First and foremost, thanks to the SEAS and Harvard communities for helping with my transition to the role of Interim Dean. I greatly appreciate the trust all of you have placed in me to continue the efforts of former Dean, now Professor, Venky. I use the word trust deliberately because that is, as much as truth, the necessary element to sustain any successful research enterprise and cultivate a flourishing School of Engineering and Applied Sciences.

The careful leadership at DEAS/SEAS over the past two decades, the generosity of our alumni and friends, and the continued dedication of our faculty, staff, and students have long kept us in sound financial and intellectual shape. We have been fortunate to have had the resources and flexibility to put good ideas into good hands—and the confidence to then get out of the way and let innovators innovate.

This past October, HBS alumnus Hansjörg Wyss gave yet another astounding vote of confidence in the power of engineering to transform our university and our world by providing the means to create a bold new multi-institutional enterprise in biologically inspired engineering.

That said, with the uncertainty caused by the current global economic crisis, we are giving a great deal of thought to the best way to move forward. We expect significant losses to our endowment due to the volatility of the markets. We also expect that government-sponsored research, gifts, and other means of support will likely decline. President Faust mentioned in her November 10 letter to the Harvard community that the university and its individual schools will all need to take appropriate steps to adapt to changing financial circumstances in the coming years.

In response, SEAS will do its share—reducing costs while maintaining our commitments to enhance the faculty and to create an administrative and physical infrastructure that is appropriately scaled to support a leading engineering program. Doing so might require making some tough choices in the months ahead. Thus we will work closely with our colleagues in the Faculty of Arts and Sciences and in the other schools to assess academic priorities and adapt nimbly to new and ongoing constraints.

Our new school will continue to mature and thrive, but at an adjusted and more measured pace. Rest assured, our aspirations—further enhancement of our educational programs, further support for fundamental and collaborative science, and the development of promising areas, such as biological and chemical engineering—remain high.

Engineers are, as you will read in this latest issue of the newsletter, ever resilient and resourceful. To borrow one of Dean Venky’s favorite phrases, at SEAS we approach every problem with a “can do” attitude. That mindset, in fact, is just what we need during uncertain times—and we have it in abundance.

To wit, our undergraduates continue to amaze me with their global outlook. During a holiday break, members of the newly formed Harvard chapter of Engineers Without Borders traveled to a small village in Central America to tackle a water contamination problem. In November, the New York Times highlighted another team of innovative students who used microbial fuel cells to create off-the-grid lighting technology in Africa.

We also have a dynamic mix of newer and seasoned researchers at SEAS—all dedicated to collaborative discovery. One recent arrival, computer scientist Hans-peter Pfister, is linking together graphics processors, typically used in videogame systems, to achieve computational muscle akin to supercomputers, to improve visualization. His efforts are already helping astrophysics and brain scientists see data in new ways.

Likewise, Lene Hau, who came to Harvard more than a decade ago, received the George Ledlie Prize for fundamentally changing our view of, and literally exchanging, light and matter. It perhaps comes as no surprise that her mentor, Jene Golovchenko, who helped her “change direction” and study ultra-cold atoms, is now developing a radical new way to sequence individual DNA molecules.

Finally, on the back cover of this newsletter you will see the practical beauty and promise that results when engineering meets biology. Given the possibility for developing biocompatible materials and even creating new organs, we expect this emerging area to remain one of our most fruitful.

Such innovations from our “can do” SEAS community reassure me that, though we face a difficult and changing financial climate, long term it is our disciplined imagination that will keep our enterprise moving ahead.

Ultimately, I see my role as helping to free up thinkers and tinkerers so that they can focus on what drives and fascinates them. I admit that this is a daring proposition, even during the best of times—but I believe it is a wise course. When we give engineers even a little bit of room to dream, they give us wonders in return.

Frans A. Spaepen
Interim Dean; John G. and Helen F. Franklin Professor of Applied Physics
Spaepen settles in as SEAS Interim Dean

Effective September 15, Materials scientist Frans Spaepen agreed to serve as interim dean for SEAS. Spaepen, the John C. and Helen F. Franklin Professor of Applied Physics and director of Harvard’s Rowland Institute, assumed administrative duties from Venkatesh Narayanamurti, who has served as dean for the past decade.

Spaepen received his undergraduate degree in metallurgical engineering at the University of Leuven in 1971 and received a Ph.D. in applied physics from Harvard University in 1975. He has served as director of the Rowland Institute at Harvard since 2002, the year the research laboratory merged with the University.

“I am grateful for this opportunity to serve as the interim dean at SEAS,” said Spaepen. “I was fortunate to have been a part of the marvelous transformation of engineering and applied sciences at Harvard over the past three decades.”

In related news, Barbara J. Grosz, Higgins Professor of Natural Sciences in Harvard’s School of Engineering and Applied Sciences, celebrated her half-year mark as the new Dean of the Radcliffe Institute for Advanced Study. Her colleague in computer science, Michael D. Smith, John H. Finley Jr. Professor of Engineering and Applied Sciences and Dean of the Faculty of Arts and Sciences, began his second year in the role.

Wyss gives $125M to create institute for biologically inspired engineering

Harvard Business School alumnus Hansjörg Wyss made an extraordinarily generous gift to Harvard to establish the Hansjörg Wyss Institute for Biologically Inspired Engineering.

Wyss’s gift of $125 million, the largest made by an individual in Harvard’s history, will formally launch a multidisciplinary effort that will be the cornerstone of Harvard’s broader efforts in bioengineering and a major thrust for SEAS.

The Wyss Institute will be a collaborative enterprise bringing together experimental scientists, theoreticians, and clinicians with expertise in engineering, biology, chemistry, physics, mathematics, computer science, robotics, medicine, and surgery from Harvard’s schools and affiliated hospitals as well as from neighboring universities.

Don Ingber, who has appointments at HMS and Children’s Hospital, and a newly created one at SEAS, will serve as the Wyss Institute’s Founding Director.

Venky “gala” event at Northwest

On September 23, the Offices of the President, Provost, and Dean of the Faculty of Arts and Sciences celebrated the decade-long deanship of Venkatesh “Venky” Narayanamurti. Nearly 300 people attended the fête, the first major event to be held in the recently completed Northwest Building. Surprise guests for what President Faust dubbed “This is your life, Venky” included former Harvard President Neil Rudenstine, who recruited Venky to Harvard, and Chancellor of UC-Berkeley Robert J. Birgeneau, a longtime colleague and family friend.

In homage to Venky’s sense of humor, Margo Seltzer, Harvard College Professor and Herchel Smith Professor of Computer Science, read a modified version of the Dr. Seuss classic, *If I Ran the Circus*, and all the guests were given copies of a custom-made book called *The Quotable Venky* (a collection of oft-overheard witticisms, with commentary). Venky kept his own remarks brief, ending with a thoughtful mantra: “Thank you, thank you, thank you, thank you.”
Interim Dean Spaepen appointed bioengineers David Mooney and Rob Howe as associate deans in SEAS.

David Mooney, Gordon McKay Professor of Bioengineering, will serve as the Associate Dean for Applied Chemical/Biological Sciences and Engineering, a newly created position; Rob Howe, Gordon McKay Professor of Engineering, will serve as Associate Dean for Academic Programs.

Mooney, a renowned tissue engineer will help manage academic and course planning as well as faculty and staff appointments and will represent SEAS to FAS committees. His role parallels that of Greg Morrisett, Allen B. Cutting Professor of Computer Science, who currently serves as Associate Dean for Computer Science and Electrical Engineering.

Howe, whose research focuses on sensing and mechanical design in motor control, will work closely with Marie Dahleh, Assistant Dean for Academic Programs, in her ongoing efforts to coordinate educational policy, cross-school programs and teaching and to oversee lecturer and visiting scholar appointments and international programs.

**Tech Review names Wood and Ham among most innovative researchers**

Donhee Ham, the John L. Loeb Associate Professor of the Natural Sciences, and Robert Wood, Assistant Professor of Electrical Engineering, were recognized by *Technology Review* magazine as among the world’s top innovators under the age of 35.

Ham was recognized for his role in building one of the smallest complete nuclear magnetic resonance (NMR) systems to date. Wood also received praise for thinking and designing on a small scale, perfecting a life-sized microrobotic fly.

“Both of these guys are fearless. What they aim for is nothing less than turning science fiction into reality,” said Greg Morrisett, Allen B. Cutting Professor of Computer Science and Associate Dean for Computer Science and Engineering at SEAS.

Additional information about past and present TR35 winners and judges is available at [www.technologyreview.com/tr35/](http://www.technologyreview.com/tr35/).

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**Overheard**

"I looked at both Harvard's school of engineering and MIT and I really think that if you want something more than the 'stereotypical' engineering experience, Harvard's school of engineering is the way to go. The faculty are amazing, and the students all are really cool."


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**Random Bits**

**Be there and be square**

Boston has history, a beautiful harbor, and an ever-increasing concentration of Ph.D. candidates. To take advantage of such braininess, Boston University Ph.D. graduate Chris Balakrishnan started Nerd Nite. Several times a year the Midway Café allows nerds and novices alike to present research to an often rowdy but always inquisitive crowd. Said one bartender, "It’s like the Discovery Channel with beer." For more details, visit nerdnite.com.

**Past tense**

Twenty-six years ago, Anthony Oettinger, now a Research Professor at SEAS, appeared on the May/June 1982 cover of *Harvard Magazine*. During a time when the most home computers blazed with 1 Megahertz CPUs (and few were connected to modems), Oettinger predicted that "Access to the wired society's wires will determine a lot about who decides to offer what quality of which communications services to what markets where."
A Roundup of Discoveries & Innovations

Engineers whip up the first long-lived nanoscale bubbles

With the aid of kitchen mixers, engineers whipped up, for the first time, permanent nanoscale bubbles—bubbles that endure for more than a year—from batches of foam made from a mixture of glucose syrup, sucrose stearate, and water. Their study appeared in the May 30 issue of the journal *Science*.

The research, led by Howard A. Stone and graduate student Emilie Dressaire, had its origins in a conference talk on foams delivered by Dr. Rodney Bee, a retired Unilever physical chemist, in 2005.

The experimental study revealed that when the bubbles were covered with the chosen surfactant mixture, the surfactant molecules crystallized to form nearly impermeable shells over the bubble surfaces. The resulting shells possessed an elasticity that allowed them to buckle over time into a remarkably regular and stable pattern.

The authors note that future applications of these microbubbles could extend the lifetimes of common gas-liquid products such as aerated personal-care products and contrast agents for ultrasound imaging. Stone and Dressaire’s coauthors also included David C. Bell from SEAS and Alex Lips from Unilever Research and Development. The research was funded by Unilever.

Scientists integrate nanowire devices directly onto silicon

Applied scientists, in collaboration with researchers from the German universities of Jena, Göttingen, and Bremen, have developed a new technique for fabricating nanowire photonic and electronic integrated circuits that may one day be suitable for high-volume commercial production.

Spearheaded by graduate student Mariano Zimmler and Federico Capasso, Robert L. Wallace Professor of Applied Physics and Vinton Hayes Senior Research Fellow in Electrical Engineering, and Prof. Carsten Ronning of the University of Jena, the findings were published in *Nano Letters*.

By incorporating spin-on glass technology, used in silicon integrated circuits, and transferring a circuit pattern onto a substrate with light, the team demonstrated a reproducible, high-volume, low-cost fabrication method for integrating nanowire devices directly onto silicon.

The team’s coauthors are postdoctoral fellow Wei Yi and Venkatesh Narayananmurti, both of SEAS; graduate student Daniel Stichtenoth, University of Göttingen; and postdoctoral fellow Tobias Voss, University of Bremen. The research was supported by the National Science Foundation (NSF) and the German Research Foundation.

Researchers demonstrate highly directional semiconductor lasers

Applied scientists at Harvard University, in collaboration with researchers from Hamamatsu Photonics in Hamamatsu City, Japan, have demonstrated highly directional semiconductor lasers with a much smaller beam divergence than conventional ones.

Led by SEAS graduate student Nanfang Yu and Federico Capasso and by a team at Hamamatsu Photonics headed by Dr. Hirofumi Kan, General Manager of the Laser Group, the findings were published online in the July 28 issue of *Nature Photonics* and appeared in the September print issue.

Semiconductor lasers are widely used in everyday products such as laser printers, but they suffer from poor directionality. The team was able to dramatically reduce the divergence angle of the beam emerging from their laser from a factor of 25 down to just a few degrees in the vertical direction. The laser could be used for long-range chemical sensing in the atmosphere without requiring bulky collimating optics.

The team’s other authors are graduate student Jonathan Fan, postdoctoral researchers Qijie Wang and Christian Pflügl, research associate Laurent Diehl—all from Harvard—and researchers Tadataka Edamura and Masamichi Ya-
Recent findings

Jene Golovchenko is among several grant winners who are developing nanopores (holes about two nanometers in diameter) that may be able to recognize individual DNA bases by their electrical or ionic signals to achieve high-accuracy sequencing of individual DNA molecules.

manishi, both from Hamamatsu Photonics. The research was partially supported by the U.S. Air Force Office of Scientific Research. The Harvard authors also acknowledged the support of Harvard’s Center for Nanoscale Systems (CNS).

Team makes breakthrough in T-rays

A group of engineers and applied physicists have demonstrated the first room-temperature, electrically pumped semiconductor laser source of Terahertz (THz) radiation, also known as T-rays. This breakthrough in laser technology, based on commercially available nanotechnology, has the potential to become a standard Terahertz source to support applications ranging from security screening to chemical sensing. T-rays can penetrate efficiently through paper, clothing, cardboard, plastic, and many other materials.

Spearheaded by SEAS research associate Mikhail Belkin and Federico Capasso, the findings were published in the May 19 issue of Applied Physics Letters. Belkin and Capasso’s coauthors are Feng Xie and Alexey Belyanin, Department of Physics at Texas A&M University, College Station, and Milan Fischer, Andreas Wittmann, and Jérôme Faist, Institute of Quantum Electronics at ETH, Zürich, Switzerland. The research was supported by the Air Force Office of Scientific Research and the National Science Foundation.

Notable grants

The National Human Genome Research Institute (NHGRI), part of the National Institutes of Health (NIH), awarded a $6.5 million grant to a team of researchers to further develop electronic sequencing in nanopores. Daniel Branton, Higgins Professor of Biology Emeritus in the Faculty of Arts and Sciences (FAS), and Jene Golovchenko, Rumford Professor of Physics and Gordon McKay Professor of Applied Physics in SEAS and Department of Physics will oversee the research.

The Defense Advanced Research Projects Agency (DARPA) awarded a $1.2 million grant to an interdisciplinary team of researchers to study surface-enhanced Raman scattering (SERS). If all phases of the development program are completed, researchers could receive a total of up to $2.9 million in funding. Ken Crozier, Assistant Professor of Electrical Engineering, will serve as the principal investigator. His coinvestigators include Eric Mazur, Balkanski Professor of Physics and Applied Physics at SEAS and the Department of Physics, and Alán Aspuru-Guzik, Assistant Professor of Chemistry and Chemical Biology at the Department of Chemistry and Chemical Biology.

Harvard was among four universities to receive part of $500,000 in funding from Microsoft’s Sustainable Computing Program. David Brooks, John L. Loeb Associate Professor of the Natural Sciences and Associate Professor of Computer Science; Gu-Yeon Wei, Associate Professor of Electrical Engineering; and Mike Smith, John H. Finley, Jr. Professor of Engineering and Applied Sciences and Dean of FAS will develop a dynamic runtime environment to link power use and load.

Kit Parker, Associate Professor of Bioengineering, will receive funding as part of a GlaxoSmithKline (GSK) and Harvard Stem Cell Institute (HSCI) five-year, $25 million-plus collaborative agreement to build an alliance in stem cell science. Parker will undertake a project focused on developing cardiomyocyte models for drug screening and discovery.

Jene Golovchenko is among several grant winners who are developing nanopores (holes about two nanometers in diameter) that may one day be suitable for high-volume commercial production; (far right) graduate student Nanfang Yu and Capasso demonstrate a highly directional semiconductor laser that has applications in photonics and communications.
Social Entrepreneurship Steps Up

Applicants spend a vast amount of time and energy trying to get into Harvard, but once there, many of the best and brightest immediately look for opportunities to leave—both the campus and the country.

In recent years, engineering undergraduates have spent time playing robotic soccer in Germany and China; studying ways to improve HIV/AIDS prevention in South Africa; conducting summer research in Bangalore, India; and even developing a novel public science display on an aerosol-based food system in Paris, France.

The following article invites you to tag along with some of our student globetrotters as they investigate ways to clean up an impure water system of a small village in the Dominican Republic and find a cheaper and more reliable way to bring lighting to a large portion of Africa.

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That Harvard administrators and advisers fully support such behavior should not be surprising. Being a global campus means, of course, opening our gates to the world. At the same time, to build a better world means that students are increasingly inspired to bring their energy and intellect to places far and wide.

Practicing good engineering

There is a machine shop in the basement of Lehman Hall that, according to Jackie Stenson, every engineering concentrator at Harvard should use.

“And yet practically no one even knows that it exists,” Stenson observes with a frown over lunch one afternoon last spring in the Currier dining hall. “We’re not required as concentrators to build anything before we get our degree. We can write programs and model systems on a computer, but we’re never asked to work with our hands. ES 51 [Computer-Aided Machine Design], the class that introduced me to the machine shop, is one of the few classes at Harvard where I made things.”

But even the machine shop isn’t enough for her.

During her junior year at the College, Stenson found herself itching for a wider workspace, so, characteristically taking matters into her own hands, she co-founded, with fellow classmates Debbie Amanti ’08 and Ray Jean ’08, an extracurricular student organization dedicated to practicing the hands-on engineering that she missed in school. The organization was called Harvard College Engineers Without Borders (HCEWB), and its workspace, she hoped, would be the world.

The three engineers founded HCEWB to bring together like-minded undergraduates—students interested in working with their hands—to use their talents and theoretical training to engineer real-life solutions to a wide range of social and public health problems in developing countries. “The idea was to learn engineering by doing it,” says Dana Lazarus, one of the group’s earliest members, “and to do good while doing it.”

Gaining insights on-site

Their first project took them south to a small village in the Dominican Republic called Suriel, where a group of medical professionals working with Doctors Without Borders had noticed a spate of waterborne illnesses in the local population. “They noticed a lot of health problems in patients that seemed to be related to poor water quality,” recalls Lazarus, who was part of the inaugural assessment team. “They thought it might be a problem that engineers could solve, and they called us.”
HCEWB quickly organized a small group—five undergraduates—that flew down in November to spend a few days interviewing residents and conducting tests in the village water system. The work began before they set foot on foreign soil—“We had no idea what the problem with the water would be. Parasites? E. coli? Nitrites, nitrates, arsenic, chlorine? We had to do research to figure out what tests to bring with us,” says Lazarus—but the principal portion of the research was done on-site on foot and in person.

Lazarus laughs when she recounts this segment of the trip. “We were working with an influential religious mission there, St. Jerome’s Costanza Mission, and there was an elderly nun, Sor Rosario, who was amazing and went everywhere with us. We went hiking to get to the source of the water, and she even came along for that part, and when we were done, everyone had muddy shoes—except for her. Hers were spotless.”

Sor Rosario, Stenson notes, was a crucial part of the HCEWB assessment team. “She immediately understood the goal of the club: students trying to learn from (Continued, p. 8)

**Lighting Africa**

A team composed of Harvard students and alumni was among the winners of the World Bank’s Lighting Africa 2008 Development Marketplace competition, held in Accra, Ghana, from May 6–8, 2008. The team’s innovation, microbial fuel cell-based lighting systems suitable for sub-Saharan Africa, netted the Harvard group a $200,000 prize.

According to the World Bank, because only 26% of Africa’s population has access to grid-based electricity, most residents rely on dangerous kerosene lamps and candles for illumination. To encourage the development of cheaper and safer lighting technologies, the organizers of Lighting Africa 2008 sought practical solutions from around the world, ultimately funding 16 of the original 400 proposals.

The winning Harvard project came to life thanks to an undergraduate course, “Idea Translation,” taught by David Edwards, McKay Professor of the Practice of Bioengineering and author of *Artscience: Creativity in the Post-Google Generation*.

“In the course we found what many of us were missing in our lives: a project that combined our love for Africa and our passion for technology,” said Harvard College alumnus Hugo Van Vuuren ’07, a South African native who took the course as a senior in the fall of 2007.

Joining Van Vuuren, an economics concentrator, were current undergraduate students Stephen Lwendo ’10 (computer science and engineering) and David Sengeh ’10 (bioengineering), who are both from Africa, and Alexander Fabry ’09 (history of science and physics), alumna Zoë Sachs-Arellano ’07 (a philosophy concentrator who cofounded the Namibia Connection Youth Network), and Aviva Presser, a graduate student at the Harvard School of Engineering and Applied Sciences (SEAS). (Continued, p. 9)
experience in the real world. And she was so responsive and socially adept—she knew absolutely everyone in the village and could read people’s reactions when we were talking to them.

Her familiarity and ease with individuals and her ability to draw on established relationships in the community were an immense help to the group during the conversations they held with Suriel residents, an unlikely but surprisingly effective tactic in HCEWB’s fact-finding strategy.

Explains Stenson, “People aren’t stupid. They know what their problems are, and if you ask them, they’ll tell you what you need to know. It’s important to ask them, even if you think you know what the problem is, because otherwise they won’t trust you. They’ll think you’re either arrogant or clueless.” Stenson’s descriptions of the complex human psychology involved in the mission seem more apt to convey the delicacy of a diplomatic operation; but her argument is that social entrepreneurship through engineering is a diplomatic operation.

Translating technology

“Technology happens in a culture. It doesn’t take place in a vacuum. It has to fit in a culture and be locally acceptable—people need to feel invested in it, to want to produce it, sell it, and buy it. It has to fit into their lifestyle.” Stenson suggests that these first principles of engineering aren’t immediately apparent in developed countries because engineers predominantly engineer for their own cultures. Engineering for foreign cultures, in a sense, is a process roughly equivalent to translation; without it, technology becomes an imposition—and a frustrating experience for both parties involved.

In other words, the hands-on experience of social entrepreneurship and engineering requires a delicate touch. Stenson, in fact, admits that constructive cultural exchange is such an integral part of doing this kind of work that historical, linguistic, and anthropological studies are as essential to her engineering education as her technical classes.

“I came to Harvard because I wanted to do work in appropriate technology. That’s a term meaning the technology that fills the gap between the high-investment infrastructure and capital projects that developed countries pursue and the most basic mortar-and-pestle technologies that you find in developing countries.

“There actually aren’t any faculty at Harvard who work in appropriate technology—but I came here because I realized I needed a liberal arts education if I wanted my work to be effective. Here, I’ve taken a class on Zulu; I’ve taken classes in African studies. I couldn’t have taken those classes at MIT.”

The outspokenness that has helped her make her own way as an undergraduate is no less evident in her commitment to HCEWB’s mission and work. “I’ve had professors point out to me that we [HCEWB] don’t really know anything, so how could we accomplish anything? My philosophy is that of course we don’t know anything; but we do know that we don’t know anything. And that’s a great place to start.” She points out that in addition to their Dominican contacts, HCEWB benefits from the guidance of two faculty advisors, Marie Daleh and Rob Wood, as well as one professional engineer, Najwa Obeid, who works in the Water Technical Resources Division at the engineering firm Parsons Brinckerhoff.

Corralling common sense

HCEWB, moreover, hopes to recruit a few more hands to help with the Suriel project next year. “We’re hoping to get more freshmen involved,” Stenson says, “especially since undergraduates now have an extra semester to declare...”
To translate their idea into a reality, the team collaborated with designer and entrepreneur Richard Kirk. Kirk is known for his development and use of a new lighting form based on electrically conducting polymers, akin to luminous plastic sheets. The students then turned to Peter Girguis, assistant professor of biology in Harvard’s Department of Organismic and Evolutionary Biology, who pioneered a microbial fuel cell (MFC) energy source suitable for the developing world.

MFCs capture energy produced by naturally occurring microbial metabolism and can generate electricity from organic-rich materials such as soil, manure, or food scraps. By contrast, most renewable energy technologies are based on solar or wind power. Unlike these and other natural solutions for generating electricity, the team says MFCs are more reliable—working day or night, rain or shine—and markedly less expensive.

The further development of the technology was encouraged by the ongoing mentorship of Presser, who served as a teaching fellow for the course (and later joined the team as a technology partner), and Paul Bottino, cofounder of the Technology and Entrepreneurship Center at Harvard (TECH) and the Idea Translation Lab, based at SEAS.

Such connections inspired the student team to not only enter the World Bank competition but to go one step further and create a social enterprise, Lebôné Solutions Inc., dedicated to solving the lighting crisis in Africa. In fact, the journey from concept to application to startup was not a direct path and continued to evolve more than a year after the course wrapped up.

“The original concept in the course started with an idea of lighting London for the 2012 Olympics and then morphed into lighting Africa,” explains Edwards, who matches the students with idea generators of all kinds, from scientists to visual artists. “The Idea Translation Lab and Harvard Initiative for Global Health (HIGH) continued to support the students after the course ended.”

With the prize money from the World Bank competition and additional HIGH funding, the team will conduct field studies in the foothills of Kilimanjaro, Tanzania.
Nota Bene

The October 11, 2008, the New York Times reported on Harvard’s plan to license “patents for black silicon to SiOnyx, a company in Beverly, Mass., that has raised $11 million in venture financing.” The novel material, created by accident in the lab of Eric Mazur, is on the verge of commercialization. The Boston Globe profiled scientific "wanderer" L. Mahadevan as a renais-
sance scholar who studies everything from how paint dries to how paper wrinkles: “Harvard lists Mahadevan as a professor of applied mathemat-
ics. He is, he finally concludes, ‘just a scientist,’ whose interest is a world where “everything is a puzzle of why and how and what.”

Venkatesh Narayanamurti wrote an editorial about the nature of innova-
tion, sponsored by Microsoft, that appeared in The Times, The Mass High
Tech. The piece coincided with the opening of Microsoft Research New
England.

Peter Rogers wrote a cover story for the August ‘08 Scientific American
article, “Running Out of Water.” The piece presents a six-point plan for saving
the world’s water to avert a global crisis.

L. Mahadevan shared his insights about everyday observations with
NPR’s Science Friday, and Harry Lewis recalled Bill Gates and the “pancake problem” on NPR (see p 13). Lewis was also featured on the
Forbes Website commenting on undergraduate innovators he had the
pleasure of teaching, including Gates and Facebook’s Mark Zuckerberg. The Christian Science Monitor high-
lighted the work of Rob Howe: “Tak-
ing a philosophy that he describes as directly inspired by biomimetics, Howe and graduate student Aaron Dollar, built a hand in 2006 that looks nothing like anything in the animal kingdom, but is capable of picking up anything a human can.”

The Discovery Channel’s Next World and the Discovery Science Channel’s
Weird Connections featured segments on Robert Wood’s microrobotic fly.

Science Careers spent time in the lab of Kit Parker, Associate Professor of
Bioengineering. In addition to Parker, who served on patrol in Afghanistan
for the U.S. Army, three members of the lab have past military experience.

IEEE Spectrum created a YouTube video featuring word-on-the-street
reactions to Harvard’s emphasis on engineering. The quick clip highlighted
the ways in which Harvard and MIT’s engineering programs complement
each another. To view: http://www.
youtube.com/watch?v=T4lUPqi99BY

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The May 20 Wall Street Journal sug-
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The 2008 Commencement edition of the Crimson featured editorials by
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Reuters news service investigated
the Stone labs feat of taking the pop out of bubbles: “[The] team created the long-lasting bubble by aerating a sugary solution of highly viscous glucose syrup with sucrose stearate and water at room temperature for two hours.” (see p 4).

Popular Science saluted a plant-
based air filter created by bioengineer
David Edwards and product designer
Mathieu LeHanneur in its 2008 Inven-
tion Awards. The filter provides a
greener way to clean.

North Bridge Magazine profiled
Michael Aziz, Gordon McKay Profes-
sor of Materials Science. In addition
to describing his research to remove
carbon dioxide from the atmosphere,
Aziz commented, “We use compact
fluorescence lights throughout the
house, and we own a hybrid car. But
we as a family are not nearly done
finding ways to reduce our carbon
footprint.”

Popular Science deemed the space-age looking plant-based air filters, created by
bioengineer David Edwards and product designer Mathieu LeHanneur, as worthy
of a 2008 Invention Award.
Promotions and Appointments

Associate Dean Appointments
Mooney and Howe
Interim Dean at the Harvard School of Engineering and Applied Sciences (SEAS) and John C. and Helen F. Franklin Professor of Applied Physics, appointed bioengineers David Mooney and Rob Howe as associate deans in SEAS (see p 3).

Directorship Appointments
Stuart M. Shieber ’81
Harvard’s James O. Welch Jr. and Virginia B. Welch Professor of Computer Science, will serve as director of the University’s new Office for Scholarly Communication (OSC).

Efthimios “Tim” Kaxiras
Gordon McKay Professor of Applied Physics and Professor of Physics, was appointed director of the Initiative for Biologicaly Inspired Engineering.

Don Ingber
Judah Folkman Professor of Vascular Biology in the Department of Pathology at HMS and Professor of Bioengineering at SEAS, was named the interim codirector of the newly established Hansjörg Wyss Institute for Biologically Inspired Engineering.

Tenure Appointments
David Parkes
Gordon McKay Professor of Computer Science
Areas: Artificial Intelligence and Computational Linguistics; Electronic Commerce

Nalin Khaneja
Gordon McKay Professor of Electrical Engineering
Areas: Control Theory and Communications; Intelligent Systems and Computer Vision; Stochastic Systems; Systems and Control

Awards

Lene Hau
The President and Fellows of Harvard College awarded the George Ledlie Prize to Lene Hau, Mallinckrodt Professor of Physics and of Applied Physics. The Ledlie Prize is awarded to someone affiliated with the University who, “has by research, discovery, or otherwise made the most valuable contribution to science, or in any way for the benefit of mankind.”

Robert Wood
Assistant Professor of Electrical Engineering, was among the winners of the U.S. Air Force’s Young Investigator Program.

Roger Brockett
An Wang Professor of Electrical Engineering and Computer Science, was awarded the 2009 IEEE Leon K. Kirchmayer Graduate Teaching Award “for inspirational mentoring of generations of graduate students who have gone on to define the field of control engineering.”

Donhee Ham
John L. Loeb Associate Professor of the Natural Sciences, and Robert Wood, Assistant Professor of Electrical Engineering, were named among Technology Review’s prestigious TR35 (see p 3).

New Arrivals

Yiling Chen
(Fall 2008)
Assistant Professor of Computer Science
Areas: Artificial Intelligence and Computational Linguistics; Electronic Commerce

Philippe Cluzel
(Fall 2008)
Gordon McKay Professor of Applied Physics in the School of Engineering and Applied Sciences and Professor of Molecular and Cellular Biology in the Faculty of Arts and Sciences
Areas: Biophysics; Materials Science; Soft Condensed Matter; Surface and Interface Science; Biomechanics; Cell and Tissue Engineering; Instrumentation and Imaging

Daniel Needleman
(Fall 2008)
Assistant Professor of Applied Physics and Assistant Professor of Molecular and Cellular Biology (jointly with the Faculty of Arts and Sciences Center for Systems Biology)
Areas: Biophysics; Materials Science; Soft condensed Matter; Surface and Interface Science; Cell and Tissue Engineering

Sharad Ramanathan
(Fall 2008)
Assistant Professor of Systems Biology (jointly with the Faculty of Arts and Sciences Center for Systems Biology)
Areas: Biophysics; Materials Science; Soft condensed Matter; Surface and Interface Science; Cell and Tissue Engineering

Peter Rogers
Gordon McKay Professor of Environmental Engineering and Professor of City and Regional Planning, was awarded the 2008 Warren A. Hall Medal. Dr. Warren A. Hall is known worldwide for his role in water resources research and education.

David Edwards
Gordon McKay Professor of the Practice of Bioengineering, was made a Chevalier dans l’Ordre des Arts et des Lettres in France, the equivalent of a knighthood in Britain.

David Parkes
Gordon McKay Professor of Computer Science, was honored as a top teacher with the Roslyn Abramson Award in May 2008. Every spring, the Roslyn Abramson Awards recognize assistant and associate professors in the Faculty of Arts and Sciences who demonstrate excellence in undergraduate teaching.

Eric Mazur
Balkanski Professor of Physics and Applied Physics at Harvard University, was been elected a fellow of the Optical Society of America (OSA) He also received OSA’s Esther Hoffman Beller Medal for “developing and globally disseminating the innovative teaching methodology now known as ‘Peer Instruction,’ which promotes deeper understanding of the fundamentals of science.”
Graduate

Siebel Scholars find success

In the movie The Secret of My Success, an exasperated young job hunter played by Michael J. Fox finds himself in a bind. He says during an interview, “How can I get any experience until I get a job that gives me experience?” To which an interviewer answers, “If we gave you a job just to give you experience, you’d take that experience and get a better job.” When Fox’s character counters that he has educational experience, the potential employer retorts, “What you’ve got is college experience, not the practical, hard-nosed business experience we’re looking for.”

Durlov Khan, who graduated with a Master’s in computer science in 2008, may have found a viable solution to this chicken-and-egg problem, thanks to the Siebel Scholars Program. Khan was among the first group of Siebel Scholars from SEAS. The program provides a $25,000 award to defray tuition and expenses for the final year of study at 10 leading universities. Though Kahn possessed an impressive work résumé—five years of consulting experience on projects at Avici, Mercury Computer, Agere, and Intel—and was employed as a senior design engineer at the MIT-startup Tilera Corporation, he decided to pause in his climb up the corporate ladder for, of all things, theory.

“Before coming to SEAS, Tilera had just completed the first generation of their multicore processor. The two critical aspects of microprocessor research are compute performance and power consumption,” he says. It turned out that David Brooks, John L. Loeb Associate Professor of the Natural Sciences and Associate Professor of Computer Science, and Gu-Yeon Wei, Associate Professor of Electrical Engineering, were working on both problems.

In fact, Khan did exactly what the founders of the Siebel Scholars program hoped he would: He bridged the gap between academic and industrial thinking. A few months after Khan graduated from SEAS and returned to Tilera, the firm launched its next generation of processors, setting new performance benchmarks.

As for Michael J. Fox’s character, he eventually weasels his way into a company through an uncle. He starts in the mailroom and then, in a matter of weeks, ends up orchestrating a leveraged buyout of the entire firm. For those in the real world, programs such as Siebel Scholars make the climb far more grounded and can have a real-world difference, profoundly affecting technology and our lives.

“The environment that Harvard sets up for its students is unambiguously geared towards bringing out the most enterprising traits within each one of us,” said Khan.

Grad student Erez Lieberman creates iShoe to aid in balance

Graduate student Erez Lieberman is working on an “iShoe” that uses NASA-developed technology to create an insole that could help elderly people keep their balance and prevent falls.

Consummate inventor Erez Lieberman, a SEAS graduate student, shows off his “iShoe”, a smart insole that could help elderly people keep their balance and prevent falls.
Remembering the pancake problem


The problem, introduced to Gates by Harry Lewis in a combinatorial mathematics course, is deceptively simple. As Lewis explained in an NPR interview: “If there are \( n \) pancakes ... what’s the minimum number of flips that suffice always to sort the stack” in such a way that the largest pancake is on the bottom and the smallest pancake is on the top.

The standard answered required a two-flip procedure. In the paper, Gates reduced the number of flips to \( \frac{1}{2}n \ln n \). The pancake problem has applications beyond just fussy chefs; the finding is relevant for building efficient networks of parallel processors.

But after 30 years, Gates’ answer no longer stacks up as number one. In September, a group of students and their faculty advisor at the University of Texas, Dallas, bested the founding father of the personal computer industry. Their solution, relying on modern computing horsepower and taking two years of dedicated work, was a mere \( 1\% \) faster. Though most line cooks would not likely flip for joy, the authors were pleased by their success, calling it a true “labor of love.”

Student Awards

The Siebel Foundation named Computer Science Master’s candidates Neil Jhaveri and Daniel Shretemberg among its 2009 scholarship winners. Jhaveri is currently working as a consultant for a healthcare technology startup to develop an IT system designed to help doctors and patients manage chronic diseases. Shretemberg is currently working as a software development intern for EMC Corporation in Southborough, Mass., where he designed and developed a new software tool used by EMC hardware and software developers.

A team composed of Harvard students and alumni was among the winners of the World Bank’s Lighting Africa 2008 Development Marketplace competition, held in Accra, Ghana, from May 6–8, 2008 (see p 7).

Three undergrads were selected as Weismann Interns: Brett Thomas ’10 worked at the joint U.S.-China Cooperation on Energy in Shanghai, China; Joseph Thumpasery ’10 worked at the joint U.S.-China Cooperation on Energy in Shanghai, China; and Xiang Ling Yap ’10 worked on the development of national cyber-security at the International Telecommunication Union in Geneva, Switzerland.

Five undergrads were awarded Herchel Smith Awards: Elliot Hawkes ’11; Minjae Kim ’10; Shira Mitchell ’09; Chelsea Zhang ’10; and Joseph Zimmerman ’10. Of the group, Elliot is in Switzerland, Minjia and Chelsea are both in Cambridge, and Chelsea is in Korea, Shira is in Israel, and Chelsea and Joseph are both in Cambridge.

Thirteen undergrads were awarded fellowships from the Program for Research in Science and Engineering (PRISE): Pablo Azar ’09; Kelly Brock ’11; Shomesh Chaudhuri ’11; Lauren Chin ’08; Pierre-Emile Duhamel ’09; Ana Garcia ’11; Prabhas Pokharel ’09; Swapna Reddy ’08; Brad Seiler ’10; Nwamaka Uzoh ’11; Andrew Wong ’09; Chelsea Zhang ’10; and Joseph Zimmerman ’10.

Two SEAS students were awarded the Thomas Temple Hoopes Prize for 2008: Jackie Stenson ’08, for her submission entitled “Silicon Chimney: Reducing indoor air pollution in rural southern Africa” (faculty sponsor member: Robert Howe); and Jie Tang ’08, for his submission entitled “Incentives for reputation systems” (faculty sponsor: David Parkes).

Experiencing GM

Pictured above (sixth from the left) Katie Grosteffon ’09 (S.B., Engineering Sciences) spent the past summer as an engineering intern at General Motors on a Sullivan Fellowship. She kept a blog about her experience. Excerpts, as well as some of her recent insights, follow:

“Over the first few days, a lot of people I met would say, “Welcome to the exciting world of automobile manufacturing” with a hint of sarcasm in their voice. For me, the world of automobile manufacturing is exciting... so much is going on in the assembly center, it amazes me... I’m still in a wide-eyed phase.

I do a lot of walking... I’m basically on my feet all day long, except for lunch time and the two meetings we have each day. Line time is 6 am to 2:30 pm, so I have to be there at 5:30 am. This week, I’ve been leaving at 2:30, but once I become a supervisor, I won’t get to leave until the line shuts down, and every day this week, the line has run overtime (have to meet the production quota).

Every day the questions we asked were about continuous improvement. How can we improve the quality of the cars that leave our area or the end of the line? How can we make the process more efficient? How can we improve how the assembly line runs? It wasn’t just the supervisors and engineers making decisions, but the people who repeated the same process hundreds of times a day and were very aware of the problems.

I was very interested to work at GM during such a turbulent time for the auto industry. Everyone worried, from the people on the line to management. But there was also a huge attitude of hope—most were certain that GM would rise again, especially with the release of the Chevy Volt [GM’s electric car]. On the second day I was at work we found out that our plant was chosen to build the Chevy Volt, and that air of excitement lasted all summer.”
Visualize This

Computer scientist Hanspeter Pfister minds the data store

Shock (“Huh?”) … Eye rubbing (“Umm.”) … Recognition (“Oh, cool!”)

That’s how passengers often react on Boston’s Red Line subway when they first see the ad featuring skiers that appear to actually whoosh down snowy peaks. The animated billboard, placed in a dimly lit tunnel between the Central and Harvard stops, touts the beauty of Vermont in winter.

Soon, computer scientist Hanspeter Pfister predicts, we will consider such displays ordinary. “If anything, we will have more screens—printable screens with OLEDs,” he says, referring to the paper-thin luminous organic light-emitting diode displays. (The prototype ad in the Boston subway, by the way, relies on a much older trick: the zoetrope.)

“I’m excited to imagine these things ending up all over the place,” he adds, bringing to mind the hypersaturated cityscape from *Bladerunner*. “Some will be for advertising, of course, but there are a lot of other interesting ways of presenting visual information.”

The Gordon McKay Professor of the Practice of Computer Science and Director of Visual Computing at the Initiative in Innovative Computing (IIC), studies ways of displaying information, from gene sequences to galaxies, and interacting with data, from sizing photos with fingertips to sharing medical e-records.

Pfister’s undergraduate course on visualization (see sidebar) provides a snapshot of how to go from data points to what designer Edward Tufte calls “beautiful evidence.” Students explore a bit of brain science, learning what features work well for the human visual system; determine what designs work best for various display media; create algorithms to tame and process mounds of raw information; and last, build the actual graphics.

“The class is about going from user interaction all the way to coming up with better visual metaphors to display abstract data,” Pfister says. If that sounds too abstract, the home viewer may recall a much maligned, but admittedly clever, example: the dynamic election maps anchors used during the recent presidential election.

Mouse brains and touch screens

Backlit by what Pfister calls “the largest television you’ve likely ever seen” members of the College class of ’73, on campus for their 25th reunion, form an uneven arc in the Scientists Discovery Room. The air conditioner in Maxwell Dworkin is off and the temperature is just above tolerable.

Despite the heat, the audience is riveted by Pfister’s visual tour of the neural circuitry of the mouse brain. As he zooms down to reveal a neurotransmitter in stunning detail, the resulting “Ahhs” bring to mind the reactions to a fireworks display. Nearby sits a table that turns out to be another screen. Akin to a huge iPhone, the system enables collaboration. Two alumni, perched on either side, practice flicking images to one another across the glass, as if passing a hockey puck.

The Discovery Room, created in collaboration with Chia Shen, Senior Scientist and Program Manager at the IIC is just that—a place to show off visual and haptic (touch) technologies. The mouse brain demo is part of the Connectome Project, involving the Brain Science Center. Pfister is working with neuroscientists to find efficient ways to transmit and visualize large-image data of three-dimensional neural networks. The trick, he explains, is loading and displaying only the data you need at the moment you need it.
He is also helping geneticists at the Broad Institute and Harvard Medical School to "understand the pathways from the genomes to the proteomes, all the way up to the disease." In jest, he "blames" the increasing number of collaborative projects in the life sciences on the influence of an exceptional former student and now postdoc, Miriah Meyer.

"I've met more people who want to collaborate with me than I can handle," he says. Pfister does not take the interest personally, concluding that the growing need for visualization and the additive nature of his expertise keep the requests coming. "I am not threatening to their science," he says. "On the contrary, I like to believe that I am helping."

Though happy to bring some order to disparate data from all realms, he reserves room for his own interests. Motioning with his hands, he exclaims, "I cannot wait until we have those touch screen interfaces in the classroom...where I can flick something on a wall and manipulate it!"

**Acting the part**

Tall, blonde, and expressive, the northern European Pfister would make for a dashing Hamlet, sans the melancholy. His parents, in fact, were both actors. Growing up, he says, they ran a "little fairy tale troupe" that traveled around Switzerland. "My dad always said 'My son will become a famous actor.' And, well, I became an engineer. Of course," he pauses, "I think being a professor has something to do with acting."

His parents were likely not too surprised that Pfister chose the computer screen instead of the stage. As a child he loved electricity. He built elaborate phone networks in his house and drove his mother crazy with the resulting obstacle course of wires.

After studying electrical engineering at ETH Zurich, he came to the United States on a Fulbright scholarship, settling on Stony Brook University. Though he originally intended to pursue the hardware side of computer science, a "life-changing" meeting with Professor Arie Kaufman led him to the emerging field of visualization.

From New York, Pfister headed to the Cambridge-based Mitsubishi Electric Research Labs (MERL). Busy with commercializing the visualization of MRI and CT data at MERL (developing a rendering system called VolumePro), he found a way to keep a foot in academia by teaching night courses at Harvard Extension School.

That connection led to his current appointment at SEAS and the IIC. In 2002, Sarah Block, a student taking Pfister's course gave him an insider's tip, mentioning that "there was going to be some form of visualization group at Harvard." Block happened to work for Professor of Astronomy Alyssa Goodman, the founding director of the IIC.

Now surrounded by experts from all fields, including an unexpected link with cartography experts, Pfister feels lucky to work on "real" scientific problems. Compared to the more focused scope of industry, he says Harvard "is a crazy busy place and has so many smart people. SEAS is really well positioned to reach out to everybody. Further, computing is becoming more and more the central focus."

**Xbox science**

In coming to Harvard, Pfister has also been able to turn back to one of his original interests, computer hardware. Staring in the early 2000s, when third-generation videogame systems such as the PlayStation 2 and Xbox caught the imagination of teenagers, the scientific community was also playing along. Embedded within each plastic box lay extraordinarily powerful graphic processing units (GPUs)—the machinery responsible for the eye-popping visuals and near real-time physics.

"People started to realize that the cards could be used for more than just games—they could also be used for powerful physics simulations," explains Pfister. Taking a lead from hackers, researchers and hardware companies alike quickly realized that with some additional tweaking and the introduction of programmable interfaces, the units could be redirected from rendering WWII soldiers in *Call of Duty* to modeling molecules. Even better, several teraflops of process-

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**Data Mining**

Students in Hanspeter Pfister's course, "Visualization," learn how to see all over again. During the 2007–08 academic year, final class projects covered topics as diverse as poetry, piano music, earthquakes, and even NBA player and team performance trends. Here is an example:

**Mapping Disaster**

Have the scale and frequency of natural disasters, such as volcanic eruptions and earthquakes, been escalating over the years on a global scale? To find out, students Gregory Gimler and Trung Tran visualized earthquakes and volcanic eruptions from the year 1900 to 2007. The team concluded that earthquakes appear to be up, whereas volcanic activity has held steady.

To view other final projects from the class, visit: www.seas.harvard.edu/courses/cs171/#projects
With the pending creation of the multidisciplinary Hansjörg Wyss Institute for Biologically Inspired Engineering and the now closer ties between SEAS and both the proudly interdisciplinary Rowland Institute and the Initiative in Innovative Computing, insiders and outsiders alike are reaching for their reference books.

What does it mean to be multidisciplinary? What does it mean to be interdisciplinary? Some use the terms interchangeably, and others have created a number of variant and related terms (see next page).

Rather than seeking a black-and-white definition, it might be safer to say that all the terms share the idea of collaboration (shared spaces rather than silos), leveraging knowledge (whatever the source), and working toward a common end (whether it be fundamental discovery in quantum physics or the next-generation treatment for HIV/AIDS).

Put more succinctly, Jeremy Bloxham, Divisional Dean for Science, said in an August 6, 2008, Nature News article, “Interdisciplinary science: Harvard under review”: “We’re realizing that we can be more than the sum of our parts.”

Likewise, in a July 11, 2008, Science article, “Steering Harvard Toward Collaborative Science,” Provost Steve Hyman expressed a desire to build a Switzerland, or neutral place, for scientific and engineering collaboration on campus. “If you are organized as a community entirely of small curiosity-driven labs, you are not organized to move advances through the pipeline to application,” Hyman was quoted as saying. “And if solving real-world problems is the goal, he adds, "you don’t want to be organized as a colony of curiosity-driven researchers.”

At Harvard, such boundary-breaking thinking is catching. The recently formed Kavli Institute for Bionano Science and the BASF Advanced Research Initiative are not only interdisciplinary and multidisciplinary, they are interfaculty and cross-school in approach. The revised undergraduate Life Sciences curriculum similarly takes an interdisciplinary approach, immersing students in chemistry, biology, and physics to ready them for the modern research lab. In October, GSAS Dean Allan Brandt announced that GSAS will establish Harvard Interdisciplinary Graduate Consortia to “encourage collaboration not only between adjacent disciplines but across the University.”

The concepts are increasingly popular, but they are by no means new. The Materials Research Science and Engineering Center (MRSEC), based at SEAS, was part of a nationwide effort by the National Science Foundation to “support interdisciplinary and multidisciplinary materials research and education.” MRSECs, which began in 1994, originated from Interdisciplinary Laboratories (IDLs) created in the 1960s. The model has scaled beautifully, since there are now 31 centers.

To put things in perspective, Interim Dean Frans Spaepen, considered one of the most collaborative researchers on campus, suggests putting definition into the idea. Before he left Rowland to become Interim Dean, Spaepen helped to set up a broad multidisciplinary Junior Fellows program at Rowland. “What you need to do is put good ideas in good hands and support an environment that enables researchers to test their own limits.”
Intersections

Visit www.seas.harvard.edu/newsand-events/ for the latest details, dates, and times for SEAS events. Here are some highlights from the past months and a list of future opportunities:

On December 13, SEAS hosted its annual Holiday Lecture, intended to inspire kids of all ages. The theme was the science of chocolate, closely related to the prior theme of the science of another favorite food, pizza. In keeping with the “gastroscience” theme, earlier in the week world-renowned chef Ferran Adrià, considered a pioneer in combining scientific methodology with cooking and known for the creation of culinary foam, spoke at Harvard.

Barbara Grosz, Dean of the Radcliffe Institute, and Higgins Professor of Natural Sciences in SEAS, presented her Dean’s Lecture on October 27. She described her research that aims to shift the burden of adaptation from human to computer so that computers respect our needs and adapt to us rather than the other way around.

Marcelo Magnasco and Constantino Baikouzis from Rockefeller University dazzled a crowd of classicists and scientists alike with their October 6 talk, “Is an Eclipse Described in Homer’s Odyssey?” Plutarch and Heraclitus believed that a certain passage in the 20th book of Homer’s Odyssey (“Theoclymenus’s prophecy”) to be a poetic description of a total solar eclipse. “What we’d like to achieve is to get the reader to pick up the Odyssey and read it again, and ponder,” said Magnasco in an article in Discover Magazine.

The Initiative in Innovative Computing (IIC) and SEAS announced the inauguration of a new joint colloquium series that will bring to the Harvard campus speakers at the frontiers of research in computing and science.

“Computation is having a major impact on science,” said IIC Director Efthimios Kaxiras, a member of the Harvard Physics and Applied Physics faculties. “Conversely, the needs of cutting-edge science are driving new developments in computer science. Interactions between computer science and computation-intensive research in other sciences form the core of the IIC mission and hold out tremendous promise.”

This fall’s joint colloquium speakers came from two major high-technology enterprises in the Boston area: Alfred Rizzi, lead robotics scientist at Boston Dynamics, and Jennifer Chayes, managing director of the new Microsoft Research New England laboratory.

Word Play

Multidisciplinary

Combining or involving several separate academic disciplines (1944 Mississippi Valley Hist. Rev. 31 17). “We are beginning to understand the necessity of what someone has called the ‘multidisciplinary approach.’”

Interdisciplinary

Of or pertaining to two or more disciplines or branches of learning; contributing to or benefiting from two or more disciplines. First used in 1937 (Jrnl. Educ. Sociol. Dec. 251). “Programs of study submitted should provide ... for training of an inter-disciplinary nature.”

(Both definitions courtesy of the Oxford English Dictionary.)

VARIANTS

If conflation wasn’t confusing enough, others have developed variant and related terms:

Pandisciplinary - One eager SEAS graduate appropriated the term pandisciplinary to describe the research culture at SEAS, saying, “That means you can do physics one day, math the next, then experimental biology, then computer science—whatever it takes—and you don’t have to apologize to anyone for it.”

ArtScience - Bioengineer David Edwards went one step further, coining the term artscience in his book, ArtScience: Creativity in the Post-Google Generation. “The fused method that results,” he writes, “at once aesthetic and scientific—intuitive and deductive, sensual and analytical, comfortable with uncertainty and able to frame a problem, embracing nature in its essence—is what I call artscience.”

Events

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Hynd Bouhia ’98
Director General, Casablanca Stock Exchange

“Saving Money Like Water

I was very happy to be able to put my country on the list,” remarked Hynd Bouhia ’98, Ph.D. in Engineering Sciences, upon being ranked 29th among Forbes magazine’s “100 Most Powerful Women.” To put that ranking in perspective, the Moroccan native was just one step behind Senator Hillary Clinton.

Bouhia, 35, currently serves as director general at the Casablanca Stock Exchange in Morocco, the third largest exchange in Africa. After earning her degree at Harvard, she worked at the World Bank in Washington, D.C., focusing on economic development and water and environmental policies in emerging economies. In 2004, the then Prime Minister of Morocco, Driss Jettou, tapped her to be his economic advisor.

“..."When water is considered as a commodity, consumers should pay for its real value. This is how a golf course in the desert can make sense as long as the water is priced for its real value."

She is quick to credit Harvard’s part in her success. “I am very grateful to have had the opportunity to study at Harvard,” she said, giving particular credit to her mentor Peter Rogers, Gordon McKay Professor of Environmental Engineering. “I believe that my degree was surely instrumental to any international recognition.”

Bouhia’s success in helping to bring a $700–million U.S. development grant to Morocco in 2007—something she lists among her proudest achievements—likely swayed the Forbes editors as well.

Upon becoming Exchange Director in 2007 you said that you wanted to “position the exchange internationally.”

So far, Morocco’s financial system has been disconnected from the international financial crisis. The level of international investors in the floating capital does not exceed 2%, and Moroccan Banks have around 4% of their assets invested abroad. We did, however, see some psychological effect on local investors that resulted in small falls of the main indicators.

In light of recent economic turmoil, is raising visibility still key?

Raising the visibility of the stock exchange at the international level remains extremely important to attract funds that are dedicated to global emerging markets. In fact, the geo-strategic position of Morocco and all the efforts undertaken by the government in terms of infrastructure and regulation set the groundwork for creating an international trade crossing point.
In some sense, emerging economies may be better off.

For countries where foreign exchange is still controlled, the financial crisis will probably slow down their plan for freeing financial fluxes. That said, as a response to the financial crisis, emerging economies will be leading the world’s growth, as they can rely on locally stimulated demand. These countries may even help advanced economies to get their rhythm back.

While you manage an abstract process, your work has tangible results for a country like Morocco.

Even within the stock exchange, there is a way to assess an abstract process on the real economy. For emerging countries, the stock exchange can play a central role in stimulating growth. Moreover, capitalism adapts itself to the context of the country. For example, with privatization in Africa, some of it was done through the stock exchange and some by direct cessions. Changes and progress have to be gradual in order to ensure its sustainability.

In fact, you began your career focusing on a related form of sustainability—resource planning for water.

Water is an economic good and needs to be considered as such by integrating it into the national planning. When water is considered as a commodity, consumers should pay for its real value. This is how a golf course in the desert can make sense as long as the water is priced for its real value. When planning for water allocation, governments should take into consideration the optimization of the resources and set priorities with long-term vision.

Peter Rogers has suggested that without conservation or appropriate technologies, the world will face a ‘freshwater crisis.’

Governments are aware of the crucial role of water. This is particularly true for water-scarce countries like Morocco. The question is how best to optimize the use of the existing resources. In that regard, an integrated strategy was defined to shift from heavy water crops (like cereals and corn) to higher-value water use in olive trees and for other tree products.

Is it fair to ask nations like India not to “act American” in terms using natural resources?

Renewable energy is at the center of all debates on energy in both advanced and emerging economies. Yet what seems easy to apply in the U.S. and Europe might not be on the top of the list in India. In the case of Morocco, the government is working on the creation of social security for low-income households to ease the weight on the government budget from subsidizing oil directly. In parallel, campaigns to raise awareness among large energy consumers are getting more and more positive feedback.

Each day, you are up against powerful odds. How do you find balance?

I have always been an optimistic and positive person. I guess what keeps me going is to believe in myself, in my country, and in the world. I also believe in the importance of balancing professional and personal life. I am taking a sabbatical year to prepare for my upcoming baby and to spend some time with my family. I would like to write a book on emerging markets’ finance and economic development—and hope to visit Harvard and my professors.

“Renewable energy is at the center of all debates on energy in both advanced and emerging economies. Yet, what seems easy to apply in the U.S. and Europe might not be on the top of the list in India.”

Be part of the Renaissance...

The Harvard School of Engineering and Applied Sciences thrives because of institutional, governmental, industrial, and alumni support. Such financial generosity, intellectual guidance, and enthusiasm will enable us to continue to enhance education and research and better society.

In the spring of 2008, Marion and Capers McDonald MBA ’88 generously established an award for Excellence in Mentoring and Advising at SEAS. This award honors faculty and staff who both contribute to the field of engineering and to the guiding and mentoring students.

The inaugural recipient of the Capers and Marion McDonald Award for Excellence in Mentoring and Advising is Michael Brenner, Glover Professor of Applied Mathematics and Applied Physics; Tutor in Biochemical Sciences. Brenner’s letters of nomination praised his kindness, grace, knowledge and flexibility as an adviser.

This fall the Office of Resource Development was pleased to welcome the addition of Beatrix Henize as SEAS’s first Director of Corporate and Foundation Relations (CFR). Her position, co-sponsored with the University’s CFR Office, is newly created, reflecting the increased emphasis at SEAS on developing stronger as well as new partnerships with industry and other key institutions.

Beatrix brings 20 years of industry and foundation relations experience in higher education (Columbia University, George Mason University, and MIT) and in health care (Joslin Diabetes Center and Memorial Sloan-Kettering Cancer Center). Most recently she was Director of Corporate Relations at Jhpiego, a Johns Hopkins University affiliated international health care organization.

To learn more about giving opportunities, please contact Linda Fates, Director, SEAS Office of Resource Development, at ord@seas.harvard.edu.
Biologically Inspired

Biologically inspired engineering aims to reveal the design principles of living systems and to use such knowledge to create new technologies, from bandages that integrate directly with skin to artificial organs. The accompanying images show some of the ways that living systems provide inspiration for bioengineers at SEAS.

Aizenberg Lab: Biomineralization and Biomimetics
Joanna Aizenberg lab’s research is aimed at understanding some of the basic principles of biomineralization and the economy with which biology solves complex problems in the design of functional inorganic materials.

Auguste Lab: Responsive Biomaterials
The focus of Debra Auguste’s lab is to develop novel biomaterials for drug delivery and stem cell engineering. Auguste investigates finding out what chemical and environmental cues influence the ways stem cells differentiate.

Mooney Lab: Cell and Tissue Engineering
David Mooney’s lab uses the tools of cell and molecular biology to study the mechanisms by which chemical or mechanical signals are sensed by cells and alter their proliferation and specialization to either promote tissue growth or destruction.

1. By tracking regeneration at the neuromuscular junction using fluorescently labeled nerves (yellow) and receptors (red) The Mooney Lab has found that vascular growth factors can promote nerve regeneration. This approach may represent a new therapeutic approach for treating disorders such as stroke, chronic peripheral ischemias, and neurodegenerative diseases. (Mooney Lab)

2. Human embryonic stem cells differentiate into specialized cell types when they aggregate into three-dimensional clusters called embryoid bodies. This scanning electron micrograph shows a three–day–old embryoid body. The fibrous coating on its surface, composed of natural biomaterial proteins, can influence the diffusive transport of molecules into the embryoid body. (Auguste Lab)

3. A polarized light micrograph shows patterned crystal growth with controlled polymorphism at the micron scale. Each 10-micron floret is made of calcite (petals), aragonite (center), and amorphous calcium carbonate (background). (Aizenberg Lab)

4. Researchers study immunoliposomes as a drug delivery system to target vasopressin, a hormone useful in stemming rapid blood loss. Shown here, human umbilical vein cord endothelial cells are treated with immunoliposomes conjugated with anti-ICAM-1 and anti-ELAM-1 antibodies and imaged under epifluorescence microscope. (Auguste Lab)

5. The presence of magnetic fields can effect a variety of cellular processes, such as mitosis, or cell division. Pictured here, an immortal HeLa cell, magnified 100x by a confocal microscope; its cell nucleus (blue); membrane (red); and liposomes (green). (Auguste Lab)

6. A thin film of gold imaged in polarized light shows the crystallized structure of organic molecules. (Aizenberg Lab)

7. Photomicrograph of mammalian cells in which the actin cytoskeleton (green); cell nuclei (blue); and adhesion sites with substrate (red) have been labeled using antibody staining. (Mooney Lab)

8. In an effort to innovate communication technology by learning from nature, the Aizenberg Lab has successfully developed synthetic routes to new, complex photonic structures. Pictured here, an array of microlenses on the brittlestar skeleton. (Aizenberg Lab)