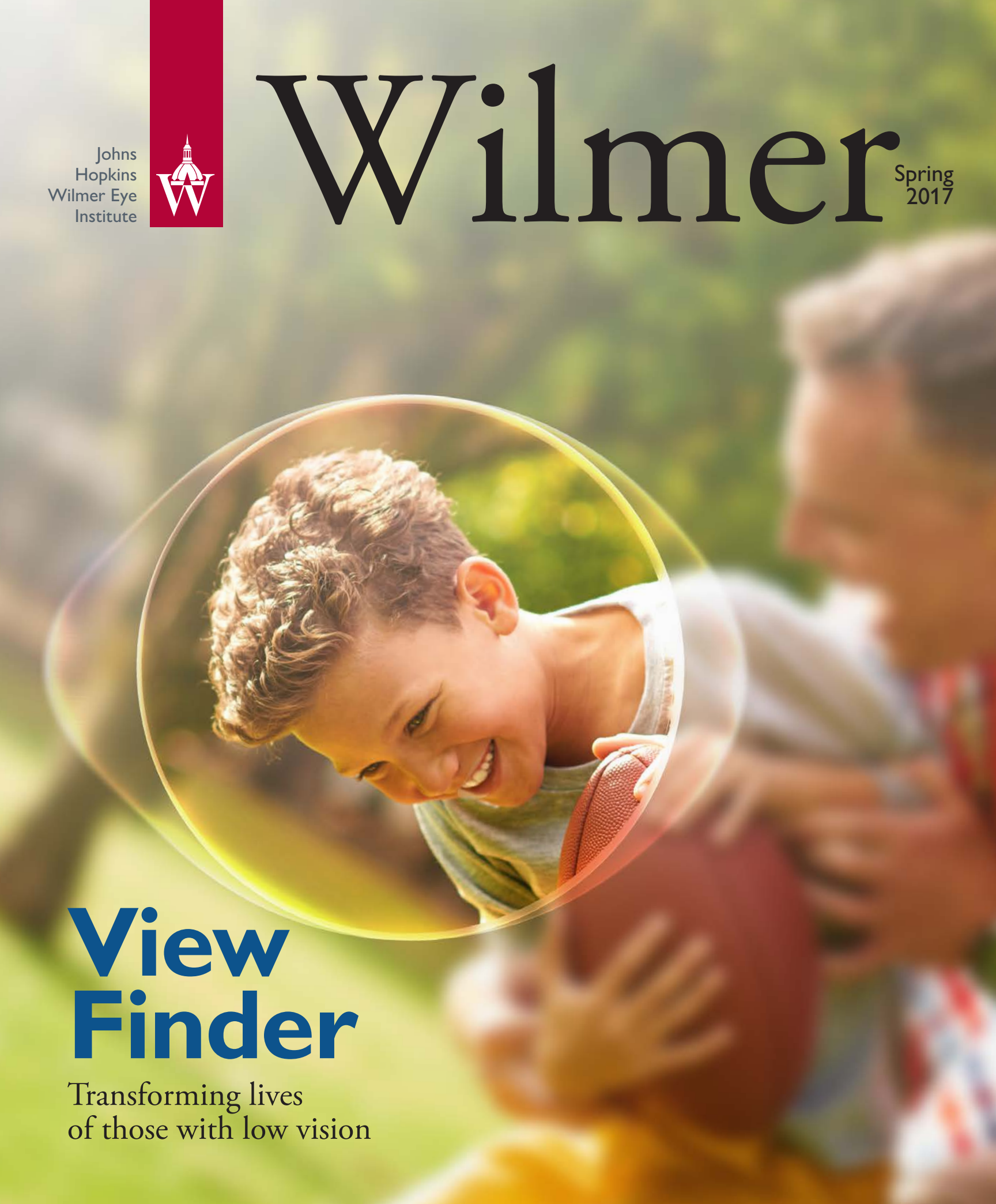
Johns Hopkins Wilmer Eye Institute

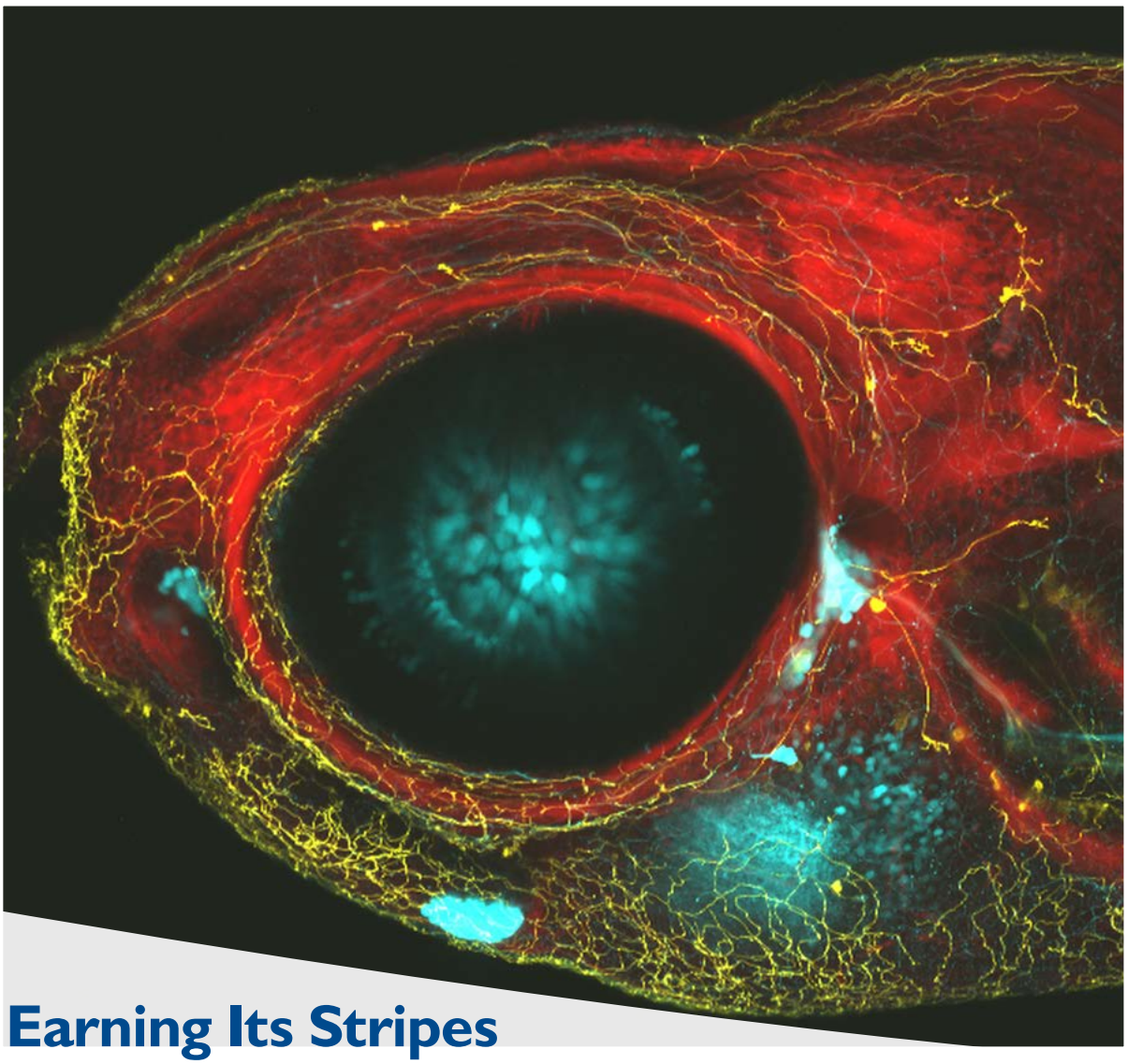
Wilmer

Spring 2017



View Finder

Transforming lives of those with low vision



Earning Its Stripes

The zebrafish has a remarkable capacity for regeneration, making it an ideal test subject for Wilmer's Jeff Mumm, Ph.D., and his colleagues, who use cells from the fish's eyes to mimic degenerative retinal diseases.

Through high-resolution, time-lapse imaging, Mumm and his lab can monitor cell-cell interactions that regulate the regenerative potential of retinal stem cells. Their end goal: to develop therapies to promote self-repair in the human eye.

This image shows the head of a living zebrafish whose genome has been altered to express a blue protein in retinal ganglion cells (RGCs) and amacrine cells—two key cell types in the eye—and a yellow protein in sensory nerves. A red dye provides contrast.

Mumm's team reported its latest findings this past April in the *Proceedings of the National Academy of Sciences*.

Through the lens of the Low Vision Enhancement System. Read more on p. 14.

FEATURES

On the cover: Artist's rendering from the point of view of a person wearing the latest version of the Low Vision Enhancement System developed by the Johns Hopkins Wilmer Eye Institute's Robert Massof, Ph.D., director of the Lions Vision Research and Rehabilitation Center. Read about it on p. 14.

DEPARTMENTS

As I See It

Dear Friends,

"Wilmer has become a breeder reactor." That's the astute comment I received recently from one of my Wilmer Board of Governors members, who went on to praise "all of the amazing things going on in the institute these days: the exciting research projects, the better treatments for patients, the new ways of teaching."

The more I reflect on this board member's observation, the more I agree with his assessment. The Wilmer Eye Institute is a remarkable entity within another remarkable entity, the Johns Hopkins University School of Medicine, and it consists of remarkable people and is supported by a remarkable network of friends, patients and alumni who have chosen to lend their sage advice and philanthropic support.

In this issue, you'll read about a small sampling of the ongoing efforts by members of Wilmer's team to make things even better. Whether it's a group of our laboratory scientists pushing to overcome the barriers that have prevented stem cell therapies from achieving their promise (p. 10) or an assistant professor with a new therapy for the corneal disease known as keratoconus (p. 18), Wilmer people are working to move the needle. And whether it is technology made possible by the investment of tens of millions of dollars (such as the virtual reality system being employed to aid patients with low vision, described in our cover story), or by the $5 and $10 donations of grateful patients (to start up our Emergency Department ophthalmic telemedicine system), these programs are making a difference today—and will do so in the future.

With this issue of our magazine, we introduce a new design, featuring larger type fonts and page sizes to provide improved readability. Prominent section breaks allow for easier navigation. Our new "Looking Forward" and "Looking Back" sections highlight the continuity of our efforts—over Wilmer's 92-year history—to improve how we care for patients and teach the next generation.

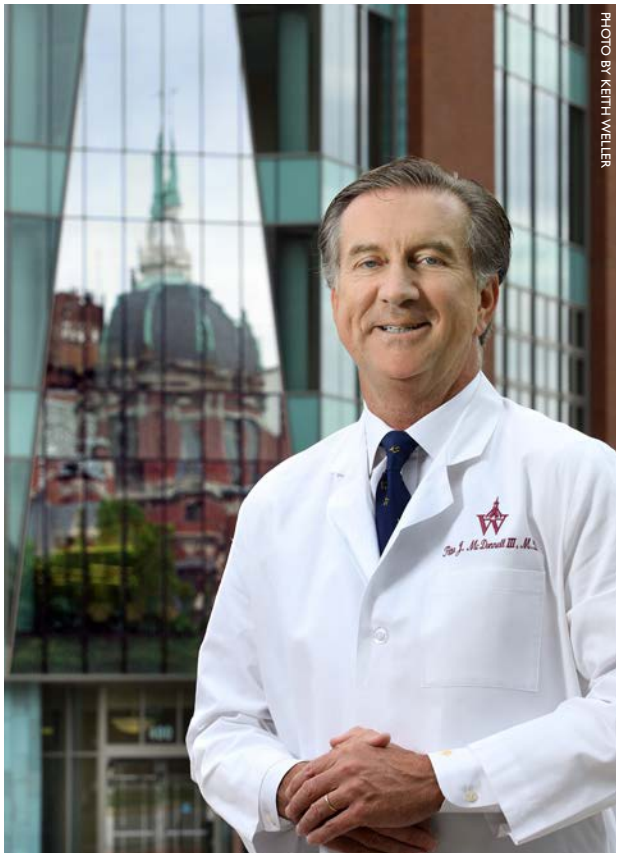


PHOTO BY KEITH WELLER

I will highlight one last important change. The new name of this magazine best summarizes in one word the unique mix of people and talents that have combined to make our institute a "breeder reactor" of new ideas and results—all in our ongoing effort to minimize and ultimately eliminate the human suffering that results from vision loss.

That word is "Wilmer."

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

News

An Expanded New Home for Columbia

TWO YEARS AGO, Wilmer's satellite office in Columbia, Md., was feeling the pinch of rapid growth in its practice, which first opened in 2004. Nine doctors and a full coterie of support staff were crammed in just 5,000 square feet of office space.

In the intervening months, the challenge grew greater, when Wilmer acquired another private practice in Columbia, increasing the number of doctors to 16. Efforts to find a new space accelerated and, in December 2016, Wilmer opened the Columbia practice in its new location in the Medical Pavilion at Howard County. The opening was celebrated with the community on May 1.

"Neither practice had the space to accommodate the full group, so we closed both shops and moved into this great new space," says Percy Jones, clinic manager for Wilmer's Columbia office, who was charged with orchestrating the move.

The new office is a full 10,000 square feet and has a contemporary layout that offers more face time between patients and doctors.

"We engineered a new way of seeing patients," Jones says. "There is no separation between the patient receiving area and the examination space. Doctors and patients interact more."

Left to right: David Glasser, M.D.; Dean Glaros, M.D., medical director of Wilmer's Columbia office; and Percy Jones, clinic manager, in the Columbia office's optical shop.

The upgraded space also includes new, state-of-the-art equipment and some technologies not previously available at the Columbia location. The office now handles more than 1,000 patient visits every week, according to Jones, with every patient being offered Wilmer's same-day appointment option.

"The obvious advantage that separates us from other practices is the vast scope of recognized experts on our staff, which creates an incredible benefit to our patients," says Dean Glaros, M.D., the office's medical director. ■

> "We engineered a new way of seeing patients. There is no separation between the patient receiving area and the examination space. Doctors and patients interact more."
> *—Percy Jones*

Back in Service

How a formerly unused slit lamp camera is transforming emergency eye care

THOUGH MOST PATIENTS would have no clue what it is called, a slit lamp is among the most common diagnostic technologies in ophthalmology.

"It's a very high-power microscope with a high-power light," says Eric Singman, M.D., Ph.D., chief of the General Eye Service at Wilmer. "It allows us to look at and inside the patient's eye. It is the mission critical tool of our business."

When Singman came to the General Eye Service six years ago, he discovered one of his slit lamps was not like the others. It was equipped with a camera—a top-of-the-line Haag-Streit slit lamp camera, to be exact.

Singman saw an opportunity. He knew Wilmer wanted to get more involved in telemedicine, and this unused camera could provide the foot in the door. "A light went off in my head. I thought, 'Imagine what a slit lamp camera could do in the Emergency Department!'" he recalls.

From an educational perspective, residents in the Emergency Department could use the camera-equipped slit lamp to share interesting cases with their mentors and colleagues. In the Emergency Department, the effect might be greater. Doctors would now have high-resolution photographic images of acute conditions that they could use to consult with a specialist

Eric Singman, M.D., Ph.D., right, with Musthapha Saheed, M.D., of Johns Hopkins' Department of Emergency Medicine

> "Now, we have this incredibly powerful tool that is changing how we serve people, and it's all made possible by the patients who benefit most from it." *—Eric Singman*

News

who might be across town—or across the world—via electronic means. From their remote locations, these specialists would know exactly what was going on.

Using the camera for telemedicine "was a no-brainer," Singman says. "It saves time, the patient gets better care and it all costs less than if the specialist had to come into the exam room."

Singman soon found himself pitching his brainstorm to his colleagues. There was one hurdle: money. The camera is expensive, but it was paid for. However, making it useful for telemedicine would require a dedicated computer and software licenses, which cost thousands of dollars. "That doesn't sound like a lot in the big scheme of things, but to the General Eye Service, it's a lot of money," he says.

To help, he turned to small donors. These are patients who appreciate the care they receive at Wilmer and make $5, $10 and $15 donations as a thank-you. Those donations add up to a lot.

"Now, we have this incredibly powerful tool that is changing how we serve people, and it's all made possible by the patients who benefit most from it," Singman says. "It's just a beautiful, generous thing to do." ■

The slit lamp camera makes it possible to consult on cases across town—or across the world.

Zimmer-Galler Tapped to Lead Telemedicine

TELEMEDICINE HAS BEEN much heralded for its ability to bring world-class specialty care to rural and underserved areas through the power of the internet to deliver high-resolution imagery, audio and data. At Johns Hopkins, however, that promise had been largely reserved to a few specialties—retina among them.

"For more than a decade, we had a successful telemedicine program for diabetic retinopathy screening," says Ingrid Zimmer-Galler, M.D., a specialist in the Retina Division at Wilmer. "Now I've been charged with coordinating [telemedicine] efforts across the whole of Johns Hopkins Medicine." Her official title is medical director of the Office of Telemedicine at Johns Hopkins.

While some telemedicine programs have thrived at Johns Hopkins, she says, what was lacking was a coordinated delivery model across the entire system.

"Our experience with the telemedicine diabetic retinopathy program has been a model for us as we broaden the reach Johns Hopkins-wide," she says. "It's exciting to me because it allows us to use technology to increase access to high-quality health care, while bringing down costs and improving efficiency."

The task before Zimmer-Galler is not small. There are six distinct hospitals within the Johns Hopkins Medicine system. In addition to the financial, technical and logistical challenges, she says, there are many hidden hurdles to a broad telemedicine program, including legal, privacy, regulatory and ethical dimensions. All must be considered.

Ingrid Zimmer-Galler, M.D., foreground, demonstrates a remote eye exam conducted by Emmoline Zaza, C.N.A.

Zimmer-Galler's initial telemedicine focus is with Johns Hopkins Community Physicians, a network of hundreds of primary care physicians, specialists and surgeons with offices across Maryland, Washington, D.C., and northern Virginia. A telemedicine system has been implemented to allow patients to have primary care visits with their Johns Hopkins Community Physicians provider from home. Once the video visit system is fully operational, the same platform will allow specialists to join from remote locations and providers to interactively communicate across the Johns Hopkins enterprise and beyond.

For those patients who do not require a physical exam and for those with impaired mobility (such as Parkinson's disease patients), telemedicine is an ideal solution, allowing them to be evaluated in the comfort of their own home and to avoid the time, expense and stress of travel, notes Zimmer-Galler.

"The interest in telemedicine has been huge across Johns Hopkins, and we're now applying the same telemedicine principles in multiple departments, including psychiatry, pharmacy, emergency medicine and pediatric cardiology, to name a few," she says. "Telemedicine brings everyone together." ■

New Additions to the Wilmer Faculty

The following people joined the Wilmer faculty in 2016-2017:

Meghan Kathleen Berkenstock, M.D.
Assistant Professor of Ophthalmology
- Sees patients at East Baltimore and Bel Air locations
- Division of Ocular Immunology

Andrew R. Carey, M.D.
Assistant Professor of Ophthalmology
- Sees patients at East Baltimore, Bayview Medical Center and Bel Air locations
- Division of Neuro-Ophthalmology

E. Randy Craven, M.D.
Associate Professor of Ophthalmology
- Sees patients at East Baltimore and Bethesda locations
- Division of Glaucoma

Amanda Dean Henderson, M.D.
Assistant Professor of Ophthalmology
- Sees patients at East Baltimore and Columbia locations
- Division of Neuro-Ophthalmology

Shannon Shan Joseph, M.D., M.Sc.
Assistant Professor of Ophthalmology
- Sees patients at Bel Air and Green Spring Station locations
- Division of Oculoplastics

Eleanor Min, O.D., F.A.A.O.
Assistant Professor of Ophthalmology
- Sees patients at East Baltimore and Odenton locations
- General Eye Service: Pediatric Eye Care–East Baltimore
- Division of Comprehensive Eye Care–East Baltimore and Odenton

Mira Menon Sachdeva, M.D., Ph.D.
Assistant Professor of Ophthalmology
- Sees patients at East Baltimore location
- Division of Retina

Donald Ural Stone, M.D.
Associate Professor of Ophthalmology
- Sees patients at East Baltimore and Bethesda locations
- Division of Cornea, Cataract and External Diseases–Bethesda
- Division of Comprehensive Eye Care–East Baltimore

Meraf Amde Wolle, M.D., M.P.H.
Assistant Professor of Ophthalmology
- Sees patients at East Baltimore and Green Spring Station locations
- Division of Cornea, Cataract and External Diseases

Jennifer Elisseeff, Ph.D., conferring with biomedical engineering master's student Alexis Parrillo

A New Wave in Regenerative Medicine

Biomedical engineer Jennifer Elisseeff is tapping into the power of the immune system to help stem cells flourish in their mission to rebuild damaged tissue.

Photos by Mike Ciesielski

FOR THOSE AFFLICTED by congenital diseases or traumatic injury, regenerative medicine holds the promise of hope. Led largely by stem cells—those biological marvels with the potential to transform into any other type of human cell—the science of tissue regeneration has garnered great attention in the medical community and in the popular press.

Nowhere in the body is that hope more pronounced than in the eye, where regeneration, it is promised, might someday lead to vision-restoring therapies for everything from cornea repair to retinal transplants.

Jennifer Elisseeff, Ph.D., has been at the vanguard of this effort. Elisseeff is not an ophthalmologist, though she is the Morton F. Goldberg, M.D., Professor of Ophthalmology at Wilmer. No, Elisseeff is an engineer. Her specialty is in creating the very precise biological surroundings in which regeneration can successfully occur.

Over the past 15 years, Elisseeff has patented several biomaterials that serve as a sort of biological scaffolding upon which new tissues can grow. These scaffolds come in many different formulations, but most are water-based gels—hydrogels, in scientific terms—made of collagen fibers. These fibers provide the structure upon which new cells can root themselves, and then the structure is infused with immune signals from the native tissue itself to help regeneration thrive.

While Elisseeff's biomaterials have shown great promise, progress in the broader field of tissue regeneration has been slow, she says.

That's primarily because stem cells

> "The cells we found weren't fighters; they were builders. Suddenly, it made sense: If you have an injury, the immune system becomes a sort of first responder to help in the rebuilding—in healing."
>
> *— Jennifer Elisseeff*

Elisseeff found an eager collaborator in oncologist Drew Pardoll, whose team is studying how different types of T cells work in various ways to help fight cancer.

Drew Mark Pardoll, M.D., Ph.D.
Director, Bloomberg~Kimmel Institute for Cancer Immunotherapy

have failed to flourish, despite being placed in welcoming environments. "I've seen study after study that injects stem cells, and they just disappear," she says. "Stem cells have been a bit of a disappointment, therapeutically speaking."

That could soon change, thanks to a chance encounter in Elisseeff's lab that has launched her into an entirely new research direction. Elisseeff has made a discovery that is turning heads in regenerative medicine. Her newest work shows that the immune system can be tapped to help stem cells better take hold—and thrive.

First Responder to Healing

Elisseeff's journey from ophthalmology to immunology happened almost by accident. During her recent research into the use of her bioscaffolding in regeneration, a peer researcher asked her to test for a type of immune cell she had not thought to look for.

Elisseeff imagined she would find the type of immune cells that fight infection or reject foreign invaders in the body. Instead, she found TH2 immune cells—so-called helper cells. They aid in healing, not fighting disease. It was a surprise, to say the least.

"The terminology of immunology is very militaristic and defense-oriented—fighting this disease and *combating* that invader," says Elisseeff. "But the cells we found weren't fighters; they were builders. Suddenly, it made sense: If you have an injury, the immune system becomes a sort of first responder to help in the rebuilding—in healing."

Elisseeff realized that the TH2 immune cells could be used to recruit and support the stem cells that will become the tissue themselves, and encourage restoration of blood flow to the new tissue.

"What is a stem cell but a seed?" she says. "That seed needs to be planted in the right environment to grow. Our biomaterials provide the right soil. But, even then, we think the stem cell still needs help from immune cells to succeed."

With this discovery, the biomedical engineer who comes to ophthalmology by way of her groundbreaking work on healing cornea damage, found herself headed to Switzerland for a six-month sabbatical at an immune engineering lab.

Such an interdisciplinary approach is becoming more common these days as researchers across the scientific spectrum find their specialties bleeding into others. The phenomenon is known to scientists as "convergence."

Convergence is the sort of phenomenon that comes to life at a place like Johns Hopkins. As soon as she returned from her sabbatical, Elisseeff discovered a world-class immunology center virtually next door at the Bloomberg~Kimmel Institute for Cancer Immunotherapy, which was launched in summer 2016. A team led by Drew Pardoll, M.D., Ph.D., at Bloomberg~Kimmel is studying how different types of T cells work in various ways to help fight cancer. A collaboration quickly developed.

"Cancer research has made great

strides in T cell therapies, and we thought these concepts could be translated to our biomaterials," Elisseeff says.

In the spring of 2016, in her first venture into immunology, Elisseeff published a groundbreaking study in *Science*. In it, she described how her bioscaffolds inspired an immune response that was very favorable to regeneration, attracting helper cells, which then produce a biochemical known as interleukin 4. "Cells in our models secrete a lot of interleukin 4. And interleukin 4 is key to regeneration," Elisseeff says.

Promising Results

The *Science* study is just the tip of the immunology iceberg for Elisseeff.

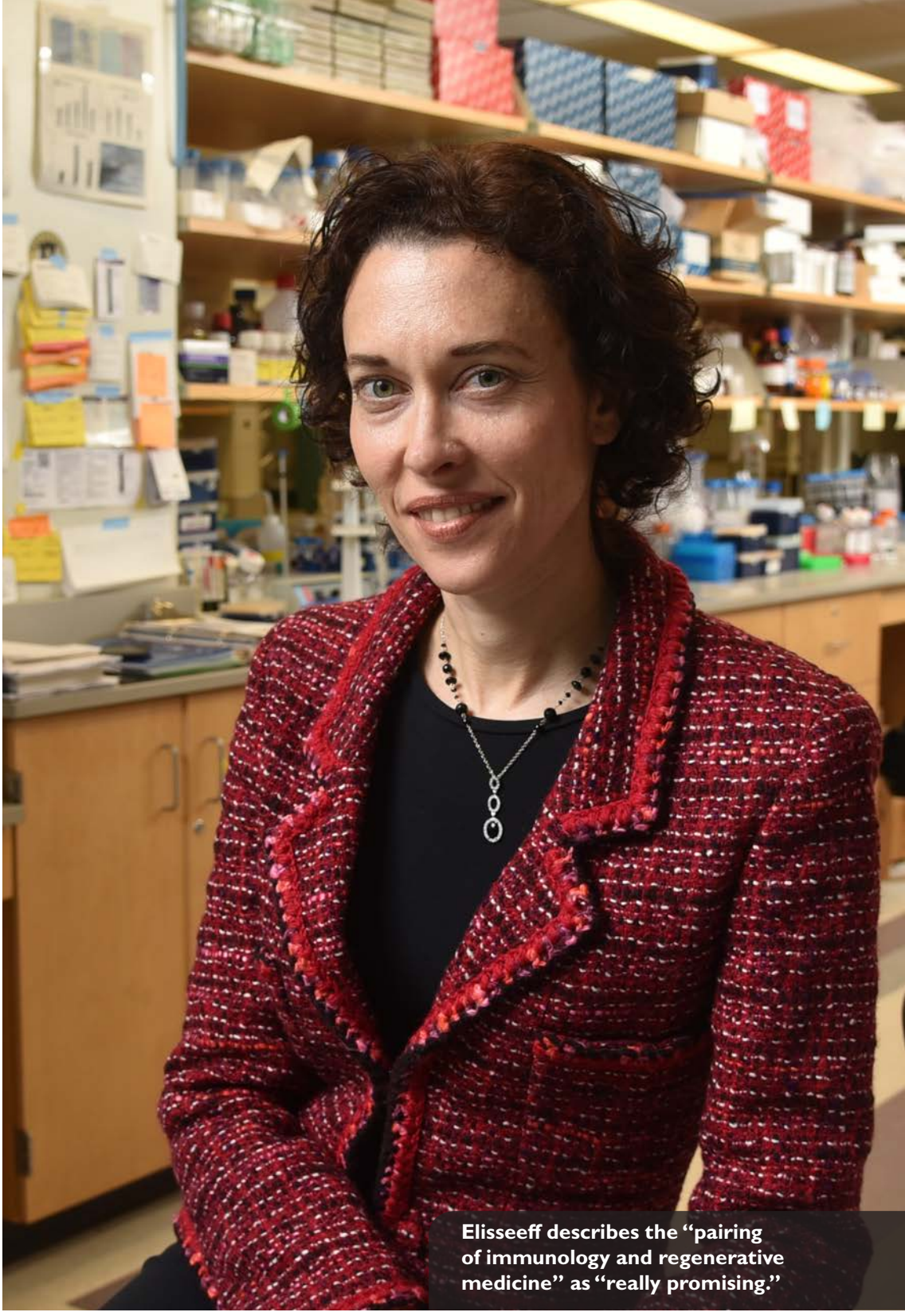
While this specific paper was looking at repairing muscle wounds, the work has profound implications in the eye and other parts of the body, Elisseeff says. She now believes that pairing biomaterials with the immune system could be the key to spurring a new wave in regenerative medicine in the eye.

"Today, corneal immunology focuses on transplant tolerance and rejection. We are considering the role the immune system plays in reducing cornea scarring and promoting regeneration. Someday, we hope, better understanding of these systems in the context of disease might lead to improvements in the cornea, the retina and other areas of the eye as well," she adds.

This new wave in eye medicine will be based on the notion that the immune system is not only a defender against invaders, but also the conductor of regeneration—and many aspects of biocompatibility are necessary for regeneration to occur without rejection.

While Elisseeff's immunology research is in the earliest stages, she hopes that by understanding and manipulating immune responses, she can improve tissue regrowth and repair.

"We think this pairing of immunology and regenerative medicine is really promising," Elisseeff says. "It'll be interesting to see where it leads." ■



Elisseeff describes the "pairing of immunology and regenerative medicine" as "really promising."

View Finder

An off-the-shelf virtual reality product holds the potential to transform life for those with low vision.

BACK IN 1990, Wilmer's Robert Massof, Ph.D., made headlines with a head-mounted video imaging system that could assist people with visual impairments make their way through the world. It provided magnification and enriched contrast that helped people with partial vision loss from conditions ranging from macular degeneration to diabetic retinopathy. These patients were not blind but rather suffered what is known in the field as low vision. Massof dubbed his invention the Low Vision Enhancement System—LVES, or "Elvis," for short.

"While there was a huge amount of publicity at the time and many 'LVES impersonators,' over the subsequent years, the technology hadn't progressed a lot," says Massof. "The components got smaller, but the equipment and the software are still expensive. The original LVES and its descendants were expensive because we had to make everything."

All that changed in recent years with the advent of the Samsung Gear VR—an affordable, high-resolution virtual reality system developed in conjunction with Facebook's Oculus Rift technology. Such systems are regularly advertised on television.

Once the new technology became available, Massof, who was funded by the Lions Club, designed a new LVES to work with an off-the-shelf Samsung Galaxy mounted in a mask worn over the eyes. It looks a bit like a high-tech ski mask covering the entire field of vision. It provides extremely lifelike, three-dimensional images served up by computer—hence the name virtual reality.

The new LVES employs real-world imagery captured by the phone's integrated camera and the 3-D capabilities of virtual reality to improve vision. The application can be tailored to the individual. If the patient has decreased central vision, for instance, the view in the headset has a magnified bubble right in the patient's central field, where the problem is most pronounced.

"After all these years, suddenly you have a consumer virtual reality product that is relatively inexpensive and readily available. We can do a lot of things that just weren't possible a quarter century ago," Massof says.

Back in the 1990s, Massof and team had to do everything on their own. The digital processing, still in its relative infancy, required a full lab for testing and a room of computers to run the code. "Now, you put this

> "After all these years, suddenly you have a consumer virtual reality product that is relatively inexpensive and readily available. We can do a lot of things that just weren't possible a quarter century ago."
> *—Robert Massof*

PHOTO BY JUSTIN TSUCALAS


IrisVision
oculus

mask on, and it's like looking at a 65-inch TV from 2 ½ feet away," Massof says.

The most profound difference is perhaps one of the most important for patients with low vision—facial recognition. In many forms of low vision, facial features appear washed out, making even family members and friends unrecognizable. The old systems were not able to adjust contrast enough to make facial features clearly visible. The powerful image processing capabilities of the Samsung Gear VR system now allow more detail to be seen than ever before, which allows the wearer to distinguish loved ones in a crowd.

One of the other advantages is also one of the least obvious, Massof adds. Image stabilization is important in an image system that operates at high magnification. He likens it to looking through a high-powered pair of binoculars. The image field bounces around with even the slightest movement of the binoculars.

The Samsung Gear VR system provides magnified video of the surrounding environment, but when very high magnification is needed, it lets the user take snapshots that then are displayed on a virtual, IMAX-like projection screen that can be viewed with natural head movements.

Using the virtual projection screen feature, Massof's new LVES even allows the wearer to surf the web, play games and watch streaming video with high magnification. Ironically, one thing the new LVES will not be is a telephone. "We're actually disabling the phone functions," Massof says. "Our visual algorithms and image processing code demand a lot of the computer. The phone functionality only slows things down."

Despite the technical advances, there remains much work to be done before all of the original LVES goals can be

achieved. Massof has been collaborating with a University of California professor who started a company in Berkeley to develop and market the system. An all-inclusive, out-of-the-box version that can be tailored to each buyer's specific visual impairment is now available under the brand name of IrisVision. For the more tech-savvy customer, there will be an a la carte version with an app that can be customized by the patient.

Meanwhile, Massof is pursuing several lines of research, evaluating the technology and conducting studies to scrutinize various image processing methods and algorithms.

"Samsung Gear VR gives us a platform to brainstorm and play," he says. "We can try a lot of things we thought about but never could do before." ■

Legacy of Support for Low Vision

"I appeal to you Lions, you who have your sight, your hearing, you who are strong and brave and kind. Will you not constitute yourselves Knights of the Blind in this crusade against darkness? I thank you!"

–Helen Keller, 1925 Lions Club International Convention
Cedar Point, Ohio, June 30, 1925

In 1956, Hellen Keller presented the Lasker Award to Arnall Patz, M.D., and V. Everett Kinsey, M.D., for discovering the link between exposure to excessive oxygen and the development of blindness in premature infants.

Keller suggested to Patz that he work with the Lions Club, which was active in helping the blind. He concluded that a partnership between the world's largest service organization and the world's leading eye institute, Wilmer, would result in great discoveries that would help people worldwide.

During the period 1978–1985, Patz made several overtures to Lions Club International to encourage the Lions to collaborate with the Wilmer Eye Institute. Spurred by these overtures, support for the partnership grew among the Lions of Multiple District 22, which represents Delaware, the District of Columbia and Maryland.

This led to a day in November 1991 when the Lions and Wilmer announced the creation of the Lions Vision Center at Wilmer. Since that time, the Lions have endowed the center and provided continuous funding and volunteer support to low vision research, rehabilitation and training at Wilmer. ■

In Memoriam:

Albert T. Milauskas, M.D.

By Morton F. Goldberg, M.D., F.A.O.S.
Director Emeritus, Johns Hopkins Wilmer Eye Institute

When Al "Big Al" Milauskas moved from Detroit to begin his residency at the Wilmer Eye Institute in the summer of 1963, he was a diamond in the rough … a very big one, with enormous aptitude and enormous promise. By the end of his residency three years later, he was a highly polished gem and remained so for the rest of his illustrious career in the Palm Springs area of California. He founded the Milauskas Eye Institute in 1980, which thereafter grew to four offices. In his Milauskas Surgicenter, he decorated the rooms with wallpaper images of the Johns Hopkins dome and other mementoes of Johns Hopkins and Wilmer.

He was a Wilmer loyalist, through and through, and was grateful for his education here. He loved our unique traditions and high standards and became extremely generous to his ophthalmic alma mater. Sadly, our greatly admired and highly respected friend, "Big Al," died on December 16, 2016, at the age of 80, following a long illness.

As a co-resident with Al, I observed firsthand and with unbridled appreciation what a gifted ophthalmologist he was, both diagnostically and surgically. During residency, for example, he single-handedly developed a new and terrific technique for diagnosing orbital blowout fractures by injecting a radiopaque fluid, "Hypaque," through the lower lid onto the roof of the orbit. This so-called "Orbitogram" was used successfully for several years before CT scanning was invented.

His landmark book on orbital fractures, *Blowout Fractures of the Orbit: With Clinical, Radiological, and Surgical Aspects*, was published in 1969. He was the sole author. Thereafter, he published and presented more than 80 articles and courses, both nationally and internationally.

Al also created a semi-integrated orbital implant (the Milauskas Implant) during residency to allow better ocular motility and a more natural orbital appearance following enucleation. He was granted a patent for his invention in 1968.

As a superlative, gentle and extremely fast surgeon, Al performed five successful strabismus operations on five young siblings one morning during his residency and finished before noon. As his co-resident, I assisted on all five of them. Whew!

During residency and ever after, Al was always assisted, in every way possible, by his beautiful and loving wife, Dorothy. They were happily married for 54 years. Dorothy and Al had four wonderful children and two grandchildren, and they share Al's happy smile.

Al Milauskas was a giant among the greats of the Wilmer pantheon of unforgettable, innovative and important ophthalmologists. His contributions will remain influential far beyond his lifetime. I miss Al and will always treasure the times we spent together, both socially and in the operating room. ■

"Until recently, no drugs or other treatments were available for keratoconus," says eye surgeon Uri Soiberman, M.D., who recently began offering a new, relatively simple surgery known as corneal cross-linking.

PHOTO BY CHRIS MYERS

Linking to the Future of Keratoconus

IN A SMALL OPERATING room at Wilmer, eye surgeon Uri Soiberman, M.D., delicately peels back the outermost layer of a patient's cornea and applies a few drops of a translucent fluid into the exposed area. Carefully replacing the corneal layer, he then shines ultraviolet light on the area. The whole operation is done in less than 90 minutes.

> This new therapy is near and dear to my heart.
>
> —*Debbie Colson*

Known as corneal cross-linking, this relatively simple surgery, which only became available at Wilmer in late 2016, is cause for celebration for the sufferers of keratoconus, which occurs in about one in every 2,000 people.

"Until recently, no drugs or other treatments were available for keratoconus," says Soiberman. "Patients would often progress to the point where we could no longer correct their vision, and then transplant was the only option to restore vision. But corneal cross-linking gives us a new tool."

With keratoconus, the cornea grows thin and weak, causing the cornea to bulge into a conelike shape. The result is blurriness and double vision that cannot always be corrected with glasses. Keratoconus begins in childhood and, depending upon the severity, grows worse over time. Some patients will have to undergo a corneal transplant in order to regain functional vision.

Corneal cross-linking was developed and evaluated by German scientists about 15 years ago and has been thoroughly tested in humans over the last decade. Only recently, however, has the U.S. Food and Drug Administration approved it for use in patients in the United States. Soon after, Wilmer was one of the first eye institutes in the United States to get a cross-linking system. The system facilitates the delicate surgery by administering a controlled dose of ultraviolet light.

With cross-linking, once the surgeon has peeled off the cornea's outermost layer, or epithelium, he or she applies a series of drops that contain riboflavin—better known as a form of vitamin B2. When exposed to ultraviolet light, riboflavin leads to the production of high-energy molecules that then cross-link the natural collagen fibers in the cornea. The result is a reinforced mesh that strengthens the weak cornea.

Donor Support for Keratoconus Research

Generous donors are partnering with Wilmer to support several key projects aimed at improving the lives of people with keratoconus:

• Why is the composition of the keratoconus cornea altered during the course of the disease? Three Wilmer researchers—Shukti Chakravarti, M.S., Ph.D.; Uri Soiberman, M.D.; and Albert S. Jun, M.D., Ph.D., the Maurice E. Langham, Ph.D., Professor of Ophthalmology and chief of the Division of Cornea, Cataract and External Eye Diseases—are on a mission to find out. Using material gathered from patients who have undergone corneal cross-linking procedures at Wilmer, as well as donated corneas, the scientists are characterizing gene transcripts in this material with next-generation sequencing methods. Their next step involves implementing bioinformatics techniques with this data to narrow down likely genes that contribute to keratoconus.

• Jennifer Elisseeff, Ph.D., the Morton F. Goldberg, M.D., Professor of Ophthalmology and director of the Translational Tissue Engineering Center, has recently developed a protocol to create a biomimetic corneal substitute, which has high transparency, suturability and a complex structure similar to the native cornea. The shape and thickness of the material can be manipulated to create implants for keratoconus, cornea transplantation and even refractive correction. ■

"It is surgery, so it needs to be taken seriously," Soiberman says, "but it's quite painless and takes just an hour and a half or so. We've had quite a few cases, and they're all looking very good."

Cross-linking is not a cure, Soiberman warns. It is more of a maintenance therapy designed to prevent further progression of keratoconus. For the one in five keratoconus patients whose disease is progressing rapidly, cross-linking can mean the difference between a full-scale cornea transplant and a relatively simple outpatient procedure.

Soiberman's work in corneal cross-linking has drawn the attention of many across the Wilmer community. One such admirer is Debbie Colson. She was recently named to the Wilmer Board of Governors and has directly supported Soiberman's study of keratoconus.

Colson's connection runs deep. She has keratoconus, but for her, cross-linking comes a little too late. She has had two corneal transplants. Her experience makes her all the more excited about cross-linking. "This new therapy is near and dear to my heart. Just to be able to provide that bit of optimism to these patients was all the convincing I needed to support Uri's work," Colson says.

While Soiberman is getting his cross-linking program up and running, he is also continuing to assess and fine-tune the cross-linking procedure. One Wilmer colleague, Kraig Bower, M.D., is monitoring the post-operative progress of several patients. Soiberman, meanwhile, is studying the keratoconus epithelium.

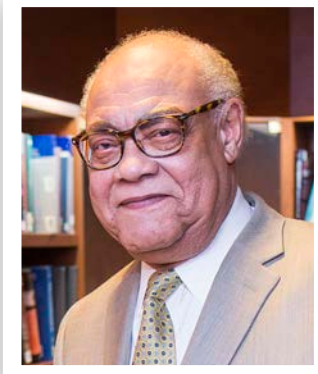
"All of these things require funding. The lab space, the equipment, even things like antibodies that are critical to my research cost hundreds of dollars each. It takes a lot to bake this cake," Soiberman says.

That is where the support of someone like Colson comes in. "Without her," says Soiberman, "all of this would be impossible." ■

Ultraviolet light, when combined with drops of riboflavin into a patient's eye, helps strengthen the cornea's collagen fibers, which have been weakened by keratoconus.

Equipped to Deliver

> We think the division sets a very high mark for professionalism and patient care. And we feel good about supporting Dr. Behrens and the team there.
>
> *—Michael Gooden*



IN 2014, Wilmer Director Peter McDonnell, M.D., asked Ashley Behrens, M.D., to return to Baltimore from a post at the King Khaled Eye Specialist Hospital in Saudi Arabia. McDonnell had a proposal. He wanted Behrens to transform what was then Comprehensive Eye Services into a full-blown division within the Wilmer system.

With the creation of the Division of Comprehensive Eye Care in East Baltimore, that vision is now a reality. The division's three full-time ophthalmologists, three part-time ophthalmologists and six optometrists serve on the front lines of patient care at Wilmer; they are often the first ones any Wilmer patient will see.

"We're pretty much a one-stop shop for most patients; we provide a broad range of services. For more serious cases, we will diagnose and refer the patients to other Wilmer subspecialties," Behrens says.

The division's services include everything from routine exams and eyeglass and contact lens prescriptions to screening and treatment for serious eye diseases, like macular degeneration, diabetic retinopathy and cancer. Cataract surgery, refractive surgery and corneal surgery are the most common in the surgical arena.

The growth of the division has even eased the patient burden on Johns Hopkins' emergency rooms. "We're seeing a lot of patients who usually would have gone to emergency rooms but who really weren't emergency patients. They just didn't know where else to turn," Behrens says. "The Emergency Department has noticed a significant drop in traffic."

Behrens has been chief of the division since its inception in 2014 and has overseen a rapid expansion. As its stature grew, the division ascended from a small area in the basement to occupy the better part of the third floor of the Maumenee Building.

Recently, Behrens celebrated the addition of two brand new exam rooms. "These two fully equipped exam spaces used to be storage rooms. Now, they are busy with patients," Behrens says.

The new exam rooms were made possible in part by generous grants from businessman-philanthropist C. Michael Gooden and his wife, Diane Oksanen-Gooden.

Michael is a patient who came to Behrens a decade ago with multiple severe eye infections that were

Eye to Eye

Ashley Behrens, M.D., with Diane Oksanen-Gooden and Michael Gooden.

proving difficult to treat. After some medical fine-tuning and intensive care, Behrens cured the infections with a treatment developed at his lab. He also performed a cornea transplant and lens replacement to restore Michael's vision.

It was the beginning of a close relationship between Behrens and the Goodens. The couple made a multiyear donation to support Behrens' research before he was assigned to the hospital in Saudi Arabia. When Behrens returned, the partnership picked up right where it had left off.

"We re-engaged with Dr. Behrens. When we heard about the division, we just thought it was a tremendous idea, where patients like me could be examined and treated or redirected to specialties if needed," Michael explains.

"We thought it was just such a positive strategy," says Diane, who nursed her husband through his eye infection scare a few years earlier. "Because we felt so strongly about what he had done for us and we believed in the broader purpose of the division, we supported that sentiment with a donation."

"We think the division sets a very high mark for professionalism and patient care. And we feel good about supporting Dr. Behrens and the team there," Michael adds.

For Behrens, the sort of support the Goodens provide is the difference between having a well-meaning but underequipped division and one that can deliver appropriate care to everyone who comes through the doors.

"The Goodens' support helped us expand the division beyond anything we had ever hoped," Behrens concludes. ■

> "The Goodens' support helped us expand the division beyond anything we had ever hoped."
>
> *—Ashley Behrens*

Johns Hopkins Wilmer Eye Institute Holiday Celebration

December 8, 2016 / M&T Bank Stadium

Wilmer Director Peter McDonnell, M.D., and his wife, Jan McDonnell, M.D., threw a winter holiday party for Wilmer employees and supporters at M&T Bank Stadium. Two honored guests were Ann and Ted Reiver, who are both on Wilmer's Board of Governors and active members of the Lions Club.

Left to right: Peter and Jan McDonnell, Ann and Ted Reiver

The Lions Vision Center at Wilmer 25th Anniversary

November 19, 2016 / Turner Auditorium, The Johns Hopkins Hospital

Left to right: John Shwed, Jim Deremeik, Dr. Judy Goldstein, Ellen Patz

The Lions Vision Research Foundation celebrated its silver anniversary marking the occasion when the Lions Club and the Johns Hopkins Wilmer Eye Institute officially dedicated the Lions Vision Center. Since that time, the Lions have completed an endowment for the center; helped fund the Dr. Arnall Patz Endowed Professorship for the Lions Vision Center; and are currently working to endow the low vision fellowship program. Wilmer is deeply grateful for the Lions' support of research and rehabilitation to improve the quality of life for those with low vision and blindness.

Events

Dedication of the Andreas C. Dracopoulos Professorship

April 20, 2017 / Johns Hopkins Wilmer Eye Institute's
Robert H. and Clarice Smith Building

Daniel Finkelstein, M.D., M.A. theology, received the Andreas C. Dracopoulos Professorship, while Mr. Dracopoulos, co-president and director of the Stavros Niarchos Foundation, looked on from an audience filled with Finkelstein's colleagues, friends and family. Wilmer Director Peter McDonnell, M.D., welcomed everyone to the ceremony, held in Wilmer's Smith Building, after which Landon S. King, M.D., executive vice dean of the Johns Hopkins University School of Medicine, presented the professorship. Also in attendance was Johns Hopkins University President Ronald J. Daniels, J.D., LL.M. Wilmer Director Emeritus Morton F. Goldberg, M.D., spoke about Finkelstein's long career at Wilmer during a lunch many guests hailed as a highlight of Johns Hopkins' events they had attended.

Left to right: Daniel Finkelstein, M.D., M.A. theology, and Andreas C. Dracopoulos, co-president and director of the Stavros Niarchos Foundation, listen to speakers at the dedication of the Andreas C. Dracopoulos Professorship.

Wilmer Director Emeritus Morton F. Goldberg, M.D., gives a talk honoring Daniel Finkelstein, M.D., M.A. theology, which included highlighting when Finkelstein met Pope John Paul II.

Charles Eberhart, M.D., Ph.D., speaking after receiving the inaugural Wilson-Whitener Professorship

Dedication of the Charlotte A. Wilson and Margaret K. Whitener Professorship of Ophthalmology

April 27, 2017 / Johns Hopkins Wilmer Eye Institute's Robert H. and Clarice Smith Building

Charles Eberhart, M.D., Ph.D., received the Charlotte A. Wilson and Margaret K. Whitener Professorship of Ophthalmology, in front of an audience that consisted of "as many pathologists as ophthalmologists," said Wilmer Director Peter McDonnell, M.D. This is fitting, as Eberhart directs the divisions of both Neuropathology and Ophthalmic Pathology. Landon S. King, M.D., executive vice dean of the Johns Hopkins University School of Medicine, awarded the professorship to Eberhart.

Legacy Society Luncheon

April 27, 2017 / Johns Hopkins Wilmer Eye Institute's Robert H. and Clarice Smith Building

The Johns Hopkins Wilmer Eye Institute celebrated members of its Legacy Society at a luncheon after the dedication of the Wilson-Whitener professorship. The Society honors the enduring legacy of Mr. Johns Hopkins and the individuals who choose to follow in our founder's footsteps by making a life-income gift or a bequest. Jeanne Wolfe, who spoke at the luncheon, is a 2016 inductee into the Legacy Society through a bequest to Neil Miller, M.D.,'s optic nerve research in memory of her late husband, Don Wolfe.

Neil Miller, M.D., the Frank B. Walsh Professor of Neuro-Ophthalmology, and Mrs. Jeanne Wolfe

Events

Board of Governors Meeting

April 27, 2017 / Johns Hopkins Wilmer Eye Institute's Robert H. and Clarice Smith Building

Wilmer Director Peter McDonnell, M.D., and Chairman of the Board, Sanford Greenberg, Ph.D., offered an update on the state of the institute to Wilmer's Board of Governors. Following the board's discussion, Megan Collins, M.D., presented an update on Vision for Baltimore, an initiative that grew out of the Baltimore Reading and Eye Disease study (BREDS), which Collins led.

Wilmer Director Peter McDonnell, M.D., listening to Megan Collins, M.D., a Wilmer pediatric ophthalmologist

Events

Dedication of the Arnall Patz Distinguished Professorship

April 27, 2017 / Johns Hopkins Wilmer Eye Institute's Robert H. and Clarice Smith Building

Kannan Rangaramanujam, Ph.D., received the Arnall Patz Distinguished Professorship, after a talk about the life of the late Arnall Patz, M.D., given by his daughter Susan Patz. Kannan, who is co-director of the Center for Nanomedicine, then spoke about the promise of nanotechnology-based targeted drug delivery systems to treat a variety of seemingly unrelated diseases that share one common attribute: inflammation. He showed how therapies targeting inflammation can have a profound impact on AMD, diabetic retinopathy and corneal diseases, making early detection and therapy possible.

Left to right: Susan Patz, Arnall Patz's daughter; Santhalakshmi Rangaramanujam, Kannan's mother; Kate Poole, Patz's granddaughter; Agaram Rangaramanujam, Kannan's father; Ellen Patz, Patz's wife; Kannan; Sujatha Kannan, M.D., Kannan's wife; Kannan's three children: Gokul, Harini and Vishnu.

'Wilmer Was It'

Six years ago, Karen Wimberly found herself living in a world that didn't look quite right. After a contractor's utility light was accidentally shone in her face, her eyes didn't readjust for several days. "It was like looking through a slice of Swiss cheese," she says. "I was afraid I was starting to have a stroke." This led her husband, Gene, to take her to the Emergency Department near their home in northern New Jersey, and then to an ophthalmologist, who referred her to a retinologist.

Despite eye drops and a taper pack of steroids, "It was getting worse," she says. "And I thought, I cannot wait. I better find somebody quickly and somebody who knows what they're doing. Once it got to that point, Wilmer was it."

Wimberly already had an indirect connection to Wilmer. David Knox, M.D., had treated her mother, Grace Bakerjian, for a rare condition called panuveitis, a serious inflammation of the uveal tract of the eye. "She was treated at Wilmer for about 12 years. My parents were living in central New Jersey at the time, and my father said he could make that drive down the turnpike with his eyes closed," she says. Back then, doctors believed her mother's disease was a "freak, isolated illness."

But 30 years later, when Wimberly reached the age her mother had been at the onset of her disease, she began to have symptoms. "What we know now is that for my mother and me, it's a rare, genetic autoimmune disorder," she says. Jennifer Thorne, M.D., Ph.D., the Cross Family Professor of Ophthalmology, in Wilmer's Division of Ocular Immunology, made the diagnosis and currently treats Wimberly.

"Before I got to Dr. Thorne and before the treatment really started working, I was in pain every day," says Wimberly. But since becoming Dr. Thorne's patient, "I've not had a bad day for a long time."

Thorne, says Wimberly, is a brilliant doctor who also has a very "reassuring quality." Wimberly adds, "I have become very fond of her."

When Wimberly lost both her mother and her father within several months of each other in 2016, gratitude for both her and her mother's treatment led Wimberly and her husband to explore a philanthropic relationship with Wilmer. That's when she learned that Johns Hopkins offers a charitable gift annuity—a way to give that would benefit Wilmer's future while providing Wimberly and her husband with lifetime income and tax savings.

To establish a charitable gift annuity, the donor transfers cash or appreciated securities to Johns Hopkins, which invests the funds and pays up to two beneficiaries (including the donor, if desired) guaranteed payments for life. After the passing of the last beneficiary, the balance of the annuity is given to the area of Johns Hopkins as intended by the donor.

Jennifer Thorne, M.D., Ph.D.; Karen Wimberly holding a photo of her parents; David Knox, M.D.

"It was a way to honor my parents' memory and to thank both Dr. Knox and Dr. Thorne for their care. It just seemed like a very reasonable thing to do all the way around," says Wimberly.

A health care social worker until her recent retirement, Wimberly appreciates the opportunity to give back. "Jesus healed the blind," she says. "These doctors are doing God's work." ■

For information about charitable gift annuities, contact the Office of Gift Planning at 410-516-7954 or 800-548-1268, email giftplanning@jhu.edu, or visit rising.jhu.edu/giftplanning.

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Wilmer Dispensary, 1929

A picture of Wilmer's Dispensary (or Outpatient Clinic) from the 1929 pamphlet, "The Wilmer Ophthalmological Institute," prepared for the formal dedication of the institute and given to the attendees.

Wilmer

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The mission of the Johns Hopkins Wilmer Eye Institute is to use and develop the finest scientific evidence to promote improved ophthalmic care and the reduction of visual disability in a collaborative environment that combines compassionate patient care, innovative research, and the training of future leaders in ophthalmology and visual sciences.

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