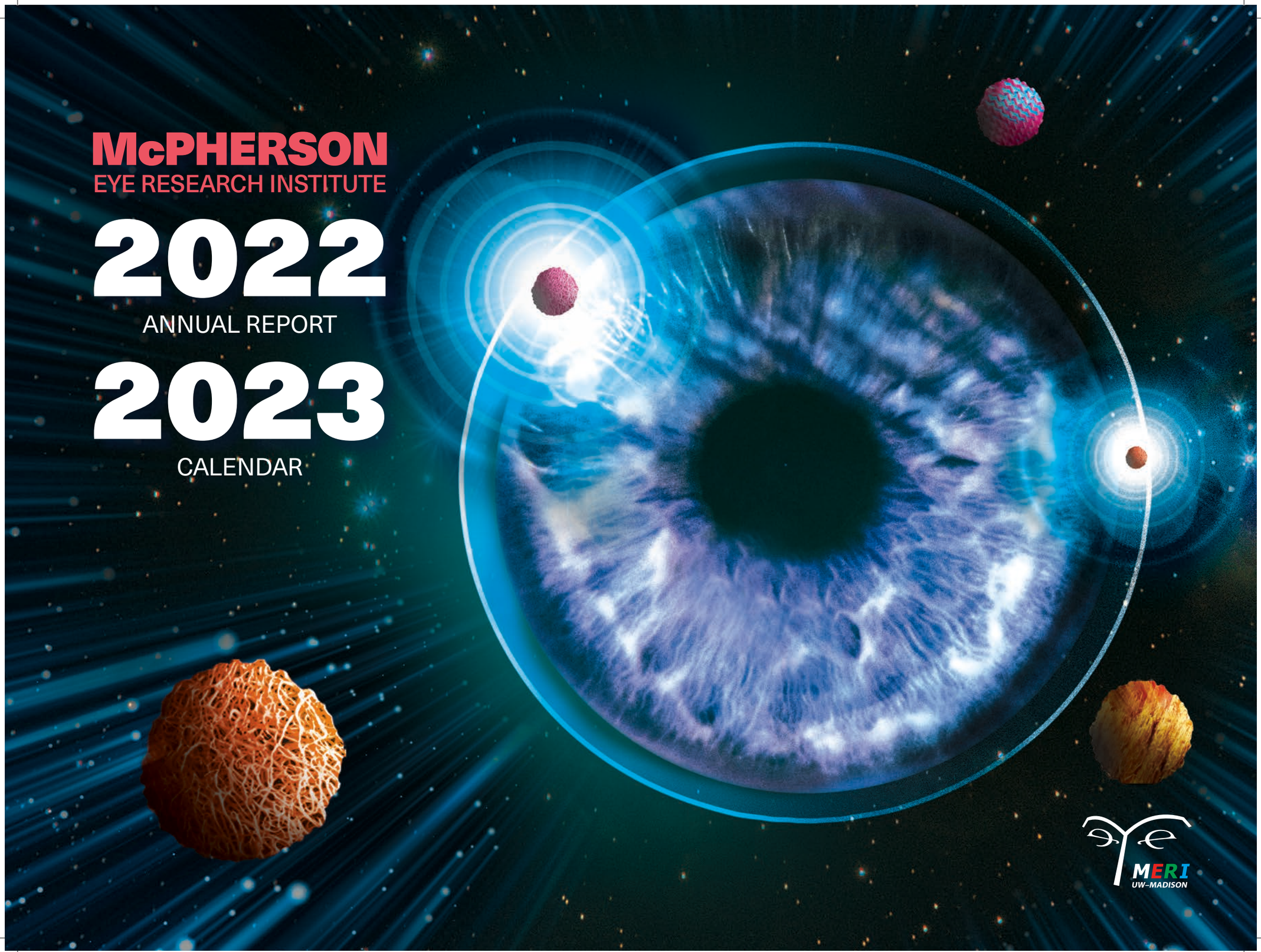
McPHERSON EYE RESEARCH INSTITUTE

2022 ANNUAL REPORT

2023 CALENDAR



MERI
UW–MADISON

Dear Friends of the McPherson Eye Research Institute,

The McPherson ERI is proud to support one of the largest and most scientifically diverse groups of distinguished and dedicated vision-related researchers in the world. While we have an abundance of expertise, technology, and innovative ideas in each of our laboratories, we also know that true breakthroughs rarely occur in isolation. Instead, they come about through open collaboration and sharing of ideas and resources. That is why 'team research' is the Institute's (and the UW-Madison's) modus operandi.

A parallel can be drawn between the McPherson ERI's mission and methods and those of another large and carefully crafted team—the scientists and engineers of the James Webb Space Telescope Project. The deep space images that the Webb has dazzled us with over the past year were not only the inspiration for this year's calendar cover, but a reminder of what can be accomplished when we pool our strengths and work together. It is also worth noting that when the Webb Project began in the 1990s, the technology necessary to achieve its goals hadn't been fully developed yet.

In the pages of this calendar, we will update you on some of the Institute's ongoing team-based efforts to push the envelope when it comes to combating blindness. We hope to convey the very real sense that the Institute is much greater than the sum of its parts (impressive though the parts may be). Highlighted projects include those using (1) induced pluripotent stem cells to grow photoreceptors with the potential to rebuild the human retina; (2) gene editing to fix mutations that cause blindness in children; and (3) novel imaging systems to monitor the health of the living human retina in ways never before achieved.

In the end, our purpose is to preserve and restore vision by advancing science and medicine with focus, innovation, and integrity. We remain united with you in seeking an end to the most devastating diseases that impact vision.

We are also grateful for your interest in our work, and for your support of the McPherson ERI. In recent years, McPherson ERI donors have provided funds for all of the projects highlighted in this calendar—thank you!

Please have a wonderful holiday season and New Year's, and a happy and healthy 2023.

Sincerely,

David M. Gamm, MD, PhD

Professor, Department of Ophthalmology and Visual Sciences • RRF Emmett A. Humble Distinguished Director, McPherson Eye Research Institute • Sandra Lemke Trout Chair in Eye Research

BRINGING IT ALL TOGETHER

Diseases that result in vision loss are as diverse as they are numerous. Many we know well enough to treat effectively today, but others have perpetually evaded our understanding and thus lack any meaningful therapies.

At the McPherson ERI, we have tasked ourselves with addressing the toughest remaining vision problems—the ones that don't follow the rules as we currently know them. To be successful in this endeavor, we have to approach vision science and medicine differently, mixing and matching our varied perspectives and skills to see and fight disease in new ways. In the next few pages, we highlight inroads that McPherson ERI researchers have made in advancing knowledge and developing future treatments for some of the most prevalent and devastating causes of vision loss—age-related macular degeneration, retinitis pigmentosa, diabetic retinopathy, and glaucoma.

Age-related macular degeneration (AMD) and retinitis pigmentosa (RP)

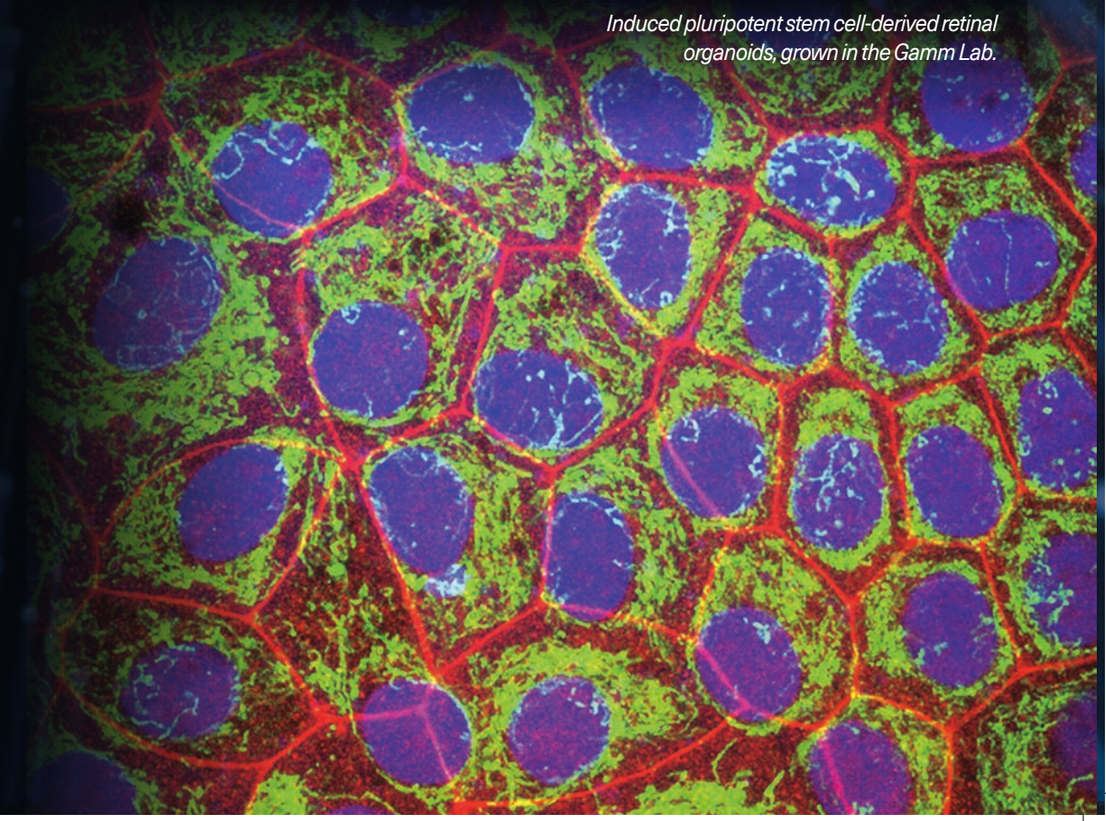
The McPherson ERI Stem Cell Consortium: Looking toward human clinical trials

Until very recently, the idea of replacing the cells in human eyes that initiate vision—the photoreceptors—was considered science fiction. Those who have followed the McPherson ERI's research for the past 10 years, though, know that what was once a fanciful dream is moving towards reality. In the last decade, 1 **David Gamm** (Sandra Lemke Chair in Eye Research) and his lab members, along with multiple collaborating researchers at UW-Madison and around the world, have used induced pluripotent stem cells (iPSCs) to create functional human photoreceptors and other retinal cells in the lab, as well as whole retinal tissues. The McPherson ERI's stem cell team, led by Dr. Gamm, includes biologists, statisticians, engineers, surgeons, and industry leaders.

2022 has seen strong forward movement towards transplantation of photoreceptors for retinitis pigmentosa and RPE (or RPE + photoreceptors) for age-related macular degeneration (AMD). Other inherited diseases that will benefit from these efforts include Usher syndrome, Stargardt disease, and Best vitelliform macular dystrophy, among many others. Pioneering research and patents from the McPherson ERI's stem cell team led to the establishment of Opsis Therapeutics, a subsidiary of FujiFilm Cellular Dynamics Inc. (FCDI), in Madison, WI. In 2021, Opsis and FCDI joined forces with BlueRock Therapeutics (Boston, MA) and Bayer AG (Germany) to take their iPSC-derived photoreceptor and RPE cell technology to patients. At least two human clinical trials are planned in the coming years—the first for retinitis pigmentosa and Usher syndrome, and the second for AMD and other forms of macular disease.

In 2022, two different studies published by McPherson ERI stem cell team members have provided strong evidence that lab-grown photoreceptor cells have "what it takes" to function in the human eye. Early in the year, neuroscientist and David and Nancy Walsh Family Professor 2 **Raunak Sinha** published a study in collaboration with the Gamm Lab showing that stem cell-derived cone photoreceptor cells can respond to light in a very similar way as those in adult non-human primates. An equally important finding came later in the year, when neuroscientist 3 **Tim Gomez's** lab reported that these same stem cell-derived cone photoreceptors have the innate ability to extend "wires"—termed axons—in order to contact other retinal cells. That study, led within the Gomez lab by 4 **Sarah Rempel** in collaboration with the Gamm lab, bolsters confidence that transplanted photoreceptors can forge the links necessary to re-establish vision-generating retinal circuits in patients whose photoreceptors have been terminally damaged.

This past year, the McPherson ERI stem cell team continued to explore innovative ways to deliver photoreceptors and RPE cells to their home in the very back of the eye using the latest engineering advances. Working with Dr. Gamm, the labs of 5 **Sarah Gong** (RRF Edwin and Dorothy Gamewell Professor) and 6 **Jack Ma** have created a 4th generation biodegradable micro-scaffold that can safely and accurately place photoreceptors and/or RPE cells under the thin, delicate retina. The team is now testing these scaffolds in preclinical studies in collaboration with the lab of 7 **Kapil Bharti** with support from the U.S. Department of Defense and the National Eye Institute. Refining the subretinal transplant procedure has also been a major Institute focus in 2022, with key improvements being made by lead retinal surgeon and stem cell team member 8 **Michael Altaweel** (Monroe E. Trout Chair in Eye Research).



Induced pluripotent stem cell-derived retinal organoids, grown in the Gamm Lab.

Retinal organoid image courtesy of the Gamm Lab

BRINGING IT ALL TOGETHER

Childhood-onset inherited retinal diseases

Bringing the power of gene editing to pediatric eye disease

The human eye—despite being one of the body's most complex and intricate organs—is an ideal target to test treatments that use CRISPR, the Nobel Prize-winning tool that can precisely alter, or 'edit', DNA associated with inherited disease. The Institute has been investigating this potential through an interdisciplinary partnership involving McPherson ERI scientists at UW-Madison, the Morgridge Institute for Research (MIR), and the Wisconsin Institute for Discovery (WID). Our team, led by 1 **Kris Saha**, is organized around a variety of cutting-edge techniques that enhance the safety, reproducibility, and efficacy of gene editing aimed at curing inherited forms of childhood blindness.

Kris Saha started exploring the idea of CRISPR-based therapies many years ago. Saha, the RRF Kathryn & Latimer Murfee Chair, is a biomedical engineer at the WID and a member of the NIH's Somatic Cell Genome Editing Consortium who has pioneered gene editing technologies. He was joined by 2 **David Gamm** (Sandra Lemke Trout Chair in Eye Research), 3 **Bikash Pattnaik** (RRF M.D. Matthews Research Professor), 4 **Sushmita Roy** (WID), and MIR biomedical engineer 5 **Melissa Skala** (RRF Daniel M. Albert Chair). Drs. Gamm and Pattnaik bring expertise in stem cells and retinal function assessment to the gene editing team. Dr. Roy is an expert in bioinformatics and computational analysis, and Dr. Skala develops non-invasive imaging methods to assess gene editing outcomes.

This NIH-supported project, now in its fourth year, uses human stem cell-derived retinal organoids created in the Gamm Lab to replicate the cellular dysfunctions of inherited pediatric eye diseases in a dish. There are many genetic conditions that cause childhood blindness, so creating organoids from patients allows the team to test gene editing strategies in the lab safely and efficiently.

The Skala Lab contributed a key technique to the project called autofluorescence lifetime imaging, which can track the natural fluorescence produced during photoreceptor activity. This experimental approach, spearheaded by Skala lab assistant scientist 6 **Kayvan Samimi**, was capable of detecting subtle biochemical changes within organoid photoreceptors. Using this technique, the team can now determine whether CRISPR-mediated gene editing is hitting its intended disease target in the human genome.

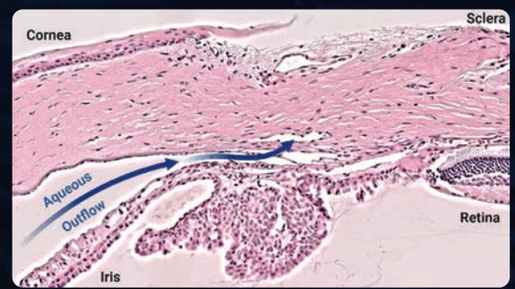
Adapted from an article by Brian Mattmiller, Morgridge Institute

Childhood-onset glaucoma

Mapping the microscopic pathways of the eye's fluid drainage system

It is possible to treat or cure a disease without understanding its origin or exact pathways, but there's no doubt that knowledge of these can point to new and effective treatments. We know that primary congenital glaucoma (PCG), a devastating ocular disorder affecting infants, is triggered by elevated pressure within the eye which leads to painful enlargement of the globe and severe damage to tissues, including the light-processing retina. The disease is caused by a failure to correctly develop the eye's main fluid drainage tissues—the aqueous humor outflow pathway. Only surgical treatment is currently possible and that is challenging and often fails, resulting in blindness and removal of the eye in a significant proportion of children.

The molecular causes of PCG are largely unknown, but we do know that one-quarter of cases can be attributed to mutations in four genes important for outflow pathway development. McPherson ERI researcher **Stuart Tompson, PhD,** was a key player in identifying two of these genes, TEK and ANGPT1. To progress further, more understanding is needed as to which exact molecular pathways are important for the formation of these crucial ocular structures. The Tompson lab is moving forward on this, utilizing state-of-the-art gene sequencing technologies to comprehensively identify all cell types and molecular pathways involved in the normal development of these tissues. Once this "atlas" is complete, it will greatly help researchers discover the elusive PCG mechanisms, enable gene-based diagnostic testing, and aid the development of more effective treatments directed at the fundamental disease biology.



The aqueous outflow pathway; image courtesy of Stuart Tompson.

A retinal ganglion cell in a mouse retina, with mitochondria showing as scattered blue-white spots. Image courtesy of the Nickells Lab.

Primary open-angle glaucoma

Delivering an energy boost to underpowered retinal ganglion cells

Mitochondria are often considered the powerhouses of the cell because they produce the energy molecules that are utilized for nearly all cellular reactions. There is an intimate relationship between mitochondria and neuronal health; studies have repeatedly shown that decreased mitochondrial function is tied to progressive neurodegeneration. For reasons we don't really understand, poor mitochondrial function impacts retinal ganglion cells (the cells that comprise the bulk of the optic nerve) more than any other neuronal cell type in the human body. For example, genetic mutations that directly impair mitochondrial function, which should affect every cell in the body, can lead to optic nerve disease and blindness as the only damaging consequence.

The performance of mitochondria also decreases naturally with age—an effect which is thought to be a major contributing factor in making retinal ganglion cells more susceptible to stresses associated with glaucoma. The glaucoma research team in the lab of **Rob Nickells** is investigating the mitochondria within retinal ganglion cells, with the goal of trying to understand how they change during times of stress. To do this, they utilize a special mouse model that expresses a fluorescent protein within the mitochondria of ganglion cells. With the aid of high resolution fluorescent microscopy, they are able to find where the mitochondria are in individual cells, and measure their size and shape in response to optic nerve damage. These measurements indicate how well the cell is able to produce energy when it is needed the most.

Additionally, the Nickells Lab is developing methods to transplant healthy young mitochondria into old retinal ganglion cells to boost their energy producing capacity. The goal is to make older ganglion cells more robust to meet the stresses they encounter as they age, especially in circumstances that would normally lead to glaucoma. The concept of 'mitochondrial transfer' is truly novel, and is being tested in other areas of the body as well; if successful, it could have tremendous applications in both curative and preventive medicine.

L, Barbara Blodi, MD; R, Amitha Domalpally, MD, PhD

Diabetic Retinopathy

UW-Madison Leads the Way in Clinical Trials

UW-Madison's outstanding clinical trial reputation stems from its location as the home of the Wisconsin Reading Center (formerly the Fundus Photograph Reading Center), founded in 1970 as the core image reading laboratory within UW's Department of Ophthalmology and Visual Sciences. Both the Medical Director of the Wisconsin Reading Center, Barbara Blodi, MD, and the Center's Research Director, Amitha Domalpally, MD, PhD, astutely oversee a range of collaborative trials designed to bring effective therapies to clinical use.

One productive long-term relationship cultivated by the Wisconsin Reading Center is with the Diabetic Retinopathy Clinical Research (DRCR) Retina Network, a network of clinical centers formed 20 years ago to increase and improve the quality of multicenter clinical research initiatives focused on retinal disorders. By collaborating with the DRCR Retina Network, UW-Madison researchers provide image analysis in clinical trials that are investigator initiated.

A trial currently at the halfway point (two years into the 4-year trial) is DRCR Protocol W, a trial with potentially major ramifications for treatment of diabetic retinopathy. Data from the Protocol W clinical trial so far suggests that early treatment of pre-existing diabetic eye disease with injections of the anti-VEGF (anti-blood-vessel-growth) drug aflibercept—marketed as EYLEA—slows the progression of early, non-proliferative diabetic retinopathy (NPDR) to the later, more symptomatic, stages. In the study, patients with NPDR received either an aflibercept injection or a sham injection (the patient is prepped for an injection but does not receive one). Over the first two years of the study, the probability that patients who received aflibercept moved to a later stage of DR was only 16.3%, while the probability that patients who received the sham injection would progress was 43.5%.

That seems like a home run, but it's important to note that the changes noticed were anatomical, with signs of increased changes to blood vessels—and not symptomatic. There was, as yet, no greater loss in visual acuity for patients who received the placebo. That is why clinical trials need to follow long-term effects. For this particular trial, the full 4-year results will be enlightening, and may well determine whether earlier injections of aflibercept will be recommended to prevent further progression of diabetic retinopathy. In this, as in many other trials, having the expertise of the Wisconsin Reading Center close at hand is critical to success.

Clinical trial description adapted from an article by Joslin Diabetes, www.joslin.org, 5/18/21.

C. Shawn Green, PhD

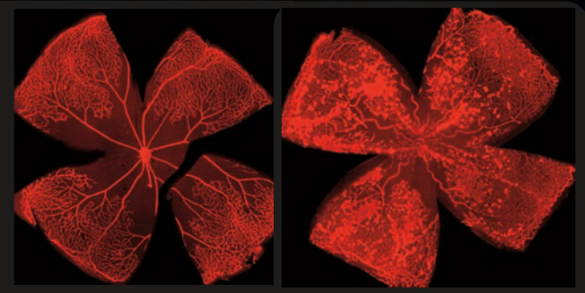
Professor » Psychology

Shawn Green's research focuses on developing and evaluating behavioral training methods to enhance human vision. Behavioral training of this type can help in overcoming all kinds of vision-related obstacles. Among other things, the Green lab works to understand an obstacle known as "the curse of specificity."

If you have an individual repeatedly practice a given visual task (for example, to indicate whether a line is oriented clockwise or counter-clockwise from vertical), they will improve at the task. However, the benefits of that practice rarely transfer to new tasks—such as, for instance, asking the individual to indicate whether a line is oriented clockwise or counterclockwise from horizontal, after training on the vertical task. This presents a significant problem if the goal is to use behavioral training to improve vision in the real world. It does an individual no good if they've improved their ability to detect visual cues via a computer training exercise if they can't then use that training in real life to, for example, detect a deer on the side of the road.

The Green lab uses a host of different approaches to attack this problem, including deploying various highly visually demanding commercial video games ("action video games") as training platforms. They have shown that dedicated training on such games improves everything from very basic visual skills to much higher cognitive abilities, such as memory and attention. Dr. Green's hope is that by better understanding which components of commercial video games allow them to produce such benefits, his lab can improve vision training outcomes for those with various low-vision conditions.

A custom child-friendly video game designed to examine the characteristics of fast-paced videos that are most important in improving visual and cognitive function. Image courtesy of the Green Lab.



Left, mouse retina with vascular obliteration; Right, mouse retina with vascular loss in the center and neovascular tufts (bright spots). Images courtesy of Ismail Zaitoun.

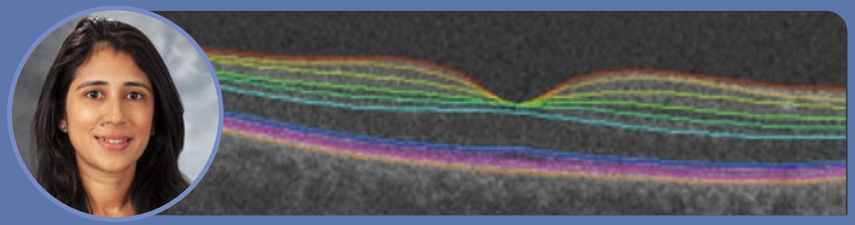
Ismail Zaitoun, PhD

Associate Scientist » Ophthalmology and Visual Sciences

Extremely premature children face many health issues, including a strong risk of vision loss. Retinopathy of prematurity (ROP) is a leading cause of visual impairment and loss in these children, affecting more than half of the 0.72% of babies born in the United States weighing 2.75 lbs or less. ROP is driven by the sensitivity of developing retinal vasculature to changes in oxygen levels in premature newborns, the reason for which remains unknown.

Ismail Zaitoun, an Associate Scientist and a principal investigator in the Department of Ophthalmology and Visual Sciences, who collaborates with Drs. Christine Sorenson's and Nader Sheibani's groups, has focused on retinopathy of prematurity at the cellular and molecular levels, hoping to treat the root causes of this devastating disease. Dr. Zaitoun has zeroed in on a family of proteins called Bcl-2 (studied extensively by Dr. Sorenson), one of whose members—called Bim—appears to have an important role to play when the developing retinal vasculature receives too much oxygen (hyperoxia), which destroys blood vessels, or too little oxygen (ischemia), which causes blood vessels to grow too profusely. In Dr. Zaitoun's experiments in a mouse model with oxygen-induced retinopathy (OIR), deleting Bim globally protected the growing blood vessels from either negative effect. Interestingly, deleting Bim in a targeted way, aiming at individual vascular cell types without global deletion, did not show the same protective effects.

With his recently funded R01 grant, Dr. Zaitoun is performing experiments to determine the exact roles played by Bim expression and by another protein, vascular endothelial growth factor (VEGF), in the inner retinal neurons and their impact on hyperoxia-induced vascular damage during oxygen-induced ischemic retinopathy. Figuring out the precise mechanisms of action undertaken by these proteins should allow for targeted therapies to prevent retinopathy of prematurity and its accompanying vision loss.



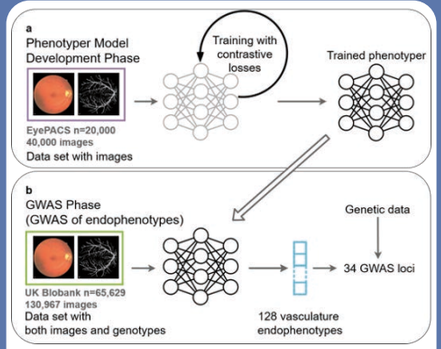
Roomasa Channa, MD

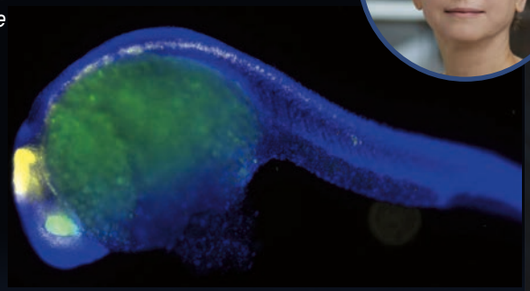
Assistant Professor » Ophthalmology and Visual Sciences

Roomasa Channa is a clinician-scientist whose research focuses on diabetes-related retinal diseases, the leading cause of vision loss among working-age adults. Artificial intelligence (AI)-based tools and techniques figure heavily in her work.

One key area of her research is the use of point-of-care artificial intelligence (AI) techniques to decrease disparities in access to disease screening and follow-up eye exams. We know that point-of-care screening can significantly improve the number of people who get diagnosed in a timely fashion. A recent study from Dr. Channa and her collaborators showed that implementation of AI-based detection of diabetic retinopathy improved compliance with screening exams from 46% to over 90%. The study used retinal cameras located at primary care sites that were connected to an AI software platform that provided immediate (within 1-2 minutes) identification of diabetic eye disease. The next steps will focus on improving the cost-effectiveness of AI screening as well as decreasing disparities in eye care access.

It is also possible to identify novel causes of vision loss in diabetes by leveraging various technological advances. Evaluation of diabetes-related eye diseases has historically been based on manual grading of fundus photos. In the past decade, there have been advances in retinal imaging, improved AI image analysis techniques, and improved handling of big data, which allow us to study diseases in much more detail than was previously possible. Dr. Channa's team is studying how to incorporate data from optical coherence tomography (OCT) images to evaluate retinal damage from diabetes. They are also using AI techniques to extract subtle disease features, called "endophenotypes," from retinal images. These features, invisible to the naked eye, can be correlated with genetic data to identify novel disease mechanisms that can point the way to more effective treatments.





One-day-old zebrafish embryo showing expression of foxe3 (green) and mab21l2 (yellow) genes in the developing eye and brain; disruption of these genes results in abnormal eye development. Image courtesy of the Semina Lab.

Elena Semina, PhD

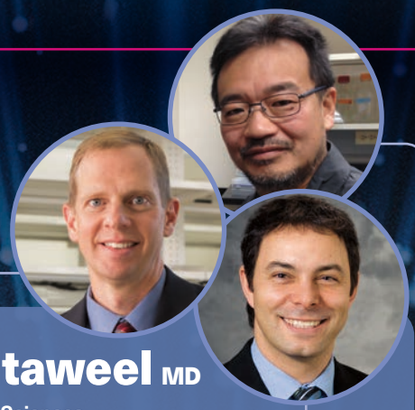
Professor and Chair » Division of Developmental Biology » Department of Pediatrics
Medical College of Wisconsin

The identification of the specific gene mutations that cause eye disease can provide a long-awaited diagnosis and also allows for screening and early detection of associated health problems. **Elena Semina's** research program studies genetic causes of human pediatric eye conditions, with an emphasis on prenatal disorders that disrupt eye development.

Dr. Semina's lab uses cutting edge DNA testing to analyze samples from individuals with a broad range of eye problems. They then study newly discovered gene mutations in zebrafish, a commonly-used animal model for such studies, to better understand what went wrong. The Semina lab has uncovered multiple new genes involved in eye disorders, including those that result in small eyes (microphthalmia) or malformed eyes (coloboma, aniridia, and Peters anomaly). Since many of the genes involved in forming the eye also play a role in the development of other parts of the body, affected children may have additional non-ocular health concerns that need to be addressed.

The ability to anticipate symptoms before they start (based on the genetic diagnosis) allows for timely interventions that can lessen the severity of disease and improve quality of life. Through participation in their studies, genetic testing is provided to eligible families free of charge, many of whom would not otherwise thave received a diagnosis. In many cases, the genetic results provide a clinical diagnosis to finally explain health issues experienced by the affected individual. In addition to these benefits, identification of new genes and mutations that cause human eye disorders can ultimately lead to better clinical management and perhaps even future treatment options.

MACULAR DEGENERATION: LEADING THE FIGHT



MONROE & SANDRA TROUT CHAIRS

The three Chairs endowed by McPherson ERI Advisory Board members and philanthropists Monroe and Sandra Trout are at the forefront of bringing new therapies for age-related macular degeneration to the clinic.

David Gamm MD, PhD

Ophthalmology and Visual Sciences » Sandra Lemke Trout Chair in Eye Research

"In the past year, my support from the **Sandra Lemke Trout Chair in Eye Research** has enabled my lab to advance efforts to produce and test a next-generation micro-scaffold for the dual delivery of retinal pigmented epithelial (RPE) cells and photoreceptors as a potential treatment for advanced age-related macular degeneration (AMD) and other macular disorders. AMD results in the loss of both of these critical cell types, and thus it is of paramount importance to devise new ways to replace them. This work also involves close collaborations with fellow McPherson ERI labs headed by Drs. Sarah Gong and Jack Ma as well as the lab of Dr. Kapil Bharti at the National Eye Institute."

Michael Altaweel MD

Ophthalmology and Visual Sciences » Monroe E. Trout Chair in Vision Research

"One of the great benefits of the **Monroe E. Trout Chair in Vision Research** is the team-based approach this supports, fostering collaboration in the effort to bring stem cell therapy to clinical trials. Our team has been dedicated to the surgical delivery of stem cell-derived photoreceptors to the sub-retinal space. This has progressed in concert with refinement of the process to produce these retinal organoids, led by Dr. David Gamm. The studies that are required prior to human clinical trials are planned for this winter."

Akihiro Ikeda DVM, PhD

Medical Genetics » Timothy William Trout Chair in Eye Research

"Support from the **Timothy William Trout Chair in Eye Research** has allowed my lab to identify that TMEM135, a protein involved in retinal aging, is a regulator of docosahexaenoic acid (DHA), which is an important fatty acid for retinal health. We were also able to discover that over-expression of the Tmem135 gene results in the abnormal appearance and degeneration of retinal pigment epithelium (RPE) cells, the severity of which is determined by genetic makeup. And, importantly, we have found the genetic location of the modifiers that determine the severity of these RPE abnormalities, which should lead to the development of new therapeutic targets for RPE atrophy in human AMD patients."

PAT AND JAY SMITH: FILLING THE GAPS

Jay Smith, Chairman of Teel Plastics, has been an insightful and valuable member of the McPherson ERI's Advisory Board since 2017. By the time Pat Smith developed age-related macular degeneration, Jay had already heard much about potential therapies in development at UW-Madison. With characteristic energy, the Smiths decided to help move AMD research forward at a quicker pace. With a gift of $1 million early in 2022, they established the **Pat and Jay Smith Macular Degeneration Treatment Innovation Program.**

The new program is addressing critical gaps in our understanding of AMD, and applying that knowledge to create more effective therapies. Three initial projects are underway: (1) AMD drug development in Nader Sheibani's lab, (2) stem cell-based AMD model systems and cell-based AMD therapeutics in David Gamm's lab, and (3) advanced imaging of the human retina in health and disease by Jeremy Rogers' lab. All have great potential for successful near-term advances in AMD treatment, and we are grateful for the Smiths' support and focus on high-priority needs.

YOU CAN SUPPORT AMD RESEARCH by giving to the McPherson ERI's Macular Degeneration Fund, **Fund #132580419.** This endowed fund was established by the Trouts and Dr. Alice McPherson in February 2022 to support AMD research until a cure is found.

RETINA RESEARCH FOUNDATION CHAIRS AND PROFESSORSHIPS

Melissa Skala PhD

Biomedical Engineering and Morgridge Institute for Research • RRF Daniel M. Albert Chair

"Improved methods for retinal imaging could provide early markers of disease to enable treatment before vision loss, and allow better tracking of treatment response to optimize therapies for each patient. We have used the Albert chair to develop methods to image molecules in the retina related to disease onset (such as melanin and retinoids), and to image individual cells in patients through adaptive optics. Ongoing work will translate these methods into human eye imaging, and streamline instrumentation so these technologies can be used across numerous medical centers."

Bikash Pattnaik PhD

Pediatrics • RRF M. D. Matthews Research Professor

"Our lab has found that ion channel defects cause rare pediatric blindness due to defective ion channel genes, which affect photoreceptor (PR) and RPE cell function. We have generated induced pluripotent stem cell (iPSC) RPE and PR harboring molecular defects to serve as suitable models for further research. We have also used our disease models to demonstrate the effectiveness of genome editing as a possible therapy, and to note its current limitations, which will need further research."

David Gamm MD, PhD

Ophthalmology and Visual Sciences • RRF Emmett A. Humble Distinguished Directorship

"Support from **the RRF Emmett A. Humble Distinguished Directorship** was utilized in 2022 to further my lab's efforts to refine methods to generate human red and green cone photoreceptors for use in cell therapies aimed at individuals with late-stage inherited retinal degenerations (such as retinitis pigmentosa, Stargardt disease, and Best disease) as well as AMD. In all of these conditions, it is the cone photoreceptors that are most important as they convey high resolution and color/daytime vision. By focusing on production of these two types of cones, we seek to make future generations of photoreceptor therapies more effective."

Kevin Eliceiri PhD

Associate Director » McPherson Eye Research Institute • Director/LOCI » Morgridge Institute for Research • RRF Walter H. Helmerich Research Chair

"My research interests are in the areas of developing optical and computational approaches to non-invasively study dynamic cellular processes like those in the eye. **The RRF Walter H. Helmerich Research Chair** supports the development of novel optical imaging methods and instrumentation for investigating the cellular microenvironment, and the development of open-source software for multi-dimensional imaging informatics."

Mrinalini Hoon PhD

Ophthalmology and Visual Sciences • RRF Rebecca Meyer Brown Professor

"Retinal neurons communicate and transfer visual information at specialized junctions called 'synapses'. Our recent research has revealed that early visual cues are instrumental in establishing the correct synaptic junctions between inner retinal neurons. The support of the **RRF Rebecca Meyer Brown Professorship** has enabled us to make progress on this exciting study which shows that a mammalian retina that develops without early visual signals forms erroneous connections leading to an impairment in the visual information that is processed by the retina. We are currently investigating the reversibility of these alterations."

Kris Saha PhD

Biomedical Engineering • RRF Kathryn & Latimer Murfee Chair

"The Saha lab engineers new gene therapies that can modify the DNA code of retinal cells. We are working with MERI-supported clinicians and biologists to test these strategies in clinical trials. Recent work has focused on developing novel nanoparticles that could be injected into the sub-retinal space to treat inherited retinal disorders."

Sarah Gong PhD

Ophthalmology and Visual Sciences and Wisconsin Institute for Discovery • RRF Edwin & Dorothy Gamewell Professor

"**The RRF Edwin and Dorothy Gamewell Professorship** will help my laboratory to develop innovative non-viral nanocarriers for safe and efficacious gene therapy and genome editing therapy."

WALSH FAMILY PROFESSORSHIP AND WALK FOR SIGHT

DAVID & NANCY WALSH FAMILY PROFESSORSHIP IN VISION RESEARCH

Raunak Sinha, PhD, Neuroscience

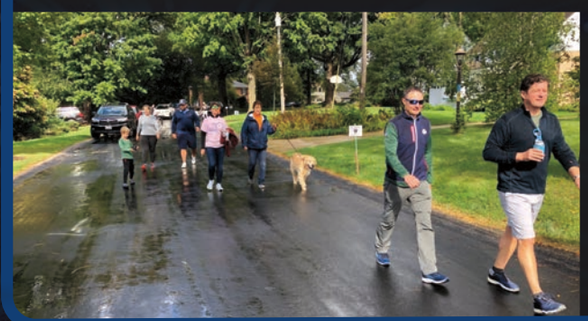
"The David and Nancy Walsh family professorship has enabled us to figure out more details about how the cone photoreceptors, which mediate daylight vision, vary in their functional properties across the visual field. In particular, we were able to determine that cones in the central part of the primate retina, the fovea, adapt to changing light levels quite differently than cones present in the peripheral part of the primate retina. The Walsh professorship has also allowed us to further understand how cone photoreceptors in the human stem cell-derived retina mature with time which provides interesting insights into human retinal development."

Walsh Family 2nd Annual Walk for Sight

September 25th, 2022

In 2021, the Walsh family began a new fundraiser for vision research—spearheaded by then eight-year-old Audrey Olsen, David and Nancy Walsh's granddaughter. Audrey was determined to do something to support her uncles, John and Michael Walsh, both of whom have Usher Syndrome Type 2C, a condition that leads to loss of vision and hearing. Audrey looped in her brother Charlie, her parents, Molly Walsh and Jeff Olsen, and her grandparents, and the result was their first annual Walk for Sight, which raised $22,000 for research at the McPherson ERI.

The Walsh family's 2022 Walk for Sight was equally successful, despite a brief rain squall. Neither rain nor snow dampens the energy of this family! We're very grateful for the time and initiative put in by Audrey and her entire family, and we highly recommend this type of event for anyone wishing to lead a vision fundraiser in their neighborhood.



MCPHERSON ERI RESEARCH GRANTS AND AWARDS 2022

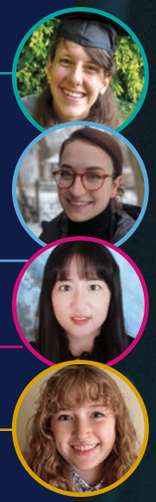
DAVID G. WALSH GRADUATE STUDENT SUPPORT INITIATIVE (GSSI) AWARD

This year's annual **David G. Walsh Graduate Student Support Initiative** award was given to two McPherson ERI members, 1 **C. Shawn Green, PhD,** and 2 **Emily Ward, PhD**—both in the Department of Psychology—to support the work of PhD candidate 3 **Mohan Ji**. Mohan's thesis focuses on understanding the visual cues that we use to determine animacy (the state of being alive) and intentionality, which is critically important for evolutionary fitness. The $12,000 GSSI grant is financed by the David G. Walsh Research Fellowship Endowment.

KENZI VALENTYN VISION RESEARCH GRANTS

Kenzi Valentyn Vision Research Awards are named in honor of Kenzi's courage and positive attitude throughout her long battle with Kearns–Sayre syndrome. As always, the McPherson ERI is grateful for the Valentyn family's dedication to vision research and outstanding participation in Cycle for Sight.

Fall/Winter 2021-22 award recipients:



Jennifer Heyward, DVM, a graduate student in Comparative Biomedical Services, Veterinary Medicine, mentored by Freya Mowat.

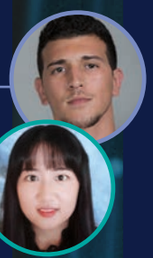
Jenna Nagy, a graduate student in Cellular & Molecular Pathology, Neuroscience, mentored by Raunak Sinha.

Ziyun Ye, a graduate student in Ophthalmology & Visual Sciences, mentored by Donna Neumann.

Clementine Zimnicki, a graduate student in Psychology, mentored by Karen Schloss.

WALSH RESEARCH TRAVEL AWARDS, FALL 2022

Walsh Research Travel Awards restarted in Fall 2022, after a hiatus during COVID. These awards, generously supported by the David G. Walsh Research Fellowship Endowment, allow trainee researchers to present their findings and connect with other researchers at conferences. Fall 2022 Walsh Research Travel Award recipients are **Jacob Khoussine** (Ophthalmology and Visual Sciences), mentored by Mrinalini Hoon, who presented his work on night blindness at Neuroscience 2022 in November; and **Ziyun Ye** (Ophthalmology and Visual Sciences), mentored by Donna Neumann, who will present her work on ocular HSV-1 infections at ARVO in April, 2023.



EXPANDING OUR VISION AWARD 2022

Yin Li, PhD, (Biostatistics and Medical Informatics) was awarded the **2022 Expanding Our Vision Award** ($10,000), for research in visual communication, cognition, perception, computer science, data visualization, or imaging advances. Dr. Li's project will develop and evaluate video-based, automated surgical skill assessment tools for cataract surgery using computer vision and machine learning.

STUDENT AND TRAINEE AWARDS 2022

The McPherson ERI distributed a variety of student and trainee awards in 2022, including:

The Dan & Ellie Albert Student Vision Research Award, supporting a summer vision research project for an SMPH student through the Shapiro Summer Internship Program, to **Tammy Zhong,** working with Yao Liu, MD, to advance teleophthalmology.

Lillian Li and her advisor, Ari Rosenberg, PhD (Neuroscience), were awarded a **Hilldale Undergraduate Award** for work which aims to elucidate the neuronal mechanisms that transform 2D retinal images into accurate and precise 3D representations.

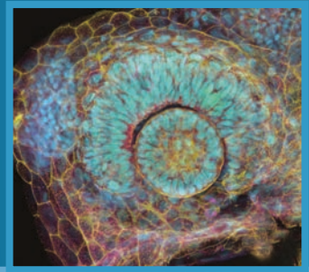
Once again, six McPherson ERI trainees received **StoryForm Science Course Awards,** underwriting their participation in the StoryForm Science workshop developed by Holly Kerby and Adam Steinberg.

UPCOMING GRANTS AND AWARDS

The McPherson ERI will add further research awards in the coming year, including a Distinguished Paper Award for McPherson ERI trainee members; a resumption of our Visiting Scholar Awards, on hiatus since 2020 due to COVID; and, excitingly, multiple $50,000 pilot grants for research on age-related macular degeneration and retinitis pigmentosa, thanks to the generosity of Roger and Lynn Van Vreede and the Robert A. Brandt Macular Degeneration Fund. Stay tuned for more information!

JANUARY

During the summer of 2022 in the Vision Gallery, the *Art from Science* exhibit featured artworks created in response to science images from McPherson ERI member research. Artists were offered a collection of over 60 images from which to select one on which to base an artwork. Madison artist Lauren Harlowe's striking contribution, an oil painting entitled Sight Lines (above), is based on an image of the eye of a zebrafish embryo (right) from the lab of Yevgenya Grinblat, PhD. **• IMAGES COURTESY OF LAUREN HARLOWE AND YEVGENYA GRINBLAT.**



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SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1 NEW YEAR'S DAY	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16 MARTIN LUTHER KING, JR. DAY	17	18	19	20	21
22 CHINESE NEW YEAR	23	24	25	26	27	28
29	30	31	1	2	3	4

FEB																														
	WED 1	THU 2	FRI 3	SAT 4	SUN 5	MON 6	TUE 7	WED 8	THU 9	FRI 10	SAT 11	SUN 12	MON 13	TUE 14	WED 15	THU 16	FRI 17	SAT 18	SUN 19	MON 20	TUE 21	WED 22	THU 23	FRI 24	SAT 25	SUN 26	MON 27	TUE 28			

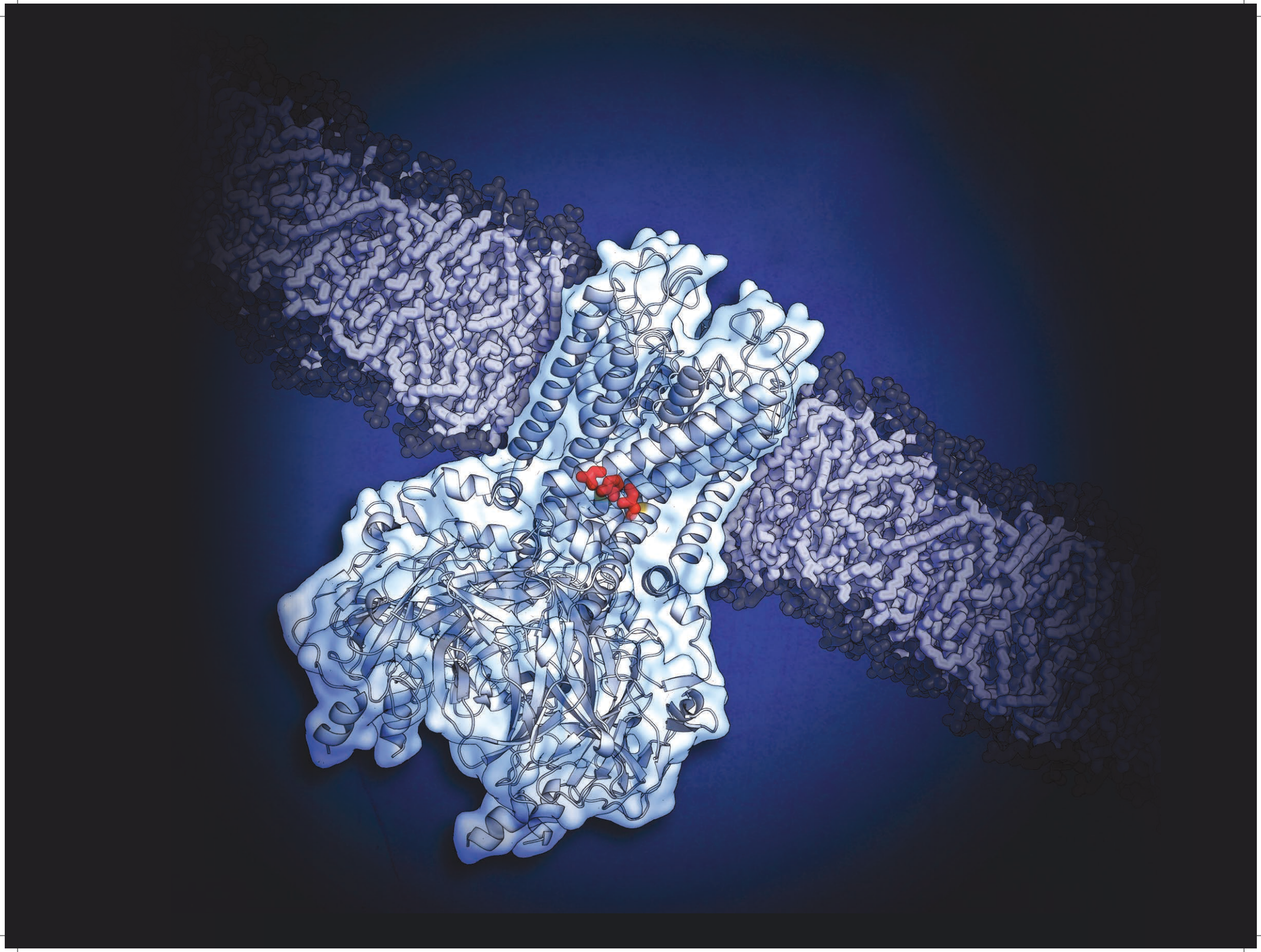
FEBRUARY

The image above shows a 3D reconstruction of a primate retinal neuron (dark green) receiving input from several photoreceptor terminals (light green). This is the first stage of information transfer in the retina between the dim-light photoreceptor and the downstream retinal neuron, and enables the retina to convey dim-light visual signals. The pictured reconstruction was generated from a serial electron microscopy image stack. • **IMAGE COURTESY OF AINDRILA SAHA, JUAN ZUNIGA AND KAINAT MIAN, SINHA LAB.**

JAN	SUN 1	MON 2	TUE 3	WED 4	THU 5	FRI 6	SAT 7	SUN 8	MON 9	TUE 10	WED 11	THU 12	FRI 13	SAT 14	SUN 15	MON 16	TUE 17	WED 18	THU 19	FRI 20	SAT 21	SUN 22	MON 23	TUE 24	WED 25	THU 26	FRI 27	SAT 28	SUN 29	MON 30	TUE 31

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
29	30	31	1	2 GROUNDHOG DAY	3	4
5	6	7	8	9	10	11
12	13	14 VALENTINE'S DAY	15	16	17	18
19	20 PRESIDENTS' DAY	21 MARDI GRAS	22 ASH WEDNESDAY	23	24	25
26	27	28	1	2	3	4

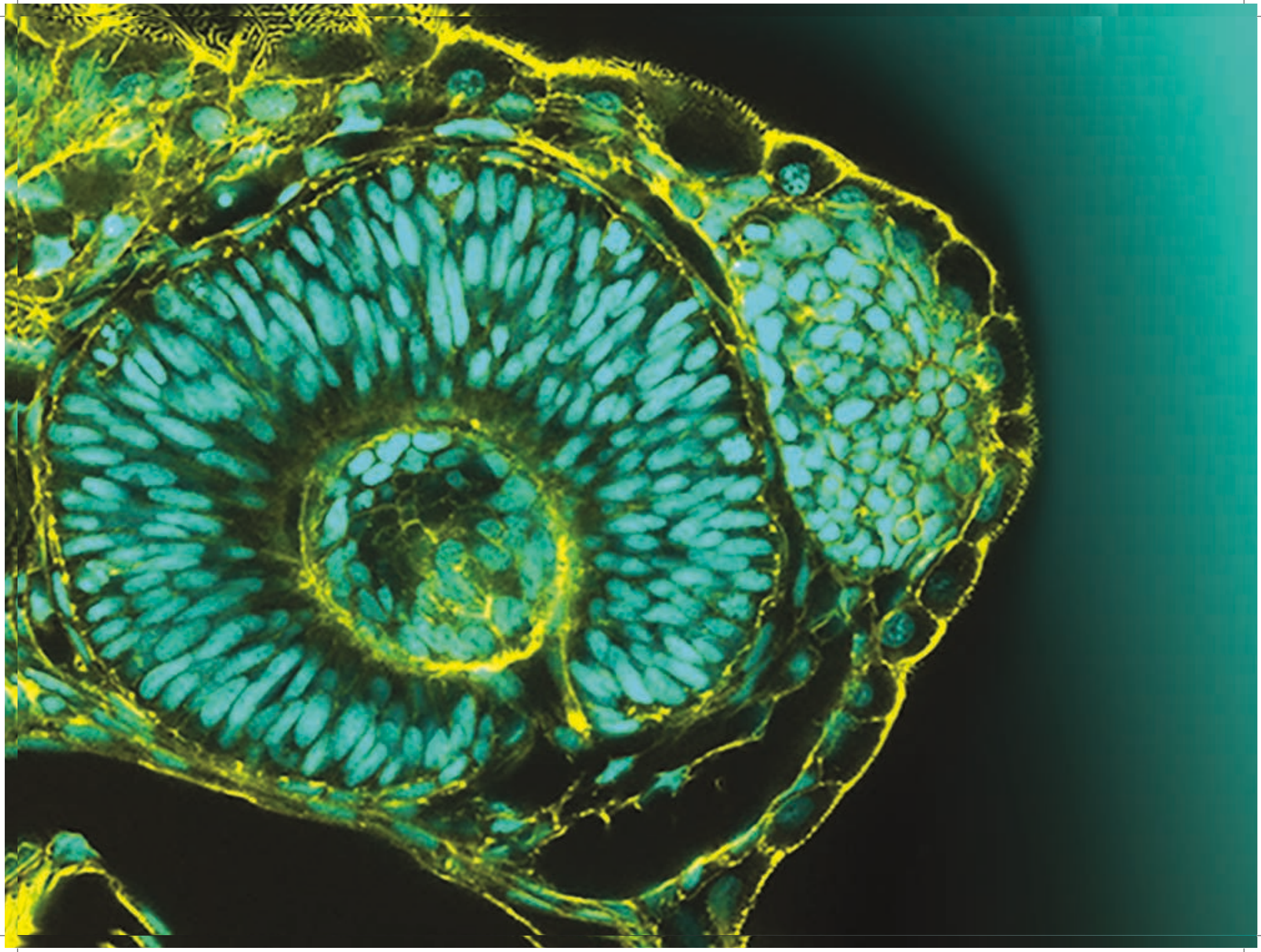
MAR	WED 1	THU 2	FRI 3	SAT 4	SUN 5	MON 6	TUE 7	WED 8	THU 9	FRI 10	SAT 11	SUN 12	MON 13	TUE 14	WED 15	THU 16	FRI 17	SAT 18	SUN 19	MON 20	TUE 21	WED 22	THU 23	FRI 24	SAT 25	SUN 26	MON 27	TUE 28	WED 29	THU 30	FRI 31



MARCH

A single amino acid change in a potassium channel (shown above) that is present in the retinal pigment epithelium causes a form of childhood blindness. Bikash Pattnaik's lab found that this mutation affects the structure of the protein in the inner surface of the cells that constricts the opening without affecting any other aspects of the protein structure. The narrowing of the space does not let potassium go through, but other small-sized ions can pass through without any hindrance. **• IMAGE COURTESY OF KATIE BEVERLY & BIKASH PATTNAIK, PATTNAIK LAB, AND H. ADAM STEINBERG OF ARTFORSCIENCE.COM.**

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
26	27	28	1	2	3	4
5	6	7 HOLI	8	9	10	11
12 DAYLIGHT SAVING TIME BEGINS	13	14	15	16	17 ST. PATRICK'S DAY	18
19	20 FIRST DAY OF SPRING	21	22	23 RAMADAN BEGINS	24	25 CYCLE FOR SIGHT 2023
26	27	28	29	30	31	1



APRIL

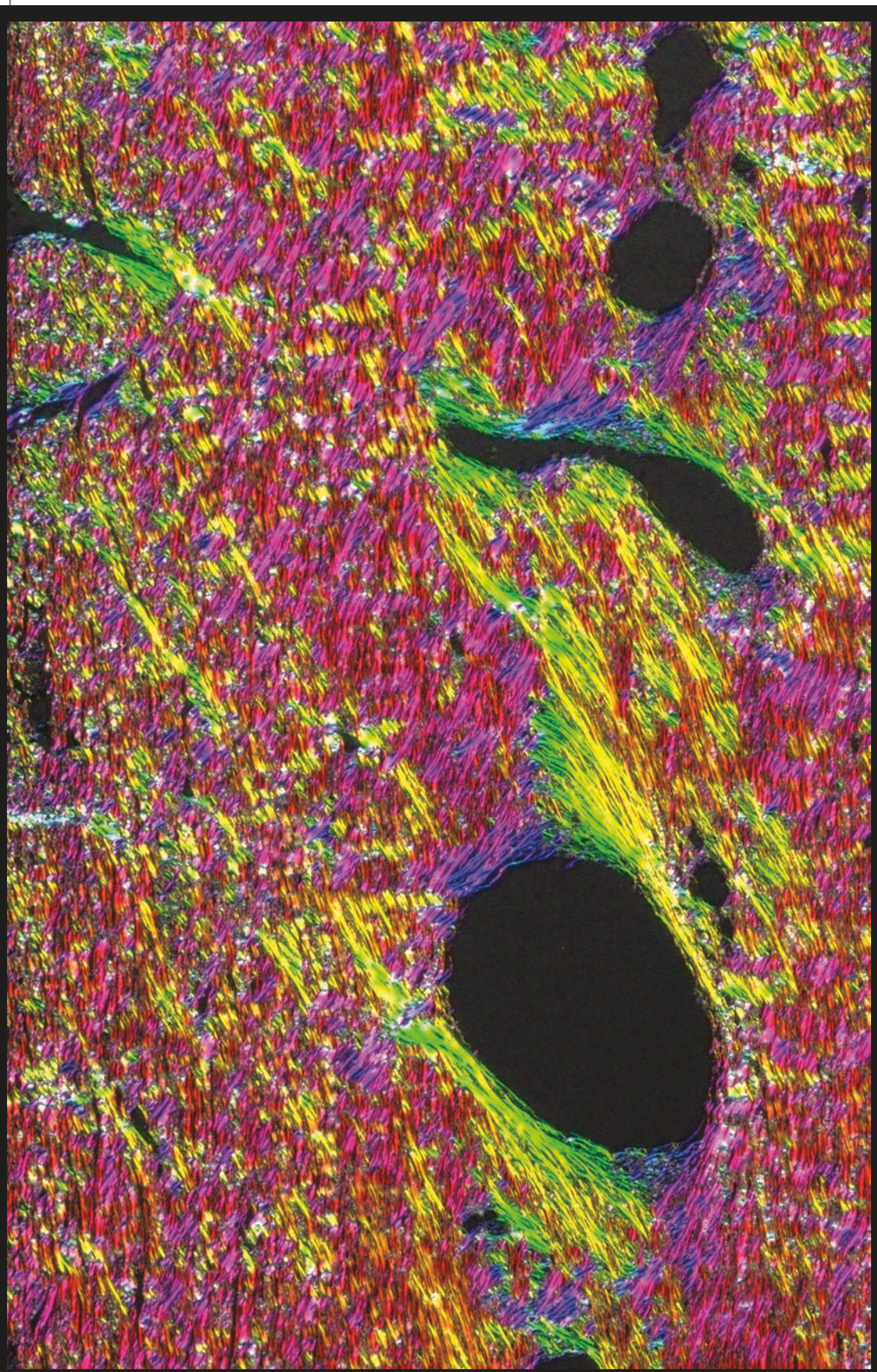
Every cell in a developing eye of a young zebrafish embryo can be seen using a specialized stain. Here, in an image from Yevgenya Grinblat's lab, cell outlines are stained in yellow and the cell nuclei are in cyan. Ease of imaging makes zebrafish an ideal model for studying the formation of eyes during embryogenesis. Because this process is largely the same in all vertebrate embryos, including humans, we can use zebrafish to understand congenital eye disorders and to find potential treatments.

• IMAGE COURTESY OF THE GRINBLAT LAB.

MAR																													
	WED 1	THU 2	FRI 3	SAT 4	SUN 5	MON 6	TUE 7	WED 8	THU 9	FRI 10	SAT 11	SUN 12	MON 13	TUE 14	WED 15	THU 16	FRI 17	SAT 18	SUN 19	MON 20	TUE 21	WED 22	THU 23	FRI 24	SAT 25	SUN 26	MON 27	TUE 28	WED 29	THU 30	FRI 31

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
26	27	28	29	30	31	1 APRIL FOOLS' DAY
2 PALM SUNDAY	3	4	5 PASSOVER BEGINS	6	7 GOOD FRIDAY	8
9 EASTER	10	11	12	13	14	15
16 ORTHODOX EASTER	17	18	19	20	21 EID AL-FITR BEGINS	22 EARTH DAY
23 / 30	24	25	26	27	28	29

MAY																													
	MON 1	TUE 2	WED 3	THU 4	FRI 5	SAT 6	SUN 7	MON 8	TUE 9	WED 10	THU 11	FRI 12	SAT 13	SUN 14	MON 15	TUE 16	WED 17	THU 18	FRI 19	SAT 20	SUN 21	MON 22	TUE 23	WED 24	THU 25	FRI 26	SAT 27	SUN 28	MON 29	TUE 30	WED 31



MAY

The protein composition and structure of the sclera (the tough outer coat of the eye) plays an important role in determining how the eye responds to internal pressure in glaucoma. In this side-by-side comparison, we can see that the collagen fibers in the sclera of a cat with inherited glaucoma (right) are organized very differently than those of a normal cat (left). Collagen fibers that go in the same direction are depicted here in the same color. • **IMAGE COURTESY OF ODALYS TORNÉ IN THE MCLELLAN LAB.**

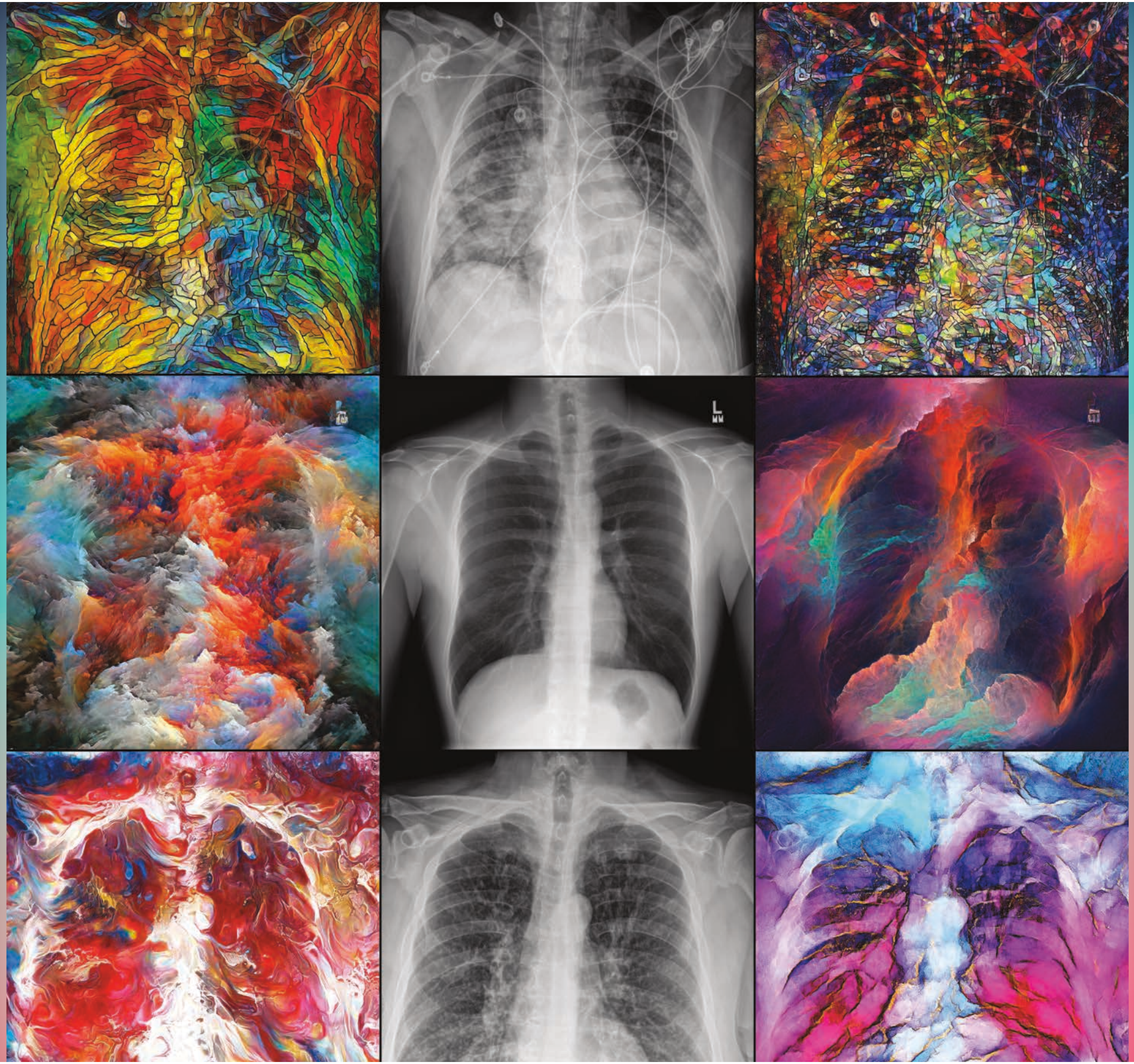
APR

SAT 1	SUN 2	MON 3	TUE 4	WED 5	THU 6	FRI 7	SAT 8	SUN 9	MON 10	TUE 11	WED 12	THU 13	FRI 14	SAT 15	SUN 16	MON 17	TUE 18	WED 19	THU 20	FRI 21	SAT 22	SUN 23	MON 24	TUE 25	WED 26	THU 27	FRI 28	SAT 29	SUN 30

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
30	1	2	3	4	5 CINCO DE MAYO	6
7	8	9	10	11	12	13
14 MOTHER'S DAY	15	16	17	18	19	20
21	22	23	24	25 SHAVUOT BEGINS	26	27
28	29 MEMORIAL DAY	30	31	1	2	3

JUN

THU 1	FRI 2	SAT 3	SUN 4	MON 5	TUE 6	WED 7	THU 8	FRI 9	SAT 10	SUN 11	MON 12	TUE 13	WED 14	THU 15	FRI 16	SAT 17	SUN 18	MON 19	TUE 20	WED 21	THU 22	FRI 23	SAT 24	SUN 25	MON 26	TUE 27	WED 28	THU 29	FRI 30



JUNE

These stylistically different takes on chest X-rays were created by Dalton Griner and Xin Tie using generative adversarial networks, computing networks designed to “learn” like the human brain learns. While these particular works of art are more beautiful than useful in radiology, GANs are used in medical imaging to enhance, classify and reconstruct information and understand the differences between X-rays of a COVID case (top row), pneumonia (bottom row) and healthy lungs (center row). The image received a Cool Science Image Award for 2022 and hung in the McPherson ERI’s Mandelbaum & Albert Family Vision Gallery. **• IMAGE COURTESY OF DALTON GRINER AND XIN TIE.**

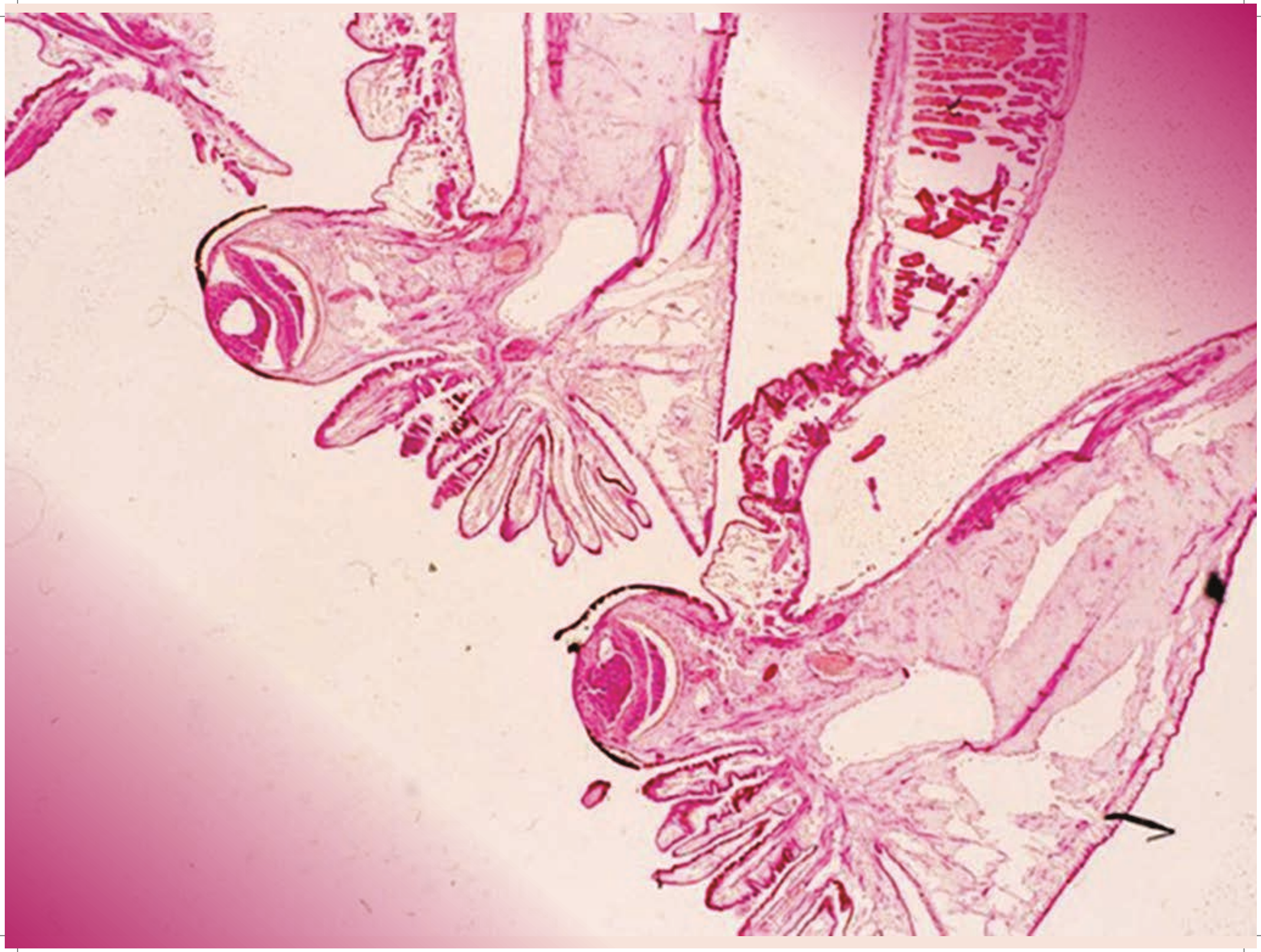
MAY

MON 1	TUE 2	WED 3	THU 4	FRI 5	SAT 6	SUN 7	MON 8	TUE 9	WED 10	THU 11	FRI 12	SAT 13	SUN 14	MON 15	TUE 16	WED 17	THU 18	FRI 19	SAT 20	SUN 21	MON 22	TUE 23	WED 24	THU 25	FRI 26	SAT 27	SUN 28	MON 29	TUE 30	WED 31

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18 FATHER’S DAY	19 JUNETEENTH	20	21 FIRST DAY OF SUMMER	22	23	24
25	26	27	28 EID AL-ADHA BEGINS	29	30	1

JUL

SAT 1	SUN 2	MON 3	TUE 4	WED 5	THU 6	FRI 7	SAT 8	SUN 9	MON 10	TUE 11	WED 12	THU 13	FRI 14	SAT 15	SUN 16	MON 17	TUE 18	WED 19	THU 20	FRI 21	SAT 22	SUN 23	MON 24	TUE 25	WED 26	THU 27	FRI 28	SAT 29	SUN 30	MON 31



JULY

Scallops are bivalve mollusks that lack a brain—but they have many dozens of eyes. The image above shows two scallop eyes prepared for microscopic viewing and stained with hematoxylin and eosin. The small eyes are at the end of small tentacles. Light reflects on the curved back of the eye like a reflecting telescope. • **IMAGE COURTESY OF COPLOW.**

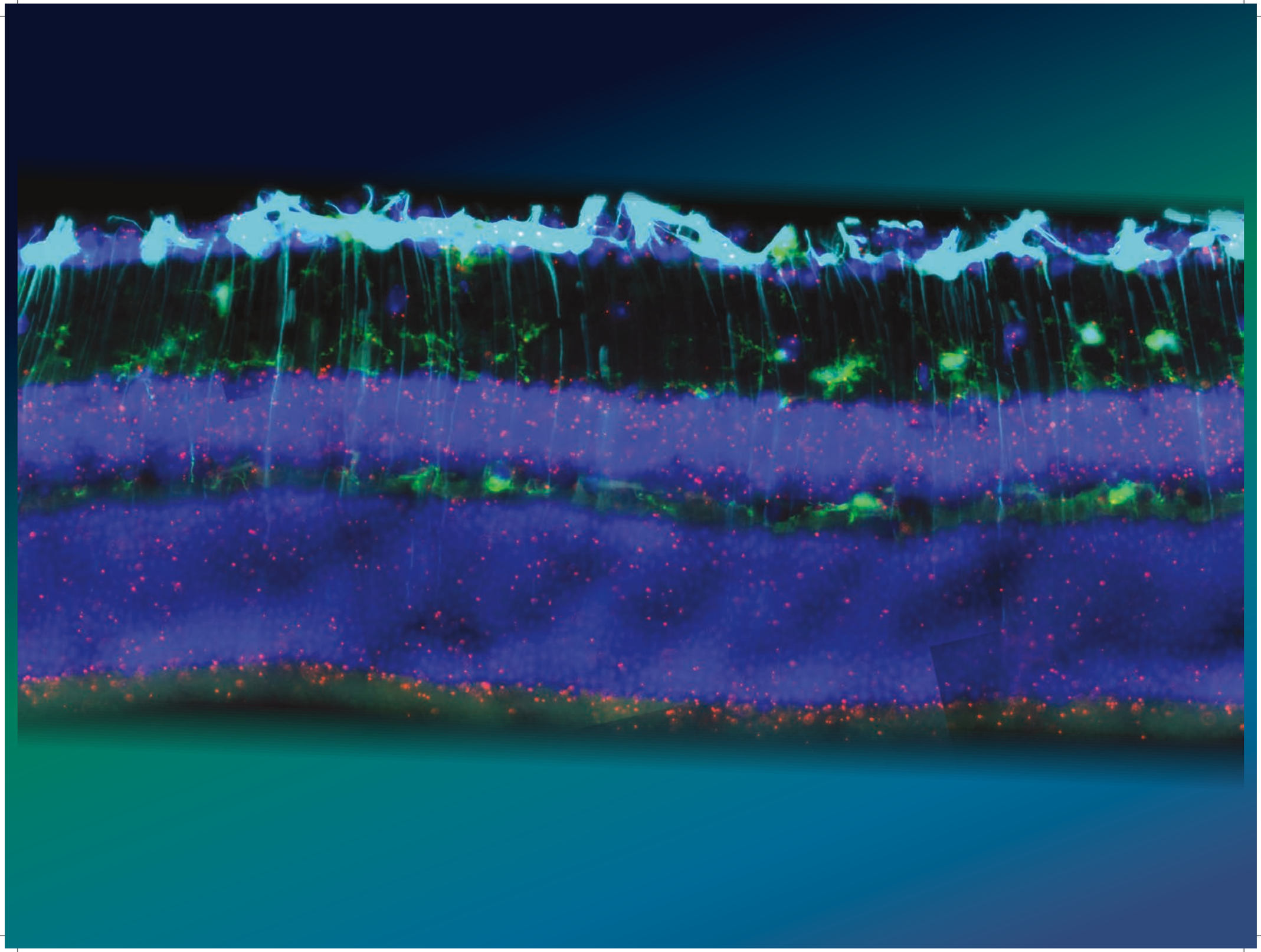
JUN

THU 1	FRI 2	SAT 3	SUN 4	MON 5	TUE 6	WED 7	THU 8	FRI 9	SAT 10	SUN 11	MON 12	TUE 13	WED 14	THU 15	FRI 16	SAT 17	SUN 18	MON 19	TUE 20	WED 21	THU 22	FRI 23	SAT 24	SUN 25	MON 26	TUE 27	WED 28	THU 29	FRI 30

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
25	26	27	28	29	30	1
2	3	4 INDEPENDENCE DAY	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23 30	24 31	25	26	27	28	29

AUG

TUE 1	WED 2	THU 3	FRI 4	SAT 5	SUN 6	MON 7	TUE 8	WED 9	THU 10	FRI 11	SAT 12	SUN 13	MON 14	TUE 15	WED 16	THU 17	FRI 18	SAT 19	SUN 20	MON 21	TUE 22	WED 23	THU 24	FRI 25	SAT 26	SUN 27	MON 28	TUE 29	WED 30	THU 31



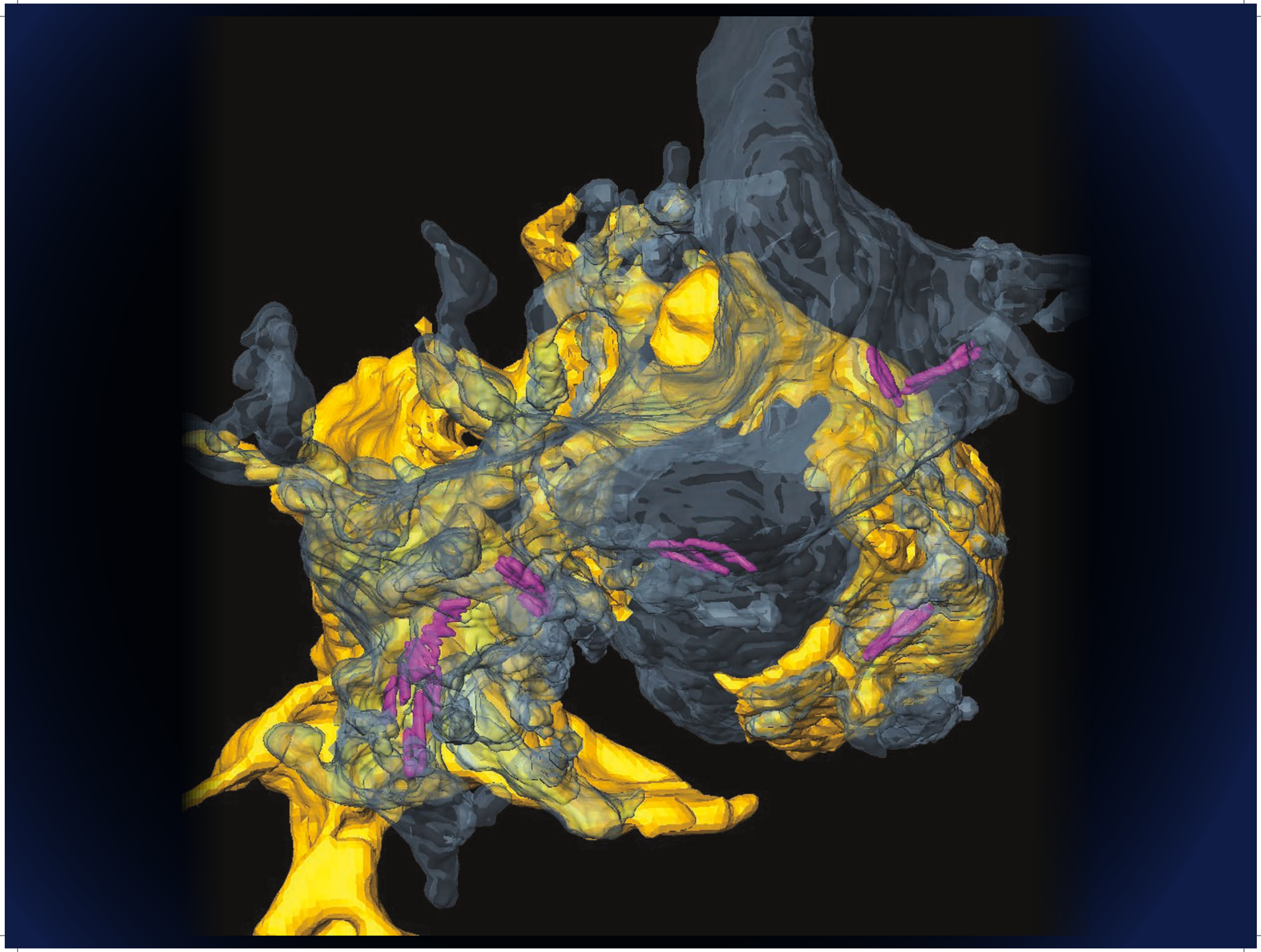
AUGUST

Shown above is a mouse retina, with different cell and protein types indicated in different colored stains. For instance, microglia, immune cells which are thought to play important roles in the inflammatory response of glaucoma and optic nerve damage, are in green. mRNA for Sigma type 1 receptors are in red. It has been suggested that targeting these receptors along with other receptors could increase neuron survival and function in neurodegenerative disease. **• IMAGE COURTESY OF TIMUR MAVLYUTOV, MCDOWELL LAB.**

JUL	SAT 1	SUN 2	MON 3	TUE 4	WED 5	THU 6	FRI 7	SAT 8	SUN 9	MON 10	TUE 11	WED 12	THU 13	FRI 14	SAT 15	SUN 16	MON 17	TUE 18	WED 19	THU 20	FRI 21	SAT 22	SUN 23	MON 24	TUE 25	WED 26	THU 27	FRI 28	SAT 29	SUN 30	MON 31

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
30	31	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2

SEP	FRI 1	SAT 2	SUN 3	MON 4	TUE 5	WED 6	THU 7	FRI 8	SAT 9	SUN 10	MON 11	TUE 12	WED 13	THU 14	FRI 15	SAT 16	SUN 17	MON 18	TUE 19	WED 20	THU 21	FRI 22	SAT 23	SUN 24	MON 25	TUE 26	WED 27	THU 28	FRI 29	SAT 30



SEPTEMBER

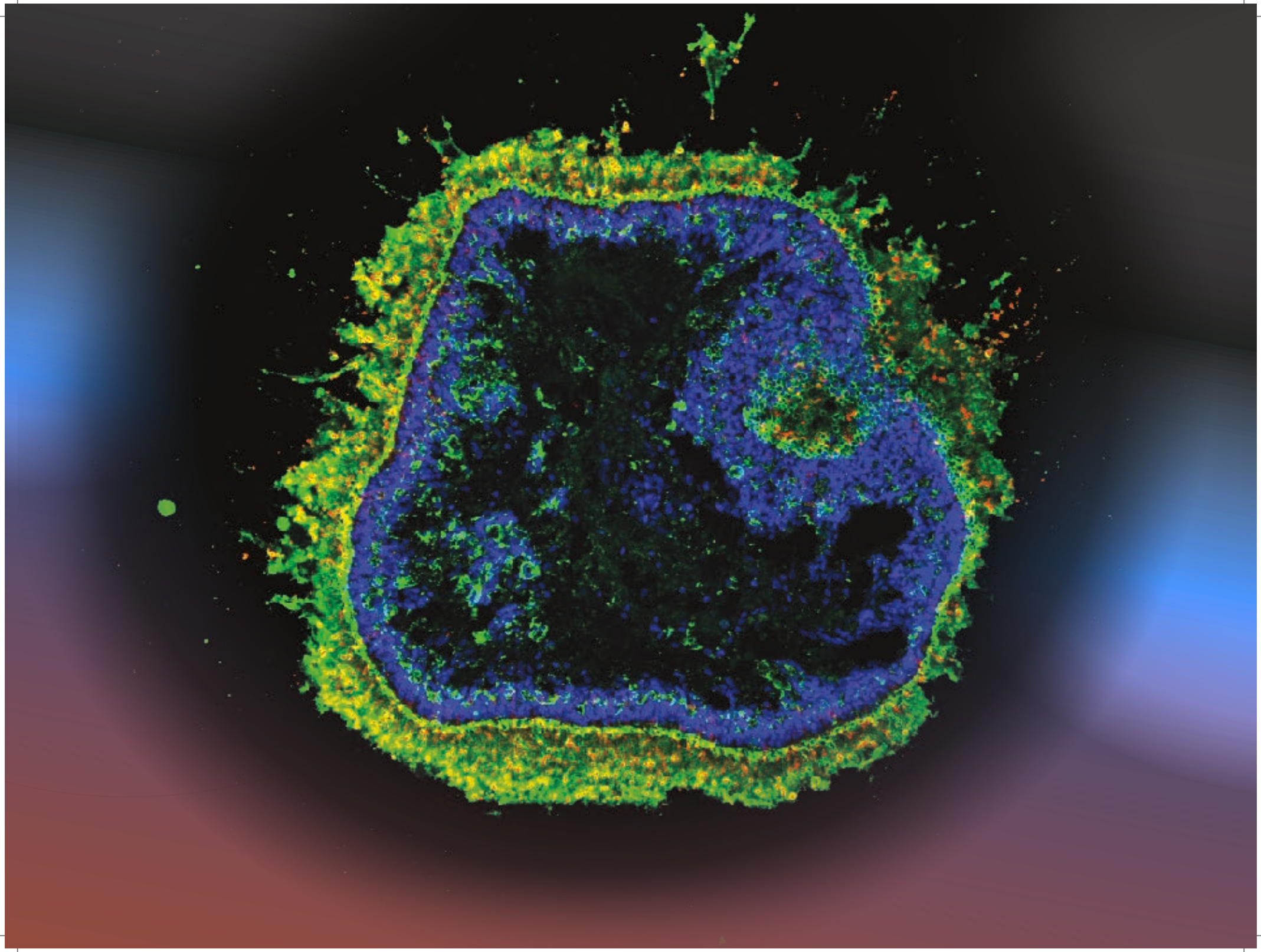
Glial cells serve as support cells for neurons. Above is a 3D reconstruction of a glial process (orange) wrapping around a retinal photoreceptor (grey) with specialized 'ribbon' contact zones (magenta). In a healthy retina, glial processes do not contact photoreceptors; however, the pictured image is from a retina where photoreceptor activity has been suppressed. Several hundred consecutive electron microscopic images were used to reconstruct the cells and connections in this image.

• IMAGE COURTESY OF SERENA WISNER, HOON LAB.

AUG																													
	TUE 1	WED 2	THU 3	FRI 4	SAT 5	SUN 6	MON 7	TUE 8	WED 9	THU 10	FRI 11	SAT 12	SUN 13	MON 14	TUE 15	WED 16	THU 17	FRI 18	SAT 19	SUN 20	MON 21	TUE 22	WED 23	THU 24	FRI 25	SAT 26	SUN 27	MON 28	TUE 29	WED 30	THU 31

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
27	28	29	30	31	1	2
3	4 LABOR DAY	5	6	7	8	9
10	11	12	13	14	15 ROSH HASHANAH BEGINS	16
17	18	19	20	21	22	23 FIRST DAY OF FALL
24 YOM KIPPUR BEGINS	25 YOM KIPPUR	26	27	28	29 SUKKOT BEGINS	30

OCT																													
	SUN 1	MON 2	TUE 3	WED 4	THU 5	FRI 6	SAT 7	SUN 8	MON 9	TUE 10	WED 11	THU 12	FRI 13	SAT 14	SUN 15	MON 16	TUE 17	WED 18	THU 19	FRI 20	SAT 21	SUN 22	MON 23	TUE 24	WED 25	THU 26	FRI 27	SAT 28	SUN 29	MON 30	TUE 31



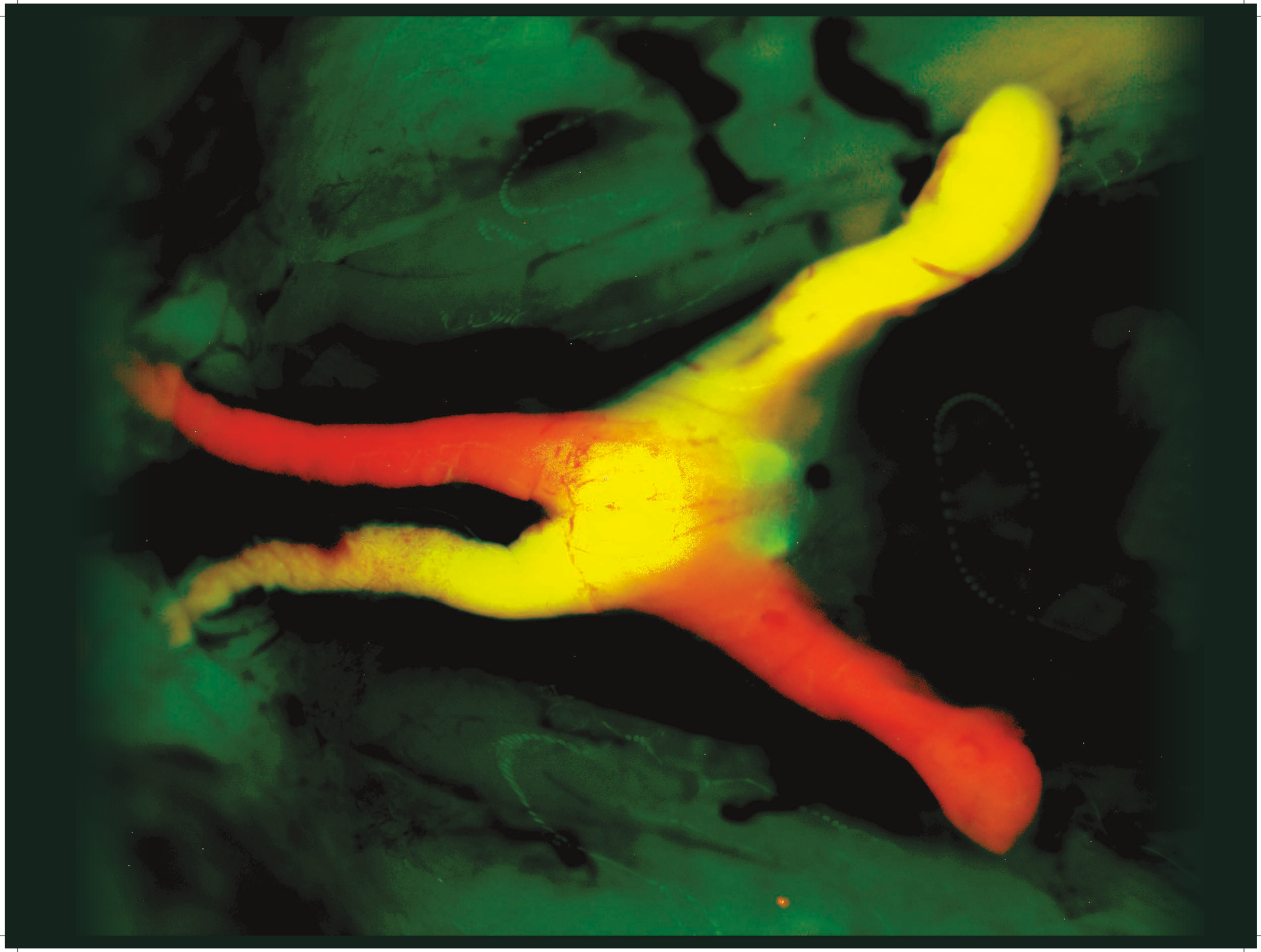
OCTOBER

The interphotoreceptor matrix (IPM) is a gel-like sticky substance that protects and gives structural support to the photoreceptor outer segments (POS) in the retina. This image shows the cross-section of a human pluripotent stem cell-derived retinal organoid displaying elongated POS in red, surrounded by IPM in green and cell nuclei in blue. These retinal organoids serve as powerful tools to model retinal diseases that affect the IPM. **• IMAGE COURTESY OF STEVEN MAYERL, GAMM LAB.**

SEP	FRI 1	SAT 2	SUN 3	MON 4	TUE 5	WED 6	THU 7	FRI 8	SAT 9	SUN 10	MON 11	TUE 12	WED 13	THU 14	FRI 15	SAT 16	SUN 17	MON 18	TUE 19	WED 20	THU 21	FRI 22	SAT 23	SUN 24	MON 25	TUE 26	WED 27	THU 28	FRI 29	SAT 30

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1	2	3	4	5	6	7
8	9 COLUMBUS DAY INDIGENOUS PEOPLE'S DAY	10	11	12 WORLD SIGHT DAY	13	14
15 WHITE CANE SAFETY DAY	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31 HALLOWEEN	1	2	3	4

NOV	WED 1	THU 2	FRI 3	SAT 4	SUN 5	MON 6	TUE 7	WED 8	THU 9	FRI 10	SAT 11	SUN 12	MON 13	TUE 14	WED 15	THU 16	FRI 17	SAT 18	SUN 19	MON 20	TUE 21	WED 22	THU 23	FRI 24	SAT 25	SUN 26	MON 27	TUE 28	WED 29	THU 30



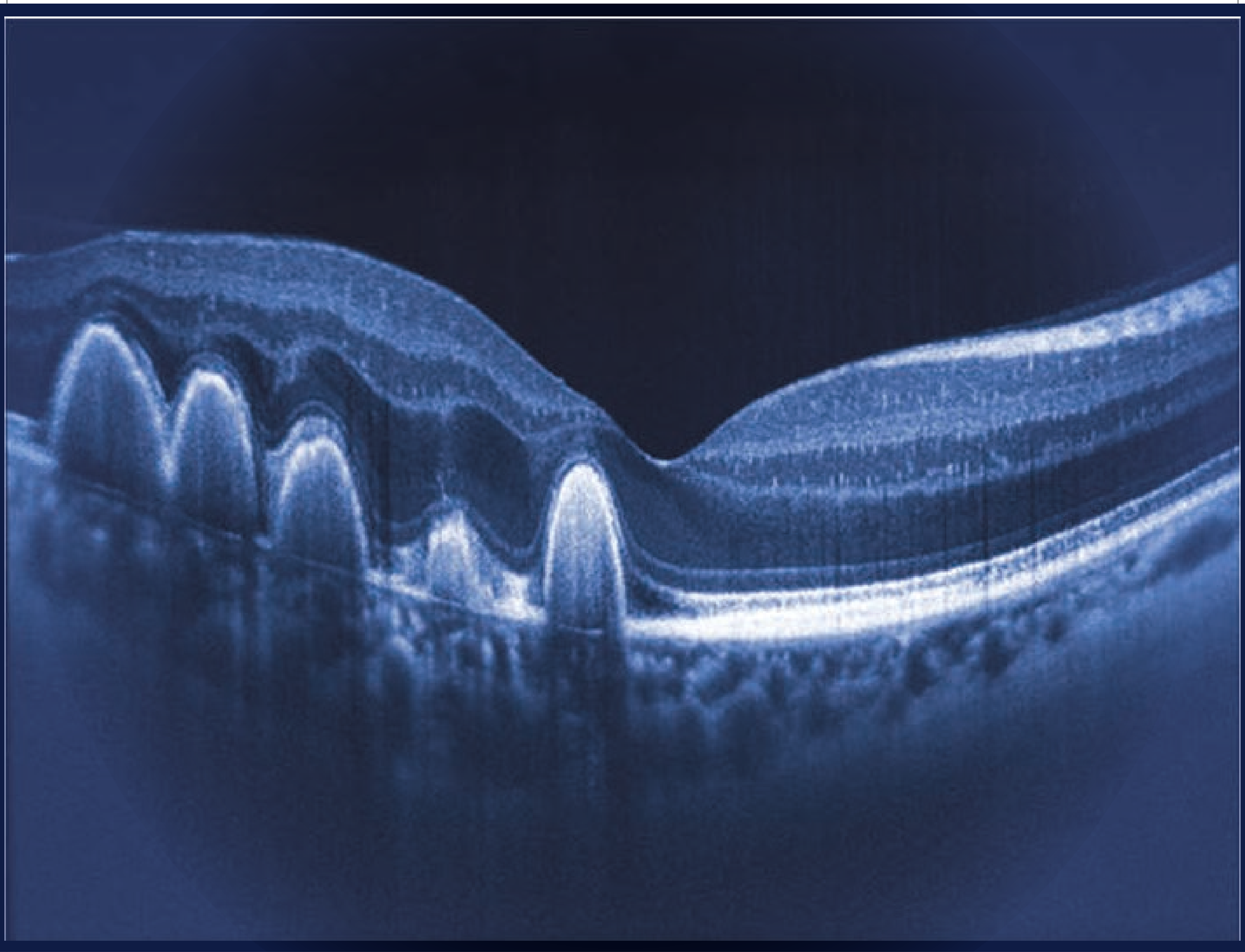
NOVEMBER

The optic nerves of a mouse are shown above, originating from the eye (to the left) and extending toward the brain (right). Each optic nerve has been labeled using a virus that fills the retinal ganglion cells with a red fluorescent protein. One of the optic nerves has been labeled chemically with a green dye, making that nerve appear yellow in this overlapping image. Optic nerves carry fibers called axons from each eye. Notice that nearly all the fibers originating from one eye project to the other side of the brain in a mouse, crossing from one side to the other at the optic chiasm. • **IMAGE COURTESY OF ROB NICKELLS.**

OCT	SUN 1	MON 2	TUE 3	WED 4	THU 5	FRI 6	SAT 7	SUN 8	MON 9	TUE 10	WED 11	THU 12	FRI 13	SAT 14	SUN 15	MON 16	TUE 17	WED 18	THU 19	FRI 20	SAT 21	SUN 22	MON 23	TUE 24	WED 25	THU 26	FRI 27	SAT 28	SUN 29	MON 30	TUE 31

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
29	30	31	1	2	3	4
5 DAYLIGHT SAVING TIME ENDS	6	7 ELECTION DAY	8	9	10 VETERANS DAY OBSERVED	11 VETERANS DAY
12 DIWALI	13	14	15	16	17	18
19	20	21	22	23 THANKSGIVING	24	25
26	27	28	29	30	1	2

DEC	FRI 1	SAT 2	SUN 3	MON 4	TUE 5	WED 6	THU 7	FRI 8	SAT 9	SUN 10	MON 11	TUE 12	WED 13	THU 14	FRI 15	SAT 16	SUN 17	MON 18	TUE 19	WED 20	THU 21	FRI 22	SAT 23	SUN 24	MON 25	TUE 26	WED 27	THU 28	FRI 29	SAT 30	SUN 31



DECEMBER

An optical coherence tomography (OCT) line scan through the fovea of a patient with non-exudative AMD is shown above. The foveal pit is at the center of the image, and multiple large drusen—the mountain-shaped projections—are seen adjacent to the fovea, resulting in alterations in the appearance of the overlying photoreceptor layers. • **IMAGE COURTESY OF JOSEPH CARROLL.**

NOV	WED 1	THU 2	FRI 3	SAT 4	SUN 5	MON 6	TUE 7	WED 8	THU 9	FRI 10	SAT 11	SUN 12	MON 13	TUE 14	WED 15	THU 16	FRI 17	SAT 18	SUN 19	MON 20	TUE 21	WED 22	THU 23	FRI 24	SAT 25	SUN 26	MON 27	TUE 28	WED 29	THU 30

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
26	27	28	29	30	1	2
3	4	5	6	7 HANUKKAH BEGINS	8	9
10	11	12	13	14	15	16
17	18	19	20	21 FIRST DAY OF WINTER	22	23
24 CHRISTMAS EVE	25 CHRISTMAS DAY	26 KWANZAA BEGINS	27	28	29	30
31 NEW YEAR'S EVE						

JAN	MON 1	TUE 2	WED 3	THU 4	FRI 5	SAT 6	SUN 7	MON 8	TUE 9	WED 10	THU 11	FRI 12	SAT 13	SUN 14	MON 15	TUE 16	WED 17	THU 18	FRI 19	SAT 20	SUN 21	MON 22	TUE 23	WED 24	THU 25	FRI 26	SAT 27	SUN 28	MON 29	TUE 30	WED 31

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2021-2022

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IN MEMORIAM

Carl Gulbrandsen, PhD, JD

After McPherson ERI Advisory Board member Carl Gulbrandsen passed away in October, 2022, Madison.com accurately described him as "a giant in Wisconsin research". As McPherson ERI Associate Director Kevin Eliceiri notes, "Carl was a tireless and passionate champion of innovation and idea discovery at the University of Wisconsin and beyond. He had major impact across campus and the state of Wisconsin on basic research, translational and commercialization activities."

Over Carl's 16 years as Managing Director of the Wisconsin Alumni Research Foundation (WARF), WARF was able to double its investment portfolio to $2.6 billion, and more than triple its annual research support to UW-Madison. The McPherson ERI was one of many research entities on the UW campus that benefited from his drive, foresight, skill, and dedication to service. Among other accomplishments, Carl was instrumental in the creation of the Morgridge Institute for Research and the Wisconsin Institute for Discovery. Carl, a Viroqua native, received both his PhD in physiology and his JD from UW-Madison. We were very pleased that his interests extended to vision research, and that he was an involved and thoughtful McPherson ERI Advisory Board member since 2018.

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Cycle for Sight Plus 2022

Cycle for Sight Plus 2022, held in late April, kept the "choose your own event" format, with teams cycling, walking, or running on their own. Once again, teams participated across the state and around the country, raising $56,300—slightly more than in 2021.

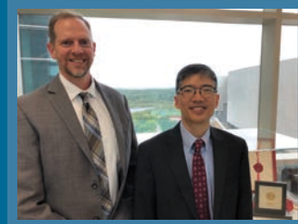
We're grateful for all of our teams, and to our terrific major sponsors, Opsis Therapeutics and the Chippewa Valley Eye Clinic. As you can see elsewhere, Cycle for Sight allows us to keep adding research grants and awards, and to increase funding for already-established awards, such as the Kenzi Valentyn Vision Research Awards. Thank you to all who participated and donated, and stay tuned for information on Cycle for Sight 2023!

March 25th, 2023

Please join us at Cycle for Sight 2023

The Mandelbaum & Albert Family Vision Gallery

Our art gallery on the 9th floor of WIMR II was back to a full schedule of new shows in 2022, kicking off the new year with *The Eye as Image*, featuring works in which the image of the eye played a prominent role. Summer 2022 brought *Art from Science*, with artwork created in response to science images from McPherson ERI member research. And *Cool Science Images 2022* filled up our gallery space in the fall, featuring the winners of UW-Madison's annual contest for the year's best science-related images.



Visiting Lecturers, 2022

The McPherson ERI was fortunate to host two highly distinguished visiting lecturers in 2022, and it is an understatement to say that researchers enjoyed the return to in-person lectures and conversations!

In September, National Eye Institute Director Michael Chiang, MD, visited UW-Madison and gave the 10th Annual McPherson Endowed Lecture, speaking on *Artificial Intelligence and Data Science for Health Care: Perspectives from the National Eye Institute.* He was able to connect with a wide range of McPherson ERI scientists during his visit.

In October, noted zoologist Dan-Erik Nilsson spoke on *The Evolution of Eyes and Vision* for the 14th Annual Vision Science Lecture, which followed the McPherson ERI's annual Poster Session—back for the first time since 2019.

WITH THANKS & APPRECIATION

July 1, 2021 to October 31, 2022

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THE FUTURE NEEDS US NOW

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