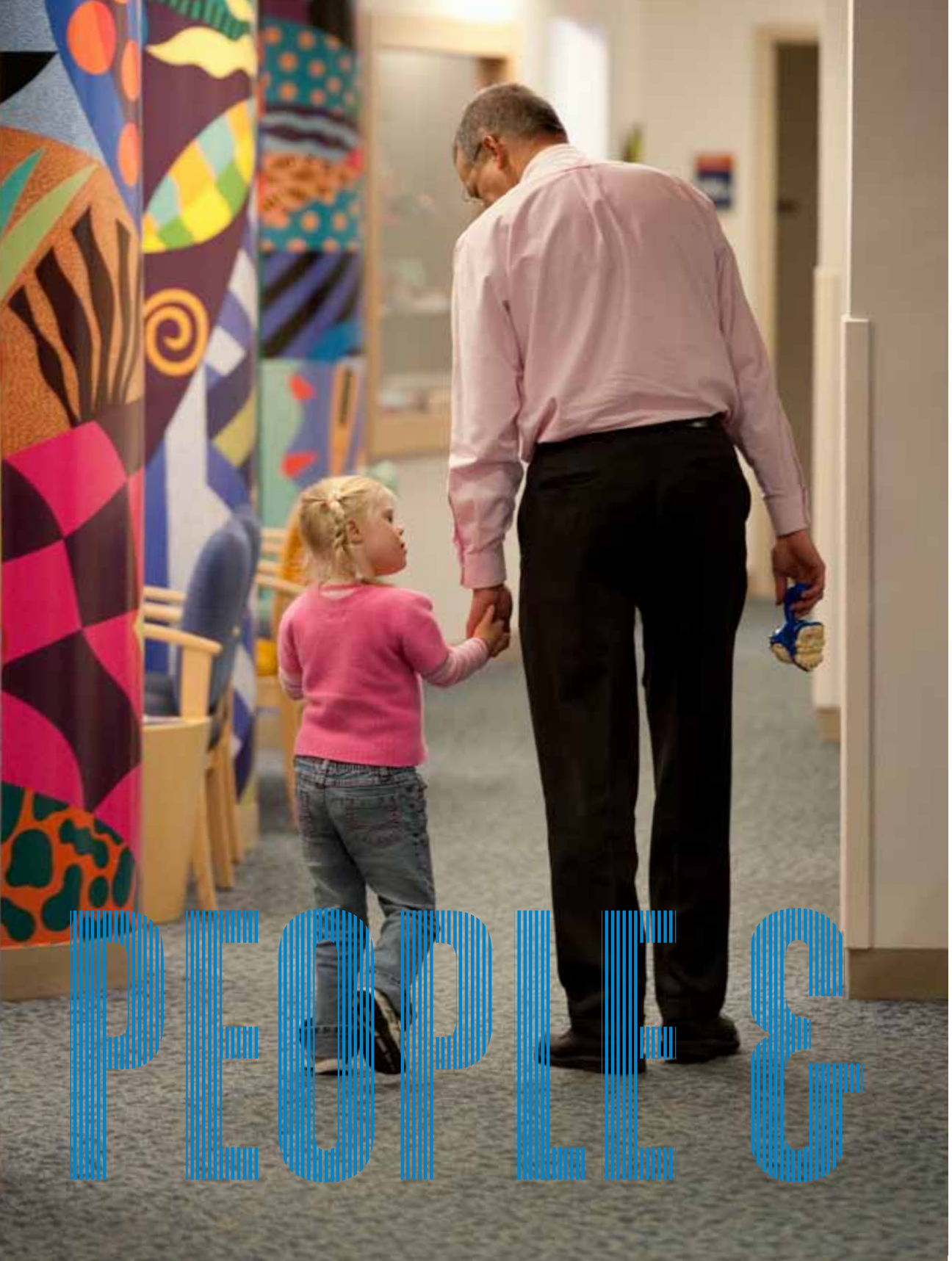
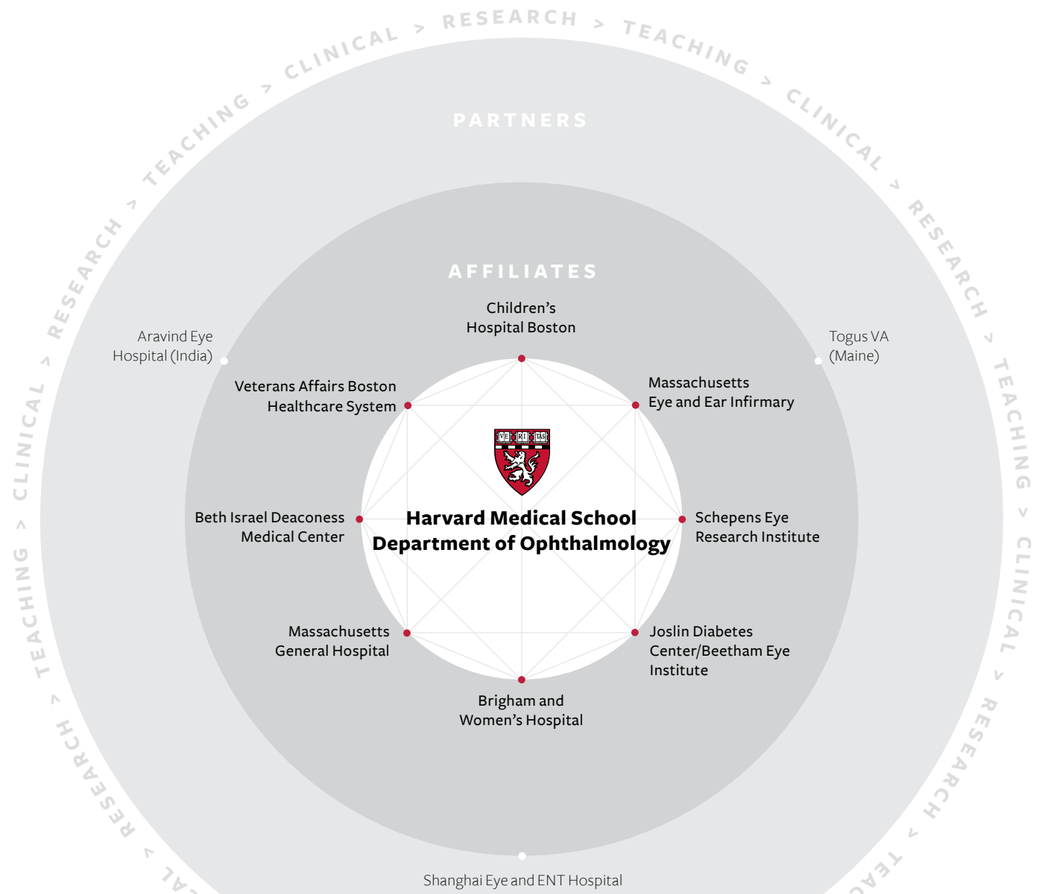


# PEOPLE OF

"Academic medical institutions like the HMS Department of Ophthalmology attract an intellectually curious faculty—individuals who push the boundaries of medicine and science in their often tenacious pursuit of answers."
—Janey Wiggs, MD, PhD, Associate Director of the Howe Laboratory, Massachusetts Eye and Ear Infirmary




# PARTNERS

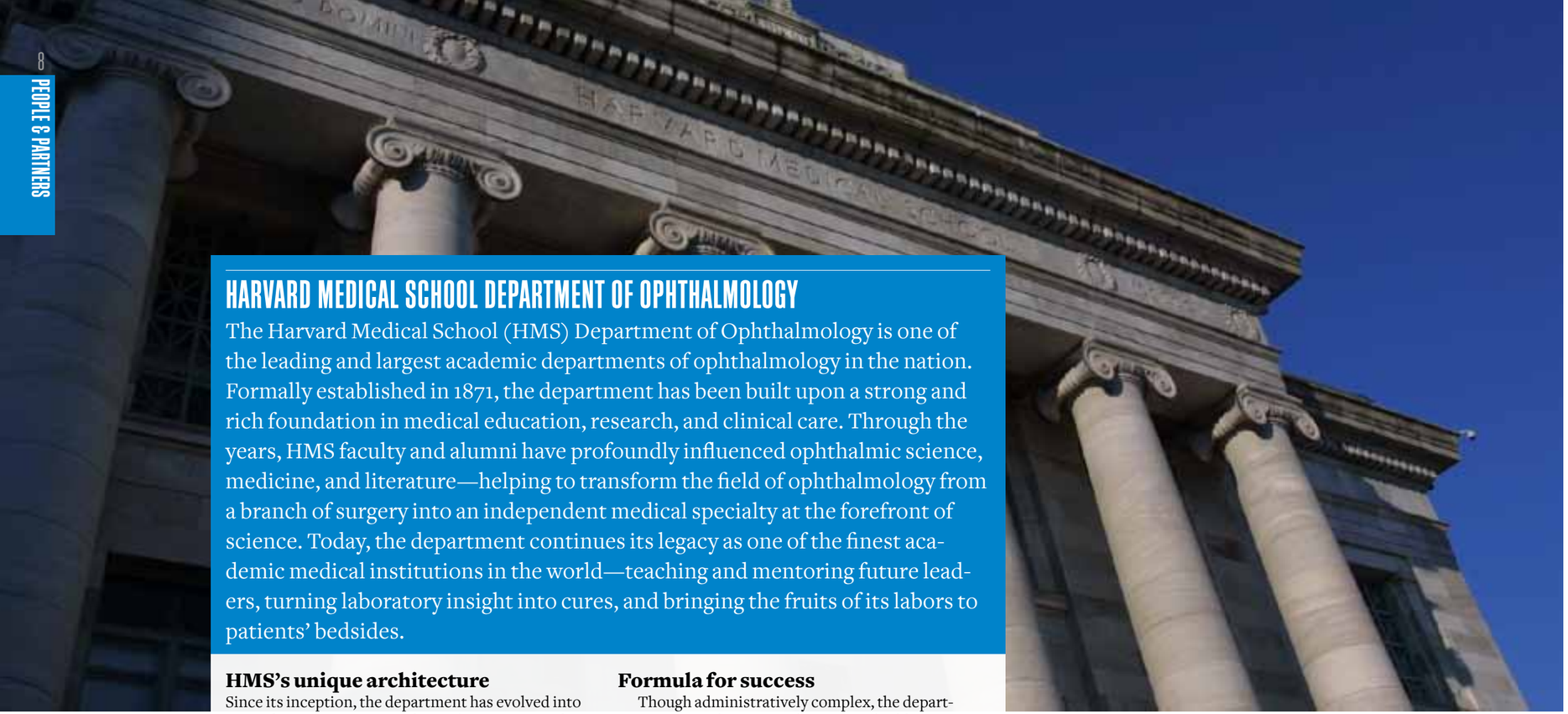


Photo: Harvard Medical School

# HARVARD MEDICAL SCHOOL DEPARTMENT OF OPHTHALMOLOGY

The Harvard Medical School (HMS) Department of Ophthalmology is one of the leading and largest academic departments of ophthalmology in the nation. Formally established in 1871, the department has been built upon a strong and rich foundation in medical education, research, and clinical care. Through the years, HMS faculty and alumni have profoundly influenced ophthalmic science, medicine, and literature—helping to transform the field of ophthalmology from a branch of surgery into an independent medical specialty at the forefront of science. Today, the department continues its legacy as one of the finest academic medical institutions in the world—teaching and mentoring future leaders, turning laboratory insight into cures, and bringing the fruits of its labors to patients' bedsides.

## HMS's unique architecture

Since its inception, the department has evolved into an academic institution with a multi-institutional structure and a broad base of clinicians and scientists. This decentralized structure is unique among other U.S. academic medical schools, which are typically integrated—physically and financially—into their affiliated universities. Unlike other medical schools, HMS does not own a teaching hospital; instead, the school comprises a network of formal hospital and research affiliations that provide the teaching, training, and research facilities for medical and graduate education. Through a system of faculty titles and cross-appointments, the hospitals and the school are closely linked.

The HMS Department of Ophthalmology is comprised of 140 full-time faculty members who carry out the majority of the department's teaching, research, and patient care activities. An additional 95 faculty members (mostly private practitioners) hold part-time HMS faculty appointments in ophthalmology and participate in various academic endeavors of the department.

Throughout the years, the department's ophthalmic network has grown in both scope and intellect. The department has recruited some of the finest clinician scientists in ophthalmology, and established key affiliations with many of the world's leading academic medical schools and research institutions. These affiliations have added significant depth and breadth to the department's core capabilities, and have created a rich and robust infrastructure steeped in multidisciplinary investigations, educational collaborations, and clinical enterprises.

## Formula for success

Though administratively complex, the department's network structure has proven highly successful for a variety of reasons. Affiliates and partners are firmly united in their commitment to educational excellence. Stimulating residency and fellowship opportunities abound throughout the HMS network—offering broad clinical and surgical exposure, as well as rewarding mentorship opportunities, to the faculty and trainees. The collaborative environment also supports a wide array of preclinical and clinical research, and inspires robust scientific partnerships among divergent yet complementary research programs; these unified efforts have led to landmark advances in patient care, many of which are highlighted in this report. Collectively, the broad clinical expertise and deep fund of knowledge allows the Department of Ophthalmology to provide sophisticated diagnostic and therapeutic care for patients, thus ensuring the best possible outcomes.

The Department of Ophthalmology also wholeheartedly embraces the vast diversity of the HMS community, which forms the intellectual backbone of the department. Students and faculty, who represent a myriad of geographical and cultural backgrounds, and are selected based on their accomplishments and future potential. Women represent 45 percent of the full-time faculty, and fill numerous senior-level positions within the department, including Chair. In no small way, the cultural and academic diversity of the HMS community prepares the students and faculty to lead with fresh vision and purpose as they take on the challenges of an increasingly global healthcare environment.

## HMS Ophthalmology historic milestones

**1869** Henry Willard Williams, AM, MD, presents at HMS the first course of lectures ever given in an American medical school by an ophthalmologist. Two years later, he is appointed to Professor of Ophthalmology, marking the formal establishment of the HMS Department of Ophthalmology in 1871.

**1891** Williams' successor, Oliver Fairfield Wadsworth, AM, MD, joins the staff of the Massachusetts Charitable Eye & Ear Infirmary (established in 1824). Soon after, the hospital becomes the hub of Harvard's ophthalmic training.

**1891** Benjamin Joy Jeffries, AM, MD, establishes one of the first ophthalmic pathology laboratories in the U.S., at Mass. Eye and Ear. In 1982, the lab is dedicated to renowned HMS ophthalmologist and alumnus, David G. Cogan, MD.

**1926** Frederick H. Verhoeff, MD, HMS Professor of Ophthalmology and Mass. Eye and Ear's first full-time researcher and pathologist, establishes the first endowed ophthalmic research unit, the Howe Laboratory, at Mass. Eye and Ear.

**1949** The world's first retina service, and first retinal disease fellowship, is established at Mass. Eye and Ear by famed HMS retinal pioneer and innovator, Charles L. Schepens, MD. Dr. Schepens is also credited with establishing the vitreoretinal subspecialty.

**1958** Claes H. Dohlman, MD, PhD, considered to be the founder of modern corneal science, establishes the world's first organized cornea subspecialty, and the first structured cornea fellowship program at Mass. Eye and Ear.

**1966** Deborah Pavan-Langston, MD becomes the first woman to be accepted into the HMS Ophthalmology residency program. Unlike her male colleagues, Dr. Langston is required to complete a two-year pre-residency fellowship. In 1973, she is appointed the first woman director of Mass. Eye and Ear's Cornea and External Disease Service.

**1974** The Berman-Gund Laboratory for the Study of Retinal Degenerations formally opens. The laboratory was conceived as a multi-disciplined research effort between Mass. Eye and Ear and Harvard with the goal of understanding the disease mechanisms involved in retinitis pigmentosa and the more than 30 related diseases that affect the retina.

**2003** Joan W. Miller, MD, is named Chair of the HMS Department of Ophthalmology and Chief of Ophthalmology at Mass. Eye and Ear. She is the first woman to hold this dual role.

# HMS OPHTHALMOLOGY VICE CHAIRS

## John I. Loewenstein, MD

Vice Chair for Medical Education, Department of Ophthalmology, Harvard Medical School

Associate Professor of Ophthalmology, Harvard Medical School

Director, Department of Ophthalmology Residency Training Program, Harvard Medical School

Associate Chief for Graduate Medical Education and Associate Clinical Chief of Ophthalmology, Massachusetts Eye and Ear Infirmary

A graduate of Massachusetts Institute of Technology, Dr. John Loewenstein received his medical degree from the State University of New York at Buffalo and completed his ophthalmology residency at Boston University (BU) School of Medicine. This was followed by a two-year clinical and research fellowship at BU. He initially joined the HMS Department of Ophthalmology as a part-time member of the Retina Service at Mass. Eye and Ear while continuing to practice privately in the Boston area. After a decade, he missed teaching and the academic environment, and in 1994, was invited to join Mass. Eye and Ear/HMS as a full-time faculty member of the Retina Service. He quickly became an integral part of the training program for medical students, residents, and fellows.

In 1996 and 2001, Dr. Loewenstein earned high accolades from HMS ophthalmology residents who honored him as Teacher of the Year. He was also a 2007 nominee for the HMS Prize for Excellence in Teaching. In 2002, with the vigorous support and unanimous approval from residents and administration alike, Dr. Loewenstein was named Director of the Residency Program. A gifted teacher, clinician, surgeon, and manager, Dr. Loewenstein has used his exceptional abilities to enhance the residency program in numerous ways. He has modified and streamlined residency rotations to improve continuity of experience, and to maximize clinical and surgical teaching. He has collaborated with colleagues at the Boston Veterans Administration Hospital to enhance the resident experience, and strengthened communication and feedback among HMS' affiliated teaching hospitals. He is also a strong advocate of achieving progress through collaboration; in this regard, he chairs a biweekly Residency Steering Committee meeting, which provides residents and faculty with a forum where they may address concerns and brainstorm about continuous improvements to the program.

Together with Associate Residency Program Director, Carolyn Kloek, MD, Dr. Loewenstein has created a structured surgical curriculum that enhances the overall training experience for residents. This invigorated curriculum includes faculty-proctored wet labs in cataract surgery, retinal surgery, glaucoma surgery, cornea surgery, and oculoplastics surgery. A step-wise introduction to phacoemulsification (cataract surgery) boosts cognitive learning and reduces resident stress, and a state-of-the-art virtual reality eye surgery simulator enables residents to practice and hone their surgical skills.

In 2008, Dr. Loewenstein was appointed Vice Chair for Medical Education. In this expanded educational role, he continues to cultivate and fine-tune the HMS Residency Program and works closely with the Fellowship Committee Chair to coordinate fellowships across HMS affiliate sites. He also collaborates with the Director of Medical Student Education and the Vice Chair of Academic Programs to identify new educational initiatives and program improvements. Since becoming Vice Chair, he has pursued a strategic vision that ensures a cohesive, challenging, and inspiring experience for students at every level of their medical education.

Dr. Loewenstein has pioneered revolutionary teaching tools to improve surgical competency in ophthalmology. Beginning in 2003, he collaborated with colleagues and experts in cognitive psychology, computer programming and ophthalmology to develop an interactive, computer program for teaching the complex art of cataract surgery. This virtual surgical tool, called the Mass. Eye and Ear Cataract Surgery Mentor, allows residents to gain critical cognitive skills in a safe, forgiving environment and eliminates risk to patients. So far, eight of 10 modules on phacoemulsification have been completed. Current efforts focus on developing the remaining modules and establishing licensing agreements to distribute the program to residents nationwide.

Dr. Loewenstein's newest initiative in resident education development is a formal study of the effect of trainee fatigue on surgical learning. Working with Drs. Carolyn Kloek, James Gordon, Director of the Gilbert Program in Medical Simulation at HMS, and Charles Czeisler, Stephen Lockley, and Brian Abaluck from the sleep medicine program at HMS and Brigham and Women's Hospital, he is evaluating retention of surgical learning in rested and sleep-deprived states using a commercial, virtual reality eye surgery simulator. He is also developing a computer-based training tool to teach residents, fellows, and practicing ophthalmologists how to screen for retinopathy of prematurity (ROP), a disease that can cause premature infants to go blind. For this effort, he is collaborating closely with Dr. Rodrigo Alvarez and other clinicians who have expertise in ROP, and leveraging the techniques used to develop the Mass. Eye and Ear Cataract Surgery Mentor.

# Reza Dana, MD, MPH, MSc

Vice Chair for Academic Programs, Department of Ophthalmology, Harvard Medical School

Claes H. Dohlman Professor of Ophthalmology, Harvard Medical School

Associate Chief for Academic Programs and Director of Cornea and Refractive Surgery Service, Massachusetts Eye and Ear Infirmary

Co-Director of Research, Senior Scientist, and W. Clement Stone Scholar, Schepens Eye Research Institute

Dr. Reza Dana is a leading international expert in corneal and ocular inflammation, and his studies have greatly elucidated the cellular and molecular mechanisms of ocular surface biology. Dr. Dana has made substantial contributions to the bodies of knowledge in both basic science and clinical research.

After receiving college-preparatory education at St. Paul's School in Concord, New Hampshire, Reza Dana pursued his baccalaureate degree at Johns Hopkins University School of Arts and Sciences, where he was elected to Phi Beta Kappa. Dr. Dana continued his postgraduate training at Johns Hopkins, where he received both his MPH and MD degrees. He performed his residency in ophthalmology at the Illinois Eye and Ear Infirmary in Chicago, followed by a clinical fellowship in cornea and external diseases at Wills Eye Hospital in Philadelphia. Dr. Dana then received additional fellowship training in immunology and uveitis at Mass. Eye and Ear, and in ocular immunology and transplantation at Schepens Eye Research Institute.

Dr. Dana was appointed Instructor in the Department of Ophthalmology at HMS in 1995; he ascended to the rank of Assistant Professor in 1997, Associate Professor in 2000, and Professor and Claes Dohlman Chair in Ophthalmology in 2007. At Schepens, Dr. Dana was appointed as Associate Scientist in 2000, the W. Clement Stone Scholar in 2002, and Senior Scientist in 2004. With numerous ongoing projects in his laboratory and multiple collaborations with other researchers, Dr. Dana is rapidly expanding his list of scientific accomplishments and publications—with over 270 publications, including 175 peer-reviewed articles to date. In addition to leading laboratory research, Dr. Dana has served on the Cornea and Refractive Surgery Service of Mass. Eye and Ear since 1996.

In 2005, Dr. Dana earned his MSc degree in Health Care Management from Harvard University; this, complemented by his scientific and clinical expertise, gives Dr. Dana a unique capacity for leadership. As Director of the Cornea and Refractive Surgery Service at Mass. Eye and Ear, a position he has held since 2006, Dr. Dana leads the world's largest and most esteemed group of clinician-scientists dedicated to cornea research and treatment. Dr. Dana became Vice Chairman of Academic Programs in the Department of Ophthalmology at HMS in 2008, and was named Co-Director of Research at Schepens in 2009. With leadership appointments at both Mass. Eye and Ear and Schepens, Dr. Dana has promoted collaborative efforts in translational research between the two institutions. Committed to the advancement of clinician scientists, Dr. Dana is a Principal Investigator of the Harvard Vision Clinical Scientist Development Program funded by the NIH, and has helped provide unparalleled training opportunities for junior investigators.

In addition to publishing numerous original research articles in top-tier scientific journals such as *Nature Medicine, Proceedings of the National Academy of Sciences,* and *Journal of Clinical Investigation*, Dr. Dana is dedicated to the dissemination of scientific knowledge. He serves on the editorial board of journals such as *Cornea, Investigative Ophthalmology and Visual Science, Ophthalmologica,* and *The Ocular Surface*. He has served as Editor of the Eye and Systemic Disease volume of *The Principles and Practice of Ophthalmology*, and as Senior Editor of *The Encyclopedia of the Eye,* published in 2010 by Elsevier.

Dr. Dana has delivered more than 120 invited and named lectures, and has been the recipient of multiple awards, including the William and Mary Greve Special Scholar Award and the Physician-Scientist Merit Award from Research to Prevent Blindness (RPB). In 2009, he was honored with the Lew R. Wasserman Award from RPB. Dr. Dana's honors also include the Achievement Award of the American Academy of Ophthalmology, the Cogan Award of the Association for Research in Vision and Ophthalmology, and the Alcon Research Institute Award.

# Patricia D'Amore, PhD, MBA

Vice Chair for Basic Research, Department of Ophthalmology, Harvard Medical School

Professor of Ophthalmology, Harvard Medical School

Professor of Pathology, Harvard Medical School

Co-Director of Research, Senior Scientist, and Ankeny Scholar of Retinal Molecular Biology, Schepens Eye Research Institute

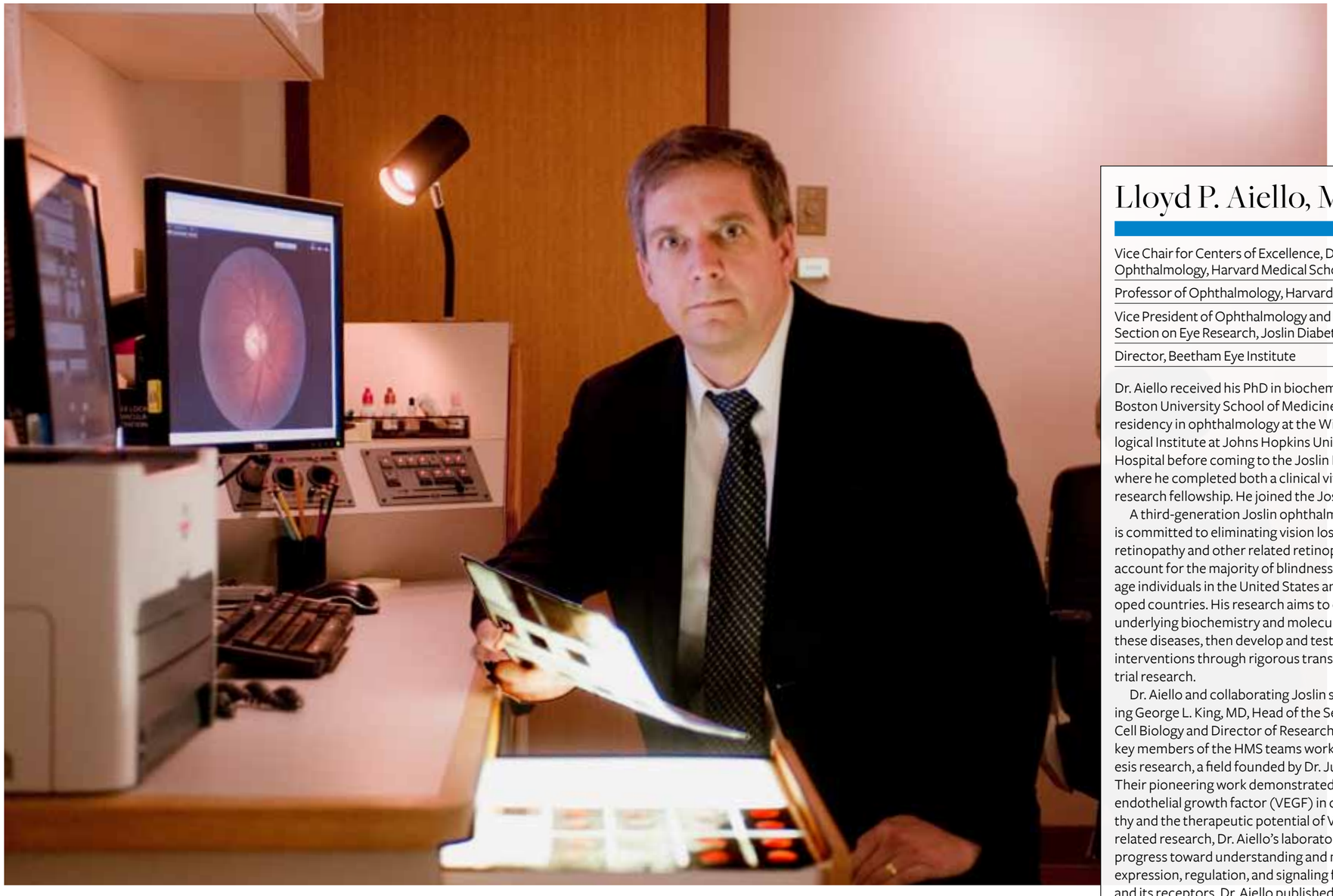
Dr. Patricia D'Amore is an internationally recognized expert of vascular growth and development, and has been at the forefront of angiogenesis research for over three decades. Investigations conducted in her laboratory have helped form the foundations of vascular-targeting therapies, which are currently used to treat various cancers and vascular diseases of the eye. Dr. D'Amore's studies have also uncovered important physiological roles of vascular growth factors—yielding crucial insight into the safe use of antiangiogenic therapies.

Dr. D'Amore received her PhD in biology from Boston University in 1977. She went on to conduct postdoctoral research in the Department of Ophthalmology and the Department of Physiological Chemistry at Johns Hopkins University School of Medicine. There, she was appointed Instructor in 1979 and Assistant Professor in 1980. Dr. D'Amore returned to Boston in 1981 to join Dr. Judah Folkman at Children's Hospital, where she has since served as a Research Associate in the Department of Surgery. At HMS, Dr. D'Amore became Associate Professor of Pathology in 1989, and was promoted to Professor of Ophthalmology (Pathology) in 1998. Dr. D'Amore also joined Schepens Eye Research Institute as a Senior Scientist in 1998, where she is the Ankeny Scholar of Retinal Molecular Biology.

To complement her scientific achievements, Dr. D'Amore obtained her MBA degree from Northeastern University in 1987, and has parlayed her knowledge and superb management skills into numerous leadership roles. Since 2001, Dr. D'Amore has served as Co-Chair of the Program in Development in Angiogenesis, Invasion & Metastasis at the Dana Farber/Harvard Cancer Center. At Schepens, she was appointed Associate Director of Research in 2002, and assumed the role of Co-Director of Research in 2009. In 2008, Dr. D'Amore became HMS Ophthalmology Vice Chair of Basic Research.

Over 50 predoctoral students and postdoctoral fellows have benefitted from the outstanding teaching and thoughtful mentorship of Dr. D'Amore. At HMS, Dr. D'Amore serves on numerous committees that promote educational and research opportunities for future and established scientists; these include but are not limited to the Minority Recruitment Committee, Joint Committee on the Status of Women, Faculty Committee on Student Research, Summer Honors Undergraduate Research Program (SHURP), Henry K. Beecher Prize in Medical Ethics Committee, Selection Committee for the Eleanor and Miles Shore Fellowship Program for Scholars in Medicine, and the Faculty Diversity Committee. Since 2003, Dr. D'Amore has served as Co-Director Director of the Leder Human Biology & Translational Medicine Program at HMS. For her efforts in training future leaders in research, Dr. D'Amore was honored in 2006 with the A. Clifford Barger Excellence in Mentoring Award.

Dr. D'Amore is also committed to fostering scientific discussion and communication. She founded the Boston Angiogenesis Meeting, now in its 13th year; this meeting continues to be a highly regarded forum for presenting new findings and promoting collaboration, understanding, and advancement in angiogenesis research. She has held editorial roles for many scientific journals, including Executive Editor of *Experimental Eye Research*, Associate Editor of *American Journal of Pathology*, and Editor-in-Chief of *Microvascular Research*. For her scientific and academic achievements, Dr. D'Amore was elected to The Academy at Harvard Medical School in 2004, and received the Senior Scientific Investigator Award from Research to Prevent Blindness in 2006. In 2009, she was elected a Gold Fellow by the Association for Research in Vision and Ophthalmology. Dr. D'Amore delivered the 2010 Isner Lecture for the Jeffrey M. Isner Endowed Memorial Lectureship, a venue for cutting-edge, thought-provoking discussions on basic and translational research. She is also the recipient of the 2012 Rous-Whipple Award from the American Society of Investigative Pathology.



# Lloyd P. Aiello, MD, PhD

Vice Chair for Centers of Excellence, Department of Ophthalmology, Harvard Medical School

Professor of Ophthalmology, Harvard Medical School

Vice President of Ophthalmology and Head of Joslin's Section on Eye Research, Joslin Diabetes Center

Director, Beetham Eye Institute

Dr. Aiello received his PhD in biochemistry and MD from Boston University School of Medicine. He completed residency in ophthalmology at the Wilmer Ophthalmological Institute at Johns Hopkins University and Hospital before coming to the Joslin Diabetes Center, where he completed both a clinical vitreoretinal and a research fellowship. He joined the Joslin staff in 1994.

A third-generation Joslin ophthalmologist, Dr. Aiello is committed to eliminating vision loss due to diabetic retinopathy and other related retinopathies, which account for the majority of blindness among working-age individuals in the United States and other developed countries. His research aims to determine the underlying biochemistry and molecular mechanisms of these diseases, then develop and test novel therapeutic interventions through rigorous translational and clinical trial research.

Dr. Aiello and collaborating Joslin scientists—including George L. King, MD, Head of the Section on Vascular Cell Biology and Director of Research at Joslin—were key members of the HMS teams working on angiogenesis research, a field founded by Dr. Judah Folkman. Their pioneering work demonstrated the role of vascular endothelial growth factor (VEGF) in diabetic retinopathy and the therapeutic potential of VEGF inhibitors. In related research, Dr. Aiello's laboratory made significant progress toward understanding and manipulating the expression, regulation, and signaling functions of VEGF and its receptors. Dr. Aiello published the first evidence that protein kinase C-beta (PKC-beta) is involved in excessive blood vessel growth and vascular leakage in diabetic retinopathy. The team went on to develop a PKC-beta inhibitor that interrupts the actions of this protein—thus opening a new therapeutic avenue for diabetic and other retinopathies.

Dr. Aiello is recognized internationally for his leadership in diabetic retinopathy research. In 2002, he founded and served as the inaugural chair for the Diabetic Retinopathy Clinical Research Network (DRCR.net), a national collaborative network dedicated to facilitating multi-center clinical research for diabetic retinopathy, diabetic macular edema, and related disorders. Funded by the National Eye Institute, DRCR.net is now comprised of 150 centers nationwide representing academic medical institutions and private practice groups.

In 2008, Dr. Aiello was named Vice Chair for Centers of Excellence (COE) in the HMS Department of Ophthalmology. These centers are designed to coordinate the department's efforts in patient care, research, and training in key areas of ophthalmology in order to leverage the expertise and core strengths of faculty across affiliates. As Vice Chair, Dr. Aiello brings a wealth of collaborative insight, experience and energy to this role. Initial COE targets include diabetic eye disease, AMD, cornea, and glaucoma.

Dr. Aiello is the author of over 130 original papers and 215 publications, including contributions to the *New England Journal of Medicine, Nature Medicine, PNAS, Journal of Biological Chemistry, Journal of Clinical Investigation, Diabetes, Lancet*, and many others covering a wide range of topics in diabetic eye disease. Dr. Aiello has received 40 national and international awards and honors, including the Alcon Research Institute Award, the ARVO/Pfizer Ophthalmics Translational Research Award, the Award of Merit in Retina Research from the Retina Society, the Senior Achievement Award from the American Academy of Ophthalmology, the Charles Schepens Award in Research, the Outstanding Foreign Investigator Award from the Japan Society of Diabetic Complications, and the Novartis Award in Diabetes. The Research to Prevent Blindness Foundation has awarded Dr. Aiello the Dolly Green Scholar Award, the Special Research Scholar Award, and the Lew R. Wasserman Merit Award; from the Macula Society, Dr. Aiello has received the Rosenthal Foundation Award and the Paul Henkind Memorial Award.

## David G. Hunter, MD, PhD

Vice Chair for Promotions and Reappointments, Department of Ophthalmology, Harvard Medical School

Professor of Ophthalmology, Harvard Medical School

Richard Robb Chair of Ophthalmology, Children's Hospital Boston

Ophthalmologist-in-Chief, Children's Hospital Boston

Dr. Hunter received his MD and PhD degrees at Baylor College of Medicine, and completed an ophthalmology residency at Mass. Eye and Ear Infirmary/HMS. Dr. Hunter furthered his training with a pediatric ophthalmology fellowship at Wilmer Eye Institute of Johns Hopkins Medical School, where he joined the faculty in both Ophthalmology and Biomedical Engineering. He returned to HMS in 2002 as Ophthalmologist-in-Chief of Children's Hospital.

During his tenure, Dr. Hunter has encouraged both clinical excellence and research innovation within the Ophthalmology division at Children's. He created the first International Fellowship in Pediatric Ophthalmology, and led the development, initiation, and funding of the Children's Hospital Boston Visiting Professorship lecture series. Since its establishment in 2006, this lecture series has brought four to six internationally recognized visiting professors to Boston each year.

A devoted mentor and teacher, Dr. Hunter was nominated for the Harvard Medical Student Teaching Award in 2004, and received the Robert Petersen Pediatric Ophthalmology teaching award in 2005. As HMS Vice Chair for Promotions and Reappointments, Dr. Hunter facilitates the academic advancement of department faculty across all HMS affiliates. He also has added to the wealth of academic strength and collaboration within the Department by rigorously recruiting faculty with dual fellowship training—combining pediatric ophthalmology and subspecialty training in neuro-ophthalmology and oculoplastics.

Dr. Hunter is best known for his expertise in complex strabismus (misalignment of the eyes) in adults and children. He is exploring and publishing innovative techniques in strabismus surgery, including the "short tag noose" adjustable suture and transposition procedures for paretic strabismus. His research also focuses on developing more accurate ways to help pediatricians identify eye problems in children.

In collaboration with Elizabeth Engle, MD, HMS Professor of Neurology and Ophthalmology, Dr. Hunter has established new clinical systems and protocols for studying the genetics of common strabismus disorders, including simple esotropia, exotropia and anisometropic amblyopia. These new protocols—which include clinical exams and sampling of affected and non-affected family members to ensure proper phenotyping—will serve as models for ongoing and future genetic studies at HMS affiliates.

A preeminent expert in optics and refraction, Dr. Hunter delivers lectures worldwide and via podcast; he has also authored numerous scientific articles, editorials, and book chapters. He co-authored *Last Minute Optics,* a widely used optics review book, and serves as Editor-in-Chief of *Journal of the American Association for Pediatric Ophthalmology and Strabismus*. For his outstanding contributions to clinical ophthalmology, Dr. Hunter has received numerous honors, including the Richard Starr Ross Clinician Scientist Award from Johns Hopkins University and the Research to Prevent Blindness Lew R. Wasserman Merit Award.

# AFFILIATES & PARTNERS

## MASSACHUSETTS EYE AND EAR INFIRMARY

Founded in 1824, the Massachusetts Eye and Ear Infirmary is a pre-eminent specialty, teaching, and research hospital caring for disorders of the eye, ear, nose, throat, head, and neck. Mass. Eye and Ear is the main primary and tertiary care facility of the HMS Department of Ophthalmology, and the hub of its teaching and research activities. The hospital's dedicated staff provides a full range of primary and subspecialty medical and surgical care to nearly 225,000 patients each year, and serves as a major referral center throughout the northeast. With a medical staff that tops nearly 130 full-time physicians and some 325 community-based physicians, Mass. Eye and Ear encourages multi-disciplinary and interdisciplinary pursuits across patient care, education, and research. Seminal contributions to these three mission-critical areas span nearly a two hundred year history and have shaped the hospital's reputation and success as a national and global center of excellence in ophthalmology and otolaryngology.

In 2011, the Schepens Eye Research Institute became a member of the Massachusetts Eye and Ear Foundation—forming the world's largest and most robust basic and clinical ophthalmology research enterprise. Both institutions are long-time collaborators in vision research,with complementary areas of expertise and technology. Together, this scientifically rich and diverse union is uniquely primed to solve the problems of and to find cures for blinding diseases.

### Educating future leaders in ophthalmology

As the flagship academic center for the HMS Department of Ophthalmology, Mass. Eye and Ear is deeply committed to providing a superb education and an exciting, fruitful learning experience to the next generation of ophthalmology health care leaders. Innovative medical training programs prepare young physicians and scientists to excel as leaders in today's increasingly complex and global health care environment. Broad clinical and surgical exposure, a first-rate mentoring program, and unparalleled research opportunities combine to offer a world class medical education experience. Each year, the department's progressive training programs attract 600+ of the highest-caliber physician applicants from around the world to match its eight residency and 14 fellowship positions.

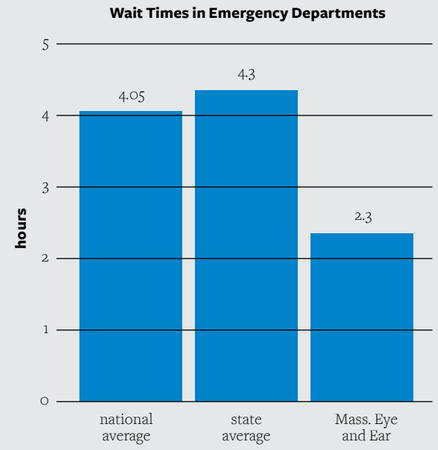
Graduates of the department's training programs are well prepared to be tomorrow's leading clinicians, researchers, and academicians. In fact, a significant number of graduating residents—nearly 60 percent—pursue academic careers after fellowship rather than establishing a full-time private practice. Today, about one in six ophthalmology chairmen in academic institutions across the United States and Canada are HMS postdoctoral alumni—striking testimony to the caliber of the department's graduates and the strength of its programs.

### Thriving patient care

Mass. Eye and Ear strives to enhance every patient's quality of life by providing the best possible care. Central to this mission is the hospital's highly skilled and compassionate team of physicians, many of whom are global leaders in their fields of specialty. Every physician specializes in at least one area of ophthalmic care; some physicians are cross-trained in multiple specialties, and nearly all have completed subspecialty fellowship training. Most conduct active laboratory and/or clinical research programs; this knowledge contributes immeasurably to their clinical, surgical, and diagnostic expertise. The talented faculty, together with scientifically advanced medical care and dedicated support staff, keeps Mass. Eye and Ear at the forefront of care.

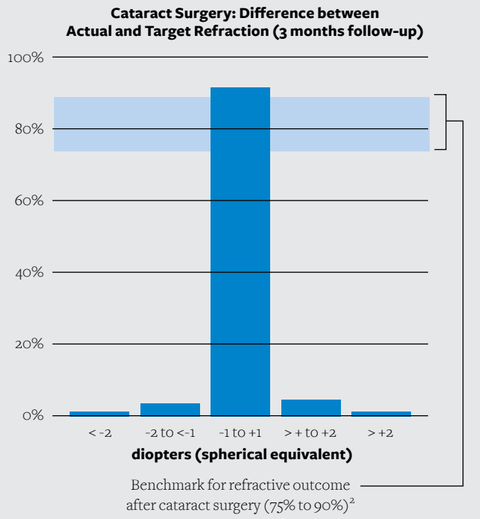
**Mass. Eye and Ear's 2010 Quality and Outcomes report highlights several benchmark standards for patient care.**

Mass. Eye and Ear's 24/7 dedicated **Eye Emergency Department** (**ED**) is the only specialized facility of its kind in New England, and provides care to over 12,000+ patients every year for a wide array of urgent ophthalmic issues. The ED has earned a stellar reputation as one of the most efficient emergency departments in the country. Compared to data from the 2009 Press Ganey Emergency Department Pulse Report, the average wait time at Mass. Eye and Ear to see an ophthalmologist in the ED is almost half the average of state and national wait times.



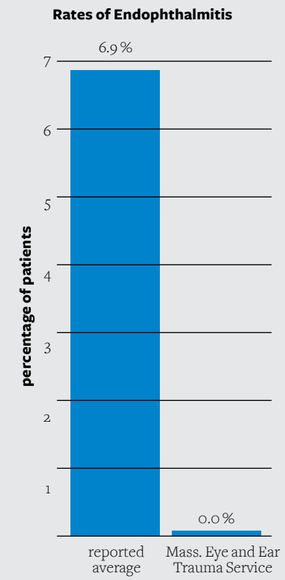

*N* = 12,239

**The Comprehensive Ophthalmology and Cataract Consultation Service** (**COS**) handles more than 20,000 patient visits each year. In addition to serving walk-in patients, COS serves as a key resource for ophthalmic referrals from the HMS network of 17 hospitals and affiliates, as well as referrals from private practitioners from all over New England. The service specializes in cataract extraction with intraocular lens implantation. Between July 2008 and June 2009, COS performed 974 cataract surgeries at Mass. Eye and Ear's main Boston campus. Surgical results exceeded national and international benchmarks (*Cataract and Refractive Surgery Today* Europe, May 2009, and Cole Eye Institute, Outcomes 2008) with 92 percent of patients achieving within 1 diopter of target refraction after surgery.




*N* = 974

Mass. Eye and Ear's **Eye Trauma Service** has developed highly successful, standardized protocols for treating emergency eye injuries. According to a recent review of all open globe injury cases treated at Mass. Eye and Ear from January 2000 to July 2007, the post-surgical infection rate of endophthalmitis was less than 1 percent. By comparison, the endophthalmitis rate in the United States is 6.9 percent after open globe repair, according to the U.S. National Eye Trauma Registry. The service also has exceeded benchmark outcomes with some of the lowest enucleation (eye removal) rates nationwide, and some of the lowest rates reported for sympathetic ophthalmia—a devastating and vision-threatening complication that can occur in the non-injured eye after open globe surgery.




*N* = 95

## Best-of-class services spur best outcomes

As a preeminent center of ophthalmic care, Mass. Eye and Ear establishes global standards for quality patient care while pushing the envelope internally to achieve the highest levels of excellence. In 2010, the hospital published its first Quality and Outcomes report, which documented clinical and surgical outcomes data for 13 subspecialty procedures. The initial impetus for this effort was to determine the quality of care and how well the patient experience is managed; ultimately, however, the report also showed that the hospital is leading the medical community in the development of outcomes measures in ophthalmic care.

## Reaching out to patients and partners

In 2008, Mass. Eye and Ear launched a strategic and collaborative plan for growth, which was designed to streamline services and expand its expertise and resources to as many people as possible. Since that time, the hospital has forged several highly successful alliances with its HMS affiliates and partners that will directly benefit patients by nurturing an environment for improved patient care, research activities, and educational programs.

Mass. Eye and Ear has added ophthalmic services in multiple satellite offices beyond Boston's city limits, providing thousands of patients with easy access to world-class care. Mass. Eye and Ear has also established its first teleretinal imaging program in MGH's Chelsea Health Center to screen patients for diabetic eye disease. Numerous expansions and modernizations to its physical facilities—including a new state-of-the-art surgical center, renovated pediatric and rehabilitation suites, and a renovated radiology department with significant equipment upgrades—have added capacity and comfort for patients. In 2010, the hospital kicked off an ambitious expansion plan that will add approximately 50,000 square feet to its central Charles Street clinical facility and a 90,000 square foot research center to its main Boston campus. Additionally, an outpatient surgical center will be developed in Boston's Longwood Medical Area. To support its new service partnerships and department expansions, the hospital has added more than a dozen esteemed physicians and researchers to its full-time staff in just the last two years. Aggressive recruitment efforts are ongoing at Mass. Eye and Ear to keep pace with its accelerated growth.


## Advancing ophthalmic science & discovery

For nearly two centuries, Mass. Eye and Ear faculty members have pioneered advances in ophthalmic medicine and research, many of which have set standards of care in the United States and abroad. The pursuit of knowledge has driven numerous groundbreaking discoveries; scientists have developed new drugs and devices, perfected new techniques, identified disease-causing genes, and translated groundbreaking laboratory research into clinical treatments that benefit scores of people. Today, the department remains at the forefront of discovery, aggressively tackling new areas of research and developing next-generation tools and technologies to combat blinding diseases. Mass. Eye and Ear provides a first-rate setting for scientists who facilitate a broad and aggressive program of basic, translational, and clinical research. Key areas of study focus on retinal degenerations, (including age-related macular degeneration and retinitis pigmentosa), glaucoma, Keratoprosthesis, corneal infections and ocular tumors. During the last several years, the department also has made significant inroads in the specialty areas of ocular genetics, regeneration, and repair.

## Bringing personalized medicine to Mass. Eye and Ear

Delivering highly targeted care to patients based on their unique genetic makeup is now an exciting possibility thanks to modern genomics and powerful new computing technologies. At Mass. Eye and Ear, transforming the hope of personalized medicine into a 21st century reality is now a vigorous focus of the department. In 2011, the department launched the Ocular Genomics Institute, which combines clinical information from a patient's electronic medical records and clinical samples from Mass. Eye and Ear's expanding biobank. Relating clinical information to tissue and DNA samples, coupled with advanced DNA sequencing and analysis technologies, will allow investigators to unravel disease mechanisms and develop new interventions at an accelerated pace. The department's ten-year goal is to have personal genome sequences embedded into the electronic medical records of the nearly 200,000 patients treated annually at Mass. Eye and Ear.

### Eric Pierce, MD, PhD

Lecturer on Ophthalmology, Harvard Medical School

Associate Director, Berman-Gund Laboratory for the Study of Retinal Degenerations, Massachusetts Eye and Ear Infirmary

Director, Ocular Genomics Institute, Massachusetts Eye and Ear Infirmary

Dr. Pierce, a clinician, educator, and preeminent leader in the area of retinal degenerations, recently joined Mass. Eye and Ear and HMS as Associate Director of the Berman-Gund Laboratory for the Study of Retinal Degenerations. As Director of the new Ocular Genomics Institute, he will direct the Genetic Therapies Program—accelerating the department's growth into advanced studies in genomic research and gene therapy. Dr. Pierce is working in close collaboration with Berman-Gund Laboratory Director Eliot L. Berson, MD, and Janey Wiggs, MD, PhD, who directs the Genetic Diagnostics section of the Institute.

Dr. Pierce's scientific efforts have resulted in groundbreaking ways to address retinal degenerations using genetic sequencing and gene therapy methods. Recently, he has used next-generation DNA sequencing to identify new retinal degeneration disease genes and to improve genetic testing for patients with inherited retinal degenerative disorders. He has also demonstrated that it is critical to functionally test DNA sequence variants to accurately identify specific disease-causing mutations. Dr. Pierce is also applying his genetic expertise to therapeutic discovery and helped demonstrate the safety and efficacy of gene therapy for the RPE65 genetic form of Leber congenital amaurosis, an early onset form of retinal degeneration.

Dr. Pierce earned a PhD in biochemistry at the University of Wisconsin-Madison and his MD at HMS/MIT Health Sciences and Technology Division. He completed his ophthalmology residency at Mass. Eye and Ear/HMS, followed by a combined research-clinical fellowship in pediatric ophthalmology at Children's Hospital Boston. He joined the faculty of Children's Hospital Boston working in clinical care and angiogenesis research for three years before being recruited to the University of Pennsylvania. In 1999, Dr. Pierce joined the F.M. Kirby Center for Molecular Ophthalmology in the Scheie Eye Institute of the University of Pennsylvania School of Medicine. He focused his work on retinal degenerations and was a member of the Division of Ophthalmology at Children's Hospital of Philadelphia, where he attained an appointment as Associate Professor of Ophthalmology.

# SCHEPENS EYE RESEARCH INSTITUTE

In 1947, World War II hero Charles L. Schepens, MD, joined the HMS Howe Laboratory as a research fellow. Recognizing the need for a dedicated eye research organization, Dr. Schepens established the Retina Foundation in 1950, representing a handful of researchers working out of a modest Boston tenement. This collaboration was renamed the Eye Research Institute of Retina Foundation in 1974 to better represent its active research program, and became formally affiliated with HMS in 1991. Today, the Institute bears the name of its influential founder, who is regarded as "the father of retinal surgery." In a cutting-edge facility just a short walk from the main campuses of Mass. Eye and Ear and Massachusetts General Hospital, Schepens researchers advance the understanding of eye disease and facilitate the transfer of scientific knowledge into clinical use. Since its inception, Schepens has trained over 600 postdoctoral fellows and produced nearly 5,000 scientific papers and books on the eye. Schepens Eye Research Institute became a subsidiary of the Massachusetts Eye and Ear Foundation in 2011.

## Leadership

In 1993, J. Wayne Streilein, MD, joined Schepens Eye Research Institute as Ankeny Director of Research. He became President in 1995, and was responsible for the Institute's substantial growth in size and impact. After Dr. Streilein's sudden passing in 2004, renowned microbiologist Michael Gilmore, PhD, was recruited as President and Ankeny Director of Research. Dr. Gilmore led the Institute for five years before joining the Howe Laboratory at Mass. Eye and Ear to focus on research. In 2009, Kenneth Fischer, MBA, was named President and Chief Operating Officer. Co-Directors of Research, Patricia A. D'Amore, PhD, MBA; Reza Dana, MD, MPH, MSc; and Eli Peli, OD, MSc, form the Institute's triumvirate research directorate.

## Unique centers of excellence

Scientific endeavors carried out at Schepens span all levels of research, from developing novel concepts to conducting clinical testing in various forms of eye diseases. Extensive preclinical investigations carried out by Schepens researchers often dovetail with ongoing basic and translational efforts at other HMS affiliates. These collaborations have led to innovative pathways for ocular disease therapies.

To advance these efforts, Schepens has formed distinct Centers of Excellence to streamline the transfer of scientific knowledge to clinical application:

### The Mobility Enhancement and Rehabilitation Center

Directed by Dr. Peli, an expert in vision rehabilitation, the Mobility Enhancement and Rehabilitation Center aims to improve eyesight in visually impaired patients. Researchers are developing novel and innovative techniques to enhance vision—and thus quality of life—for people with various forms of vision loss, including strabismus, amblyopia, age-related macular degeneration (AMD), and hemianopia.

### Center for Corneal & External Eye Disease Research

The interdisciplinary research in the Center for Corneal & External Eye Disease Research focuses on multiple conditions that affect the cornea, such as dry eye disease, corneal dystrophies, infections, and injuries. Dr. Dana, a renowned immunologist and forerunner in corneal research, directs this center, which has helped develop numerous pharmacological treatments and innovative therapeutic methods.

### Center for Age-Related Macular Degeneration (AMD) Research

Among retinal diseases, AMD is of particular concern as it becomes more and more prevalent with increasing life expectancies. Led by Dr. D'Amore, a world-renowned authority in AMD, the Center of Excellence for AMD Research brings together outstanding scientists, engineers, and clinicians to decipher the mechanisms of AMD and combat this growing cause of vision loss.

### Minda de Gunzburg Center for Ocular Regeneration

The Minda de Gunzburg Center for Ocular Regeneration forms an arena for developing revolutionary methods to regenerate eye tissues. Michael Young, PhD, a leading expert in tissue and stem cell transplantation, leads the effort to develop regenerative therapies for various diseases, including AMD, glaucoma, corneal disease, and ocular cancer.

# CHILDREN'S HOSPITAL BOSTON

A leader in pediatric healthcare for more than 130 years, Children's Hospital Boston first opened in 1869 as a 20-bed facility in Boston's South End. Since then, scientists at Children's Hospital have made important contributions in eradicating some of the major illnesses that have threatened young lives. Today, the hospital stands out as a preeminent institution for pediatric care by utilizing cutting-edge research from disciplines such as genomics, proteomics, and informatics. Children's Hospital has also revolutionized treatment options for infections, congenital disorders, and other childhood diseases.

The Department of Ophthalmology at Children's Hospital Boston is the largest group of full-time practicing pediatric ophthalmologists in the United States. Here, children and families receive the most advanced testing and treatment available for all types of visual impairments. Specialized services are available for misaligned eyes (strabismus), cataract and retinal degenerative conditions, as well as comprehensive evaluation and treatment of patients with eye muscle problems or refractive concerns. The Department of Ophthalmology is a collaborative environment that includes clinicians at the top of their field, award-winning principal investigators, and trainees from around the world.

## Innovative treatments for pediatric eye disorders

Led by Ophthalmologist-in-Chief David G. Hunter, MD, PhD, the Ophthalmology Department is known internationally for its innovative techniques in treating difficult pediatric vision problems. Ophthalmologists at Children's Hospital have extensive experience performing cataract extraction and intraocular lens implantation in infants and children. In some cases, Botox (botulinum toxin A) is used in young children to correct strabismus instead of eye muscle surgery. When eye muscle surgery is needed, ophthalmologists can use adjustable sutures, which allow for adjustments to be made in the position of the eye after surgery. Children's is also at the leading edge of treatment for complex strabismus in children, and recently presented a webcast for management of Duane syndrome using transposition surgery and adjustable sutures.

## Multidisciplinary programs

Collaboration is central to the success of Children's Hospital, and multidisciplinary programs allow teams of physicians and scientists with training in different scientific fields to work together to address specific medical problems. Located in the John F. Enders Pediatric Research Laboratories and in the Karp Family Research Laboratories, the Multidisciplinary Programs uniquely


position Children's Hospital to be a pioneer in the applications of vascular biology, bioinformatics, genomics, clinical research, neurobiology, translational research, and stem cell research.

## Expanding partnerships: a model for growth

In 2009, the Department of Ophthalmology of Children's Hospital Boston began a formal relationship in patient care with Mass. Eye and Ear Infirmary and Children's Hospital Ophthalmology Foundation (CHOF). This unique arrangement furthers the mission of both institutions to increase access to patient care in a seamless fashion and integrate training and research programs.

## World-changing research

The research mission of Children's Hospital encompasses clinical research, basic research, postdoctoral training of new scientists and community service programs. With over $225 million in annual funding, Children's Hospital Boston is home to the world's most dynamic research enterprise at a pediatric center. Significant ophthalmologic advancements have been made at Children's in the field of retinopathy of prematurity, revealing the important role of growth factors in this vision-robbing childhood disease. Studies conducted in collaboration with Mass. Eye and Ear have shed new light on the etiology of vision loss in glaucoma, revealing the chain of molecular and cellular events that damage the optic nerve. During the last two decades, intense research at Children's has uncovered some of the genetic underpinnings of strabismus, revealing the underlying genetics of seven inheritable forms of the disorder.

# BEETHAM EYE INSTITUTE AT THE JOSLIN DIABETES CENTER

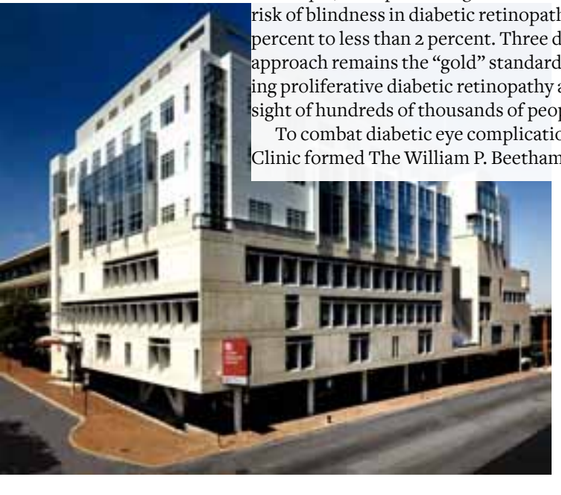
Joslin Diabetes Center is the world's premier diabetes research and clinical care institution, and is dedicated to improving the lives of people with diabetes. Joslin Diabetes Center owes its existence to Elliott Proctor Joslin, MD, who is widely considered to be the pioneer of modern diabetes management. When Dr. Joslin began his private practice in 1898, he became the first physician in the United States to specialize in diabetes—which was still a poorly understood disease with few treatment options. In 1952, Dr. Joslin's practice became formally known as the Joslin Clinic, which moved to its current location in the Longwood Medical Area in 1956.

With the discovery of insulin in the 1920s came substantial growth in the life span of patients with diabetes. Unfortunately, increased life expectancy also brought an increased risk of vascular complications—including diabetic retinopathy. By the 1950s, diabetic retinopathy had become the leading cause of blindness in the United States.

## Combating diabetic eye complications at the Beetham Eye Institute

In the 1960s, Joslin physicians Lloyd M. Aiello, MD, and William P. Beetham, MD, noticed that retinal scarring (from causes other than diabetes) could prevent retinal blood vessels from proliferating, bleeding and detaching—and thus prevent vision loss—in patients with diabetic retinopathy. Drs. Aiello and Beetham developed a method that used lasers to create scars in retinas. This technique, laser photocoagulation therapy, reduced the risk of blindness in diabetic retinopathy from over 75 percent to less than 2 percent. Three decades later, this approach remains the "gold" standard of care for treating proliferative diabetic retinopathy and has saved the sight of hundreds of thousands of people worldwide.

To combat diabetic eye complications, the Joslin Clinic formed The William P. Beetham Eye Institute (BEI), a dedicated on-site eye research center that fosters close partnerships between physicians and scientists at Joslin and BEI. Through the years, this model of collaboration has accelerated bench-to-bedside therapies for patients. Beetham researchers were some of the first to define complications from diabetic eye disease, and have led preeminent discoveries and improvements in diabetes eye care that have preserved vision for more than nine million people worldwide. Today, the Institute participates in virtually every major medical trial for diabetic retinopathy in the United States, some 24-26 trials at any given time.



## A new wave of discoveries

Despite advances in eye care, some patients with diabetes still suffer visual loss. Today, Joslin clinicians and researchers from the BEI continue their quest to develop new and improved methods to prevent diabetes-related eye complications. HMS Professor of Ophthalmology, Dr. Lloyd P. Aiello, MD, PhD, is Head of Joslin's Section on Eye Research and Director of the Beetham Eye Institute. In recent years, Dr. Aiello and other BEI members have been at the forefront of several key discoveries that may soon yield better treatments and therapies. These include the development of inhibitors to prevent proliferation, bleeding, and detachment of blood vessels in the back of the eye, as well as the development of treatments that block the activation of a molecule called protein kinase C (PKC). Previously, BEI researchers found PKC to be a major signaling pathway that, when activated, can trigger early cellular changes in the eye leading to diabetic retinopathy. Investigators have also identified several key risk factors for diabetic eye disease—such as the thickness of the retina and changes in blood flow in the back of the eye—that may enable clinicians to better predict who may be at risk for the disease.

## Preventing blindness through patient participation

Dr. Elliott P. Joslin believed that patient participation and empowerment were vital in the effort to control diabetes. Fulfilling this vision is the Joslin Vision Network (JVN), implemented by Joslin researchers in 1990. This initiative uses advanced video technology to detect abnormal retinal blood vessels, and not only allows regular and noninvasive screenings of diabetic retinopathy (at over 70 sites in the United States and abroad), but also allows patients in the network to participate in clinical trials. Through its 50-Year Medalist program, the Joslin Diabetes Center also recognizes individuals who live with diabetes for 50 years or longer without apparent complications. Many Medalists are participating in a long-term study that is yielding important clues into the prevention of diabetic retinopathy.

# MASSACHUSETTS GENERAL HOSPITAL

Massachusetts General Hospital consistently ranks in the top 1 percent of the nation's medical institutions and is second in U.S. News & World Report's most recent, "America's Best Hospitals Survey." Working collaboratively within Harvard's broad network, the clinicians and researchers in this world-class institution are bringing scientific breakthroughs to ophthalmic practice.

## Allies in comprehensive eye care

In close collaboration with multiple HMS affiliate and partner institutions, Massachusetts General Hospital (MGH) offers comprehensive and expert care for a broad range of eye conditions. In 2009, the hospital teamed with Mass. Eye and Ear to establish the Mass. Eye and Ear/Massachusetts General Hospital Department of Ophthalmology, an innovative alliance that formalized the centuries-old clinical and academic partnership between the two world-class institutions. The department is staffed by Mass. Eye and Ear physicians under the direction of HMS Ophthalmology Chief and Chair, Joan W. Miller, MD. Deeper collaboration and joint programmatic planning is enhancing the quality of care, research, and teaching at both institutions. Patients, in particular, will benefit from this closer connection with seamless access to the most innovative care available anywhere in the world.

The proximity to Mass. Eye and Ear also allows access to advanced diagnostic tests, such as optical coherence tomography, optic nerve imaging, and fundus tomography. The Mass General Hospital for Children provides pediatric services in collaboration with ophthalmologists from Children's Hospital Boston—both primary pediatric teaching sites for HMS. These valuable alliances allow the ophthalmology specialists at MGH to determine the best possible course of treatment for each patient.

## Neuro-ophthalmology consultation

Because visual function is closely integrated with neurological function, many conditions that affect the brain may also affect vision. Through a streamlined consultation process, physicians from Mass General's neurology, neurosurgery, and inpatient services work jointly with Mass. Eye and Ear's Neuro-Ophthalmology Service to provide unparalleled services to patients with neuro-visual complications, as well as patients with primary neurological conditions that may cause visual disturbances. This service is widely recognized for handling rare neuro-ophthalmic conditions, and receives many referrals from general ophthalmologists and optometrists. In addition, the service coordinates ophthalmic inpatient consultation for urgent patient care.

## Cooperative pathology programs

The Mass General Hospital Surgical Pathology Service and Mass. Eye and Ear's David G. Cogan Laboratory of Ophthalmic Pathology collaborate extensively to provide enhanced diagnostic services. The staff and full spectrum of diagnostic methods from MGH's surgical pathology services are available to facilitate the diagnostic and research work undertaken in the Cogan Laboratory. Cooperative programs between MGH and ophthalmic pathology specialists also support clinico-pathology research projects and enhanced educational and training initiatives throughout the HMS Ophthalmology campus.

## Teleretinal screening program

Another vital alliance between Mass General Hospital and Mass. Eye and Ear was realized in 2008 when a teleretinal imaging program was established at MGH's Chelsea Health Center. The program provides expanded, preventive care to high-risk patients with diabetes. Retinal images are sent electronically to Mass. Eye and Ear and screened for diabetic retinopathy and other pathologies, enabling early intervention and potential sight-saving diagnosis and treatment. This program also provides primary care practices with key diabetes screening results that are central to meeting major performance measures of health care insurers.

# VETERANS AFFAIRS BOSTON HEALTHCARE SYSTEM

The Veterans Affairs Boston Healthcare (VHA) System—one of 171 VA health care facilities across the country—is a full-service tertiary care center that provides a broad spectrum of medical, surgical, and rehabilitative care to veterans across New England and the Veterans Integrated Service Network 1. The medical center encompasses three main campuses and five outpatient clinics located within a 40-mile radius of Boston.

## Providing world-class care to veterans

Affiliated with Boston University and Mass. Eye and Ear/HMS, the VA Boston Ophthalmology Department provides veterans with a full complement of eye care and services with specialization in vitreoretinal diseases, glaucoma, neuro-ophthalmology, oculoplastics, cataract, strabismus, and cornea/external eye diseases. In recent years, under the leadership of Chief of Ophthalmology, Mary K. Daly, MD, the department's reputation for delivering excellence in patient care has flourished; today, it is a premier provider of ophthalmic care within the VA national network. The busy department offers 24/7, on-call access to more than 20,000 patients every year; a number that has steadily climbed in recent years along with an influx of ophthalmic referrals from other VA centers across the country. The department continually strives for innovation and, for example, is one of a handful of VA medical centers nationwide that offers certain highly specialized procedures such as the Boston Type I Keratoprosthesis (KPro) surgery pioneered by HMS Emeritus Professor, Claes Dohlman, MD, PhD; other innovative procedures include Descemet's stripping endothelial keratoplasty and treatments for choroidal melanoma.

## Training partners

The VA Boston Healthcare System has a strong educational partnership with Mass. Eye and Ear and HMS. Residency training is a key mission area of VA ophthalmology. Guided by Dr. Daly, the department has significantly improved the quality and depth of its training program in just the last few years, which has evolved into a highly structured curriculum comprised of surgical conferences, weekly faculty lectures and journal clubs, with greater participation from residents. HMS residents complete one six to seven week block rotation at the VA each year of residency with exposure to general and subspecialty clinical care in retina, cornea, glaucoma, oculoplastics, and neuro-ophthalmology, as well as hands-on surgical training. Third-year residents receive intensive cataract training and serve as primary surgeons on a large volume of cataract and glaucoma surgeries. The department utilizes state-of-the-art equipment, including two Eyesi virtual reality simulators to help residents hone their surgical skills.

## Supporting innovations in research

Historically, the U.S. Department of Veterans Affairs has supported innovative R&D efforts in many areas of healthcare to improve the lives of Americans. This same spirit of purpose drives ongoing research efforts at the VA Boston. Since 2001, the VA has supported the efforts of HMS Professor of Ophthalmology, Dr. Joseph Rizzo III, MD, in the Boston Retinal Implant Project. In this endeavor, Dr. Rizzo leads a team of physicians, scientists, and engineers to develop an implantable microelectronic retinal prosthesis that can eventually restore some vision to people blinded by retinitis pigmentosa and age-related macular degeneration (AMD). This highly challenging and multidisciplinary research is being carried out by the Center for Innovative Visual Rehabilitation located at the VA.


Veteran's Affairs Boston Healthcare System, Jamaica Plain campus

## Mary K. Daly, MD

Lecturer on Ophthalmology, Harvard Medical School

Associate Professor of Ophthalmology, Boston University School of Medicine

Chief of Ophthalmology, Veterans Affairs Boston Healthcare System

Associate Director, HMS Ophthalmology Residency Training Program, Veterans Affairs Boston Healthcare System

Dr. Mary K. Daly obtained her BA from Harvard College in 1994 and her MD degree from Johns Hopkins University in 1998. After completing an ophthalmology residency at the Wilmer Eye Institute at Johns Hopkins in 2002, she conducted fellowship training in cornea and external eye disease at Moorfields Eye Hospital, London. Dr. Daly specializes in complex cataract, anterior segment, and corneal surgery including keratoprosthesis and Descemet's stripping endothelial keratoplasty.

Since 2005, Dr. Daly has championed transformative changes within the Department of Ophthalmology at the Boston VA, boosting continuity and quality of patient care, expanding research efforts, and creating an enhanced training rotation for HMS residents. Under her guidance, the department's staff, programs, and services continue to grow at a rapid clip. She has recruited superb clinical and research talent to the department, including clinician scientists from Mass. Eye and Ear and the Boston University School of Medicine, tripling the number of full-time staff in the last two years. She credits VA Boston Leadership—including Dr. Kamal Itani, Chief of Surgery; Dr. Michael Charness, Chief of Staff; and Mr. Michael Lawson, Medical Center Director—for their tremendous support of Ophthalmology at VA Boston and for always putting the patients first. "Today, I'm proud to say that our staff and capabilities are at the leading edge of technology, and we are providing premier ophthalmic services to our veterans. It's unbelievably rewarding to work here and with this particular patient population," says Dr. Daly. "I know everyone, including the residents, consider themselves lucky to be taking care of this wonderful group of people."

Dr. Daly is a valued member of the Veterans Affairs Boston Integrated Ethics Committee, which strives to ensure ethical practices in the Veterans Healthcare Administration and foster a strong ethical environment and culture through ethical leadership.

Dr. Daly is also a clinical champion of the Ophthalmic Surgical Outcomes Data Committee (OSOD) under the direction of Mary Lawrence, MD, Deputy Director of the Vision Center of Excellence. The VA Boston is one of five OSOD pilot sites tracking ophthalmic surgery data in order to establish a prospective outcome-based program for comparative assessment and enhancement of the quality of cataract surgery across the VA system.


MARK C. KUPERWASER, MD

# BETH ISRAEL DEACONESS MEDICAL CENTER

Beth Israel Deaconess Medical Center (BIDMC) is one of the nation's preeminent academic medical centers, committed to providing excellence in clinical care, teaching, research, and community outreach. A major teaching hospital of Harvard Medical School with more than 1,250 full-time medical staff, BIDMC is ranked each year as a "Best Hospital" by U.S. News & World Report in multiple specialties. BIDMC's focus on safe and quality patient care has helped establish them as a national leader in health care quality, safety and transparency. BIDMC's thriving research programs, state-of-the-art clinical care and unparalleled medical education are recognized worldwide.

## The BIDMC Division of Ophthalmology

Located within the Longwood Medical Eye Center, the BIDMC Division of Ophthalmology provides comprehensive medical and surgical treatment of eye diseases. Dr. Frank Berson, Chief of the Division of Ophthalmology, leads an exceptionally trained team of ophthalmologists, all of whom hold academic appointments in the HMS Department of Ophthalmology. In research and clinical care, the Division collaborates with other HMS affiliates, including Beetham Eye Institute at Joslin Diabetes Center and Mass. Eye and Ear.

Under the direction of Jorge G. Arroyo, MD, MPH, the Retina Service serves an international patient base, and handles some of the most complex vitreoretinal cases utilizing a complete array of state-of-the-art equipment and intraocular instruments. Dr. Arroyo is a sought-after authority in complex vitreoretinal and other surgical techniques and has participated in research studies on age-related macular degeneration (AMD), retinal detachment, and diabetic retinopathy.

## Converging disciplines

In conjunction with the Department of Ophthalmology, the Neuro-Ophthalmology Service, under the direction of Nurhan Torun, MD, employs a wide range of ophthalmologic and neurologic evaluative techniques to provide care for patients with neurological difficulties. The Eye Movement Laboratory provides quantitative assessment of difficulties with eye movements and visual perception, both for research and for patient care needs.

BIDMC partners with the nearby Joslin Diabetes Center, a preeminent diabetes research and clinical care organization, to provide patients with a spectrum of multidisciplinary care for diabetes and endocrine disorders in both inpatient and outpatient settings. The BIDMC/Joslin Collaborative Eye Care Program offers diabetes-specific ophthalmic care focused on preventing and treating eye disease. Ophthalmologists in this program are specially trained to treat complex eye conditions associated with diabetes.

## Highly lauded teachers and mentors

Using outstanding depth of knowledge and experience, BIDMC's esteemed team of mentors, educators, and clinicians play a key role in the education of HMS ophthalmology residents and fellows. All second-year residents rotate through BIDMC and participate in comprehensive ophthalmology and subspecialty clinics, including retina, glaucoma, and neuro-ophthalmology. Surgical experience is also a primary focus of this rotation, and residents spend a significant amount of time participating in cataract, retina, and glaucoma surgeries. Drs. Berson and Arroyo, and Mark Kuperwaser, MD, have received teaching awards from Mass. Eye and Ear/ HMS ophthalmology residents, most recently Dr. Kuperwaser in 2010.

## Frank G. Berson, MD

Associate Professor of Ophthalmology, Harvard Medical School

Chief, Division of Ophthalmology, Beth Israel Deaconess Medical Center

As Chief of the Division of Ophthalmology at BIDMC, Dr. Berson is an integral member of the world-renowned surgical staff in the HMS Department of Ophthalmology. He holds an academic appointment as Associate Professor in Ophthalmology at HMS. Dr. Berson was recently recognized by BIDMC for his milestone anniversary of 30 years of service.

Board-certified in ophthalmology, Dr. Berson received his MD degree from HMS in 1971. After completing an internship in surgery at Beth Israel Hospital, he went on to complete his residency and fellowships in ophthalmology at Mass. Eye and Ear. Dr. Berson's clinical interests are focused on glaucoma and cataracts. For more than two decades (1982–2004), he served as Director of Medical Student Education for Mass. Eye and Ear/HMS Department of Ophthalmology. From 1982 to 1992, he was the Director of the HMS Ophthalmology Residency Training Program.

Dr. Berson currently serves on the Executive Committee and the Subcommittee for Promotions and Reappointments in the HMS Department of Ophthalmology. At BIDMC, he is a member of the Board of Overseers and Treasurer of the Beth Israel Surgical Foundation.

# BRIGHAM AND WOMEN'S HOSPITAL

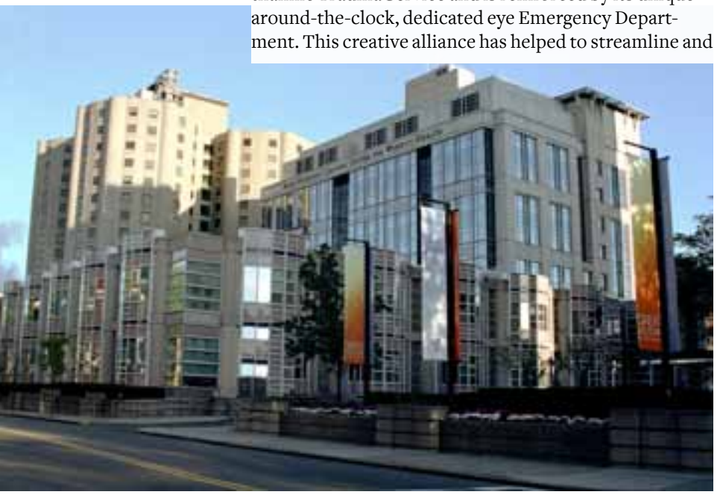
Brigham and Women's Hospital (BWH) is committed to upholding the best practices in eye care. Centrally located in Boston's Longwood Medical Area, BWH has established a strong partnership with the Mass. Eye and Ear Department of Ophthalmology to ensure that their patients have convenient and direct access to best-in-class eye care providers and services.

The hospital's guiding philosophy is to utilize an exceptionally trained and experienced team of eye care providers, resources, and technology to achieve an optimal outcome for every ophthalmology patient.

## Comprehensive care through collaboration

BWH offers comprehensive ophthalmology services and most subspecialty eye care through this clinical affiliation with Mass. Eye and Ear, which offers world-renowned expertise and diagnostic and treatment capabilities unmatched in the region.

As the result of a comprehensive partnership, Mass. Eye and Ear began providing inpatient subspecialty ophthalmic care and emergency eye trauma coverage to BWH patients in 2009. Trauma care at BWH is coordinated by the director of the Mass. Eye and Ear Ophthalmic Trauma Service and is reinforced by its unique around-the-clock, dedicated eye Emergency Department. This creative alliance has helped to streamline and boost quality of care for patients who can now receive 24/7 on-site treatment at BWH from an outstanding group of physicians who rank as one of the leading eye trauma management teams in the country.



## Integrated clinical services and training

A second innovative alliance in 2009, led by Mass. Eye and Ear and the Beetham Eye Institute at Joslin Diabetes Center, has enabled continuity of follow-up care (post discharge) for BWH patients with the establishment of a new, outpatient comprehensive ophthalmology service (COS) at One Joslin Place. Located in the heart of the Longwood Medical Area the service is directed by Lloyd Paul Aiello, MD, PhD, and staffed by Mass. Eye and Ear ophthalmologists with participation from Joslin retina specialists and BWH neuro-ophthalmologist director, Dr. Don Bienfang. The service provides BWH with outpatient services, as well as inpatient consultations and marks yet another important milestone in collaborative service development among HMS affiliates. Patients can receive routine annual eye and vision exams as well as spectacle and lens correction. Comprehensive evaluation and treatment of complex and systemic disorders, such as cataract, glaucoma, diabetes, macular degeneration, retinal detachment, conjunctivitis, and dry eye are also provided.

The Neuro-Ophthalmology service of the Brigham and Women's Hospital Department of Neurology diagnoses and treats disorders involving the visual pathways and eye movements. A number of neurological conditions affect the areas of the brain devoted to vision. Disturbances of these important visual areas may produce debilitating symptoms, and often require high-quality, specialized care.

# ARAVIND EYE HOSPITALS

The Aravind Eye Care System of India is the world's largest provider of eye care services, encompassing five hospitals, three managed eye hospitals, an international research foundation, an ophthalmic product manufacturing center, and a training center. Committed to the prevention of needless vision loss, the Aravind Eye Hospitals are revolutionizing the concept of efficient and sustainable eye care across the developing world.

Upon his retirement in 1976, Govindappa Venkataswamy, MD, established the GOVEL Trust to support an alternate health care model. Under this Trust, the Aravind Eye Hospitals were created as a self-sustaining system that not only provides affordable high-quality care for millions of individuals, but also serves as a model example of sustainable health care. For its remarkable impact, the Aravind Eye Care System has been honored with several prestigious awards, including the 2007 The António Champalimaud Vision Award, the 2008 Gates Award for Global Health, and the 2010 The Conrad N. Hilton Humanitarian Prize.

## International partnership

Since 1988, HMS senior residents have had the option of an elective rotation at Aravind Eye Hospital in Madurai. This unique training experience offers residents an unparalleled learning experience in international eye care, and the opportunity for hands-on clinical and surgical exposure to many ophthalmic conditions rarely encountered in the United States. Since the program's inception, more than 100 seniors have opted to experience an Aravind rotation.

Expanding on this educational partnership, HMS Ophthalmology and Aravind leadership recently conducted two joint grand rounds teleconferences. These interactive, high-tech events have allowed faculty from both institutions the opportunity to present grand rounds cases in real time, and share observations and insights.


## Research and development

Several Aravind programs, catering to all levels of ophthalmic teaching and training, are designed to meet the demands of a growing ophthalmic health care system. More recently, Aravind has expanded its research facilities and created PhD programs for medical and non-medical graduates. In 2010, there were 26 research projects being conducted in the department, with significant growth predicted for coming years.

## Telemedicine: remote care and communication

As part of its comprehensive success, Aravind utilizes telemedicine to reach out to remote rural areas using computers, video conferencing and the Internet. Through these technological services, eye care service is made accessible and affordable by reducing travel cost and time for the patients. In addition, telemedicine provides a network for eye care providers to share their knowledge and expertise.

## SHANGHAI EYE AND ENT HOSPITAL

Founded in 1952, the Shanghai Eye and ENT Hospital of Fudan University is a leading specialty hospital, which integrates medical care, education and research, providing patient care for the health of eye, ear, nose, throat, head, and neck. This 430-bed hospital is also a post-graduate teaching center of the Medical School of Fudan University, and offers subspecialty training to ophthalmologists and otolaryngologists across China.

### Beginning an international dialogue

HMS Ophthalmology faculty and Chinese colleagues from Shanghai Eye and ENT Hospital have begun a dialogue aimed at exploring potential research and educational opportunities. This endeavor began in earnest in December 2010, when several HMS faculty members traveled to Shanghai Hospital on a five-day international outreach trip. The group received a tour of the institution and presentations on its clinical and research efforts. Faculty gained a solid perspective of the hospital's ophthalmology training process, as well as the needs of the population they serve; today, for example, there are only 600 phacoemulsion/cataract surgeons to serve the country's population of 1.3 billion. During their visit, HMS faculty provided an overview of ongoing research efforts within the HMS Ophthalmology Department, as well as details about the organization, structure of the HMS Department of Ophthalmology Residency Training Program, and innovations to the curriculum.

### Collaborations aim to advance science and education

This initial exchange proved highly successful, and HMS Ophthalmology reciprocated in the spring of 2011 when the faculty welcomed to Boston a five-member ophthalmology team from Shanghai. The two-month visit gave team members first-hand exposure to a full range of learning opportunities, including general ophthalmology and subspecialty training practices. With specialties in glaucoma, retina, cornea, and cataracts, each Shanghai physician shadowed a faculty mentor from Mass. Eye and Ear in the operating room and clinic. Another goal of the team was to learn about the department's residency training program. Shanghai ophthalmologists attended educational programs and lectures, and met with investigators to explore potential research collaborations.

Ultimately, faculty members from both institutions look forward to a productive relationship, which will advance academic programs and scientific endeavors in various subspecialty fields in China.

## TOGUS VETERANS AFFAIRS MEDICAL CENTER

Togus Veterans Affairs Medical Center strives to advance health care through research and education, with an emphasis on preventive, primary, and specialty interventions in both outpatient and inpatient settings. The dedicated staff at Togus VAMC provides high-quality and timely care to better serve veterans.

### History

On March 21, 1866, Congress established the National Homes for Disabled Volunteer Soldiers (NHDVS) to provide care for wounded soldiers; soon thereafter, the Eastern Branch of NHDVS in Togus, Maine was established. In 1930, the Togus NHDVS became a part of the Veterans Administration, which provides benefits to veterans and their dependents. Since its inception in 1866, Togus VAMC has grown to be recognized locally, regionally, and nationally as a leader in quality patient care. Today, the Department of Veterans Affairs Medical and Regional Office Center has an operating bed capacity of 176 beds, with a staff of approximately 900 full-time and part-time employees.

### Ophthalmic care

As a regional referral center for ophthalmology in the state of Maine, Togus VAMC provides various clinical services, including general surgery, ophthalmology, neurosurgery, pain management, and optometry. Here, senior residents work with staff ophthalmologists in surgical procedures for a broad range of ocular disease (including cataracts and glaucoma) as well as retina laser procedures. Togus VAMC is an academic affiliate of Mass. Eye and Ear and the New England College of Optometry.

### Telemedicine: medical care at a distance

Togus VAMC contributes greatly to the growing success of telemedicine programs, such as the Joslin Vision Network (JVN). Implemented in 1990, the JVN uses advanced digital video technology to detect abnormal retinal blood vessels. In 2005, over 1,200 patients from Togus VAMC were selected to participate in a clinical trial through JVN. This study demonstrated the utility of JVN for identifying the severity of wide-ranging ocular conditions, thus determining the appropriate treatment priorities for eye care and allowing clinicians to provide "care at a distance."

## CAMBRIDGE HEALTH ALLIANCE

A Harvard-teaching affiliate, Cambridge Health Alliance (CHA) is an award-winning, integrated health system that serves Cambridge, Somerville and Boston's metro-north communities. CHA encompasses three hospital campuses, an extensive primary care network, the Cambridge Public Health Department, and a health plan, Network Health, which provides comprehensive health coverage to more than 160,000 Massachusetts residents. Community health is a major focus of CHA, which provides high quality care to a diverse population, the majority of who are non-English speaking patients and represent socio-economically disadvantaged populations.

CHA has gained national standing and recognition for its superb quality of care and innovative programs, including a 2010 "Best in Class" for Culturally and Linguistically Competent Care by the American Hospital Association Institute for Diversity; and, since 2004, has been named multiple times as one of the Top 100 Most Integrated Health Systems in the U.S. by SDI, a leading healthcare market insight and analytics firm. In 2010, the National Committee for Quality Assurance ranked CHA Network Health as one of the top ten Medicaid health plans in the U.S.

CHA has established several key academic affiliations that offer residents a unique public health care experience. Through an educational partnership with the Harvard Department of Ophthalmology, CHA provides surgical training to residents during a six-week, part-time rotation in their first year (PGY-2). Residents work alternatively under the direction of attending ophthalmologists, Vincent James Patalano II, MD and Steven Patalano, MD, both of whom are Ophthalmology faculty members of HMS. Resident training focuses on an introduction to intraocular surgical techniques for comprehensive ophthalmologists. During the rotation, residents observe, assist and perform ophthalmic surgery basic techniques, and also gain exposure to cataract extraction with intraocular lens implantation by phacoemulsification.

HMS Instructor in Ophthalmology, Joseph Ciolino, MD, and Mass. Eye and Ear Clinical Fellow, Houman Hemmati, MD, PhD, at the Massachusetts Institute of Technology (MIT). Drs. Ciolino and Hemmati are collaborating with Professor Robert S. Langer (David H. Koch Institute Professor), Daniel Kohane, MD, PhD (MIT and Children's Hospital), Claes Dohlman, MD, PhD (Mass. Eye and Ear), and others on the development of long-term drug delivery systems for use in a wide range of ophthalmic conditions.

HMS Department of Ophthalmology researchers and clinician scientists are continuously turning insights into cures that benefit scores of people. Many discoveries and developments, past and present, are helping to enhance the knowledge and practice of ophthalmology worldwide. Here are some of these outstanding achievements:

# DISCOVERIES MAKING A DIFFERENCE

## RETINA

- Isolated the gene governing retinoblastoma, a potentially fatal eye tumor affecting young children. This gene is also a prototype for an entire class of genes relating to cancers of the breast, bone, bladder, and lung.
- Pioneered the use of proton beam therapy for successfully treating intraocular malignant melanoma with minimal or no damage to surrounding tissue.
- Isolated the gene that causes a form of retinitis pigmentosa, a hereditary and degenerative blinding disease of the retina.
- Made the first diagnosis of retinopathy of prematurity, a form of blindness caused by excessive amounts of oxygen given to premature babies.
- Introduced scleral buckle surgery for retinal detachments (to North America).
- Developed laser photocoagulation therapy, which revolutionized the diagnosis and treatment of diabetic retinopathy, and has remained the gold standard of therapy for more than 25 years.
- Developed photodynamic therapy (PDT) with verteporfin (Visudyne®), the first FDA-approved drug treatment for neovascular "wet" age-related macular degeneration (AMD).
- Discovered the role of vascular endothelial growth factor (VEGF) in ocular neovascularization in two of the most common causes of blindness: AMD and diabetic retinopathy.
- Participated in the development of anti-VEGF drugs for treating AMD and diabetic retinopathy. Given by intraocular injection, this new class of inhibitors has been shown in clinical trials to help 90 percent of patients avoid moderate vision loss, while one-third experienced gains in vision.
- In collaboration with Swedish colleagues, developed an algorithm called WINROP; based on measures of postnatal weight gain, this algorithm can predict retinopathy of prematurity nine weeks before development of disease.
- Identified the role of environmental factors in promoting AMD, and how nutritional factors may lower the risk of AMD.
- Demonstrated the utility of vitamin A palmitate in retinitis pigmentosa.
- Implanted the first microelectronic retinal prosthesis in a human eye (an array of 100 microelectrodes) to stimulate residual elements of the retina in a patient with advanced retinal degeneration.
- Validated and implemented the first ocular telemedicine program—the Joslin Vision Network (JVN)—for early detection of diabetic retinopathy. JVN nonmydriatic images have been validated for diabetic retinopathy severity grading against the Early Treatment Diabetic Retinopathy Study protocol, which involves fundus photographs and clinical examinations.
- Identified genetic pathways that increase the risk of advanced diabetic retinopathy. A collaboration with the University of San Diego demonstrated that a polymorphism in the promoter region of the erythropoietin gene increases the risk for proliferative diabetic retinopathy.
- Developed (with MIT and MGH researchers) optical coherence tomography, the most widely used and non-invasive imaging modality in retina.

## CORNEA

- Developed the Boston Keratoprosthesis (Kpro), the world's first and most popular artificial cornea, with more than 5,000 implantations to date in 50 countries.
- Discovered the first drug to cure the virus infection, Herpes Simplex, which causes severe damage to the cornea.
- Elucidated the molecular and physiological mechanisms of corneal swelling and edema that contribute to corneal clouding. These discoveries laid the groundwork for many techniques currently used to restore corneal clarity and visual acuity in patients.
- Elucidated the role of VEGFR3 as the mechanism by which the cornea remains avascular (without blood vessels). This body of work formed the basis for ongoing clinical studies of novel therapies to treat graft rejection and other inflammatory disorders, including dry eye disease, which affects millions of people worldwide.
- Demonstrated the protective role of certain molecules (called mucins) to prevent infections on the cornea and surrounding tissue. This key discovery had multiple crossovers to other areas of investigation, including human reproduction and infectious diseases.

## STRABISMUS

- Discovered seven different forms of strabismus arising from a variety of genetic errors in brainstem motor neuron development. This body of work defined a new category of congenital disorders that leave children unable to move their eyes in specific directions.
- Discovered that earlier intervention in unilateral coronal synostosis (by way of endoscopic strip craniectomy) can prevent sight-threatening strabismus and astigmatism.

## OPTIC NERVE/GLAUCOMA

- Paul A. Chandler, MD, and W. Morton Grant, MD, describe clinical features of glaucoma, and form definitive concepts in the management of the disease. Their book Chandler and Grant's Glaucoma remains an authoritative reference text since its first publication in 1965.
- Identified several genetic and molecular mechanisms underlying the pathology of pediatric glaucoma.
- Demonstrated (in postnatal mice) successful full-length regeneration of the optic nerve.
- Identified several genetic, hormonal, and environmental factors associated with various forms of glaucoma, a diverse group of conditions that can potentially damage the optic nerve.
- Identified novel targets for potential neuroprotective strategies in glaucoma management.

# COLLABORATING TO CURE

## HMS Ophthalmology Centers of Excellence drive collaboration

From novel clinical and research partnerships to new educational venues, many exciting initiatives in recent years are transforming "business as usual" within the HMS Department of Ophthalmology. Contributing to this momentum, the HMS Department of Ophthalmology has launched Centers of Excellence (COEs) in key subspecialty areas that draw on the exceptional talent and resources of the HMS community. These efforts are advancing scientific discovery, expand training opportunities, and bringing new innovations into the clinic. COEs are underway in the areas of diabetic eye disease, age-related macular degeneration (AMD), cornea, and glaucoma.

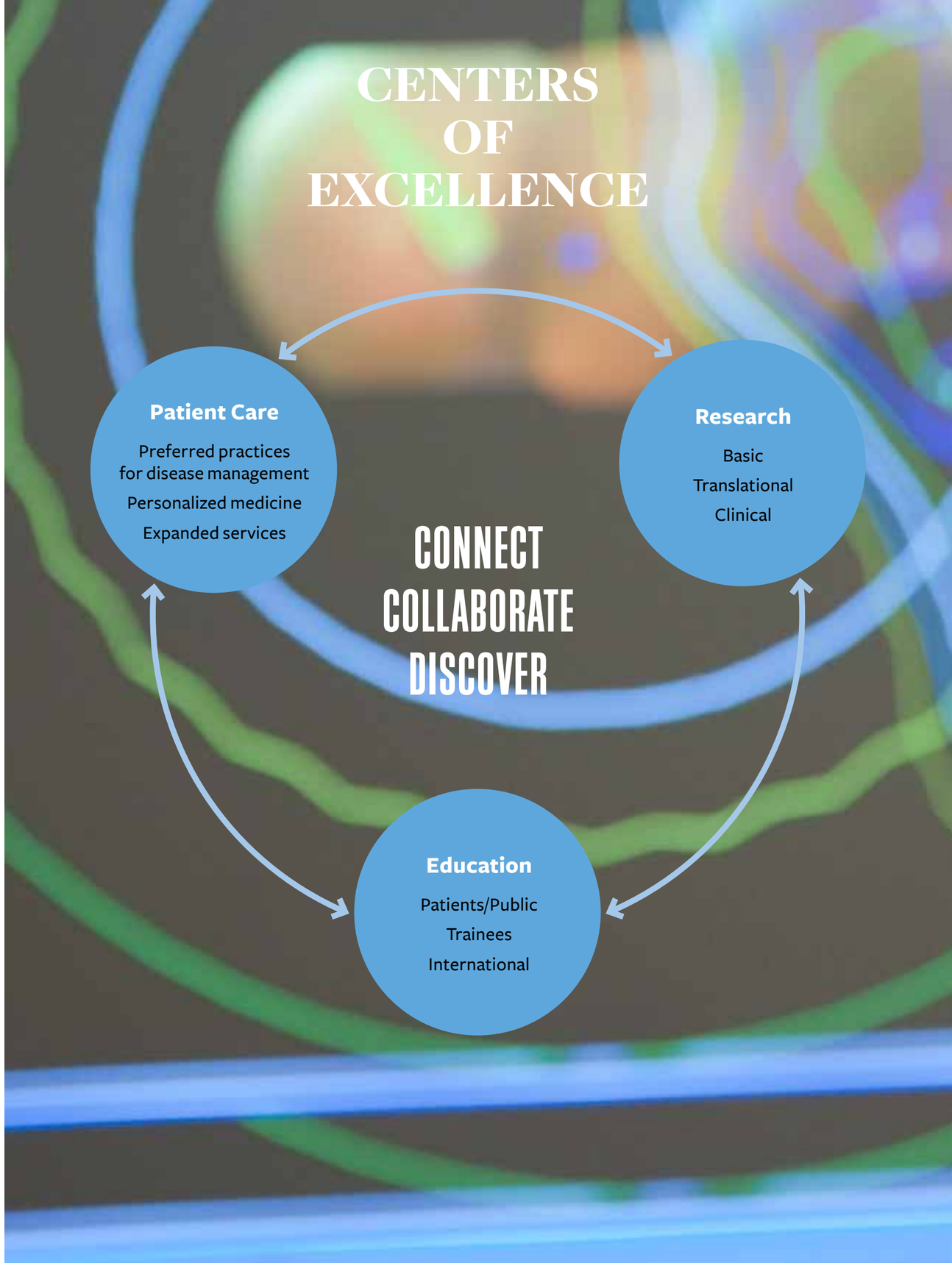
"Momentous leaps in science, biotechnology, and medicine in the last decade have brought the future of healthcare to our doorstep—creating unprecedented opportunities for advancement," says Lloyd P. Aiello, MD, PhD, HMS Ophthalmology Vice Chair for Centers of Excellence and Director of the Beetham Eye Institute at Joslin Diabetes Center. "Centers of Excellence allow us to lead by design and create communities of collaborators that will bring the next generation of advances to fruition. COEs also provide the framework for moving information and ideas across campus with improved speed and access, helping us to accelerate progress in all aspects of our mission."

COEs integrate the clinical, research, and academic objectives of HMS's six ophthalmology affiliates and broad faculty base of 140 full-time clinicians, scientists, and academicians—creating an information network that links ideas, resources, and people in pursuit of common goals. Each center is a catalyst for collaboration—creating a multidisciplinary "think tank" that identifies new training opportunities, broadens the scope of research at every juncture, and elicits the highest benchmark standards in all aspects of clinical care.

## Core Concepts

- Utilize inherent leadership and expertise to build the key structure, components, and mechanisms of each center for maximum results.
- Identify communication strategies that integrate academic, clinical, and research objectives, and spark cross-institutional involvement.
- Develop unified and readily accessible standards and metrics to improve patient care across the HMS campus and to lead national benchmark standards of care.
- Establish, maintain, and share preferred practice patterns through an ongoing clinical quality program that utilizes robust, evidence-based surgical and outcomes review.
- Facilitate vital research, educational, and clinical partnerships within HMS and in collaboration with community and academic institutions across the United States.
- Expand training opportunities and boost recruitment efforts through stimulating and supporting mentorship, resident, and fellowship programs.
- Create a focus for new funding opportunities that attract sponsorship from government, industry, foundation, and private donors.

As the HMS COEs continue to evolve, department Chair Joan Miller, MD, anticipates that they will be a global resource for innovation. "As our world becomes increasingly connected, we need to embrace strategic partnerships that advance collaboration and connections in our three mission-critical areas," she said. "COEs represent a scalable healthcare model that will help forge these synergies and usher in advancements that resonate here and around the world."



# CENTERS OF EXCELLENCE

## CENTERS OF EXCELLENCE HIGHLIGHTS

**Diabetic eye disease**
- BEI clinical research program (DRCR.net)
- Joslin Vision Network (model for preferred practice patterns)
- Latino diabetes initiative

**Age-related macular degeneration (AMD)**
- Public symposia and outreach
- Biennial AMD International Symposium
- Experimental models for ocular research

**Cornea**
- Translational research center
- Ocular Surface Imaging Center
- Monthly cornea conference

**Glaucoma**
- Clinical/research faculty focus groups
- State-of-the-art glaucoma laboratory
- Glaucoma COE newsletter

### Optimizing eye care

The use of evidence-based data helps identify the best eye care delivery systems. The Diabetes COE, for example, is using data-driven management practices for its acclaimed international imaging program, the Joslin Vision Network (JVN), to evolve standards across other areas of diabetic eye disease. Lessons learned from the JVN can now be used to improve screening techniques, rigorously validate imaging methods, establish detailed metrics, and engage in multi-institutional collaboration. All of this information can be fed continuously to other faculty engaged in related research within HMS and with outside collaborators.

### Delivering care in real time

In just one year, patient referrals to the department's new Ocular Surface Imaging Center (OSIC) have increased ten-fold thanks to high-tech imaging equipment and enhanced diagnostic methods developed by OSIC Director, Pedram Hamrah, MD. These optimized tools and techniques enable real-time and non-invasive imaging, allowing our physicians to diagnose, monitor, and track disease progression and treatments with unprecedented speed and precision. These methods also eliminate the need for invasive biopsies and slow cultures, and reduce the wait time for results from three to seven days to less than 24 hours. In many cases, results can be read during the patient's visit. For thousands of patients each year, this means better diagnosis, treatment, and outcomes.

### Tools of the trade

Nidek Confoscan 4.0 and the Heidelberg-HRT 3 Rostock Cornea Module confocal microscopes; Haag-Streit IM 900 digital slit lamp camera, and a Optovue Ocular Coherence Tomographer with cornea module.

### Focus for funding

COEs create new funding opportunities in every aspect of the mission of the Department of Ophthalmology. For example, researchers in the AMD Center of Excellence conduct preclinical investigations using a variety of animal models, and carry out small-scale clinical trials to establish a foundation for proof-of-concept in humans In recent years, work with these models has led to revolutionary treatments for macular degeneration, including the photodynamic therapy and a number of antiangiogenic agents. Today, HMS investigators use models for angiogenesis, diabetic retinopathy, retinal detachment, glaucoma, intraocular tumors, and uveitis to develop novel pharmaceutical, biological, and gene-therapy approaches to treat eye diseases. Investigators are also developing the first dry AMD primate model to better understand the pathophysiology of the disease, as well as potential therapeutic targets. To learn more, contact Kim Fechtel at kim_fechtel@meei.harvard.edu.

### Tear down those walls!

COEs engender a disease-driven approach that break down traditional research silos, and engage basic researchers and clinicians scientists in direct and focused dialogue. Pertinent clinical opportunities can then be identified and moved from bench to bedside with greater speed. "At any given time, ophthalmology faculty members are leading investigations for 50 to 75 clinical trials in various phases, and pursuing vital grant research," notes Dr. Joan Miller, HMS Ophthalmology Chair. "COEs simplify our communication structure and open the floodgates for scientific inquiry and discovery across the department in complimentary areas. What's happening in AMD research, for example, may yield critical insight into diabetic eye research, and vice versa. It may also embolden scientists to take their research in entirely new directions."

### Making connections:

COEs provide a scalable platform for expanding collaboration, education, and training opportunities. For example, a monthly glaucoma focus group was the flashpoint for merging the research efforts of Louis Pasquale, MD, from Mass. Eye and Ear and Emmanuel Buys, PhD, from Mass General. During a recent meeting, Dr. Buys spoke to the group about his research on a knockout mouse model that turned out to have direct relevance to Dr. Pasquale's epidemiology research on primary open-angle glaucoma. Finding common ground, they teamed up with Schepens scientists Bruce Ksander, PhD, and Meredith Gregory-Ksander, PhD, to validate that the mouse model is applicable to POAG in humans. The group has submitted an R21 grant application to NIH. "This cross-fertilization of ideas is an exciting hallmark of the glaucoma Center of Excellence," says Dr. Pasquale. "We learn first-hand about ongoing work across the department, and how our clinically relevant findings may have direct application to what our colleagues are discovering in the lab."

### One size does NOT fit all

Ten years ago, the Human Genome Project provided a genetic blueprint of the DNA code that ushered in a revolution in personalized medicine. The goal at HMS is to capture genetic variations that contribute to human disease and use it to improve patient care for every disease we treat. COEs provide an integrated framework for delivering personalized medicine to every patient. By merging clinical data (electronic medical records) with a biorepository of donor DNA and tissue samples, HMS clinician scientists can draw unprecedented insights as to how diseases manifest, and the best route to intervention based on a patient's unique genetic and biological make-up.

## CHILDREN'S HOSPITAL OPHTHALMOLOGY FOUNDATION AND MASS. EYE AND EAR FORM A PEDIATRIC POWERHOUSE

In August 2009, Massachusetts Eye and Ear Infirmary and the Children's Hospital Ophthalmology Foundation (CHOF) combined their pediatric services, creating one of the most comprehensive pediatric ophthalmology networks in the country. Under this new partnership, general pediatric ophthalmology and strabismus care at Mass. Eye and Ear is being provided by Children's ophthalmologists, while Mass. Eye and Ear physicians offer subspecialty care in glaucoma and cornea disease at Children's Hospital Boston. Both HMS affiliates have long cooperated on patient care, research and academic activities; this innovative clinical partnership streamlines patient care while broadening access to services, and more tightly integrates training and research activities.

"Delivering the best possible care to every patient is always our first priority," notes HMS Ophthalmology Chief and Chair, Joan Miller, MD. "Children's Hospital Boston has built one of the country's premier practices in ophthalmology. Integrating their depth of experience into our core services enables us to deliver seamless and integrated care to our most vulnerable patients."

"This partnership is a significant milestone in keeping us a top-tier pediatric care provider," said David Hunter, MD, PhD, Ophthalmologist-in-Chief at Children's Hospital Boston. "It reinforces our already deep commitment to quality patient care by making our world-class services increasingly accessible to patients, including treatment for the most complicated eye and vision problems."

### Raising the bar on research

By pooling resources and a patient base that combines pediatric eye and adult strabismus cases, the new alliance also enhances investigative teamwork carried out internally, and brings more opportunity for the department—and patients—to participate in benchmark clinical studies on an international scale. Melanie Kazlas, MD, Medical Director of the Children's Hospital Ophthalmology Foundation at Mass. Eye and Ear, describes one such study that involves the Pediatric Eye Disease Investigative Group (PEDIG), a collaborative network funded by the National Institute of Health that facilitates multicenter clinical research in strabismus, amblyopia and other eye disorders that affect children.

HMS Instructor in Ophthalmology, Suzanne Johnston, MD, is Principal Investigator of a randomized clinical trial comparing observation vs. occlusion therapy for intermittent exotropia. Using rigorous study protocols, the study aims to better understand the natural history and progression of intermittent exotropia (wandering eye) and determine the best method of managing the disease in young patients. Until now, there have been no studies to verify the efficacy of current treatments," says Dr. Kazlas. "Studies like this provide important public health implications because they help establish standards for solving common childhood problems in eye disease using evidenced-based medicine."

Currently, more than 60 sites comprising 120 pediatric ophthalmologists and optometrists in the United States, Canada, and the United Kingdom participate in the PEDIG network on various studies.

"Forward-thinking consortiums like PEDIG help generate new ideas that can then be pursued in a collaborative, well-designed study. Integrating Mass. Eye and Ear and CHOF pediatric services gives us the sizeable patient base required to participate, as well as the vital research resources and support staff we need to carry out a long-term study," noted Dr. Kazlas.

### Patient empowerment

Bringing CHOF to Mass. Eye and Ear also affords patients more opportunities to participate in ongoing investigations. Some patients, for example, have contributed clinical information in the form of blood, tissue, and DNA samples that have helped to elucidate the genetics of common forms of strabismus. Study participation is empowering for many patients whose vital contributions can help pave the way for new treatments or lead to a cure for their disease.

### Enhancing resident education

The clinical alliance between CHOF and Mass. Eye and Ear also has enhanced resident education with added exposure to important pediatric ophthalmology and strabismus topics through lectures at both institutions. The Pediatric Ophthalmology Visiting Professor Lecture Series, organized by Dr. Anne Fulton, HMS Professor of Ophthalmology, invites faculty who are leaders in the field of pediatric eye disease and strabismus to lecture and interact with faculty, residents, and students. These lectures are televised remotely to Mass. Eye and Ear's main campus and CHOF's Waltham location.

## DRCR.NET PROVES THE POWER OF PARTNERSHIP

Launched in September 2002, the Diabetic Retinopathy Clinical Research Network (DRCR.net) was a timely development. In prior decades, vigorous scientific investigations conducted by researchers in the HMS Department of Ophthalmology and in laboratories across the globe had led to exciting breakthroughs elucidating the role of vascular endothelial growth factor (VEGF) in neovascular (wet) age-related macular degeneration (AMD). Integral to these studies was the groundbreaking work of scientists at the Beetham Eye Institute (BEI) at the Joslin Diabetes Center. At BEI, research focuses on unraveling the molecular mechanisms responsible for diabetic eye diseases, and finding potential therapeutic targets that may lead to successful clinical treatments for patients with diabetic retinopathy, diabetic macular edema, and related disorders. Numerous studies followed—conducted at BEI and elsewhere—implicating VEGF and other pivotal compounds in the disease process.

Despite the milieu of scientific discovery, there was no mechanism in place to quickly move data from hypotheses and laboratory studies into multicenter clinical trials. Lloyd P. Aiello, MD, PhD, HMS Professor of Ophthalmology and Director of BEI, realized the critical need for a standardized infrastructure and support system, which could be used to mine and evaluate rapidly accumulating data, then conduct clinical trials using rigorous scientific protocols. He founded the DRCR.net, a national collaborative network dedicated to facilitating multicenter clinical research for diabetic eye disease.

Supported through a cooperative agreement from the National Eye Institute and the National Institute of Diabetes and Digestive and Kidney Diseases, the DRCR.net has grown to include 150 participating sites nationwide, including international participation from sites in India, Scotland, and Denmark. Nearly 300 investigators from academic medical institutions as well as private community practice groups participate in the network, including one out of every three retinal specialists across the country. In its brief history, the DRCR.net has rapidly emerged as the premier clinical trial group in diabetes—mentioned in the U.S. Congressional Record—and lauded by the National Institute of Health as establishing the paradigm for collaborative clinical trials.

"Clinically rigorous testing requires large numbers of patients and participation from large numbers of centers," says Dr. Aiello, who has been recognized internationally for his leadership in diabetic retinopathy research and served as the network's inaugural chair. "The DRCR network enables us to tap this vast pool of resources and, in short order, identify key clinical areas that need to be addressed, recruit patient volunteers, and carry out high quality multicenter trials. In less than a decade, this powerful means of collaboration has led to remarkable clinical gains that have refined our knowledge of diabetic eye disease and how we manage patients."

### Melanie A. Kazlas, MD

Instructor in Ophthalmology, Harvard Medical School

Medical Director, Children's Hospital Ophthalmology Foundation, Massachusetts Eye and Ear Infirmary

Dr. Melanie Kazlas received her BS degree cum laude at Rensselaer Polytechnic Institute in 1987. Following completion of her MD in 1989 and an internship in 1990, both at Albany Medical Center, Dr. Kazlas completed her residency in ophthalmology at Manhattan Eye, Ear and Throat Hospital (MEETH). She went on to complete an ophthalmology and strabismus fellowship at MEETH in 1994. She served as Acting Director of the Pediatric Ophthalmology and Strabismus Service at Mass. Eye and Ear from 2006 until 2009, at which time she was appointed Medical Director of the Children's Hospital Ophthalmology Foundation at Mass. Eye and Ear.

Dr. Kazlas provides comprehensive evaluation and treatment for babies, children, and adults of all ages with strabismus (otherwise known as misaligned eyes or crossed eyes). In addition to pediatric and adult strabismus, Dr. Kazlas specializes in amblyopia (commonly known as lazy eye), retinopathy of prematurity, and all other areas of pediatric ophthalmology. Exceptionally trained in delicate surgical techniques required for difficult cases of strabismus, Dr. Kazlas has earned a stellar reputation for her compassionate and innovative diagnostic and treatment approaches.

Dr. Kazlas is an active health educator, and serves as a leading expert in strabismus and pediatric ophthalmology for ABCNews.com. Dedicated to providing the pediatric community with the best care possible, Dr. Kazlas has teamed with Mass. Eye and Ear's Outreach staff to provide eye screenings to at-risk pediatric populations at Boston's Camp Harbor View and Neighborhood House Charter School. A member of the New England Ophthalmologic Society, Dr. Kazlas has also co-authored several papers including historical and current practices in pediatric intraocular lens implantation, ocular injuries in shaken baby syndrome, and diplopia after surgical repair of facial trauma.

**DRCR.net:**
**A model clinical research program**

Tier 1 recruiter for multiple consecutive years, and #1 nationally in quality in multiple consecutive years (2010 statistics):

- 100% completion of primary outcome visits
- 99% patient retention
- 99% visit completion
- 93% on-time study visit completion
- .02 protocols deviations per visit (average)

## UNITED STATES AND INDIA PARTNER TO ADVANCE VISION RESEARCH

As the world becomes increasingly connected, there is a greater need to build viable global healthcare partnerships. In 2005, an initiative funded by the National Institute of Health led to one such collaboration: the US INDO Joint Working Group, a vision research partnership between the U.S. National Eye Institute (NEI) and the Indian government's Department of Biotechnology (DBT). Co-Chair of the initiative is Janey Wiggs, MD, PhD, Associate Director of the Howe Laboratory of Ophthalmology, Associate Chief for Clinical Research at Mass, Eye and Ear Infirmary, and Director of the Genetics Diagnostics section of the department's new Ocular Genomics Institute. As Co-Chair, Dr. Wiggs oversees the U.S. effort, which includes research projects from physicians and researchers from academic medical institutions throughout the U.S.

The exploratory vision science group first met in India in 2005 to identify and facilitate research opportunities between the two countries. The group visited three institutions that deliver high quality eye care and conduct active, vibrant research programs: Aravind Eye Hospital in Madurai, the largest eye care provider in the world and a long-standing educational partner of the HMS Department of Ophthalmology; Sankara Nethralaya in Chennai; and LV Prasad Eye Institute in Hyderabad. Through a series of meetings and workshops, the U.S. team and Indian colleagues paired research interests and skills, which spanned several areas of the molecular genetics of eye disease, including clinical aspects and harmonization of clinical measurement techniques and terminology. Additional areas included translational physiology and the identification, development, and exchange of research resources.

Today, several projects are well underway. For her part, Dr. Wiggs teamed with David Friedman, MD, MPH, PhD, from Johns Hopkins University and Ronnie George, MD, a clinician scientist from Sankara Nethralaya, to study the application of consanguineous pedigrees to mapping of complex genetic traits.

In 2008, Dr. Wiggs received a grant for a National Eye Institute study entitled India-US Genetics Study of Ocular Quantitative Traits. The purpose of the project is to determine the viability of consanguinity for quantitative trait mapping, and to identify genes that are associated with specific ocular characteristics that are risk factors for common, complex eye diseases. During the last several years, Drs. Wiggs and George have worked together to develop project logistics and strategies and to execute each phase of the study, from identifying study participants, to collecting blood samples and analyzing data.

The underlying hypothesis of the study is that consanguineous families—compared to nuclear families—may provide a more powerful way to identify genetic factors responsible for quantitative ocular traits. For example, optic nerve size is a quantitative trait that is passed from generation to generation, and larger optic nerves may carry an increased risk of developing glaucoma. In the long term, this information may provide a rich source of genotype/phenotype data that can be mined for genetic insights into blinding diseases such as glaucoma. Analysis of data gathered from the study is currently underway.

Besides having the potential for advancing vision science, the study demonstrates the growing importance of cross-border collaboration. "If our underlying hypothesis proves correct—that consanguineous pedigrees do, indeed, provide a more robust genetic roadmap for flushing out faulty genes—then we'll have the information needed to accomplish two important goals: helping to pave the way for new diagnostic and therapeutic capabilities, and applying that knowledge to reduce the burden of blindness worldwide," notes Dr. Wiggs. "It's a win-win for the U.S. and India, with positive global consequences."


Members of the U.S. Indo Joint Working Group

**"TFOS embraces Harvard's 1650 Charter and mission statement, in that it strives to create knowledge, to advance the sciences, to educate leaders and to pursue excellence in a spirit of productive cooperation."**
*—Dr. David Sullivan, TFOS President*

## THE TEAR FILM & OCULAR SURFACE SOCIETY BUILDS A GLOBAL EYE RESEARCH COMMUNITY

During the past several decades, a significant international research effort has focused on understanding the composition and regulation of the ocular surface tear film. This effort was motivated by the recognition that the tear film is critical for maintaining corneal and conjunctival integrity, protecting against microbial challenge, and preserving visual acuity. In addition, research has been stimulated by the knowledge that deficiency of the tear film—commonly called "dry eye"—occurs in innumerable individuals throughout the world and over 40 million people in the United States alone. Dry eye may lead to desiccation of the ocular surface—potentially resulting in visual disability and vision loss.

To promote further progress in this field of vision research, David A. Sullivan, PhD, HMS Associate Professor in Ophthalmology, founded and created a global eye research community that became known as the Tear Film & Ocular Surface Society (TFOS). The mission of TFOS, which was incorporated as a non-profit organization in 2000, is to advance the research, literacy, and educational aspects of the field of tear film and ocular surface. Since incorporation, TFOS has launched numerous initiatives, including:

- Organization of International Conferences on the TFOS in Maui in 2000, Puerto Rico in 2004, Taormina in 2007, and Florence in 2010.
- Organization of a special experts' meeting, entitled "Global Treatments for Dry Eye Syndrome: An Unmet Need," in Florence in 2010. This meeting addressed accepted and emerging clinical endpoints of dry eye with regulatory authorities from around the world.
- Publication of a 1,385-page book (Adv Exp Med Biol 2002, vol 506), to provide an educational foundation and scientific reference for research on the tear film, ocular surface, and dry eye disease.
- Organization of the International Dry Eye Workshop (DEWS), and publication of the DEWS report in The Ocular Surface (TOS). The DEWS Report updated the definition, classification, and diagnosis of dry eye disease, and assessed its etiology, mechanism, global impact, management, and therapy. This report, termed the "Regulatory Bible" in Europe, required a 3-year effort of more than 65 experts—21 who are associated with the HMS Department of Ophthalmology.

Dry Eye WorkShop Steering Committee (left to right): front row, Drs. Michael Lemp (USA), Anthony Bron (USA), Kazuo Tsubota (Japan) and David A Sullivan (USA); row 2, Janine Clayton (USA), Gary Foulks (USA), Murat Dogru (USA); row 3, Kelly Nichols (USA), Ilene Gipson (USA), Debra Schaumberg (USA) and Stephen Pflugfelder (USA); row 4: Alan Tomlinson (UK) and J.Daniel Nelson (USA)

- Creation of TFOS TV, which features many important diagnostic procedures cited in the DEWS Report.
- Sponsorship of TOS, and facilitation of its growth into the 3rd highest ranked ophthalmic journal in the world.
- Organization of the International Workshop on Meibomian Gland Dysfunction (MGD), and publication of this TFOS MGD report in March 2011 in IOVS. The TFOS MGD Report provides an evidence-based evaluation of meibomian gland structure and function in health and disease. MGD is very likely the most frequent cause of dry eye. The report required over 2 years of effort from more than 50 leading clinical and basic research experts and is being translated into 12 languages.
- Collaboration with the ARVO, EVER, MEACO, ICO, AAOpt, AOptA, BCLA, British Royal Society of Ophthalmology, Japanese Dry Eye Society, Asia Pacific Academy of Ophthalmology, International Symposium on Ocular Pharmacology and Therapeutics, and São Paulo Federal University in organizing scientific sessions.
- Awarding of more than 120 Young Investigator Travel Awards.

Dr. Sullivan, TFOS President, notes that "TFOS activities have significantly helped to promote increased international awareness of external eye diseases, enhance governmental funding for tear film and ocular surface research, stimulate the development of therapeutic drugs and diagnostic devices, and influence the design and conduct of clinical trials of new and unique treatments for ocular surface disorders." At present, TFOS has a distribution to thousands of basic scientists, clinical researchers and industry representatives in more than 80 countries. For more information, visit: www.tearfilm.org.