



A Day in the Life

Dean's Report | 2012–2013

HARVARD MEDICAL SCHOOL

**Leading Discovery. Healing
Lives. Defining Medicine.**

**Never content to
rest upon past
achievements,
members of the
HMS community
fuse intellect,
passion and
innovation to
boldly shape
the future of
medicine, each
and every day.**

- 1** Message from
the Dean
- 6** Education
- 10** Discovery
- 16** Service
- 22** Facts and Figures
 - HMS Leadership
 - Preclinical
 - Department Chairs
 - Affiliated Hospitals
and Institutions
 - HMS by the
Numbers
 - Collaborations
Across Harvard
 - Fundraising
Highlights
 - Financial Report



Dean Jeffrey S. Flier

Light breaks over Longwood Avenue as a surgical team scrubs for a liver transplant. A student prepares for a seminar on bacterial pathogenicity, and a research fellow turns in after a night spent chasing a misfolded protein. Hours later, a pediatrician examines a newborn while an occupational therapist coaches a war veteran through a new regimen. In Africa, HMS teams work to improve tuberculosis treatment outcomes in Lesotho, one of the world's poorest countries. ■ This is Harvard Medical School: a community of innovators—exceptional teachers, clinicians, researchers, physician-scientists, students and staff—who set standards for discovery and service that are emulated around the world. A common mission unites all: to alleviate human suffering caused by disease.

Progress & Possibilities, a video surveying the past year, may be viewed at <http://hvrld.me/S7bLNy>





Harvard

Medical School opened its doors in 1782 with three students. Today, the School encompasses nearly 12,000 faculty members, some 1,700 students, and thousands of research and clinical trainees. In 2012, incoming students hailed from 10 countries, 29 states and the District of Columbia. Women constituted 52 percent, and under-represented minorities 21 percent, of the Class of 2016.

Every day, thousands of men, women and children receive care at Harvard's teaching hospitals, which, along with its research institutes, make Boston an epicenter of biomedical research and world-class patient care. The School's reach, however, extends far beyond clinical care and inquiry.

HMS policy experts provide critical insights into the design and delivery of the country's health care. The Center for Primary Care—made possible through a \$30 million anonymous gift—is developing models for team-based medicine and preventive care that will strengthen and transform a discipline in crisis. The Center's new Academic Innovations Collaborative, launched in 2012, will provide exciting new opportunities for students.

While HMS advances the delivery of health care in the U.S., it is also taking a leadership role in service throughout the world. In Peru and Bangladesh, HMS microbiologists collaborate with clinicians to stem the spread of

cholera, while in Haiti, HMS workers promote hygiene, vaccinations and access to clean water. In Portugal, HMS educators are implementing a new model for clinical research training programs.

Evolving the Curriculum

To prepare tomorrow's leaders, HMS continually reviews how medicine and science are taught. Following reaccreditation by the Liaison Committee on Medical Education, which praised curriculum reforms, including the Principal Clinical Experience, a new Task Force on the Redesign of the Preclerkship Curriculum was convened to undertake a comprehensive reassessment in AY2013.

As HMS faculty are advancing novel team-based learning initiatives and experimenting with the development of new "smart classrooms," the Scholars in Medicine program, designed to nurture a passion for scholarship and innovation, provides students and faculty with new avenues for mentorship and collaboration. Nearly 160 students embarked on a broad spectrum of scholarly projects, from basic science to translational and clinical research, medical humanities and global health.

To address a major need, in 2012, HMS introduced a therapeutics track for students in the life-science PhD programs at Harvard University, providing an integrated curriculum in therapeutics and related fields,



12:05 AM

Well Newborn Nurseries
Brigham and Women's Hospital

including systems approaches. This initiative bridges pharmacology and therapeutics for graduate students interested in drug discovery and development. It will enable the cultivation of a community of scholars engaged in new ways of thinking about therapeutics, able to link molecu-

Lise Johnson, clinical instructor in pediatrics and director of the Well Newborn Nurseries at Brigham and Women's, examines newborn Morissen Eliot Cunningham.



HMS Day in the Life Series
Experience life on campus and beyond
<http://hms.harvard.edu/content/day-life>

lar discoveries and clinical applications. HMS graduate education also offers four master of medical sciences programs, including two in clinical investigation, one in biomedical informatics and, the newest, in global health delivery, which launched in July 2012.

Frontiers of Knowledge

Progress in medicine begins with discovery in the laboratory. HMS researchers made numerous scientific advances in 2012, from the creation of the most detailed map to date of protein interactions within the cells of a multicellular organism, to next-generation

sequencing of cancer genomes that point the way to targeted therapies. Where do these and other discoveries lead?

Always, they lead to more questions.

And sometimes they lead to a more precise diagnosis, to a better therapy or to improved human health.

To accelerate translational breakthroughs, key HMS initiatives encourage integration and collaboration across disciplines. The new Initiative in Systems Pharmacology unites researchers from many fields to investigate the systems-level effects of thera-

peutic drugs, with the potential to improve drug discovery and development and patient care.

Harvard Catalyst | The Harvard Clinical and Translational Science Center is fostering broad clinical and translational collaborations while identifying ways to speed new therapies to patients. Investigators representing 33 participating institutions and schools are tackling a host of challenges, from seeking personalized asthma therapy to understanding the biology of brown fat for obesity treatment to assessing injured brain tissue non-invasively using new diagnostic techniques that better inform treatment decisions.

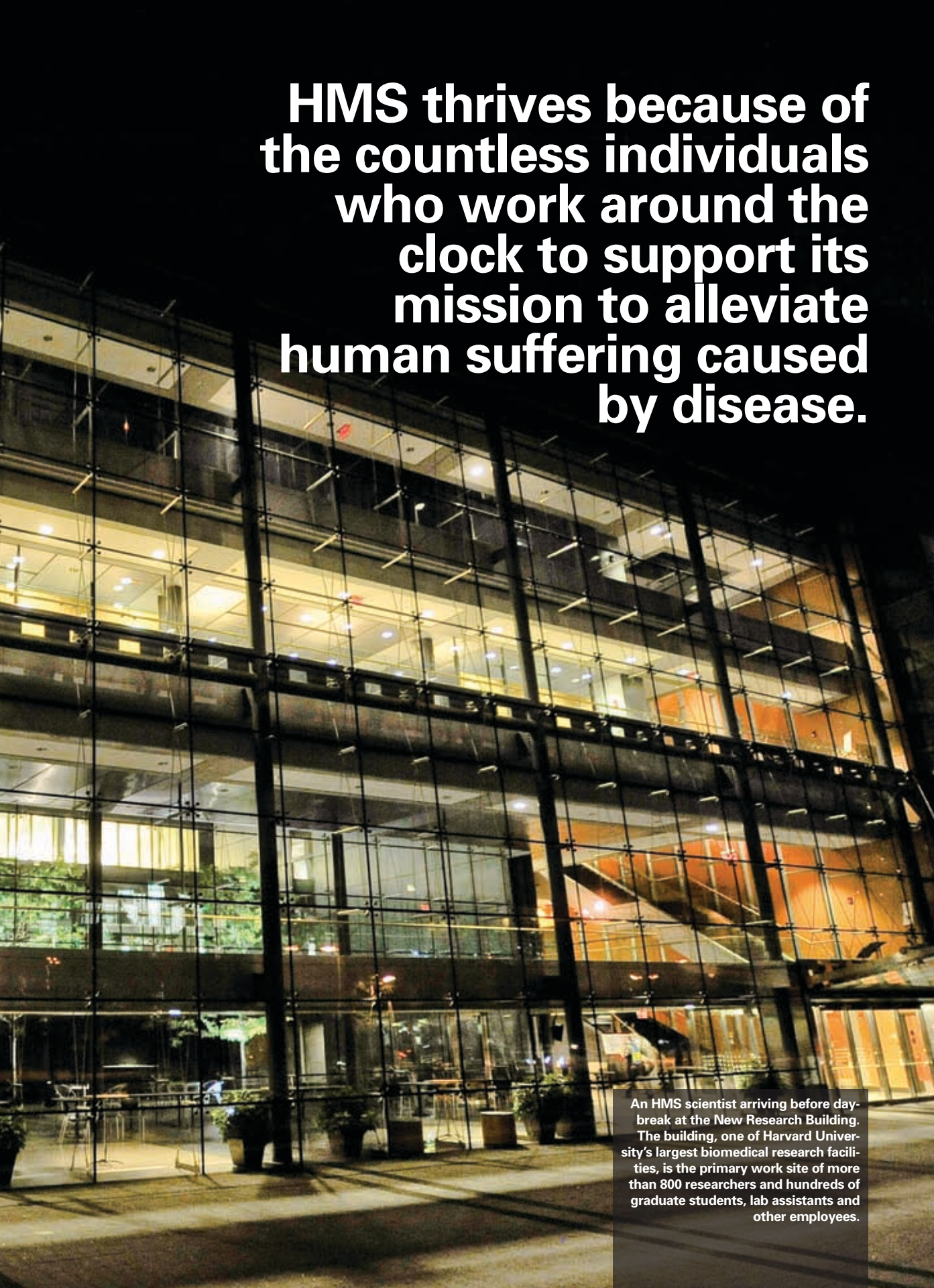
In labs and classrooms, clinics and hospitals, the achievements of the HMS community reflect a shared dedication to core values of education, discovery and service. I am pleased to highlight in this report a few of the past year's remarkable accomplishments, and I am privileged to pay tribute to the many members of the HMS community who serve it in so many ways.

From the biomedical researchers who advance our understanding of the underlying causes of disease and the practitioners whose care transforms lives, to the educators who train the next generation of physician-scientists and the staff who support a shared mission, Harvard Medical School is shaping the future of medicine, person by person, one day at a time.



02:17AM

Keeping Tabs on the Science
New Research Building



**HMS thrives because of
the countless individuals
who work around the
clock to support its
mission to alleviate
human suffering caused
by disease.**

An HMS scientist arriving before day-break at the New Research Building. The building, one of Harvard University's largest biomedical research facilities, is the primary work site of more than 800 researchers and hundreds of graduate students, lab assistants and other employees.

Education

Lulu Tsao, a first-year student, gets hands-on practice during Introduction to the Profession, a course that provides a general approach to patient care and a broad overview of the medical vocation.

For over 200 years, the School has influenced the design of medical education throughout the world.



Essential to the enterprise of discovery and learning at HMS is the constant drive to develop effective new methods for educating the next generation of physicians and scientists, teaching them how to incorporate both the art and science of medicine into practice to meet the demands of a rapidly evolving health care profession.

In 2012, the Program in Medical Education, led by Jules Dienstag, the Carl W. Walter Professor of Medicine and dean for medical education, continued a rigorous process of evaluation and improvement. The Task Force on the Redesign of the Preclerkship Curriculum is exploring revisions to the New Pathway Program's Fundamentals of Medicine preclerkship curriculum, including the introduction of novel pedagogy in basic and social sciences, pathophysiology and introductory clinical skills.

Responding to changes in the way contemporary students learn, and recognizing advances in learning theory, the task force is reassessing not only what should be taught in the preclerkship years, but also how it should be taught and by whom. Among the challenges:

Stephen Odom, instructor in surgery at Beth Israel Deaconess Medical Center, leads a traditional group tutorial in a "smart classroom." Digital case materials are reviewed during the class. Students solve problems alongside professors and rebroadcast work to high-definition screens in the room.

balancing the basic and social science curriculum with enhanced training in clinical skills, providing students with access to HMS experts in both content and pedagogy, and transforming siloed courses by introducing broad multidisciplinary and thematic approaches. Key goals include the integration of more team-based learning in preparation for team-based practice, and utilization of innovative technologies to enhance both teaching and learning.

In 2012, a new capstone course was piloted to prepare graduating medical students for the most profound transition in medical training: from student to intern. The course is designed to equip graduates for challenges such as the midnight page or abnormal labs as well as the emotionally difficult tasks of pronouncement of death, notification of family and autopsy requests.

New Clinical Skills Center

Construction of a flexible multifunctional clinical skills center begins in winter 2013. Located in the Tosteson Medical Education Center, the 5,500-square-foot facility will feature 18 clinical exam rooms for clinical skills instruction (interviewing and physical examination) and for objective structured clinical examinations—multi-station evaluations that incorporate standardized patient actors, radiologic images and other clinically relevant materials. Video capabilities allow faculty to review student-patient interactions, and movable walls accommodate larger groups of students participating in simulation exercises.

Smart Classrooms

New "smart classrooms," opened in February 2012, are facilitating team-based learning and "just-in-time" teaching approaches. Features include interactive whiteboards, high-resolution flat screens, patient simulation technology, a simulated clinical exam room, and video and teleconferencing capabilities. The classrooms support medium- and small-group interactive teaching, peer teaching observation, teaching and evaluation of clinical skills, and simulation of clinical situations and pathophysiological processes. A grant from the Harvard Initiative for Learning and Teaching is funding an analysis of the features of these innovative classrooms to inform future classroom design.



Scholars in Medicine

The Scholars in Medicine program, entering its second year, requires students to complete a scholarly project during medical school. A required course, Pursuing Inquiry in Medicine, provides guidance on scholarly inquiry and on how to seek mentors, develop proposals, and communicate research aims, methods and results. Students identify a mentor in the HMS community and draft a proposal for a project that most will pursue the following summer. In 2012, the first 159 student projects ranged from basic science to primary care and from the medical humanities to health care policy.

Increasing Scholarship Aid

HMS continues to reduce financial burdens on students. The average debt per graduating student in 2012 was \$104,800, about 10 percent lower than four years earlier. More than 20 percent of the graduating class benefited from loan-forgiveness programs, in total receiving more than \$850,000 in debt relief. Some students were eligible for additional relief, including a combined \$420,000 available upon completion of residency. Need-based scholarships totaling \$15 million were awarded, an increase of 10 percent over the previous year. Contributions by HMS alumni continue to be a critical source of scholarship aid.

Graduate Education

A 2012 National Research Council review cited the national leadership of HMS graduate programs, praising PhD students as “the engines of change through cutting-edge research that is at the interface of science, medicine, global health



Above, Eran Hodis, a first-year student, learns basic clinical skills, such as taking vital signs, and works through a clinical case on the patient simulator.

Below, custodians Elsa Lemus (left) and Anne Verdier help ensure that facilities are conducive to learning, working and conducting research. Custodial staff are a vital part of a University-wide sustainability effort; this year, Harvard recycled more than 50 percent of its waste stream.

and health policy.” Continued examination of these programs is fundamental to developing new ways to excel and meet the needs of this important student population.

A new Master of Medical Sciences (MMSc) in Global Health Delivery provides training in the improvement of health services in resource-constrained settings. Four students, including two Haitian physicians, enrolled in the fall of 2012. One of the Haitian doctors is analyzing disaster preparation; the other is researching the social and economic impact of long-term therapy for HIV/AIDS. A physician from Burundi is exploring barriers to family planning in his country, and an HMS student earning an MD and MMSc concurrently is researching food policy in the Navajo nation.

The School is working on several continents to advance research and education opportunities for HMS clinicians, scientists, students and faculty. Ultimately, patients will reap the rewards.

Program in Graduate Education

PhD programs at HMS continue to rank among the best. Led by David Golan, professor of biological chemistry and molecular pharmacology and dean for graduate education, these programs enroll more than 140 new students each year in nine areas: bioinformatics and integrative genomics, biological and biomedical sciences, biophysics, chemical biology, immunology, neuroscience, speech and hearing bioscience and technology, virology and systems biology. For professionals with, or concurrently studying for, MD or PhD degrees, HMS also offers studies leading to an MMSc in bioinformatics, clinical and translational investigation, or global health delivery.





Therapeutics in Life Science Research. A new HMS therapeutics track for students in the life-science PhD programs at Harvard addresses the critical need to translate molecular discoveries into clinical applications. An interdisciplinary faculty team from the Departments of Biological Chemistry and Molecular Pharmacology, Microbiology and Immunobiology, and Systems Biology designed the integrated curriculum in therapeutics and related fields, including systems approaches. A new therapeutics course helps PhD students explore broadly interconnected themes that will lead to new drug discovery and development. Students will participate in internships at pharmaceutical or biotechnology company labs, a clinical research lab or a regulatory agency.

Curriculum Fellows. The curriculum fellows are PhD-level scientists who work with HMS faculty to enhance medical and graduate education. Among the pilot programs to be supported by curriculum fellows is a quantitative-science boot camp, now in its second year. This four-day intensive session equips entering PhD students with computational methods and tools to support the next

Anca Barbu, instructor in surgery at Massachusetts General Hospital, directs second-year students Demyana Azer (center) and Ashley Aluko during the head and neck exam.

generation of discoveries. In 2012, the School approved a second phase of funding, supporting eight three-year fellowships.

Harvard Catalyst Postgraduate Education

Harvard Catalyst, directed by Lee Nadler, Virginia and D.K. Ludwig Professor of Medicine and dean for clinical and translational research, is providing training programs and funding that spark synergies between laboratory, clinical and population scientists. Among new offerings in 2012, a network medicine course explored how networks of molecules and cellular components interact. A spring Network Science in Biology and Medicine Symposium was followed in the fall by a three-day course. "Nanocourses" that provide more in-depth training are planned for spring 2013.


In addition, many member institutions provide courses in translational medicine, with more than 250 featured in a new online catalog at <http://catalyst.harvard.edu>.

Continuing Medical Education

The broad offerings of the Department of Continuing Education, led by Sanjiv Chopra, professor of medicine and faculty dean for continuing education, reach tens of thousands of physicians and health care professionals. The diverse portfolio provides extraordinary opportunities to maintain and improve skills, increase knowledge and improve performance. The goal is not only to inform and inspire but also to integrate new knowledge into participants' work. In 2012, 715 distinct courses and conferences were offered nationwide. CME also offered 65 online courses to nearly 60,000 clinicians from 175 countries. These courses are provided free to physicians in more than 55 countries.

The Faculty Committee on Strategic Planning for Continuing Education was charged with developing novel ways to expand the core curriculum to broaden its impact, reassessing best teaching practices and evaluating the infrastructure needed to support pedagogical excellence as well as the methods that will improve distance learning techniques to facilitate peer-to-peer learning opportunities. Additionally, a subcommittee on executive education investigated how to best expand offerings to a wider and more diverse professional audience.

Discovery

A hand wearing a white nitrile glove holds a dense bundle of fiber optic cables. The cables are thin and have a rainbow-like iridescent sheen. In the background, a portion of a periodic table of elements is visible, showing elements like Selenium (Se), Tellurium (Te), and Antimony (Sb). The overall image has a blue and orange color scheme.

**We are on the cusp
of an era when our
knowledge and
technology will
contribute to disease-
prevention strategies,
benefiting millions
worldwide.**

In 2012, HMS faculty members published more than 10,000 scholarly articles, an unrivaled output that reflects equal success at earning sponsored research funding. Guided by William Chin, Bertarelli Professor of Translational Medicine and executive dean for research, and by Bruce Donoff, Walter Guralnick Distinguished Professor of Oral and Maxillofacial Surgery and dean of the Harvard School of Dental Medicine, faculty members received \$295.3 million for sponsored programs, representing 36 percent of Harvard University's sponsored portfolio, including \$255.7 million in federal awards. Of these awards, \$242.5 million came in grants from the National Institutes of Health.

The unparalleled size and scope of the research enterprise, however, can obscure countless individual stories of long hours, late nights, unexpected collaborations, thrilling insights, inevitable setbacks and scientific

The Center for Primary Care's annual Innovations Conference connects primary care innovators and practitioners working to solve the nation's health care crisis.

advances large and small, basic and therapeutic, incremental and revolutionary.

The research highlighted below provides a small glimpse into the breadth of exploration and discovery at HMS. Learn more at <http://hms.harvard.edu/research>.

Harvard Catalyst | The Harvard Clinical and Translational Science Center

Designed to speed scientific discovery and collaboration in a continuous cycle from the lab to the clinic and back, Harvard Catalyst now has a membership of 1,500 researchers.

In September 2012, the Regulatory Knowledge and Support Program expanded a system facilitating collaborative clinical research by executing an Institutional Review Board (IRB) Common Reliance Agreement among 20 institutions, including all Harvard institutions, HMS affiliates, and the Broad Institute of MIT and Harvard.

Previously, proposals for multisite clinical studies were submitted to each institution's review board. The new system integrates cross-institutional clinical research studies by reducing multiple reviews. Individual or consolidated IRB review expedites assessment of study design, risks and benefits, and improves protections for research participants.

The Harvard Catalyst Clinical Research Center, headed by Alvaro Pascual-Leone, recently appointed associate dean for clinical and translational research, developed a new informatics tool to standardize online scheduling of outpatients and inpatients enrolled in clinical studies. This tool optimizes use of clinical facilities, allowing investigators to schedule study visits quickly and conveniently.

In 2012, Harvard Catalyst focused on five specific critical health issues, inviting researchers to apply for new grants. One funded area focuses on childhood obesity, a topic that attracted a broad spectrum of leaders in academia and public health to an April summit.

Other funded research areas include probing cancer disparities, advanced imaging, childhood health and the creative use of the Shared Health Research Information Network (SHRINE), an innovative Web-based tool researchers can use to search multiple hospital databases of pooled de-identified patient data. In the first round of competitive applications, 19 researchers each received



a \$2,500 award and advanced to a second round, with four receiving an additional \$50,000 to pursue SHRINE-inspired ideas.

Biological Chemistry and Molecular Pharmacology

Characterizing Membrane Proteins without Crystallization

Researchers solved a technical problem that has hindered structural characterization of membrane proteins in dynamic non-crystalline states. The team, led by James Chou, HMS professor of biological chemistry and molecular pharmacology, explained in a *Nature* study how they combined nuclear magnetic resonance (NMR), DNA nanostructure fabrication and molecular fragment searching to determine membrane protein structure. To date, X-ray crystallography has been the dominant tool for depicting the structures of proteins, but in many cases long-standing efforts to crystallize membrane proteins have yet to succeed. The HMS team focused on mitochondrial uncoupling proteins, consisting of approximately 300 amino acids. The proteins, present largely in brown fat, catalyze the influx of protons to the mitochondrial matrix. This activity uncouples oxidative phosphorylation while dissipating the lost membrane potential as heat, a process that generates warmth in newborns and may be harnessed to help overweight adults burn calories and lose weight. More broadly, the new NMR approach will benefit many fields



Stan Pashkovski, a graduate student in the lab of Assistant Professor of Neurobiology Sandeep Robert Datta, uses a multi-photon microscope to probe neural activity to understand how the brain transforms information from the environment into meaningful behaviors.

Below, Yunsun Nam, a research fellow in the lab of Piotr Sliz, assistant professor of pediatrics at Boston Children's Hospital, prepares an experiment using a nuclear magnetic resonance (NMR) system for small-molecule NMR spectroscopy.

involving membrane channels and transporters. A new department chair, Stephen Blacklow, Gustavus Adolphus Pfeiffer Professor of Biological Chemistry and Molecular Pharmacology, was appointed in September.

Cell Biology

Moving Cargo inside Cells

Within every cell, molecular “motors” transport cytoplasmic cargo. One such motor is the protein dynein, which moves packets of RNA, organelles and proteins along a microtubular track, generally toward the cell nucleus. Even viruses can hitch a ride. In a *Cell* study, Samara Reck-Peterson, assistant professor of cell biology, showed that the regulator protein Lis1 functions as a molecular clutch, uncoupling dynein’s ATP-driven engine from microtubular track binding. This uncoupling may function to keep dynein stationary and attached to its track while cargo is being loaded. Once the clutch is released, the dynein-cargo complex is free to move to its destination. Defects in dynein regulation play a role in neurological diseases, so understanding the steps involved may lead to new treatments.

Genetics

Solving Population Mysteries

Research has revealed that North and South America were populated in three ancient waves of migration, not one. Although the majority of Native Americans descended from a single group that crossed a land

bridge between Asia and North America more than 15,000 years ago, two subsequent migrations also occurred, as reported in *Nature* by David Reich, HMS professor of genetics, and coinvestigator Andrés Ruiz-Linares, professor of human genetics at University College London. Data from 52 Native American and 17 Siberian groups and more than 300,000 DNA sequence variations showed three deep lineages and indicated that complex migrations occurred from the Arctic to the tip of Chile. A separate *Nature Genetics* study disclosed how a team headed by Steven McCarroll, assistant professor of genetics, analyzed structurally complex regions of the human genome, giving an unprecedented view of the variability and history of a human genome region associated with fertility and Parkinson's disease.

Global Health and Social Medicine

Peruvian Children and Tuberculosis

The global burden of tuberculosis in children is inadequately understood, but millions are likely affected. A team headed by Mercedes Becerra, associate professor of global health and social medicine, and Carole Mitnick, assistant professor, documented TB among children exposed at home to a person with multidrug-resistant TB (MDR-TB). A retrospective study in the *Pediatric Infectious Disease Journal* focused on populations in Lima, Peru. The researchers identified the first patient treated for MDR-TB in each household, then looked at TB incidence in other household members over time. They found that children were at highest risk for contracting TB the first year after the index patient began treatment for MDR-TB. After four years, children accounted for 20 percent of household cases. TB rates in these children were 30 times higher than those in the general population, pointing to the need to promptly identify and appropriately treat affected children in households where MDR-TB is present.

Health Care Policy

Assessing U.S. Health Care

In a study in the *Journal of the American Medical Association*, a research team led by J. Michael McWilliams, HMS assistant professor of health care policy, examined the effect of Medicare Part D, the prescription-drug

benefit extended to seniors in 2006. Previous research showed an increase in medication use, reduced out-of-pocket expenses and improved adherence to medications after its implementation. The new study showed that reductions in non-drug spending also occurred, suggesting that improved medication use helped reduce non-drug spending. Another study, led by Michael Chernew, professor of health care policy, in the *New England Journal of Medicine*, examined a payment system called the alternative quality contract, as implemented by a large health insurer. In this system, provider groups assumed accountability for spending and were eligible to receive bonuses for quality. Researchers found a modest slowing of spending and improved quality of care.

Microbiology and Immunology

Identifying Pathogens with Precision

With drug-resistant infections on the rise, clinicians need fast, effective ways to detect specific pathogens and determine their susceptibility to antibiotics. A research team led by Deborah Hung, assistant professor of microbiology and immunology at Massachusetts General Hospital, showed that the detailed RNA signature of specific pathogens, extracted from clinical samples, can identify a broad spectrum of infectious agents such as bacteria, viruses, yeast and parasites. This research, in the *Proceedings of the National*

At Beth Israel Deaconess Medical Center, Daniel Jones, professor of surgery, scrubs in. Jones has established a national program in minimally invasive surgery, bariatric surgery and surgical training using simulation.



Academy of Sciences, also demonstrated how to determine whether bacterial transcripts, after being given a brief pulse of various test antibiotics, are susceptible or resistant to the test drugs. The findings may form the basis of a diagnostic platform across a broad range of infectious diseases, allowing clinicians to determine the best treatment option earlier, reducing treatment delays and improving outcomes.

Neurobiology

Renewing Inner-ear Cells

How complex cells maintain structure and function while undergoing renewal is a key question in cellular biology. Hair cells of the inner ear, for example, are not replaced during an individual's lifetime, so their subcellular proteins and organelles must be continuously renewed, especially when damaged. Among the organelles involved are stereocilia, cilia-like protrusions that are extremely sensitive to movement and essential for hearing and balance. Loud noise can damage the stereocilia's dense actin filaments, which must be repaired, a process studied by David Corey, professor of neurobiology. Previous research suggested a rapid process, occurring from the top down by means of a molecular "conveyor belt." Using multi-isotope imaging mass spectrom-

Risa Burns, assistant professor of medicine at Beth Israel Deaconess Medical Center, accompanies her dog Cosmo on rounds. Both are part of a program that helps patients reduce stress and anxiety, improving their psychological and emotional well-being.

etry, a sensitive method developed by Claude Lechene, associate professor of medicine at Brigham and Women's Hospital, the research team measured the incorporation of new protein in the stereocilia of lab animals. Their findings, published in *Nature*, showed that the stereocilia were exceptionally stable, with protein turning over in months rather than days, and that repair seemed to occur by splicing in new actin rather than by adding protein to the end of the conveyor belt. Only the very tips of stereocilia had rapid turnover, possibly related to regulation of the mechanosensory machinery. Further research holds promise for better understanding of and treatment for hearing loss.

Stem Cell and Regenerative Biology

Rebuilding the Brain's Circuitry

HMS scientists rebuilt genetically diseased circuitry in a section of the mouse hypothalamus, an area controlling energy balance and body weight. The research, reported in *Science*, demonstrated that complex and intricately wired circuitry of the brain, long considered incapable of cellular repair, can be rewired with the right type of neuronal replacement parts. These findings showed that new neurons of the right types and at the right developmental stage to "build" the circuitry during initial development were able to integrate functionally, anatomically, molecularly, synaptically, electrophysiologically and, with behavioral function, to rewire complex circuitry in the mammalian brain. This supports the idea that precisely controlled maturation of the right types of neurons from progenitors or stem cells might offer new therapeutic approaches to rewire the brain for conditions in which specific sets of neurons degenerate or are damaged, such as ALS, spinal cord injury and Parkinson's disease. The research was led by Jeffrey Macklis, professor in the Department of Stem Cell and Regenerative Biology, professor of neurology and a principal faculty member of the Harvard Stem Cell Institute, jointly administered by HMS and the Harvard Faculty of Arts and Sciences. Senior authors also included HMS Dean Jeffrey S. Flier, Caroline Shields Walker Professor of Medicine, and Matthew Walker Anderson, associate professor of pathology at Beth Israel Deaconess Medical Center.





Systems Biology

Gene's Rhythm Affects Cell Fate

Like a traffic cop at a busy intersection, the anti-cancer gene that encodes p53 has the ability to interpret a variety of signals and orchestrate different responses. Activated when cells are under stress, p53 can dictate DNA repair, cell cycle arrest, and senescence or cell death, earning it the reputation of “guardian of the genome.” How p53’s rhythms control cell fate and produce different outcomes is the focus of studies by Galit Lahav, associate professor of systems biology. As published in *Science*, her research team used a combination of mathematical models and experiments to show how a pulsed signal from p53 triggers DNA repair and cell recovery. When the signal is sustained, senescence is accelerated. More broadly, the findings suggest that in addition to the presence and level of a protein, its rhythm also carries crucial information.

Harvard School of Dental Medicine

Osteoporosis Prevention

Research discoveries at HSDM promise to improve patient care in unexpected areas. In 2012, scientists made a key discovery about vascular endothelial growth factor (VEGF), a protein involved in blood-vessel growth and bone development. A team led by Bjorn Olsen, Hersey Professor of Cell Biology at HMS and professor of developmental biology and dean for research at HSDM, discovered

Allison O'Neill, instructor in pediatrics at Boston Children's Hospital, examines Ariana Fernandez, who was diagnosed with acute lymphoblastic leukemia. After treatment, Ariana's disease is now in full remission.

that VEGF stimulates differentiation of mesenchymal stem cells (MSCs) into bone-forming cells and prevents their differentiation into fat cells. VEGF is typically secreted by cells into their surrounding spaces, where it binds to receptor molecules on the cell surface, but in this case, as described in the *Journal of Clinical Investigation*, VEGF was found to work inside the cells. Previous research showed that as people age, MSCs are more likely to become fat cells than bone cells, leading to osteoporosis. Further research is now under way to learn which genes and proteins are regulating VEGF's ability to stimulate bone and repress fat-cell formation, providing potential targets for drugs to prevent osteoporosis.

Office of Technology Development

Harvard University's Office of Technology Development (OTD) fosters the development of breakthrough therapeutics by generating industry collaborations through patent licensing, strategic research alliances, and start-up company and new venture agreements. In 2012, OTD forged several partnerships between HMS and the biopharma industry. Among them was the third collaboration with UCB, a global biopharma leader focused on immunology and disorders of the central nervous system. UCB is providing up to \$4.5 million over three years to support a project titled “Mining the Human Microbiome,” led by faculty studying the human microbiome in the intestine. They are classifying new bacterial species and studying their impact on the immune system to identify new drugs that may prevent or treat a panoply of immunological diseases. Another alliance, with Boehringer Ingelheim, supports eight translational research projects that aim to identify novel signaling pathways and new drug targets in oncologic, cardiometabolic, fibrotic and infectious diseases.

Conflict of Interest Policy

Committed to the highest professional standards of ethical conduct, in 2012, HMS substantially completed the implementation of a revised Policy on Conflicts of Interest and Commitment, which provides guidance and mechanisms for transparency, disclosure, and collaboration between HMS faculty members and industry partners.

Service

In Lesotho, a mountainous African country with the third-highest HIV infection rate in the world, HMS doctors use small planes to deliver supplies and reach people too sick to travel. HMS physicians work with governments worldwide to train health workers and establish clinics.

On this shrinking planet, our reach as caregivers and health policy leaders has no boundaries.



"The purpose of human life," Albert Schweitzer said, "is to serve and to show compassion and the will to help others." At HMS, service to humanity is a guiding principle. The Office for Diversity Inclusion and Community Partnership, led by Dean Joan Reede, associate professor of medicine, is one of many that strives to foster a culture that values and promotes diversity inclusion, mentoring and service to school and community, recognizing individuals who embody excellence in these areas.

HMS faculty members, fellows, students, staff, clinicians and scientists bring to this mission remarkable resources and expertise, whether volunteering to care for homeless patients, as Ernesto Gonzalez, professor of dermatology at Mass General, has done for 20 years, or mentoring disadvantaged

Katalin Danji (right), instructor in medicine at Hebrew SeniorLife, assists patient Anna Aliberti. Danji and other geriatricians provide comprehensive medical care at the long-term care facility and two post-acute units. They also conduct research at the Institute for Aging Research.



high-school students who dream of medical careers, as does Alphonso Brown, assistant professor of medicine at Beth Israel Deaconess, through his ICAN Medical Scholars Program.

Service takes many forms. This year, the National Institutes of Health recognized Gary Yellen, professor of neurobiology, with a Pioneer Award for improving treatment for patients with drug-resistant epilepsy. Sanofi and the Institut Pasteur recognized John Mekalanos, Adele Lehman Professor of Microbiology and Molecular Genetics and head of the Department of Microbiology and Immunobiology, for groundbreaking discoveries in cholera pathogenesis that point toward new vaccines and treatments.

Supporting this remarkable faculty body is Dean for Academic and Clinical Affairs Nancy Tarbell, C.C. Wang Professor of Radiation Oncology, whose team fosters a diverse and inclusive climate. To retain and recruit the finest educators, physicians and scientists, in 2012 HMS implemented a variety of initiatives introduced by the Task Force on Faculty Development and Diversity. The senior promotions process was streamlined under the direction of Dean for Faculty Affairs and Assistant Professor of Population Medicine Maureen Connelly, resulting in a record number of faculty members—more than 100—being promoted to professor in 2012. Average approval time for promotions was reduced from 16 months to nine. As of fall 2012, there were 166 women professors at HMS. Six percent, or more than 670 faculty members, come from groups underrepresented in medicine.

What follows are a few examples of the commitment to public service at HMS. These constitute a small but representative sample of the excellence, dedication and impact of HMS students, faculty and staff.

Service at Home

Family Van. In 2012 the HMS Family Van celebrated 20 years of serving more than 40,000 patients in Boston neighborhoods, providing free curbside health education, preventive care, screenings and referrals. Co-founded by Nancy Oriol, dean for students and associate professor of anaesthesia, with former HMS student Cheryl Dorsey, this wellness center on wheels increases

access to health services in seven medically underserved neighborhoods. During a three-hour neighborhood stop, health workers see as many as 30 patients, assisted by HMS students and other volunteers. Much of their work addresses undiagnosed chronic illnesses, such as hypertension and diabetes. Providers are now able to assess their impact with Mobile Health Map, an online data tool developed at HMS and used by more than 450 mobile health vans across the U.S.

Crimson Care Collaborative. Launched in 2010 by HMS students, the Crimson Care Collaborative offers an opportunity for students supervised by faculty to provide clinical care to patients in underserved communities. Open evenings for patients' convenience, the clinics have expanded to five sites. The initiative, supported by the John D. Stoeckle Center for Primary Care Innovation at Mass General and supported by the HMS Center for Primary Care, serves scores of patients each week.

Innovations in Primary Care. HMS students are entering medicine at a time of crisis in primary care. The new Center for Primary Care—with inaugural director Russell Phillips, the William Applebaum Professor of Medicine, and co-director Andrew Ellner, HMS instructor in medicine—is meeting the challenge.

Gabrielle Samsock, whose Make-A-Wish Foundation request was to be a Harvard Medical School student, is instructed by RN Darren Tavernelli at the Shapiro Simulation and Skills Center, part of an intensive one-week program coordinated by Robert Kitts, clinical instructor in psychiatry at Boston Children's Hospital.

The Center's Academic Innovations Collaborative is providing new models of patient care at 18 affiliated primary care teaching practices serving more than 270,000 patients. The Innovation Fellows Program supports faculty developing innovations in primary care and serving as student mentors. Both initiatives leverage team-based care and information technology to improve care while lowering costs. In October 2012, the Center's second annual conference highlighted the breadth of innovation taking place across Greater Boston, shared knowledge and excitement about transforming primary care, and forged new connections among primary care innovators and practitioners. HMS fourth-year students will be offered a primary care leadership and management elective in 2013.

Education Outreach. The HMS Office for Diversity Inclusion and Community Partnership reaches out in a variety of ways to children in underserved communities. These efforts include Explorations, which convenes approximately 400 middle-school students from Boston and Cambridge each fall to explore biomedical careers at HMS laboratories. The students return in the spring for Reflection in Action: Building Healthy Communities, which reinforces their earlier research experiences.

Service Abroad

Transforming Health Care Worldwide. With a vision of translating scientific knowledge and expertise into excellent health care delivery worldwide, particularly among the poor and marginalized, physician anthropologist Paul Farmer, Kolokotronis University Professor, leads the Department of Global Health and Social Medicine. Farmer is also co-founder of Partners In Health (PIH), an international nonprofit that provides direct health care to thousands in resource-poor areas. PIH, Brigham and Women's, and the Department of Global Health and Social Medicine collaborate to integrate research, teaching and service. One platform for this work is supported by the HMS Programs in Global Health and Social Change, which comprise health delivery research and training initiatives in clinical domains, including infectious disease, non-communicable disease, mental health, surgery, primary care and newborn





Left, Ernesto Gonzalez, professor of dermatology at Massachusetts General Hospital, examines a patient at the Boston Health Care for the Homeless Program. Gonzalez received the Dean's Lifetime Achievement Community Service Award for 20 years of volunteer service.

health, as well as in public policy, health systems strengthening and global medical education. These initiatives extend from Boston's Roxbury neighborhood to as far away as China, Haiti, Peru, Tanzania and Russia.

Advancing Health Care in Rwanda. HMS has joined an academic consortium partnering with the new Rwanda Human Resources for Health Program. The consortium includes more than a dozen of the leading U.S. medical, nursing and public health schools. PIH and the Clinton Health Access Initiative are supporting this effort, led by the Rwandan Ministry of Health. Faculty from HMS, Brigham and Women's, and Boston Children's Hospital are supporting Rwanda's growing medical and educational capacity and helping to establish a world-class, self-sustaining national health care system there.

Worldwide Research Collaborations

In recent years, HMS academic and research programs have expanded their global reach. Chairing the Committee on Global Projects and Sites is David Golan, dean for graduate education. HMS is in discussions with academic leaders in several countries to explore opportunities for new research and education alliances. The following are a few of the international initiatives undertaken by HMS in 2012.

Portugal. The Harvard Medical School-Portugal Program in Translational Research and Information provides a global model for enriching research and education. In this program, members of HMS and affiliated institutions are collaborating with Portuguese colleagues on the development of an exemplary clinical and translational research program aimed at providing long-term benefits to the local population. In 2012, 30 Portuguese physicians immersed themselves in the newly created clinical research training program in their country.

Dubai. The Dubai Harvard Foundation for Medical Research, created to drive scientific

inquiry in the Middle East and to address the region's most pressing health problems, awarded three new three-year research fellowships in 2012 to postdoctoral researchers from the region, each mentored by an HMS faculty member. One fellow is investigating the genetic origins of congenital strabismus; another, the novel genes linked with congenital myopathies, a group of genetic disorders involving abnormal skeletal muscle structure and function that affects large portions of the population in the Middle East; and another, the molecular mechanisms that govern the development of myelodysplastic syndromes, a diverse set of disorders involving clonal hematopoietic stem cells.

Switzerland. The Bertarelli Program in Translational Neuroscience and Neuroengineering is a partnership with the École Polytechnique Fédérale de Lausanne (EPFL). Through research grants for collaborative projects, it aims to integrate engineering and neuroscience research, with the goal of moving basic research toward translational applications. The Bertarelli Program also sponsors an annual symposium on neuroengineering and a vibrant student-exchange program between HMS and EPFL.

Below, access to clean drinking water is a challenge for millions. Wilfredo Matias, a second-year HMS student, photographed the well, below, in Haiti where he spent part of the summer of 2012 studying sanitation and supply issues in an effort to help contain the spread of cholera.



Honors and Awards

MacArthur Foundation

Benjamin Warf, associate professor of surgery and director of the neonatal and congenital anomaly neurosurgery program at Boston Children's, was named a 2012 John D. and Catherine T. MacArthur Foundation Fellow. Warf, who founded a pediatric neurosurgery hospital in Uganda in 2000, noticed the country's poor children suffered an unusually high incidence of hydrocephalus, fluid buildup in the skull that puts pressure on the brain. He developed an endoscopic procedure, combining reduction of the fluid-producing tissue with restoration of normal fluid circulation, that avoids dependence on implanted shunt devices that fail over time. Warf continues to oversee the Ugandan hydrocephalus project as well as a program that has trained 20 neurosurgeons from developing countries in the new technique.

Institute of Medicine

Donald Ingber, Judah Folkman Professor of Vascular Biology in the Department of Pathology at Boston Children's, and founding director of the Wyss Institute for Biologically Inspired Engineering at Harvard University, was elected to the Institute of Medicine, one of the highest honors in the field of medicine in the U.S. Its members advise government agencies, policymakers and medical professionals on health care issues. Ingber has shaped the field of biologically inspired engineering through his pioneering interdisciplinary work in mechanobiology, angiogenesis and cell structure.



Above, the HMS Family Van provides free preventive health services, referrals and health education to individuals in underserved neighborhoods across Boston.

Below, Benjamin White, instructor in surgery, at the Massachusetts General Hospital Department of Emergency Medicine, which records 88,000 emergency room visits annually.

Warren Alpert Foundation Prize

The drug bortezomib has radically altered the therapeutic landscape for thousands of individuals with multiple myeloma and ushered in a new class of drug: the proteasome inhibitor. Four key players in its development were honored with the 2012 Warren Alpert Foundation Prize, which recognizes discoveries that promise to dramatically improve human health. Alfred Goldberg, professor of cell biology; Kenneth Anderson, Kraft Family Professor of Medicine at Dana-Farber Cancer Institute; Paul Richardson, R.J. Corman Associate Professor of Medicine at Dana-Farber; and Julian Adams of Infinity Pharmaceuticals, shared the \$250,000 prize.

Robert Wood Johnson Foundation Award

Somava Stout, instructor in medicine and vice president for patient-centered medical home development at Cambridge Health Alliance, is among 10 inaugural winners of the Young Leader Award established in 2012 by the Robert Wood Johnson Foundation. The award recognizes leaders age 40 and under for exceptional contributions to improving the health of the nation. Stout is a primary care physician committed to improving the health of people in underserved communities through patient-centered health system redesign.

Daniel D. Federman Teaching Award Celebration

This year, the HMS Program in Medical Education honored faculty and staff who "through their excellence in teaching, impact and influence the professional lives of students long after graduation." The 2012 awards were named in honor of Daniel D. Federman, the Carl W. Walter Distinguished Professor of Medicine and former dean for medical education.

Excellence in Mentoring Awards

HMS is dedicated to fostering a culture of excellence in mentorship. Successful career development is bolstered by quality mentoring relationships. The



Office for Diversity Inclusion and Community Partnership recognizes outstanding mentorship efforts by sponsoring the HMS/HSDM Excellence in Mentoring Awards. In 2012, four faculty members were recognized with the William Silen Lifetime Achievement in Mentoring Award: Ross Baldessarini, professor of psychiatry at McLean Hospital; Stephen Calderwood, Morton N. Swartz, M.D. Academy Professor of Medicine at Mass General; Joseph Loscalzo, Hersey Professor of the Theory and Practice of Physic at Brigham and Women's; and R. Michael Scott, professor of surgery at Boston Children's. In addition, five faculty members received the A. Clifford Barger Excellence in Mentoring Award, and eight received the Young Mentor Award.

Richard A. Gillis Award for Excellence in Medical Education

The 2012 inaugural recipient of this award was the staff of the Office of Curriculum Services, which Gillis, former executive director of curriculum programs, established and led until his death in October 2011.

Endowed Professorships

This past year HMS was proud to grant numerous endowed professorships, representing the highest honor bestowed on faculty. Also, in March, through an initiative made possible by the generosity of alumni and friends, HMS marked the Inaugural Celebration of the Quadrangle Endowed Professoriate, which recognized all basic and social science incumbents to professorships established since the School's founding in 1782.

The following represent the most recent HMS endowed professorships (July 1, 2011 – June 30, 2012).

More HMS awards can be viewed at:
<http://hms.harvard.edu/all-news?tid=16>

Bruce Bean, Robert Winthrop Professor of Neurobiology

Christophe Benoist, Morton Grove-Rasmussen Professor of Immunohematology

Joshua Boyce, Albert L. Sheffer Professor of Medicine in the Field of Allergic Disease

Rami Burstein, John Hedley-Whyte Professor of Anaesthesia

Richard Cambria, Robert R. Linton Professor of Surgery in the Field of Vascular and Endovascular Surgery

Constance Cepko, Bullard Professor of Genetics and Neuroscience

James Chodosh, David Glendenning Cogan Professor of Ophthalmology in the Field of Cornea and External Disease

George Church, Robert Winthrop Professor of Genetics

Jonathan Cohen, Bullard Professor of Neurobiology

Kirk Daffner, J. David and Virginia Wimberly Professor of Neurology

Jeffrey Golden, Ramzi S. Cotran Professor of Pathology

Paul Farmer, Kolokotronis University Professor and chair of the Department of Global Health and Social Medicine, reviews the case of a tuberculosis patient in Achham, Nepal. One-third of the world's population lives with TB, the leading cause of death for people with HIV/AIDS.

Ann Hochschild, Maude and Lillian Presley Professor of Microbiology and Immunobiology

Ronald Kessler, McNeil Family Professor of Health Care Policy

Randall King, Harry C. McKenzie Associate Professor of Cell Biology

Diane Mathis, Morton Grove-Rasmussen Professor of Immunohematology

Christopher McDougle, Nancy Lurie Marks Professor of Psychiatry

Hans Christoph Oettgen, Children's Hospital Boston Professor of Pediatric Immunology

Norbert Perrimon, James Stillman Professor of Developmental Biology

Russell Phillips, William Applebaum Professor of Medicine

Stuart Quan, Gerald E. McGinnis Professor of Sleep Medicine

James Rathmell, Henry Knowles Beecher Professor of Anaesthesia

David Rattner, Warsaw Family Professor of Surgery

Paul Richardson, R.J. Corman Associate Professor of Medicine

Joseph F. Rizzo III, David Glendenning Cogan Professor of Ophthalmology in the Field of Neuro-Ophthalmology

Pamela Silver, Elliot T. and Onie H. Adams Professor of Biochemistry and Systems Biology

Peter Sorger, Otto Kraymer Professor of Systems Pharmacology

Janey Wiggs, Paul Austin Chandler Associate Professor of Ophthalmology



Facts and Figures

HEALTH

**Extraordinary
leadership and vision
contribute to the
unique community
that is HMS, where
many hands improve
the health of
thousands, one
person at a time.**

HMS LEADERSHIP

Jeffrey S. Flier, MD

Dean of the Faculty of Medicine

ACADEMIC DEANS

William W. Chin, MD

Executive Dean for Research

Sanjiv Chopra, MB, BS

Faculty Dean for Continuing Education

Maureen Connelly, MD, MPH

Dean for Faculty Affairs

Jules Dienstag, MD

Dean for Medical Education

David E. Golan, MD, PhD

Dean for Graduate Education

Lee Nadler, MD

Dean for Clinical and Translational Research

Nancy Oriol, MD

Dean for Students

Joan Reede, MD, MS, MPH, MBA

Dean for Diversity and Community Partnership

Nancy J. Tarbell, MD

Dean for Academic and Clinical Affairs

HARVARD SCHOOL OF DENTAL MEDICINE

R. Bruce Donoff, DMD, MD

Dean

ADMINISTRATIVE DEANS

Richard G. Mills

Executive Dean for Administration

Wesley Benbow

Associate Dean for Finance and Chief Financial Officer

Gretchen Brodnicki

Dean for Faculty and Research Integrity

Judith Glaven

Associate Dean for Basic and Interdisciplinary Research

Rainer Fuchs

Chief Information Officer

Lisa Muto

Associate Dean for Institutional Planning and Policy

Susan Rapple

Dean for Resource Development

Richard Shea

Associate Dean for Campus Planning and Facilities

Julie Stanley

Chief Human Resources Officer

Gina vild

Associate Dean for Communications and External Relations and Chief Communications Officer

PRECLINICAL DEPARTMENT CHAIRS

Stephen Blacklow, MD, PhD

Gustavus Adolphus Pfeiffer Professor of Biological Chemistry and Molecular Pharmacology Chair, Biological Chemistry and Molecular Pharmacology (Oct. 2012)

Joan Brugge, PhD

Louise Foote Pfeiffer Professor of Cell Biology Chair, Cell Biology

Paul Farmer, MD, PhD

Kolokotronis University Professor of Global Health and Social Medicine Chair, Global Health and Social Medicine

Michael Greenberg, PhD

Nathan Marsh Pusey Professor of Neurobiology Chair, Neurobiology

Stephen Harrison, PhD

Giovanni Armenise—Harvard Professor of Basic Biomedical Science Acting Chair, Biological Chemistry and Molecular Pharmacology (Oct. 2009 – Sept. 2012)

Marc Kirschner, PhD

John Franklin Enders University Professor of Systems Biology Chair, Systems Biology

Barbara McNeil, MD, PhD

Ridley Watts Professor of Health Care Policy Chair, Health Care Policy

John Mekalanos, PhD

Adele Lehman Professor of Microbiology and Molecular Genetics Chair, Microbiology and Immunobiology

Douglas Melton, PhD

Xander University Professor of Stem Cell and Regenerative Biology Co-chair, Stem Cell and Regenerative Biology

David Scadden, MD

Gerald and Darlene Jordan Professor of Medicine Co-chair, Stem Cell and Regenerative Biology

Clifford Tabin, PhD

George Jacob and Jacqueline Hazel Leder Professor of Genetics Chair, Genetics

AFFILIATED HOSPITALS AND INSTITUTIONS

Beth Israel Deaconess Medical Center
 Boston Children's Hospital
 Brigham and Women's Hospital
 Cambridge Health Alliance
 Dana-Farber Cancer Institute
 Forsyth Institute (HSDM affiliate as of Jan. 1, 2012)
 Harvard Pilgrim Health Care Institute
 Hebrew SeniorLife
 Joslin Diabetes Center
 Judge Baker Children's Center
 Massachusetts Eye and Ear
 Massachusetts General Hospital
 McLean Hospital
 Mount Auburn Hospital
 Schepens Eye Research Institute
 Spaulding Rehabilitation Hospital
 Veterans Affairs Boston Healthcare System

HMS By THE NUMBERS

Total faculty **11,951** | Tenured and tenure-track faculty on the HMS campus, in nine preclinical departments **185** | Voting faculty, campus and affiliates **5,163**
 Full-time faculty, campus and affiliates **9,077**

Nobel Prizes (Medicine or Physiology; Peace) **9** prizes; **15** recipients | Howard Hughes Medical Institute investigators **30** | Members, Institute of Medicine **124** | National Academy of Sciences **62**

Total MD students **700** | Total PhD students **767**
 *MD-PhD basic sciences **158** | Social sciences **18**
 (*included in MD and PhD totals) | Total DMD students **150** | Total MMSc students **69** | Trainees (residents and postdoctoral fellows) **8,867**

Students entering in 2012:
 MD (includes 11 MD-PhD) **164** | Applicants **5,804**
 Admitted **226** (3.9%) | Matriculated (includes 11 MD-PhD) **164** | Men **78** (48%) | Women **86** (52%)
 Underrepresented in medicine (African American, Native American, Hispanic) **35** (21%) | Asian **48** (29%)

Entering PhD, DMD and MMSc students, 2012:
 PhD **147** | DMD **35** | MMSc **34**

Additional joint-degree programs:
 MD-MBA; MD-MPH; MD-MPP

Medical school alumni **9,646** (MD and MMSc degrees)

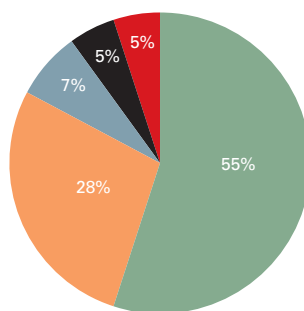
COLLABORATIONS ACROSS HARVARD

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

FUNDRAISING HIGHLIGHTS

Harvard Medical School depends upon a wide network of generous men and women who believe in its mission to alleviate human suffering caused by disease. We are fortunate that our circle of supporters from the community at large continued to expand in fiscal year 2012, as we welcomed new friends to our constituency of alumni, volunteers, faculty, staff, foundations and corporations. In fact, more than 4,000 supporters gave nearly \$62 million, making a tangible impact on our ability to help people live longer, healthier lives.

In education, these gifts are supporting student scholarships and advancing continuing medical education, medical-legal inquiry and medical ethics. In the area of discovery, these gifts propel the largest biomedical research engine in the world, supporting research in virtually every domain, from exploring human origins to understanding the effects of the circadian clock to advancing translational medicine. And finally, in the area of service, these gifts are bolstering our commitment to transforming health care systems in the U.S. and abroad, including shaping policies that are both comprehensive and financially viable.



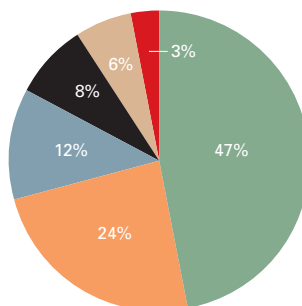
HMS GIFTS AND PLEDGES By PURPOSE

- Teaching/Research: 55%
- Professorships/Faculty: 28%
- Discretionary/Unrestricted: 7%
- Financial Aid/Student Support: 5%
- Other: 5%

Fy 2012 OPERATING REVENUE

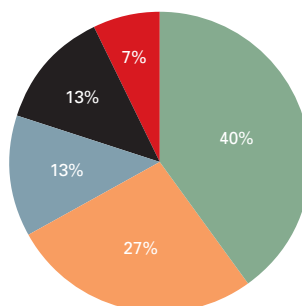
■ Research grants and contracts	\$285,181,297	47%
■ Endowment distribution for operations	\$147,556,154	24%
■ Other revenues*	\$70,757,576	12%
■ Rental income	\$49,138,777	8%
■ Gifts for current use	\$33,247,929	6%
■ Tuition (net)	\$17,873,843	3%
Total	\$603,755,576	

* Includes continuing medical education, publications and royalties



Fy 2012 OPERATING EXPENSES

■ Personnel cost	\$253,499,380	40%
■ Supplies and other expenses	\$170,161,668	27%
■ Research subcontracts and affiliates	\$83,114,562	13%
■ Plant operations and interest	\$81,640,701	13%
■ Depreciation	\$44,143,579	7%
Total	\$632,559,890	



FINANCIAL REPORT

Harvard Medical School's 2012 fiscal performance reflects continued efforts to achieve a sustainable financial future, one that supports a superior and affordable educational experience for students, an ongoing investment in the School's world-class faculty and research facilities, and an environment that will sustain a talented workforce.

In 2012 operating revenues totaled \$603.8 million, a 3 percent decrease of \$21.1 million, as compared to restated FY 2011 revenues. This decline in operating revenues was primarily the result of the anticipated winding down of federal stimulus funding for research through the American Recovery and Reinvestment Act.

Over this same period, total operating expenses increased by 1 percent, or \$5.7 million, to \$632.6 million. While core research expenses were

carefully managed in anticipation of the expected reduction in stimulus funding, HMS continued to carefully invest in areas of strategic priority, such as systems pharmacology, genetics and neurobiology, and to support regulatory compliance initiatives.

In addition, HMS continued to lower its debt service and total debt, paying down an incremental \$5.2 million in long-term debt at the end of the fiscal year.

Overall, the School ended FY 2012 with an expected operating deficit of \$28.8 million, versus a restated FY 2011 operating deficit of \$2.1 million. To address this deficit and in response to increasing external pressures, HMS is further strengthening the financial planning process and making strategic investments that promise to generate new sources of revenue.

Credits: Writing and editing by M.R.F. Buckley, R. Alan Leo and Christine Paul; design and art direction by Paul DiMattia; writing, editing and photo management by Angela Alberti; photo assistance by Kim Serrechia; editing, fact checking and proofreading by Susan Karcz, Ann Marie Menting and Jake Miller; distribution management by Lindsey Bourcier; printing by Kirkwood Printing. Photography by Justin Ide, Tom Kates, Steve Lipofsky, Wilfredo Matias, Jake Miller, John Soares and David Stone; other photos courtesy of the Artavanis-Tsakonas Lab at HMS; Mim Adkins, Family Van; Patrick Bibbins, Boston Children's Hospital; iStock; Jeffrey Karp, the Karp Lab; MGH Photo Lab; MGH-UCLA Human Connectome Project; Sam Ogden, Dana-Farber Cancer Institute; and Bec Rollins, Partners In Health.

Produced by the HMS Office of Communications and External Relations: Gina Vild, Associate Dean of Communications and External Relations and Chief Communications Officer, 107 Avenue Louis Pasteur, Suite 111, Boston, MA 02115, (617) 432-0442, communications@hms.harvard.edu



HARVARD
MEDICAL SCHOOL

25 Shattuck Street
Boston, Massachusetts 02115
www.hms.harvard.edu