

SPECIALTY REPORT | FALL 2017



New York
Eye and Ear
Infirmary of
Mount
Sinai

Department of Ophthalmology

www.NYEE.org



This
report is
dedicated to
the memory
of
**Joseph B.
Walsh, MD.**

Defining the
**Future of
Eye**
and Vision
Care

“As NYEE **continues to grow** and innovate, I am confident that **further progress** in clinical care, scientific research, and **medical education** will follow.”

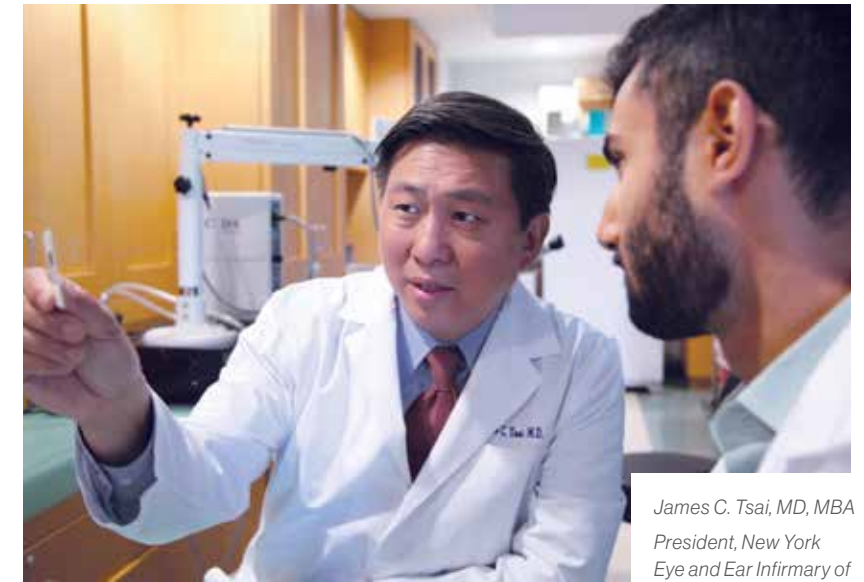
—James C. Tsai, MD

- 3 — Message From the Chair
- 4 — Launch of Pediatric Specialty Eye Care Center Is a Big Step for Kids With Glaucoma
- 6 — A Complex Pediatric Case at NYEE Is Met With Teamwork and Creativity
- 8 — A New Center of Excellence to Drive Innovation, Education and Technology
- 10 — NYEE’s Growing Footprint Is a Boon to Clinical Trials
- 11 — New 2017 National Institutes of Health Research Grants
- 12 — Training the Next Generation of Ophthalmology Leaders
- 14 — OCT Angiography Makes New Inroads in the Early Detection of Glaucoma and Diabetic Retinopathy
- 15 — Heading Off Diabetic Retinopathy Through Teleophthalmology Screening
- 16 — A Game Changer for Treating Keratoconus
- 18 — Pushing the Borders of Discovery Through a New Eye and Vision Research Institute
- 19 — A Global Expert Sees Major Progress in Treating and Even Curing Glaucoma

Each and every day, I am honored and privileged to work with the dedicated and talented physicians, scientists, staff, and trainees at New York Eye and Ear Infirmary of Mount Sinai (NYEE) and the Icahn School of Medicine at Mount Sinai (ISMMS). When I began my tenure at NYEE and Mount Sinai in September 2014, the merger of the ophthalmology departments at these two storied institutions appeared to represent a real opportunity for growth and collaboration, but also a road filled with many challenges and hurdles along the way. After three years, I am pleased to announce that we have emerged a stronger, healthier, and more robust organization, one committed more than ever to advancing eye and vision care throughout the New York metropolitan area, as well as nationally and internationally. With two outstanding residency programs in ophthalmology, the Department of Ophthalmology at ISMMS and Mount Sinai Health System recently graduated a talented class of 11 residents (7 at NYEE and 4 at The Mount Sinai Hospital) and 10 clinical fellows who will continue the rich tradition of providing compassionate, high quality care to all patients.

The enormous clinical breadth and depth at NYEE allows for unparalleled synergies and collaboration with the many translational research and academic initiatives at ISMMS. With that goal in mind, the Department of Ophthalmology is proud to announce the creation of the Mount Sinai/ NYEE Eye and Vision Research Institute under the leadership of Douglas Jabs, MD, MBA. We are particularly grateful to the McGraw Family Foundation for their recent \$2 million gift to help support the faculty recruitment of Bo Chen, PhD and his leading NIH-supported basic and translational research to the new Institute.

To further position NYEE at the forefront of innovation, we have also created the Ophthalmic Innovation and Technology Program, led by Sean Ianchulev, MD, MPH. One of the initiatives of this program will be establishing a micro-surgical intervention center of excellence, bringing patients closer to the benefits of leading-edge technology and minimally invasive surgical techniques. As Director of the Ophthalmic Innovation and Technology Program, Dr. Ianchulev will partner closely with Douglas Buxton, MD (Jorge N. Buxton, MD Microsurgical Education Center) and Richard Rosen, MD (The Shelley and Steven Einhorn Clinical Research Center), who oversee two of the most advanced hospital-based teaching and research facilities in the world.



James C. Tsai, MD, MBA
 President, New York Eye and Ear Infirmary of Mount Sinai
 System Chair, Department of Ophthalmology
 Delafield-Rodgers Professor of Ophthalmology, Icahn School of Medicine at Mount Sinai

We are also pleased to announce that NYEE contributed the most ophthalmologists cited in the “Best Doctors in New York” 2017 issue of *New York Magazine* (in collaboration with Castle Connolly Medical). Our large geographic footprint throughout the New York metropolitan area allows for easy patient access to a comprehensive array of medical services, as well as entry to cutting-edge clinical trials. The institution’s commitment to clinical excellence is reflected in the innovative programs we’ve launched in tele-ophthalmology, ophthalmic imaging and adaptive optics, and corneal collagen cross-linking. Through the generosity of a \$500,000 pledge from the RICBAC Foundation, a pediatric specialty eye care center at NYEE will be created to enable the housing and coordination under one roof of a full range of pediatric eye care specialists and services, research activities, and formal training programs focused on taking care of children with the most complex ocular diseases.

As NYEE continues to grow and innovate, I am confident that further progress in clinical care, scientific research, and medical education will follow. We will continue to use our synergies and strengths to create new opportunities for patients to access our exceptional care, expand our state-of-the-art technology for disease characterization, and share our academic expertise nationally and internationally. In these ways, NYEE will be well positioned to carry on its legacy of high quality and compassionate patient care as the institution enters its third century of community service in 2020. ■

Launch of Pediatric Specialty Eye Care Center Is a Big Step for Kids With Glaucoma

“The specialty eye care center will be a place where we can take the resources and technologies we already have to the next level.”

—Joseph Panarelli, MD

Glaucoma surgery has enjoyed something of a renaissance in recent years with innovations like trabecular bypass implants, suprachoroidal shunts, and other micro-invasive procedures. With additional testing, these approaches and many others could well become part of the armamentarium for treating children with glaucoma, a population that has been difficult to treat in the past.

That is a role for which New York Eye and Ear Infirmary of Mount Sinai (NYEE)—one of the most active pediatric glaucoma and cataract centers in the Northeast—is uniquely equipped. A grant last October of \$500,000 from the RICBAC Foundation has enabled us to get our pediatric specialty eye care center off the ground. Planned as one of the most advanced facilities of its type in the country, the center will enable us to house and coordinate under one roof a full range of pediatric eye care specialists and services, research activities, and

formal training programs for physicians who are often unaware of the complexities of treating childhood ocular diseases, particularly glaucoma.

“The specialty eye care center will be a place where we can take the resources and technologies we already have to the next level and really become the national leader in complex pediatric care,” says Joseph Panarelli, MD, Assistant Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai and a glaucoma specialist at NYEE. Some of the biggest gains to be realized, he adds, are in the field of research, where the center would merge the recognized strengths of the Icahn Institute for Genomics and Multiscale Biology and The Charles Bronfman Institute for Personalized Medicine with the clinical expertise of NYEE.

“A tremendous opportunity exists to use genetic information from our patients to better understand at the molecular level the causes and possible treatments and cures for some of the most devastating children’s eye diseases,” emphasizes Dr. Panarelli. In partnership with Mount Sinai’s BioMe BioBank program, this information would help grow a repository of samples and specimens linked with medical information to enable researchers to conduct genetic, epidemiologic, molecular, and genomic studies.

As one of the region’s largest pediatric ophthalmology programs, NYEE has become known for treating the most difficult and complex cases, sometimes involving infants as young as several days. In the case of glaucoma, the new pediatric specialty eye care center will allow us to expand our capabilities for children of all ages who present with primary congenital glaucoma, glaucoma following cataract surgery, glaucoma associated with systemic conditions, and juvenile open-angle glaucoma.

“It’s critical to detect children with glaucoma as early as possible to prevent significant and permanent vision loss,” says Dr. Panarelli. “And we believe the pediatric specialty eye care center can make a big difference in the lives of these kids by expertly treating their conditions and then actively managing their visual development.” ■



Joseph Panarelli, MD, checking on the progress of his pediatric patients



A Complex Pediatric Case at NYEE Is Met With Teamwork and Creativity

The morning after the normal delivery of her daughter Hudson, Desiree Mitchell was shattered by news from the director of the NICU where Hudson was born. He informed her that both of her baby's eyes were opaque, and that the left one was shut and smaller than the other. "The physicians thought she had cataracts, or that I had an infection, like rubella, that had caused this abnormality," she recalled.

Not satisfied with the diagnosis or vague answers to her questions from hospital physicians, she acted on a referral from a professional colleague and brought Hudson to New York Eye and Ear Infirmary of Mount Sinai (NYEE) in December 2013. The child was seen immediately by a group of specialists who, working closely together in the weeks that followed, would recognize this case as among the most complex and challenging they had ever handled, even by the standards of a large referral center like NYEE, which handles the toughest of the tough.

Joseph Panarelli, MD, Assistant Professor of Ophthalmology, Icahn School of Medicine at Mount Sinai, summarized Hudson's condition as severe anterior segment dysgenesis, a condition which results from abnormal embryologic development of the eyes. The child was born with limbal dermoids, scleral ectasia, complete corneal opacification, and a maldeveloped

anterior segment which led to glaucoma in one eye. "We were challenged at every step of the way," recalls Dr. Panarelli, a widely known pediatric glaucoma specialist, "and had to come up with creative ways for essentially reconstructing the whole front of the eye."

Making that process possible were the combined and carefully coordinated efforts of a team of three highly skilled NYEE pediatric ophthalmologists in the fields of glaucoma, corneal transplant and cataract surgery. Soon after concurring on the complex diagnosis, the specialists undertook their multi-stage treatment plan. It began with corneal transplantations and in an usual step, the surgeons had to carefully remove the limbal dermoid which covered most of the cornea. This was followed by intraocular lens extraction and cataract surgery performed by Ronald Gentile, MD, Professor of Ophthalmology at Icahn School of Medicine. Given the abnormal anatomy and poor visualization, this was one of the most difficult parts of the procedure.

The final surgical step – to relieve intraocular pressure and implant a shunt to correct poor drainage outflow from the baby's right eye, the better of the two – illustrates the resourcefulness of doctors immersed in this case. Explains Dr. Panarelli, who led the glaucoma surgery: "I quickly found out I couldn't suture the implant to the eye because the scleral was too thin and the muscles were



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—Joseph Panarelli, MD



Hudson and her mom, Desiree Mitchell, at a recent follow-up visit with Dr. Panarelli

extremely atrophic. As an alternative, I had to attach the implant to a separate piece of donor cornea tissue and anchor that tissue to the child's limbus, allowing the implant to hang back in its proper position. That's not typically how I do this procedure, but every step of this case challenged us as surgeons."

Well aware of the physical obstacles their months-old patient faced, team members set a realistic goal of bringing even limited vision to the right eye, knowing the left one was too damaged to restore. And to that end, doctors who painstakingly managed the case were extremely pleased with the results. More than three years after her round of surgery, Hudson can detect colors, light and shapes from her right eye. While the prognosis for the left eye is poor,

physicians believe additional surgeries down the road might be able to further improve vision in the right.

"Any vision this child is able to get out of even one eye can make a big difference in terms her independence and ability to get around," emphasizes Dr. Panarelli, who has two young children of his own. That point was driven vividly home to him recently as he watched the youngster, back in his office for a routine exam, glued to the bright red image of a happy-faced Elmo flashing across the screen of her handheld. "A case like this is very uplifting for me personally and, I'm sure, for the rest of our team," he muses. "We agree to take them on because we know how to do them and do them well—and because we know the impact they can have on a patient's life." ■

A New Center of Excellence to Drive Innovation, Education And Technology

With its bicentennial just two years away, New York Eye and Ear Infirmary of Mount Sinai (NYEE) is doubling down on innovation and technology to drive its nationally ranked hospital in the years ahead. To that end, in June we launched the Ophthalmic Innovation and Technology Program to spearhead the development and clinical adoption of new surgical approaches and technologies, the kind that have already begun to transform the fields of glaucoma, cataract, corneal, and retinal disease treatment.

“The program’s overriding mission... will be ensuring that any new surgical tools and techniques that emerge are faster, safer, and more effective for patients.”

—Sean Ianchulev, MD

Pioneering some of those advances in recent years has been the physician-inventor-entrepreneur who was named as Director of the new program, Sean Ianchulev, MD, MPH. “Micro-interventional technologies are starting to make great strides, and we want New York Eye and Ear to become the focal point for that revolution in the New York metropolitan area,” says Dr. Ianchulev, who is also Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai. “That means being among the first to introduce exciting new technologies to our patients, and being the preferred partner of industry and innovators in the ophthalmic field who have bright ideas and need to clinically implement them.”

That’s a familiar role for Dr. Ianchulev, who as former head of ophthalmology clinical research at Genentech led the development of Lucentis, a major biologic treatment for age-related macular degeneration and diabetic macular edema. He was also the inventor of intraoperative aberrometry, an advanced technology for precision biometry and guidance during cataract surgery, and led development of the Microstent Cypass, the only supraciliary microstent indicated for intraocular pressure lowering in glaucoma, recently approved by the U.S. Food and Drug Administration. More recently, he created the first micro-interventional technology for phaco-less cataract surgery, commercialized by Iantech, Inc., which Dr. Ianchulev co-founded.

At NYEE, Dr. Ianchulev plans to make the Ophthalmic Innovation and Technology Program a center of excellence, bringing in world-renowned experts to train faculty and residents in the most advanced surgical



technologies, and recruiting additional topflight talent to serve as “innovation champions” for NYEE’s various clinical departments. The program’s overriding mission, he points out, will be ensuring that any new surgical tools and techniques that emerge are faster, safer, and more effective for patients.

“We’re seeing the first wave of micro-interventional technologies in the form of new micro-stents that are being used for glaucoma surgery,” notes Dr. Ianchulev. “The next stage is cataract surgery, where micro-intervention will define the future.” For his part, Dr. Ianchulev has developed miLOOP, a pen-like device that

uses micro-filament technology to fragment the lens for removal through a micro-incision. This promises to make cataract extraction more efficient, less invasive, and less dependent on capital-intensive phaco-emulsification systems, as well as easier for physicians to learn.

As it works to turn new technologies into effective therapies for patients, the Ophthalmic Innovation and Technology Program will also be focused on commercializing them. Here, the program is teaming up with Mount Sinai Innovation Partners (MSIP), an in-house group committed to opening up new relationships with pharmaceutical, biotechnology, and medical service

companies to license and bring to market innovative new ideas originating with Mount Sinai laboratories and faculty.

“NYEE is the oldest specialty hospital in the United States,” says Dr. Ianchulev, “and being able to harness its enormous talent and expertise to be on the cutting edge of innovation and new technology will be critical to its success well into the future.” ■

Fellows and residents during a hands-on course at the Jorge N. Buxton Microsurgical Education Center at NYEE under supervision of attending physicians

NYEE's Growing Footprint Is a Boon to Clinical Trials

“By expanding our network of satellite offices, we’re not only fueling our research program but making NYEE more attractive as a clinical site for sponsors of important national trials.”

—Paul Sidoti, MD

At the heart of New York Eye and Ear Infirmary of Mount Sinai's commitment to the public is easy accessibility to the panoply of services we provide. That includes clinical trials as a way of ensuring that patients who qualify can take advantage of the most advanced medicines and devices, particularly when conventional treatments haven't proven successful for them.

The steady growth of NYEE's geographic footprint across the metropolitan area is putting those trials within reach of ever-growing numbers of people. And that broadening of our catchment area translates into larger and more diverse groups of patients we are able to draw on for clinical research. For some trials, such as the InnFocus MicroShunt®, we rank among the top recruiting sites in the country, in partnership with major sponsors.

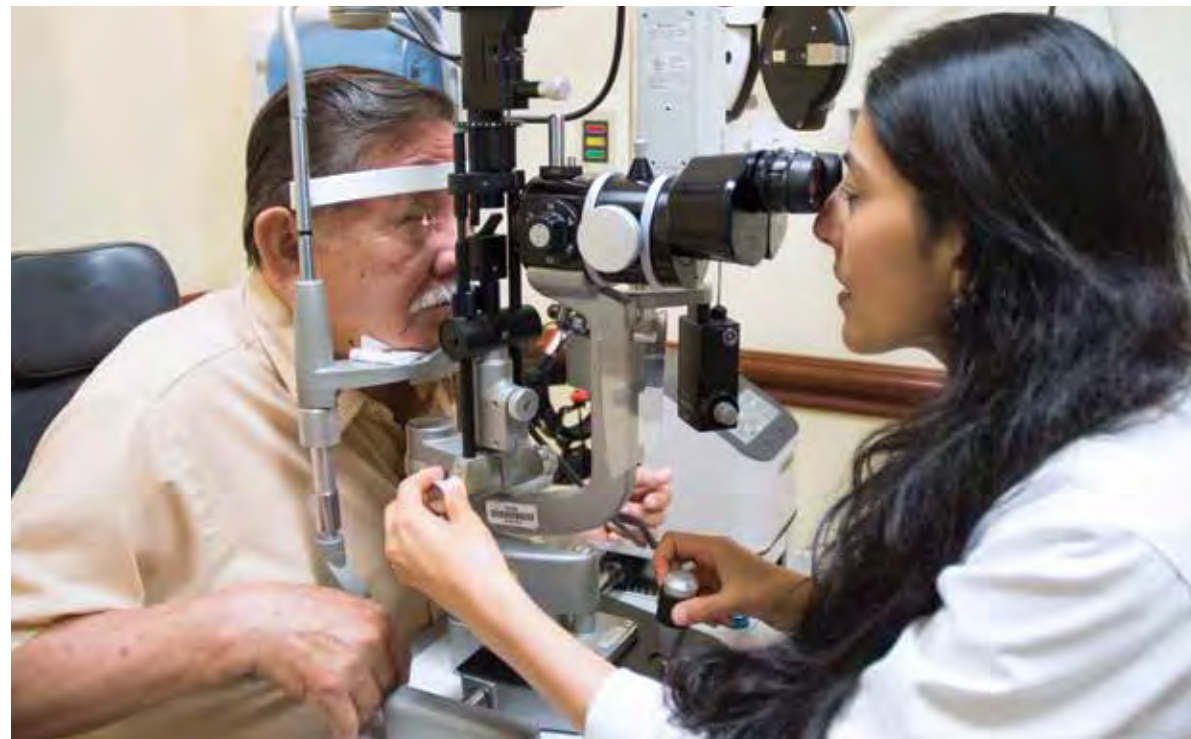
“By expanding our network of satellite offices, we’re not only fueling our research program but making NYEE more attractive as a clinical site for sponsors of important national trials,” says Paul Sidoti, MD, Deputy Chair for Clinical Affairs, NYEE. He points out that many of the satellite offices across New York City and Long Island have clinical trial coordinators and physicians on staff, who serve as another source of patients for large-scale studies.

NYEE's research enterprise is also benefitting from its integration in 2013 with the Mount Sinai Health System. “That partnership has enabled us to combine wet-lab research located at the uptown campus of Mount Sinai with actual patient care and monitoring that's centered at NYEE downtown,” explains Salvatore Loiacono Jr., MPA, Vice President of Ophthalmology Services at NYEE.

“The collaboration also extends across departments so that we’re now able to merge, for example, the clinical skills of NYEE with the expertise of the Icahn Institute for Genomics and Multiscale Biology for specific studies.”

The growth of telemedicine is another way NYEE is expanding patient access to top-flight ophthalmic care as well as clinical trials. Through our teleophthalmology program, we’re making it simple and convenient for diabetes patients to get screened for diabetic retinopathy while visiting their primary care physician within Mount Sinai's health network. Non-mydratric images taken by a trained assistant using a digital retinal camera are then relayed through a secure network at Mount Sinai to NYEE where they are read by a dedicated ophthalmologist. ■

Meenakshi Gupta, MD, examining a patient with diabetic retinopathy at The Bendheim Family Retina Center



New 2017 National Institutes of Health Research Grants

SURGICAL IHH TREATMENT TRIAL		
Principal Investigator	Project Number	Duration
Mark J. Kupersmith, MD	1U10EY025990-01A1	5 years
The Surgical IHH (SiihTT) will compare medical therapy with surgical therapies in patients with idiopathic intracranial hypertension (IIH) who have moderate to severe vision loss to provide an evidence base for treating these individuals at high risk for developing blindness. This study will address an important healthcare issue as IIH is a severe complication of obesity that targets women.		
Direct Cost	Indirect Cost	Funding
\$14,530,606	\$4,487,222	\$19,017,828
AGE-RELATED CHANGES IN HUMAN RETINAL MICROVASCULATURE		
Principal Investigator	Project Number	Duration
Yuen Ping Toco Chui, PhD	1R01EY027301-01	5 years
Age-related degeneration of the retinal vasculature is one of the most pervasive developments in the aging eye, resulting in increased susceptibility to vision threatening ocular diseases, such as diabetic retinopathy. Noninvasive retinal imaging studies of the vascular structure and function will be conducted in groups of healthy aging controls, as well as in patients with diabetic retinopathy. These studies provide the first structural and functionally-based characterization of the vasculature in the normal aging retina and identify more sensitive and predictive biomarkers by highlighting the differences and similarities between normal aging and diabetic retinopathy.		
Direct Cost	Indirect Cost	Funding
\$1,358,963	\$708,509	\$2,067,472
A HYPERSPECTRAL APPROACH TO RPE FLUOROPHORES IN AMD		
Principal Investigator	Project Number	Duration
Roland Theodore Smith, MD, PhD	1R01EY027948-01	4 years
Age-related macular degeneration (AMD) causes vision loss in millions worldwide. The long-term goal of this six-investigator collaboration is to develop AMD diagnostics based on hyperspectral AF for spectral, molecular biopsy of the RPE, linking clinical pathology to underlying molecular composition. Hyperspectral AF imaging, unlike conventional AF imaging, acquires 3-dimensional “hypercubes” of data (2 spatial coordinates – x, y - and 1 spectral - wavelength). We explored imaging data with novel tensor-based tools exploiting multiple excitation wavelengths to discover RPE spectral signatures and their spatial distributions. We propose to link fluorophores to granules, RPE cells, tissue, and AMD stages in three aims using a common human tissue source.		
Direct Cost	Indirect Cost	Funding
\$1,311,231	\$232,827	\$1,544,058



Hyperspectral Autofluorescence (AF) image of disintegrating cells from a donor with advanced age-related macular degeneration (AMD)

Training the Next Generation Of Ophthalmology Leaders

New York Eye and Ear Infirmary of Mount Sinai (NYEE) is one of the nation's leading institutions for training the next generation of ophthalmic specialists on the strength of its comprehensive residency and fellowship programs.

“Our goal is to provide our residents and fellows with the very best opportunities for clinical and scholarly advancement.”

—Anita Gupta, MD

“Our immense surgical and clinical volume, coupled with outstanding faculty in each specialty field, make NYEE a great place for fellows and residents to train, practice, and do research,” says Paul Sidoti, MD, Deputy Chair for Clinical Affairs, NYEE. “Residents and fellows have the opportunity to work with a large number of surgeons and are exposed to a broad range of technologies and approaches to managing disease and surgical problems. In terms of resources, they benefit from the fact that we have 19 operating rooms and one of the best microsurgical labs in the country.”

Both residency and fellowship programs at NYEE put trainees at the center of very busy outpatient settings where, under the supervision of experienced attending physicians, they treat and provide ongoing care to a diverse range of patients. The Infirmary's 21 residents and 9 fellows last year handled some 80,000 patient visits to the outpatient ophthalmology clinics at NYEE.



Above: Glaucoma fellow Robert Fargione, MD, attending physician Kateki Vinod, MD, and international observer Rodrigo Proft, MD, observe pars plana vitrectomy and drainage of choroidal effusions surgery

Left: Paul Sidoti, MD (second from left) and Richard Rosen, MD (behind Dr. Sidoti) perform the surgery, with scrub tech Stacey Carrington (left), Dr. Fargione (right), and Dr. Proft (behind Dr. Fargione)



“We take great pride in the fact that our fellows have their own clinic where they assume ownership of patients—seeing them, operating on them, and closely following them post-operatively,” notes Joseph Panarelli, MD, Assistant Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai and Director of the Glaucoma Fellowship at NYEE, which accepts two new trainees a year. “They really learn how to take the next step toward becoming a glaucoma specialist.”

Residents follow a similar pathway. “What speaks volumes about our program is that when residents finish training,

they're skilled enough to start practicing ophthalmology or academic enough to go on to specialty training at some of the best fellowship programs across the country,” points out Anita Gupta, MD, Assistant Professor of Ophthalmology at the Icahn School of Medicine and Director of the Residency Program at NYEE. “Last year, our three-year residency program received more than 500 applications for seven positions.”

NYEE further distinguishes itself from training programs elsewhere by exposing residents and fellows to an extraordinary volume of patients presenting with a wide

spectrum of ophthalmic disease—from routine problems to complex conditions requiring the collaborative care of multiple subspecialties. The opportunity to manage these patients under the supervision of first-class faculty and with access to the latest diagnostic and therapeutic technologies is what makes the clinical training at NYEE unparalleled.

“Our goal is to provide our residents and fellows with the very best opportunities for clinical and scholarly advancement,” asserts Dr. Gupta. “In that way, NYEE is truly helping to inspire the next generation of leaders in the fields of ophthalmic care, research and global health.” ■

OCT Angiography Makes New Inroads In the Early Detection of Glaucoma and Diabetic Retinopathy

“OCT angiography is helping us to disassemble part of the complexity of glaucoma.”

—Richard Rosen, MD

Optical coherence tomography angiography (OCTA) is revolutionizing the field of ophthalmic imaging, and researchers working with clinicians from New York Eye and Ear Infirmary of Mount Sinai (NYEE) are pushing the technology further through significant enhancements in quantitative perfusion density mapping and image averaging. These improvements in the visualization of microvascular networks and the analysis and display of retinal vascular perfusion density, described in two recently published clinical studies, are enabling OCTA to become a more predictive and powerful tool for diagnosing glaucoma and diabetic retinopathy.

“The software enhancements originally developed by Toco Chui, PhD, in our Adaptive Optics Lab are essentially allowing us to better map the progress of these diseases over time,” says Richard Rosen, MD, Vice Chair and Director of Ophthalmic Research at NYEE, and co-author of both studies. “If we see a defect on OCT angiography and are able to determine how abnormal it is, it may help us to choose an earlier point to intercede, when the possibility to reverse the disease still exists, as opposed to waiting until the damage is quite advanced.”

One of the greatest impacts is expected to be in the field of diabetic retinopathy, where perfusion density mapping may ultimately supplant current disease scaling methods. Fluorescein angiography has been the standard tool for evaluating the severity of the disease for more than 50 years, but it has well-known limitations, among them that it is invasive and time-consuming, and can cause nausea and vomiting as well as skin and eye discoloration. OCTA, on the other hand, is noninvasive and yet able to provide a three-dimensional, cross-sectional view of the retinal capillaries and larger vessels with micrometer-scale depth resolution of vascular lesions that develop in the disease.

OCTA, based on the split-spectrum amplitude-decorrelation algorithm (SSADA), is the ideal platform for the new quantitative graphic mapping techniques for analyzing and displaying retinal vascular perfusion density. SSADA allows specialists to separately image and measure the deep and superficial retinal capillary layers as well as the choroidal capillaries. The enhancements contributed by Dr. Rosen and Dr. Chui, an Assistant Professor of Ophthalmology at the Icahn School

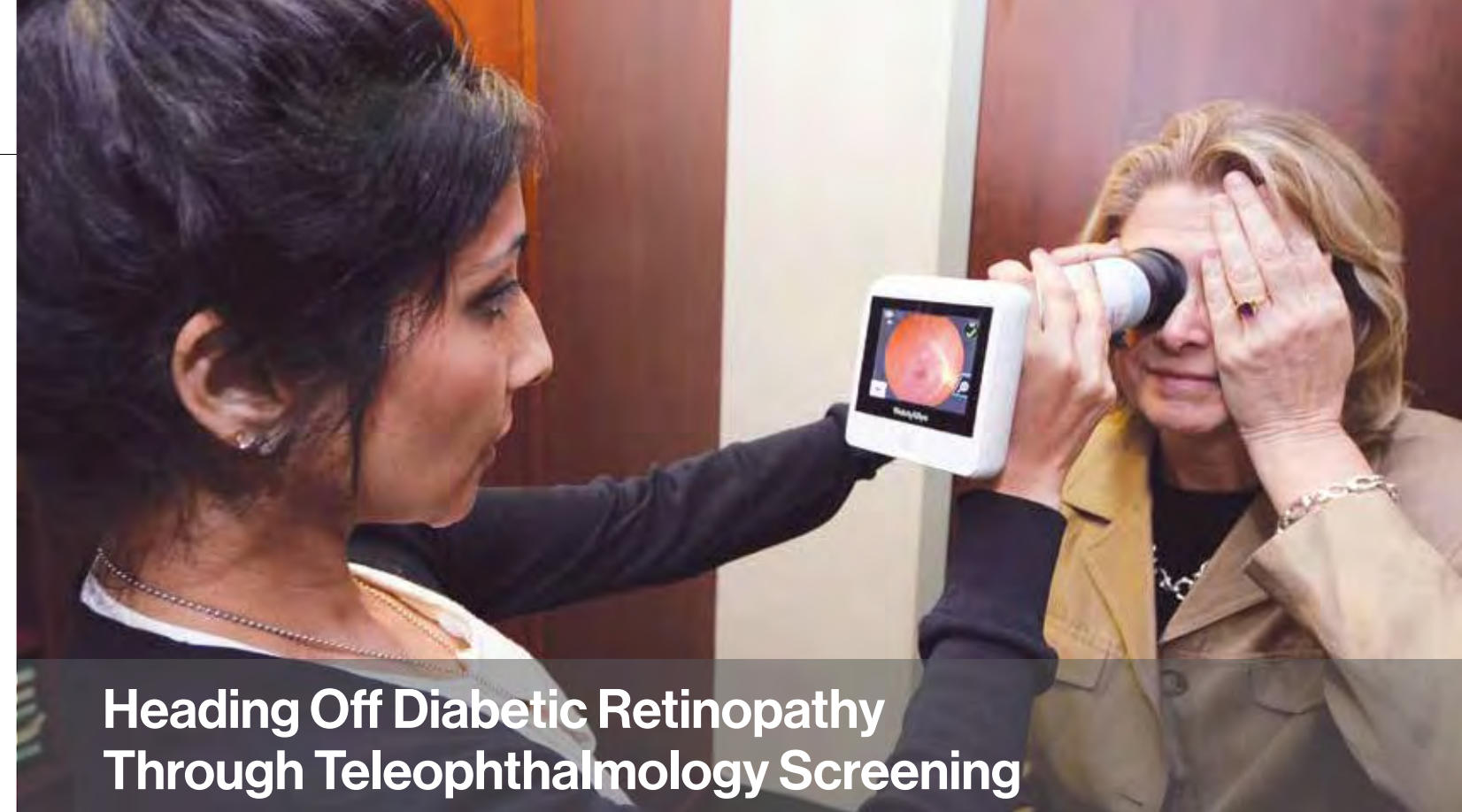
of Medicine at Mount Sinai, are color-coded perfusion density maps which have the ability to highlight and quantify progressive retinal perfusion changes in diabetic retinopathy as well as many other vascular-related disorders.

Earlier detection of glaucoma is another area OCT angiography is helping to transform. By providing a clinically accessible and reliable method for visualizing the microvascular networks using motion contrast imaging processing, very subtle changes in the retinal nerve fiber layer condition can be detected. More recently, image registration and averaging have been added to further enhance the visualization of the radial peripapillary capillary (RPC) network, which supports the retinal nerve fiber layer and the optic disc. “OCT angiography gives us a better handle on the vascular health of the optic nerve than we’ve had in the past,” explains Dr. Rosen, “which is critical to our understanding of glaucoma. By evaluating these radial peripapillary capillaries, we can better appreciate the different forms of glaucoma, looking at the contribution of vascular perfusion versus the impact of intraocular pressure.”

Image averaging based on multiple scans in a single imaging session is a relatively simple method for improving the overall appearance and quantitative results of RPC network studies. In the course of their study, researchers found that higher-quality images and accurate vascular segmentation typically require at least four to five scan repetitions.

“OCT angiography is helping us to disassemble part of the complexity of glaucoma,” says Dr. Rosen, who is also Director of Retinal Services at NYEE and Professor of Ophthalmology at the Icahn School of Medicine. “By providing us with more factors to measure and manipulate, it may lead us to new approaches to contain the disease before its effects on the patient are irreversible.”

To that end, Dr. Rosen is heading up another study focused on detecting through OCTA subclinical macular ischemia in diabetic retinopathy as a way to prevent late ocular complications. That study has received an award of \$150,000 from the New York State Department of Health’s 2017 Empire Clinical Research Investigator Program (ECRIP). ■



Heading Off Diabetic Retinopathy Through Teleophthalmology Screening

With diabetes on the rise worldwide, what better way to zero in on retinopathy before it results in irreversible loss of vision for patients than by tapping into the extraordinary potential of telemedicine? That’s the founding principle behind the New York Eye and Ear Infirmary of Mount Sinai (NYEE) teleophthalmology program, which began reaching out more than a year ago to at-risk patients while they’re visiting their Mount Sinai primary care physicians.

“We know that diabetic patients don’t often visit the eye doctor,” explains Meenakshi Gupta, MD, Assistant Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai, Co-Director of Tele-Retinal Imaging and a vitreoretinal surgeon at NYEE. “We realized that by targeting these patients through our primary care colleagues at Mount Sinai, we could provide a valuable service.”

Providing the backbone for the program is a stationary fundus camera, located in the primary care offices, to capture non-mydriatic images of the back of the eye. Photographs from this digital retinal camera, taken by medical assistants who have been specially trained, are transmitted through a secure platform to NYEE, where they are interpreted weekly by Dr. Gupta. “Most of the images are very readable,” she reports. “The retinal or optic nerve pathology we’ve been able to detect, in addition to diabetic retinopathy, has been quite impressive.” Indeed, between 10 and 15 percent of the patients screened so far have been shown to have diabetic retinopathy, and were urged to follow up with an ophthalmic specialist.

Still in its early stages, the teleophthalmology program is taking steps to equip more primary care offices at Mount Sinai with fundus photography—the longer-range goal being to expand that capability to physicians in the surrounding community. Helping to pave the way is a new generation of portable, handheld devices for snapping photographs of the back of the eye, some so compact they can be attached to a cell phone. “As these devices become smaller, less expensive and easier to use,” notes Dr. Gupta, “we will be able to scale our tele-retinal imaging program and ensure more people receive essential eye care.”

Sophia Saleem, MD, Assistant Professor of Ophthalmology at the Icahn School of Medicine and Medical Director of Telemedicine at NYEE, emphasizes that teleophthalmology is not a replacement for a comprehensive eye exam, but a valuable supplement. It’s also an opportunity, she adds, for NYEE to add considerable value to the broader health care system for diabetic patients as it moves away from fee-for-service and toward quality metrics. “For diabetic patients,” she says, “that means getting to their A1C goals, having specific lab work done, and scheduling an appointment with their eye doctor.”

“Telemedicine will be the primary access point for many people to get their health care in another 10 to 15 years, and our system is heavily invested in that opportunity,” Dr. Saleem says. “We want to provide a practical solution for patients to receive the quality care they need for their eyes through their primary care physician.” ■

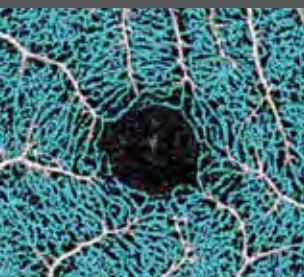
Sophia Saleem, MD, taking a fundus photo using the latest handheld camera

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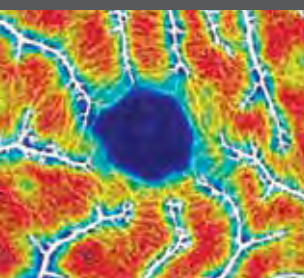
—Sophia Saleem, MD



Macular OCT Angiograph



Isolated Retinal Capillaries



Retinal Capillary Density



A Game Changer for Treating Keratoconus

Corneal collagen cross-linking (CXL) could offer a dramatic change in how people with keratoconus are treated in this country, following its approval by the U.S. Food and Drug Administration in April 2016. A growing body of clinical evidence suggests that CXL has the ability to slow the progression of the disease by stabilizing the corneal contour and improving visual function in some patients. The foundation for the currently employed corneal collagen cross-linking techniques were developed in Europe by researchers at the University of Dresden in the late 1990's. Reports from the *Dutch National Organ Transplant Registry* and the *Norwegian Transplant Registry* show, too, that the technique has reduced the need for corneal transplantation in keratoconus patients within their respective countries.

“Collagen cross-linking is a relatively simple procedure that will definitely change the outcomes for many patients.”

—David Ritterband, MD

New York Eye and Ear Infirmary of Mount Sinai (NYEE) is one of a handful of centers in the New York metropolitan area equipped to do collagen cross-linking. Nearly 20 physicians at NYEE have been trained and certified to perform the minimally invasive procedure using the only CXL system (from Avedro) approved for use in the United States.

“Collagen cross-linking is a relatively simple procedure that will definitely change the outcomes for many patients,” notes David Ritterband, MD, Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai and System Chief of the Refractive Surgery Division at the Mount Sinai Health System. “It will also start to change the paradigm of how we treat keratoconus by underscoring the need to detect the condition as early in life as possible through corneal topography followed by careful monitoring of any changes over time.”



Safe and effective corneal collagen cross-linking, performed in NYEE's Laser Vision Correction Center, applies not just to keratoconus but to corneal ectasia following refractive surgery. The procedure begins by numbing the eye and scraping the epithelial cells from the surface of the cornea. Riboflavin (vitamin B2) eye drops are then applied repeatedly for a half-hour so that they saturate the corneal stroma. Next, clinicians shine an ultraviolet light on the eye for another 30 minutes while drops continue to be administered. The combination of riboflavin and ultraviolet light strengthens the bonds between collagen fibers and changes the configuration of the collagen, a significant development for individuals with

keratoconus whose corneas thin and bulge outward, resulting in blurred or double vision, astigmatism, and, in extreme cases, the need for corneal transplants. The 60- to 90-minute cross-linking procedure—performed months apart in each eye—concludes with application of a bandage contact lens on the surface and anti-inflammatory drops during the following month.

Corneal collagen cross-linking is most effective when done in the early stages of the disease, before the cornea has become too misshapen and vision has been compromised. For that reason, Dr. Ritterband believes there will be a growing movement among

ophthalmologists to get a baseline corneal topography in any child with astigmatism or extreme nearsightedness that could be a subclinical sign of keratoconus. “Even when pediatric ophthalmologists see these patients, they don't realize they may have evidence of the disease on corneal topography,” he explains. “Corneal topography meets the gold standard of how we diagnose keratoconus at an early age. And if we can find these people in their early teens or even younger, we can begin treating them with collagen cross-linking to halt progression of the disease and vision loss.” ■

Patient receiving riboflavin (vitamin B2) eye drops as part of the collagen cross-linking procedure on her left eye. Her right eye needed a cornea transplant.

Pushing the Borders of Discovery Through A New Eye and Vision Research Institute

“The Institute underscores Mount Sinai’s commitment to significantly expand and nurture its eye and vision research portfolio and recruit top scientific talent with an array of expertise.”

— Douglas Jabs, MD

Mount Sinai Health System’s vast wealth of scientific and medical resources is now being focused on breakthrough discoveries in the field of ophthalmology through creation of the Mount Sinai/New York Eye and Ear Eye and Vision Research Institute. By fostering cross-departmental collaborations, the Institute plans to become a top 10 NIH-funded ophthalmology research center.

“The Institute underscores Mount Sinai’s commitment to significantly expand and nurture its eye and vision research portfolio and recruit top scientific talent with an array of expertise,” says Douglas A. Jabs, MD, MBA, Professor of Ophthalmology and Medicine at the Icahn School of Medicine at Mount Sinai and Director of the Mount Sinai/New York Eye and Ear Eye and Vision Research Institute. “Our goal is to bring together disparate groups of researchers who by working collectively will be much more productive than working in isolation.”

The Institute plans to work synergistically with many of the well-established academic departments and research centers at Mount Sinai, including The Friedman Brain Institute, the Icahn Institute for Genomics and Multiscale Biology, and The Black Family Stem Cell Institute. Areas

expected to benefit from these joint efforts include stem cell and regenerative biology of the visual system, genetic and genomic links to eye disease, and advanced ocular imaging.

The Institute is beginning to take shape as two highly experienced researchers come on board. They are Bo Chen, PhD, most recently Associate Professor in the Departments of Ophthalmology and Neuroscience at Yale University School of Medicine, and Roland Theodore Smith, MD, PhD, most recently Professor of Ophthalmology at New York University School of Medicine and Director of the Retinal Imaging Laboratory there for the past 18 years. Dr. Chen’s research focus has been retinal degenerative diseases characterized by the loss of photoreceptors and ganglion cells, while Dr. Smith has developed novel retinal imaging instrumentation and quantitative analysis methods directed especially at age-related macular degeneration. These scientists are the core of an anticipated team of 10 members to be split between bench researchers at Mount Sinai’s uptown Manhattan campus and clinical/translational researchers at NYEE downtown. The former will concentrate on areas deemed high priority by NIH (such as retinal and neuronal regenerative medicine and the biology of aging), while the latter will leverage NYEE’s strengths in areas like imaging, outcomes research and molecular diagnostics.

According to Dr. Jabs, who has chaired numerous NIH-funded, multicenter national and international clinical trials, the Eye and Vision Research Institute will seek out strategic areas of overlap. For example, he points out that NYEE performs about 2,000 vitrectomies a year, providing a wealth of data for scientists investigating human retinal diseases. What’s more, he hopes to build on NYEE’s strengths in ophthalmic imaging by creating an optic nerve Reading Center to provide a valuable asset to glaucoma and neuro-ophthalmic clinical studies by evaluating images, such as retinal photographs, fluorescein angiograms, and optical coherence tomograms (OCT).

The Institute will be both complementary to and synergistic with NYEE’s recently formed Ophthalmic Innovation and Technology Program. That initiative, launched in June, will look to develop the latest surgical technologies and techniques in rapidly evolving areas of glaucoma, cataract, corneal, and retinal disease treatment. ■

A Global Expert Sees Major Progress In Treating and Even Curing Glaucoma

The 100th anniversary this year of the discovery of exfoliation syndrome (XFS) by a young Finnish ophthalmologist, John Lindberg, provides a fitting occasion for New York Eye and Ear Infirmary of Mount Sinai (NYEE) Director of Glaucoma Research and Surgeon Director Emeritus Robert Ritch, MD, to reflect on the recent progress that has been made in understanding the genetic and biological mechanisms of the disorder, which is now known to be the most common recognizable cause of open-angle glaucoma worldwide, affecting some 80 million people. “For years I kept saying that exfoliation syndrome was an ocular manifestation of a systemic disease with specific underlying genetic, biochemical, and cell biological mechanisms, but very few people were listening,” asserts Dr. Ritch, who was voted as the inaugural President of the 20-year old Lindberg Society consisting of 75 scientists worldwide. “It was thought to be a Scandinavian disease, and was largely ignored by Americans.”

That changed dramatically in 2007 with the discovery by a genetic consortium in Iceland of two single nucleotide polymorphisms (SNPs) in the LOXL1 (lysyl oxidase-like 1) gene, present in 99 percent of Caucasians with XFS, an age-related disease characterized by the production and accumulation of a whitish, flaky material in many non-ocular as well as ocular tissues. LOXL1 is a major component of the extracellular matrix. That discovery opened the door to numerous studies worldwide on the prevalence of these SNPs in different populations. More recently, six additional genes have been described, all involving the extracellular matrix in one way or another, including one mutation which protects against developing XFS. Intensive research is beginning into the nature of the regulation of LOXL1 and the function of the other genes and how they fit together. The goal is to be able to manipulate the production and/or function of the LOXL1 gene.

The breakthrough also validated Dr. Ritch’s long-held theories on the etiologies and mechanisms of various glaucomas, and served to energize and sharpen his research through the extensive work of The Glaucoma Foundation, which he founded in 1994 and serves as Medical Director and Chairman of the Scientific Advisory Board. Five years ago, the Foundation devoted all its resources and funding into studying XFS, convening annual “Think Tanks” which invites scientists and clinicians from around the world. For 90 years, XFS was



Robert Ritch, MD, with a glaucoma patient

virtually ignored, and only a small number of people were actively engaged in research on it. As a result of the efforts of the Think Tank and nearly \$1 million in pilot grants, the number of active researchers has more than quadrupled. At this year’s World Glaucoma Congress in Helsinki, Finland, for the first time, four symposia were devoted to XFS.

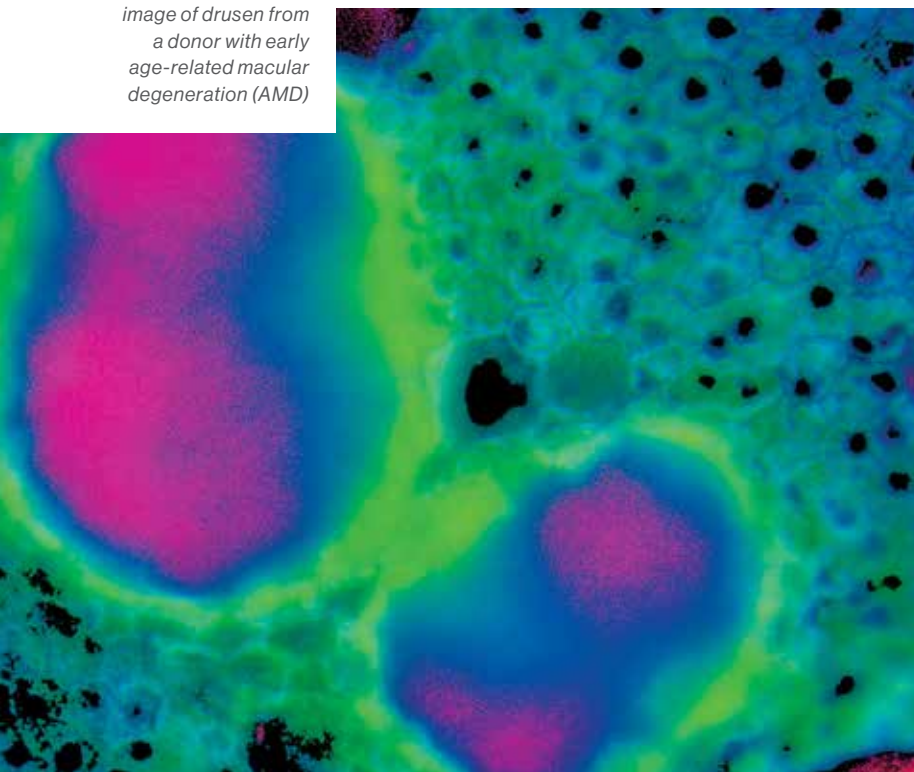
Studies are now underway not only in genetics but in gene-environment interactions, molecular and cellular biology, detecting biomarkers, and creating an animal model of the disease. Three years ago, a patient of Dr. Ritch’s from Brazil, Moise Safra, donated \$1 million to research on the biology of XFS. Teaming up with Audrey Bernstein, PhD, at SUNY Upstate Medical University in Syracuse and J. Mario Wolosin, PhD, at Mount Sinai, they discovered that XFS is a disease of abnormal lysosomal function, failure of microtubular organization, and decreased mitochondrial function. This was the first time in history that the pathways of cellular dysfunction had been described for any major type of glaucoma. With much more to be discovered, it opens the door to a panoply of new approaches and modalities to treatment affecting the formation of XFS itself and the potential to prevent or reverse the disease prior to the onset of glaucoma and not just try to lower intraocular pressure once glaucoma has begun.

The field is clearly starting to capture the kind of respect Dr. Ritch felt it was so long denied. All of which leaves Dr. Ritch, who has won more than 60 national and international awards over the course of his celebrated career, more convinced than ever that glaucoma is an eminently “preventable, reversible and even curable disease.” ■

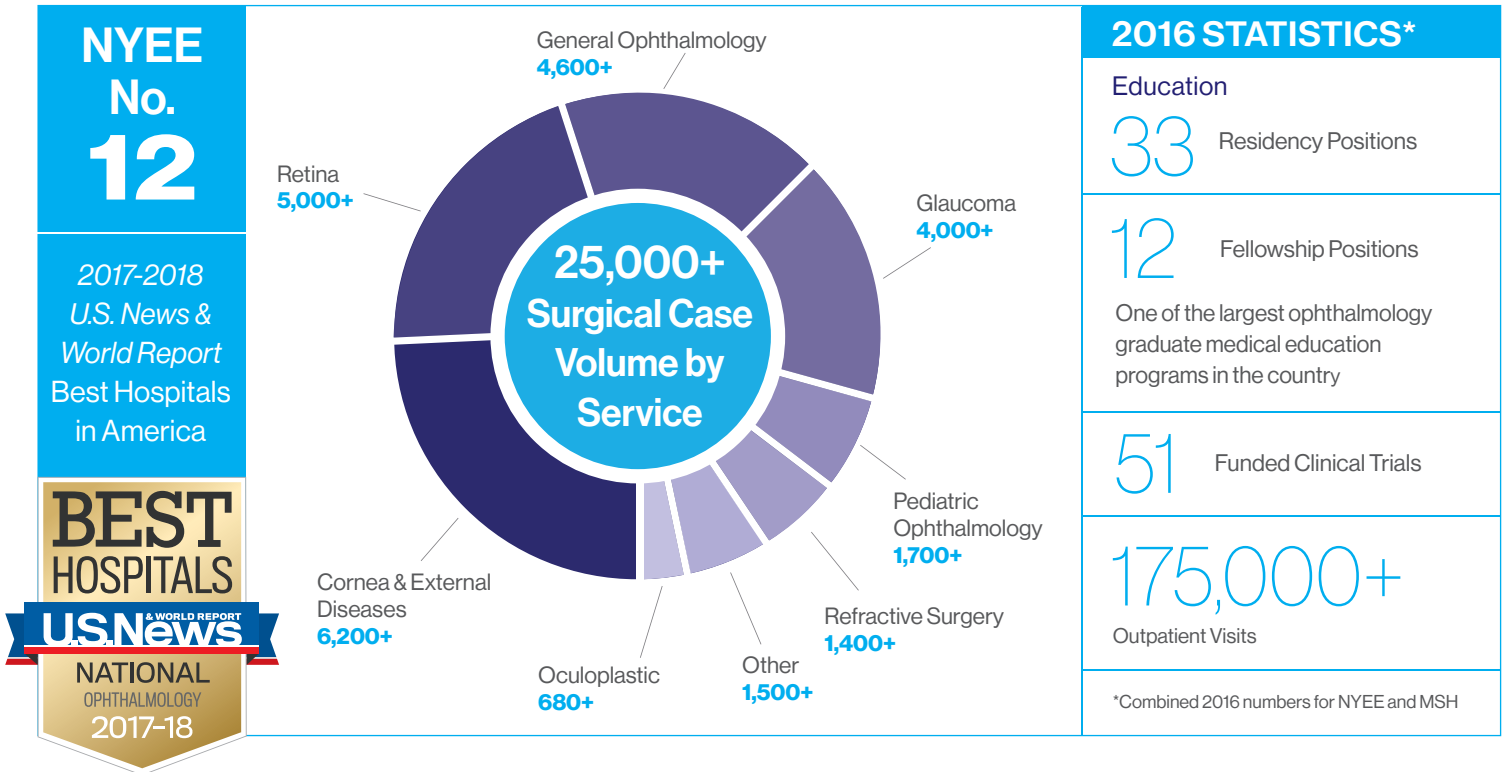
“For years I kept saying that exfoliation syndrome was an ocular manifestation of a systemic disease... but very few people were listening.”

— Robert Ritch, MD

Hyperspectral autofluorescence (AF) image of drusen from a donor with early age-related macular degeneration (AMD)



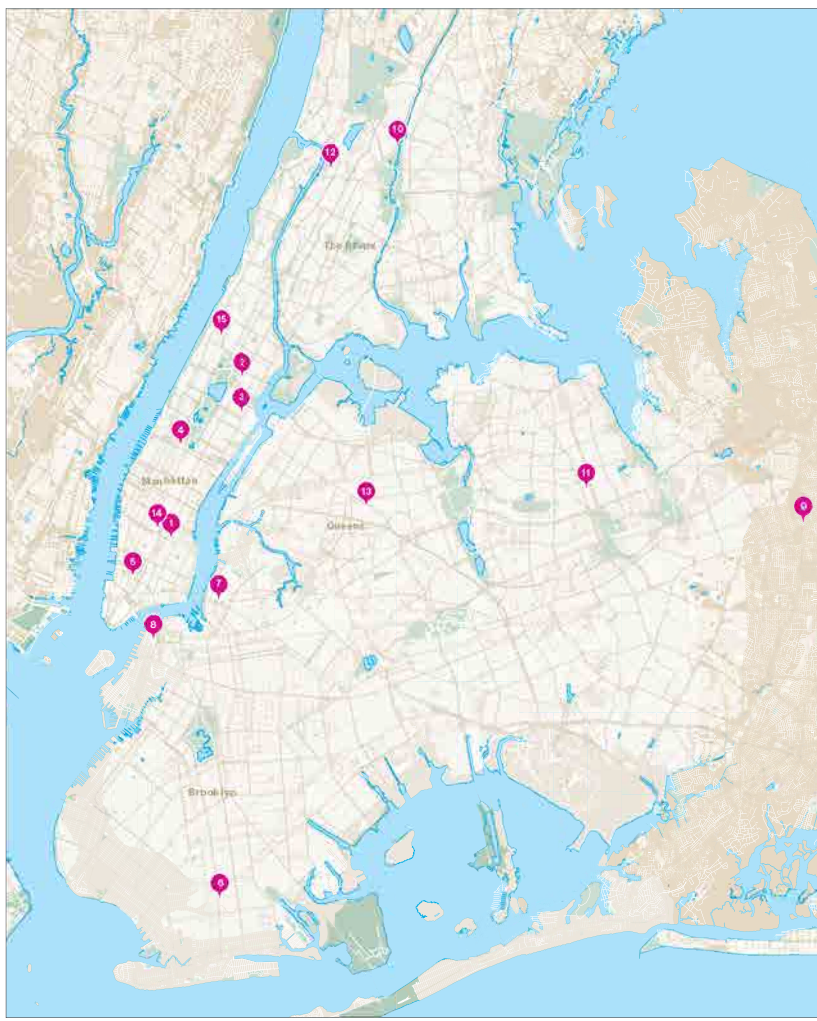
Department of Ophthalmology at a Glance: New York Eye and Ear Infirmary of Mount Sinai (NYEE) and The Mount Sinai Hospital (MSH)



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