

Precision+Innovation

Defining the Future
of Ophthalmology



New York
Eye and Ear
Infirmary of
Mount
Sinai

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Message from James C. Tsai, MD, MBA

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At no other time has ophthalmology been changing at a more dizzying pace, led by breakthroughs in the treatment and diagnosis of debilitating disease and the way we deliver our services to patients and the community. For more than 200 years, New York Eye and Ear Infirmary of Mount Sinai (NYEE) has remained committed not just to keeping up with change in our field, but working tirelessly to lead it.

The following two articles demonstrate how that commitment has evolved in the key areas of technology and training. One describes how our researchers are deploying the vast potential of artificial intelligence to develop accurate new algorithmic tools to predict if and when individuals are likely to develop glaucoma or age-related macular degeneration. The other article reveals how we are breaking ground in another way: through a joint internship program that combines general medicine with ophthalmology to maximize learning opportunities for the next generation of ophthalmologists.

We believe these new pathways at NYEE can serve to enlighten other professionals in our field who are faced with the same complex challenges. For that reason, we hope you'll give these articles a moment of your time.



11th Annual Steven M. Podos, MD, Symposium and Lecture: Innovations in Ophthalmology

Date and Time: Friday, June 3, 2022, 8:30am – 4:30pm EDT

This live streamed webinar is designed to provide participants with an update on a variety of topics related to the management of complex ophthalmic disorders in adults and children, including ocular surface disease, neurotrophic keratitis, malignant glaucoma, central retinal artery occlusion, and cataract surgery.

For additional information and to register, visit:
mssm.cloud-cme.com/11thPODOS

Breaking New Ground in Disease Detection With the Help of Artificial Intelligence



Benefiting from a rich library of heterogeneous image data sets, New York Eye and Ear Infirmary of Mount Sinai (NYEE) is expanding the breadth and depth of its artificial intelligence (AI) research to uncover innovative new ways to detect and treat common ophthalmic diseases like glaucoma and macular degeneration.

The institution's researchers are attempting to disentangle the pathogenesis of glaucoma, the second leading cause of blindness worldwide. As a vital part of that initiative, they

are building a computational algorithm to identify individuals who are at risk of early-onset central vision damage from primary open-angle glaucoma. "These patients don't present with unusually high intraocular pressure (IOP), yet their form of glaucoma can be visually disabling, impairing their depth perception and ability to read," says Louis Pasquale, MD, Deputy Chair of Research for the Department of Ophthalmology at the Icahn School of Medicine at Mount Sinai, and Director of the Mount Sinai/NYEE Eye and Vision Research Institute. "We're

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using our data sets to develop a deep-learning algorithm that can look into the future to predict who are the likely candidates, based on their imaging, for this early pattern of glaucomatous functional loss." The hope is to establish more aggressive IOP-lowering regimens for these patients to prevent this pattern of loss from developing.

Similarly, an NYEE research team is building an algorithm to detect hemorrhages that can develop on the optic nerve head, a telltale sign that a glaucoma patient will progress over the next several years. Scientists and engineers are drawing on a large optic nerve image set to develop and train an AI-driven tool that can overcome the inability of humans to detect these hemorrhages in the clinic.

In another AI project that's pushing the boundaries of glaucoma research, Dr. Pasquale and his colleagues at Harvard Medical School decompose visual field findings into their component parts to ascertain unique causes of each type of glaucomatous loss. Driving this effort is the development of a data set based on early-onset glaucoma visual field changes from a U.S.-based cohort of health care professionals. This information has been enriched by covariant data—including demographics, genetics, and medical history—that is helping to bridge the gap in our understanding of glaucoma.

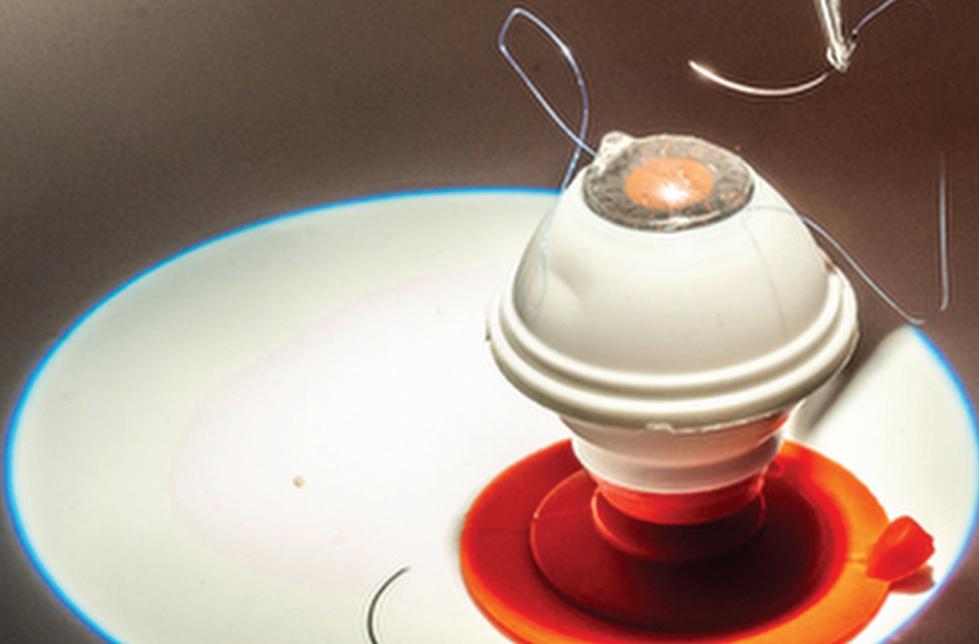
"From this visual field data, we've already shown 14 different patterns, and learned that being of African heritage is the

No. 1 risk factor for presenting with the more advanced patterns of vision loss," explains Dr. Pasquale. "This finding has tremendous implications for screening because we've always had the mindset that glaucoma is strongly age-related. Our data supports that, but it also underscores the need to screen people of African descent earlier in life to detect a potential glaucoma problem before it reaches one of the advanced patterns we've shown."

In the field of age-related macular degeneration (AMD), an NYEE team of researchers has developed for the first time a family of AI-based models that can not only identify patients at risk for AMD, but also those who are likely to progress to late-stage AMD within one to two years if they don't seek ophthalmic care. These unique models use an ensemble of deep-learning screening methods and AMD-specific algorithms to classify patients into early, intermediate, or advanced AMD categories, followed by a machine-learning technique to predict progression to late-stage AMD. The system's accuracy for predicting disease progression within one to two years is 86 percent.

"By alerting patients and their physicians to the potential dangers ahead for AMD, we believe this innovative technology could play a very important public health role," says R. Theodore Smith, MD, PhD, Director of Biomolecular Retinal Imaging at NYEE, who helped develop the models.

Creating a Fluid Pathway From Internship to Residency



Skills transfer course:
A dry-lab session with trainees practicing advanced anterior segment skills.

A joint internship program at Mount Sinai that integrates general medicine with ophthalmology is maximizing learning opportunities for students while paving the way for broad changes in how residency training is structured and delivered. The initiative, which brings together the resources of New York Eye and Ear Infirmary of Mount Sinai (NYEE) and Mount Sinai Beth Israel, is allowing residents to hit the ground running when they begin their three-year ophthalmology program, including earlier exposure to microsurgical skills training.

"There's been an explosion in knowledge, technology, and surgical techniques over the past 30 years in the field of ophthalmology, but we haven't grown beyond the same three years

of training," says Paul A. Sidoti, MD, Deputy Chair for Education, Department of Ophthalmology, Icahn School of Medicine at Mount Sinai, and Chair of Ophthalmology at NYEE. "Our joint internship program gives us a small but important block of additional time to expose new trainees to our subspecialty clinics and to introduce them to basic eye examination techniques and the treatment of ophthalmic emergencies during their internship year."

Medical school graduates who match to NYEE's residency program now divide their internship year between nine months of general medicine at Mount Sinai Beth Israel and three months of ophthalmology training at NYEE and The Mount Sinai Hospital. The joint internship program will complete its second full

year on July 1, its 10 participants then transitioning to what is already the largest accredited ophthalmology residency program in the country.

"Preparing these trainees to do more in their first year of residency will give us the leeway to streamline some of the traditional features of the program," points out Dr. Sidoti. "For example, instead of developing microsurgical skills in the second and third years of residency, we plan to start the process in the first year."

As part of that learning experience, residents have round-the-clock access to NYEE's Jorge N. Buxton, MD, and Douglas F. Buxton, MD, Microsurgical Education Center. In this technologically advanced wet lab with its 16 microscope-

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and audio-visual-equipped stations, trainees hone the skills and techniques they'll soon take to patients in the operating room. They also have the opportunity to develop and refine their intraocular surgical skills on NYEE's state-of-the-art EyeSi surgical simulator. Residents also benefit from their rotation among clinic and acute care sites across the boroughs of New York City with their diverse mix of patients and complex ocular pathologies. They will have the opportunity to get involved in research projects after getting an introduction to ophthalmology during their internship.

Indeed, the brief time spent by students in their internship year will prepare them in a host of ways for their next phase of specialty training and clinical responsibilities. Their new familiarity with the multiple training sites that are now an integral part of the NYEE ophthalmology training program and the professionals who work there will enhance their ability to care for patients and maximize learning opportunities when they rotate through the consultation services and clinics at these locations as residents. And by being able to examine and operate on patients earlier in their

residency, they'll be better positioned to learn from these one-on-one encounters. "The comprehensive programs we're able to offer interns and residents typify our commitment to best-in-class education," emphasizes Dr. Sidoti. "By continuing to expand and streamline these initiatives—like our joint internship program—we remain among the leaders in educating the next generation of ophthalmologists."



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