.m. Sunday, Dec. 5, at Jadwin Gymnasium. In addition, free admission will be given to anyone who brings two nonperishable food items to the Princeton women's basketball game vs. Drexel at 7 p.m. Friday, Dec. 17, at Jadwin Gym. All donations support the Friends of Mercer Street Food Bank.

Through Friday, Dec. 17, donations of nonperishable food items and personal hygiene products for the Mercer Street Friends Food Bank will be collected

at several campus sites: New South; Engineering Quadrangle, Room C230; Jadwin Gym; Helm Building; MacMillan Building; Robertson Hall; Dillon Gymnasium; Lewis Thomas Laboratory; Nassau Hall, Room 9; 200 Elm Drive; Green Hall; 185 Nassau St.; 22 Chambers St.; Princeton Plasma Physics Laboratory; University Chapel; Butler Tract Apartments, Common Room; 701 Carnegie Center; 87 Prospect Ave.; Lewis Library; East Pyne Hall; 171 Broadmead; and the 100 level of Frist.

University community members also may support the Send Hunger Packing Program, which provides school-aged children in need with nutritionally sound, easy-to-open meals to get them through the weekend.

Additionally, campus and local nonprofit groups are participating in initiatives to collect donations including books, games, gift certificates, food, personal care items, toys, winter jackets and sleepwear. Participating organizations are Anchor House/Angel's Wings, the Crisis Ministry of Princeton and Trenton, Community House, Health Care Ministry of Princeton, Home-Front, Princeton Nursery School, the YWCA Princeton St. Nicholas Project and Womanspace. For more information about these organizations and donations needed, visit the Office of Community and Regional Affairs website at <www.princeton.edu/community> or contact Erin Metro at 258-5144 or <emetro@princeton.edu>.

In addition, community members can start saving men's and women's business attire for the annual gently used clothing drive planned for January. Details will be announced at a later date.

The outreach initiatives are sponsored by the Office of Community and Regional Affairs, the Graduate School, the Department of Athletics, the Department of Facilities, the Office of the Dean of Undergraduate Students and Hoagie Haven. ♥

More news on the Web

Visit the News at Princeton Web page at <www.princeton.edu/main/news> for other recent stories, including the following:

- U.S. President Barack Obama has named Princeton's Andrew Houck and Joshua Shaevitz as recipients of the Presidential Early Career Awards for Scientists and Engineers, the highest honor bestowed by the federal government on young professionals in the early stages of their independent research careers. Houck, an assistant professor of electrical engineering, and Shaevitz, an assistant professor of physics and the Lewis-Sigler Institute for Integrative Genomics, are among 85 recipients who will receive awards at a future White House ceremony.
- The U.S. Federal Trade Commission has named Edward Felten, a Princeton professor of computer science and public affairs, as the agency's first chief technologist to help guide government policy in an era when technology has a growing influence on businesses and consumers. Felten, the founding director of Princeton's Center for Information Technology Policy, will take a one-year leave of absence beginning in January.
- Strong immunity may play a key role in determining long life, but may do so at the expense of reduced fertility, a study led by Princeton ecologist Andrea Graham has concluded. An 11-year study of a population of wild sheep located on a remote island off the coast of Scotland that gauged the animals' susceptibility to infection may give new insight into why some people get sicker than others when exposed to the same illness.



Leslie Krausk/University of Edinburgh

Research into the immunity of wild sheep to infection may yield new insights in why some people get sicker than others when exposed to the same illness.

- Princeton scientists have identified genes responsible for controlling reproductive life span in worms and found they may control genes regulating similar functions in humans. The work, led by molecular biologist Coleen Murphy, suggests that someday researchers may be able to develop ways to maintain fertility in humans, allowing women who want to delay having children to preserve that capacity and extend their reproduction, and to prevent maternal age-related birth defects.
- Princeton's Keller Center and the International Internship Program have developed a new research and teaching collaboration and student exchange initiative between the University and ConRuhr, a consortium of three universities in Germany's Ruhr region. The program aims to expose engineering students to international approaches to technology, research and leadership, while giving them hands-on research experience in their field of study.
- After nine years of scanning the sky, the Wilkinson Microwave Anisotropy Probe space mission, known as WMAP, has concluded its observations of the cosmic microwave background, the oldest light in the universe. The spacecraft not only has given scientists their best look at this remnant glow, but also firmly established the scientific model that describes the history and structure of the universe.
- A surprising level of activity discovered in "sleepy" cells throughout the human body could be a key to good health. Fibroblasts, which are found in connective tissue such as ligaments and tendons, long have been viewed by scientists as crucial but dull, quietly performing their essential function of providing the structural framework for tissue. But now, after years of research, a team of Princeton scientists led by molecular biologist Hilary Collier has discovered that while these unassuming cells are in "sleep" mode, they actually are working much harder than previously thought to fend off destructive chemicals.
- Publishing ideas in a hard-to-read typeface may make concepts harder to learn but easier to retain, according to a new study. Princeton psychologist Daniel Oppenheimer, along with Connor Diemand-Yauman, a 2010 Princeton graduate, and Erika Vaughan, a Ph.D. candidate at Indiana University, assessed whether changing the font of written material could improve the long-term learning and retention of information presented to students. The study, which was part of Diemand-Yauman's senior thesis at Princeton, will be published in an upcoming volume of *Cognition*.
- A technique for tracing the origins and spread of ideas could make it easier to gauge the influence of notable scholarly papers, buzz-generating news stories and other information sources. The project, led by Princeton computer scientist David Blei, relies on computer algorithms to analyze how language morphs over time within a group of documents and to determine which documents were the most influential.
- A gene's location on a chromosome plays a significant role in shaping how an organism's traits vary and evolve, according to findings by scientists at Princeton and New York University. The study, co-authored by Princeton genomics professor Leonid Kruglyak, suggests that evolution is less a function of what a physical trait is and more a result of where the genes that affect that trait reside in the genome.

Perspective on: Trends in U.S. employment

Name: Henry Farber

Title: Hughes-Rogers Professor of Economics

Scholarly focus: Labor economics, with a focus on worker mobility, labor unions and wage dynamics

Interview conducted by Ushma Patel

Though the Great Recession officially ended in June 2009, the U.S. unemployment rate has remained above 9 percent. What are some of the reasons for the weak job market?

Bottom line — people aren't spending so firms are not hiring. Of course, it's always the case in recessions that firms lay off workers; they figure out how to be more productive, and productivity — at least in the early parts of a recession — actually grows. Firms have learned to work a bit more productively so they don't feel they need more workers, or they're afraid to hire more workers. The added factor this time around is that this recession is so broad-based that individuals generally are holding back from spending; their savings rates are at rather high levels. As a result, firms say, why should I hire more workers? People aren't buying things.

It's a vicious cycle, where the way to get people to buy things is to hire more workers, and the way to hire more workers is for people to buy more things, which is why we needed and probably still need a very aggressive stimulus package that pumps money into the economy and has firms hiring workers. I see no signs of a brisk recovery in the labor market, and the labor market always lags in recessions. It's the last thing to fall in the beginning and the last thing to come back at the end.

What is the outlook for those workers who have lost jobs during the recent recession?

The outlook appears to be quite a bit worse than in earlier recessions. The latest data, which covers the period of the recession through 2009, shows that the workers who lost jobs in this recession are much less likely to be employed than in any earlier

recession we have data on. Only about half of workers who report having lost a job between 2007 and 2009 were employed in January 2010. In any recession I have data on, and that goes back to the early 1980s, the re-employment rate never fell below 60 percent. The unemployment durations are staggeringly long, twice what they were.

More bad news is that those workers who lose full-time jobs and manage to find another job suffer larger earnings declines on average than in earlier recessions. This is largely because they are more likely than in earlier recessions to have found a part-time job rather than a full-time job.

What does your research show about trends in job security in the United States?

I would say that a decline in job security in the U.S. has been going on for at least 20 years. Companies have moved toward a mode of operation where they have a smaller core of long-term employees. In earlier times, when a recession came, you tended to try to protect your core. Now, firms may feel they have less of a core to protect. As a result, they engage in layoffs a bit more easily than they did in the past.

What are some of the causes, over the long term, for declining job security?

One cause stems from around 1980, when the U.S. eliminated mandatory retirement. The government made it illegal for employers and employees to engage in a voluntary agreement where you'd work for a firm and leave when you were 65. The ability of workers to continue working past age 65 can make long-term employment relationships less valuable to firms because they need renewal where they can hire

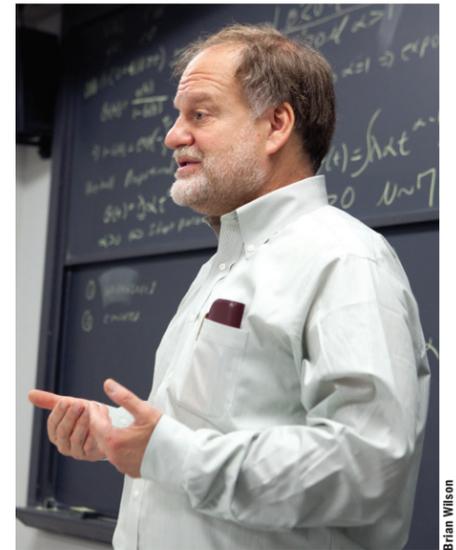
younger workers and where workers who have had a long and productive career can be phased out.

The other part of it is that the world has become more competitive. In 1960, Americans bought American-manufactured goods for the most part, and the firms that produced those goods had a protected market. Now, in a more competitive world, U.S. capital is very mobile and flows all over. In China, U.S. companies own a fair amount of productive capacity and they employ Chinese workers to build things. It's more profitable for them. What U.S. workers have to offer employers is, frankly, less rare than it used to be. There are good work forces in lots of places.

How much does job security differ for various parts of the work force?

It's pretty dramatic. Between men and women, the trend in declining job security is most evident for men — it's just stark. For women, that trend was offset for a long time by their increased commitment to the labor force. Forty years ago, women would routinely leave the labor force to have children and maybe come back later when their children were older. Nowadays, those absences, if any, are fairly brief. Many more women stay and don't give up their jobs, so the trend for women is to have more stable employment than in the past. They have been doing this in the teeth of this storm of declining job structures that are not oriented toward long-term employment, so what we have seen for women was an increase in job security for a while, followed by some minor decreases.

The other interesting fact is that declining job security is completely restricted to the private sector. If anything, job security is much greater in



Brian Wilson

the public sector than it was 30 years ago. I find that rather remarkable, and it feeds into the current debate about the appropriate size of government.

You are teaching two courses this semester. Have your students become more interested in the labor market and economics over the last few years?

Generally, enrollments in economics are at record levels at Princeton. Our total enrollments in undergraduate economics classes this term is up 26 percent from the same term last year. Enrollments of freshmen and sophomores are at record levels. I think the students' interest is genuine and has been piqued by the recession. Economics is in the news every day. People want to know who's right and what's going on. It's something they can relate to because they see it around them. They probably all know people who have lost their jobs. I have three children, two of whom have lost jobs in this recession.

In my economics classes, I try to teach students to think like economists. What I try to do is point out the real intellectual content and demonstrate how this is a very useful way of seeing the world. It's not just about how to make money. This is a way of being a good citizen and understanding important issues that are at the forefront of public debates. That's central to my personal teaching philosophy. ♥

University to showcase sustainability initiatives at open house

RUTH STEVENS

The latest campus and local community green initiatives will be showcased at Princeton's Sustainability Open House from 3 to 7 p.m. Tuesday, Nov. 16, in the Chancellor Green Rotunda.

Organized by the University's Office of Sustainability, the event will coincide with the publication of Princeton's second annual Sustainability Report. The online report, set to be released Nov. 15, will describe progress toward goals since the University adopted its Sustainability Plan in February 2008. The first report was released in November 2009.

The open house will feature interactive displays and demonstrations from the working groups, academic and research programs, and student initiatives that are part of the effort to measure sustainability performance across University operations, teaching, research and student activities. Sustainable food samples will be served.

A short opening ceremony will begin at 3:30 p.m. Executive Vice President Mark Burstein will deliver remarks, along with Danny Growald, a senior majoring in ecology and evolutionary biology and the former undergraduate chair of Princeton Students United for a Responsible Global Environment, a campus climate action group.

This is the second open house organized by the Office of Sustainability. The first one, in September 2008, focused on introducing the Sustainability Plan and drew a crowd of 900 to the Frist Campus Center.

This year's event was moved to Chancellor Green — closer to Nassau Street — and includes the goal of incorporating both campus and community groups. Local nonprofit organizations and businesses will participate.

"We are very excited by the enthusiasm of the 45 campus and community participant groups this year!" said Shana Weber, manager of the Office of Sustainability. "We are really looking forward to a dynamic and fun 'fair-like' atmosphere to celebrate and sample a smorgasbord of green options."

Teams from the campus and local communities have been invited to enter a Trash Sculpture Contest, and more than 40 have done so. The works of art will be displayed and voting for award winners will take place during the open house. At 6:30 p.m., University Vice President and Secretary Robert Durkee will announce the winners of three cash awards from among sculptures judged by a panel of jurors and of the "people's choice" award from among the remaining works.

Those participating in the open house also will have an opportunity to check out electric and low-emission vehicles and to recycle their personal (non-University) computers, cell phones and handheld devices.

Working groups staffing displays will include those involved in campus energy systems, sustainable dining, landscaping practices and transportation alternatives. Among the academic and research programs on hand will be the Princeton Environmental Institute to showcase its environmental research, education and outreach, and the School of Architecture with

models and images of sustainable designs.

Student groups planning to participate include the Princeton BEE Team (beekeeping), the Student Environmental Communication Network (green videos), Engineers Without Borders (sustainable design solutions for the developing world) and the EcoReps (campus recycling and waste reduction). The Pace Center for Civic Engagement will provide information on sustainability fellowships and civic action trips, and the Princeton Blairstown Center will offer details on adventure-based educational youth programs.

Among the community participants will be the Stony Brook-Millstone Watershed, the D&R Greenway, the Princeton Regional Schools Garden Project, Freecycle, the Princeton Record Exchange and Greendesign.

For more information, contact the Office of Sustainability at <sustain@princeton.edu>. ♥

NASSAU notes Nov. 15-Dec. 12

UPcoming

Panel: "A Midcourse Correction? The 2010 Elections in Perspective"

4:30 p.m. Nov. 15
Robertson Hall, Room 16

Lecture: "The Ashtray"

Errol Morris, filmmaker
8 p.m. Nov. 15
McCosh Hall, Room 50

Book talk: "Sizing up the Universe: The Cosmos in Perspective"

Richard Gott and Robert Vanderbei
4:30 p.m. and 7 p.m. Nov. 16
Lewis Library, Room 346

Lecture: "What Happened to Frances Hodgson Burnett's Harry Potter? The Rise and Fall of a 19th-Century Children's Classic"

Ulrich Knoepfelmacher
5 p.m. Nov. 17
Firestone Library, Main Gallery

Lecture: "David E. Kelley '79 in Conversation With Jordan Roth '97"

5 p.m. Nov. 17
185 Nassau St., Stewart Theater

Open house: Davis International Center

2:30 to 5 p.m. Nov. 18
120 Alexander St., First Floor

Lecture: "Science vs. Religion: What Scientists Really Think"

Elaine Howard Ecklund, Rice University
4:30 p.m. Nov. 18
Lewis Library, Room 120

Lecture: "Health-Security Relationships in the 21st Century"

12:30 p.m. Nov. 19
David Franz, Midwest Research Institute
Icahn Laboratory, Room 280

Performance: "Family Feudalism"

Princeton Triangle Club
8 p.m. Nov. 19 and 20
McCarter Theatre Center

Concert: "Chansons Francaises"

Princeton University Chamber Choir
3 p.m. Nov. 21
Alexander Hall, Richardson Auditorium

Lecture: "Roger Casement, the Congo, Ireland and Latin America"

Mario Vargas Llosa and Paul Muldoon
4:30 p.m. Nov. 22
McCosh Hall, Room 50

Lecture: "Banks, Shadow Banks and the New Face of Wall Street"

Andrew Ross Sorkin, The New York Times; Gary Gensler, U.S. Commodity Futures Trading Commission; and Jon Corzine
4:30 p.m. Nov. 22
Robertson Hall, Room 16

Symposium: "Good for the Jews? A Symposium of Scholars and Artists on Jewish Identity in American Theater and Performance"

9 a.m. to 5:30 p.m. Dec. 11
185 Nassau St., Stewart Theater

McCarty to deliver President's Lecture on political polarization

Princeton political scholar Nolan McCarty will speak on "The Polarization of American Politics" in the next installment of the President's Lecture Series at 4:30 p.m. Thursday, Dec. 2, in McCosh Hall, Room 10.

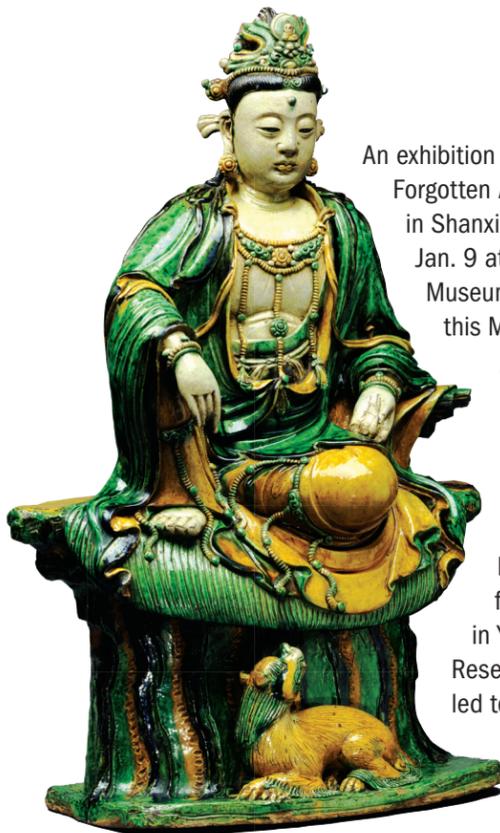
McCarty will present research on congressional behavior over the past 150 years to show that American politics has become more partisan and divisive than in the past. He also will explore the causes of rising polarization.

McCarty is the Susan Dod Brown Professor of Politics and Public Affairs and associate dean of the Woodrow Wilson School of Public and Interna-

tional Affairs. He is the author (with Keith Poole and Howard Rosenthal) of "Polarized America: The Dance of Ideology and Unequal Riches."

Virginia Zakian, Princeton's Harry C. Wiess Professor in the Life Sciences, will present the final President's Lecture at 4:30 p.m. Thursday, March 24, in the Friend Center, Room 101.

The lecture series was started by President Tilghman in 2001 to bring together faculty members from different disciplines to learn about the work others are doing in a variety of fields. The talks will be webcast; viewing information will be available at <www.princeton.edu/webmedia>. ♥



Bruce M. White

An exhibition titled "Green, Amber, Cream: Forgotten Art of a Ceramic Workshop in Shanxi, China" will run through Jan. 9 at the Princeton University Art Museum. The exhibition includes this Ming dynasty (1368-1644) glazed ceramic statue of the Buddhist deity Guanyin, which was acquired by the museum in 2005. The sculpture was made in 1500 by the artist Qiao Bin, who was part of a family workshop operating in Yangcheng, Shanxi Province. Research on the Guanyin has led to the discovery of other significant works by Qiao family artisans.



Paper money can be viewed as works of art in the exhibit "Money on Paper: Bank Notes and Related Graphic Arts From the Collections of Vsevolod Onyshkevych and Princeton University." Currency from the University's Numismatic Collection — including bank notes from Czechoslovakia in 1929 (left) and New Jersey in 1763 (right) — will be on view through Jan. 2 in the Leonard Milberg Gallery for the Graphic Arts at Firestone Library.

CALENDARlinks

For broader listings of campus public events:

PUBLIC EVENTS CALENDAR
<www.princeton.edu/events>

Information on tickets is available at the website below:

UNIVERSITY TICKETING
<www.princeton.edu/utickets>
258-9220

For listings by selected University sponsors:

- Art Museum**
<artmuseum.princeton.edu>
258-3788
- Athletics**
<www.goprincetontigers.com>
258-3568
- Center for African American Studies**
<www.princeton.edu/africanamericanstudies/events>
258-4270
- Council of the Humanities**
<humanities.princeton.edu/calendar>
258-4717
- Frist Campus Center**
<www.princeton.edu/frist>
258-1766
- Lewis Center for the Arts**
<www.princeton.edu/arts/events/calendar>
258-1500
- Library**
<www.princeton.edu/~rbsc/exhibitions>
258-3181
- McCarter Theatre**
<www.mccarter.org>
258-2787
- Music Department**
<www.princeton.edu/music>
258-4241
- Office of Information Technology**
<www.princeton.edu/eos>
258-2949
- Public Lecture Series**
<lectures.princeton.edu>
- President's Lecture Series**
<www.princeton.edu/president/presidents_lecture_series>
258-6100
- Princeton Institute for International and Regional Studies**
<www.princeton.edu/~piirs/calendars>
258-4851
- Princeton University Concerts**
<www.princeton.edu/puconcerts>
258-2800
- Richardson Auditorium**
<www.princeton.edu/richaud>
258-5000
- School of Architecture**
<soa.princeton.edu>
258-3741
- School of Engineering and Applied Science**
<www.princeton.edu/engineering/events>
258-4554
- Woodrow Wilson School of Public and International Affairs**
<wss.princeton.edu/events>
258-2943

For additional events sponsored by specific departments, programs and offices:

University "A to Z" search page
<www.princeton.edu/main/tools/az>

For audience members needing assistance:

Office of Disability Services
<www.princeton.edu/ods>
258-8840

To offer submissions for "Nassau notes," use the online form:
<www.princeton.edu/main/news/share/submitevents>



Courtesy of the Princeton University Library Department of Rare Books and Special Collections

Balancing constitutional rights with national security

BY USHMA PATEL

CONFIDENTIAL. SECRET.
TOP SECRET.

Diane Snyder, a lecturer in politics and freshman seminars at Princeton and a former senior CIA officer, wrote the words on the chalkboard and then fielded a barrage of questions from her students about the U.S. government's categories of classified information.

What is the default category of classification? "There is no default," she said.

If you can't divulge anything that is classified, why do these distinctions matter? "They're based on the degree of damage that would occur to national security if the information were made public," she said. For example, leaks of confidential information such as a parking lot access code likely would cause minor damage, while leaks of highly classified, sensitive information such as codes for accessing nuclear facilities would have more dire repercussions, Snyder noted.

Snyder directed research in artificial intelligence, developed information exchange protocols for arms control negotiations and conducted various assignments overseas during her 12 years with the CIA. She shares her past experiences to lend a real-world perspective to the freshman seminar "The Rest of the Story: The Six O'Clock News, Intelligence, National Security and You." The course explores American national security issues and constitutional rights such as privacy, due process and free speech, which date to the founding of the country and have remained at the center of public debate since the Sept. 11, 2001, attacks.

"Students now only know a post-9/11 world, so their attitudes are more tuned in than the average post-Cold War student whom I taught in 1995," said Snyder, who has taught the freshman seminar every fall since 2005. She began teaching at the University in 1995.

"Today's students also have far more access to information or news, and the course is designed to help them be discerning in how they understand the news," she said. "I want them to be able to weigh the big picture critically and ask themselves if their government is making the right choices for them and the country — given what information they have — but also be aware of the difficult tradeoffs the government encounters

when making choices about national security activities."

Snyder and her 15 students examine how to balance the government's duty to keep the country secure, the press's role as a watchdog and the public's right to know about the government actions on their behalf. Along with readings and personal anecdotes, Snyder incorporates various resources to communicate the material, from government documents and CIA guest speakers to TV shows such as "24" and the film "Good Night and Good Luck." Using popular culture to demonstrate important topics such as torture, investigative journalism and the use of Facebook and Google, Snyder aims to make serious issues of national security, privacy and free speech more accessible to the students.

Freshman Alex Chuka said he appreciates what Snyder brings to the class in terms of experience, enthusiasm and humor. According to Chuka, she has "a wit that allows her to step occasionally outside her own skin and poke fun at the very institutions to which she devoted so many years."

The seminar is fast paced, to keep up with both the large amount of material in the 40-page syllabus and Snyder's high energy. The recent class session that included the designations of classified information focused on the freedom of the press, especially in dealing with leaks of information related to national security.

AND INQUIRY DISCOVERY

FRESHMAN SEMINARS LAUNCH ACADEMIC JOURNEYS

Through the freshman seminar program, students this fall are becoming intimately acquainted with Princeton's emphasis on inquiry and discovery.

Freshman seminars set the course for the students' years at the University by enabling them to build strong relationships with faculty members and their classmates in a close-knit setting. The seminars provide an educational experience that students often consider one of the highlights of their time at Princeton.

Among other subjects, students in freshman seminars this fall are exploring genetics, sustainable technologies, national security and the relationship between soccer and politics in Latin America. A total of 460 freshmen are enrolled this semester in 34 seminars, each of which is hosted by a residential college. Class discussions often continue in informal settings both on and off campus, through meals, guest lectures, field trips and other activities.

This issue of the Princeton University Bulletin features four of the seminars being offered this semester. ♥

"What's the line between the press's responsibility to inform public debate, so you can have an informed populace that can vote intelligently, as opposed to blabbing secrets that shouldn't be blabbed?" Snyder asked the students.

Snyder pointed out that while leaking classified information is illegal for those with security clearance, the First Amendment protects members of the press.

"Can I call Bob Woodward [of The Washington Post] and say, 'Hey, there's this thing going on at the agency and I really think you ought to know about it and frankly, the public ought to know about it'? What

happens to me and what happens to Bob Woodward?" she asked. "I'm in trouble; he gets the Pulitzer Prize."

Snyder noted that even if classified information is leaked and published in the media it is still not declassified, as only certain elements of the government have that authority.

For background on whether the press had enough information to make decisions about disclosing sensitive information, the students had read press revelations in 2006 that the U.S. government — with the cooperation of an international banking cooperative — was engaged in surreptitiously

Continued on page 8



Diane Snyder (right), a lecturer in politics and freshman seminars and a former senior CIA officer, shares her past experiences to lend a real-world perspective to the freshman seminar "The Rest of the Story: The Six O'Clock News, Intelligence, National Security and You."

Tilghman

Continued from page 1

genetics bears upon the question of the extent to which the expression of genes is "hardwired" or preprogrammed, or shaped by circumstance.

"The big idea we start with is: 'How is the genome interpreted, and how are stable decisions that affect gene expression inherited from one cell to the next?'" Tilghman said about the content of the class. "This is one of the most competitive areas of molecular biology at the moment, and the students are reading papers that in some instances were published this past year. As a consequence, one of the most common answers I have to give to their questions is, 'We just don't know.'"

In the weekly course, which is designed to be accessible to anyone who has taken high school biology classes, Tilghman assigns readings of science papers published in leading journals. She walks the students through the questions at the base of the studies, the evidence presented and the legitimacy of the conclusions. The freshmen respond freely to the dynamic mix of ideas.

"We all get a chance to speak, ask questions and have open-ended discussions about various topics that arise each week," said freshman Michael Moses. "I think that this seminar will definitely leave a lasting impression on all its members."

In fast-paced, three-hour sessions, Tilghman packs in lessons on the formidable lexicon of molecular biology. She treats lab experiments as though they are logic puzzles, creating opportunities for students to think

out loud. She frequently says, "OK, let's talk this through," and checks in to ensure that students are retaining details.

For example, during a class when she started to launch into a description of an experiment, Tilghman stopped to ask: "What is it called when genes jump from one chromosome to another?" The class chimed instantly: "Translocation."

As the class progressed, the students posed Tilghman with a series of their own questions, including why Dalmatians are spotted (not because of epigenetics — they lack a gene that controls pigmentation) and whether Alzheimer's disease may be caused by an epigenetic change to a neuron (probably not). In response, Tilghman probed their thinking, creating a give-and-take environment similar to a collaborative lab meeting.

"I absolutely enjoy the class: I'm learning a tremendous amount, but it doesn't feel like work," said freshman Gitanjali Gnanadesikan. "In fact it's a lot of fun. Not only is the subject interesting, Professor Tilghman has done a wonderful job in constructing the course so that we discuss not only the mechanics of epigenetics, but the ideas behind important scientific papers in the field, how the discoveries were made and what might come next."

The focus of a recent class was on two milestone papers in epigenetics published three decades apart. Tilghman pointed to the first, a 1961 Nature paper written by the British scientist Mary Lyon displayed on a screen at the front of the room. The study explains how X chromosomes can sometimes be

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Making sustainable energy technologies come alive

CAROL PETERS

Almost anywhere he looks, Princeton professor Craig Arnold sees energy.

“Plants convert light to sugar — this is chemical energy,” Arnold told students in his freshman seminar on “Science and Technology for a Sustainable Future.” “Cars take chemical energy and convert it to linear motion. We convert electrical energy into visible light by using a light bulb.”

For Arnold, an associate professor of mechanical and aerospace engineering and an associated faculty member of the Princeton Environmental Institute, the intricacies of energy are central to his research. In his freshman seminar, Arnold conveys his fascination with the subject to “get students to think, ‘I can make a difference.’”

Students said the seminar helps inform their strong interest in sustainability topics. Designated as the Donald P. Wilson '33 and Edna M. Wilson Freshman Seminar, the course is an outgrowth of Princeton's Grand Challenges Program, an interdisciplinary effort to address global environmental problems.

“I was the president of an environmental organization in high school, so I have always been interested in energy issues,” said freshman Emily Eitches. “This class is so relevant and topical. Already I understand things

so much more than I did before, such as how energy works, the societal and bureaucratic parts of energy production and how many people are involved in the process of creating energy.”

In a recent session, Arnold told students about the life of the 19th-century English physicist and chemist Michael Faraday, whose experiments and discoveries led to the use of electricity in technology and whose experience pro-

Faraday, he said, recognized an effect whereby changes in a magnetic field produced an electrical current. This concept is the basis for the modern-day electrical generator.

“By doing so he invented a new kind of physics” and demonstrated a new method that is at the heart of many of today's discussions about electricity, Arnold said. “These discoveries changed the world.”

what happened to Faraday's work. About 50 years elapsed before people were able to turn Faraday's discoveries into efficient and practical devices, Arnold said.

“Does this still happen today? It does, and this is a real problem. It is known as the ‘valley of death,’” said Arnold, who also is an inventor. “If we invent the next great energy-producing widget in our lab, unless there's money, the political will and a technological need, it won't leave the lab and reach the public.”

Faraday's life story is key for another reason, Arnold said. “Faraday had a fourth-grade education and did not know calculus from trigonometry, but he had an instinct and he wasn't afraid to ask the questions, ‘What if I do this or that, or flip this around?’” Arnold said. “Today scientists still must be fearless and ask, ‘How does this work? How can I make it better? How can we avoid getting stuck in a rut and come at the problem from another place?’”

Field trips are part of the seminar as well. During a visit to the University's energy plant, which employs a technology known as cogeneration, the students learned how technologies evolve into more sustainable applications.

During a tour conducted by Edward Borer, the energy plant manager, stu-

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Craig Arnold (left), an associate professor of mechanical and aerospace engineering, is leading the freshman seminar “Science and Technology for a Sustainable Future.” Freshmen Kojo Quaye (center) and Andrew Shafer (right) participate in a laboratory exercise using Legos, wire, magnets and voltage meters to construct small electric generators.

vides a model for the challenges facing today's technology innovators.

In the 1820s, the battery had recently been invented and people were just starting to understand electricity. Scientists thought of it like water flowing through a pipe, but did not appreciate that invisible forces occurring around the wires could be important, Arnold explained.

To demonstrate Faraday's law of induction — if the magnetic field is altered, an electric current will travel through wire — Arnold led the class through a lab in which the students used Legos, wire, magnets and voltage meters to construct small electric generators using Faraday's ideas.

The lesson on Faraday was not just about the discovery itself, but also

Kicking off a study of Latin America through soccer

JENNIFER GREENSTEIN ALTMANN

Caroline Stone is taking the freshman seminar “Soccer in Latin America: Politics, History and Popular Culture” to learn why so many people are addicted to the sport. After serving as a volunteer in an after-school program for Hispanic youngsters in her hometown of Greenville, S.C., she saw up close “how amazingly obsessed the kids were with soccer,” and she wanted to understand “why soccer completely consumes so many people,” she said.

Stone and 14 other Princeton freshmen — most soccer addicts themselves — are spending the semester exploring the sport's function in politics, the impact of violence in the game and questions of race and social mobility in Latin America. Certainly, they are getting to talk about Pelé, too.

“The enormous success of Latin American soccer on the world stage has largely been disproportional to

the region's role in the global economy and geopolitics,” said Bruno Carvalho, an assistant professor of Spanish and Portuguese languages and cultures, who is teaching the class. “One of our hypotheses, then, is that the sport can provide a window into how different countries in the region have thought of themselves in relation to the world.”

Carvalho has a deep personal interest in the topic of the course, which is designated as the Barrett Family Freshman Seminar. “I grew up in Brazil, playing soccer and attending matches at Rio's famous Maracanã and São Januário stadiums,” he said. “My lifelong relationship to the sport is part of what made me interested in developing this course.”

The freshmen are reading works by Uruguayan author Eduardo Galeano, short stories and poetry, as well as viewing photography and films, including the documentary “The Two Escobars” about the marriage of crime and sport in Colombia. They

will explore how dictatorial regimes of the 1960s and 1970s attempted to co-opt soccer, and how the sport, in a region of deep inequalities, functions to both bring people together and to distract them from larger social issues.

Carvalho believes there is much to be learned through the prism of soccer, even in an academic setting.

“There is still a lingering notion that athletic activities — or even the appreciation of sport — must be incompatible with intellectual life or critical thinking,” he said. “An institution like Princeton successfully combines both academics and sports, and this class shows that they can be part of the same conversation.”

In a recent class, the discussion turned to the use of modern building materials like steel and cement in the 1920s, which allowed massive stadiums — seating as many as 60,000 spectators — to be built in Brazil and Mexico. Carvalho asked the students about the significance of the new stadiums, used for sports and other events, to Latin American leaders.

“The government could put on a large spectacle and prove they had the control to deal with it,” said freshman Elizabeth Smith.

Carvalho agreed. The stadium experiences in that period were meant to be “spectacles of order closer to military parades than sports events today,” he said. “They could display the country at its most civilized, and here we're using the word ‘civilized’ with quotations.”

“It almost seems the stadium was supposed to civilize” the people, freshman Samuel Lazerwitz pointed out, “to show the glory of this way of life.”

But soccer matches instead became rowdy gatherings that served as a form of release for the working classes, Carvalho explained.

The students went on to discuss how issues of race played out in soccer in this period, and the differences between soccer in Latin America and Europe.

“It's an interesting way to look at Latin American history and politics — through the lens of soccer,” Lazerwitz said during a class break. “I really took the class because of soccer, but I'm enjoying it so much because we see the way soccer relates to other issues.”

Gabriella Guzman is thrilled to be in the class. “I really wanted to be in a freshman seminar because of the intimate environment. You get to know your fellow classmates and your professor really well,” she said. “I love soccer,” she added. “It's more than just a game.” ♥



Fifteen freshmen are spending the semester studying the politics and history of soccer in Latin America, exploring how questions of race and social mobility are connected to the game. Bruno Carvalho (far left), an assistant professor of Spanish and Portuguese languages and cultures, is teaching the freshman seminar.

Sensor

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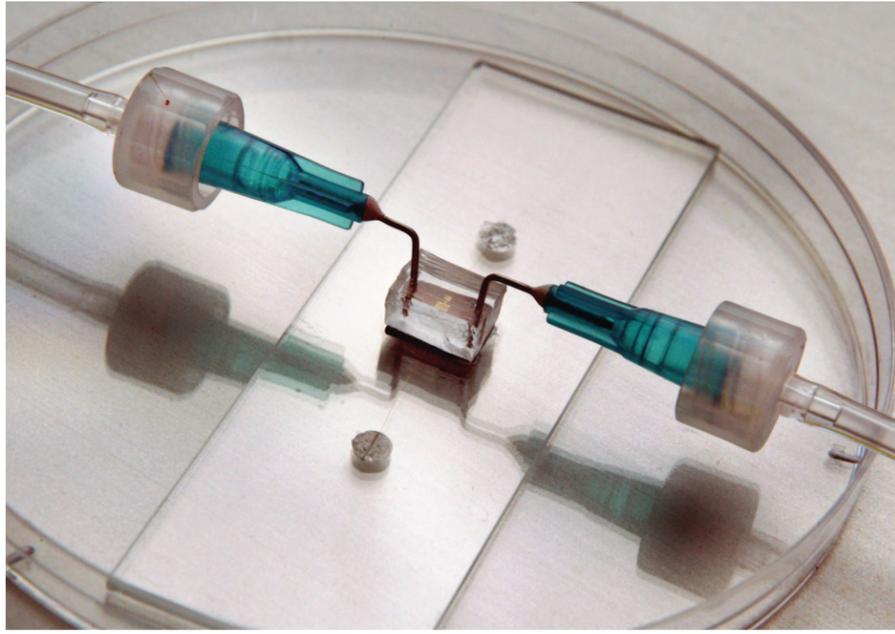
knots declined from 53,000 birds to 27,000 birds between 2000 and 2002. The decline has been linked to the reduction in the number of horseshoe crabs, as a result of harvesting their blood for medical testing and their use as fishing bait for eel and conch.

In response, Delaware, Maryland and New York have limited the number of crabs that can be harvested each year to less than 150,000, and New Jersey has implemented a moratorium on harvesting the crabs.

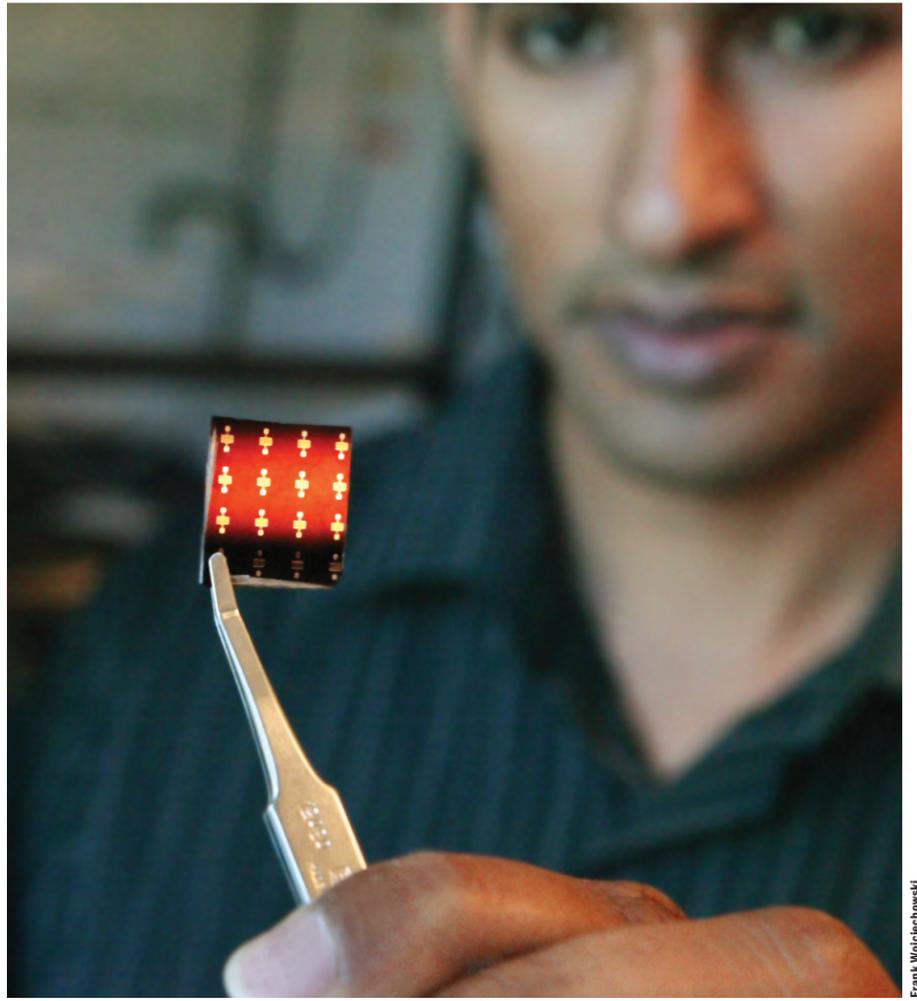
In 2009, since implementing the measures, the number of red knots visiting Delaware Bay was estimated at 24,000, up from 18,000 the year before, but still far lower than the population of 100,000 to 150,000 of two decades ago.

The researchers hope that technology based on their electronic chip will eventually replace LAL as the standard for contamination testing, obviating the need for horseshoe crab blood and helping both the crabs and the red knots rebound.

At the same time, producing this new sensory device would not put pressure on the frog species. “No frogs were harmed in the making of this sensor,” McAlpine said. ♥



Frank Wojciechowski



Frank Wojciechowski

ABOVE: An electronic chip developed by Princeton engineers may be used to check medical devices and drugs for bacterial contamination. The chip, held by doctoral candidate Manu Mannoor, is coated with antimicrobial peptides from the skin of an African frog, which can be synthesized in a laboratory. The sensor would help ensure the survival of the horseshoe crab, whose blood typically has been used to identify contamination. **LEFT:** The chip generates an electrical signal as a warning when the frog peptides attached to it come in contact with bacterial contaminants.

Arnold

Continued from page 7

dents learned how the plant is powered by a large combustion engine. “We generate Princeton’s electricity with big engines to turn the generator — just like your Lego ones, only they are bigger, less flimsy and more precise,” Borer said.

One problem with combustion engine technology, he noted, is that

during this process heat is created and in most plants it is wasted. Princeton has overcome this problem by harvesting this heat for other purposes.

“This is the notion behind a cogeneration plant,” Borer said. “Instead of the heat getting away through the chimney we use it on campus for a number of things, such as heating water and buildings. This ultimately saves the University a significant amount of electricity and money.”

For their final projects, students will present tabletop demonstrations of sustainable energy technologies at the Liberty Science Center in Jersey City, N.J. The project presents an opportunity for the freshmen to be creative and gain insights into a subject about which they are passionate, Arnold said.

Freshman Max Rubin said, “The number one threat to the future of mankind is environmental deterioration. Now that I am a student at Princeton, I thought instead of

waiting for someone else to find a solution, I should jump into the fray and try to solve it myself.

“I took this class because I want to understand more about sustainable energy solutions such as nuclear fusion, algae, solar and wind,” Rubin said. “We probably won’t be able to solve our environmental problems unless we use less energy. For this to happen, cultural and political change must occur before scientists can implement the technology needed to reduce our energy usage.” ♥

Snyder

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tracking financial transactions for connections to terrorist activity.

Said one student, “The editors thought they understood what the government was doing well enough to expose it. Treasury Secretary John

Snow said you have no idea how complicated it is — bankers may back out. But ... people need to know.”

As different case studies were discussed, the students took sides, with Snyder moderating and posing new questions. When a student observed that civil liberties are constricted during times of war and terrorist threats, Snyder elaborated by relating McCarthyism in the 1950s with persecution

of Japanese Americans during World War II.

The theme of secrecy versus openness continued in the student presentation, given by Chuka and classmate Emily Tseng. They began with the Alien and Sedition Acts of 1798, which were meant to suppress dissent with the government by citizens and the press, and followed with case studies on a book written by a

military code breaker, military censorship of the press and reporting on CIA surveillance of Soviet telecommunications. Throughout, the presenters posed questions about the decisions made by the government and the press.

Chuka said the classroom discussions lead to “very spirited debates.” Often, he said, “we come out with our own perceptions changed as a result of our interactions with each other in class.” ♥

Tilghman

Continued from page 6

inactive in mammals. Tilghman, seated at the table’s head, scanned the students’ faces and asked, “If women have two X chromosomes and men have an X and a Y, what does it tell you?”

The room fell silent. After a pause a student ventured: “That you don’t really need a Y to survive?”

Tilghman’s face brightened. “Exactly,” she said.

Lyon’s classic study was based on observing a certain strain of female mice carrying a mutation in one of the two copies of a gene on the X chromosome that is responsible for pigmentation in the coat. Based on

the striped pattern of the fur, she proposed that only one of the two X chromosomes was active in any given cell; the other X chromosome must be silent. The stripes, she argued, arose because the decision as to which X to inactivate was a random one and occurred early in development. Thus only some of the cells produced pigment because they had inactivated the X chromosome that contained the mutation, while the cells that had inactivated the X chromosome that had a normal gene could not produce the black pigment. Lyon noted a similar pattern seen in the coats of some cats.

Tilghman uses success stories like these to make a point about progress in research. One must work hard, she says, and be willing to accept the fact

that most papers represent incremental advances. The payoffs do come, though. “Every once in a while, in science, the sky opens up,” Tilghman said, smiling. “You get a breakthrough.”

She displayed an image on the screen showing large messy splotches of ribonucleic acid captured in a lab technique known as gel electrophoresis. These are experimental results from the second paper she assigned, a 1991 Nature report on work led by Carolyn Brown of Stanford University. “What would you do if you got these results?” Tilghman asked.

One student replied: “I would think I screwed up!”

“Ah,” Tilghman responded with a smile. “Always be skeptical. Very good.”

Brown’s paper, which goes on to show that the RNA blobs are not lab

accidents but real, is of great interest to epigenetics researchers. As the class talked it through, they learned that Brown was able to show that the gene Brown had discovered was highly unusual because it was only expressed from the inactive X chromosome — a completely unexpected and counter-intuitive result that opened up a new avenue of study on X chromosome inactivation.

Through such studies, Tilghman emphasizes that epigenetics is both fascinating and complicated.

It is a message reinforced at the end of the class when Tilghman asked one last question, too involved, however, to be answered at that time, despite the students’ expectant looks.

“We’ll see,” Tilghman said. “That’s for our next class!” ♥