

Wilmer Eye
Institute



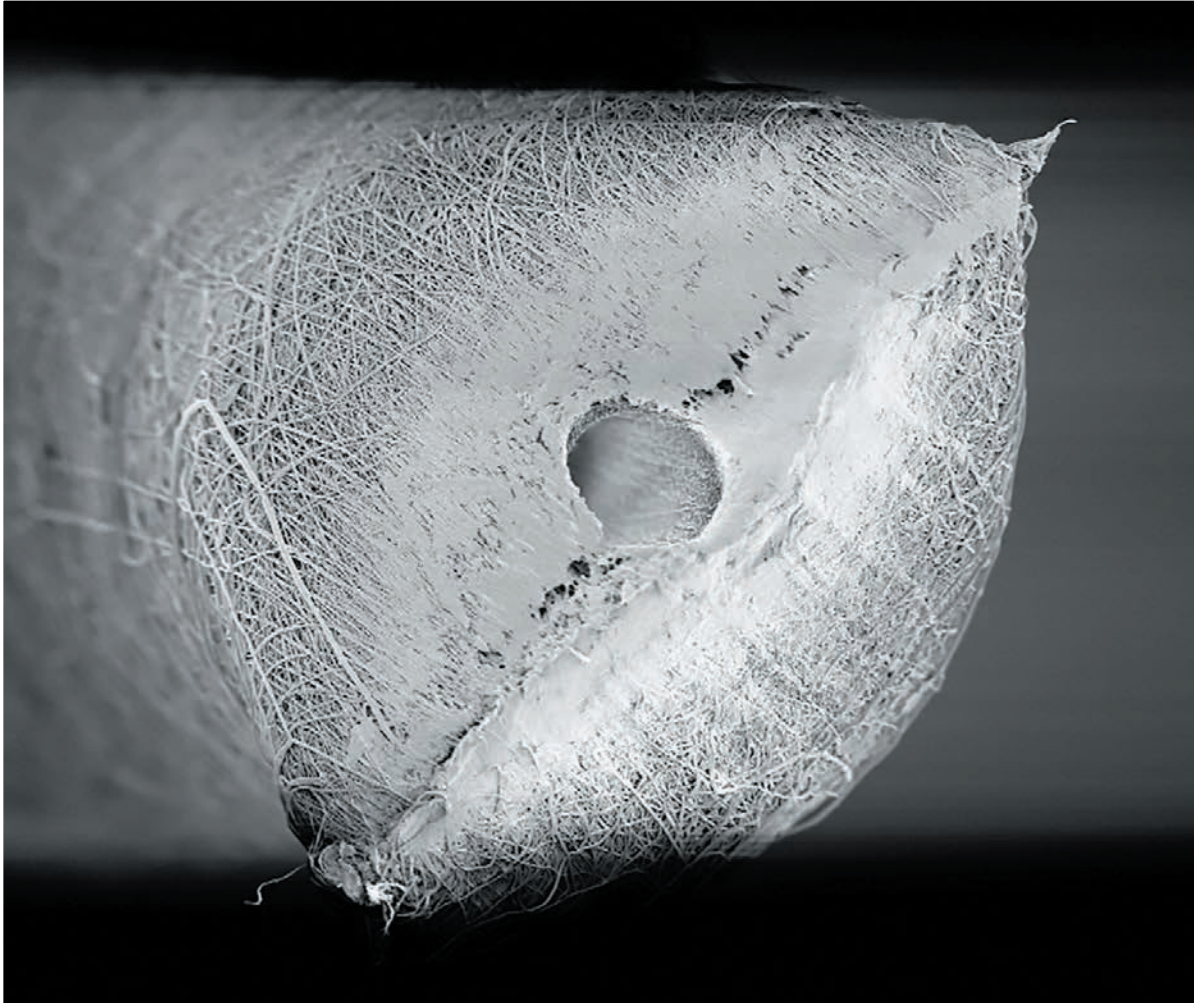
Wilmer

Spring
2019

The Power of Artificial Intelligence

Harnessing the potential
of deep learning

LOOKING FORWARD



Healing Fibers

One solution to glaucoma involves surgically inserting a tiny tube—or shunt—that acts as a drain to release fluid pressure in the eye. But sometimes, while the eye is healing, the openings in the shunts can prove too big and too much fluid drains out, a condition known as hypotony, which can affect a patient's vision.

Now a Wilmer team has designed tiny shunts created by spinning ultrathin fibers (1,000 times thinner than a human hair) around a template wire. Shunts created using this technique can be built

with two layers, which can help the shunt change diameter over time to prevent hypotony.

The biodegradable inner layer has a smaller opening to maintain the amount of pressure the eye needs to heal. "After the eye has had a chance to heal, the tissue that is laid down in that process prevents hypotony," says Ian Pitha, M.D., Ph.D., the team leader. "Then, the inner layer dissolves away, leaving behind the permanent shunt with a wider opening."



Wilmer's Low Vision leadership, Bob Massof and Judy Goldstein. Read more about Wilmer's efforts to build the low vision field on pg. 14.

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On the cover: An abstract big data visualization (Getty images)

As I See It

Dear Friends,

Science is an endeavor that spans generations. Wilmer faculty members spend their careers working toward future treatments, inspired by the tradition that is firmly rooted in our past as the first eye institute to combine research, teaching and patient care. We believe, as did our founder, Dr. William Holland Wilmer, that the research we carry out makes us better doctors and better teachers.

While this is “in our DNA” at Wilmer, it’s always heartening when the external world affirms this conclusion. Therefore, I was delighted this year when the Association for Research in Vision and Ophthalmology (ARVO), the world’s largest organization of scientists studying the eye, chose seven Wilmer faculty members for prestigious awards—a record number for Wilmer that highlights the deep bench of scientists and clinician-scientists we have working here.

Because our faculty members benefited from excellent teachers when they were in training, we prioritize mentoring. The Lions Low Vision Fellowship is one example of a mechanism Wilmer faculty members created to build the research skills of doctors interested in the field of vision rehabilitation. Funded by the Lions Clubs, the fellowship allows the awardee to learn valuable research techniques while also practicing medicine. The goal is to create the next generation of leaders in this field and ensure they are steeped in Wilmer’s tradition of integrating research, education and collaborative clinical care.

In the same spirit of collaboration, a wide swath of Wilmer doctors—from residents to senior faculty members—have embarked on research into how artificial intelligence can improve the care and clinical experience of patients. Each of the dozen projects currently underway involves clinicians paired with technical experts; together they are exploring this rapidly developing suite of tools that is already transforming medical care.

Wilmer attracts people with the entrepreneurial spirit needed to tackle the “new,” and we also work hard to provide an environment that stacks the odds in favor of our faculty’s success. A story about a young faculty



member—a retina specialist—supported by several philanthropists in her efforts to understand the earliest effects of diabetes on the eye exemplifies how Wilmer faculty members receive the support they need to pursue their best ideas. Early-career philanthropic support for promising young faculty members replenishes Wilmer’s pipeline of talented scientists and clinician-scientists. These doctors will be discovering the therapies of tomorrow—and no doubt garnering accolades in decades to come that, like this year’s ARVO awards, will validate Dr. Wilmer’s foundational vision to unite research, teaching and patient care under one roof.

Peter J. McDonnell, M.D.
William Holland Wilmer Professor and Director

Same-Day Appointments Improve Care, Save Money

IT BEGAN AS a simple question from Wilmer Eye Institute Director Peter J. McDonnell, M.D.: “Wouldn’t it be great if any patient could call and get an appointment the same day?”

Eric Singman, M.D., Ph.D., the Milton and Muriel Shurr Division Chief of the General Eye Service clinic at Wilmer, has always been up for a challenge, so almost immediately, he began talking with staff members about what it would take. That was in 2014. Today, what started as an experiment has become a signature service that is offered across all of Wilmer’s clinics. Every patient who calls for an appointment has the option to be seen within 24 hours.

Wilmer now schedules 1,000 same-day appointments every month—some 14 percent of patients, notes Singman. “It’s pretty clear. People like being seen conveniently,” he adds.

Gina Locco is clinical operations manager. She runs the scheduling team and worked closely with Singman to make the idea of same-day appointments a reality. She helped figure out how to do it from a logistical standpoint and put procedures in place with the team of schedulers taking calls on the phone.



Eric Singman presenting an award to members of Wilmer’s call center, the engine of the same-day appointment initiative.

Working with just a single doctor at first—Singman himself—the team soon expanded the offering to the General Eye Service division. Within six months, the program was such a hit that all of Wilmer was offering same-day appointments, Locco says.

“In April 2019, the clinic booked its 50,000th same-day appointment,” says

News



“In April 2019, the clinic booked its 50,000th same-day appointment.”

—Gina Locco

Locco proudly. It is a milestone that seemed improbable, if not impossible, five years ago.

Same-day appointments are more than a high-profile service for Wilmer. Singman says they improve care by getting patients to see doctors faster. They are also a tremendous cost-saving measure. Eye concerns can be worrisome, and patients with nonurgent issues often turn to emergency rooms rather than wait for an appointment. “Try telling an anxious patient their eye problem isn’t urgent,” Singman says.

By keeping patients out of the ER, same-day appointments save money. To find out just how much, Singman devised a study to compare dollars to dollars and minutes to minutes. “We plumbed the data,” he says.

Turning to Epic, Johns Hopkins Medicine’s electronic medical record software, he worked with senior clinical IT analyst Kerry Smith; ophthalmologist Michael Boland, M.D., Ph.D., who is the IT director at Wilmer; and others to look back over the years and calcu-

late the savings.

What the team discovered surprised even Singman. The average difference is \$782 and almost six hours of wait time for eye patients who opt for same-day outpatient appointments over a visit to the ER.

“The ER costs at least three times as much and has three times the wait,” Singman says. “Patients—and their insurers—are going to like that data.”

A paper based on his finding won first prize in its category at the High Value Practice Academic Alliance and will be published in the journal *JAMA Ophthalmology*.

While pleased with these findings, Singman points out that the majority of patients who make same-day appointments are for nonurgent matters. In 2016, when Wilmer had more than 26,000 same-day appointments, a little more than 6,000 were urgent, he says. “Same-day appointments are for any reason,” says Locco. “Contacts, yearly eye exam, urgent or nonurgent. There are no limitations.” ■

Eye Cancer in the Crosshairs

With the arrival of Zelia Correa, Wilmer patients can benefit from fine-needle biopsies.



Zelia Correa, center, preparing to perform a fine-needle biopsy on a patient's eye.

News



Zelia Correa makes a presentation to Wilmer's Board of Governors.

AS MIRACULOUS AN ORGAN as it may be, the eye can be home to a remarkable array of conditions. Some of those conditions are just that—mere flaws, benign, not threatening to sight or health. Others, however, are more serious and can lead to blindness or even death. Spotting the difference between the two is the business of Zelia Correa, M.D., Ph.D.

Correa, who joined Wilmer in 2018, is one of just a handful of ophthalmologists nationwide who specializes in eye tumors and is able to do a biopsy on questionable tissues inside the eye.

She has been practicing medicine for two decades, both in her native Brazil and for 12 years at the University of Cincinnati. In that time, she has become one of the leading specialists in identifying and treating ocular melanoma, retinoblastoma, ocular metastasis, conjunctival melanomas and other cancers of the eye.

Correa, the Tom Clancy Professor of Ophthalmology at Wilmer, uses long, extremely narrow-gauge, flexible needles that can reach deep inside the eye and collect small samples of cells to be analyzed by pathologists. She is quick to point out that she did not invent the procedure, but she has modified and perfected it.

“We’re going to put a needle in there. We’re going to get a tiny specimen. And we’re going to do it without harming the eye,” she says to patients. “And that’s what we did,” she says, noting that complications have occurred in less than 1 percent of the 1,000 or so procedures she’s done in the last 20 years.

Within the last decade, scientific advanc-

es in molecular and tumor evaluations have made it easier to achieve medical indication to justify doing a biopsy. “Knowing what you might be dealing with is important prior to testing any potential cancer and is key to yielding results that are helpful to patients,” says Correa.

She adds that she now performs biopsies for virtually all patients with any choroidal tumor that is likely to be a melanoma. Confirming a malignancy and characterizing the genetic makeup of the particular tumor make it possible to fine-tune treatment to the individual, potentially opening up the possibility of clinical trials using new therapies.

In addition, biopsies can be performed after a patient has completed cancer treatment and can be helpful to spot a recurrence, before it has spread and when it is still possible to treat locally.

As she points out, uveal melanoma carries a significant risk of metastasis.

The procedure is done on an outpatient basis and is “very minimally invasive,” Correa notes. The needles she currently uses are 27-gauge—just a few hundredths of an inch in diameter and extremely long. This makes them pliant and flexible, allowing Correa to steer the needle with great precision. The typical biopsy requires only a handful of cells for a diagnosis that could save a life.

“I think fine-needle biopsies are very important and necessary to 21st-century eye care,” Correa says.

In her newest endeavor, Correa is using artificial intelligence and machine learning to improve diagnosis. In these cutting-edge

disciplines, computers scan biopsy images and teach themselves to recognize cancers. Often the computers make connections that even highly trained pathologists do not. These advances hold the promise of taking ocular oncology in exciting new directions.

“Being in the Hopkins environment, Wilmer has access to a robust infrastructure of artificial intelligence expertise and banks of supercomputers ready and able to do the math,” Correa says.

Soon, Correa will begin enrolling patients for studies looking at artificial intelligence to aid in detecting and predicting outcomes of eye tumors. Other studies on the horizon are a multicenter trial looking at biological hallmarks of metastasis and a single-institution trial to explore complications from radiation therapy in people treated for eye cancer.

Though still new to Wilmer, Correa says her transition has been very positive. She values the easy access to Wilmer’s world-class research infrastructure and researchers. Collaboration with other labs at Johns Hopkins strengthens her own work. Each time she has a new idea, she says, it always seems there is another Johns Hopkins lab doing similar work, often in other parts of the body, that can yield insights for her work on the eye.

“The opportunity for multidisciplinary collaborations and the fundamental support for research is just tremendous here, and that has such a positive impact on patient care,” Correa says. “This is what brought me to Wilmer.” ■



“I think fine-needle biopsies are very important and necessary to 21st-century eye care.”

—Zelia Correa

The Power of Artificial Intelligence

Across Wilmer, scientists are harnessing the promise of “deep learning” to transform research and patient care.

By Jessica Wilson

THE NUMBERS are staggering. About 8 million people in the United States have an early, often asymptomatic, stage of age-related macular degeneration (AMD), a leading cause of blindness in those over 50.

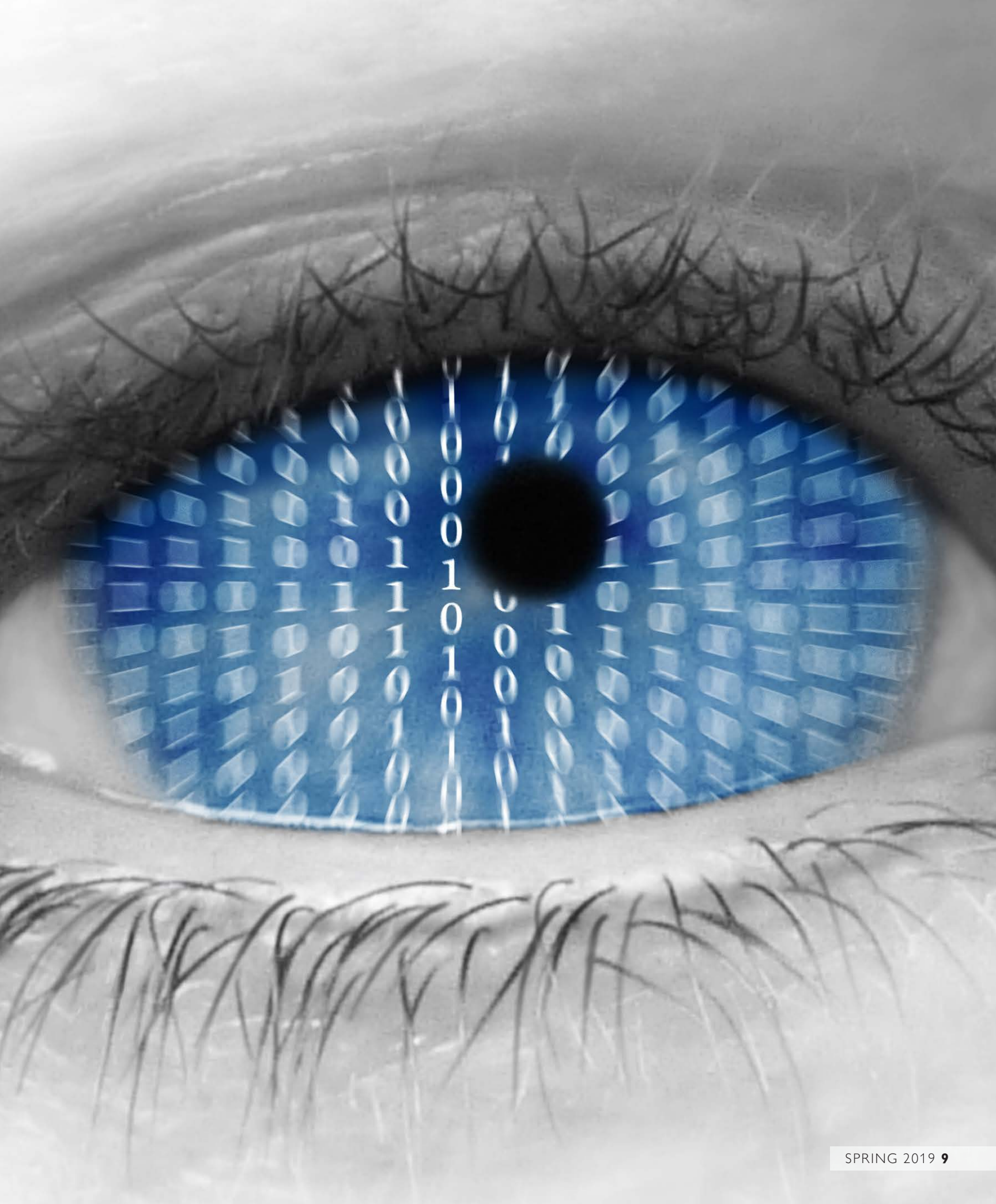
“AMD requires careful monitoring by an ophthalmologist, but we estimate only about 4 million of those in this asymptomatic stage even know they have it,” says Neil Bressler, M.D., Wilmer’s James P. Gills Professor of Ophthalmology. “We—ophthalmologists—can’t look in each person’s eyes to find who has this intermediate stage that needs monitoring because we would work all day, all night,” he says.

But what if computers could be trained

to do the job instead? Suppose they could even *teach themselves* an algorithm to identify the signs of AMD—areas of debris that have accumulated behind the retina, called drusen—on photos of retinas?

This “deep learning” approach was precisely the strategy that Bressler and a team of computer scientists at the Johns Hopkins University Applied Physics Lab (APL), with whom he’s been working for more than 10 years, undertook recently in an important study aimed at expanding access to eye care by tapping into the power of technology.

Their work is just one of a dozen projects currently underway at Wilmer that are harnessing advances in artificial intelligence to



At the Core

Wilmer faculty members who are launching projects involving artificial intelligence have an important new resource to help them in their work: the Wilmer Artificial Intelligence Research Network (WAIRN).

Wilmer ophthalmologists Samuel Yiu, M.D., Ph.D., and T.Y. Alvin Liu, M.D., both currently involved in deep learning projects, are serving as the administrative core of WAIRN. The network is an open, inclusive platform that aims to foster collaborations among investigators and to encourage the cross-pollination of ideas.

Yiu and Liu envision WAIRN as a conduit to help faculty members connect with the best technical partners and to “share resources and not duplicate efforts.” As an example, Liu notes that the Johns Hopkins Malone Center for Engineering in Healthcare is one place to search for technical expertise in artificial intelligence. However, “Malone is a huge place, and many people there do artificial intelligence. But there are many forms of it. And sometimes they may not be familiar with working with medical data,” says Liu. This is where WAIRN can step in and recommend the best fit for a Wilmer faculty member’s project.

“Wilmer is really serious about artificial intelligence, which has the potential to change medicine as we know it,” says Liu. “We’re trying to build a collaborative system so that Wilmer can be at the forefront of this fast-moving field.”



“What’s becoming clear is that harnessing this new technology holds the promise of transforming much of ophthalmology, and this is now a Wilmer-wide effort.”

—Wilmer Director Peter J. McDonnell

T.Y. Alvin Liu, standing, and Samuel Yiu, the administrative core of the new Wilmer Artificial Intelligence Research Network.

improve clinical care in ophthalmology. In glaucoma, Jithin Yohannan, M.D., is using deep learning, as well as other machine learning approaches, to predict the likelihood of disease progression and ultimately improve patient outcomes. While in the cornea division, Albert Jun, M.D., Ph.D., the chief of the division and the Walter J. Stark, M.D. Professor of Ophthalmology, is devising an algorithm to more accurately select intraocular lenses for patients undergoing cataract surgery, and Shameema Sikder, M.D., director of the Center of Excellence for Ophthalmic Surgical Education and Training, is creating new, more effective methods for improving cataract surgery skill.

“What’s becoming clear is that harnessing this new technology holds the promise of transforming much of ophthalmology, and this is now a Wilmer-wide effort,” says Wilmer Director Peter J. McDonnell, M.D. “Computer science can perform some tasks extremely well, freeing up ophthalmologists to focus their time and energy on only those tasks that require all their years of training and that call for ‘the human touch.’”

The Future Is Now

The concept of neural networks, a basis for deep learning, has been around since the 1940s and is modeled on how the brain works. Sikder describes

neural networks as producing “smart, iterative learning.” Neural networks begin with an algorithm, which ingests data and learns something about that data that can be applied to assess something else, she says.

“It [the algorithm] learns it once and then looks at it slightly differently, then learns it again and looks at it in multiple different ways to really get a full picture,” she says. “Like if you take an elephant and first, you touch the ears, and then you touch the tail, and then you touch the skin, and over time, if you feel enough parts, you’ll actually have an assessment that it really is an elephant in the room.”

To run programs, computers use central processing units, which are good at tackling calculations in sequential order. In order to run all of the iterations required for deep learning to succeed, a lot of hardware is required. And that’s expensive. A little less than a decade ago, however, researchers began to use graphical processing units, GPUs, which had been popularized for video games, to “supercharge” computing. They perform tasks in parallel—vastly increasing the iterations an algorithm can perform, for a lot less money.

The final piece of the puzzle that has launched deep learning into everyday conversation is the availability of data—a lot of data. The most useful data are that which are already

labeled, because the algorithm needs labeled data to learn. Because of their roots in the video game universe, GPUs are good at rendering images. GPUs paired with deep learning algorithms are especially good at analyzing medical images.

A Picture Is Worth...

It was precisely the plethora of images available to Bressler and the ophthalmology research community that drew the interest of APL researchers to his work in macular degeneration.

The deep learning technique Bressler’s team used is “supervised learning.” To begin this process, a research team decides what it wants the neural network algorithm to learn to recognize based on the type of labeled data available. Then the team members gather the data, which they divide into a training dataset and a testing dataset.

For Bressler’s project, researchers chose the presence of drusen on fundus images taken of retinas. Next, they created a neural network algorithm to read the images. For each image, the algorithm is told the “ground truth.” Each time Bressler’s team fed an image to their neural network, they would provide “the ground truth” by stating, “this image has drusen” or “this image does not have drusen.” After viewing thousands of images paired with the ground truth, the neural network

“If we can predict what’s going to happen in [a patient’s] future based on how things look today, that’ll be really powerful.”

—*Jithin Yohannan*

learned to sort the images into the two categories with increased accuracy.

Once the neural network is trained, researchers feed it testing data in order to validate the neural network’s accuracy. The neural network algorithm Bressler’s team created accurately identified AMD between 88.4 percent and 91.6 percent of the time, which is comparable to the accuracy achieved by human experts. They published the results in *JAMA Ophthalmology* in 2016.

“Deep learning artificial intelligence tools represent a new generation of screening for eye diseases that require less time and skilled personnel, while generating expert evaluations as if a patient were being diagnosed by one of the top clinicians at Wilmer,” says Bressler. “These AI tools hold the promise to widen access to Wilmer’s ophthalmic care and to detect and treat these retinal diseases *before* substantial vision loss has occurred, when treatments usually are most effective.”

Increasing Access

Many of Wilmer’s deep learning AI projects focus on increasing access to diagnostic care for conditions that are asymptomatic. People with systemic diseases, such as diabetes and sickle cell disease, are at risk for retinopathy. While they are usually referred for annual eye exams, many don’t follow up because they are not experiencing eye problems or have too many other

medical appointments to juggle.

“Patients with diabetes [often] have a lot going on in their lives,” says Roomas Channa, M.D., Wilmer’s chief resident for 2017–2018. “We need to make detection of eye problems easier for these patients.”

Channa and Ingrid Zimmer-Galler, M.D., a Wilmer retinal specialist, have partnered with Risa Wolf, M.D., an endocrinologist in the Johns Hopkins Children’s Center, to use the first FDA-cleared AI screening device on pediatric patients with diabetes. Currently, the device is cleared by the FDA for adults, so part of their study focuses on testing its performance in children. Another part of their study aims to examine how effective an AI screening device is in an endocrinologist’s clinic. Because all people with diabetes see their endocrinologist, Channa’s team supposes that an AI screening device in that office will increase compliance with the recommended annual eye screening for patients with diabetes.

Adrienne Scott, M.D., a retinal specialist at Wilmer, is pursuing a similar strategy to help patients with sickle cell retinopathy, her area of research. She and third-year resident Sophie Cai, M.D., are exploring whether they can build a deep learning algorithm that recognizes the retinal signs of sight-threatening sickle cell retinopathy.

Since sickle cell retinopathy is rarer

than AMD and diabetic retinopathy, the researchers have fewer images available to train a neural network. “We want to see if, with one of these rarer diseases with a smaller dataset, we can still extract information to be able to develop an algorithm,” says Cai.

Recognizing the challenges ahead, Scott remains undaunted. “Sickle cell is a disease that needs increased access to this type of care and to streamlined care in general for the sake of patient convenience and cost,” she says.

The Power of Prediction

Since deep learning has the capacity to improve patient outcomes because of its predictive power, researchers are using data to train the algorithms to spot patterns humans cannot.

“As humans, we know how to classify or identify glaucoma or classify AMD. But if we can predict what’s going to happen in [a patient’s] future based on how things look today, that’ll be really powerful,” says Yohannan, Wilmer’s current chief resident. One of his research projects aims to do that for glaucoma patients.

When patients present with glaucoma, they take a visual field test that assesses their peripheral vision using 52 points of data. The better their peripheral vision is, the less severe the glaucoma. As patients continue with treatment, they continue to take visual field tests so doctors can track the

Artificial Intelligence Projects at Wilmer

ABNORMAL OPTIC DISC DETECTION

- Clinical experts: **Neil Miller, M.D.**, and **T.Y. Alvin Liu, M.D.**

AGE-RELATED MACULAR DEGENERATION

- Clinical experts: Wilmer's **Neil Bressler, M.D.**, and **T.Y. Alvin Liu, M.D.**; **Jun Kong, M.D., Ph.D.** (now a retina specialist on the faculty of China Medical University with the Fourth Affiliated Hospital in Shenyang, China); and **Katia Pacheco, M.D.** (now with the Brazilian Center of Vision Eye Hospital, Brasilia, Distrito Federal, Brazil)

CATARACTS

- Clinical experts: **Albert Jun, M.D., Ph.D.**, and **John Ladas, M.D., Ph.D.**

GLAUCOMA

- Clinical expert: **Jithin Yohannan, M.D.**

KERATOCONUS

- Clinical expert: **Samuel Yiu, M.D., Ph.D.**

PEDIATRIC DIABETIC RETINOPATHY

- Clinical experts: **Roomasa Channa, M.D.**; **Risa Wolf, M.D.** (endocrinologist at the Johns Hopkins Children's Center); **T.Y. Alvin Liu, M.D.**; and **Ingrid Zimmer-Galler, M.D.**, executive clinical director of the Johns Hopkins Medicine Office of Telemedicine (project under the auspices of the Office of Telemedicine)

SICKLE CELL RETINOPATHY

- Clinical experts: **Adrienne Scott, M.D.**, and **Sophie Cai, M.D.**

SURGICAL EDUCATION

- Clinical expert: **Shameema Sikder, M.D.**, director of the Center of Excellence for Ophthalmic Surgical Education and Training

UVEAL MELANOMA

- Clinical experts: **Zelia Correa, M.D., Ph.D.**, and **T.Y. Alvin Liu, M.D.**

progression of the disease.

While some patients get treatment and level off, others get treatment and rapidly decline.

Using a large database of about 210,000 visual field tests, Yohannan has constructed both deep learning and other machine learning algorithms to predict which patients are at risk for rapidly progressing glaucoma based on their very first field test. Thus far, he is pleased with the results.

"If you did this by chance alone, it would be about 50/50—it can be one category or the other. But just on this dataset, we're about able to get 90 percent accuracy. So correctly classify nine-tenths of people," says Yohannan.

"In the future, it would be valu-

able if a patient comes in to get their first field test and we can tell them, you're at high risk for progressing, and we want to keep a close eye on you. Maybe those are the patients we want to see every two or three months rather than every six months," says Yohannan.

Jun and his research partner, John Ladas, M.D., Ph.D., are also exploiting the awesome pattern recognition ability of neural networks. Their deep learning algorithm predicts how an eye will heal after cataract surgery. This will allow surgeons to choose the most accurate focusing power for the artificial lens the patient will receive during the surgery.

With Great Power Comes Great Responsibility

Patients can take heart that Wilmer researchers are approaching these issues with eyes open. Optimism is great, but so is verification.

"There is a lot of buzz in the media about health care and AI. Like everything new, it will follow a curve of enthusiasm followed by skepticism before we reach a balance where we really understand its role in patient care," says Channa. "I think we need more research into how implementing a particular AI algorithm helps the patient and the health care system."

Fortunately, Wilmer specializes in research aimed at connecting discoveries to patient care. ■

The ‘Echo Effect’

Thanks to funding from the Lions Clubs, a clinical fellowship is vastly expanding knowledge and care for patients with low vision.

By Andrew Myers | Photos by Chris Myers

“We’re now starting to see the proteges of former fellows returning to Wilmer as fellows themselves.”
—Bob Massof

WHEN JUDY GOLDSTEIN, O.D., looks out at the world, she sees a rapidly graying population in desperate need of low-vision services to improve their quality of life. And yet, for reasons that are not immediately clear, it can be difficult to encourage young eye specialists into careers in the field.

Goldstein, who is chief of the Lions Vision Research and Rehabilitation Center (Wilmer’s Low Vision division), says that part of the challenge is that the caregiver must be equal parts physician, therapist, counselor and educator. To maximize a patient’s quality of life, low vision faculty and staff members spend a great deal of time and attention to coordinate the best combination of treatment strategies.

Treatments can range from prescribing specialized lenses that allow

patients to drive a car to counseling them that they must discontinue driving and put alternative transportation options in place. Dedicating one’s career to rehabilitation medicine takes a unique commitment to caring for the entire person and the recognition that the success of treatment often depends on engaging and motivating the patient to understand and participate in the process.

Often, the appointments take a lot longer than in other specialties and involve extensive education and counseling. And in medicine, as in almost any profession, time means money. Many young ophthalmologists and optometrists, often burdened by school debt, opt for higher-paying careers in other specialties.

“Low vision is not a high-volume field,” Goldstein says. “And there are

Judy Goldstein and Bob Massof. She is the chief, and he is the research director of the Lions Vision Research and Rehabilitation Center—Wilmer’s Low Vision division.



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“The Lions fellowship is just a year of training in one’s life, but fellows truly connect to the mission and grow in their love for the work.”
—*Judy Goldstein*



Ashley Deemer

too few who do this kind of work.”

Rectifying this problem has become one of Goldstein’s missions, and she has enlisted an old friend—the Lions Clubs—to help her do it. For the last 30-plus years, the Lions have contributed millions of dollars to the Lions Low-Vision Research Fund at Wilmer. And in the last decade or so, the civic organization has extended its commitment to the Lions Low Vision Fellowship, \$100,000 annually that underwrites a full year of clinical and research training for low vision specialists at Wilmer. The fellow’s time is split 80 percent in the clinic and 20 percent doing research.

The goal of the fellowship is to seed Wilmer’s particular brand of care as widely as possible. One recent fellow, a glaucoma specialist, hailed from Thailand and has returned to his native country to help lead the low vision program at King Chulalongkorn Memorial Hospital.

The fellowship is open to ophthalmologists and optometrists who have completed their residencies. In return, they get a full year of intensive training at Wilmer. Bob Massof, Ph.D.,

is the research director of the Lions Low Vision Fellowship. He says that in the fellows’ research component, they learn key data gathering, analysis and writing skills that are needed to establish their research careers. Most complete their year at Wilmer with a published paper to show for it.

“We’re now starting to see the proteges of former fellows returning to Wilmer as fellows themselves,” Massof says. “It’s great to see this echo effect.”

The emphasis on research sets the Lions program apart. The fellows not only study existing rehabilitation techniques, therapies and technologies but conduct investigations that expand the body of knowledge about low vision care.

Patients in the mid-Atlantic are blessed to have a low vision program like Wilmer, says Lion Larry Burton, chair of the Lions Vision Research Foundation. “But it’s not the norm across the country or even internationally,” he says, “and we want to spread the wealth as far as we can.”

Recently, the Lions have taken things a dramatic step forward, leading an effort to permanently endow

WILMER EYE INSTITUTE



Lions John Shwed, left, and Larry Burton at Wilmer. Shwed heads the Lions' development committee, which raises funds for the Lions Low Vision Fellowship endowment, and Burton is chair of the Lions Vision Research Foundation.

the fellowship—a gesture requiring at least \$2.3 million in funding to yield an annual fellowship of \$100,000.

The Lions—often known as “the Knights of the Blind”—have been committed to Wilmer’s low vision care since Arnall Patz was Wilmer director in the 1980s. “The clinical fellowship was a natural extension of that work,” says John Shwed, who heads the Lions’ development committee and is the one charged with raising the endowment.

Shwed points to the approximately 5 million people in the U.S. with low vision and says: “We wanted to make

a statement that those people matter.”

Ashley Deemer, O.D., is a recent Lions fellow who stayed on as a faculty member after her training. For her, the work in low vision, and the fellowship, are personal.

“I have a grandma with glaucoma,” Deemer says. “Her caregivers treated her medical conditions, but no one was addressing her quality of life, and that’s where the low vision program really pays off.”

Deemer used her fellowship to get involved with a project looking at the frequent connection between macular

degeneration and depression, assessing two therapeutic options. For someone who had no prior research experience, the chance to learn at Wilmer was invaluable.

“It was just too good an opportunity to pass up,” she says.

Goldstein says the fellowship has one additional intent that is not always apparent.

“The Lions fellowship is just a year of training in one’s life, but fellows truly connect to the mission and grow in their love for the work,” she says. “Then, it becomes a career.” ■

Bridging the Gap

Early support is crucial for promising young researchers like Mira Sachdeva.

By Andrews Myers | Photos by Chris Myers

“Initially, I even had to borrow pipettes from a neighboring lab.”

—Mira Sachdeva

WILMER'S MIRA SACHDEVA, M.D., Ph.D., is following an intriguing research avenue into how and why neurons die in conditions like diabetic retinopathy. In this area, most current research is focused on treating the leakage of blood vessels in the retina. But Sachdeva has chosen to look earlier in the disease process: when retinal neurons seem to die even before the blood vessels are damaged.

Her strategy is to protect the healthy neurons, rather than wait to treat damaged ones. If she is successful, the treatments she might one day discover could also be applied to other potentially blinding eye conditions, including macular degeneration and retinal detachment.

While a provocative strategy, it is as-yet unproven. So, when Sachdeva launched her lab as a new faculty member, she faced an all-too-familiar challenge for talented young researchers at academic medical institutions across the country: funding. Even with a promising idea for a new avenue of scientific exploration, the

financial burdens of getting a lab up and running can be prohibitive.

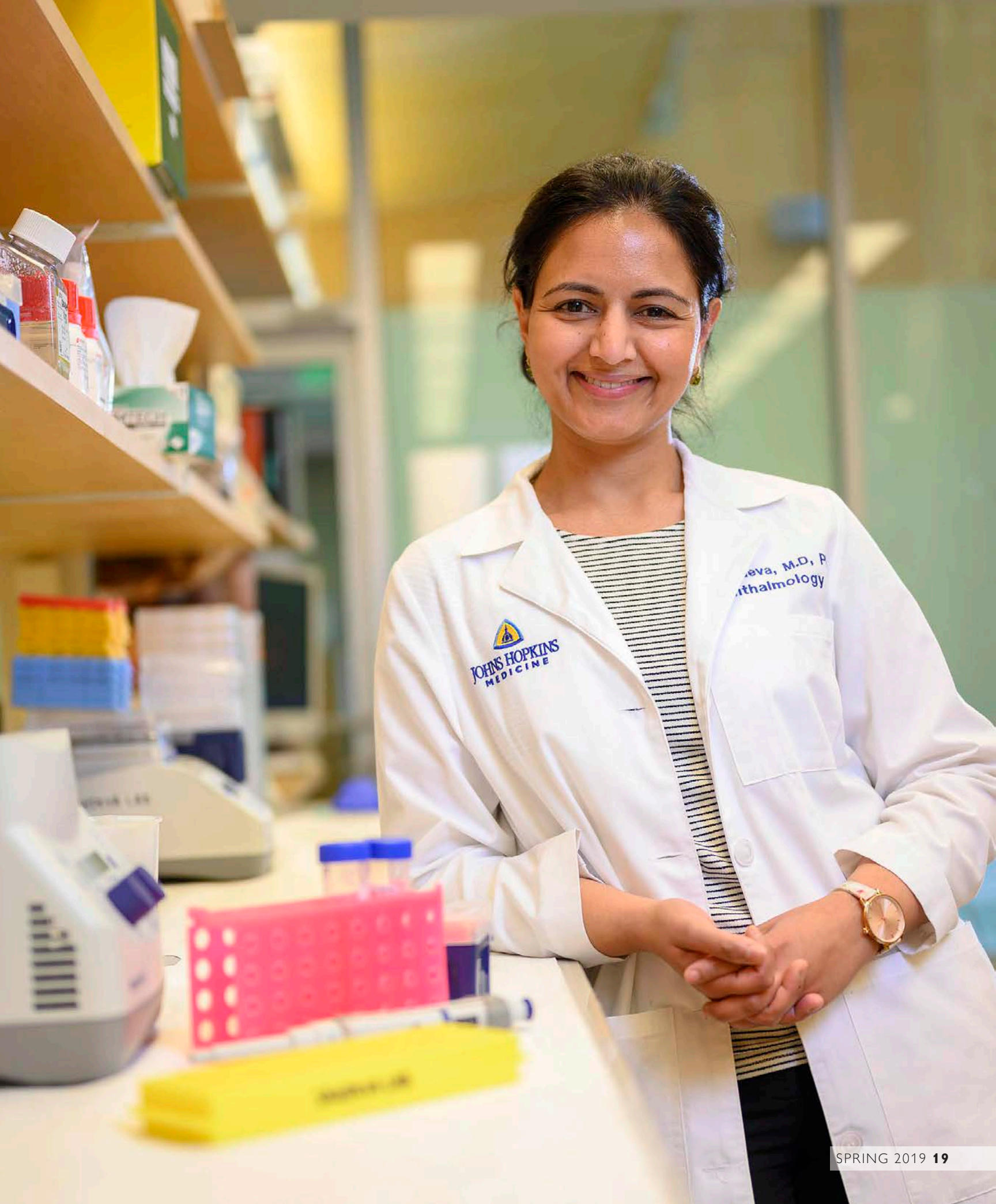
When she began her work, Sachdeva had been allotted precious lab space by her department but lacked the necessary research tools and equipment.

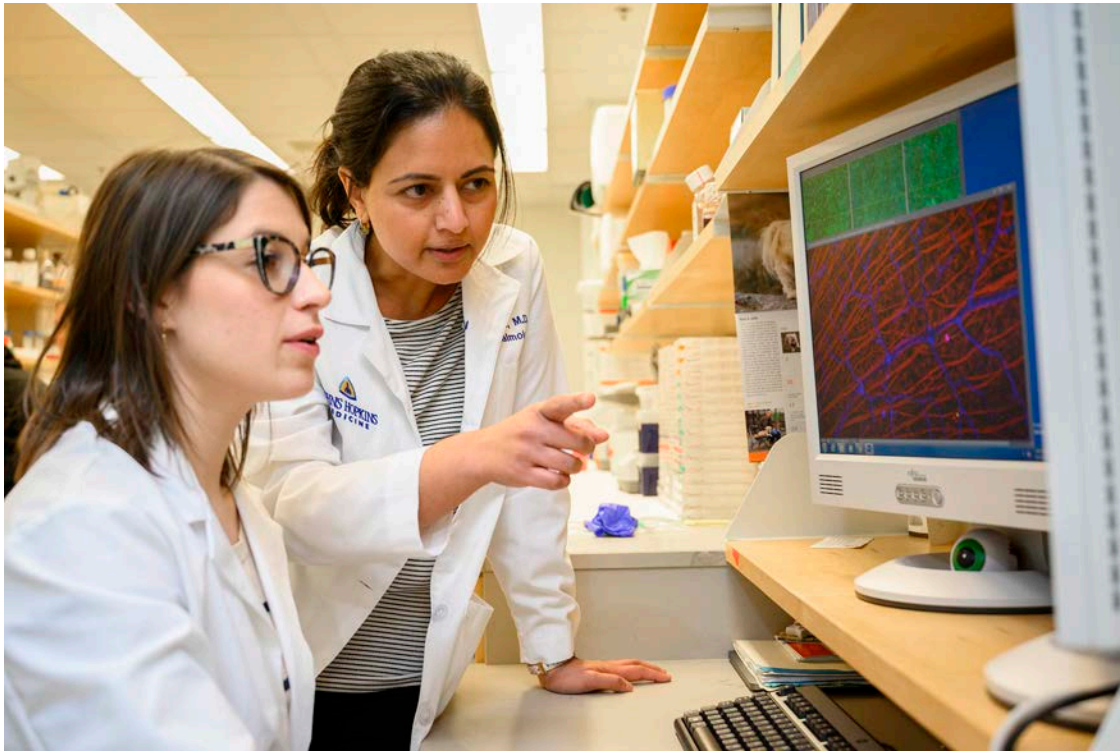
“Initially, I even had to borrow pipettes from a neighboring lab,” Sachdeva says.

Large grants from institutions like the National Institutes of Health and major foundations rarely go to unproven ideas. Meanwhile, the cost of equipment and lab assistants is high and rising by the year.

As a retina surgeon, Sachdeva splits her time between revenue-generating clinical work and grant-supported research. She is able to do this because she secured a grant from Wilmer—known as a K12 grant, funded by the National Eye Institute—to help offset her salary enough to allow her to work in the lab several days a week. More recently, in March, she won her own individual K08 grant from the National Eye Institute, a prestigious award that will continue to provide her salary support to conduct her research.

Physician-scientist Mira Sachdeva in her lab, where she is unravelling how diabetic retinopathy begins on the cellular level.





Sachdeva, right, consulting with her laboratory technician Kelcy Klein, who ensures research work continues when Sachdeva is in clinic seeing patients.

These early-career K grants are designed to ensure valuable protected research time for promising clinician-scientists. However, they offer little additional funding for research equipment, supplies and personnel—and not enough for the full salary of a laboratory technician, an important asset for someone like Sachdeva, who must spend time away from her lab in the clinic and operating room.

To bridge that gap for Sachdeva and other young researchers, Wilmer turns to a broad network of individual donors.

Sachdeva receives support from the Robert P. and Arlene R. Kogod Family Foundation and through a bequest from the estate of Eleanor Young. (Though Young was never a patient at Wilmer, she suffered from age-related macular degeneration and wanted to support the ongoing quest for a cure,

so she named Wilmer in her estate plan.)

“Dr. Sachdeva was recommended highly to us,” says Robert Kogod of the reasons for his philanthropy. “And my wife and I are happy to support interesting new researchers, especially at a premier organization as respected as Wilmer.”

Named a Ryan scholar during her first year as a faculty member in the Retina Division, Sachdeva received funds from an endowment donated by the family of the late ophthalmologist Stephen Ryan, M.D., awarded to new clinician-scientists who show great promise in the beginning of their careers.

Allan and Claire Jensen also support Sachdeva. Allan is a former chief resident at Wilmer, now in private practice in Baltimore, who trained at Wilmer from 1969 to 1974, in addi-

tion to doing a yearlong fellowship at the Massachusetts Eye and Ear Infirmary. Noting how much Wilmer has grown (there were only two full professors during his years here, he notes, while today there are many dozen fully funded professors), Jensen says he is impressed with the new generation of researchers.

They are smart, creative and eager to make their mark, he says, adding, “A donation seemed a good way to recognize my belief in them.”

Sachdeva is grateful for and humbled by the support. She finds it both encouraging and a constant reminder that what young researchers need most is simply someone to believe in them.

“You can never lose sight that the support is someone’s hard-earned money being invested in you,” Sachdeva says. ■

Eye to Eye

‘Not Your Ordinary Patient’

As a child, Sarah Hill founded a nonprofit that continues to fund research into the condition that threatens the vision of many young patients worldwide.

LIKE MANY RECENT Johns Hopkins University graduates, Sarah Hill has begun to contemplate what’s next in life. And, inspired in part by her father, Peter Hill, M.D., a renowned emergency physician and senior vice president of medical affairs for the Johns Hopkins Health System, she is strongly leaning toward a career in medicine.

Hill, however, has a bit more emotional capital invested in her pursuit of medicine than most of her peers. She suffers from juvenile idiopathic arthritis (JIA), an autoimmune disorder in which the body essentially attacks its own healthy tissues as if they were alien.

JIA carries serious complications, like the well-known joint inflammation common to arthritis. A rarer but more serious complication is uveitis, which can lead to glaucoma, cataracts and full-on blindness if not tended to carefully.

“Sarah is not your ordinary patient,” says Wilmer’s Jennifer Thorne, M.D., Ph.D., a leading expert in uveitis. Thorne, the Cross Family Professor of Ophthalmology, assumed Hill’s care in 2007 from Douglas Jabs, M.D. “Sarah is smart and curious, and she had a lot of questions about her dis-



KEITH WELLS

Sarah Hill, left, with her current ophthalmologist and mentor, Jennifer Thorne.

Eye to Eye

“Sarah is a rock star ... She’s fun and has a great sense of humor, but, above all, she’s just a resilient and a service-oriented person.”

—Jennifer Thorne

ease and her care that we didn’t have answers to,” says Thorne, who is also the chief of the Division of Ocular Immunology.

Hill experienced uveitis and glaucoma before she was barely 7. In the years since, she’s had corneal transplants performed by Albert Jun, M.D., Ph.D., Wilmer’s Walter J. Stark, M.D. Professor of Ophthalmology; several surgeries for glaucoma performed by Pradeep Ramulu, M.D., Ph.D., Wilmer’s Sheila K. West Professor of Ophthalmology; and she will undergo cataract surgery soon. Nonetheless, the resolute Hill says things are going as well as can be expected. Well enough, in fact, that her disease will not prevent her from becoming a doctor.

“I was reluctant at first to go into medicine mostly because I’ve spent too much time in doctors’ offices, but as I’ve gotten older, I know my passion is in one-on-one patient relationships,” Hill says.

When Hill was barely 10 years old, Jabz challenged his young patient to learn more about her own disease. “He told me, if I could raise some money,

he would do the research,” Hill recalls.

With a clever plea to friends and family accompanying a traditional holiday card, Hill founded a nonprofit known as K.U.R.E.—Kids Uveitis Research and Education.

To date, the K.U.R.E. Fund has raised nearly \$300,000—most from small donations no more than a few hundred dollars each, Thorne notes. Those funds go exclusively to research into JIA-related uveitis. That research has yielded at least six peer-reviewed papers published in medical journals, helped fund uveitis-focused resident research projects and talks at Wilmer, and inspired two major international conferences specifically dedicated to JIA. At one, Hill was a patient voice on a panel of doctors and researchers.

“Sarah is a rock star,” Thorne says. “Other kids with uveitis recognize her on the floor at Wilmer. She’s fun and has a great sense of humor, but, above all, she’s just a resilient and a service-oriented person.”

Hill says that when she transitioned into Thorne’s practice, there was not the slightest hiccup in her care. Thorne picked up right where

Jabz left off, and the two women now share more than the typical doctor-patient relationship. Thorne attended Hill’s college graduation dinner and has continued to mentor her through several medical-related internships and volunteer positions, including Hill’s current stint as a program associate for Health Leads at the Harriet Lane Clinic at Johns Hopkins. In that paid role, Hill coordinates important health-related resources—ranging from securing food stamps to acquiring medication—for low-income Baltimoreans.

Together, Hill and Thorne also make determinations as to where and how K.U.R.E. funds will be spent. Their current initiative is a study to better understand the genetic roots of JIA and its associated medical concerns.

Thorne says she has a strong research program going, and she finds herself traveling frequently to speak about JIA and uveitis across the country.

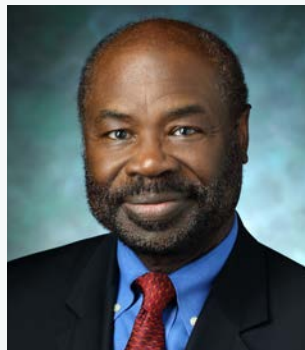
“It’s all because of Sarah and the K.U.R.E. Fund,” Thorne says. “She’s a special woman.” ■

Awards



Wilmer Director Peter J. McDonnell, M.D., was named to the **ARCS (Achievement Rewards for College Scientists) Foundation Alumni Hall of Fame**. The ARCS Foundation supports U.S. graduate and undergraduate scholars by providing financial awards in science, engineering and medical research. McDonnell was an ARCS Scholar in 1981 and 1982 as a student at the Johns Hopkins University School of Medicine. In announcing his induction, ARCS cited McDonnell's seven patents, more than 250 published articles and his directorship of Wilmer, the largest ophthalmology department in the country.

Basil Morgan, M.D., was presented with the **American Academy of Ophthalmology Secretariat for State Affairs 2018 Hall of Fame Award**. This award is given each year to an academy member whose patient advocacy demonstrates a commitment to public policies supporting quality medical and surgical eye care in the recipient's home state. Morgan has been a valued leader and mentor to numerous other Maryland ophthalmologists eager to get involved with patient advocacy.



Oliver Schein, M.D., received the **Armstrong Award for Excellence in Quality and Safety** from Johns Hopkins Medicine in 2018. This award is presented to the physician who partners with patients, families, colleagues and staff members to optimize patient outcomes and eliminate preventable harm. By evaluating operating room processes, Schein continuously challenges Wilmer to improve. He has also implemented cost-saving strategies in the surgical center, saving hundreds of thousands of health care dollars.

Awards

ARVO Recognition

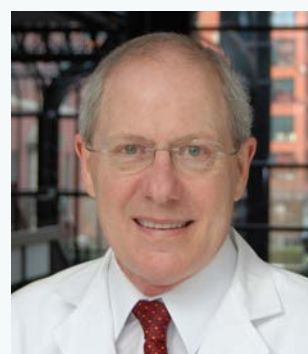
A professional association for ophthalmologists and vision researchers, the Association for Research in Vision and Ophthalmology (ARVO) includes nearly 12,000 researchers from 75 countries, making it the largest vision research organization in the world. The ARVO Foundation provides support for innovative and novel vision research, particularly work with translational impact that fosters collaboration between clinicians and basic scientists.

“Considering that brilliant scientists from around the world are eligible for these prestigious awards,” says Wilmer Director Peter J. McDonnell, M.D., “it is truly remarkable that we have so many faculty—ranging from junior to senior—receiving recognitions this year. While it has been common in past years for Wilmer’s scientists to win one or two awards, that there are seven awardees at this year’s meeting is without precedent.”

Jeremy Nathans, M.D., Ph.D., and King-Wai Yau, Ph.D., received the **2019 Helen Keller Prize for Vision Research** from the Helen Keller Foundation and BrightFocus Foundation, awarded at the ARVO Annual Meeting. The award recognizes research excellence in vision science, as demonstrated by a number of significant contributions or a single contribution of exceptional importance to the field. Early in the careers of Nathans and Yau, their research overlapped extensively, and they have collaborated on several projects through the years. In the sphere of vision, Nathans’ research focuses on retinal development and disease, and Yau’s on light detection by the retina.



Harry Quigley, M.D., and Thomas Johnson III, M.D., Ph.D., received the **2019 Dr. David L. Epstein Award**. Given to a senior investigator with a strong history of vision research in glaucoma as well as a record of mentoring clinician-scientists, the award will fund a research project led by a mentee of the senior investigator. Quigley is the senior investigator, and Johnson his mentee. Johnson’s project involves developing a protocol to transplant stem cell-derived retinal ganglion cells and successfully integrate these into a recipient retina.





Mandeep Singh, M.D., Ph.D., received the inaugural **2019 Bert M. Glaser, MD Award for Innovative Research in Retina**. This award is given to an early-career investigator for a novel discovery that has changed the understanding or treatment of a retinal disease or condition. Singh received this award for his research into cellular materials transfer, or “cell fusion,” between photoreceptor cells in the retina. His discovery of a new pattern of cellular behavior in the eye increased the understanding of how retinal cells interact with each other and could lead to the development of new treatments to regenerate the retina.



Sheila West, Ph.D., Pharm.D., received the **2019 Mildred Weisenfeld Award**. This award recognizes scholarly contributions to the clinical practice of ophthalmology. In West’s case, her research has informed all aspects of the World Health Organization guidelines for trachoma elimination.



Donald Zack, M.D., Ph.D., received the **2019 Friedenwald Award**. This award honors outstanding research in the basic or clinical sciences as applied to ophthalmology. Zack and his colleagues are studying how to differentiate stem cells into retinal ganglion cells, in the hope that someday they might offer the possibility of restoring vision to glaucoma patients who have already lost significant vision due to ganglion cell death.

Events

Board of Governors Meeting

Nov. 7, 2018 / Wilmer Eye Institute's Robert H. and Clarice Smith Building

Wilmer Board of Governors' Chair

Sanford D. Greenberg, Ph.D., and Wilmer Director Peter J. McDonnell, M.D., updated the board on the efforts of Wilmer since the spring 2018 meeting, after which two Wilmer faculty members presented to the group. First, Laura Ensign, Ph.D., shared her research about applying nanomedicine to drug delivery in the eye. Earl Randy Craven, M.D., chief of Wilmer's Bethesda clinic, then discussed plans to increase Wilmer's service to patients in the Washington metro area.



At the meeting, Wilmer Director Peter J. McDonnell awards Meredith Cross the Aida de Acosta Root Breckinridge Award for her commitment to Wilmer and personal fundraising efforts. Pictured here, left to right, Norma Tiefel, the inaugural recipient of the Breckinridge Award, McDonnell, and Meredith Cross.



Laura Ensign and her son Matthew pull off the drape to reveal the plaque naming her the inaugural Marcella E. Woll Professor of Ophthalmology on Wilmer's Professorship Wall.

Dedication of the Marcella E. Woll Professorship in Ophthalmology

Nov. 7, 2018 / Wilmer Eye Institute's Robert H. and Clarice Smith Building

Laura Ensign, Ph.D., received the Marcella E. Woll Professorship in Ophthalmology. When discussing her professional accomplishments, Ensign cited the importance of the support and encouragement from her mentors and family, especially her eldest son. She next discussed her research, which has yielded approaches for administering drugs that lead to increased and sustained drug delivery to precisely targeted cells and tissues. Her research program includes treatments for ocular diseases, gastrointestinal diseases, cancers, conditions related to women's health and microbiome-based disorders.

Vision for the Future

Sharon D. Solomon Recognized as First African American Full Professor in Wilmer History

Feb. 25, 2019 / Maryland State House (Annapolis)

Sharon D. Solomon, M.D., Wilmer's Katharine Graham Professor of Ophthalmology, was honored on both the Senate and House floors at the State House in Annapolis with citations from Gov. Larry Hogan and the Assembly recognizing that she is the first African American to be promoted to full professor in the history of the Wilmer Eye Institute. Sen. Shirley Nathan-Pulliam introduced Solomon, recognizing her for her many accomplishments thus far, including her extensive work chairing various international ophthalmology committees, serving on the editorial board of major journals in her field, and presenting and publishing her research across the globe.



On the Senate floor of the Maryland State House, left to right, Wilmer Director Peter J. McDonnell, Sen. Shirley Nathan-Pulliam, Sharon Solomon holding her citation and Wilmer Director Emeritus Morton Goldberg.

In 1925, the nation's first university eye clinic to combine eye patient care, research and teaching was established, thanks to the generosity of friends and former patients of William Holland Wilmer. Your legacy gift will ensure Dr. Wilmer's legacy continues through education, treatment and pioneering research. Consider these opportunities to leave a meaningful legacy while taking into account your personal goals.

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COURTESY OF DEPARTMENT OF ART AS APPLIED TO MEDICINE,
JOHNS HOPKINS UNIVERSITY'S SCHOOL OF MEDICINE

How did professors teach students and their physician colleagues about eye diseases in the time before we had the cameras and video technologies of today? In the original planning of the Wilmer Eye Institute, administrators set aside space and funding for a medical artist devoted solely to ophthalmology. Annette Smith Burgess (pictured above, standing) was selected to fill this

position in 1926 at the behest of founder William Holland Wilmer.

Over the next several decades, Burgess painted and drew practically all the illustrations that appeared in medical publications covering work and research at the Wilmer Eye Institute. She became the foremost painter of the ocular fundus and a world-renowned ophthalmic artist.

Her prolific career as Wilmer's medical illustrator spanned 35 years until her retirement in the early 1960s.

Today, the Department of Art as Applied to Medicine at Johns Hopkins, where Burgess studied under founding director Max Brödel, celebrates her legacy with an award to honor excellence in ophthalmological illustration.

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