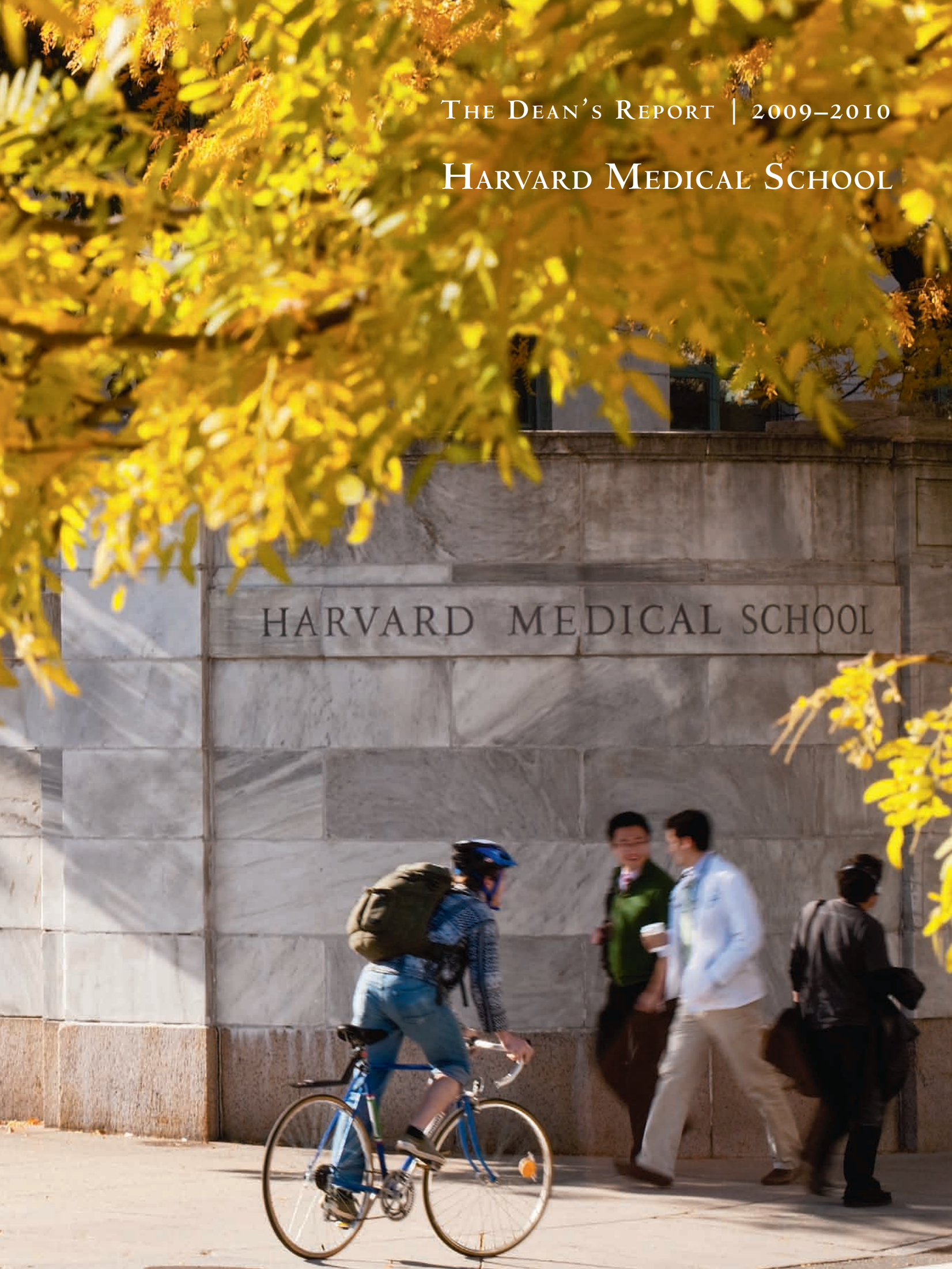


The Dean's Report | 2009–2010

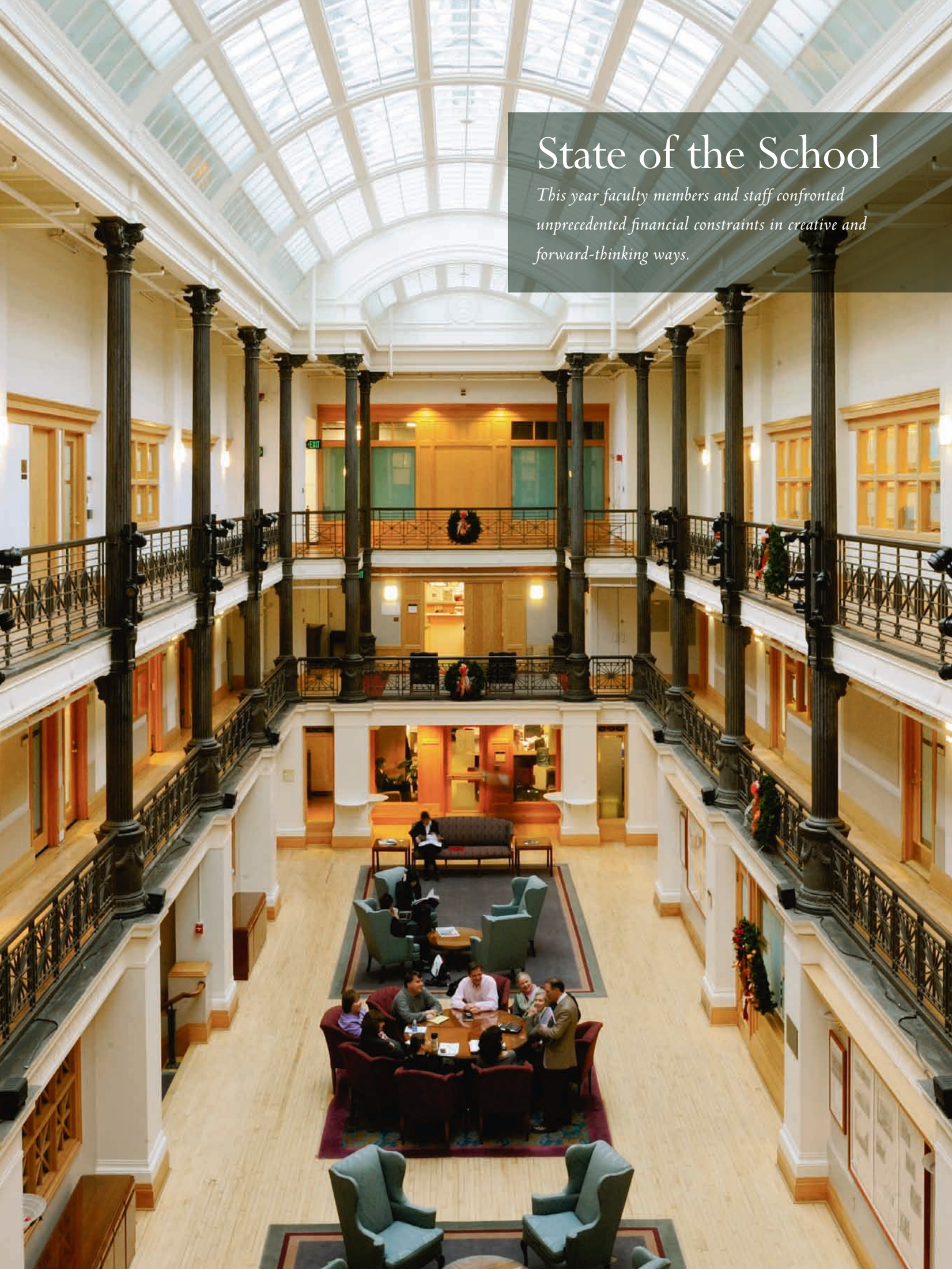
Harvard Medical School

2009–2010

The Dean's Report

Despite a challenging financial climate, the Harvard Medical School community came together in 2009 as never before, training remarkable clinicians and scientists while advancing discovery in service to society and health.

Contents



State of the School

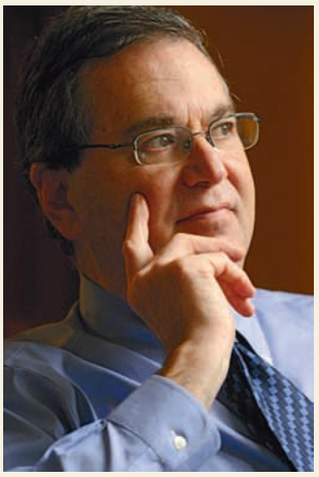
This year faculty members and staff confronted unprecedented financial constraints in creative and forward-thinking ways.

> We cannot predict how insights gained in the laboratory today might one day impact our lives. As our knowledge base rapidly expands, scientists from disparate disciplines must join together and pool their expertise.

Message from the Dean

When great minds come together, advances in science and medicine seem virtually limitless.

The Harvard medical community had cause to celebrate when, in October 2009, Harvard Medical School Professor of Genetics Jack Szostak received the world's highest honor in biomedicine: the Nobel Prize in Physiology or Medicine. Szostak, who is based at the HMS-affiliated Massachusetts General Hospital, was honored for laboratory discoveries that help explain how cells age and die and how cancers arise.



Jeffrey S. Flier, dean of the Faculty of Medicine

It was Szostak who, in the 1980s, predicted the existence of an enzyme, telomerase, that builds and maintains protective caps on the ends of chromosomes. These caps, called telomeres, would grow shorter each time a cell divided were it not for this special enzyme, which for a limited time in an organism's lifespan adds back bits of DNA. Collaborations among Szostak and two other scientists who shared the prize, Elizabeth Blackburn and Carol Geiger, explain why aging cells ultimately stop dividing, while in cancer telomerase is reactivated, prompting cells to divide endlessly.

The scientists' triumph shows what can happen when fertile minds meet, brainstorm and pool ideas. Their discovery also reminds us why researchers must be free to explore science at its most basic level, shedding light on how living organisms evolve and function, regardless of whether their efforts seem immediately relevant to human disease. We cannot predict how insights gained in the laboratory today might one day impact our lives.

As our knowledge base rapidly expands, scientists from disparate disciplines must join together in novel combinations, since it is far beyond the capacity of any single individual to master the complexity of multiple rapidly evolving fields, such as genetics, cell biology and bioinformatics. At HMS we place great emphasis on forging connections among people and institutions at Harvard, throughout Boston and around the globe.

Thanks to these links, powerful new ideas are emerging from the HMS campus, or Quadrangle ("Quad"), and the School's affiliated hospitals and research institutions.

New relationships have sprung up among physicians and scientists, bringing the fruits of their work to people worldwide. Collaborations are being struck among HMS, its clinical affiliates and other Harvard schools through Harvard Catalyst; within hybrid institutions, such as the Broad Institute of MIT and Harvard and the Wyss Institute for Biologically Inspired Engineering; and between HMS and the governments of countries seeking to invest in medical education and the life sciences.

Distance is no barrier in the Internet age. Indeed, HMS is helping spearhead a radical shift in the scientific culture. We are united in a common mission: to serve society by training clinicians and scientists and by making discoveries and translating them into better healthcare.

From Crisis Springs Opportunity

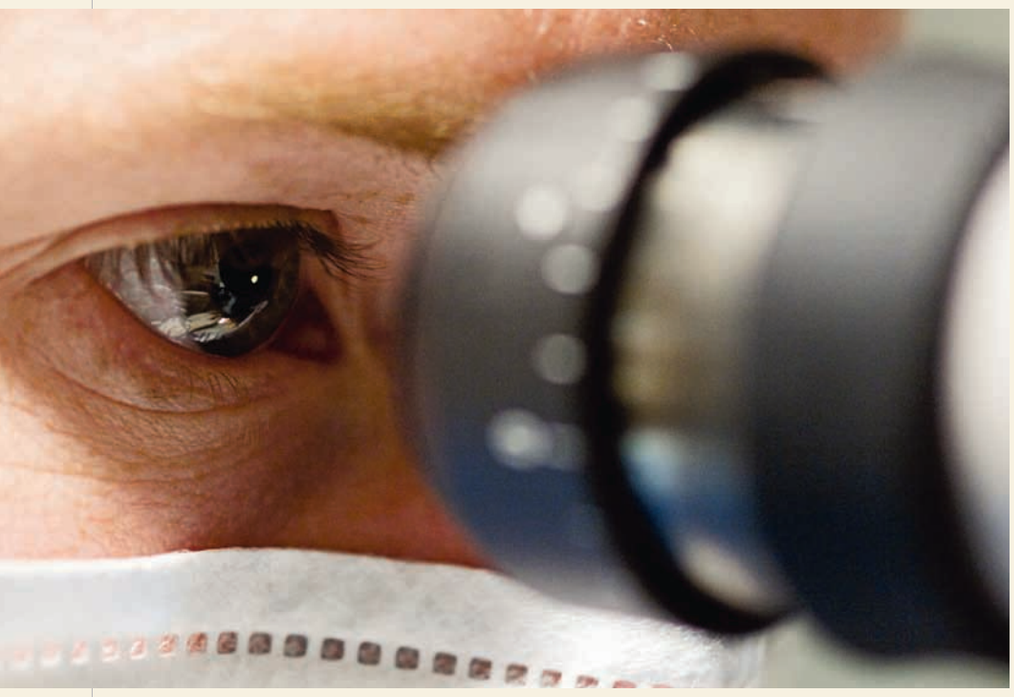
Despite the onset of a global financial crisis in 2008 and the necessity of slowing the ambitions outlined in our Strategic Plan (http://hms.harvard.edu/public/strategy/P1_full.pdf), we have seen remarkable progress in advancing our key priorities. When construction of the University's planned science complex in Boston's Allston neighborhood was put on hold, we quickly identified alternative space for programs we had planned to relocate and initiated renovations to maintain our momentum.

We could not have grappled so successfully with these challenging economic circumstances without the dedication and creativity of our School community. Faculty members and staff confronted unprecedented financial constraints in

HMS attracts the best students from all over the world.

forward-thinking ways. By strategically eliminating almost all of a projected multi-million-dollar deficit in FY 2009, we put the School on more stable financial footing while continuing to make steady progress toward the Strategic Plan's five core goals:

- Revitalizing medical, graduate and postgraduate-level education;
- Nurturing a more unified community;
- Lowering obstacles that prevent collaboration among thousands of faculty and students within HMS, its 17 affiliated hospitals and research institutions, and Harvard's ten other schools;
- Seizing opportunities in biomedical research to increase well-being for individuals and a global society, particularly in realms such as human genetics, neuroscience, bioengineering, immunology and therapeutics; and
- Coordinating new investments in imaging, computational and other tools and technologies.



Insights gained in the laboratory today may one day improve human health.

Translational or "bench-to-bedside" research. Led by HMS, a center for clinical and translational research—established in 2008 with a grant from the National Institutes of Health and supplemental support from our School, Harvard University and its major teaching affiliates—has already outstripped expectations for igniting innovation in biomedicine. As the name implies, Harvard Catalyst aims to jumpstart fruitful interactions among thousands of faculty, students and trainees at the School and the institutes and healthcare organizations with which it enjoys close ties.

By funding creative, innovative projects by faculty members from disparate disciplines who assemble into unexpected and highly productive teams, Harvard Catalyst is tapping into a virtually bottomless well of potential innovation. To date, its offerings include pilot funding to launch studies too novel and daring to compete successfully for public funds.

For example, one basic scientist who discovered an anticoagulant protein in the *E. coli* bacterium has teamed with clinicians to develop the protein into a new class of blood-thinning drugs. Other projects include a fruitfly-based screen for drugs against leukemias and a molecular imaging test useful for studying the biological basis of depressive symptoms.

Through the powerful Harvard Catalyst website, researchers can identify potential collaborators. They can also search a database of funding sources with a tool aptly named "Grant Central." Walls that just two years ago divided laboratory and clinical researchers have begun to crumble.

Perhaps the most dramatic example of the way HMS and its affiliates have joined forces to advance patient care was the signing in 2009 of a landmark Reliance Agreement that will expedite the process by which they launch multicenter clinical research studies. Motivated by the success of Harvard Catalyst, HMS and eight institutions—Beth Israel Deaconess Medical Center, Brigham and Women's Hospital, Children's Hospital Boston, Dana-Farber Cancer Institute, the Harvard School of Public Health, the Harvard Faculty of Arts and Sciences, Joslin Diabetes Center and Massachusetts General Hospital—will revolutionize the clinical trials process within our community by reducing delays due to overlapping and redundant reviews by two or more institutions.

Sophisticated facilities provide a sterile environment for living organisms under study.

Stem cell research. HMS faculty appointments are held by all members of the joint HMS–Harvard University Department of Stem Cell and Regenerative Biology, an academic department created in 2007, headquartered in Cambridge and informally known as SCRB ("Scrub"). The founders of this academic department also launched the Harvard Stem Cell Institute, a still-larger organization comprising faculty researchers from the University, HMS and 11 of our affiliates. Between the two entities, about 700 researchers and trainees are capitalizing on the power of stem cells to regenerate.

For illnesses ranging from heart disease and diabetes to amyotrophic lateral sclerosis, or ALS, stem-cell-derived therapies hold great promise. In a 2009 news report heard around the world, a team at Massachusetts General Hospital unveiled stem cell lines derived not from discarded human embryos but from adult stem cells. The advance will enable investigators to make rapid strides in tissue engineering and organ transplantation.

Bioengineering. The Wyss Institute for Biologically Inspired Engineering is now housed adjacent to our New Research Building—an unexpected benefit of the pause in construction at the Allston science complex. At this unique institute, faculty from HMS and the Harvard School of Engineering and Applied Sciences are borrowing engineering principles from the natural world to invent materials, nanotechnologies and devices to aid people with myriad diseases and disabilities.

Hundreds of trainees, researchers and technicians are engaged in stem cell science.

Human genetics. Many illnesses can be traced to mutations in our DNA, while subtle variations may predispose us to a disease or help protect us against one. Given rapidly evolving whole-genome screening technologies and computers capable of interpreting vast amounts of data, our understanding of the role of inheritance in human disease is evolving at lightning speed.

Our formidable genetics faculty aims to lead a dynamic Harvard-wide initiative in human genetics. Their vision has won vigorous support from University President Drew Faust and a committee of University faculty leaders. We intend to launch this exciting initiative during 2010.

Immunology. By mining expertise in immunology and microbiology that is both broad and deep, we envision ameliorating, curing or even eradicating scores of human diseases that result not only from infection by pathogens but also from inflammation, from cardiovascular disease to multiple sclerosis. We aim to build a continuum between the culture dish and the patient in the same spirit of discovery that led three HMS Nobel laureates—John Enders, Thomas Weller and Frederick Robbins—to culture the poliomyelitis virus in non-nervous tissue, paving a route to safe vaccines for poliovirus (and, later, viruses for chickenpox, measles and other diseases).

A custom fluidic system maintains bacteria being challenged by drug treatments.

A major goal is to identify principles underlying susceptibility to disease and disability and develop treatments grounded in that new knowledge. In parallel, we will redouble efforts in the study of fundamental and translational immunology and inflammatory biology underlying numerous prevalent diseases.

Therapeutics. Recognizing that many discoveries made in our laboratories offer great promise as the foundation for the development of new classes of therapies as well as devices, in 2008 we began planning for a Therapeutics Initiative. This effort will engage several departments, including Biological Chemistry and Molecular Pharmacology, Systems Biology and Microbiology and Molecular Genetics. In 2010, we will begin marshaling the resources and talent the School needs to take a commanding lead in this area.

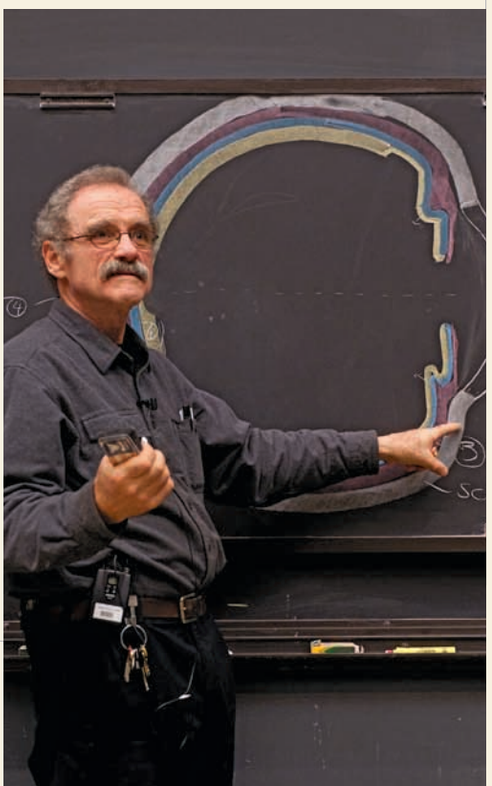
Training Leaders in Science and Medicine

At HMS, educating tomorrow's leaders—scholars, scientists, clinical practitioners and architects of health policy—remains a paramount goal. During 2009, we took steps to make teaching and learning more interdisciplinary and to cultivate a stronger awareness that we are all global citizens.

Decades ago, medical students passively acquired knowledge in lecture halls. In the mid-1980s, HMS rolled out a radically altered curriculum that required students to take responsibility for their own learning by analyzing real-life case studies. Today, students are encouraged to learn by generating new knowledge themselves.

This year marked the culmination of an effort begun in 2006 to reform the curriculum once again. For the first time, instead of training at many of HMS's affiliated healthcare centers, all of our third-year students trained at one of several HMS clinical affiliates. This focus allowed every student to engage deeply in the workings and unique culture of a single complex organization. As a result, mentoring relationships with faculty grew stronger and the learning experience was enriched.

Learning by no means begins and ends in Boston. We took our training mission across the Atlantic in April 2009, when HMS and the Portuguese Ministry of Science, Technology and Higher Education entered into a long-term collaboration in medical education. Fueled by major support from the ministry, this agreement established the HMS–Portugal Program in Translational Research and Information. Investigators at HMS and Portugal's seven medical schools and five principal research laboratories



Takeda Professor of Cell Biology Daniel Goodenough has served on the HMS faculty for almost 40 years.

Second-year students in Patient–Doctor II master clinical skills, including the patient exam and interview.

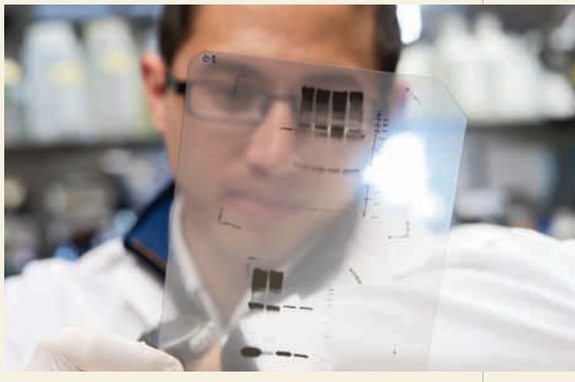
will collaborate in research. Health information will also be developed for Portuguese health professionals and the public.

Other countries have since approached HMS to explore similar relationships. These alliances hold potential to be "win-win" agreements through which hundreds of tomorrow's physicians and scientists might carry out research and seek training.

The world will never have too many outstanding physicians and researchers. In a major step toward relieving our own students' burdens of debt, we increased scholarship funding in academic year 2008–2009 by $3 million, a nearly 40 percent increase over the previous year. I am personally committed to sustaining this level of funding over the long term. Financial considerations must not bar the world's most qualified students from joining our community.

Sadly, we lost a true giant of American medical education reform in May with the death of former HMS Dean Daniel Tosteson. During his 20-year tenure as dean, from 1977 to 1997, Dan had an extraordinary impact on the identity of HMS as a biomedical educational and research institution productively engaged with the larger world. He was also the driving force behind our then-revolutionary New Pathway curriculum, a model other American medical schools hastened to follow.

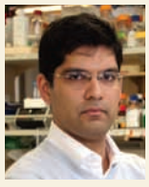
In expressing deep gratitude for Dan's leadership, I know I speak for all who knew and worked with him, and for the thousands of students whose careers were shaped by his vision.



Carlos Loya is both a research assistant and a graduate student in cell biology.

Expanding Our Talent Pool

Students aspiring to a career in medicine traditionally spend the first two of their four years on the HMS Quad studying biochemistry, genetics and other medically related sciences before learning to be physicians at affiliated hospitals and outpatient clinics. Within the School's ten preclinical departments, our students encounter senior and junior faculty members at the leading edge of the social and biological sciences. One of our most important goals is to maintain the excellence of this distinguished faculty community. Despite the economic downturn, we have continued to pursue our agenda by resuming our recruitment of extraordinary faculty members. In the past academic year, the HMS Quad welcomed six new superstars:



Sandeep Robert Datta, came to the Department of Neurobiology as an assistant professor, the first new recruit by Department Chair Michael Greenberg. Datta's research focuses on understanding how neural circuits in the brain extract information from the environment and translate it into appropriate behavioral responses.

Steven McCarroll, a nationally recognized expert in human genetics, joined the Department of Genetics as assistant professor. McCarroll studies variations in the structure of the human genome among individuals and populations, probing links between these variations and disease.

Diane Mathis and Christophe Benoist, two major figures in immunology, have joined the Department of Pathology at HMS from Joslin Diabetes Center, an affiliate of the School. Mathis and Benoist, both professors of pathology, conduct research on T cell differentiation and autoimmunity. They are investigating immunological mechanisms involved in diabetes and rheumatoid arthritis.

Gaudenz Danuser, formerly professor of cell biology at the Scripps Research Institute, is a dynamic young leader in developing lasers that can render visible even the miniscule components of cells. Now, as an HMS professor of cell biology, he continues to push the envelope in developing new methodologies in biological science.

Michael Springer, assistant professor in Systems Biology, explores the relationship between genotype—the genetic material of our DNA—and phenotype, its outward manifestations. His interests lie in how biochemistry, molecular design and wiring can allow cells to process information from their environment and respond appropriately. By comparing similar pathways in related species and duplicated genes within the same species, he will tease out the significance of their quantitative features.

Owing to the far-sighted support of **Philip Leder**, the John Emory Andrus professor of genetics and former founding chair of our Department of Genetics, we will bring to the department a leading cancer biologist at the full professor level and at least one junior faculty member. Leder, a giant in cancer genetics, has dedicated a pool of funds developed under his leadership to this purpose, as well as to student financial aid and medical and graduate education through the Leder Human Biology and Translational Medicine Program.

Residency training programs at the HMS-affiliated hospitals and institutes are among the world's most competitive.

Sustaining Our Collective Future

With potentially devastating global climate changes predicted within our children's lifetime, we must do all we can to safeguard life on this planet. As part of a University-wide effort, we at HMS aim by 2016 to curb greenhouse gas emissions by 30 percent below a 2006 baseline. Our sustainability programs focus on energy conservation projects, waste reduction, and green renovation projects, such as that of Global Health and Social Medicine headquarters in 2009.

We were delighted when the DePace laboratories in the Department of

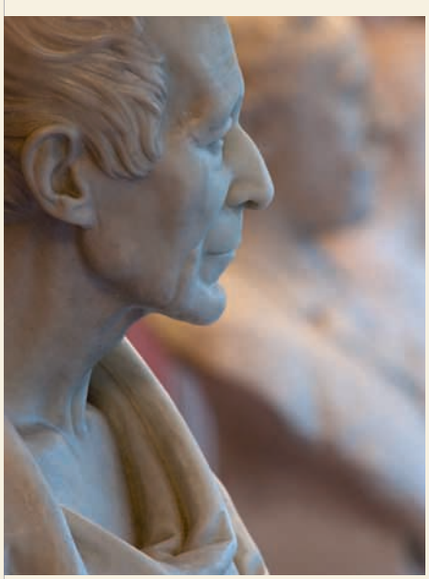
Systems Biology received LEED ("Leadership in Energy and Environmental Design") Gold certification from the U.S. Green Building Council, the first research "wet lab" at Harvard to do so.

Philanthropy Fuels Progress

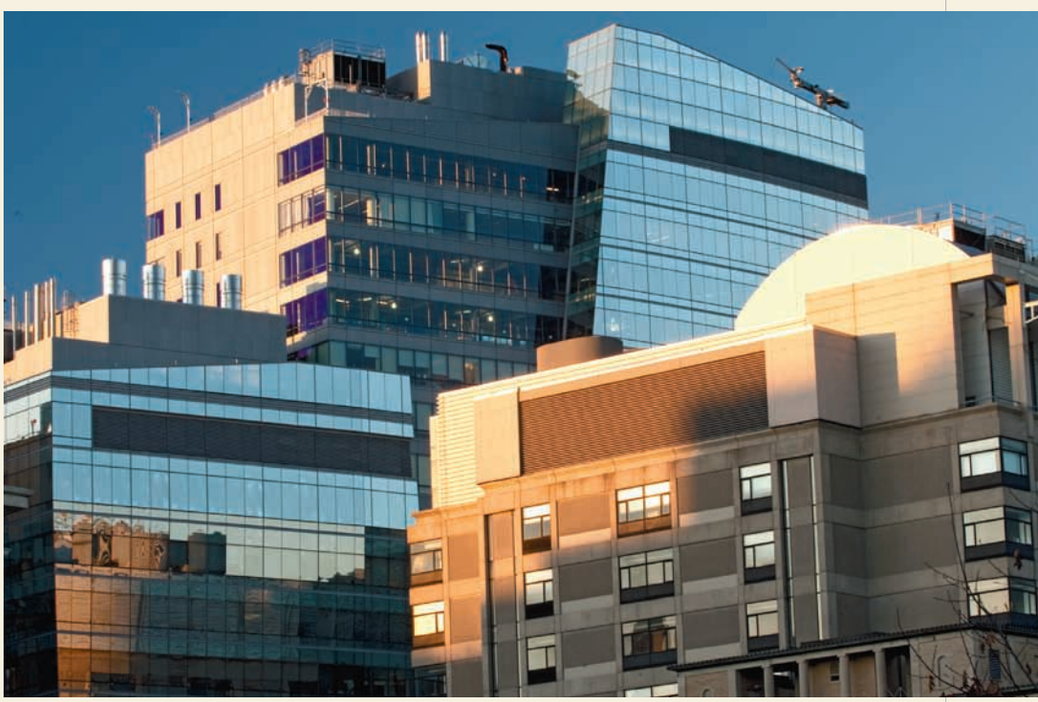
Harvard Medical School has throughout its history remained a valued institution in the eyes of many loyal supporters. In fiscal year 2009, more than $97.3 million in gifts and pledges came to the School, a reflection of our training and research missions and our reputation as the world's top research medical school.

Contributions from visionary donors are benefiting research in key areas. For example:

- A gift of $5 million from Nancy Lurie Marks launched the Nancy Lurie Marks Clinical and Research Fellowship Program in Autism. Autism, a complex developmental disorder of early childhood, is the focus of several leading neurobiologists at HMS;
- Paul Glenn, founder of our Glenn Laboratories for the Biological Mechanisms of Aging, provided an additional $5 million in support to build upon our efforts to delay age-related diseases and extend the human "healthspan;"
- An $8.2 million bequest from the estate of James Stillman, Class of 1932, will enable HMS to award scholarships to medical students who would otherwise be unable to study with us.



Established in 1782, HMS combines a tradition of excellence with leading-edge research and training programs.



HMS and other distinguished biomedical institutions stand in the heart of Boston's Longwood Medical Area.

A United Front

Across Harvard medicine, our faculty are making advances on multiple fronts. Between September 2008 and June 2009, 383 faculty members were promoted—211 to assistant professor, 122 to associate professor and 50 to full professor. Of the 50, nine were new recruits; ten were women; and just one was an underrepresented minority. As dean, I am determined to expedite the promotions process and recruit and bring up through the ranks outstanding faculty from groups that remain significantly underrepresented at HMS.

HMS is an institution with enormous potential. At this moment in history, our challenge is to transform traditional ways of teaching, learning and exploring the living world. Any path we take toward advancing human health will not be a solo journey. It is by engaging with others—be they here on campus, across the University, a part of our Boston affiliates or citizens of nations thousands of miles away—that we can have the greatest impact.

Resources

Harvard Medical School competed successfully for grants, including $80 million in federal funds aimed at restarting the American economy.

Challenge, GO and other Recovery Act grants, along with additional federal and private funding to HMS affiliates and other institutions, are fueling efforts to advance biomedicine and health by HMS faculty and collaborators near and far.

Recovery Act Provides Critical Support

After a hectic spring and summer of grant writing, Quad-based investigators at Harvard Medical School were awarded more than 109 research grants, payable over two years, through the American Recovery and Reinvestment Act, or ARRA. As of mid-December, these stimulus funds exceeded $80 million.

Since the Recovery Act was signed into law in February 2009, the federal government has injected $10 billion in extramural funding into the National Institutes of Health (NIH). This unprecedented surge of support for health and science research follows nearly six years of flat funding and the inflation-driven erosion of real support. At least ten research teams have received approximately $21 million over two years in a new and highly competitive NIH Challenge Grant category. These grants jumpstart multidisciplinary projects deemed likely to have a high impact in biomedicine and public health. In addition to the many proposals submitted by HMS-based researchers, still greater numbers were crafted by faculty based at HMS-affiliated institutions.

The Recovery Act awards include 24 NIH Grand Opportunities (GO) grants to faculty at HMS, its major affiliates and the Harvard School of Dental Medicine of approximately $40 million—a total representing only one year of funding, with more to come next year. These awards will launch new, boldly creative lines of inquiry representing innovative departures from well-traveled roads of scientific thought. Each GO grant, if successful, has the potential to transform a key scientific field.

Other Challenge and GO grants, along with supplemental funding to HMS-affiliated hospitals and other institutions, are fueling efforts to advance biomedicine and health by HMS faculty and collaborators near and far. In one impressive example, HMS faculty obtained the largest fraction of ARRA funding awarded to conduct exome and whole-genome sequencing in thousands of individuals from phenotyped cohorts such as that of the Framingham Heart Study. This effort is expected to translate rapidly expanding knowledge from the human genome into tools for predicting, preventing and treating disease.

According to a quarterly report submitted in accordance with the Recovery Act principles of accountability and transparency, as of September HMS had created or retained the equivalent of 41 full-time jobs. For details, visit http://recovery.gov.

Lloyd M. Aiello Receives Alpert Prize for Preventing Blindness in Diabetes

Lloyd M. Aiello (right) accepts the Warren Alpert Foundation Prize from Herb Kaplan, the foundation's president.

HMS Clinical Professor of Ophthalmology Lloyd M. Aiello, the founding director of the William P. Beetham Eye Institute at Joslin Diabetes Center, received the 2008–2009 international Warren Alpert Foundation Prize in September 2009. Aiello joins an elite group of physician–scientists and researchers, which includes seven Nobel Prize winners.

Aiello was celebrated for pioneering a method to treat a complication of diabetes in which weak, leaky blood vessels proliferate in the retina, leading to hemorrhage and vision loss. Today the vast majority of patients with this condition, known as diabetic retinopathy, retain their vision, thanks to research and clinical trials led since 1967 by Aiello and his father-in-law, the late William P. Beetham. At a scientific symposium in Aiello's honor, clinicians and scientists recounted the history of Aiello's work and outlined new strategies for preventing diabetic eye disease.

Diabetes will affect 366 million individuals by 2030, according to the World Health Organization. In response to this looming crisis, Aiello has created the Joslin Vision Network, a telemedicine program that brings diagnostic

tools and treatments to patients in remote locations.

The Warren Alpert Foundation supports groundbreaking research, scholarship and service by individuals and organizations dedicated to understanding and curing disease. Recipients are chosen by the foundation's distinguished scientific advisory board, which is chaired by HMS Dean Jeffrey Flier.

Grants Back African American Scientists

Two African American biological and chemical science postdoctoral fellows at HMS received research fellowships from the United Negro College Fund and Merck & Co., Inc. They are Glenn Rowe, a research fellow in medicine at Beth Israel Deaconess Medical Center, and Temitope Sodunke, a fellow in radiation oncology at Massachusetts General Hospital. The fellowships provide up to $85,000 along with training, mentoring, networking and institutional support.

Epigenetics Grant Goes to Broad Institute

A five-year grant of approximately $15 million from NIH designates the Broad Institute of MIT and Harvard as one of four Reference Epigenome Mapping Centers in the United States. These centers are exploring a set of cues that help specify when and where in the body genes are activated. These "epigenetic" cues are not contained in the core DNA sequence.

To decipher and analyze these controls, researchers are studying at least 100 types of human cells, including embryonic stem cells. They are using the latest methods in stem cell biology, genomics technology, computation and production-scale research.

Bradley Bernstein, a co-principal investigator, Broad Institute associate member and assistant professor of pathology at Massachusetts General Hospital, said, "By glimpsing the normal epigenome at unprecedented breadth and depth, we will lay the groundwork for insights into the epigenetic basis of cancer and other diseases."

Harvard Catalyst Gives and Receives

The Harvard Clinical and Translational Science Center, known at HMS as Harvard Catalyst, began speeding improvements in human health by sparking collaborations across Harvard University and HMS-affiliated healthcare centers.

In September 2009, Harvard Catalyst received the largest Recovery Act grant awarded to HMS: $15 million. These funds will support a new network, the eagle-i Consortium, which will link biomedical scientists to valuable, hard-to-find resources—from reagents to facilities—at HMS and eight other institutions: Dartmouth College, Jackson State University, Morehouse School of Medicine, Montana State University, Oregon Health and Science University, the University of Alaska–Fairbanks, the University of Hawaii–Manoa and the University of Puerto Rico. Eventually the network will expand, sparing scientists across the country duplication of effort and accelerating discovery.

In March and November, Harvard Catalyst awarded 127 one-year, $50,000 pilot grants for projects that bring researchers together from across disciplines and institution at Harvard to tackle problems posed by illness and disability. Examples include an attention test for elderly drivers; a study of interventions to reduce obesity among African American schoolchildren; a fruitfly-based screen for drugs to combat leukemia; and a molecular imaging test for use in probing the biology of depressive symptoms.

Pilot funds enable research teams to generate the preliminary data necessary for securing longer-term funding, an especially important consideration for junior investigators looking to establish independent research programs. (For a story on Harvard Catalyst, see page 24.)

New National Institute of Health grants are fueling potentially transformative studies.

Accelerator Grants Boost Early-Stage Enterprise

Now in year three, Accelerator Fund grants from the Harvard Office of Technology Development help bridge the gap between discovery and development, speeding the delivery of innovative and potentially transformative technologies.

Seven of eight projects funded in September 2009 totaling $1.2 million went to HMS researchers. Several projects aim to develop inhibitors for molecular processes involved in disease, engaging the labs of **Daniel Finley**, professor of cell biology, **Marcia Haigis**,

assistant professor of pathology and **Junying Yuan**, professor of cell biology. Others led by **Thomas Bernhardt**, assistant professor of microbiology and molecular genetics, and **Stephen Lory**, professor of microbiology and molecular genetics, seek new antimicrobial agents. **Constance Cepko**, professor of genetics, is working on gene therapy to preserve vision. **Jose Halperin**, associate professor of medicine, is testing a new biomarker for the pre-diabetes state of impaired glucose intolerance. For more information, see http://www.techtransfer.harvard.edu.

Transforming Science

Sixteen HMS faculty members were among 115 nationwide to receive two kinds of prestigious High-Risk Research Awards from NIH.

Transformative R01 (T-R01) Program

New in 2009, this program funds visionary projects with the potential to transform a scientific field. Preliminary results are not required, and no budget cap is imposed. Recipients are free to pursue fresh, bold ideas, regardless of the resources their research might require, and are accorded the flexibility to work in large, complex teams if a problem demands it.

Frederick Ausubel, professor of genetics at Massachusetts General Hospital (MGH), hopes to identify next-generation anti-infectives that block pathogens' adaptation to host physiology.

Sylvie Berton, associate professor of medicine at MGH, will build on work in basal cells in the epithelia of organs. She aims to create new model systems for determining the 3-D relationships and functions of various epithelial cell types as basal cells detect and respond to drugs, hormones, chemicals and pathogens within the organ cavity.

Gaudenz Danuser, professor of cell biology, and Klaus Hahn, of the University of North Carolina–Chapel Hill, aspire to establish a new paradigm for studying cellular signal transduction and decision processes that combines biosensor design and live-cell imaging.

Ru-Rong Ji, associate professor of anesthesia at Brigham and Women's Hospital (BWH), and **Charles Serhan**, the Simon Gelman professor of anesthesia at BWH, are using newly uncovered endogenous proresolving lipid mediators to see whether and how they can prevent and even reverse neuropathic pain after injury.

Loren Walensky, assistant professor of pediatrics at Dana-Farber Cancer Institute, will intertwine chemistry, biology and medicine to create high-throughput technology that identifies protein targets and their sites of interaction.

Innovators of the Future

New Innovator Awards support investigators with highly original ideas very early in their careers—typically before they have sufficient data to secure longer-term R01 grants, the mainstay of funding for researchers' best ideas.

Mark Albers, instructor in neurology at MGH, will study the olfactory neural circuit as a systems-level model for neurodegenerative diseases.

Fernando Camargo, assistant professor of stem cell and regenerative biology at Children's Hospital Boston (CHB), will perform an analysis of stem cell dynamics and differentiation using cellular barcoding.

Theodore Cohen, assistant professor of medicine, BWH, and assistant professor of epidemiology, Harvard School of Public Health, will explore prevalence, risk factors and consequences of complex *M. tuberculosis* infections.

Gabriel Kreiman, assistant professor of ophthalmology, CHB, will search for neuronal correlates of visual awareness.

J. Rodrigo Mora, assistant professor of medicine, MGH, will reassess the physiological role of gut-specific lymphocyte homing and its implications for autoimmunity and tolerance.

Sunitha Nagrath, instructor in surgery, MGH, received funding for engineering sensitive microfluidic multiplex technology for isolating circulating endothelial progenitor and tumor cells, in order to study angiogenesis and metastasis in cancer development and progression.

John Pezaris, instructor in surgery, MGH, will explore the machine–brain interface with the potential to restore touch to amputees, for example.

Patrick Purdon, instructor in anesthesia, MGH, will take a neural systems approach to monitoring and drug delivery for general anesthesia.

John Rinn, assistant professor of pathology at Beth Israel Deaconess Medical Center, will focus on RNA and chromatin formation.

Magali Saint-Geniez, instructor in ophthalmology at Schepens Eye Research Institute, is interested in the bioengineering of Bruch's membrane for the treatment of age-related macular degeneration.

Endowed Chairs

Professorship in Psychosomatic Medicine

In June 2009, Dean Jeffrey Flier announced the Professorship in Psychiatry in the Field of Psychosomatic Medicine/Consultation at HMS and Massachusetts General Hospital (MGH) and congratulated first incumbent Theodore Stern. The chair honors Professor of Psychiatry Ned Cassem, a consultation psychiatrist at MGH, and will carry Cassem's name upon his retirement. According to Massachusetts General Physicians Organization Chairman and CEO David Torchiana, the professorship is Harvard's first in psychosomatic medicine, which focuses on psychophysiologic disorders.

In addition to recognizing the many grateful patients who contributed to the chair, Dean Flier thanked the family who helped make it possible: Lisa Steele; her mother, the late Jane Cook; and her aunt, Jessie Cox.

Cardiovascular Chair Honors Heart and Mind

In May 2009, Dean Jeffrey Flier led a celebration of the Commonwealth Professorship in Cardiovascular Medicine at HMS and Children's Hospital Boston (CHB). The chair will be renamed for first incumbent Jane Newburger upon her retirement. However, said Children's CEO James Mandell, "We do not expect the name change for at least 20 more years."

Gifts from Newburger's grateful patients, friends and colleagues made the chair possible. Department of Cardiology Chair James Lock, the Alexander S. Nadas professor of pediatrics at Children's, described Newburger's "virtually inexhaustible well of empathy and sympathy." Newburger turned the spotlight back on her colleagues' high standards in patient care and research, adding, "This is one of the greatest thrills of my life."

Guthart Chair a Beacon for Neuroendocrinologists

At the May 2009 celebration of the Laurie Carrol Guthart Professorship in Neuroendocrinology at HMS and MGH, Dean Jeffrey Flier paid tribute to Leo Guthart and daughters Becky and Peggy. Guthart's wife, Laurie, he said, was a woman known for her "incredible devotion to her family, and to doing good for others."

Dean Flier was deeply impressed, he said, with work accomplished through the clinical and translational science center known as Harvard Catalyst by the chair's first incumbent, clinician–scientist Anne Klibanski. Widely praised for setting high standards for other cure-oriented researchers, Klibanski is "a role model and mentor," said Peter Slavin, president of MGH.

Klibanski's thanks to the Guthart family rang with the expectation that their support would strengthen her field. Leo Guthart recounted his awakening to the idea of endowing a leadership position in neuroendocrinology and expressed indebtedness to Klibanski for the care she gave his daughter Peggy.

Ojemann Professorship Supports Pioneering Neurosurgery

At the June 2009 celebration of the Robert G. and A. Jean Ojemann Professorship in Surgery at HMS and MGH, HMS Dean Jeffrey Flier thanked past and present grateful patients, colleagues and friends, among them HMS Board of Fellows members John and Ginny Kaneb and HMS alumnus Griffith Harsh.

Of Robert Ojemann, the chair's namesake, Gerald Austen, the Edward D. Churchill professor of surgery at MGH, said, "My admiration for Bob started in 1957 and has never changed." Pioneering neurovascular surgeon Christopher Ogilvy, the first incumbent, was a "perfect match" for the professorship, according to Robert Martuza, the William and Elizabeth Sweet professor of neurosurgery and chief of the Neurosurgery Service at MGH.

For Ogilvy, the appointment was "the high point of my career." Of his benefactors, the Ojemanns, he added, "Bob and Jean had a profound influence on the institution."

Linde Professorship Offers Vision for Cancer Therapeutics

At the January 2009 celebration of the Linde Family Professorship at HMS and Dana-Farber Cancer Institute (DFCI), Dean Jeffrey Flier noted that the chair would support cancer therapeutics research "with the goal of delivering better, targeted drugs to those in need." At DFCI, President and CEO Edward Benz said the Lindes' endowment—part of a larger, "magnificent" gift—would help construct a stable foundation for chemical biology.

The chair's first incumbent is DFCI Chief Scientific Officer Barrett Rollins, "a faculty leader who pulls together all of our research activities," Benz said. Devising

therapies based on disease-related molecular abnormalities is "an incredibly complex undertaking," Rollins said, but one the Lindes' "visionary" gift would advance.

Describing his family's battles with cancer, Edward Linde* expressed "comfort and confidence that the chair will be occupied with distinction."

* *Edward Linde passed away on January 11, 2010.*

Dohlman Chair to Advance Ophthalmology

The celebration of the Claes H. Dohlman Professorship in Ophthalmology at the Massachusetts Eye and Ear Infirmary in December 2008 was a tribute to Dohlman, the founder of modern corneal science and a professor emeritus of ophthalmology who remains active at MEEI. Of the chair's first incumbent, Reza Dana, Dohlman said, "When it comes to corneal inflammation, he is by far the leader in the world."

Dana expressed gratitude to his family and to the many generous people, among them Joan Miller, the Henry Willard Williams professor of ophthalmology at MEEI and head of that department, who led the creation of the chair. Dana also gave thanks to Wayne Streilein, who at the time of his death in 2004 was president of Schepens Eye Research Institute. "No single person had more to do with my being here," Dana said.

Rosen Chair Primes Immunology Research

Since November 2008, the Fred S. Rosen Professorship in Pediatrics at HMS, the Immune Disease Institute (IDI) and Children's Hospital Boston has been strengthening collaborations among HMS and IDI researchers. The new chair acknowledges Rosen's pioneering investigations of primary immune deficiencies and his work in developing intravenous gamma globulin therapy.

Rosen was "the quintessential translational researcher," according to Fred Alt, the Charles A. Janeway Professor of Pediatrics at HMS and the scientific director for IDI. With Dean Jeffrey Flier and Children's President James Mandell at the Medical School's Jeffrey Modell Immunology Center were Fred Modell and his wife, Vicki. Rosen was a teacher, healer, adviser, friend and devoted physician to son Jeffrey, who died at age 15, Vicki Modell said.

The first Rosen Professor is Klaus Rajewsky. Addressing him, Vicki Modell quoted from *The Little Prince*, sketching a landscape of stars as beacons linking explorers at the frontier of molecular immunology. A gratified Rajewsky called his inspirational colleagues and laboratory "a little universe in itself."

Elite Science Recognized with Korsmeyer Chair

Though he died in 2005, Stanley Korsmeyer still brings people together. At the November 2008 reception for the Stanley J. Korsmeyer Professorship in Medicine at HMS and the Dana-Farber Cancer Institute, Dean Jeffrey Flier quoted Robert Horvitz of MIT, who said, "Stan was everybody's hero as a scientist and as a human being."

DFCI President and CEO Edward Benz called both Korsmeyer and first incumbent Bruce Spiegelman "super-elite scientists." While Korsmeyer changed scientists' view of programmed cell death, Benz said, Spiegelman did the same for energy metabolism. "It's a joyous thing that there will be a Korsmeyer professorship 100 years from now," Spiegelman said.

Korsmeyer's widow, Susan, thanked all those who supported the professorship. It is only a matter of time, she said, before drugs based on her late husband's research would enter clinical trials.

Enders Professorship in Pediatric Infectious Diseases

Opening the October 2008 celebration of the John F. Enders Professorship in Pediatric Infectious Diseases at HMS and Children's Hospital Boston, Dean Jeffrey Flier called the late Enders "truly legendary." With HMS professors Thomas Weller and Frederick Robbins, Enders received the Nobel Prize in 1954 for research that paved the way for developing vaccines for polio.

Flier also praised the chair's first incumbent, Michael Wessels, for his own vaccine research. With Porter Anderson, a former HMS faculty member who endowed the chair, Wessels developed the concept of molecular mimicry, in which similarity in the genetic sequence of self and foreign peptides leads to an autoimmune response. The discovery contributed to the development of vaccines for Group B *Streptococcus*, noted Gary Fleisher, the Egen Family Foundation Professor of Pediatrics and chair of the Department of Medicine at CHB. It was humbling, Wessels said, to hold a professorship named for one giant in infectious disease and supported by another.

Academic Programs

Harvard Medical School is, first and foremost, a training ground for practitioners, innovators and leaders in science and medicine.

Harvard Medical School marked a major milestone in medical education reform and continued to nurture the careers of people interested in patient-related research, an all-too-rare species.

Milestones in Medical Education

In academic year 2008–2009, Harvard Medical School marked a major milestone in medical education reform: For the first time, all third-year students became engaged for a full year in the unique culture of one primary HMS clinical affiliate instead of rotating among them. Class members completed a common curriculum and, while most pediatric rotations took place at Children's Hospital Boston, students chose a home base at Beth Israel Deaconess Medical Center, Brigham and Women's Hospital, Massachusetts General Hospital or the Cambridge Health Alliance.

HMS is the first medical school to introduce students to patient care in such an integrated way, according to HMS Dean for Medical Education Jules Dienstag, the Carl W. Walter professor of medicine. Faculty mentors now describe relationships with students as deeper and more meaningful, while students report sustained empathy toward patients, with whom they now have more time to forge connections.

"The Principal Clinical Experience was one of the driving forces behind medical educational reform," said Dienstag. "We expect it to be a model for other medical schools."

About half of MD students now dedicate a fifth year to research, global health projects or other areas of scholarly inquiry, Dienstag said. To enable all graduates to become "thought leaders and advocates of change in their fields," he said, education reform at HMS will, within the next two years, ask all students to complete a scholarly project in areas such as laboratory science, clinical investigation, global health or the social sciences.

HMS Lays Track to Clinical and Translational Research Careers

How does one become a clinical or translational researcher—one who advances human health by ushering laboratory findings through a gauntlet of tests and trials, to the point where a safe, effective new form of patient therapy emerges? There has never been a direct training pathway, so HMS faculty leaders are building one.

A major goal of the National Institutes of Health-funded Harvard Clinical and Translational Science Center—called Harvard Catalyst—is to nurture the careers of people interested in patient-related research, an all-too-rare species. While in the past, fellows and junior faculty relied on luck and persistence in discovering a clear direction and a senior mentor, a well-defined curriculum will now lead them, step by step (for details, visit http://catalyst.harvard.edu/learning.html).

In May, Elliott Antman, HMS professor of medicine at Brigham and Women's Hospital, was named director of the Harvard Catalyst Program for Postgraduate Education in Clinical and Translational Science. Antman, a cardiologist, has led patient trials that have raised the standard of care for cardiovascular disease worldwide. In 2009, he and other faculty leaders took major steps to integrate education, training, mentoring and career development for physicians, basic scientists and others. For example:

- A weeklong course to be offered three times a year, Introduction to Clinical Investigation, began teaching basic principles and methods used in patient-based research to trainees, who also honed their skills in analyzing, synthesizing and evaluating data;
- Hundreds of courses, workshops and seminars at Harvard's schools and 17 HMS affiliates were also opened to trainees at every level, and new courses were planned;
- KL2 MeRIT awards provided two years of salary support and advanced training to several exceptional young investigators who, with a well-matched senior mentor, will complete a disease-specific research project;
- New programs were launched for underrepresented minorities: the ten-week Summer Clinical and Translational Research Program for college students and the eight-week Visiting Research Internship Program for medical students;
- Shared course offerings and faculty leaders were identified to strengthen HMS master's degree programs (to date, Scholars in Clinical Science and Clinical Investigator Training).

Third-year student Matthew Baker (center) learned the basics of surgery during his Principal Clinical Experience clerkship.

Antman and David Golan, HMS dean for graduate education and professor of biological chemistry and molecular pharmacology, are working to align current and future master's programs with graduate and postgraduate programs offered through the Harvard Catalyst and HMS. Golan oversees the School's PhD programs, including the Harvard Catalyst–supported Leder Human Biology and Translational Medicine Program and the Harvard Catalyst Program for Graduate Education in Clinical and Translational Science.

Reinvigorating Research in Teaching and Learning

The Academy was reborn in 2009 as the HMS Academy for Teaching Excellence and Educational Innovation. Directing the evolution of this research and training center is Richard Schwartzstein, the Ellen and Melvin Gordon professor of medical education and a senior physician in medicine at Beth Israel Deaconess Medical Center.

By introducing new teaching methods and technologies to Harvard educators, the reinvigorated Academy will continuously improve learning and methods of assessing students and postgraduate clinical and research trainees. The Academy also supports education-related research by faculty members.

Nancy Lurie Marks Foundation Spotlights Autism

For the first time, HMS launched a training program that will build a community of junior faculty members, postdoctoral trainees and medical students with a common interest in one group of diseases. With a six-year grant totaling $5 million from the Nancy Lurie Marks Family Foundation, the School will intensify research on autism and related disorders.

Like other efforts to promote translational science at HMS, the Nancy Lurie Marks Clinical and Research Fellowship Program in Autism supports basic and clinical research. Working in genetics, genomics, neurology, neuroscience and other fields, each Nancy Lurie Marks fellow (junior faculty member or postdoctoral trainee) and scholar (medical student) will pair with an expert mentor in autism to undertake research at HMS or an affiliated medical center.

At the new program's helm are Michael Greenberg, the Nathan Marsh Pusey professor of neurobiology and chair of that department, and co-director Joseph Volpe, a clinical researcher and the Bronson Crothers distinguished professor of neurology at Children's Hospital Boston.

Incoming medical students don short coats on White Coat Day, a ceremonial orientation event.

From left: HMS–Portugal Program Director Tomas Kirchhausen, professor of cell biology; Jeffrey Flier, HMS dean; Mariano Gago, Portuguese minister of science, technology and higher education; and Manuel Heitor, Portuguese secretary of state for science, technology and higher education. Not pictured is Maria Carmo Fonseca, the program's director in Lisbon.

HMS–Portugal Program Promotes Research, Education and Awareness

In May 2009, the Harvard Medical School–Portugal Program in Translational Research and Information was launched by HMS and the Portuguese Ministry of Science, Technology and Higher Education. Fueled by $55 million in funding over six years, the initiative—with a website at http://www.hmsportugal.org—aims to foster durable collaborative ventures among Portuguese and Harvard research groups involving faculty, trainees and students.

Goals include expanding translational research across Portugal's leading research laboratories and seven medical schools and disseminating the latest health and medical information to the public. The program will also award collaborative grants in translational and clinical research to HMS–Portuguese teams.

Dubai–Harvard Research Collaboration Gains Momentum

The Dubai Harvard Foundation for Medical Research supports collaborative research on diseases and health issues endemic to the Middle East between laboratories in the region and at HMS. In 2009, the foundation made its second series of Collaborative Research Center Awards and granted two additional three-year postdoctoral research fellowships.

One initiative draws on the strengths of five regional research centers to identify genes that cause primary immunodeficiency diseases, such as liver disease. Principal investigators Raif Geha, the James L. Gamble professor of pediatrics at Children's Hospital Boston (CHB), and colleague Luigi Notarangelo, professor of pediatrics and of pathology, will work with collaborators at United Arab Emirates University; Kuwait University; King Saud University, Saudi Arabia; American University of Beirut; and Ege University Medical School, in Turkey.

A second initiative aims to explore genetic variations that cause birth defects and define their prevalence in Middle East populations. The research team includes Christine Seidman, professor of genetics and the Thomas W. Smith professor of medicine at Brigham and Women's Hospital (BWH); Patricia Donahoe, the Marshall K. Bartlett professor of surgery at Massachusetts General Hospital (MGH); Richard Maas, professor of medicine at BWH; and researchers at the King Faisal Specialist Hospital and Research Center in Riyadh, Saudi Arabia; the American University of Beirut; and the Weill Cornell Medical College in Qatar.

Postdoctoral Fellow Maha Al-Mozaini is investigating post-transplant lymphoproliferative disorder with Jay Fishman, professor of medicine at MGH. Manal Alaamery is working in the lab of Christopher A. Walsh, the Bullard professor of neurology at CHB, to identify genes that control cerebral cortex development.

HMS, School of Public Health in Global Health Delivery

In July 2009, students from HMS and the Harvard School of Public Health attended the new, three-week summer Global Health Effectiveness Program at Harvard. Students were introduced to epidemiology, organizational behavior and management by analyzing case studies. The course drew public health professionals from around the world, including physicians with the nonprofit Partners In Health working in Rwanda, Lesotho and Haiti.

Research and Discovery

From laboratories on the HMS Quad to affiliated hospital beds and clinic exam rooms, researchers aim to bridge the gap between petri dish and patient.

From left, Sabrina Spencer, John Albeck and Suzanne Gaudet, members of Peter Sorger's lab in Systems Biology, have found that genetically identical cells can have vastly different reactions to the same cancer drug due to their varying protein levels.

Cancer's Random Resistance to Drugs

When investigating the effectiveness of a new cancer drug, scientists in the lab of Peter Sorger, a professor in the Department of Systems Biology, noticed that the percentage of malignant cells that succumbed to the drug—and the percentage that survived—remained remarkably consistent throughout generations. It wasn't genetics; the cells were genetically identical. The ability to survive, they found, was the result of protein levels that varied from cell to cell. Furthermore, the researchers found that the levels of the protein—and the traits the protein triggered—were passed down to the non-responders' daughter cells in a process that had nothing to do with heritability. In their May 2009 report in *Nature*, the researchers note that this pass on death is transient; a cell may well perish in subsequent treatments. Knowing that random resistance plays a role in chemotherapeutic success, the scientists say, may help others design more effective anti-cancer drugs.

Pathogen Structures Share Common Origin

Biology often shows us that dependable structures are conserved, even across species. It is not always easy, however, to decipher the historical links between structures that evolution has changed. But a team led by John Mekalanos, the Adele Lehman professor of microbiology and molecular genetics and head of the Department of Microbiology and Molecular Genetics, reported in March 2009 in the *Proceedings of the National Academy of Sciences* and *Cell Host and Microbe* that they had found such a link between a syringe-like structure that makes certain infectious bacteria deadly—in cholera, the structure carries poison—and another, well-studied structure, the hollow tube "tail" of bacterial viruses. The bacteriophage's tail injects its genetic material into a cell during infection. By analyzing amino acid sequences in key proteins in both structures, Mekalanos and colleagues discovered molecular similarities that linked the structures through time. This link, they suggest, may allow drug developers to use what is known about bacteriophage tails to find ways to prevent the bacterial syringe from forming and functioning.

New Clues to Killing Cancer Cells

Nascent cancer cells need community to thrive. If, during a tumor's formative stages, a cell loses contact with the extracellular matrix to which its peers are attached, it kills itself. Scientists have long thought that cell suicide, or apoptosis, was the sole route by which homeless cancer cells perished. But researchers working with Joan Brugge (right), the Louise Foote Pfeiffer professor of cell biology and head of the Department of Cell Biology, have discovered an alternate path: starvation. Alone, these cells lose their ability to harvest energy, the team reported in the August 2009 *Nature*. This finding emerged when the researchers, studying why some isolated breast epithelial cells died despite being endowed with a cancer-causing gene that prevented apoptosis, found that the altered cells had shut down their intracellular system for transporting glucose, their prime energy source. Finding that the treated cells were under oxidative stress, the scientists treated them with antioxidants. To the researchers' surprise, the treated cells survived by using fatty acids as an energy source. Further defining the metabolism of precancerous cells could point drug developers toward new tumor-killing strategies.

India's Billion People Traced to Two Ancestral Gene Lines

A close inspection of the genomes of 25 diverse populations in India, a nation of one billion people awash in political, linguistic and socioeconomic differences, found that nearly all descend from two ancestral populations. The findings, reported in the September 2009 *Nature* by co-first author David Reich, an associate professor in the Department of Genetics, suggest that nearly all Indians today bear the genetic echoes of Ancestral North Indians, who are genetically like western Eurasians, and Ancestral South Indians, whose genomic makeup may be unique in the world. The exceptions appear to be people on the Andaman Islands in the Bay of Bengal, who descend exclusively from the Ancestral South lineage. The study offers a toolkit for deciphering genetic relationships, historical variations and, of keen interest to modern medical sleuths, differing rates of gene-based diseases.

Resetting the Body's Clock

For travelers, chasing the sun across time zones can be exciting, even invigorating—until jet lag hits. But an anti-lag aid may be on the way. Reporting in June 2009 in *PLoS Computational Biology*, a research team at Brigham and Women's Hospital describes a new software program that uses light levels, sleep schedules and other measures to calculate the countermeasures needed to reset the body's internal clock to the time in the destination country or even for a new work schedule. Team leaders Elizabeth Klerman, an HMS associate professor of medicine at the hospital, and Dennis Dean, a computational research associate in the hospital's Division of Sleep Medicine, believe their math-enhanced intervention could halve the number of days a traveler would need to adjust to a new time zone. They are now applying the findings to different scenarios, including proposals for changes to resident training schedules.

Pregnancy Weight Gain, Childhood Obesity Linked

Weight gain in pregnancy—even at currently acceptable levels—may actually set the stage for obesity in children, while a mother's weight loss during this period may improve health outcomes for both her and her infant. In papers published in *Obstetrics and Gynecology* (November 2008) and the *American Journal of Epidemiology* (July 2009), teams led by Emily Oken, an assistant professor in the Department of Population Medicine, report that the risk of obesity in adolescents can be directly linked with the weight their mothers gained during pregnancy and that the risks for adverse short- and longer-term health outcomes, such as preterm delivery and childhood obesity, can decrease for obese women and their children if the mothers lose weight during pregnancy. These data, the researchers say, should encourage a re-examination of acceptable weight-gain standards for pregnant women.

U.S. Health Improvements Found Deeply Inequitable

According to researchers in the Department of Health Care Policy, this nation's efforts to improve care for individuals with cardiovascular disease and diabetes improved significantly between 1999 and 2006. Yet while improvements in the control of these diseases were found in all population groups, the gains did little to reduce healthcare inequities between groups. In an April 2009 report in the *Annals of Internal Medicine*, a research team led by J. Michael McWilliams, an assistant professor of health care policy and medicine in the department, concluded that national improvements in care for cardiovascular disease and diabetes have not triggered consistent reductions in racial, ethnic or socioeconomic differences. Only the leveling effect of Medicare succeeded in diminishing some of these disparities. The researchers suggest that these findings could inform any debate over universal health insurance.

Key Immune Cells Lower Insulin Resistance

Fat cells serve as reservoirs of energy to be tapped in times of need but also play a part in hormonally controlling the body's intake and use of energy. When permutated, fat cells spur changes to the body's inflammatory response, ultimately causing insulin resistance, a hallmark of Type 2 diabetes. Studies published in August 2009 in *Nature Medicine* by the laboratory of Diane Mathis and Christophe Benoist, professors in the Department of Pathology, together with Steven Shoelson at Joslin Diabetes Center, explore how those permutations contribute to insulin sensitivity. According to the researchers, fat tissue contains immune cells known as regulatory T cells. In lean mice, these cells produce anti-inflammation signals that prevent insulin resistance. Obese mice, however, have markedly lower levels of these cells. When the researchers raised the levels of these T cells, the obese mice became less resistant to insulin—a discovery that could have implications for treating Type 2 diabetes.

Stem Cell Lines to Expedite Human Disease Studies

Researchers attempting to use human stem cells to study specific diseases have struggled to maintain robust generations of the cells in culture dishes—until now. In the lab of George Daley, an associate professor in the School's Department of Biological

Chemistry and Molecular Pharmacology and at Children's Hospital Boston, investigators have taken somatic cells from patients with Duchenne muscular dystrophy, Parkinson's disease, Down syndrome and other diseases and reprogrammed the cells, inducing them to adopt the potential for the functional diversity of embryonic stem cells, which are difficult to acquire, yet retain their ability to grow well in culture. In the September 2008 issue of *Cell*, the scientists report success in producing immortal stem cell lines that carry the genes or genetic components for ten human diseases, many of which are difficult or impossible to study in animal models. These cell lines, which will eventually be deposited at the Harvard Stem Cell Institute, will be available to researchers seeking to study molecular mechanisms of the diseases, test potential drugs and correct genetic defects underlying each disease.

Viewing the Brain's Details

Finding new ways of peering far below the brain's surface drives the work of Bernardo Sabatini, an associate professor in the Department of Neurobiology. A new imaging technique, reported in August 2009 in *Neuron* by Sabatini and his research colleagues, makes it possible to decipher with amazing clarity even infinitesimally small structures of neurons. Sabatini has produced snapshots of the lollipop-like structures known as dendritric spines, which serve as receiving points for chemical messages sent between neurons. The team's custom-designed laser scanning microscope penetrates tissue using wavelengths of light that maintain their focal integrity to yield sharp tableaus at depths that cause light from similar imaging tools to scatter—a boon to investigators seeking a better understanding of the brain's structures and their functions.

A Fresh Attack on Type 1 Diabetes

Work from the lab of Maria Koulmanda, an HMS associate professor of surgery at Beth Israel Deaconess Medical Center, suggests a way to help people with Type 1 diabetes mellitus control inflammation—and regain healthy levels of blood glucose. In this form of diabetes, the body's immune system destroys islet cells that produce insulin, a hormone essential to the conversion of glucose into energy. In 2007, Koulmanda's team showed that a form of inflammation in fat and muscle blocked glucose from moving from the bloodstream into tissues. In a report in an October 2008 edition of the *Proceedings of the National Academy of Sciences*, the researchers demonstrated that a protein, AAT, made by the liver in response to inflammation, restores glucose's movement. The researchers have obtained funding and, together with a team of clinical investigators, are moving forward with clinical trials using AAT, already an approved treatment for a heritable form of emphysema, in patients with Type 1 diabetes.

Medicine from Mother Nature

Plants' medicinal powers—foxglove's digitalis and the Pacific yew tree's taxol, for example—give scientists strong incentives to search for, test and develop new compounds from nature's pharmacopoeia. Consider the hydrangea root. A team of scientists led by Harvard School of Dental Medicine researcher Malcolm Whitman, a professor in developmental biology, has discovered that halofuginone, a molecule synthetically derived from this root, regulates the body's inflammatory response by halting the development of T helper 17 cells, which produce interleukin-17. This cell type is linked with the outsized immune responses of autoimmune diseases such as multiple sclerosis, rheumatoid arthritis and scleroderma. In June 2009 the researchers reported in *Science* that the plant-root derivative halted multiple sclerosis in a mouse model. The scientists suspect that halofuginone may hold promise as an anti-inflammatory agent.

In Africa, High HIV-Drug Adherence Rates Reflect Social Bonds

A village may do more than simply raise a child; it may keep the grown child alive. Research shows that despite significant hurdles of distance, deprivation and malnutrition, people living with HIV and AIDS in sub-Saharan Africa are far more likely to adhere to their rigorous treatment regimens than people in North America are. Adherence rates that often exceed 94 percent appear related to a sense of mutual obligation within impoverished communities that is essential for survival. In their January 2009 report in *PLoS Medicine*, co-authors Norma Ware, an HMS associate professor in the Department of Global Health and Social Medicine, and David Bangsberg, an HMS lecturer on medicine at Massachusetts General Hospital and the Harvard Initiative on Global Health, suggest that a strong sense of social responsibility and an emphasis on preserving social capital explain adherence success.

At Harvard University's Smithsonian Center for Astrophysics, a scientist was developing atomic clocks when his research inspired a surprising offshoot: the design for a low-magnetic-field, walk-in MRI scanner. The magnet inside this novel machine would be safe for patients with metal implants and pacemakers, and its upright design would allow for more precise imaging of posture-dependent blood and air flow. The inventor, physics professor Ronald Walsworth, built a prototype in the late 1990s—yet it sat, largely untested, for nearly a decade.

The problem? "Not many programs fund these kinds of projects," Walsworth explains. "It's hard to get money for work that transitions between physics and biomedical imaging."

Enter Harvard Catalyst. Also known as the Harvard Clinical and Translational Science Center, this virtual center was created with a five-year, $117.5-million grant to Harvard Medical School from the National Institutes of Health, replacing smaller grants previously awarded to the School's affiliated hospitals and institutes. As its name suggests, Harvard Catalyst aims to spark collaborative work among thousands of laboratory and clinical researchers, many of whom have never worked together before. The center persuades them to pool their expertise—no small feat, says Harvard Catalyst's visionary director, Lee Nadler, dean for clinical and translational research at HMS (pictured above).

"All the components necessary to make an impact on human illness already exist at Harvard," Nadler says. "Unfortunately, relatively few of these researchers have ever found themselves in the same 'reaction vessel,' leaving their potential virtually untapped."

Intriguing Combinations

HMS Dean Jeffrey Flier enlisted Nadler to lead the creation of Harvard Catalyst, which in 2009 began awarding one-year pilot grants to teams of researchers with intriguing ideas. So far, 127 grants—of $50,000 each—have united 475 investigators from 23 Harvard schools and hospitals as well as the Broad Institute and MIT. Bacterial geneticists now work with experts in blood coagulation; neonatologists join microbiologists; cancer vaccine specialists team with polymer engineers.

A team led by Walsworth received a pilot grant that helped pay to move his MRI scanner to Massachusetts General Hospital's (MGH) Martino Center for Biomedical Imaging. The grant also financed technical improvements to the machine and tiled the floor. These improvements are "grungy, non-sexy things," Walsworth says, but they have laid the

Harvard Catalyst

Catalyst of Innovation

groundwork for studies that aim to demonstrate the scanner's cost-efficiency and value to patient care.

Another pilot grant linked MGH pediatrician Nicolas Oreskovic with faculty at Harvard's Graduate School of Design to study how the brain responds to varied elements of architectural design. That group is identifying features that promote physical activity. Meanwhile, Assistant Professor of Medicine Karen Hacker—along with colleagues at Harvard Law School, Tufts University and Cambridge Health Alliance, as well as with community groups—is examining how residents' fear of immigration-enforcement policies deters them from seeking healthcare in one low-income, ethnically diverse town.

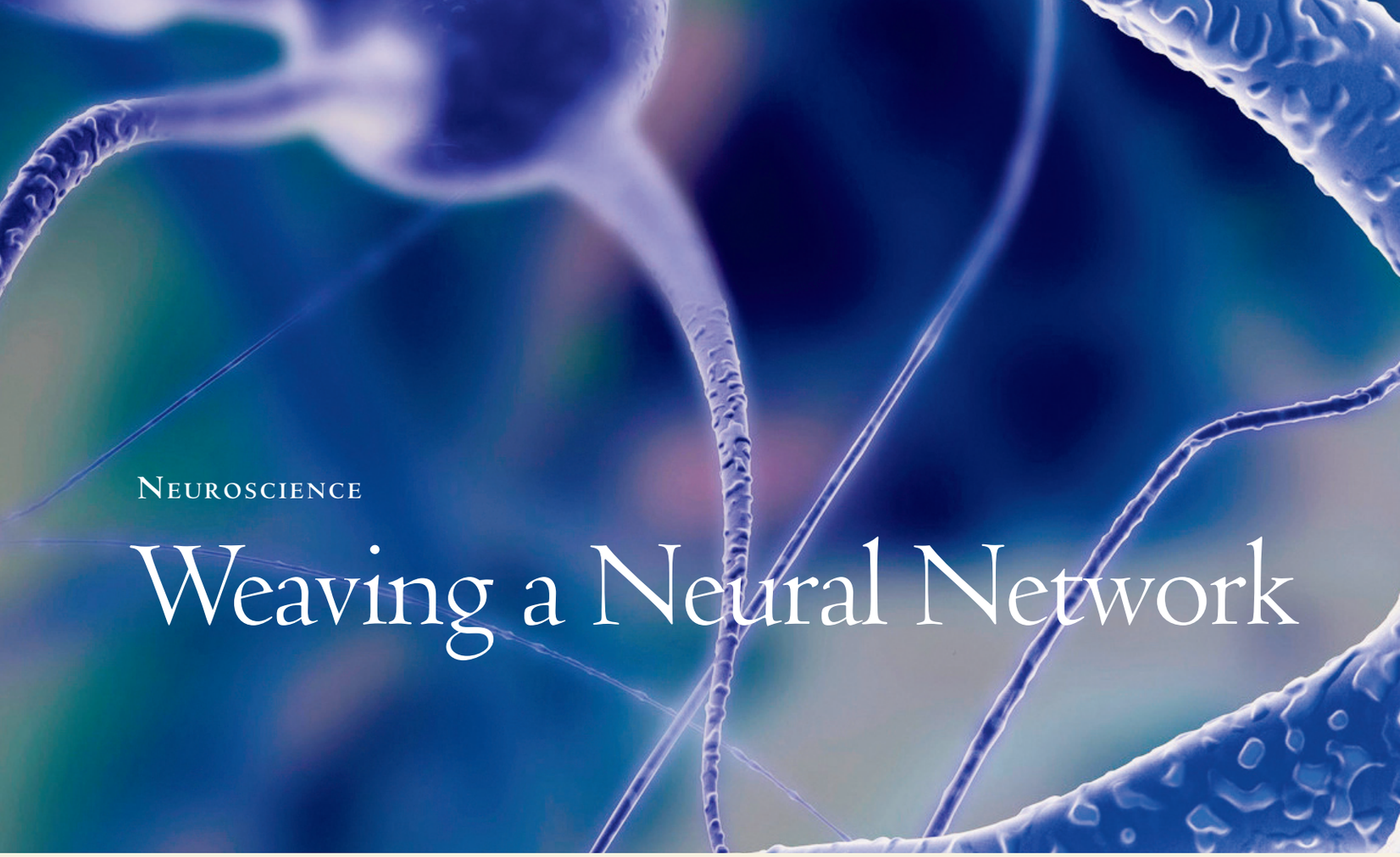
Nurturing Tomorrow's Physician–Scientists

A major Harvard Catalyst goal is to train and assist young researchers. "We're integrating the School's master's programs and offering more courses to help investigators apply laboratory discoveries to human subjects," Nadler explains. "We want researchers to come in with a baseline of knowledge and leave being Yoda." This past fall, a new five-day course to be offered three times a year, Introduction to Clinical Investigation, drew more than four times as many applicants as the 100-seat classroom could hold. Harvard Catalyst links investigators to a common laboratory, to nurses and other professionals, and to "dream teams" of biostatisticians who can design and analyze studies.

Key to this process has been Harvard Catalyst's website (http://catalyst.harvard.edu), which literally maps researchers' whereabouts and details their expertise and discoveries. A powerful search engine scours the site's pages, applications and databases, helping visitors locate people, publications, clinical trials, facilities and additional funding sources.

Taking the concept of pooling assets one step further, Harvard Catalyst and eight universities from New Hampshire to Hawaii and Alaska to Puerto Rico recently won a $15 million stimulus grant to forge the eagle-i Consortium. The group is building a "discovery network" to help translational researchers anywhere in the country locate and share resources, from core facilities to reagents and tissue banks.

Inspired alliances among brilliant minds—and game-changing research—embody the spirit of Harvard Catalyst. Says Walsworth: "We've all got great ideas, but it's been difficult to bridge to other researchers and get funded. That's what Harvard Catalyst is doing, and I'm grateful for it."



Neuroscience

Weaving a Neural Network

In the brain, connections are what count. Molecules connect with receptors and chemical messages are exchanged. New junctions form, and learning expands. Neural networks collaborate, memory is accessed, and a word, gesture or thought results.

Connections among brain researchers—within the Department of Neurobiology at Harvard Medical School and across the University—are generating discoveries related to how the brain receives cues from the environment and converts them into learning, memory and behavior.

"Our researchers have inherited the legacy of vision researchers David Hubel and Torsten Wiesel," says Department Chair Michael Greenberg. "Many aspects of our work stem from their discovery that our interactions with the environment shape the development and function of the nervous system. We continue to carry the torch passed us by these Nobelists, but we're doing so in ways that not long ago were unimaginable."

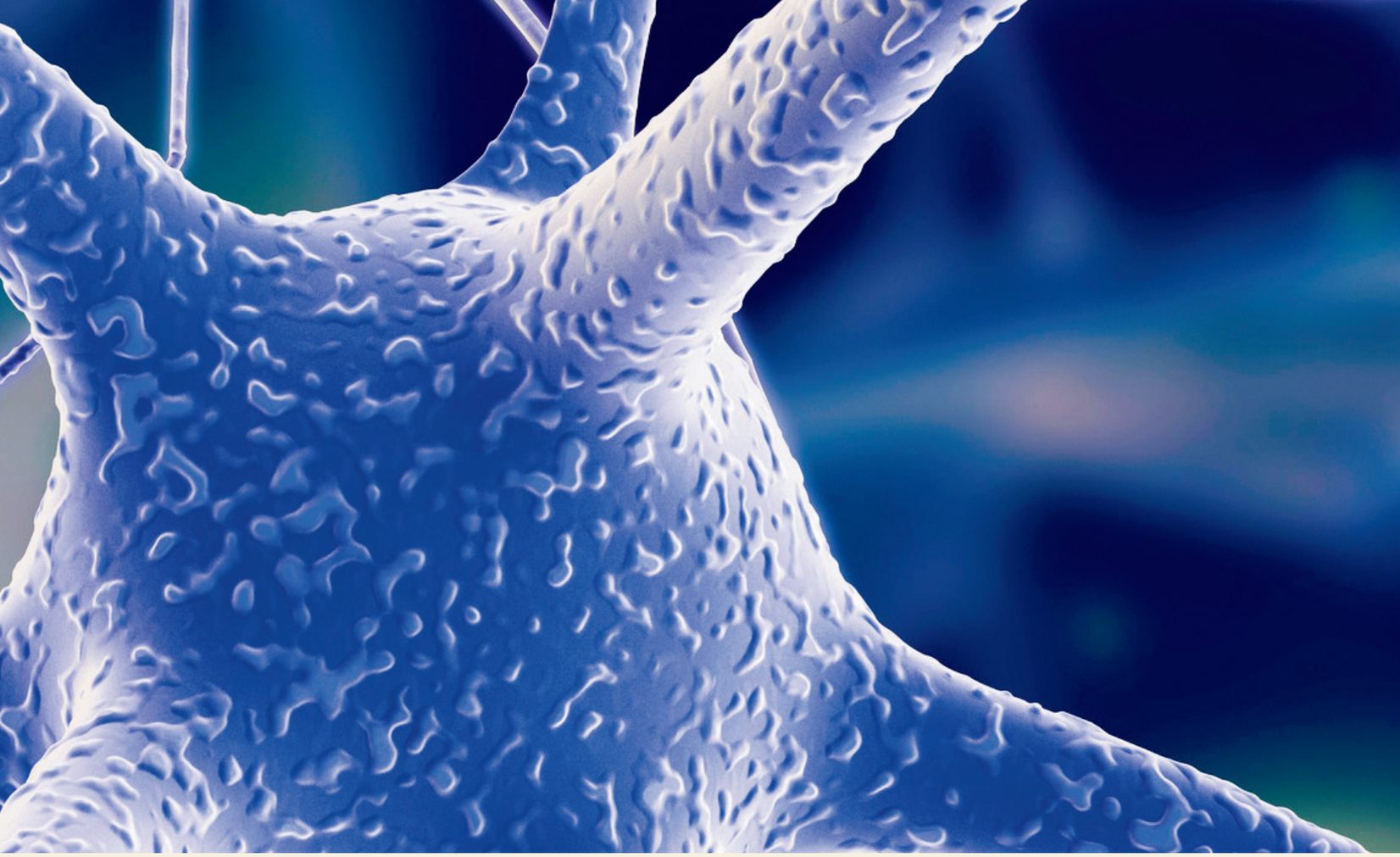
Reflections of this legacy can be found in the work of Bernardo Sabatini, an associate professor and Howard Hughes Medical Institute investigator. Sabatini studies how synapses—the junctions across which neurotransmitters travel from one neuron to another—form, operate and change in response to external stimuli. He also builds sophisticated tools that are advancing scientists' understanding of synaptic structure and function.

Depth Perceptions

Recently, Sabatini's lab has devised a delivery system for channelrhodopsin, a light-activated protein that triggers dopamine production in the neurons of mice. In humans, dopamine assists in the learning process and modulates activity in the basal ganglia, a midbrain region involved in Parkinson's disease.

Sabatini injected viruses containing unactivated channelrhodopsin into mouse cells in the basal ganglia, then exposed the cells to light, triggering dopamine production. With this molecular fiberoptic system, Sabatini can control the manufacture of dopamine within the brain of a living animal—a technique that may one day allow physicians to treat neurodegenerative disorders from within the cell.

Another tool, one developed collaboratively by Sabatini and Harvard University biophysicists, is an imaging advance that brings into plain view once-invisible structures critical to neural processes. This tool, a hybrid microscope that weds



two-photon microscopy with a technique called stimulated emission depletion, sharpens the resolution of minuscule structures such as dendritic spines, the wispy projections that support synapses.

The Nose Knows

The subcellular-eye view provided by Sabatini's innovation will factor large in studies of the central brain by a new HMS recruit: Sandeep Robert Datta, assistant professor in neurobiology. An expert on the brain's olfactory system, Datta investigates ways in which odors drive innate mammalian behavior.

Evolution has cemented the neural pathways that dictate animals' responses to smells. Locating food, selecting a mate and detecting predators—each is shaped by olfactory cues. Datta uses such genetically programmed pathways to investigate the neural circuits that translate signals sensed by a specific receptor in the nose into useful actions.

Datta's nose–brain research has sparked a connection between him and Stephen Liberles, an assistant professor of cell biology, who studies how information from chemosensors in the nose contribute to behavior. Their joint studies of genes, cells and cell signaling could lead to a better understanding of anxiety disorders—perhaps even to new treatments.

Moving Closer to Cures

As research in neuroscience blossoms, so too do its connections to clinical applications. Recently, Greenberg was tapped to direct a six-year, $5 million initiative to bring advancements in the neurobiological bases of autism to bear on new ways to treat the disorder. The Nancy Lurie Marks Clinical and Research Fellowship Program in Autism will place the next generation of researchers in the laboratories of autism experts at the School, the affiliated hospitals and across the University, all focused on deciphering the genetic origins of the disease.

A brain-research community is coalescing as HMS neuroscientists foster and extend research collaborations with colleagues at the Children's, Beth Israel Deaconess and Brigham and Women's hospitals. "We dream of bridges—more bridges—between buildings, so that movement among people and ideas is eased," Greenberg says. "Connections will carry us a bit closer to the development of therapies and cures for neurological and psychiatric diseases—and will help sustain our legacy of discovery."

Wyss Institute for Biologically Inspired Engineering

Build it Like Mother Nature

Frank Lloyd Wright knew nature could teach architects a thing or two. Inspired by the contours of the landscape, Wright designed buildings with organic forms. With a similar philosophy, researchers are charting a new course in medicine through the Wyss Institute for Biologically Inspired Engineering, launched in 2009 with the largest philanthropic gift to Harvard in the University's history—$125 million—from engineer–entrepreneur Hansjörg Wyss.

The Institute brings together researchers and clinicians from Harvard's Medical School and School of Engineering and Applied Sciences (SEAS), its affiliated hospitals and nearby institutions, and provides them with funding, space and expert technical assistance to build on revolutionary advances in engineering, nanotechnology, synthetic biology and computer science. Although their ideas carry a high risk of failure, they also have the potential to yield big dividends for human health.

"We're adopting the same simple, ingenious design principles that nature uses to create new medical devices and biomaterials," says Donald Ingber, the Institute's founding director and an HMS professor of pathology at Children's Hospital Boston.

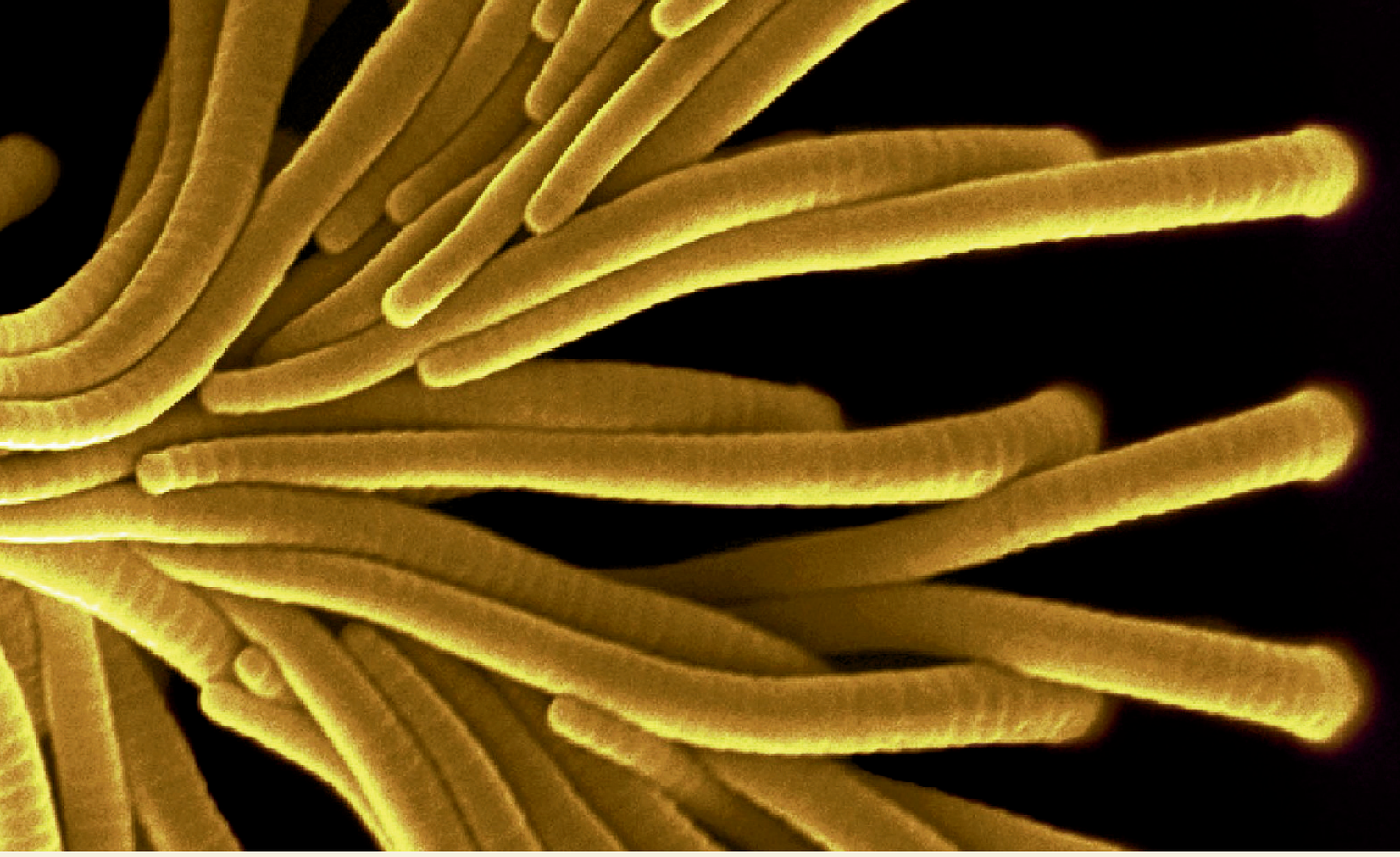
Wyss teams discard stale patterns of thought by embracing strategies living systems use to adapt and compete for survival. Some of these tactics run counter to what scientists and engineers learn during their formal training. Take nature's approach to noise.

"Nature harnesses noise instead of trying to minimize it," says Ingber, using natural selection to illustrate his point. Genetic noise—in the form of random DNA mutations—produces populations of cells with slightly differing DNA blueprints and traits.

Electrical engineers despise noise and strive to eliminate it from equipment, from radio transmitters to lasers. Wyss researchers recognize that the human body bears little resemblance to a cool, quiet room for computer servers. This complex multi-cellular organism instead resembles an experimental polyrhythmic symphony in which the musicians work from their own scores, yet are flexible enough to improvise.

Relying on insights from nature may enable Wyss researchers to innovate where others have failed. Take tissue engineering: Instead of working in a petri dish, a team led by Ingber etched three-dimensional channels into a flexible, translucent

▲ In a step toward creating adhesives, drug delivery systems and other useful tools, Wyss Institute researchers led by Joanna Aizenberg have synthesized nanobristles that self-assemble into helical shapes, which are ubiquitous in nature.



cube and filled them with cells to recreate key structures found in the lung. The resulting "lung on a chip" expands and contracts rhythmically. It breathes. "We could never have achieved this necessary level of complexity in a dish," Ingber says. He hopes this and other tiny organ surrogates will provide an alternative to animal models. "We're not interested in making incremental improvements to existing materials and devices," he declares. "We're trying to shift paradigms."

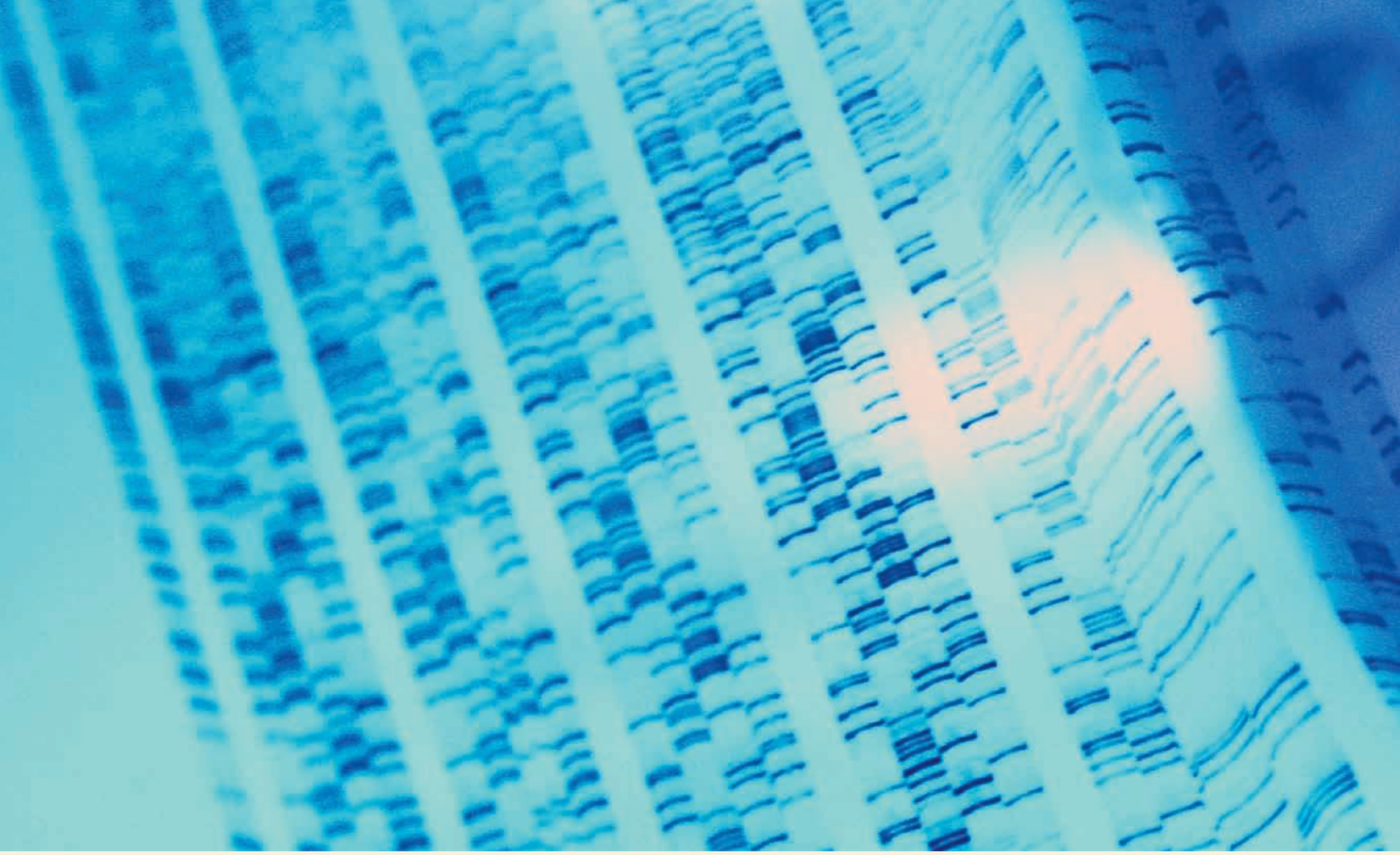
Another Wyss team is developing an assistive device for children with cerebral palsy and other forms of brain injury that isn't stiff and awkward like a leg brace but instead is as soft and lightweight as clothing.

With seed funding from the Wyss, Eugene Goldfield, an HMS assistant professor of psychology at Children's Hospital Boston, is designing a programmable "second skin" to re-educate an injured nervous system. The skin will be made of many tiny "smart agents" that sense movement and then collaborate with patients' leg muscles to help them move.

"Without prompting from Don Ingber, I probably would have fumbled along on my own for a long time," says Goldfield. "Don realized it was important for me to connect with robotics experts, so he showed up one day and offered me a ride over to the School of Engineering and Applied Sciences." There, Goldfield met SEAS Associate Professor of Computer Science Radhika Nagpal, who is interested in robotic systems that adapt like living systems. Her group has created a self-balancing table composed of 12 identical robots that cooperate without guidance from a leader, responding to disturbances to keep the table level.

For help in mimicking nature's principle of self-organization, Nagpal and Goldfield turned to Harvard Microrobotics Laboratory founder and SEAS professor Robert Wood. Wood brings to the project new force-generating lightweight materials that he uses to make insect robots fly.

"We need each other desperately," says Nagpal of the trio's shared vision, which has drawn them out of their comfort zones. That is, after all, what the Wyss Institute is about: moving bold ideas through a discovery phase to the point where they capture interest—and funding—from government or industry.



Between any two individuals and among human populations, the DNA sequence differs by a fraction of one percent. From this tiny percentage, scientists can reconstruct the ancestral origins of a society and glean clues as to why an individual or group is more susceptible to a trait or disease than the next.

A change of even a single base—G, A, T or C—in a string of DNA's nucleotide building blocks can lead to biological differences that affect health in subtle ways. So too can 100,000-letter chunks that are repeated, reversed or deleted, a type of genome variant known as copy number variation, or CNV.

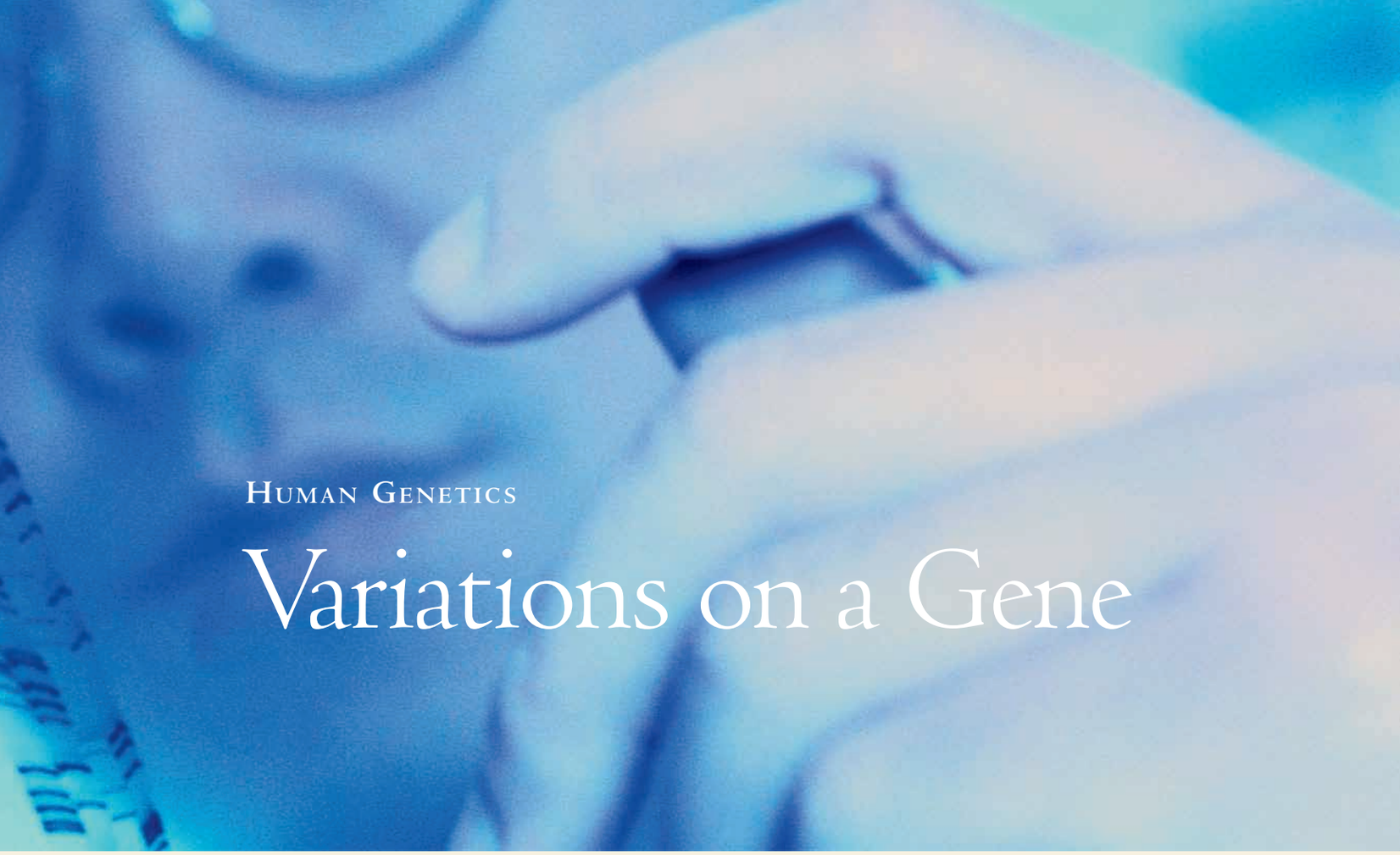
"Until 2008, we knew about inherited copy number variations the way 14th-century cartographers knew about distant continents: In some vague way, we knew they were out there," recalls Steven McCarroll, an assistant professor of genetics who joined Harvard Medical School in August 2009. "We didn't know what features of the human genome they encompassed, or what stories they had to tell."

In the past few years, however, specific CNVs have been connected to common diseases and traits, thanks in part to McCarroll, who helped develop technologies that can detect those associations. McCarroll's work has linked one large deletion to the chronic inflammatory bowel condition called Crohn's disease, another to the excess pound of weight carried by more than half of all people of European ancestry, and yet another to an increased risk of graft-versus-host disease following bone marrow transplantation. The new technology also has helped others at HMS to discover CNVs that contribute to autism, schizophrenia and congenital heart defects.

McCarroll is now collaborating with fellow geneticist David Reich, who leverages genetic variants to uncover medically relevant risk factors in African Americans and other minority groups. Reich, an associate professor of genetics, and his colleagues recently traced all the peoples of India to just two ancestral gene lines.

Too Much Information?

Rapid progress in human genetics is enabling scientists to ask new questions. "They still want to know, 'Can we identify specific genes that underlie risk?'" says Mark Daly, associate professor of medicine at Massachusetts General Hospital (MGH). "But now they ask, 'What do those genes tell us about basic human biology?' and 'How can we turn that understanding into ideas for new therapeutic interventions?'"



Human Genetics

Variations on a Gene

Daly turbocharged research in 2000 by observing that human DNA recombines in large blocks, or haplotypes, permitting essential neighborhoods of genes—and deletions—to travel together through generations over tens of thousands of years.

Now that technological advances and falling costs have unleashed full-genome sequencing, data are gushing out ahead of scientists' and physicians' abilities to interpret them. As a personal health horoscope, an individual's genome provides dubious forecasts of his or her disease risks. But HMS faculty aim to change that by sequencing the genomes of thousands of people and correlating that data with details about their health and medical histories.

In one example, genetics professor George Church and colleagues launched the Personal Genome Project to sequence the genomes of 100,000 volunteers. As DNA and trait data become publicly available, researchers worldwide will be able to make sense of the data trove and improve sequencing methods, ultimately turning every individual's genome into a tool for predicting disease risk and guiding his or her healthcare. According to Department of Genetics Chair Clifford Tabin, Harvard is rising to that task. "We have the greatest collection of human geneticists in the world," he says.

Need to Know

Concentrated within the Department of Genetics at HMS, Harvard's genetics expertise extends to the Medical School's affiliated hospitals and institutes. Clinicians and experts in genomic methods, statistics and informatics draw upon banks of tissue and clinical data, while basic scientists explore genetic variations' influence on humankind's origins, structure, function, evolution and distribution.

A Harvard-wide human genetics initiative proposed by a faculty committee has won the backing of University President Drew Gilpin Faust. HMS Dean Jeffrey Flier, Professor of Genetics David Altshuler and others aspire to educate students and physicians, develop undergraduate courses and build an interdisciplinary research community.

Why is human genetics a strategic priority? Says Altshuler, "It's precisely because the time is now to capture what can be learned about disease mechanisms and turn it into disease prevention and treatment."

Global Health and Social Medicine

All Health is Global

As an undergraduate at the University of California at Berkeley, Manasa Patna was struck by unsettling parallels between the city of Berkeley and urban slums in India, her birthplace. While growing up in California, Patna returned often to India, sometimes visiting the sprawling city of Bangalore.

In socially progressive Berkeley, Patna encountered some of the same inner-city problems that plagued Bangalore: a huge homeless population, for example, and power imbalances between the genders that robbed women of autonomy. Patna immersed herself in helping people who, for various reasons, could not get healthcare.

Since coming to Harvard Medical School, Patna's aspirations have taken her to Nicaragua, Indonesia, India—and, yes, Boston. For Patna and others interested in global health, "global" is not synonymous with "foreign" or "international." According to Paul Farmer, a world authority in the field and the new chair of HMS's Department of Global Health and Social Medicine (above, with patient), global health is about the "science of delivery" from Alabama and disaster-struck Haiti to Zimbabwe.

The Wisdom of Crowds

Patna belongs to a generation of medical students for whom this emerging science will be both life and career. These students want to remove cultural roadblocks and redress infrastructure failures that prevent breakthroughs at HMS from reaching Rwanda and Boston's Roxbury neighborhood.

"When I was an MD student at Harvard in the late '80s and we'd have meetings on global health, two or three other students would show up," says Farmer, the Maude and Lillian Presley professor of global health and social medicine. "Today you get crowds."

The HMS Office of Enrichment Programs (OEP) provides a snapshot of students' commitment: a steady stream of doctors-in-training are gravitating toward overseas research projects and clinical electives. Since 2003, on average, 32 students have traveled to 21 countries each summer between their first and second years to take part in an OEP-funded research or service project. These days, about 40 fourth-years choose either a Spanish-speaking primary care elective in one of six Latin American countries or a non-language-based clinical elective in Mexico, South Africa, Palestine, Taiwan,

China or India. One factor contributing to the surge in interest in global health is information technology's ability to connect people around the world in real time. Avian flu, SARS and the H1N1 flu also have raised awareness of how interdependent countries and cultures really are. Then there are the global economy and the porous nature of borders. In addition, by investing in research in developing countries, organizations such as the Bill & Melinda Gates Foundation have opened new routes to people all around the world.

When these factors converge, the world gets smaller. Suddenly, the global village starts to feel like the global neighborhood.

Science With Legs

As Farmer sees it, a true global health program identifies the poorest demographics—regardless of geography—and explores what works, how it works, how to replicate it and how to bring it to scale. As a discipline, global health must trace an unbroken trajectory from advances in medical school laboratories to destitute populations.

HMS Dean Jeffrey Flier is committed to bringing discoveries to where they're needed most—or, as Farmer puts it, to "putting the legs on science."

"We need more programs that train physicians in delivery science," Farmer says. "If you want to study cardiology, there's a direct path from medical school to residency training to fellowship. We're building a trajectory for global health." The Department of Global Health and Social Medicine is now scaling up a program for treating multi-drug-resistant tuberculosis in Russia and Peru, for example, aided by a $15 million grant from the National Institutes of Health.

As for Patna, she's back at HMS after finishing a one-year master's degree at the Harvard School of Public Health. There her thesis focused on maternal health in India. After she becomes an obstetrician–gynecologist, she hopes to work in reproductive health in the United States and abroad. While staying close to patients one-on-one is a goal, it won't be enough.

"I also want to do research that will influence policy," Patna insists. "I want to help build cost-efficient healthcare delivery systems that serve countries."

Outreach

As it builds a diverse, inclusive biomedical community in Boston, the School also offers training for clinicians around the world.

Identifying minority candidates through an array of outreach programs is helping the School diversify its faculty ranks. Health disparities remain an important research focus.

Exceptional Minority Faculty: Enriching the Ranks

LeRoi Hicks, assistant professor of medicine and instructor of health care policy at HMS (at far left, with patient), was introduced to the School in 1994 through the Visiting Clerkship Program, in which HMS-affiliated hospitals bring minority medical school students to Boston for four weeks of hospital-based training in their third or fourth years. Hicks, a recipient of a Brigham and Women's Hospital (BWH) Minority Faculty Development Award, is among the standouts to join the HMS faculty. Identifying minority candidates through an array of outreach programs is helping the School enrich its faculty ranks. Such efforts aim to draw students from middle and high schools, colleges and medical schools into academic biomedical careers.

Today, Hicks, an attending hospitalist physician in internal medicine at BWH, studies the impact of race, cultural background and physician behavior on minority health and quality of care. His work has received major funding from the National Institutes of Health, the Robert Wood Johnson Foundation and the Commonwealth Fund.

Center of Excellence in Minority Health and Health Disparities

In September 2009, HMS reinvigorated its Center of Excellence in Minority Health and Health Disparities with major funding from the U.S. Health Resources and Services Administration. The center, originally funded in 2002, will build upon educational programs—among them, a summer pre-matriculation program—to enhance the academic performance and exposure to research careers of minority students.

The center grant also will expand cultural competency training for faculty, residents and students; support career development for minority trainees and junior faculty; and give students and faculty opportunities to study minority health issues and gaps in health status between whites and racial and ethnic minority groups. Center Director Joan Reede also envisions a new postgraduate fellowship in health disparities.

Family Van Study: Prevention Saves Money

Since 1992, HMS students and faculty have brought medical advice and preventive services at no charge to underserved neighborhoods in Boston through the Family Van, a health clinic on wheels. The van offers free testing, screening and education in such areas as nutrition, weight management, diabetes, heart disease and pregnancy. In 2008, HMS Dean for Students Nancy Oriol, the clinic's co-founder, was a co-principal investigator for a study of the Family Van's cost-effectiveness. The findings: for every $1 invested, the van saves $36 in healthcare costs.

Dean of Students Nancy Oriol (third from left) co-founded this mobile health clinic.

Oriol and colleagues developed a "return on investment calculator" with $400,000 from the Boeing Corporation. The tool, applicable to any mobile health clinic, is essentially a set of algorithms that turns data about patient visits and services into dollars and cents. With additional funding, and as more of the Mobile Health Clinic Network's 300 U.S. members share data, the tool—online at www.mobile-healthmap.org—can be expanded for use all around the country, Oriol said.

Innovative Study: Women of Color in Academic Medicine

What factors support or impede career advancement for minority women in academic medicine—institutional, sociocultural and individual—and what might be done to promote their entry, progression and persistence in ascending the career ladder? To find out, HMS Dean for Diversity and Community Partnership Joan Reede and co-principal investigator Emorcia Hill have launched the first in-depth study of Latina, Asian, Native American and African American women at U.S. medical schools.

Reede and Hill will receive $1 million over four years from the National Institutes of Health to survey female faculty members from the instructor to full professor levels with an MD and/or PhD. Participating with HMS are 11 other medical schools that vary with regard to percentage of women of color on the faculty, research intensity and location: Duke, University of California –San Francisco, Connecticut, Nebraska, Puerto Rico and Stanford Universities; Case Western Reserve School of Medicine; Charles Drew University of Medicine and Science; Meharry Medical College; Morehouse School of Medicine and Mount Sinai School of Medicine. Study findings will provide both novel insights concerning the medical schools' faculties and serve as a potential basis for decision-making.

Six Earn Dean's Community Service Awards

Each year, the Dean's Community Service Awards are presented in recognition of extraordinary volunteer service by members of the HMS community, honoring faculty, trainees, students and staff.

In 2009, Holcombe Grier, professor of pediatrics at Dana-Farber Cancer Institute, and Lyle Micheli, clinical professor of orthopedic surgery at Children's Hospital Boston, each won a Lifetime Achievement Award—Grier for his service to the Boston Ronald McDonald House, and Micheli for work with the Children's Hospital Boston Division of Sports Medicine/Boston Public Schools Sports Medicine Initiative. Marie-Louise Jean-Baptiste, HMS assistant professor of medicine at Cambridge Health Alliance, earned the faculty award for her work with the Cambridge Medical Care Foundation; Jenny Tam, research fellow in medicine at Massachusetts General Hospital, received the trainee award for her involvement in the Science Club for Girls program; Robert Daly, class of 2010, received the student award for his work with the Humsafar Trust; and Anna Phelan, staff assistant in the IT department, received recognition for her service with Amnesty International USA, Group 133.

From left: Dean Jeffrey Flier with Community Service Award recipients Anna Phelan, Marie-Louise Jean-Baptiste and Jenny Tam; not pictured are Robert Daly, Holcombe Grier and Lyle Micheli.

Awards, New Lectureship Celebrate Diversity

The 2009 Diversity Awards ceremony, held in November, featured the second Howard, Dorsey, Still Lecture, named for the first three African Americans to graduate from HMS—Edwin Howard and Thomas Dorsey, in 1869, and James Still, in 1871. The lecture, which focused on interstitial pneumonia, was delivered by Talmadge King, HMS '81, chair of the Department of Medicine at the University of California–San Francisco.

The 2009 Harold Amos Faculty Diversity Awards celebration honored four members of the HMS community for their commitment to making the School a more welcoming and inclusive place: Jessica Henderson Daniel, HMS associate professor of psychology in the Department of Psychiatry at Children's Hospital Boston; Sanjay Gulati, instructor in psychiatry at Cambridge Health Alliance; Peter Slavin, president of Massachusetts General Hospital; and Jocelyn Spragg, lecturer on medicine at Brigham and Women's Hospital. Ingrid Pabón, administrative manager for Harvard Catalyst, received the Sharon P. Clayborne Staff Diversity Award.

Diversity Award winners, left to right, front to back: Ingrid Pabón, Sanjay Gulati, Jessica Henderson Daniel, Peter Slavin and Jocelyn Spragg.

Continuing Education Opens HMS to the World

HMS is open to clinicians throughout the world through the School's Department of Continuing Education, which each year awards more than two million CME credits to about 90,000 clinicians. In addition to the more than 260 courses offered on site and online, about 375 conferences are held at 17 HMS-affiliated hospitals and institutes.

HMS hosts seven annual three-day courses, Current Clinical Issues in Primary Care Medicine, in collaboration with six schools: Baylor College of Medicine; Columbia University College of Physicians and Surgeons; the David Geffen School of Medicine at UCLA; the Northwestern University Feinberg School of Medicine; The Johns Hopkins University School of Medicine and the University of Miami Miller School of Medicine. Thousands of clinicians choose among scores of lectures covering all aspects of primary care medicine.

Proliferating online courses—57 to date—have reached 23,000 physicians in 160 countries. A growing international Postgraduate Association offers yearly and lifetime memberships, which provide tuition discounts on live courses, free CME online courses and other benefits. In 2009, department leaders advanced the all-important goal of developing strategies to better evaluate learning effectiveness.

Harvard School of Dental Medicine Dean Bruce Donoff

Dental School Shares Leadership in Child Dental Health

The Harvard School of Dental Medicine (HSDM) in 2009 forged an agreement to collaborate with King's College London on the leadership program of the Global Child Dental Health Taskforce, established in 2006 to identify, train and mentor 400 dental leaders. At the helm are Bruce Donoff, dean of HSDM, and Raman Bedi, head of the Centre for International Child Oral Health at the King's College Dental Institute. The goal: to build a network of national taskforces around the world to drive improvements in oral health through cutting-edge preventive measures.

At HMS, Hinton Scholars Explore AP Biology

For the fifth year, HMS welcomed 60 college-bound students from the Boston public schools and their teachers to build upon their work in Advanced Placement Biology after school. The students, known as "Hinton Scholars" in honor of the first African American professor at HMS, William Hinton, hear lectures and perform laboratory experiments that enrich the AP curriculum, for which their teachers prepare during the summer.

Boston high school students respond to a robot's simulated medical needs.

People

Outstanding HMS faculty members are role models for students, who in turn energize and inspire their mentors.

Everett Anderson, the James Stillman professor of comparative anatomy, emeritus (third from left), shares a laugh with students.

New Appointments

Physician–Humanitarian is New Global Health Chair

Paul Farmer, the Maude and Lillian Presley professor of global health and social medicine at HMS, was named chair of the Department of Global Health and Social Medicine in July 2009. He succeeded Jim Yong Kim, now president of Dartmouth College.

"Few have done more to improve health in developing countries than Paul," said Dean Jeffrey Flier. "His scholarship and international work have made him one of the world's most respected global health experts." While still a medical student at HMS, Farmer co-founded Partners In Health, a nonprofit organization that delivers healthcare to impoverished regions of the world. Today, PIH serves millions of people in ten countries, including the United States. As rural Haiti's largest healthcare provider for more than 25 years, PIH is playing a major role in aiding the country's recovery from the devastating earthquake that struck in January 2010.

Farmer, who also holds a PhD in anthropology from Harvard, writes extensively on health and human rights and on the impact of social inequalities on health. His many awards include the Carter Award for Humanitarian Contributions to the Health of Humankind, from the National Foundation for Infectious Diseases; the Margaret Mead Award, from the American Anthropological Association; and the Outstanding International Physician (Nathan Davis) Award, from the American Medical Association. Farmer received a "genius" grant from the John D. and Catherine T. MacArthur Foundation in 1993.

Board of Fellows Welcomes New Members

The Board of Fellows welcomed three new members in 2009. As supporters of HMS and advisers to the School's leaders, members bring intelligence, creative thinking and commitment to their roles.

Phill Gross is the co-founder and managing director of Adage Capital Management, based in Boston. Adage manages assets for foundations as well as endowments, including those for Harvard University. Previously, Gross spent 18 years at the Harvard Management Company.

Jeffrey Leerink in 1995 founded the first independent healthcare research firm, Leerink Swann, now widely regarded as the premier healthcare investment bank. The firm serves institutional and life-sciences clients and has earned "Best of the Boutiques" honors from *Institutional Investor* magazine for the last seven years.

Ansbert Gadicke, a member of the HMS Systems Biology Council, is the founding general partner of MPM Capital, which invests globally in innovation in the life sciences and healthcare.

Jack Szostak (left) is the 15th HMS faculty member to win the Nobel Prize.

Honors and Awards

Nobel Prize Honors HMS Professor Jack Szostak

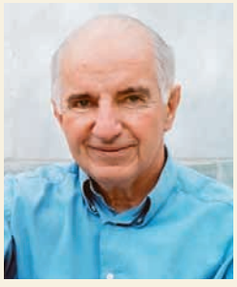
Jack Szostak received the 2009 Nobel Prize in Physiology or Medicine, along with Elizabeth Blackburn and Carol Greider, for the discovery of how chromosomes are protected by telomeres and the enzyme telomerase. Research by Szostak, a professor of genetics and member of the Department of Genetics at HMS and the Department of Molecular Biology at Massachusetts General Hospital, showcases the fundamental importance of basic science and how it can open up new fields of investigation.

Szostak's prize-winning work focused on the stability of chromosomes in yeast cells. With Blackburn, he demonstrated that nucleotide sequences at the ends of chromosomes of one species could protect chromosomes of a distant species. As Szostak recognized, this implied the existence of an entirely new enzymatic activity that served to protect the ends of chromosomes from degradation. This discovery, cited by the Nobel committee, has impacted scientists' understanding of aging and led to potential treatments for cancer and other diseases.

First-year students Bau Truong (left) and Brennan Bollman

Nine from HMS Elected to Institute of Medicine

Nine HMS faculty members are among the 65 new appointees to the Institute of Medicine (IOM), the health arm of the National Academy of Sciences. The IOM is an independent, nonprofit organization that provides unbiased advice to decision makers and the public on healthcare issues and national health policy. The nine are:



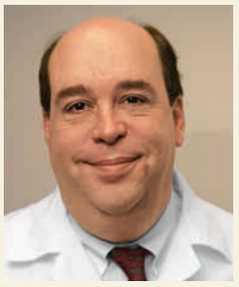
Alfred Goldberg, professor of cell biology, HMS: Goldberg's laboratory studies the importance of protein breakdown to the body's immune defenses; the reasons this process kicks into high gear in cancer and certain other disease states; and strategies for controlling this destruction.

Daniel Haber, Kurt J. Isselbacher/Peter D. Schwartz professor of medicine at Massachusetts General Hospital (MGH): Haber and his colleagues study the genetics of cancer. In addition to characterizing tumor-suppressor genes implicated in breast cancer and Wilms tumor, they aim to identify somatic mutations linked to drug susceptibility in lung cancer. Haber, a Howard Hughes Medical Institute investigator, directs the MGH Cancer Center.

Isaac Kohane, Lawrence J. Henderson professor of pediatrics, Children's Hospital Boston, and associate professor of medicine, Brigham and Women's Hospital: Kohane leads collaborations at HMS and its affiliated hospitals that use genomics and computer science to study cancer and brain development, with an emphasis on autism. His work has led to the creation of cryptographic health identification systems, automated personal health records and peer-to-peer pathology information networks.

Joan Reede, dean for diversity and community partnership, HMS: Reede oversees programs designed to increase the number of minority faculty, physicians and scientists in postgraduate medical education at HMS and its 17 affiliated institutions. She has established model programs to develop minority faculty that emphasize mentoring and leadership and that draw outstanding underrepresented minority students into the pipeline.

Gary Ruvkun, professor of genetics, MGH: Ruvkun played a pivotal role in the discovery of microRNAs. Currently investigating longevity and fat storage, he has shown that the nematode *C. elegans* controls its metabolism and longevity through an insulin-signaling pathway, and that insulin signaling in the nervous system is key to lifespan.



Clifford Saper, James Jackson Putnam professor of neurology, Beth Israel Deaconess Medical Center: Saper's laboratory focuses on integrated functions maintained by the hypothalamus, including the regulation of wake–sleep cycles, body temperature and feeding. The lab's goals are to identify the neuronal circuitry that helps regulate these responses and to discover how certain neurological and psychiatric disorders disrupt these responses in the human brain.

Megan Sykes, Harold and Ellen Danser professor of surgery and professor of medicine, MGH: Sykes's research aims to use blood or bone marrow transplantation as immunotherapy to achieve graft-versus-tumor effects while avoiding rejection. Her lab is investigating clinically feasible, nontoxic methods of re-educating T cell, B cell and natural killer cell components of the immune system to accept transplants from the same or different species without long-term anti-rejection therapy.

Bruce Walker, professor of medicine, MGH: Walker studies the cellular immune response to human viral pathogens, particularly HIV-1 and hepatitis C viruses. His focus is on the immune control of acute viral infections, viral

evolution under immune selection pressure, antigen processing and immunodominance, and "elite controllers" of HIV—people who succeed in living well without medication.

Ralph Weissleder, professor of radiology,MGH: Weissleder studies in vivo molecular imaging, which has led to such novel technologies as magnetic nanoparticles for MRI and enzyme-activatable probes for the detection of early cancers by laparoscopy and other minimally invasive techniques. He is currently investigating the use of molecular libraries and screens as well as nanomaterials and exploring ways of imaging and tracking cell populations in vivo, especially stem cells.

Another Laurel for Cancer Scientist

Rakesh Jain, the A. Werk Cook professor of radiation oncology (tumor biology) at MGH, was elected to the National Academy of Sciences (NAS). Jain is the first from the HMS faculty

—and only the ninth person in history—to be elected to the NAS as well as the Institute of Medicine and the National Academy of Engineering. Jain studies tumor pathophysiology using innovative imaging techniques. His lab showed that angiogenesis-inhibiting drugs repair the leaky, disorganized blood vessels of tumors and reduce edema in the brains of mice with glioblastoma as well.

Systems Biologist Honored as University Professor

Harvard University President Drew Gilpin Faust named HMS researcher **Marc Kirschner** a University Professor, Harvard's highest professorial distinction. The University Professorship, created in 1935, honors "individuals of distinction ... working on the frontiers of knowledge, and in such a way as to cross the conventional boundaries of the specialties."

Kirschner, the Carl W. Walter professor of systems biology and founding chair of that department at HMS, was appointed to the John Franklin Enders University Professorship.

Kirschner is a pioneer in studying the evolutionary origins of the vertebrate body plan, in particular the chordate nervous system. His laboratory studies the frog embryo as a model system of cell development, watching how it orchestrates numerous signals to create a final, complex organism. Understanding cell morphogenesis is vital to understanding normal cell development and cell regeneration; it also sheds light on cancer.

Among many other honors, Kirschner received the Gairdner Foundation's International Award in 2001.

Alumna Yvette Roubideaux directs the U.S. Indian Health Service.

Alumna Directs Indian Health Service

President Barack Obama nominated HMS alumna Yvette Roubideaux to direct the Indian Health Service (IHS). She was confirmed in May. A member of the Rosebud Sioux tribe, she is the first woman to lead the IHS. After graduating from HMS and earning an MPH from the Harvard School of Public Health, Roubideaux completed the primary care internal medicine residency program at Brigham and Women's Hospital. She is a former fellow of the Commonwealth Fund/Harvard University Fellowship in Minority Health Policy and has devoted her professional life to improving quality of care for American Indians and Alaska Natives. Most recently she was an assistant professor in the Department of Family and Community Medicine at the University of Arizona College of Medicine. Her research has focused on diabetes in American Indians and Alaska Natives and on American Indian health policy.

Carol Nadelson has steered an unusual course in academic medicine.

Leader of Women In Medicine Receives Renaissance Woman Award

Carol Nadelson, HMS professor of psychiatry at Brigham and Women's Hospital, accepted the Foundation for the History of Women in Medicine's 2009 Alma Dea Morani, MD, Renaissance Woman Award in a ceremony at Countway Library in October. The award honors an outstanding woman physician or scientist in North America who has furthered the practice and understanding of medicine and made significant contributions outside of medicine.

Nadelson pioneered work in women's health and mental health; dedicated herself to the education and mentoring of students, physicians and the public; and provided inspirational leadership in psychiatry and medicine. She has steered an unusual course in academic medicine, devoting herself to innovative and evolving areas of investigation, clinical understanding and education. Her work has left an indelible mark on patients and generations of students and colleagues.

Global Health Chair Becomes United Nations Envoy

Former President Bill Clinton, the United Nations special envoy to Haiti, has appointed HMS professor **Paul Farmer** to serve as his deputy. As deputy special envoy to Haiti, Farmer will help the UN and Clinton advance the Caribbean nation's economic and social development. He will retain his position as the Maude and Lillian Presley professor of global health and social medicine and head of that department at HMS.

Farmer is a cofounder of Partners In Health, the largest healthcare provider in Haiti. PIH operates a multiservice healthcare clinic in Cange that includes a primary school, surgery wing, outreach training program, 104-bed hospital and 12 medical facilities across Haiti's Central Plateau and Artibonite regions.

Microbiologist–Activist Receives National and International Awards

Jonathan Beckwith, the American Cancer Society professor of microbiology and molecular genetics at HMS, received two prestigious awards: from the National Academy of Sciences, the 2009 Selman A. Waksman Award in Microbiology for excellence in that field; and, from the Edinburgh International Science Festival and the City of Edinburgh Council, the 21st Annual Edinburgh Medal, for significant contributions to the understanding and well-being of humanity.

Beckwith, who led the first team to isolate a gene from the chromosome of a living organism, is being honored for his work in gene regulation, protein targeting and secretion, disulfide biochemistry and the development of gene fusions as an experimental tool. He is a vigorous critic of the notion that crime, poverty and other social problems are rooted in genes rather than culture and environment.

HMS professor Paul Farmer checks in on patients at Rwinkwavu Hospital in Rwanda, run by Partners In Health and the country's Ministry of Health.

Students

Students admitted to medical and science programs at Harvard Medical School are a breed apart—not only brilliant, but also set on reshaping their chosen field for the better. The six introduced here give just an inkling of the general excellence and ambition of the student body.

Financial aid helps open doors to the best applicants no matter their socioeconomic circumstances, but student debt can be onerous. In 2009, about one-third of MD students benefitted from a $3 million-per-year Middle-Income Initiative launched by HMS Dean Jeffrey Flier to supplement a range of available scholarships. Much work—and fundraising—lies ahead, however, to ensure that Harvard remains truly accessible to all who qualify for admission.

Jonathan Abraham

PhD 2010; MD Health Sciences and Technology 2012

For an aspiring physician–scientist, it doesn't get any better than this: the week before Jonathan Abraham started Harvard Medical School, in 2006, he identified the molecular receptor through which a group of deadly hemorrhagic fever viruses infects human cells.

"It was a very exciting experience," remembers Abraham, who had spent the summer at Children's Hospital Boston in the laboratory of Hyeryun Choe, HMS associate professor of pediatrics. The discovery is the basis for Abraham's PhD thesis, which uses structural and molecular biology to understand how these viruses, which cause Ebola-like disease, hitch a ride through the body on the receptor.

Abraham—whose family emigrated from Haiti to Montreal, where he was born, and later to Queens, New York—is drawn to understanding and finding novel treatments for infectious diseases, particularly those endemic to impoverished, underserved areas. "This is an opportunity for me to do something I'm passionate about, and to give back," he said.

His dad worked as a security guard and drove taxis and school buses, Abraham said, and both parents made great sacrifices to open up opportunities for him and his three older brothers. Abraham also credits "constant, good mentoring" by teachers along the way. His "academic parents," as he calls these trusted counselors, helped him navigate a path of achievement to Harvard College, to a postgraduate year at the Vaccine Research Center of the National Institute of Allergy and Infectious Diseases, and finally to HMS. His research in the Choe lab has brought him full circle—back to collaborating with his college mentor, Stephen Harrison, the Giovanni Armenise–Harvard professor of basic biomedical science.

In turn, Abraham has tutored schoolchildren in Roxbury, Massachusetts, and introduced young Haitian immigrants to biomedical science careers. "I try to be a role model, ocular proof that it can be done," he said.

Maya Babu

MD, MBA 2010

Maya Babu plans to be a neurosurgeon and to shape government health policy, two endeavors not typically linked. An MBA will buttress her work on patients' behalf, she explained, by grounding her in finance and economics.

Having majored in neuroscience and psychology at the University of Minnesota, Babu expected to gravitate to neurology. (Her father is a physicist and her two aunts are pulmonologists; there are no surgeons in the family.) But to her surprise, it was neurosurgery that she most enjoyed—"the quick thinking, dealing with trauma, balancing all aspects of patient management."

In college, Babu served on boards, councils and commissions on local, state and federal levels to aid at-risk youth. Recognized with awards and national scholarships for public service, she represented America's Promise, an alliance of organizations that help children succeed, at a White House luncheon and Rose Garden ceremony.

At Harvard Medical School, Babu is working with Michael Groff, chief of the Beth Israel Deaconess Medical Center's neurosurgical spine service, to develop a way to stabilize the cervical spine using implanted carbon fiber cages. With neurosurgeons at the Massachusetts General Hospital, she explored the socioeconomic and financial consequences of the federal Emergency Medical Treatment and Labor Act, which guarantees people emergency services regardless of their ability to pay.

Babu's interests in business and the brain converged when she helped develop a business and fundraising plan for a patent-protected technology that suppresses neuronal activity in patients with chronic pain. Her team was a semi-finalist in 2009 competitions at MIT and Harvard Business School.

"Ultimately, it still comes down to the human dimension for me," said Babu,

who has set her sights on a neurosurgery residency. "I've got to treat each patient as if he or she were my loved one."

Jacqueline Hom

Harvard School of Dental Medicine
DDM 2010

When she was just 14, Jacqueline Hom went through the phone book calling dentists until she found one who would let her volunteer. Two years later, when her curiosity about oral health melded with a budding passion for social justice, Hom joined an expedition to Bolivia to assist with dental care for homeless and orphaned children.

Hom received a full-tuition scholarship, the Presidential Scholars Award, to HSDM. In her first year, she spearheaded an effort to start a dental insurance plan for graduate and undergraduate students at Harvard University. " 'Global' oral health isn't just about developing countries," she said. Today, Hom chairs the Global Oral Health Committee in the student-run public health organization Oral Health Pursuit of Equity Network and is active in HSDM's Global Oral Health Initiative.

Growing up, Hom and her sister were immersed in their mother's Chinese and Jamaican heritage. International experiences have since been a constant. Hom's dental honors thesis focused on the influence of culture on dental healthcare in Beijing, for example, and during a yearlong break from HSDM she completed internships at the World Health Organization, the United Nation's Fund for Women and The Smile Train.

Then, for one life-changing year in Haiti, Hom ran a clinical trial on oral health in HIV-positive children as a National Institutes of Health/Fogarty Clinical Research Scholar. "There were no oral health investigators, no dental equipment or supplies, no personnel," she said. "It was just me, brimming with excitement about the idea that this HIV hospital could be an oral health research, service and training center."

The University of North Carolina is Hom's next stop. By combining a residency in pediatric dentistry with a public health policy and management doctoral program, she said, she hopes to "bring oral health to as many children as I can."

Carrie Lucas

Division of Medical Sciences, Biological and Biomedical Sciences Program, PhD 2010

Orchestrating attacks on foreign invaders comes naturally to immune cells, but they can also be taught to befriend, or "tolerate," transplanted organs. Through her research, Carrie Lucas aims to coax T cells to become tolerant of donor tissue that is not an immunological match.

"If we can develop ways to get a patient to accept stem cells from a donor's bone marrow," Lucas said, "that patient's immune system will be re-educated to treat all other donor tissue as 'self'—and we can prevent transplant rejection and eliminate the need for toxic, immunosuppressive drugs."

In the laboratory of Megan Sykes, the Harold and Ellen Danser professor of surgery and professor of medicine at Massachusetts General Hospital, Lucas conducts numerous studies on mechanisms of T cell tolerance in a mouse model. One notable study began in 2007 when she came up with a plan to use targeted in vivo delivery of small interfering RNA molecules to turn off and kill T cells that pose a threat to donor cells, without interfering with infection-fighting T cells. In 2008, Lucas was the primary author of a successful R21 grant from the National Institutes of Health, and today she and Sykes are pursuing her idea with Judy Lieberman, HMS professor of pediatrics at the Immune Disease Institute.

Lucas has always been driven, whether as a competitive gymnast growing up or while at the University of North Carolina–Chapel Hill, from which she graduated early. At Harvard, she has received prestigious biomedical research fellowships from the Department of Defense and the HMS Division of Medical Sciences.

Lucas envisions postdoctoral research that will broaden her understanding of immune tolerance by allowing her to focus on autoimmunity or chronic viral infections like HIV and hepatitis C. "Immunology is an incredibly fascinating field," she said, "one with broad clinical implications and many big questions still waiting to be answered."

Michael Nevarez
MD 2010

Though Michael Nevarez originally saw himself as an engineer, the ten years he volunteered with a youth summer camp on a Native American reservation in Arizona inspired an about-face. Those summers, starting in high school, had "a dynamic impact on my direction in life," he said.

Even while putting his engineering degree from California Polytechnic State University to work for two years, Nevarez saved vacation time for the camp. By then he was certain: "I wanted the efforts of my life to be in service to others." After two years in research at Stanford, he entered Harvard Medical School.

A fourth-year rotation took him back to Arizona, this time to an Indian Health Services hospital serving the Navajo Nation. "It's been a privilege to return in a clinical role and to learn from patients about their communities," he said.

Although his mother was raised in Poland and his father's family is from Mexico, Nevarez spoke English primarily until he took a medical Spanish course at HMS. He led an initiative to create the same opportunity for fellow students. Between classes, he also joined the Board of the Medical Students of Las Americas and mentored children at a therapeutic day school.

Nevarez is drawn to psychiatry, he said, because he enjoys "listening, asking questions and engaging in dialogue about what matters most in patients' lives and why." He plans a residency in adult psychiatry, followed by a fellowship in child and adolescent psychiatry. Ultimately he aims to practice in underserved areas.

In his spare time he runs, because it gives him the same sense of living in the moment that he tries to bring to patient encounters. "They share the most fragile details of their lives," he said. "To be present amidst that interaction, with your full attention, is an honor."

Eric Zwemer
MD 2011

Since high school, Eric Zwemer has performed magic at birthday parties and summer camps for seriously ill children. "Magic is a distraction," said Zwemer, who uses tricks and illusions to entertain and empower.

Between years at Princeton, where he studied psychology and neuroscience, Zwemer spent summers as a classroom aide to children with autism and at one of Paul Newman's Hole in the Wall Gang camps for pre-teens and adolescents with AIDS, sickle cell anemia and other chronic diseases. "I realized you could have a big effect if you could restore normalcy," said Zwemer, who plans to do a pediatrics residency.

In 2007, Zwemer received the Ghiso Fellowship for Compassionate Care and spent his summer exploring the role of magic in pediatric palliative care. As a member of Children's Hospital Boston's Pediatric Advanced Care Team, he bonded with patients by performing and teaching magic. He also ran a magic workshop for a spinal muscular atrophy conference, tailoring tricks to patients with motor deficits and, in one case, a girl with a rare metabolic disorder who was also blind.

Like about half of all HMS students, Zwemer is devoting a fifth year to research. At Dana-Farber Cancer Institute's Perini Family Survivors' Center, he is engaged in psychosocial research with cancer survivors, evaluating strategies for preventing the late side effects of certain lifesaving therapies. To lower survivors' risk of skin cancer and encourage them to apply sunscreen, he is evaluating the use of a UV light camera that spotlights skin at high risk for UV damage.

Zwemer said his parents found rewarding careers—his father is a clinical psychologist, his mother a high school math teacher—and are making a difference in the small Virginia community where he grew up. "They always told me to find a job that I love," he said. "And I have."

In Memoriam

The Harvard medical community mourned the passing of the following faculty members between September 2008 and October 2009.

Leon Eisenberg, *the Maude and Lillian Presley professor emeritus of social medicine at HMS, died on Sept. 15, 2009. He was 87.*

Internationally known in pediatric psychiatry, Eisenberg was among the first to explore autism and its relationship to patients' families and social settings; he also pioneered randomized placebo-controlled clinical trials of pediatric psychiatric medications. Eisenberg was appointed chair of psychiatry at Massachusetts General Hospital in 1967. The following year, prompted by the assassination of Martin Luther King, Jr., Eisenberg helped launch the School's affirmative action program and subsequently recruited many outstanding African American and other minority applicants to the School. Eisenberg also played a major role in building the Department of Social Medicine at HMS (now Global Health and Social Medicine).

Franklin Epstein, *the William Applebaum professor of medicine at Beth Israel Deaconess Medical Center, died on Nov. 5, 2008. He was 84.*

A leading nephrologist who remained passionately engaged in research, teaching and clinical care until several weeks before his death, Epstein arrived in Boston in 1972 to head the Harvard Medical Unit at Boston City Hospital. Within one year, he was appointed chairman and physician-in-chief of the Department of Medicine at what is now Beth Israel Deaconess Medical Center. There, his major clinical interests included the mechanisms of renal failure, preeclampsia and other medical complications in pregnancy, and disorders of water, sodium and potassium.

Don Fawcett, *the Hersey and James Stillman professor emeritus of comparative anatomy at HMS, died on May 7, 2009. He was 92.*

A pioneer in electron microscopy, Fawcett is credited with bringing cellular structure and function to the world's attention. Fawcett, a 1942 graduate of HMS, served as an assistant professor of anatomy at HMS before becoming chair of the Department of Anatomy at Cornell Medical School in 1955. Four years later, he returned to HMS, where he was named chair of the Department of Anatomy and the Hersey and James Stillman professor of comparative anatomy. From 1975 to 1977, Fawcett also served as senior associate dean for preclinical sciences. After retiring in 1981, he spent several years working in parasitology at the International Laboratory for Research in Animal Diseases in Nairobi, Kenya.

A. Stone Freedberg, *professor of medicine emeritus and retired director of cardiology at Beth Israel Hospital, died on Aug. 18, 2009. He was 101.*

When Freedberg joined the HMS community in 1941 as a research fellow at Beth Israel Hospital, now Beth Israel Deaconess Medical Center, he began a medical career at Harvard that spanned more than six decades. Although he retired from the faculty in 1974 as professor of medicine emeritus, he remained active in Harvard's health services for nearly two more decades. Freedberg, a cardiologist, also conducted extensive research in cardiac physiology. In 1940 he identified the bacterium now known as *Helicobacter pylori* in patients with stomach ulcers, helping build the foundation for the work of the 2005 winners of the Nobel Prize in Physiology or Medicine.

Harvey Goldman, *professor of pathology at Beth Israel Deaconess Medical Center, died on April 6, 2009. He was 76.*

An expert in gastroenterological pathology, Goldman studied inflammatory conditions of the esophagus, stomach and intestines; helped develop criteria for, and a classification of, colonic dysplasia that complicates inflammatory bowel disease; and published seminal papers describing mucosal biopsies of the gut. At HMS, where in 1976 he was named professor of pathology, Goldman held educational leadership positions, including that of faculty dean for medical education. He remained at Beth Israel Deaconess Medical Center for five decades, becoming vice chair of pathology in 1996.

Shukri Khuri, *professor of surgery at the VA Boston Healthcare System and Brigham and Women's Hospital, died on Sept. 26, 2008. He was 65.*

Khuri was recruited in 1976 to the VA Boston Healthcare System, where he was chief of both cardiothoracic surgery and surgical services. There he launched the landmark National Surgical Quality Improvement Program to set standards for assessing and improving surgical outcomes and safety. Khuri became chief of surgery at the West Roxbury VA in 1984 and, later, HMS professor of surgery and vice chair of the Department of Surgery at Brigham and Women's Hospital. His research led to the first metabolic tool for the online assessment of myocardial protection during cardiac surgery.

Robert Leffert, *professor of orthopedic surgery at Massachusetts General Hospital, died on Dec. 7, 2008. He was 75.*

A decorated U.S. Navy veteran, Leffert was an expert in hand and shoulder orthopedics who held numerous national leadership positions. In 1972, he was recruited to Massachusetts General Hospital, where he became chief of both the Surgical Extremity Rehabilitation Unit and the Department of Rehabilitation Medicine. He was promoted to HMS professor of orthopedic surgery in 1991. After retiring from clinical practice nine years later, Leffert retained various leadership posts at MGH and remained a dedicated educator.

William Meissner, *professor emeritus of pathology at Beth Israel Deaconess Medical Center, died on Dec. 6, 2008. He was 95.*

An expert on the thyroid gland, Meissner joined the Department of Pathology at New England Deaconess Hospital, now part of Beth Israel Deaconess Medical Center (BID), in 1942 and was named an instructor at HMS five years later. From 1963 to 1971 he chaired the pathology departments of both the Deaconess and the New England Baptist Hospital. Meissner retired in 1979, three years after the Deaconess had consolidated laboratories into one building and honored him by naming them the William A. Meissner Laboratories.

Harry Mellins, *professor emeritus of radiology at Brigham and Women's Hospital, died on Jan. 22, 2009. He was 87.*

An expert genitourinary radiologist, teacher, mentor and scholar, Mellins was an iconic figure in U.S. academic radiology. Recruited in 1969 as an HMS professor of radiology, he served as chief of diagnostic radiology and as residency program director at the Peter Bent Brigham Hospital, a Brigham and Women's Hospital forerunner, for 30 years. Mellins received gold medals from the Society of Uroradiology, of which he was a founding member and former president, as well as the American Roentgen Ray Society and the Association of University Radiologists. He retired in 1991.

John Nemiah, *professor emeritus of psychiatry at Beth Israel Deaconess Medical Center, died on May 11, 2009. He was 90.*

An elegant prose stylist who saw his field transformed by the growing role of medication in treating mental illness, Nemiah edited the *American Journal of Psychiatry* from 1978 to 1993. He trained in psychiatry at Boston City Hospital and Massachusetts General Hospital, where he remained through 1967, rising from psychiatrist and psychoanalyst to acting head of the Department of Psychiatry. The following year Nemiah was named HMS professor of psychiatry and appointed psychiatrist-in-chief at Beth Israel Hospital, now Beth Israel Deaconess Medical Center. He retired in 1985.

Alfred Pope, *professor emeritus of neuropathology at McLean Hospital, died on Feb. 13, 2009. He was 94.*

A pioneer in psychiatric research and founding member of the International Society of Neurochemistry, Pope developed techniques for analyzing the brain, thereby forging the field of microneurochemistry. He was the first to observe and report the deficits of cholinergic neurotransmission, an advance that led to effective therapeutics for Alzheimer's disease. In 1946, five years after graduating from HMS, Pope was recruited to McLean Hospital where, as director of the Ralph Lowell Laboratories, he strove to shed light on mental illness by bridging neurobiology and the psychosocial sciences. He became professor of neuropathology in 1964 and professor emeritus in 1983.

Michael Shannon, *professor of pediatrics at Children's Hospital Boston, died on March 10, 2009. He was 55.*

Shannon, who in 2004 became the first African American full professor of pediatrics at HMS, fostered highly original research on the mechanism of toxicity and treatment for the "date-rape" drug gamma-hydroxybutyrate; he also defined the clinical syndromes of theophylline poisoning and introduced now-standard management protocols. Shannon, who joined the faculty in 1987, directed the Lead and Toxicology Treatment Program and the Pediatric Environmental Health Center. He also served as chief of both the Division of Emergency Medicine and the Division of Clinical Pharmacology.

Peter Sifneos, *professor emeritus of psychiatry at Beth Israel Deaconess Medical Center, died on Dec. 9, 2008. He was 88.*

Sifneos, a 1946 graduate of HMS, was a pioneer in psychotherapy. In the late 1960s, while director of the Inpatient and Outpatient Psychiatry Services at Massachusetts General Hospital, he experimented with ways to shorten the length of dynamic psychotherapies. He also introduced the term "alexithymia," describing a condition in which patients can neither access nor verbalize emotions. He became an HMS professor of psychiatry in 1974. For 26 years he was associate director of the psychiatry department at Beth Israel Hospital, now Beth Israel Deaconess Medical Center.

Armen Haig Tashjian, Jr., *professor emeritus of biological chemistry and molecular pharmacology, died on July 3, 2009. He was 77.*

Tashjian, HMS class of '57, founded the Department of Molecular and Cellular Toxicology at the Harvard School of Public Health, where he studied environmental chemicals and therapeutic agents. Tashjian co-edited *Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy,* a text used worldwide. In 1961 he became a research fellow at the Harvard School of Dental Medicine, where he was promoted to professor of pharmacology in 1970. In 1978 he attained this rank at HMS, where he became professor of biological chemistry and molecular pharmacology. He retired in 1999.

I. David Todres, *professor of pediatrics (anesthesia) at Massachusetts General Hospital, died on Sept. 26, 2008. He was 73.*

Todres was widely regarded as a founder of pediatric critical care medicine and an authority on pediatric medical ethics. He spearheaded the establishment of Massachusetts General Hospital's Pediatric Intensive Care Unit, only the third in the country. Todres joined HMS and MGH in 1971 as an associate director of the Neonatal and Pediatric Intensive Care units and served as director from 1978 to 1988. Promoted to professor in 2000, he remained at MGH his entire career.

Daniel C. Tosteson, *the Caroline Shields Walker distinguished professor of cell biology and dean of Harvard Medical School for two decades, died on May 27, 2009. He was 84.*

Tosteson's greatest legacy to HMS was the New Pathway curriculum, which put students in charge of their own learning and ignited a national transformation of medical education. He established new departments—including those of Genetics, Cell Biology, Healthcare Policy and Social Medicine—and led the development of a conflict-of-interest policy that became a national model. He also introduced the Giovanni Armenise–Harvard Foundation, which supports basic research at HMS and in Italy, and Harvard Health Publications, which disseminates information to the public. With supporters David and Hildegarde Mahoney, he founded and championed the Harvard Mahoney Neuroscience Institute. Through his research on membrane phenomena, Tosteson, a 1948 HMS graduate, also expanded scientists' understanding of rheumatoid arthritis and other degenerative diseases.

Mary Ellen Beck Wohl, *professor emeritus of pediatrics at Children's Hospital Boston, died on Oct. 9, 2009. She was 77.*

Wohl specialized in pediatric lung diseases, developing innovative techniques to evaluate lung function in infants. After joining Children's in 1962, Wohl worked to optimize care and outcomes for cystic fibrosis and HIV infection, developing multi-center clinical trials of treatments for both diseases. She served as chief of the Division of Respiratory Diseases from 1980 to 2002 and directed the Cystic Fibrosis Center from 1986 to 2005.

Alumni News

Harvard Medical School alumni—nearly 10,000 strong—are an extraordinary group, leaders in their fields in science and medicine. Throughout the year, they come together for reunions, timely topical programs and regional events around the country.

Jennifer Pline (left) at the 25th reunion class symposium "Brave New World—Journeys in Medicine"

Among the highlights of 2009 was a talk in Washington, D.C., on the history of U.S. healthcare reform by David Blumenthal '74, the national coordinator for health information technology in the Department of Health and Human Services. Blumenthal is one of several alumni who have joined the administration of President Barack Obama. For their stories and other alumni news, visit http://alumni.hms.harvard.edu.

Boston Alumni and Friends Event Dean Jeffrey Flier was the featured speaker at this special annual event in Gordon Hall in May. Local alumni gathered for an update on news from the School and to reconnect with one another.

Alumni Council member Rahul Sakhuja '03

Alumni Week For four days in June, approximately 1,000 alumni from classes ending in 4 and 9 and their spouses, friends and colleagues came to the Harvard Medical School Quadrangle to enjoy one another's company and attend symposia.

New York Alumni and Friends Event Hosted by Alumni Association Chair George Thibault '69 and the HMS Alumni Association, a timely program titled "Swine Flu: How Worried Should We Be?" attracted more than 100 alumni to the Harvard Club of New York in October. Dean Jeffrey Flier moderated a panel of HMS faculty experts—Raphael Dolin '67, David Knipe and Anthony Komaroff—who spoke and answered questions about the history, pathology and prevention of flu.

Annual Alumni Volunteer Leadership Dinner The HMS Office of Resource Development hosted the Annual Alumni Volunteer Leadership Dinner at the Harvard Club of Boston in June for alumni and fundraising volunteers. Dean Jeffrey Flier, Alumni Relations Chair George Thibault '69 and Alumni Fund Chair Mark Hughes '86 thanked the volunteers for their hard work.

David Blumenthal '74, advisor to the Obama administration (center) with S. Ward Cassells III '79 (left) and Earl Steinberg '78

Washington, D.C., Alumni and Friends Event The topic "Healthcare in the Obama Administration" brought nearly 100 local alumni and two HMS students from the Class of 2013 to the Columbia Country Club in Chevy Chase, Maryland, in May. David Blumenthal '74, retraced the history of U.S. healthcare reform.

Emily Ceisler and Mark Blitzer, Class of '91

Alumni Association Chair George Thibault '69 with HMS students (from left) Amy Franciscovich '12, Shawn Anthony '09 and Melina Marmaelis '12

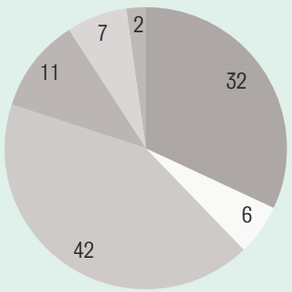
Financial Summary

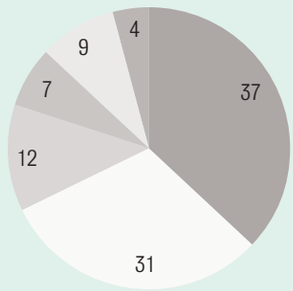
Harvard Medical School ended fiscal year 2009 with a $1.4 million core operating loss, a significant improvement compared to a $16.8 million loss for fiscal year 2008.

Primary factors contributing to this improved operating performance include higher operating income resulting from growth in the HMS endowment distribution from 2008 levels and a higher research indirect-cost recovery. Partially offsetting these favorable results was a reduction in rental income.

Operating expense reductions were also achieved in fiscal year 2009 as the School began implementing measures to address the new economic environment. Savings were achieved in core salary and benefits expenses, space occupancy costs and supplies through a major effort to address the Medical School's cost structure.

As reflected in the pie charts below, total operating revenue and expenses indicate a loss of $2 million. This total reflects reductions in activity on restricted endowments and on gifts not considered part of core operations.





Operating Revenue

Endowment	$ 182,266,202	32%
Tuition (Net)	34,481,798	6%
Grants and Contracts	245,914,776	42%
Other Revenues	65,724,247	11%
Rental Income	42,573,045	7%
Gifts for Current Use	11,056,259	2%
	$582,016,327	

Operating Expenses

Academic Expenses	$ 214,102,417	37%
Research and Training	179,146,047	31%
Facilities	67,469,671	12%
Administration	42,899,811	7%
Debt Service	55,715,219	9%
Other	24,702,913	4%
	$584,036,078	

The Harvard Medical Community

MD students	705
DMD students	147
PhD students	556
Trainees (interns, residents and postdoctoral fellows)	8,224
Total tenured and tenure-track faculty based on HMS campus (within the School's 10 preclinical departments)	146
Voting faculty, HMS campus and affiliates (assistant, associate and full professors)	4,519
Full-time faculty, HMS campus and affiliates	8,259
Part-time faculty, HMS campus and affiliates	2,758
Medical School alumni*	9,168
Dental School alumni*	2,446
Nobel Prizes (in Medicine or Physiology; Peace)	9 prizes; 15 recipients
Howard Hughes Medical Institute investigators	31
Institute of Medicine members	123
National Academy of Sciences members	65

* *Living*

17 Affiliated Hospitals and Institutes

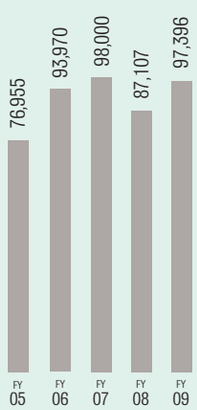
Beth Israel Deaconess Medical Center
Brigham and Women's Hospital
Cambridge Health Alliance
Children's Hospital Boston
Dana-Farber Cancer Institute
Forsyth Institute
Harvard Pilgrim Health Care
Hebrew SeniorLife
Joslin Diabetes Center
Judge Baker Children's Center
Massachusetts Eye and Ear Infirmary
Massachusetts General Hospital
McLean Hospital
Mount Auburn Hospital
Schepens Eye Research Institute
Spaulding Rehabilitation Hospital
Veterans Affairs Boston Healthcare System

Research Collaborations Across Harvard University

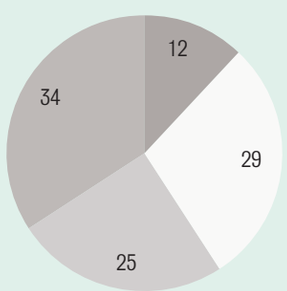
Broad Institute of MIT and Harvard
Harvard Stem Cell Institute
Wyss Institute for Biologically Inspired Engineering

Fundraising Highlights

Harvard Medical School depends upon thousands of organizations, friends, alumni, faculty and staff to ensure that it remains the best medical school in the world. In FY 2009, philanthropic gifts to the School totaling $97.3 million will advance biomedical research and prepare the world's brightest minds for leadership roles in science and medicine.



Total HMS Gifts and Pledges FY05–FY09 ($ in millions)



FY09 Giving by Constituency (%)

12 Alumni
29 Corporations and Foundations
25 Hospitals and Other Affiliates
34 Individuals and Family Foundations

Dean's Report 2009–2010

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