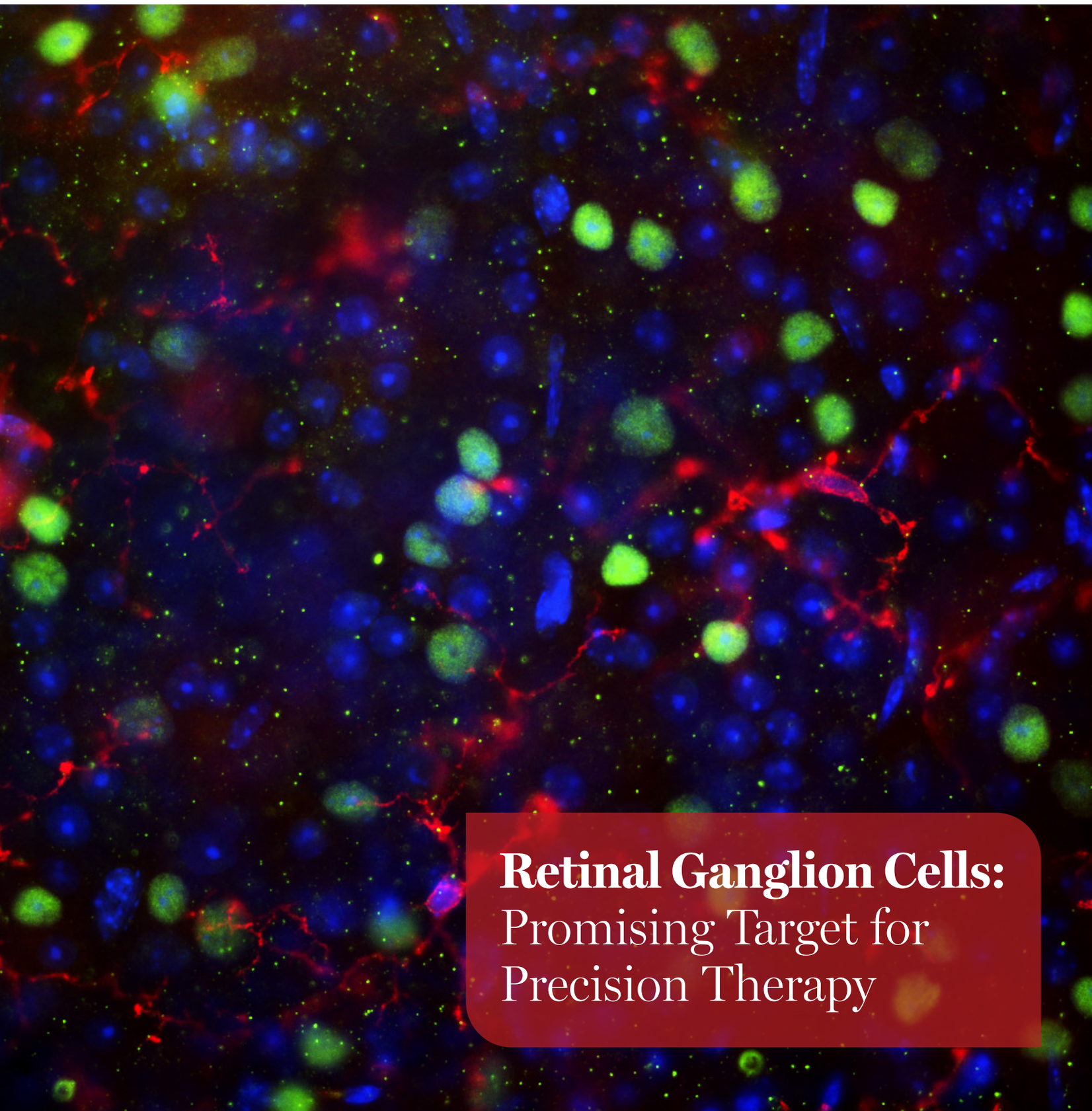
annual report 2020

scheie vision

Penn Medicine | Department of Ophthalmology



Retinal Ganglion Cells: Promising Target for Precision Therapy

IN THIS ISSUE

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Cover: **Image of retinal ganglion cells from Qi Cui, MD, PhD. Green: retinal ganglion cells, blue: cell nuclei within the ganglion cell layer, red: microglia.**

If you would like to add/remove your name from this mailing list, or would like to receive our electronic newsletter, please email **Alexandra.Brodin@pennmedicine.upenn.edu** or call **215.662.8044**.

A MESSAGE FROM THE CHAIR

Welcome to the annual edition of *Scheie Vision*. In the midst of great uncertainty and many challenges, our Department has made critical advances this past year, with remarkable progress in research, education, patient care, and community service – all of which you can read about in this issue.

This year, the outbreak of the novel coronavirus (COVID-19) required us to make changes in each of these areas to keep our Department and our community safe. Through careful adherence to safety and PPE guidelines, as well as innovation by Department leaders, we have been able to continue providing outstanding patient care at higher than pre-COVID levels, while maintaining social distancing in waiting areas, elevators, and hallways. In this issue, you can read about what to expect at your next in-person appointment at Scheie, and learn more about the Department's approach to telemedicine.

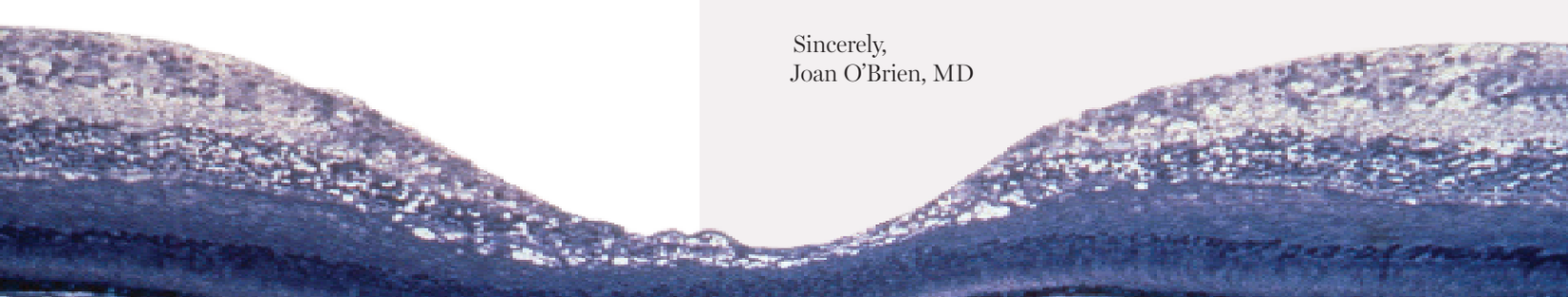
Our researchers continue to make groundbreaking developments, with several also conducting research on COVID-19. In this edition, we highlight three innovative studies on retinal ganglion cells, which are increasingly being considered as a target for precision therapy for glaucoma and other retinal diseases. We also feature a cross-departmental project with Dr. Daniel Yoshor, who recently joined UPenn as the Chair of the Department of Neurology. Dr. Yoshor's research utilizes a visual cortical prosthetic that employs dynamic brain stimulation, allowing blind and sighted patients to "see" shapes. You can also read about how Dr. Zujaja Tauqeer, a second-year resident, helped to improve the Scheie wet lab for generations of residents to come.

Our faculty and staff are committed to providing safe, effective care to all of our patients. In 2020, our physicians saw 112,617 patient visits and performed 2,191 surgeries. We share the story of one of these patients—Hilda Friedman, a 96-year-old visual artist who has donated several of her paintings to be displayed in waiting areas at Scheie. You can also read about the inspiring journey of Tracy Minish, a NASA employee with retinitis pigmentosa. After seeking out genetic testing at Scheie, Tracy formed a close relationship with Dr. Jean Bennett, who has devoted her career to finding a cure for patients with inherited retinal degenerations.

Finally, we highlight our mission to provide support to underserved populations throughout Philadelphia. As the pandemic paused in-person gatherings, the Penn Center for Low Vision Rehabilitation's Vision Loss Support Group moved to a virtual platform. Although the group could not meet in person, members still came together virtually to support and encourage one another.

I would like to express my sincere appreciation to all members of the Scheie community as we continue to navigate these challenging times. The courageous efforts of our faculty, staff, trainees, and patients have allowed us to preserve and advance the missions of the Scheie Eye Institute. I hope you will find inspiration as you read through these articles, and I wish you all a safe and healthy holiday season.

Sincerely,
Joan O'Brien, MD



RESEARCHERS DISCOVER TWO DRUGS THAT CAN PROTECT AGAINST GLAUCOMA IN PRECLINICAL MODELS

By Kristen Mulvihill

Recent studies led by Qi N. Cui, MD, PhD and Joshua Dunaief, MD, PhD discovered two drugs can protect retinal ganglion cells (RGCs) in a mouse model of glaucoma.

Glaucoma is an eye disease that slowly damages the optic nerve and RGCs. It is the leading cause of irreversible blindness worldwide, predominantly affecting individuals over the age of 60. By 2040, approximately 112 million people around the globe are predicted to be living with glaucoma.

This neurodegenerative disease can cause permanent loss of the visual field, usually due to high pressure inside the eye, or intraocular pressure (IOP). There are limited therapeutic mechanisms to effectively slow disease progression; all available treatments reduce IOP. However, glaucoma can continue to progress even in patients who achieve normal IOP levels after treatment, so it is necessary to investigate novel glaucoma therapies.

"All available treatments for glaucoma target IOP control, which is not sufficient to prevent vision loss in a significant number of patients," explained Dr. Cui.

The teams of Dr. Cui, Assistant Professor of Ophthalmology, and Dr. Dunaief, Adele Niessen Professor of Ophthalmology, sought to examine new treatments with the potential to target other risk factors in glaucoma. They found that the drug deferiprone (DFP) and the compound NLY01 can protect RGCs in a mouse model of glaucoma.

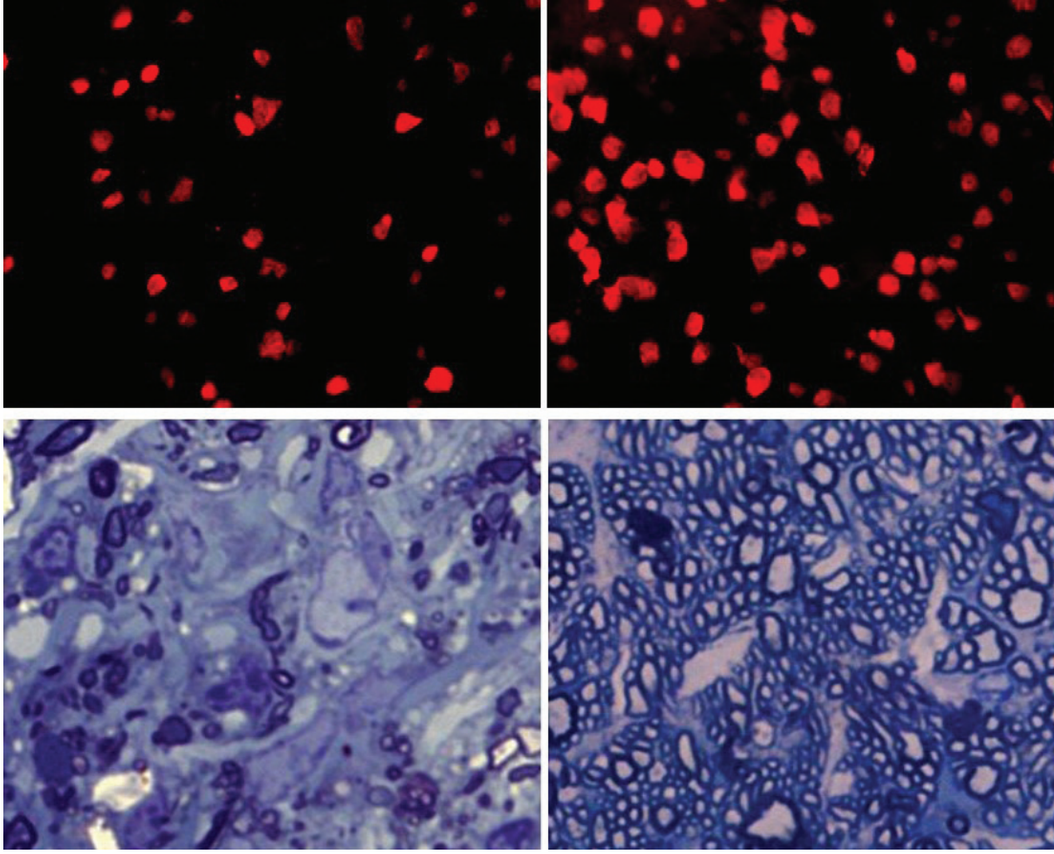
DFP is an orally-administered iron chelator approved by the FDA to treat patients with iron overload. The drug has been used to treat mouse models of macular degeneration and retinal degeneration, both of which are associated with oxidative stress. Oxidative stress, often produced by excess iron, likely plays a role in the development of glaucoma.

To test whether DFP could be protective in glaucoma, the team used microbead injections to induce elevated IOP in a group of mice. The researchers found that administering DFP was protective against RGC and optic nerve loss. These results, published in *Experimental Eye Research*, suggest

Dr. Qi Cui.

Dr. Joshua Dunaief presenting a lecture at the 2019 Macula Society Meeting.

All available treatments for glaucoma target IOP control, which is not sufficient to prevent vision loss in a significant number of patients."



Treatment with both drugs improved RGC soma and optic nerve axon survival (right-sided images) compared to untreated eyes (left-sided images).

that iron chelation by DFP may provide neuroprotection in glaucoma. An additional study showed that DFP was protective in a mouse model of chronic, inherited glaucoma—the DBA/2J mouse. This study was led by Modupe (Funmi) Adetunji, a fourth-year medical student at the Perelman School of Medicine (PSOM).

From left to right: Modupe (Funmi) Adetunji and Jacob Sterling.

"DFP or another iron chelator could potentially become a treatment for glaucoma patients after clinical trials are conducted," said Dr. Dunaief.

In a similar study, the research team investigated the effects of NLY01 in a mouse model of glaucoma. NLY01 belongs to a class of drugs called Glucagon-like peptide-1 receptor (GLP-1R) agonists, which are commonly used to treat Type 2 diabetes. In experimental animal models, other GLP-1R agonists have shown potential in preventing degeneration in Parkinson's and Alzheimer's diseases.

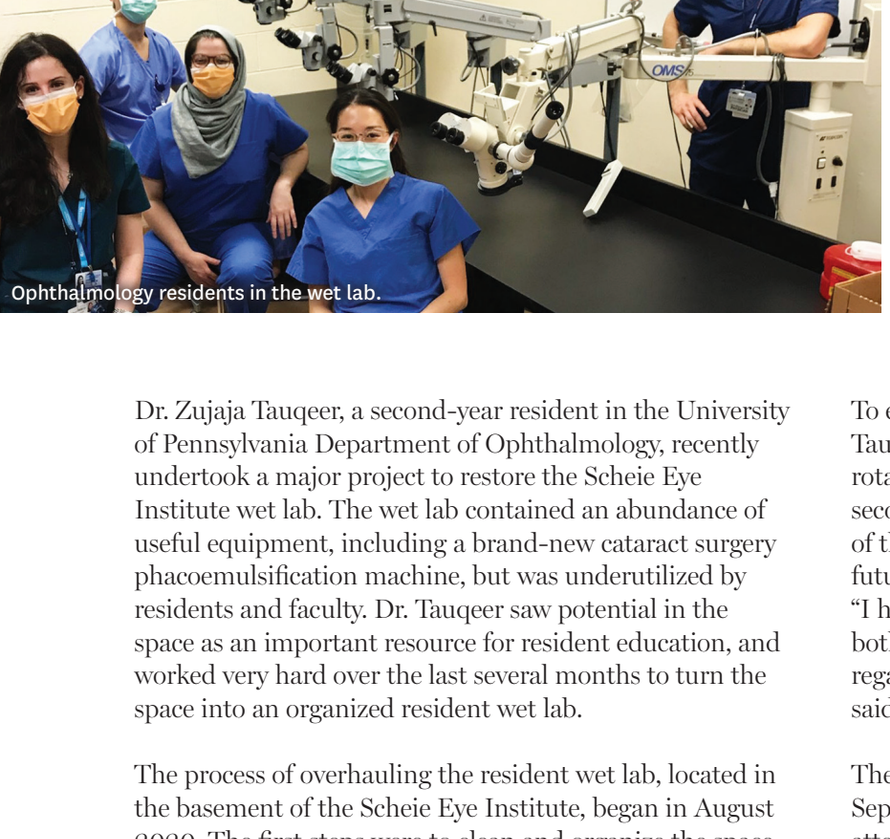
To examine the effects of NLY01 on glaucoma, the team, led by PSOM MD/PhD student Jacob Sterling, again used microbead injections to elevate IOP in a group of mice. In this study, IOP elevation triggered the production of cytokines, which are produced by immune cells and can contribute to inflammation. Furthermore, they revealed that cytokines can stimulate transformation of retinal support cells called astrocytes. This transformation can cause these cells to become harmful and promote RGC and vision loss in glaucoma.

The team found that NLY01 successfully reduces retinal inflammation and prevents astrocyte transformation and RGC death in this mouse model of glaucoma. These results, published in *Cell Reports*, suggest that NLY01 has the potential for clinical use in the treatment of glaucoma. Clinical trials are in progress to test NLY01 in Parkinson's disease, which will help determine the safety and efficacy of the drug for future glaucoma clinical trials. Neuraly, Inc., a biotechnology company pioneering therapeutics for neurodegenerative diseases, recently announced a strategic sponsored research agreement with UPenn to study the use of NLY01 to target a mechanism of glaucoma.

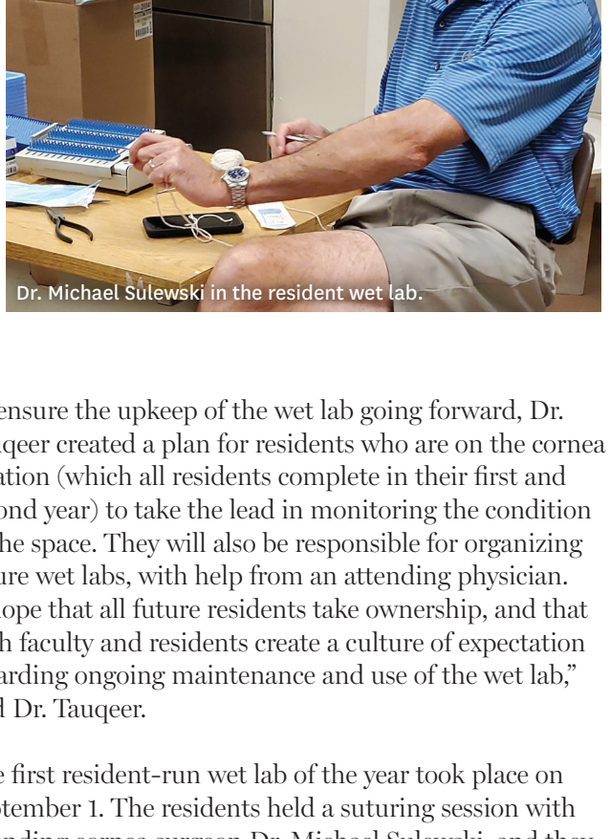
Given both significant findings, DFP and NLY01 will be tested in additional mouse glaucoma models. If proven protective, Drs. Dunaief and Cui plan to advance the drugs to clinical trials. ■

OPHTHALMOLOGY RESIDENTS OVERHAUL SCHEIE WET LAB

By Alexandra Brodin



Ophthalmology residents in the wet lab.


Dr. Michael Sulewski in the resident wet lab.

Dr. Zujaja Tauqeer, a second-year resident in the University of Pennsylvania Department of Ophthalmology, recently undertook a major project to restore the Scheie Eye Institute wet lab. The wet lab contained an abundance of useful equipment, including a brand-new cataract surgery phacoemulsification machine, but was underutilized by residents and faculty. Dr. Tauqeer saw potential in the space as an important resource for resident education, and worked very hard over the last several months to turn the space into an organized resident wet lab.

The process of overhauling the resident wet lab, located in the basement of the Scheie Eye Institute, began in August 2020. The first steps were to clean and organize the space, which involved coordinating with maintenance staff. Dr. Tauqeer also worked with the Scheie operating room staff and the Department's regular equipment suppliers to obtain ongoing supplies of tissues and instruments for use in surgery practice.

To ensure the upkeep of the wet lab going forward, Dr. Tauqeer created a plan for residents who are on the cornea rotation (which all residents complete in their first and second year) to take the lead in monitoring the condition of the space. They will also be responsible for organizing future wet labs, with help from an attending physician. "I hope that all future residents take ownership, and that both faculty and residents create a culture of expectation regarding ongoing maintenance and use of the wet lab," said Dr. Tauqeer.

The first resident-run wet lab of the year took place on September 1. The residents held a suturing session with attending cornea surgeon Dr. Michael Sulewski, and they hope to continue having wet labs on different topics. Dr. Tauqeer also hopes to obtain a new teaching microscope with an integrated projection screen to facilitate wet lab instruction, as well as individual sets of instruments for each resident to have for practice throughout his or her time in residency.


Dr. Michael Sulewski instructing residents.

96-YEAR-OLD PATIENT AND ARTIST DONATES

PAINTINGS TO SCHEIE

By Rebecca Salowe

Hilda Friedman, 96-year-old visual artist, is a longtime patient of the Scheie Eye Institute. Recently, she donated three large paintings to be displayed in waiting areas at the Institute.

A Philadelphia native, Hilda grew up in a row house in South Philadelphia with her parents and three older sisters. As a child, she loved to draw (especially her grandmother's cat), but her family did not have the money to provide her with art training. "My father was a nature lover and taught me a lot," she recalled. "My mother was artistic, but it was the Depression years."

Hilda attended South Philly High School and obtained her BA on a scholarship from Hobart and William Smith College. She married young to her late husband, Eli Friedman, who was a pharmacist. At the time, married women were not allowed to live in the school dormitories, so Hilda and her husband rented a small apartment.

When Hilda first took up art in the 1950s, not many people in her family took her interest seriously—but she was not deterred. She went on to study drawing at the Tyler School of Art at Temple University, which led to the watercolor phase of her work. "I was very interested in color at that time," she explained. "It was just becoming big in cinematography and films. I came into contact with every face of printmaking and color."

When she reflects on the watercolor phase of her work today, Hilda marvels at the vast size of these pieces. "I used to do watercolors that were 40 by 60 inches," she said. "I mean, you have to be crazy to do a watercolor that size. How did I do that? It just came from within."

Hilda also pursued education in lithography and printmaking at the Academy of Fine Arts in Philadelphia, silkscreening at the Fabric Workshop, and art history at the Barnes Foundation.

During this time, Hilda taught classes at the Philadelphia Museum of Art, Wayne Art Center, and St. Joseph's University. "They sent kids to me thinking that I can make them into artists, but it doesn't work like that," she said. "So I tried to get the children interested in work other than just the prints of their fingers."

In the 1970s, Hilda experienced a sudden loss of half of

her field of vision. After learning that she had melanoma in her right eye, her nephew researched the condition. She came to Scheie for further evaluation. While under the care of Dr. Harold Scheie and Dr. William Frayer, she learned that she needed to have the eye enucleated.

Hilda describes her persistence and positivity as being key to returning to art after the surgery. "People say it was very relaxing for you—it's not," she said. "But it's good to keep your brain connected. The work is a metaphor for my life. In other words, it comes from inside."

The later phases of her work focused on metal. Hilda, having recently lost her husband, describes this phase as a response to her grief. "I was really a reactor," she said. "In Mexico in the church, they use metal to express their grief. So I began to explore how the elements of color that I learned about in my watercolor phase related to different kinds of metal." She remembers being drawn to how she had to "look" for the subject and the "cryptic" feeling of the work.

Hilda maintains a website filled with images of her watercolor and acrylic collection and engraved steel and plexiglass collection. Today, her work is in a phase of wood, which often creates interesting logistical challenges. "I'm not quite sure what I've done," she said. "I'm not a very large person and not too young, so I had to work on a flat table."

Hilda is still a patient of the Scheie Eye Institute, most recently seeing Dr. Mina Massaro. The two have formed a strong bond. Before the pandemic, Dr. Massaro and her daughter even visited Hilda's studio. "Mrs. Friedman is an inspiration to me," said Dr. Massaro. "She sees beauty in everything. I'm fortunate to have developed a bond that goes beyond the traditional doctor-patient relationship."

Recently, Hilda donated three large paintings to be displayed at Scheie, which now hang in the second floor waiting room. At one of her recent appointments, she was waiting to be examined, when somebody pointed out to other patients that she was the artist of the pieces on the wall. "The patients were reacting and giving me ideas, and I was so happy," she said. Another one of her wood paintings is in the process of being donated to Scheie.

The rest of Hilda's work is displayed around the world, including at the Dancing Grounds (New Orleans) and at her granddaughter's dance studio.

Hilda lives in Wynnewood, Pennsylvania in the same home that she has lived in since the 1950s. She has two daughters, three grandsons, twin granddaughters, and six great-grandchildren. Outside of painting, her hobbies include listening to opera, reading poetry, and maintaining her yard filled with plants. She is still active in her studio, working on her wood phase.

Dr. Mina Massaro and Hilda pose in front of the three watercolors donated to Scheie Eye Institute.

The most recent phase of Hilda's art centers around wood.

Hilda's work is available for sale or placement in galleries and museums. Her work can be viewed at hildafriedman.com.

Support group members enjoying Tactile Day with Philly Touch Tours at the Penn Museum in 2019. They have been meeting virtually since the pandemic began in March 2020.

SUPPORTING INDIVIDUALS WITH VISION LOSS DURING A PANDEMIC

By Kristen Mulvihill

As in-person group gatherings came to a halt amid the global coronavirus (COVID-19) pandemic, the Penn Center for Low Vision Rehabilitation's Vision Loss Support Group moved to a virtual platform.

Led by Ranjoo Prasad, OD, the center supports individuals with visual impairments that can no longer be improved through medical or surgical means. The support group, led by Sheri Grand Drossner, a Clinical Research Coordinator at the Scheie Eye Institute, serves as a platform for members to share their experiences, ask questions, and learn from other participants and guest speakers.

With its first meeting held in January 2017, the Vision Loss Support Group typically meets in person each month in the Ralston House. However, starting in March, the group had to cancel in-person meetings as a result of the spread of COVID-19.

"After missing that first meeting, we quickly decided that we still needed a way to stay in touch and feel connected to one another," explained Sheri. Marquis Vaughn, Community Outreach Coordinator, organized a private teleconference line through the University of Pennsylvania for the participants, and until recently, continued with the calls every other week. At the end of June, group meetings transitioned to BlueJeans, offering participants the chance to connect with both audio and video. The group now holds meetings once a month.

> We are so blessed to have one another, especially during these uncertain times."

Despite not being able to meet in person, the group's mission to support individuals with vision loss is still upheld virtually. "Having the ability and the time to share fears, frustrations, inspirational thoughts, and tips has been invaluable to our participants, especially during the pandemic," said Sheri.

Under normal circumstances, the group hosts occasional guest speakers who share expertise on various topics, including the assistive devices and technologies available for patients with vision loss. In August, the group virtually invited speakers from Associated Services for the Blind and Visually Impaired (ASB), including Beth Deering, Chief Program Officer, and Lynn Heitz, Director of Education and Enrichment Programming. Beth and Lynn shared information about ASB services and how to access these resources during the pandemic. In September, the group hosted Angel Chambers from the Free Library of Philadelphia to describe the programs offered and how to register for these services.

The COVID-19 pandemic has brought great uncertainty and panic to individuals around the globe. During meetings, members of the support group voiced concerns about social isolation, experiencing a lack of motivation, and being inundated with distressing news. Regarding transportation issues and safety concerns, members also expressed anxieties about traveling to essential places, like doctors' offices and grocery stores. Many individuals with visual impairments rely on shared-ride programs, such as SEPTA's CCT program, which was very limited at the beginning of the pandemic.

"Discussing these issues was particularly useful for helping participants realize they are not the only ones feeling this way," said Sheri. "Some participants had inspiring and uplifting comments to share, discussing the things they are enjoying, such as having time to try new recipes or practice meditation and prayer."

"Although the group meets virtually now, the connections and eagerness to support one another are still there," said Marquis. "We are so blessed to have one another, especially during these uncertain times."

While the group continues to progress in the midst of this health crisis, they hope to meet in person again when it is safe to do so. However, Dr. Prasad and Sheri have discussed how to continue the use of the virtual platform in conjunction with their in-person meetings, offering an opportunity for members lacking transportation to still participate in the group.

Serving as an outlet during these precarious times, the virtual Vision Loss Support Group has received positive feedback from participants. "The group members are so appreciative to have this outlet for connection, and we are so happy to organize and provide it," said Sheri.

"I can only say wonderful things about having the ability to hold the group virtually," said Dr. Prasad. "Even though the members would love to meet in person, they are very grateful for the continued connection."

Tracy with his guides after completing the Houston Half Marathon in 2019.

NASA EMPLOYEE TRACY MINISH supports the mission to end blindness

By Kristen Mulvihill

Tracy Minish was in high school when he was diagnosed with retinitis pigmentosa (RP), a rare, inherited eye disease that causes severe visual impairment. This disease has attacked Tracy's family for generations, with his son Carson now the fifth generation of his family to receive the diagnosis. Now, at age 65, Tracy has less than five degrees of his field of vision remaining.

Often diagnosed in childhood or adolescence, RP is a group of rare, genetic disorders involving the breakdown and loss of cells in the retina. The disease changes how the retina responds to light, causing a gradual loss of vision.

Despite growing up with this blinding condition, Tracy participated in football, wrestling, and track, discovering creative mechanisms to assist with navigation. "A teammate would allow me to hold onto their jersey to get into the stadium, and I would use a towel as a tether to move around with friends at night," he recalled. To date, Tracy has completed 31 marathons with the help of a guide, including the Boston, New York, and Chicago Marathons.

After graduating from the University of Georgia with a degree in Computer Science, Tracy was recruited by NASA's Johnson Space Center, where he has remained for over 36 years. He currently serves as the Mission Control Center Operations Manager and helps to oversee space ventures, review upcoming mission events, and supervise training simulations and test activities. To create a setting in which Tracy can succeed and prosper, NASA provides him with the assistive technologies required to perform his duties.

"With the tools I have at NASA, I can manage emails, review and redline documents, create presentations, and chair meetings as well and as independently as a sighted person," he explained.

In addition to his impressive career at NASA, Tracy visits schools and organizations to advocate for individuals with disabilities. He previously served as the chair of the No Boundaries (NoBo) Employee Resource Group at NASA, a program geared towards supporting individuals with disabilities. "I am passionate about reaching out to our youth with disabilities and letting them know their dreams can be made a reality," said Tracy. "It is our responsibility to ensure they have access to tools, training, education, and encouragement to help them reach their goals."

In 2016, Tracy and his wife Sherry were flipping through channels on the television when they stumbled across a program about the challenge to end blindness by 2020. Several researchers, including Jean Bennett, MD, PhD, F.M. Kirby Professor of Ophthalmology, were featured.

Dr. Bennett has devoted her career at the University of Pennsylvania (UPenn) to finding a cure for patients with inherited retinal degenerations. In 2017, Dr. Bennett, Albert Maguire, MD, Professor of Ophthalmology at UPenn, and their collaborators received landmark FDA approval for the first gene therapy to target an inherited disease. The therapy significantly improves vision for patients with mutations in the *RPE65* gene, which is associated with RP. This year, Drs. Bennett and Maguire received the inaugural Sanford and Susan Greenberg 20/20 Prize to End Blindness, awarded to individuals with the greatest contribution to ending blindness by 2020.

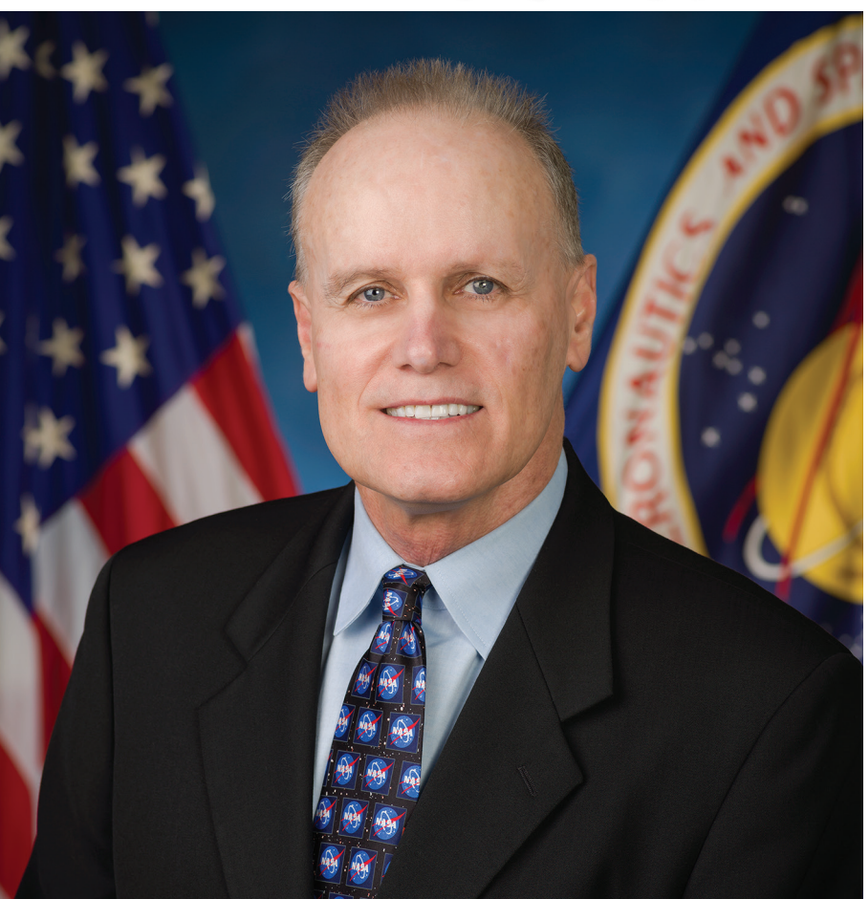
The TV program sparked months of deliberation for Tracy, who finally decided to undergo DNA testing in 2017. At first, he was dissuaded by his local retina specialist in Houston, who told Tracy that DNA testing was too expensive and there wouldn't be a cure for RP in his lifetime. With his son and future grandchildren in mind, Tracy sent an email to Dr. Bennett sharing his family's battle with RP. Dr. Bennett responded the very next day. "My wife and I teared up as we read her email," he said.

Tracy and Carson provided DNA samples and later flew to Philadelphia to meet with Dr. Bennett and her team at UPenn. Dr. Bennett isolated Tracy's specific mutation, discovering that he has RP with mutations in the *PRPF31* gene. Tracy now urges individuals with hereditary diseases to have their DNA tested and remains optimistic that current research will lead to a cure.

"Dr. Bennett has cured one form of RP, and her passion and tenacity to push the research forward until all genetic diseases are eradicated makes her a hero to my family and to all families who have loved ones with vision loss," he said.

Tracy hopes to return to Penn for human trials for *PRPF31*, and to visit Dr. Bennett, her research team, and her family. "There is great hope for all people battling blindness because of the research Dr. Bennett and others like her are performing today," said Tracy. "Curing blindness was once something I could only read about in my Bible, but Dr. Bennett and others like her are true miracle workers." ■

Tracy visiting with visually impaired students.



Tracy with his grandson Hank and his son Carson.

Professor of Neurology

Receives Prestigious Low Vision Research Award

By Kristen Mulvihill

In June 2020, Geoffrey K. Aguirre, MD, PhD, Associate Professor of Neurology, received the Research to Prevent Blindness (RPB) / the Lions Club International Foundation (LCIF) Low Vision Research Award. The award supports scientists launching innovative research that focuses on damage to the visual system.

RPB, founded in 1960, is the leading nonprofit organization that funds eye research targeting the treatment and prevention of vision-threatening diseases. This year, the foundation celebrated its 60th anniversary.

As a behavioral neurologist and neuroscientist, Dr. Aguirre studies cortical organization for vision, and how this is altered by neurologic and ophthalmic diseases. Dr. Aguirre is one of the many vision scientists across the University of Pennsylvania who collaborates with the Department of Ophthalmology. His RPB-funded project focuses on examining retinal ganglion cell (RGC) function in retinitis pigmentosa (RP) by measuring brain responses.

Dr. Aguirre's research will also examine the neural basis of photophobia (i.e. light sensitivity) in RP, which is a common symptom.

RP is a group of rare, genetic disorders involving the breakdown and loss of cells in the retina. The disease alters how the retina responds to light, causing those affected to slowly lose their vision.

The retina contains RGCs, which transmit visual information to the brain. Numerous blinding diseases adversely affect the function of RGCs, including RP. Although RGCs serve a critical role in vision, it has proven difficult to accurately measure from the eye how these cells are altered in individuals with RP. Dr. Aguirre's project will instead measure responses from the brain, where these signals are amplified and spread over the visual cortex.

To accomplish this, Dr. Aguirre will have individuals look at special kinds of flickering light while their brain activity is measured using an MRI machine. By flickering the light at different rates and by varying the color information in the light, the stimulation will target the different kinds of RGCs in the retina. The different classes of RGCs carry separate information important for vision and visual health, and little is known regarding how the different classes are impacted by diseases like RP.

An MRI scanner will be used to measure brain activity produced by the different kinds of lights. Using techniques developed previously in his lab, Dr. Aguirre can then map the brain activity back to the location of the source of the signal from the retina. This will result in maps of the functional health of each of the RGC classes.

Dr. Aguirre will collaborate with Tomas Aleman, MD, an accomplished retinal degeneration specialist and Associate Professor of Ophthalmology, to obtain these measurements in patients with RP. Dr. Aleman is an expert in the measurement of the structure of the retina in these diseases, and together, Drs. Aguirre and Aleman will work to relate alterations in structure to alterations in retinal function.

This novel technique may be used to target the growing set of retinal gene and stem cell therapies, an area of intense research focus in the Department of Ophthalmology.

"I am thrilled for the opportunity to continue a long history of collaboration with the Department of Ophthalmology. Dr. Aleman and I are eager to understand the changes in vision that accompany RP," said Dr. Aguirre. "It turns out that the brain is the perfect place to measure the function of the eye. Even when the eye moves, brain signals remain locked in place to the retina, allowing us to make precise measurements. We are optimistic that what we learn will help better target therapy for retinal disease."

Other researchers and trainees to receive individual awards from RPB spanning the last ten years include Hannah Schultz; Tianyu Liu; Kenneth Shindler, MD, PhD; Devang Bhoiwala; David Brainard, PhD; Joshua Dunaief, MD, PhD; and Artur Cideciyan, PhD.

NEW METHOD OF GENERATING RETINAL GANGLION CELLS: STEP TOWARDS TARGETED GLAUCOMA THERAPY

By Alexandra Brodin

Dr. Chavali in his lab, sequencing DNA obtained from patient stem cells to identify pathogenic mutations that make individuals susceptible to glaucoma.

Venkata R. M. Chavali, PhD, Assistant Professor of Ophthalmology at the University of Pennsylvania (UPenn), recently led a study to develop a promising new methodology for differentiating stem cells into retinal ganglion cells (RGCs) in vitro. This methodology has the potential to lead to more targeted treatments for glaucoma, the leading cause of irreversible blindness worldwide.

A NEW VISION FOR TREATING GLAUCOMA

Primary open-angle glaucoma (POAG), the most common form of the disease, is characterized by chronic, progressive degeneration of the optic nerve, a cord-like structure responsible for carrying neural signals from the eyes to the brain. Damage to the optic nerve is caused by the death of retinal ganglion cells (RGCs), which are neurons located in the retina. The axons of RGCs collectively form the optic nerve.

Current therapeutic strategies for glaucoma focus on management of intraocular pressure (IOP) to slow disease progression. However, even if diagnosed in early stages, approximately 30% of patients continue to worsen despite IOP-lowering treatments. This suggests that more research is needed on additional underlying disease mechanisms independent of elevated IOP, which, once understood, could provide further therapeutic targets for glaucoma.

Because human RGCs do not regenerate naturally after they deteriorate, the idea to restore or replace damaged RGCs is very attractive as a potential therapy. Stem cells provide investigators with the opportunity to generate new, viable RGCs. These RGCs can then be used to study the various factors that cause these cells to deteriorate in vitro and in mouse models.

In recent years, vision scientists have found that RGCs can be generated using induced pluripotent stem cells (iPSCs), which are somatic cells that have been reprogrammed to an embryonic-like state. Researchers can guide iPSCs toward any type of cell lineage that may be required for experimental and therapeutic purposes, including the RGC lineage. The differentiation of iPSCs toward the RGC lineage allows researchers to study how to slow RGC death

Dr. Chavali conducting research in his lab.

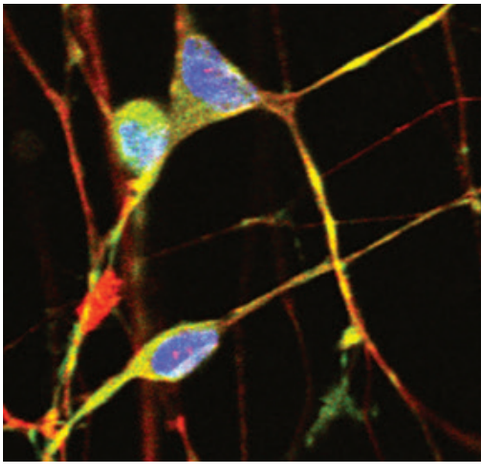


Image of retinal ganglion cells.

in glaucoma patients and reverse degeneration of the optic nerve by restoring or replacing damaged RGCs.

GENERATING RETINAL GANGLION CELLS

Over the past decade, different methods for generating RGCs from embryonic stem cells and iPSCs have emerged. One example is the use of a three-dimensional (3D) culture such as a retinal organoid for the generation and isolation of RGCs. However, developing the retinal organoid generally requires a significant amount of time (approximately 40 to 60 days). This method also generates extraneous material, from which the RGCs must be selectively removed, leading to manual bias, lower reproducibility, and ultimately a diminished yield.

Dr. Chavali's study, published in *Nature Scientific Reports* in 2020, builds on prior attempts to generate RGCs by creating an efficient and reproducible methodology that avoids the problems found in other protocols. "I wanted to generate a protocol that was efficient, highly reproducible, had limited manual selection and yields highly pure RGC cultures," said Dr. Chavali. To conduct this research, he partnered with Dr. Jason Mills, who was then Director of the Induced Pluripotent Stem Cell (iPSC) Core at the Center for Advanced Retinal and Ocular Therapeutics (CAROT).

Dr. Chavali began working on stem cell-based methods of generating RGCs four years ago, inspired by the National Eye Institute's Audacious Goals Initiative. This program encouraged researchers to propose innovative cross-disciplinary projects to restore vision in the retina.

The methodology that Dr. Chavali's team developed uses two-dimensional (2D) cell cultures and does not require manual separation of cell clusters. The process involves two main stages. In the first stage, iPSCs are differentiated into retinal progenitor cells (RPCs), an intermediary cell type along the RGC lineage. "The uniqueness of our protocol is that we generate almost 100% of the RPCs from iPSCs," said Dr. Chavali. "This is a unique advantage we have going into the second step."

In the next stage, they used small molecules and proteins to inhibit several pathways, including BMP, TFG-b

(SMAD), and Wnt, to mature the RPCs towards the RGC lineage. To avoid the need for manual selection of cells through this process, Dr. Chavali's team used a cross-hatching technique, which aids in the formation of RGCs with less variability and is distinct from other studies of this kind. The entire two-stage process takes only 35 days to complete and has been shown to yield a highly pure and robust population of RGCs.

The relatively short time frame of RGC differentiation and very high yields (up to 95% pure) are two significant advantages of this methodology. Another advantage is the absence of manual RGC separation from a retinal organoid, which can prevent damage to the newly generated RGCs. Currently, Dr. Chavali is investigating neuroprotective compounds (which work to protect cells from damage) to further help RGCs survive for long periods of time and tolerate stress more effectively.

Finding out ways to help patients with glaucoma is very important to me."

LOOKING AHEAD

This novel protocol is an important step towards the development of more targeted and effective treatments for glaucoma. Moving forward, Dr. Chavali plans to continue working to further improve the iPSC-RGC maturity by culturing them along with retinal astrocytes and other retinal cell types. He also intends to use this methodology to study genetic mutations that lead to RGC loss in patients and work towards a targeted therapy for patients whose glaucoma has a genetic basis.

In order to translate these findings into a strategy for treating glaucoma, Dr. Chavali's lab is studying the molecular mechanisms of RGC death by applying oxidative stress and other conditions to simulate RGC loss in vitro. In collaboration with Dr. Katherine Uyhazi, who was recently appointed as an Assistant Professor of Ophthalmology at UPenn, he is testing potential treatment strategies in mouse models of glaucoma by injecting the purified iPSC-RGCs. These experiments are currently ongoing with very encouraging preliminary results.

"Finding out ways to help patients with glaucoma is very important to me," said Dr. Chavali. "I'm confident that our methodology of generating RGCs is a vital tool we can use to investigate mutations that cause RGC loss and offer a targeted therapy to patients with glaucoma." ■

in memory of dr. alan s. crandall

By Alexandra Brodin

Alan S. Crandall, MD, was a surgeon at the John A. Moran Eye Center, University of Utah, specializing in glaucoma, cataract, and anterior segment surgery. He graduated from the Utah School of Medicine in 1973 and completed his ophthalmology residency at the Scheie Eye Institute. On October 2, 2020, after nearly 40 years of practicing ophthalmology at the Moran Eye Center, Dr. Crandall sadly passed away from a sudden illness.

Dr. Crandall devoted his life to providing the best possible patient care and advancing the field of ophthalmology. In addition to his renowned surgical skills, Dr. Crandall was an innovative researcher, leading the development of several new surgical techniques. He was a dedicated and enthusiastic teacher, always working hard to ensure that ophthalmology residents and trainees had the knowledge and skills to become outstanding clinician scientists. Dr. Crandall was also devoted to humanitarian programs and was deeply invested in offering ophthalmic services in places with limited access to medical care. He founded and served as the Senior Medical Director of the Moran Global Outreach Division. His leadership and desire to serve took him all over the world, including Ghana, Nepal, and South Sudan, where he performed free eye surgeries and trained others in ophthalmic surgery.

The passing of Dr. Crandall is an enormous loss to the field of ophthalmology and is deeply felt by all who knew him. He is remembered as a brilliant physician, a passionate humanitarian, and a treasured friend and colleague. ■

New Stimulation Paradigm Allows

BLIND AND SIGHTED PATIENTS TO 'SEE' SHAPES

By Rebecca Salowe

A recent publication in *Cell* reported that a visual cortical prosthetic that employs dynamic brain stimulation allows blind and sighted patients to "see" shapes. This study was led by visual neuroscientist Dr. Daniel Yoshor, who recently joined the University of Pennsylvania (UPenn) as the Chair of the Department of Neurosurgery and Vice President of Clinical Integration and Innovation.

This report builds on decades of research on the development of a bionic, prosthetic eye. Like previous models, the design relies on a camera to directly send visual information to the visual cortex in the brain. This process bypasses the optic nerve, which is damaged in many adults with vision loss.

Visual information from the camera is delivered to the brain through electrodes placed on the visual cortex. A small electrical pulse then stimulates the brain to create a phosphene, which is a spec of light that floats through the field of vision. In recent years, bioengineering advances have led to the development of devices with dozens of electrodes that are wirelessly powered and controlled.

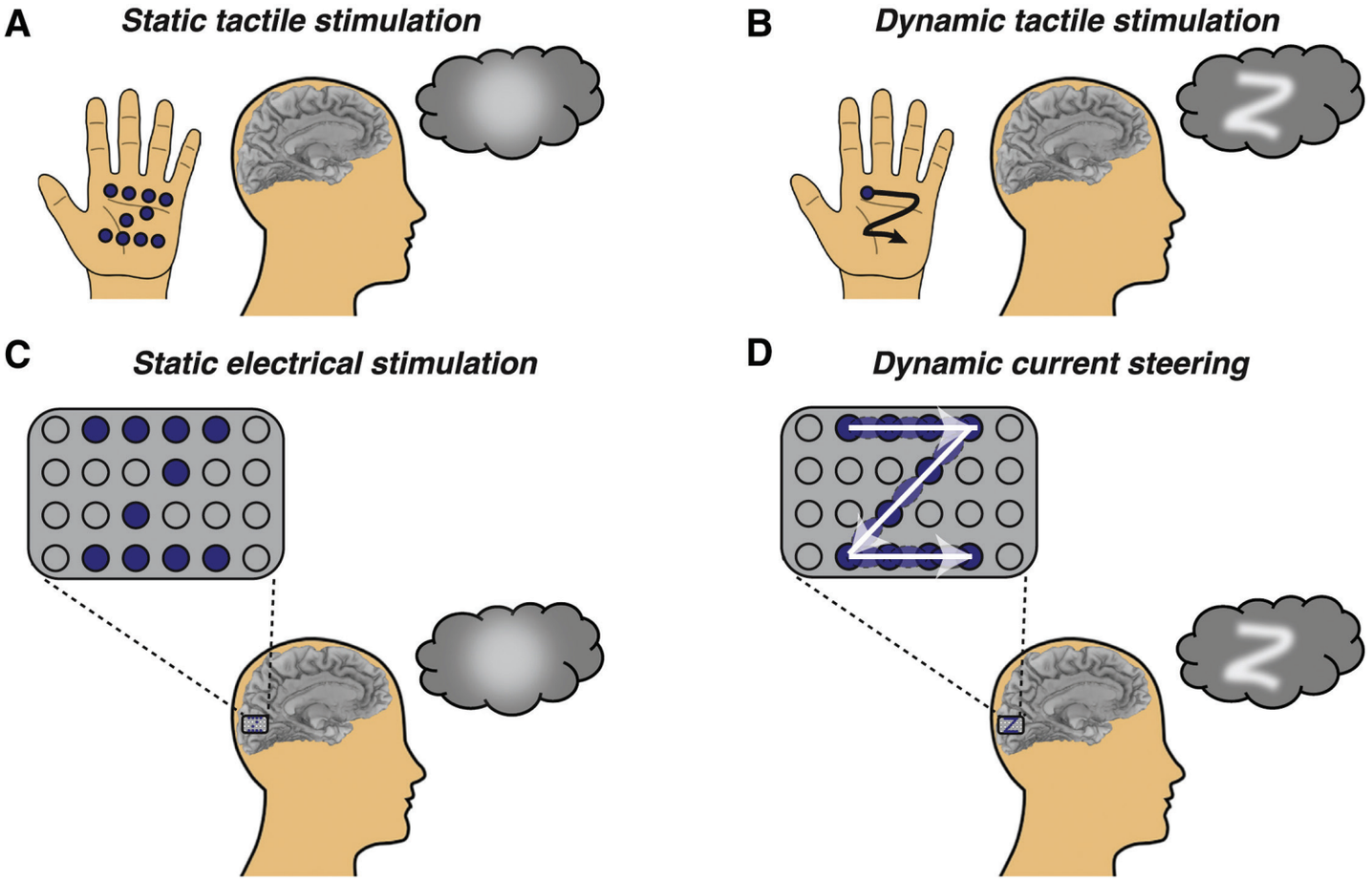
However, this progress leaves important questions unanswered. What happens when multiple areas of the visual cortex are stimulated? Will the resultant phosphenes combine into a single coherent image?

Unfortunately, recent research shows that phosphenes created by multiple electrodes do not behave like "pixels in a screen" that readily merge into one full image. Recognizing this gap, Dr. Yoshor and colleagues sought to develop new stimulation paradigms that could lead to a clinically usable device.

"Instead of stimulating multiple points on the brain all at the same time, we stimulate the brain dynamically, using electrical stimulation to paint an image on the brain," Dr. Yoshor explained.

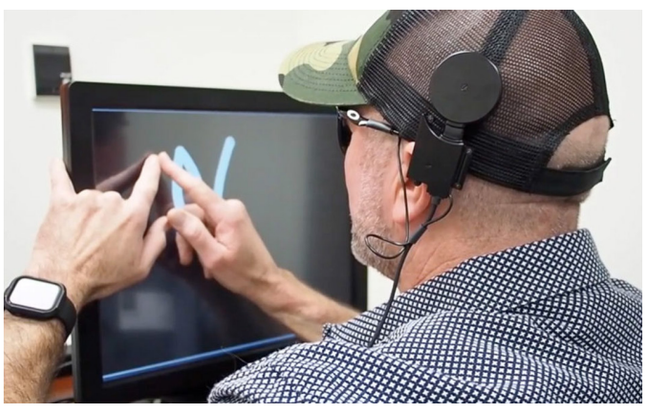
In addition to this dynamic stimulation, Dr. Yoshor and colleagues also used a technique called current steering to stimulate areas of the brain located in between electrodes. By passing a current between two adjacent electrodes, a virtual electrode is created at an intervening location. The proportion of current from each electrode can be varied, changing the location of the virtual electrode. In other words, researchers can manipulate the current to create phosphenes at additional intermediate locations.

How does this help to create a full image for the patient? By varying the current dynamically on a rapid timescale, the goal is to create the perception of a phosphene moving on a continuous line. This is in contrast to the simultaneous appearance of many phosphenes that do not create a coherent image.



Most individuals cannot identify a letter if it is pressed onto their palms. However, having the letter traced on the palm is usually effective – a process that Dr. Yoshor mimics with this new form of dynamic brain stimulation. *Image copyright obtained from Beauchamp et al., 2020, Cell 181, 774–783.*

To test this idea, dynamic stimulation sequences were developed to correspond to different letter-like forms. Four sighted patients and two blind patients were included in the study. The sighted patients already had electrodes implanted in their brains to monitor epilepsy.



A study participant uses his finger to trace the visual percept of a letter on a touch screen. *Image copyright obtained from Beauchamp et al., 2020, Cell 181, 774–783.*

After the electrodes were stimulated, the participants were asked to reproduce the letter shapes on a touchscreen. Over many trials, both sighted and blind participants could reliably draw, name, and discriminate each letter.

"It was remarkable how intuitive this was for patients," said Dr. Yoshor. "With very little training, they were able to recognize letters produced with dynamic stimulation."

Dr. Yoshor and colleagues compared this method to traditional static stimulation of electrodes. With static stimulation, patients could not identify the letters. Dr. Yoshor hypothesizes that the phosphenes may coalesce into a single phosphene, explaining this outcome.

Though this study only examined outlines of letters, future studies could expand to include common objects such as houses, faces, or bodies.

These results have important implications for visual cortical prosthetics. In the future, it may be possible for these devices to create coherent, full images for blind patients, which could have life-changing consequences.

"While there is still a lot of work to be done, the ability to generate a percept of a visual form is an important step towards the development of a visual prosthetic that can restore useful vision to the blind," said Dr. Yoshor. "I look forward to working with my new colleagues at UPenn in neuroscience, bioengineering, and ophthalmology, to make further advances that can help patients with irreversible blindness."

Dr. Yoshor's co-authors William Bosking, Denise Oswalt, and Michael Beauchamp have also moved to UPenn to continue this research. ■

telemedicine ramps up

AT SCHEIE DURING CORONAVIRUS PANDEMIC

By Alexandra Brodin

Dr. Mina Massaro in a telemedicine appointment.

In March, the Scheie Eye Institute began offering telemedicine services as an option to non-urgent patients in order to practice social distancing and limit the spread of COVID-19. All urgent patients were still seen in person.

Telemedicine refers to clinical services, such as diagnosis and disease management, that are offered through telecommunications technology, including consultations and follow-up visits over videoconference. Telemedicine is distinct from telehealth, which is a broader term that includes non-clinical services, such as continuing medical education.

At Scheie, all non-urgent appointments (including elective services, non-urgent follow-ups, routine eye screenings, and optical shop appointments) were cancelled starting on March 16, 2020. Patients who had their appointments cancelled were given the option to have an appointment via telemedicine.

The most evident advantage of practicing telemedicine during a pandemic is that patients and physicians do not risk exposure to the virus through an in-person visit. Ophthalmologists were at an especially high risk during the height of the pandemic, when personal protective equipment (PPE) was more limited, because proper eye examination often requires close proximity to the patient. Telemedicine became an alternative option for Scheie physicians to continue to care for their patients. “I was really quite surprised at how much I could see on the surface of the eye through the video,” said Scheie dry eye disease (DED) specialist Mina Massaro-Giordano, MD.

Although social distancing was the primary benefit, other advantages to using telemedicine have emerged in the last several months. The standardization of telemedicine creates new options for patients with chronic disabilities and immunodeficiencies, who may have been hesitant to come onsite for care even before the pandemic.

Telemedicine also provides a unique opportunity for physicians to see inside their patients' home environments. This insight allows physicians to advise patients on ways to improve their environment and day-to-day activities. For example, Dr. Massaro can observe whether a patient is looking up at the computer screen, which forces the eyes to open wide, or looking down, which allows the eyes to partially close. With DED, keeping the eyes fully open can lead to greater dryness and irritation, so Dr. Massaro can advise patients to adjust the angle of their computer screens.

Physicians can also learn more about how patients are managing their eye care at home. With telemedicine, Dr. Massaro has the opportunity to see the eye drops that patients are using at home, which they usually would not bring to an in-person appointment. They can show her how they are using the drops, and she can instruct patients in the best way to administer them.

In the same vein, Thomasine Gorry, MD, MGA, Associate Professor of Clinical Ophthalmology, has found that discussing test results with patients is often simpler over videoconference. "It is so clear to the patient what we're talking about, and there are no other distractors in the room," said Dr. Gorry. "I find that, in terms of conveying the message of what the illness is or what the patient's medical status is, telemedicine visits are actually very efficient."

Telemedicine can also provide isolated patients with a social outlet. For some patients, seeing their regular physician over telemedicine can be comforting when they are unable to do their regular activities. "Many patients have been closed in their houses for months," said Dr. Massaro. "It's very isolating. To all of a sudden see a friendly face at the other end of the computer—I think it's very empowering for patients."

Though the advantages outweigh the disadvantages, telemedicine does present some unique challenges. Some patients have limited access to technological devices or are unfamiliar with the channels of communication required for a virtual visit. Physicians may connect with patients by telephone, if videoconference options fail.

Another limitation is that telemedicine cannot support most ophthalmic testing and procedures. To be able to offer in-person testing while also limiting the spread of the coronavirus, Scheie developed the Telemedicine Enhancement Pathway (TEP). Along with Dr. Eydie Miller, Chief of the Glaucoma Service, Dr. Gorry led the development of the TEP.

The TEP is a process for seeing patients with well-known eye diseases that require consistent monitoring, such as glaucoma. The process involves two main steps. First, patients who have been identified as appropriate candidates for TEP come to Scheie to receive testing ordered by their physicians. They wait in an area specifically designated for the TEP, and are seen by a technician who has been assigned to the pathway. Patients do not typically see their physician during this in-person visit.

Dr. Thomasine Gorry.

Usually within two weeks, patients on this pathway meet remotely with their physicians to review the results and discuss treatment plans, if applicable. The structure of this pathway maximizes efficiency and reduces potential exposure to COVID-19, since the patients do not have to wait to meet with their physician in person.

Innovations like the TEP can become bright spots amid the crisis, and give physicians and leaders something inspiring to work towards. "We're still at the hard work stage, but one triumph has been the ability to connect with my colleagues over a great idea," said Dr. Gorry. "You can't overestimate what that means when you're otherwise isolated. So we had a great opportunity to reconnect and bring this forward."

The TEP is currently serving primarily glaucoma patients. Dr. Gorry and her team are working to expand this pathway for patients with other diseases that require consistent monitoring, including diabetic retinopathy and macular degeneration.

Leaders in telemedicine at Scheie believe that telemedicine care will persist in various ways beyond the pandemic. Conditions like DED lend themselves well to telemedicine, as the surface of the eye can readily be examined through a video camera. Moving forward, physicians will be able to decide how much to integrate telemedicine into their workflow, based on what works best for their individual practices and patient bases.

Dr. Katherine Uyhazi.

Drs. Jean Bennett and Albert Maguire with their dogs, who received the experimental gene therapy (photo credit: Peggy Peterson).

drs. jean bennett and albert maguire receive end blindness award

By Alexandra Brodin

The Scheie Eye Institute congratulates Jean Bennett, MD, PhD, the F.M. Kirby Professor of Ophthalmology, and Albert Maguire, MD, Professor of Ophthalmology, on receiving the Sanford and Susan Greenberg Outstanding Achievement Prize from the End Blindness 2020 campaign.

End Blindness 2020 supports the development of curative solutions to blinding diseases. The Sanford and Susan Greenberg Prize recognizes individuals who have had the greatest impact on advancing research for vision restoration.

Drs. Bennett and Maguire were selected for their pioneering work to develop the first-ever FDA-approved gene therapy for an inherited disease. This gene therapy targets a form of Leber's congenital amaurosis (LCA) caused by a mutation in the *RPE65* gene. Patients who undergo this gene therapy receive a one-time subretinal injection of a viral vector containing a normal copy of the *RPE65* gene. This treatment, known as Luxturna, restored vision in children and adults with *RPE65*-related LCA and received historic FDA approval in 2017.

The research that led to Luxturna will pave the way for the development of gene therapies for other blinding diseases. "Sanford and Susan Greenberg are extraordinary people who have turned Sanford's terrible misfortune in losing his sight into an inspiration for others," said Dr. Bennett. "Albert and I intend to use this award to continue to make the Greenberg's dreams of sight restoration and prevention of blindness come true."

Gustavo Aguirre, VMD, PhD, Professor of Medical Genetics and Ophthalmology at the University of Pennsylvania School of Veterinary Medicine, and William Hauswirth, PhD, Professor of Ophthalmology at the University of Florida, were also recipients of this award. The $1 million prize will be distributed evenly between the four awardees.

Dr. Bennett intends to donate part of her funds to Katherine Uyhazi, MD, PhD for her start-up package with the University of Pennsylvania. Dr. Uyhazi has recently accepted a full-time faculty appointment in the Department of Ophthalmology and is working to develop stem cell-based therapies for retinal degenerative diseases. "Dr. Uyhazi's efforts will provide the perfect complement to our gene therapy studies, as they could ultimately lead to tissue transplantation approaches to restore vision," explained Dr. Bennett.

In 2018, Drs. Bennett, Maguire, and collaborators also received the António Champalimaud Vision Award for their advances in retinal gene therapy, and Dr. Bennett was a co-recipient of the Sanford Lorraine Cross Award.

what to expect

YOUR APPOINTMENT AT SCHEIE

By Alexandra Brodin

Beginning in March, all non-urgent appointments at the Scheie Eye Institute were cancelled in order to keep patients, staff, and physicians safe in the height of the COVID-19 pandemic. Non-urgent appointments included elective services, cataract surgeries, non-urgent follow-up appointments, routine screenings, and appointments for glasses or contact lenses. Urgent cases, which were carefully defined by the Department for each ophthalmic subspecialty, have proceeded throughout the pandemic.

In May, as researchers began to gain a deeper understanding of the novel coronavirus and adequate PPE was obtained, the Department created a system for phasing back non-urgent appointments. With thousands of appointments in the patient backlog, ophthalmology technicians and patient service representatives worked to ensure each patient was re-scheduled with the appropriate physician at the right time.

As of October 2020, the Department safely reached pre-COVID patient volumes. Below, we outline what changes you can expect at your next appointment at the Scheie Eye Institute.

WHEN YOU ARRIVE

When you arrive for an in-person appointment, you may notice the lobby looks very different. Plexiglass barriers have been placed at the front desk and throughout waiting areas to limit exposure to potentially infectious droplets. Seating is also arranged to ensure social distancing, and overflow areas have been established for each of the waiting areas in case they become too full. Visits to our optical shop are scheduled by appointment only.

Upon entering the building, all patients are required to have their temperature taken by a staff member (with a threshold of 99.0). Patients are also required to wear a mask or facial covering throughout their time in the building, and the mask must cover the nose, mouth, and chin. Signs have been placed in exam rooms and waiting areas to demonstrate the proper way to wear a mask or facial covering, and any patient without a mask will be provided with one. All surfaces in the exam room are cleaned in between patients, and waiting areas are cleaned in accordance with University of Pennsylvania Health System (UPHS) and CDC guidelines.

The Department has also implemented a strict visitor policy. For all appointments and consultations, patients are not allowed to bring anyone with them, unless someone is needed to help with care. If you need someone to accompany you to your appointment, please reach out to your physician for approval to bring a companion who is over 18 years old. If someone else drove you to the appointment, he or she must wait outside of the building for the appointment to be finished (with the exception of approved companions).

The staff and physicians in the Department are so grateful for their patients' respect of these precautions. The above requirements will help us continue to fight the pandemic.

TELEMEDICINE ENHANCEMENT PATHWAY

Your physician may identify you as a candidate for the Telemedicine Enhancement Pathway (TEP), a new program that allows established patients with long-term conditions (such as glaucoma, diabetic retinopathy, or macular degeneration) to come on-site for an imaging/testing appointment. After this initial visit, the patient meets virtually through videoconference or by telephone with his or her physician. During this telemedicine visit, the patient and physician review the results together and discuss a care plan. This discrete two-step pathway reduces exposure to the virus, as well as patient wait times since the patient can return home as soon as the onsite imaging/testing is complete. Patients are advised to contact the TEP Coordinator (215-662-8023) for any help throughout the process.

It is important to note that a TEP imaging/testing appointment is not appropriate for urgent symptoms (including loss of vision, sudden onset of flashes, floaters, extreme eye pain, sudden bleeding from the eye, excessive discharge from the eye, new or severe headaches, extreme light sensitivity, or severe itching). If you are experiencing any of the above symptoms, please contact the Scheie Eye Institute Call Center at 215-662-8100.

TELEMEDICINE APPOINTMENT

Although the Scheie Eye Institute has phased back in-person appointments, telemedicine remains an important method of providing care. Telemedicine appointments take place virtually, with patient and physician meeting over videoconference or by telephone. If you are using video as well as audio, your physician may perform an examination of the surface of the eye using the camera on your device, or instruct you in the use of an at-home vision test. Individual situations vary, and you can find more information in another article from this issue, titled "Telemedicine Ramps Up at Scheie During Coronavirus Pandemic."

It is our mission at Scheie to ensure the safety, health, and well-being of our patients. The precautions described above will remain in place as we continue to navigate the pandemic together.

Note: This article was last revised on 11/05/2020. Given that the pandemic is an ever-changing situation, please check our website and social media accounts for the most recent guidance.

SCHEIE BY THE NUMBERS FY2020*

63 CLINICAL & RESEARCH FACULTY

2,191 SURGERIES PERFORMED BY FACULTY

17 OPHTHALMIC SPECIALTIES

112,617 PATIENT VISITS

140 FACULTY PUBLICATIONS

A LEADER IN RESEARCH IMPACT

117 H-INDEX

100+ CLINICAL STUDIES IN PROGRESS

100% OF GRADUATING RESIDENTS PURSUE TOP FELLOWSHIP PROGRAMS

12 PENN MEDICAL STUDENTS MATCHED A TOP OPHTHALMOLOGY RESIDENCY PROGRAM

RESIDENCY PROGRAM RANKED **no. 3** IN NATION FOR RESEARCH OUTPUT PER ALUMNUS

FACULTY HAVE TRAVELED TO **30+** COUNTRIES FOR CLINICAL SERVICE

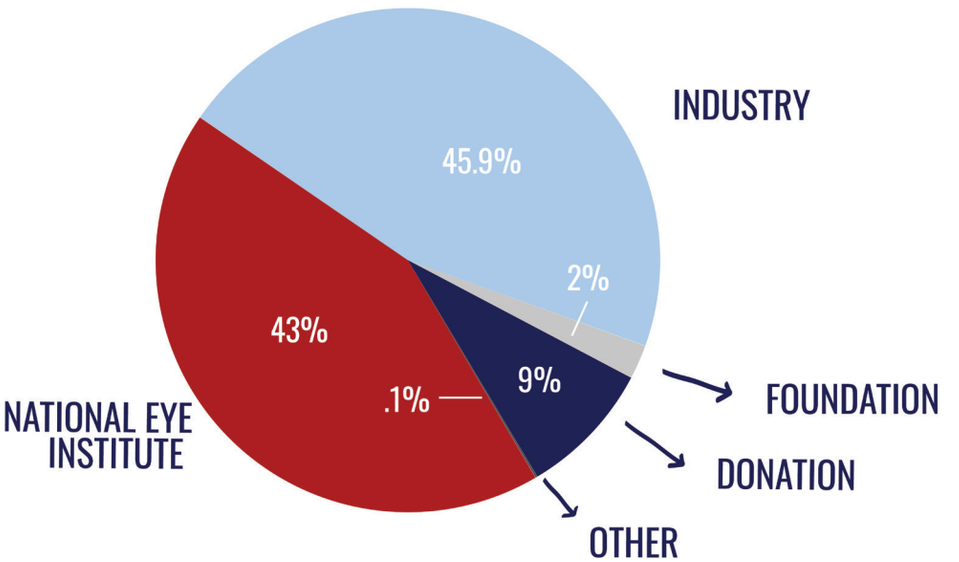
CREATED BY KRISTEN MULVIHILL

TOP 3 IN THE NATION FOR NATIONAL EYE INSTITUTE FUNDING

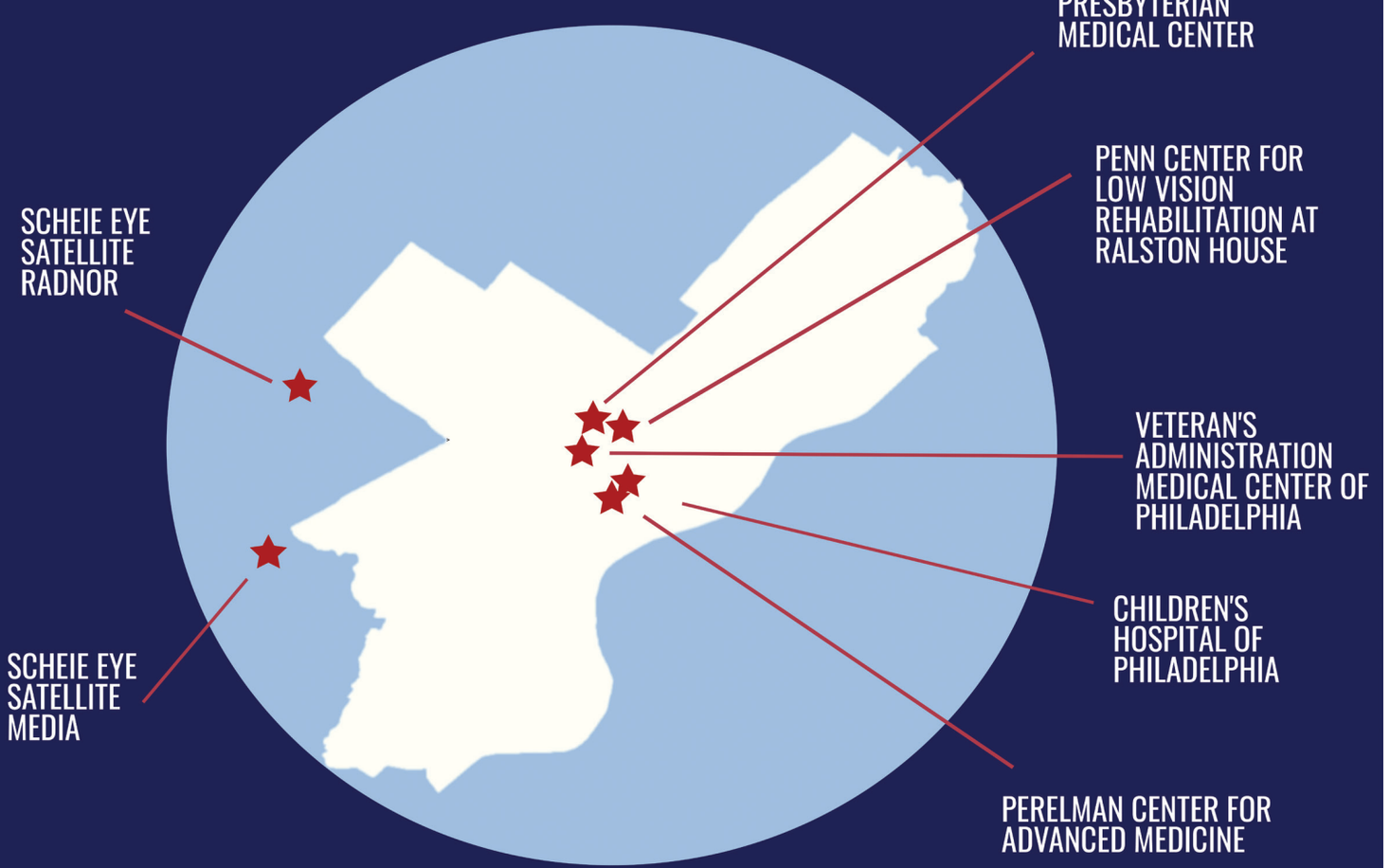
of active projects

$17,415,916

SOURCES OF EXTERNAL FUNDING FOR CLINICAL STUDIES



SCHEIE OFFERS EYE CARE IN SEVEN CLINICAL FACILITIES ACROSS PHILADELPHIA AND DELAWARE COUNTY



*July 1, 2019 - July 1, 2020

scheie welcomes

By Rebecca Salowe

Julia E. Reid, MD

The Scheie Eye Institute is delighted to welcome Dr. Julia E. Reid as an Assistant Professor of Clinical Ophthalmology at the Children's Hospital of Philadelphia (CHOP).

Dr. Reid attended medical school at New York Medical College. During her residency at The Ohio State University, she became interested in the specialty of pediatric ophthalmology.

"I loved building a rapport with young patients and serving as their advocate," Dr. Reid explained. "I was also drawn to the comprehensive nature of the field. It demands a wide variety of skills to care for patients of various ages, from infants to teenagers. And then there is the lightheartedness and resilience of children I care for, which continues to inspire me every day."

After completing her fellowship in Pediatric Ophthalmology at CHOP, Dr. Reid practiced in Wilmington, Delaware for four years, before returning to CHOP as a faculty member. "It's a privilege to practice alongside colleagues whom I learned so much from as a fellow," she said. "In returning to CHOP, I was especially drawn to the high standard of patient-focused care, the teaching opportunities, the chance to work with extremely talented colleagues, and the healthy work environment." Dr. Reid is also looking forward to teaching residents and fellows.

Her research interests, which she will continue to pursue at CHOP, include abusive head trauma and associated ocular findings, and applications of machine learning to ophthalmology.

"Seeing the devastating visual consequences of abusive head trauma first-hand motivated me to conduct research in this area," she said. "In particular, I have collaborated with others to determine predictors of the long-term visual outcomes of children who sustain retinal hemorrhage from abusive head trauma."

Dr. Reid also plans to explore the use of artificial intelligence and machine learning in ophthalmology, a growing field of research. Last year, she co-authored the first review paper describing machine learning applications for pediatric ophthalmology.

Outside of work, Dr. Reid enjoys spending time with her family, dog, and friends. She loves the outdoors, especially skiing, hiking, and visiting national parks.

Samantha Dougherty, OD

The Scheie Eye Institute is delighted to welcome Samantha Dougherty, OD, who recently began her position as an optometrist.

Dr. Dougherty graduated from Shippensburg University with a Bachelor of Science in Biology. She then attended the Southern College of Optometry in Memphis, TN, before completing her residency in Ocular Disease and Surgical Co-management. "I was drawn to optometry because it offers the ability to improve the quality of a person's life through their vision," she said.

Prior to coming to Scheie, Dr. Dougherty worked at Clompus, Reto & Halscheid Vision Associates, and Chesapeake Eye Care and Laser Center. Her appointment at the Scheie Eye Institute began in July 2020.

"It is an honor to join the team at Scheie," she said. "I look forward to collaborating with different specialties to provide the best care possible for our patients. I grew up in Delaware County, and I look forward to serving nearby communities."

In her free time, Dr. Dougherty enjoys reading, cycling, and yoga, as well as spending time with her two rescue dogs, Riley and Finn.

Charles "Chip" Barbara

The Scheie Eye Institute is delighted to welcome Charles "Chip" Barbara as the new Chief Operating Officer for the Ophthalmology Department. In this role, Chip will oversee all administrative functions and work with Dr. Joan O'Brien to carry out the departmental tripartite mission.

Chip received his Bachelor's degree in Economics from the University of Maryland and his Master's degree in Science & Finance, with a concentration in Medical Services Management from Johns Hopkins University (JHU).

He spent his impressive 30-year career at Johns Hopkins Medicine, where he most recently served as the Johns Hopkins Health System's (JHH) Sr. Director of Operations Integration. Prior to this role, he was the JHU/JHH Administrator for the Department of Medicine, where he oversaw the department's administrative, operational, financial, and programmatic development.

Chip officially began his new role at Scheie on November 2, 2020. "I am humbled and appreciative to have been offered this opportunity to be part of the Scheie Eye Institute and Penn Medicine community," said Chip. "I look forward to working with Dr. O'Brien and doing all that I can to support the Department of Ophthalmology's faculty, trainees, technicians, patients, research, and administrative support staff in their efforts to fulfill the tripartite mission and serve the public."

dear friends

Scott M. Goldstein, MD
Pediatrics & Adult
Oculo-Facial Plastic Surgeon
Tri-County Eye & Wills Eye Institute

The year 2020 will long remain one for the record books. In the so-called "year of the eye," we have seen the nation and world transformed by the COVID-19 pandemic. Interestingly, similarities and lessons can be drawn from the 1918 flu pandemic that ravaged Philadelphia more so than any other American city.

In the midst of World War I, President Woodrow Wilson continued to focus the nation towards Europe and downplayed the growing flu pandemic. In mid-September 1918, troops returning to Boston and Philadelphia brought the influenza H1N1 virus with them. Some of these individuals included naval doctors that were to spend time in the Philadelphia Navy Yard and at the University of Pennsylvania. Details about the flu coming to Philadelphia were downplayed by the city, and life went on as usual.

A mere ten days later on September 28, 1918, over 200,000 Philadelphians gathered for the Liberty Loan War Bond parade. It was the largest gathering and parade in Philadelphia history. The Public Health Department at the time said there was no need for concern. Unfortunately, they were dead wrong. Within 72 hours, every hospital bed in all 31 Philadelphia-area hospitals was filled. Within a few weeks, thousands were dead. Many of the deceased were in their 20's and 30's, sadly leaving hundreds of children orphaned. In fact, my wife's great-grandfather was one victim of the deadly virus after attending the parade.

On the medical front, most patients presented with a high fever, cough, conjunctivitis, and distorted color vision. This rapidly progressed over hours with bleeding from the nose, ears, and eyes before the onset of a severe lung infection, cyanosis, and death. It was reported that nearly 1 in 4 victims had eye involvement. The best "treatment" of the day? Whiskey! With many physicians recruited to the war effort, the burden of care often fell to medical students, nurses, and seminary students in the area.

Fast forward to now and recall that the COVID-19 pandemic was first reported by a Chinese ophthalmologist, who later died from the novel virus. Thankfully, we have a much more sophisticated medical care system in place today with a better understanding of viral processes, as well as more extensive resources, to fight these infections compared to 1918. Yet as I write this in the midst of the third surge, some hospitals are close to reaching capacity in their ICUs and hospital systems are being strained, particularly in the Midwest and more rural areas of the country. As much as we knew in 1918 that wearing a mask was the best way to stay safe, many Americans have failed to learn this lesson of science and history.

The COVID-19 surge in March and April left ophthalmic surgeons feeling the biggest brunt of the US medical shutdown, with cataract surgery volume diminished by 97%. Many of our offices shut down or saw severely restricted patient visits until we could develop protocols to keep ourselves, our staff, and our patients safe. Medical student and resident curriculums took a drastic change this year, with much of the education going virtual and patient care limited this past spring. This applies as well to practicing physicians and continuing medical education. All national meetings, as well as our own Scheie Alumni Meeting, transitioned to virtual events.

Despite these once-in-a-lifetime circumstances, we have all grown and persevered together. We have gained foresight by learning from hindsight. The 1918 pandemic took almost four years to fully burn out, but my hope is that an imminent vaccine for the COVID-19 virus will bring a more rapid resolution to this pandemic. More than ever, I encourage everyone to stay safe, stay healthy, and stay engaged with each other and our beloved Department of Ophthalmology!

Scott M. Goldstein, MD res '00, fel '02
President, Scheie Alumni

SAVE the DATE

Saturday, April 17, 2021

2021 Scheie Eye Institute Alumni Association CME Accredited Conference

More details to come.

Meet Our Team

Comprehensive Ophthalmology
Charles Nichols, MD
Dwight Stambolian, MD, PhD
Jane Portnoy, MD
Paul Tapino, MD
Thomasine Gorry, MD, MGA
Deborah Herrmann, MD
Allison Brucker, MD

Cornea
Stephen Orlin, MD
Christina Moon, MD
Michael Sulewski, MD

Dry Eye
Giacomina Massaro-Giordano, MD
Vatinee Bunya, MD, MSCE

Glaucoma
Eydie Miller-Ellis, MD
Prithvi Sankar, MD
Eve Higginbotham, SM, MD
Victoria Addis, MD
Qi Cui, MD, PhD
Prathima Neerukonda Atluri, MD
Amanda Lehman, MD, MSc

Low Vision
Ranjoo Prasad, OD

Neuro-Ophthalmology
Madhura Tamhankar, MD
Kenneth Shindler, MD, PhD
Ahmara Ross, MD, PhD
Grant Liu, MD

Ocular Oncology
Joan O'Brien, MD
Katayoon Baradaran Ebrahimi, MD

Ocular Pathology
Vivian Lee, MD

Oculoplastics
Sonul Mehta, MD
César Briceño, MD

Optometry
Alisha Fleming, OD
Stacey Cesarano, OD
Sara Bierwerth, OD
Samantha Dougherty, OD
Shelly Cutler, OD

Pediatric Ophthalmology (CHOP)
Monte Mills, MD
Brian Forbes, MD, PhD
William Anninger, MD
Gil Binenbaum, MD, MSCE
William Katowitz, MD
Stefanie Davidson, MD
Robert Avery, DO, MSCE
Priyanka Kumar, MD
Karen Revere, MD
Anne Jensen, MD
Julia Reid, MD

Retina & Vitreous
Alexander Brucker, MD
Samuel Jacobson, MD, PhD
Albert Maguire, MD
Tomas Aleman, MD
Benjamin Kim, MD
Brian VanderBeek, MD, MPH
Katherine Uyhazi, MD, PhD

Uveitis
Nirali Bhatt, MD

Research Faculty
Jean Bennett, MD, PhD (CAROT)
Maureen Maguire, PhD (CPOB)
Richard Stone, MD
Artur Cideciyan, PhD
Joshua Dunaief, MD, PhD
Gui-shuang Ying, MD, PhD
Jessica Morgan, PhD (CAROT)
Manzar Ashtari, PhD, DABR (CAROT)
Ebenezer Daniel, MBBS, MS, MPH, PhD
Venkata Ramana Murthy Chavali, PhD

Emeritus Faculty
Juan Grunwald, MD
Alan Laties, MD
James Katowitz, MD
Graham Quinn, MD, MSCE
Stuart Fine, MD
Edward Pugh Jr, PhD

2020-2021 Fellows

Charles Miller, MD, PhD (Retina)
Danielle Sarlo, DO (CHOP Pediatric Ophthalmology)
Erin O'Neil, MD (Retinal Degeneration & Medical Retina)
Frank Chin, MD (Glaucoma)
Gillian Paton, MD (Neuro-Ophthalmology)
Jessica Thayer, MD (CHOP Pediatric Ophthalmology)
Moe Aung, MD, PhD (Neuro-Ophthalmology)
Sana Bautista, MD (CHOP Oculoplastics)
Tina Xia, MD (Retina)

2020-2021 Residents

First Year Residents
Brian Nguyen, MD
Samantha Marek, MD
Tianyu Liu, MD
Tomas Andersen, MD, MPH
Vivian Qin, MD

Second Year Residents
Daniel Choi, MD
Dario Marangoni, MD, PhD
Diana Kim, MD
Jennifer Nadelmann, MD
Zujaja Tauqeer, MD, DPhil

Third Year Residents
Delu Song, MD
Enny Oyeniran, MD
Lana Verkuil, MD
Meera Ramakrishnan, MD
Yafeng Li, MD, PhD

Faculty Awards
(July 1, 2019 – Present)

Manzar Ashtari, MD, DABR
- Committee Member, Best Practices Committee, Organization for Human Brain Mapping

Jean Bennett, MD, PhD
- 2019 Charles L. Schepens Award, American Academy of Ophthalmology (co-recipient)
- 2020 Distinguished Investigator Award, Association for Clinical and Translational Science
- 2020 Scientific Achievement Award, Life Sciences, Pennsylvania
- 2020 Award for Distinguished Research in the Biomedical Sciences, Association of American Medical Colleges (co-recipient)
- 2020 Boberg-Ans Award, the Danish Ophthalmological Society, Copenhagen, Denmark (co-recipient)
- Sanford and Susan Greenberg 20/20 Prize to End Blindness (co-recipient)

César Briceño, MD
- Penn Medicine Dean's Award for Excellence in Clinical Teaching
- Advisory Dean Appointment, Perelman School of Medicine

Alexander Brucker, MD
- 2020 Philadelphia Magazine Top Doctor
- 2020 Castle Connolly Top Doctor

Artur Cideciyan, PhD
- Vision Research Publication of the Year 2019 (co-recipient)

Ebenezer Daniel, MBBS, MS, MPH, PhD
- 2020 Achievement Award, American Academy of Ophthalmology

Joshua Dunaief, MD, PhD
- Director Appointment, NIH-funded Vision Clinician Scientist K12 Program, University of Pennsylvania

Deborah Herrmann, MD
- 2020 Philadelphia Magazine Top Doctor
- 2020 Castle Connolly Top Doctor
- 2020 Castle Connolly Exceptional Women in Medicine

Samuel Jacobson, MD, PhD
- Vision Research Publication of the Year 2019 (co-recipient)

William Katowitz, MD
- Member Appointment, The Orbital Society
- 2020 Philadelphia Magazine Top Doctor
- 2020 Castle Connolly Top Doctor

Vivian Lee, MD
- Certificate of Appreciation, Committee on Admissions, Perelman School of Medicine
- Committee Member, Committee on Admissions, Perelman School of Medicine
- Co-Chair Appointment, Committee on Admissions, Perelman School of Medicine

Albert Maguire, MD
- 2019 Charles L. Schepens Award, American Academy of Ophthalmology (co-recipient)
- 2020 Award for Distinguished Research in the Biomedical Sciences, Association of American Medical Colleges (co-recipient)
- 2020 Boberg-Ans Award, the Danish Ophthalmological Society, Copenhagen, Denmark (co-recipient)
- Sanford and Susan Greenberg 20/20 Prize to End Blindness (co-recipient)

Maureen Maguire, PhD
- The Retina Society's J. Donald M. Gass Medal (co-recipient)
- President-Elect, Association for Research in Vision and Ophthalmology

Mina Massaro-Giordano, MD
- Elected into Academy of Master Clinicians, Penn Medicine

Eydie Miller-Ellis, MD
- 2020 Philadelphia Magazine Top Doctor
- 2020 Castle Connolly Top Doctor
- 2020 Castle Connolly Exceptional Women in Medicine

Monte Mills, MD
- 2020 Philadelphia Magazine Top Doctor
- 2020 Castle Connolly Top Doctor

Joan O'Brien, MD
- Elected Silver Fellow, Association for Research in Vision and Ophthalmology
- 2020 Health Communication Division Award, International Communication Association
- 2020 Philadelphia Magazine Top Doctor
- 2020 Castle Connolly Top Doctor
- 2020 Castle Connolly Exceptional Women in Medicine

Stephen Orlin, MD
- 2020 Philadelphia Magazine Top Doctor
- 2020 Castle Connolly Top Doctor

Graham Quinn, MD, MSCE
- Outstanding Humanitarian Award, American Academy of Ophthalmology

Ahmara Ross, MD, PhD
- Harold Amos Faculty Development Award
- American Glaucoma Society Young Clinician Scientists Award
- North American Neuro-Ophthalmology Young Investigator Award

Prithvi Sankar, MD
- Senior Advisor, Perelman School of Medicine Class of 2021

Michael Sulewski, MD
- Certificate of Appreciation, Committee on Admissions, Perelman School of Medicine

Madhura Tamhankar, MD
- 2020 Philadelphia Magazine Top Doctor
- 2020 Castle Connolly Top Doctor
- 2020 Castle Connolly Exceptional Women in Medicine

Gui-shuang Ying, MD, PhD
- Outstanding Achievement Award in Ophthalmology & Visual Science, Overseas of Chinese Ophthalmological Society

Faculty Publications

(July 1, 2019 – July 1, 2020)

Agawu, A., Fahl, C., Alexis, D., Diaz, T., Harris, D., Harris, M. C., Aysola, J., Cronholm, P. F., & Higginbotham, E. J. (2019). **The influence of gender and underrepresented minority status on medical student ranking of residency programs**. *Journal of the National Medical Association*, 111(6), 665-673.

Ammar, M. J., Carroll, R., Kolomeyer, A., Ying, G. S., Whitehead, G., Brucker, A. J., & Kim, B. J. (2020). **Clinical utility of beta-D-glucan testing for endogenous fungal chorioretinitis or endophthalmitis**. *Retina*.

Ammar, M. J., Scavelli, K. T., Uyhazi, K. E., Bedoukian, E. C., Serrano, L. W., Edelstein, I. D., Vergilio, G., Cooper, R. F., Morgan, J. I. W., Kumar, P., & Aleman, T. S. (2019). **Enhanced S-cone syndrome: Visual function, cross-sectional imaging, and cellular structure with adaptive optics ophthalmoscopy**. *Retinal Cases and Brief Reports*.

Areaux, R. G., Orlin, S. E., Zaidman, G. W., Kothari, K., Wilson, L. B., Huang, J., Ying, G. S., & Binenbaum, G. (2020). **Anatomic and visual outcomes of corneal transplantation during infancy**. *Journal of AAPOS*, 24(3), 134. e1-134.e6.

Asbell, P. A., Maguire, M. G., & DREAM Study Research Group. (2019). **Why DREAM should make you think twice about recommending omega-3 supplements**. *The Ocular Surface*,

17(4), 617-618.

Bal, S., Ying, G. S., Tomlinson, L., Binenbaum, G., & Postnatal Growth and Retinopathy of Prematurity (G-ROP) Study Group. (2019). **Association of weight gain acceleration with risk of retinopathy of prematurity**. *JAMA Ophthalmology*, 137(11), 1301-1305.

Barry, G. P., Tauber, K. A., Fisher, M., Greenberg, S., Zobal-Ratner, J., & Binenbaum, G. (2019). **Short-term retinal detachment risk after treatment of Type 1 retinopathy of prematurity with laser photocoagulation versus intravitreal bevacizumab**. *Journal of AAPOS*, 23(5), 260.e1-260.e4.

Barry, G. P., Tauber, K. A., Greenberg, S., Lajoie, J., Afroze, F., Oechsner, H., Finucane, E., & Binenbaum, G. (2020). **A comparison of respiratory outcomes after treating retinopathy of prematurity with laser photocoagulation or intravitreal bevacizumab**. *Ophthalmology Retina*.

Baumann, B. H., Shu, W., Song, Simpson, E. M., Lakhal-Littleton, S., & Dunaief, J. L. (2019). **Ferroportin-mediated iron export from vascular endothelial cells in retina and brain**. *Experimental Eye Research*, 187, 107728.

Baumann, B. H., Shu, W., Song, Y., Sterling, J., Kozmik, Z., Lakhal-Littleton, S., & Dunaief, J. L. (2019). **Liver-specific, but not retina-specific, hepcidin knockout causes retinal iron accumulation and degeneration**. *The American Journal of Pathology*, 189(9), 1814-1830.

Bavinger, J. C., Ying, G. S., Daniel, E., Grunwald, J. E., Maguire, M. G., & Comparison of Age-Related Macular Degeneration Treatments Trials Research Group. (2019). **Association between cilioretinal arteries and advanced age-related macular degeneration: Secondary analysis of the comparison of age-related macular degeneration treatment trials (CATT)**. *JAMA Ophthalmology*, 137(11), 1306-1311.

Bavinger, J. C., Yu, Y., & VanderBeek, B. L. (2019). **Comparative risk of endophthalmitis after intravitreal injection with bevacizumab, aflibercept, and ranibizumab**. *Retina*, 39(10), 2004-2011.

Bedoukian, E. C., Zhu, X., Serrano, L. W., Scoles, D., & Aleman, T. S. (2020). **NMNAT1-associated cone-rod dystrophy: Evidence for a spectrum of foveal maldevelopment**. *Retinal Cases and Brief Reports*.

Bellsmith, K. N., Dunaief, J. L., Yang, P., Pennesi, M. E., Davis, E., Hofkamp, H., & Lujan, B. J. (2020). **Bull's eye maculopathy associated with hereditary hemochromatosis**. *American Journal of Ophthalmology Case Reports*, 18, 100674.

Berg, E. J., Ying, G. S., Maguire, M. G., Sheffield, P. E., Szczotka-Flynn, L. B., Asbell, P. A., Shen, J. F., & DREAM Study Research Group. (2020). **Climatic and environmental correlates of dry eye disease severity: A report from the dry eye assessment and management (DREAM) study**. *Translational Vision Science & Technology*, 9(5), 25.

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Binenbaum, G., & Ying, G. S. (2020). **Inquiries on the validation of a model to reduce retinopathy of prematurity testing-reply**. *JAMA Ophthalmology*, 138(6), 711.

Bunya, V. Y., Massaro-Giordano, M., Vivino, F. B., Maguire, M. G., Baer, A. N., Gonzales, J. A., & Ying, G. S. (2019). **Prevalence of novel candidate sjögren syndrome autoantibodies in the Penn sjögren's international collaborative clinical alliance cohort**. *Cornea*, 38(12), 1500-1505.

Carroll, R. M., & Kim, B. J. (2019). **Asymptomatic adults in a single family with familial exudative vitreoretinopathy and TSPAN12 variant**. *Ophthalmic Genetics*, 40(5), 474-479.

Chakravarty, D., Saadi, F., Kundu, S., Bose, A., Khan, R., Dine, K., Kenyon, L. C., Shindler, K. S., & Das Sarma, J. (2020). **CD4 deficiency causes poliomyelitis and axonal blebbing in murine coronavirus-induced neuroinflammation**. *Journal of Virology*, 94(14), e00548-20.

Chen, M., Cooper, R. F., Gee, J. C., Brainard, D. H., & Morgan, J. I. W. (2019). **Automatic longitudinal montaging of adaptive optics retinal images using constellation matching**. *Biomedical Optics Express*, 10(12), 6476-6496.

Chen, M., Gee, J. C., Morgan, J. I. W., & Aguirre, G. K. (2019). **Shape decomposition of foveal pit morphology using scan geometry corrected OCT**. *Ophthalmic Medical Image Analysis*, 11855, 69-76.

Chen, Z., Jiang, R., Chen, M., Zheng, J., Chen, M., Braidy, N., Liu, S., Liu, G., Maimaitiming, Z., Shen, T., Dunaief, J. L., Vulpe, C. D., Anderson, G. J., & Chen, H. (2019). **Multi-copper ferroxidase deficiency leads to iron accumulation and oxidative damage in astrocytes and oligodendrocytes**. *Scientific Reports*, 9(1), 9437.

Chévez-Barrios, P., Eagle, R. C., Krailo, M., Piao, J., Albert, D. M., Gao, Y., Vemuganti, G., Ali, M. J., Khetan, V., Honavar, S. G., O'Brien, J., Leahey, A. M., Matthay, K., Meadows, A., & Chintagumpala, M. (2019). **Study of unilateral retinoblastoma with and without histopathologic high-risk features and the role of adjuvant chemotherapy: A children's oncology group study**. *Journal of Clinical Oncology*, 37(31), 2883-2891.

Cipollari, E., Szapary, H. J., Picataggi, A., Billheimer, J. T., Lyssenko, C. A., Ying, G. S., Shaw, L. M., Kling, M. A., Kaddurah-Daouk, R., Rader, D. J., Praticò, D., Lyssenko, N. N., & Alzheimer's Disease Metabolomics Consortium. (2020). **Correlates and predictors of cerebrospinal fluid cholesterol efflux capacity from neural cells, a family of biomarkers for cholesterol epidemiology in Alzheimer's disease**. *Journal of Alzheimer's Disease*, 74(2), 563-578.

Comparison of Age-related Macular Degeneration Treatments Trials (CATT) Research Group, Writing Committee:, Martin, D. F., Maguire, M. G., Fine, S. L., Ying, G. S., Jaffe, G. J., Grunwald, J. E., Toth, C., Redford, M., & Ferris, F. L. (2020). **Ranibizumab and bevacizumab for treatment of neovascular age-related macular degeneration: Two-year results**. *Ophthalmology*, 127(4S), S135-S145.

Cooper, R. F., Aguirre, G. K., & Morgan, J. I. W. (2019). **Fully automated estimation of spacing and density for retinal mosaics**. *Translational Vision Science & Technology*, 8(5), 26.

Cui, Q. N., Bargoud, A. R., Ross, A. G., Song, Y., & Dunaief, J. L. (2020). **Oral administration of the iron chelator deferiprone protects against loss of retinal ganglion cells in a mouse model of glaucoma**. *Experimental Eye Research*, 193, 107961.

Daniel, E., Maguire, M. G., Grunwald, J. E., Toth, C. A., Jaffe, G. J., Martin, D. F., Ying, G. S., & Comparison of Age-Related Macular Degeneration Treatments Trials Research Group. (2020). **Incidence and progression of nongeographic atrophy in the comparison of age-related macular degeneration treatments trials (CATT) clinical trial**. *JAMA Ophthalmology*, 138(5), 510-518.

Dryja, T. P., Demirs, J. T., Twarog, M., & Lee, V. (2019). **Complement Proteins in the Retina in Cancer - Associated Retinopathy**. *JAMA Ophthalmology,* 137(12),1458-1460

Dufour, V. L., Cideciyan, A. V., Ye, G. J., Song, C., Timmers, A., Habecker, P. L., Pan, W., Weinstein, N. M., Swider, M., Durham, A. C., Ying, G. S., Robinson, P. M., Jacobson, S. G., Knop, D. R., Chulay, J. D., Shearman, M. S., Aguirre, G. D., & Beltran, W. A. (2020). **Toxicity and efficacy evaluation of an adeno-associated virus vector expressing codon-optimized RPGR delivered by subretinal injection in a canine model of X-linked retinitis pigmentosa**. *Human Gene Therapy*, 31(3-4), 253-267.

Dufour, V. L., Yu, Y., Pan, W., Ying, G. S., Aguirre, G. D., & Beltran, W. A. (2020). **In-vivo longitudinal changes in thickness of the postnatal canine retina**. *Experimental Eye Research*, 192, 107926.

Duncan, J. L., Liang, W., Maguire, M. G., Audo, I., Ayala, A. R., Birch, D. G., Carroll, J., Cheetham, J. K., Esposti, S. D., Durham, T. A., Erker, L., Farsiu, S., Ferris, F. L., Heon, E., Hufnagel, R. B., Iannaccone, A., Jaffe, G. J., Kay, C. N., Michaelides, M., Pennesi, M. E., Sahel, J. A., & Foundation Fighting Blindness Consortium Investigator Group. (2020). **Baseline visual field findings in the RUSH2A study: Associated factors and correlation with other measures of disease severity**. *American Journal of Ophthalmology*, 219, 87-100.

Farazdaghi, M. K., Katowitz, W. R., & Avery, R. A. (2019). **Current treatment of optic nerve gliomas**. *Current Opinion in Ophthalmology*, 30(5), 356-363.

Fayet, B., Racy, E., Bordonné, C., Katowitz, J. A., Katowitz, W. R., & Brémond-Gignac, D. (2019). **Complex stenoses and CT features of the nasolacrimal canal in congenital nasolacrimal duct obstruction**. *Ophthalmic Plastic and Reconstructive Surgery*, 35(6), 594-599.

Flaxel, C. J., Adelman, R. A., Bailey, S. T., Fawzi, A., Lim, J. I., Vemulakonda, G. A., & Ying, G. S. (2020). **Age-related macular degeneration preferred practice pattern®**. *Ophthalmology*, 127(1).

Flaxel, C. J., Adelman, R. A., Bailey, S. T., Fawzi, A., Lim, J. I., Vemulakonda, G. A., & Ying, G. S. (2020). **Diabetic retinopathy preferred practice pattern®**. *Ophthalmology*, 127(1), 66-145.

Flaxel, C. J., Adelman, R. A., Bailey, S. T., Fawzi, A., Lim, J. I., Vemulakonda, G. A., & Ying, G. S. (2020). **Posterior vitreous detachment, retinal breaks, and lattice degeneration preferred practice pattern®**. *Ophthalmology*, 127(1).

Flaxel, C. J., Adelman, R. A., Bailey, S. T., Fawzi, A., Lim, J. I., Vemulakonda, G. A., & Ying, G. S. (2020). **Idiopathic epiretinal membrane and vitreomacular traction preferred practice pattern®**. *Ophthalmology*, 127(2), 145-183.

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Faculty In the News

Below is a selection of recent news stories featuring our ophthalmology faculty's research and clinical work.

November 10, 2020: Drs. Qi Cui and Joshua Dunaief – **Neuraly Announces Strategic Sponsored Research Agreement with UPenn to Explore Use of NLY01 to Therapeutically Target a Neuroinflammatory Mechanism of Glaucoma**. *Yahoo! News*: "A study recently published by the Penn team in *Cell Reports* provides evidence that NLY01 has the potential for clinical use in the treatment of glaucoma and potentially other retinal diseases."

September 21, 2020: Dr. Vatinee Bunya – **Yes, Your Eyes Can Get Sunburned – Here's How to Make Sure That Doesn't Happen**. *SHAPE Magazine*: "Like having sunburned skin, photokeratitis is not usually noticed until after the damage has occurred. There is usually a delay in symptoms of a few hours to 24 hours after the exposure to UV light."

September 10, 2020: Dr. Eve Higginbotham – **Advocacy and Action: How Eve Higginbotham Is Dismantling Racist and Sexist Systems One Step at a Time**. *Penn Medicine News*: "Higginbotham has also long been invested in investigating the barriers that women – and particularly women of color – face in science, engineering, and medicine."

July 7, 2020: Dr. Ranjoo Prasad – **"Going Blind: Coming Out of the Dark About Vision Loss" Panel Discussion**. *Associated Services for the Blind and Visually Impaired*: "I think what a lot of people don't realize is that vision loss is very wide. Education, awareness, and advocacy are very important."

June 10, 2020: Dr. Deborah Herrmann – **10 Possible Reasons Your Eyes Are Acting Weird, According to Doctors**. *Prevention*: "Your eyes are connected to your central nervous system and everything else. Something that's affecting your body can be affecting your eyes as well."

June 8, 2020: Dr. Joshua Dunaief – **New Treatments for Macular Degeneration Are On the Way**. *Wall Street Journal*: "Scientists may be just a few years away from delivering new treatments for age-related macular degeneration (AMD), the leading cause of irreversible vision loss in people more than 50 years old."

May 2, 2020: Dr. Eve Higginbotham – **Coronavirus Is Especially Cruel to Minorities. A Doctor Prescribes Solutions**. *The Philadelphia Inquirer*: "If anything positive can come from this pandemic, it could be that it forces society to address the structural inequities described a century ago. Lives and livelihoods are at stake."

April 28, 2020: Dr. Eve Higginbotham – **For This Physician, Communication Is Better Medicine Than Ever in the COVID Era**. *The Philadelphia Inquirer*: "Within this context, I am more mindful than ever of the words I choose when I speak with my patients."

March 13, 2020: Dr. Vatinee Bunya – **How to Maintain Good Eye Health, According to Doctors**. *Good Housekeeping*: "Take out contacts at night, Dr. Bunya advises, even if they're labeled for long-term wear—sleeping in them ups your risk tenfold for eye infections because it gives bacteria time to multiply."

March 4, 2020: Dr. Artur Cideciyan – **In a 1st, Scientists Use Revolutionary Gene-Editing Tool to Edit Inside a Patient**. *NPR*: "'Inherited retinal diseases are a good choice in terms of gene-based therapies,' says Artur Cideciyan, given that the retina is easily accessible. But Cideciyan cautions that other approaches for these conditions are also showing promise, and it remains unclear which will turn out to be the best."

February 12, 2020: Dr. Jean Bennett – **Blazing a New Trail in Gene Therapy for Retinal Disease**. *Ophthalmology Times*: "The drug (Luxturna), according to Jean Bennett, MD, PhD, was the first to develop a path for the development of genetic treatments for blindness and provided motivation for ophthalmologists and insurers to carry out genetic testing."

February 6, 2020: Dr. Brian VanderBeek – **Keeping Up Regular AMD Treatment Visits Tied to Less Vision Loss Over Time.** *Reuters*: "People with a common age-related eye disease who show up regularly for their doctor's visits get to keep more of their sight than those who skip appointments or stretch the time between visits, a new analysis suggests."

January 15, 2020: Dr. Qi Cui – **Maximizing Quality of Life in Glaucoma**. *Ophthalmology Times*: "Quality-of-life issues have stepped into the spotlight for glaucoma, and ophthalmologists are learning how to incorporate new insights and tools into their clinical practice."

January 6, 2020: Dr. Mina Massaro – **Announcing 11 New Members of the Academy of Master Clinicians**. *Penn Medicine Office of the Dean*: "Membership in the Academy recognizes those Penn Medicine clinicians who exemplify the highest standards of clinical excellence, humanism and professionalism and is the highest clinical honor to be bestowed on a Penn physician."

Note: This list includes a selection of news items published in 2020. For a complete list, visit https://www.pennmedicine.org/departments-and-centers/ophthalmology/about-us/news/faculty-in-the-news.

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The Scheie Eye Institute is the Department of Ophthalmology at the University of Pennsylvania. Scheie has been a leader in the field of ophthalmic research, education, and patient care for 146 years. Many of our greatest advancements in vision-saving therapy have been made possible by donations from individuals and organizations.

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