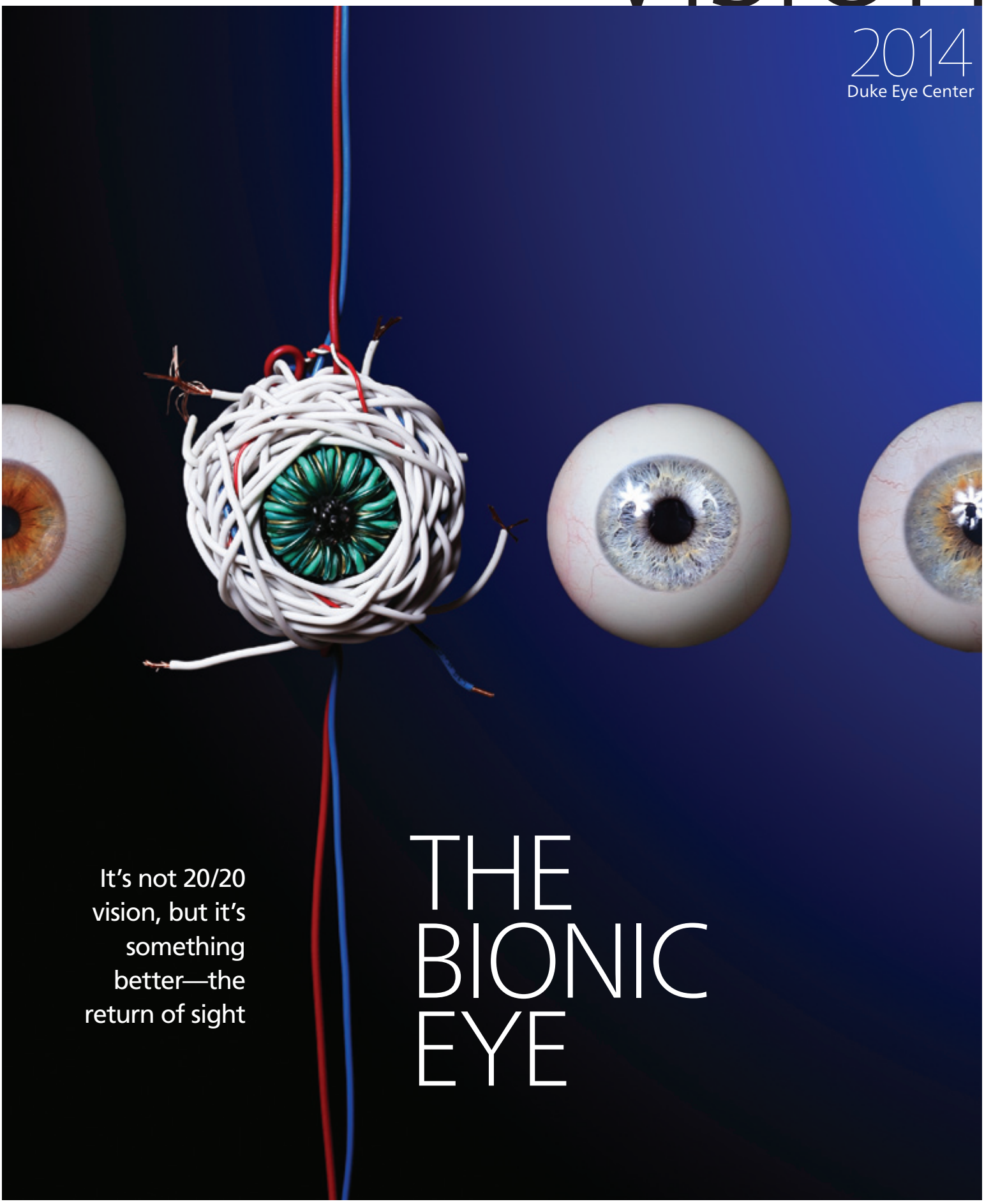
vision

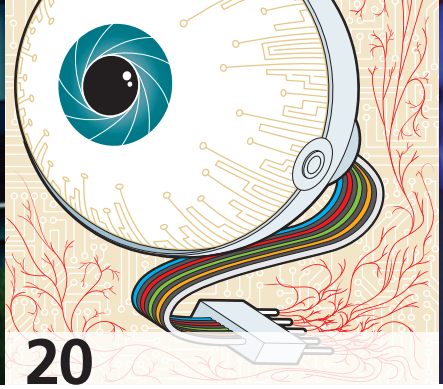
2014

Duke Eye Center



THE BIONIC EYE

It's not 20/20 vision, but it's something better—the return of sight



VISION

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Q&A with David L. Epstein

WHAT EXCITES YOU THE MOST ABOUT THE DUKE EYE CENTER TODAY?

Very soon there will be a search committee from the Duke University School of Medicine to choose my successor as chairperson of ophthalmology. I am currently in my 22nd year as chair, having overseen a greater-than-six-fold increase in faculty size, along with expansion of our three missions of patient care, research, and education. And it's a probing question as to what I am most excited about today given this long-term perspective.

First of all, I am so proud of our faculty, fellows, residents, and students, and the transforming culture of inquisitiveness and innovation that has been created in the Duke Eye Center through everyone's efforts. In addition, the faculty has created a very special environment focused on true breadth and depth in what I like to call "disease teams" of clinical faculty, MD clinician-scientists, and PhD basic scientists. And my prediction is with the research components of the Albert Eye Research Institute and the modernization and expansion of clinical facilities in the new Hudson Building, the Duke Eye Center is poised to be the true national leader in innovation in ophthalmology. What I am most proud of is the unity of culture of inquisitiveness that has expanded logarithmically under my watch as chair. The faculty and all the trainees are truly the hope for the future of improving the care of patients with eye disease worldwide.

So I am most excited about the culture of innovation that exists among all at the Duke Eye Center, including our Eye Center Advisory Board members, who are committed to us beyond "bricks and mortar," but also to our people and programs for the future good of patients with eye disease. In fact, my dream is for there to be an ocular innovation center in the new Hudson Building that brings together students, trainees, and faculty from various other schools at Duke. It would be a working laboratory for innovations focused initially on ophthalmology, but then scalable to other components of the Duke University School of Medicine and Health System. The components are all here, and the Duke Eye Center can be the catalytic nexus to make it happen.

When the time soon comes for me to step down as chair, it's this continuing vision of the Duke Eye Center—as a center for innovation—in which I hope to continue to be an organizing ambassador.

I hope you will share this vision for ocular innovation at Duke and with me help enable a special destiny for the Duke Eye Center in transforming innovation. And this is truly what I am most excited about!

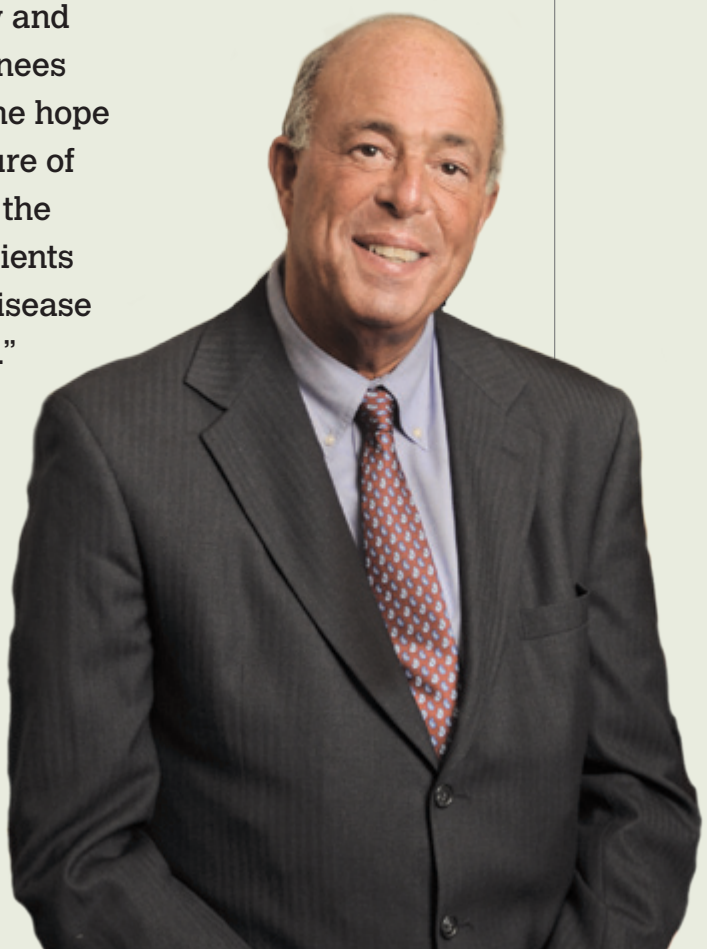
Sincerely,

David L Epstein M.D.

David L. Epstein, MD, MMM

Chair, Department of Ophthalmology

"The faculty and all the trainees are truly the hope for the future of improving the care of patients with eye disease worldwide."



Milica Margeta

Margeta selected for Machemer Research Award

Milica Margeta, MD, PhD, was selected for the prestigious Robert Machemer Resident Research Award for her project "CSF protein levels in children with idiopathic intracranial hypertension (IIH)." Her work was presented in June at the 2013 Duke Eye Center Residents and Fellows Day.

The Robert Machemer Research Award, established in 1999, recognizes a resident whose clinical or basic science research proposal demonstrates high intellectual curiosity and outstanding scientific originality, and has a significant impact on the clinical management of persons with ophthalmic disease. The award honors Robert Machemer, MD, a past chair of the Duke Department of Ophthalmology.

Michael Allingham

Wei Huang

Heed Award winners

Current fellows Michael Allingham, MD, PhD, and Wei Huang, MD, PhD, have been awarded the prestigious Heed Ophthalmic Foundation Fellowship. The Society of Heed Fellows is a public charitable and educational foundation that provides funding for postgraduate studies in ophthalmology and the ophthalmic sciences. Beginning with the appointment of the first fellow in 1989, the society has provided more than $430,000 in support of its mission.

Young appointed to NIH and WIO

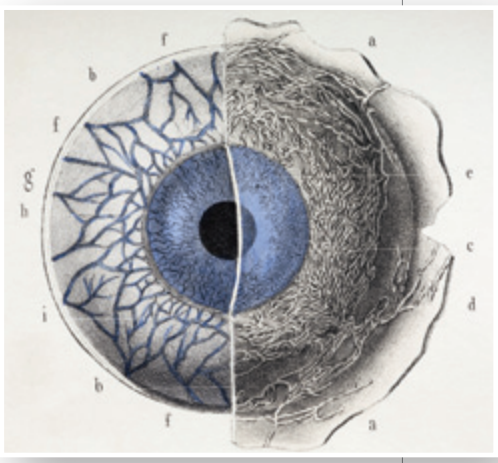
Terri Young, MD, has been named a member of the Diseases and Pathophysiology of the Visual System Study Section in the Center for Scientific Review at the National Institutes of Health for a six-year term that began in July 2013. Members are selected on the basis of their demonstrated competence and achievement in their scientific discipline, based on their research accomplishments and publications in scientific journals.

Young was also appointed to the Women in Ophthalmology (WIO) board of directors as treasurer for two years. She began her term in January 2013. Women in Ophthalmology was founded in the mid-1970s to enhance and improve the professional environment for women ophthalmologists. WIO encourages diversity, impartiality, and economic parity, and strives to cultivate new opportunities for leadership, education, and public service in the field of ophthalmology now and for future generations of women.

Paloma Liton

Liton awarded Young Investigator Grant

Paloma Liton, PhD, has been awarded the 2013 Alcon Research Institute (ARI) Young Investigator Grant. This grant is intended to encourage and to promote the early career development of clinicians and scientists entering research in vision science and ophthalmology. Liton will receive $50,000 to support her research into the investigation of the potential role of alpha L-iduronidase (IDUA), a lysosomal enzyme involved in the degradation of glycosaminoglycans, in the pathophysiology of ocular hypertension and glaucoma. Only eight researchers from around the world are selected for this award each year.



Epstein receives Fuqua appointment

David L. Epstein, MD, MMM, has received an appointment as a visiting research scholar in Duke's Fuqua School of Business (while he continues as chair of the Ophthalmology Department) and will be involved in strategic issues relating to educational and research program initiatives.

Vajzovic receives Knights Templar Award

The Grand Commander of Knights Templar of North Carolina awarded new Duke Eye Center faculty member Lejla Vajzovic, MD, with a $50,000 check earmarked for research. Vajzovic won a national competition for research funding from the national Knights Templar Eye Foundation. The foundation previously supported direct patient care costs and in 2010 moved to redirect their efforts to support pediatric ophthalmology research. Members of the North Carolina chapter, centered in New Bern, were very proud that the funding remained in state this year.

Lejla Vajzovic

Kratz inducted into ASCRS Hall of Fame

Former Duke ophthalmology and ENT resident ('51) Richard P. Kratz, MD, DSci, who advanced ophthalmology through his adoption and early teaching of phacoemulsification, was inducted into the American Society of Cataract and Refractive Surgery (ASCRS) Hall of Fame on April 20, 2013.

Kratz was chief of ophthalmology and ENT in the US Army 49th General Hospital in Tokyo, Japan, finishing his service in 1947. He is or has been a member of 15 ophthalmological societies and is a founding member of ASCRS, the Contact Lens Association of Ophthalmologists, the Joint Commission on Allied Personnel in Ophthalmology, and the National Ophthalmological Society. He has served as president, chairman, or board member of several societies and has received numerous awards and given many honorary lectures.

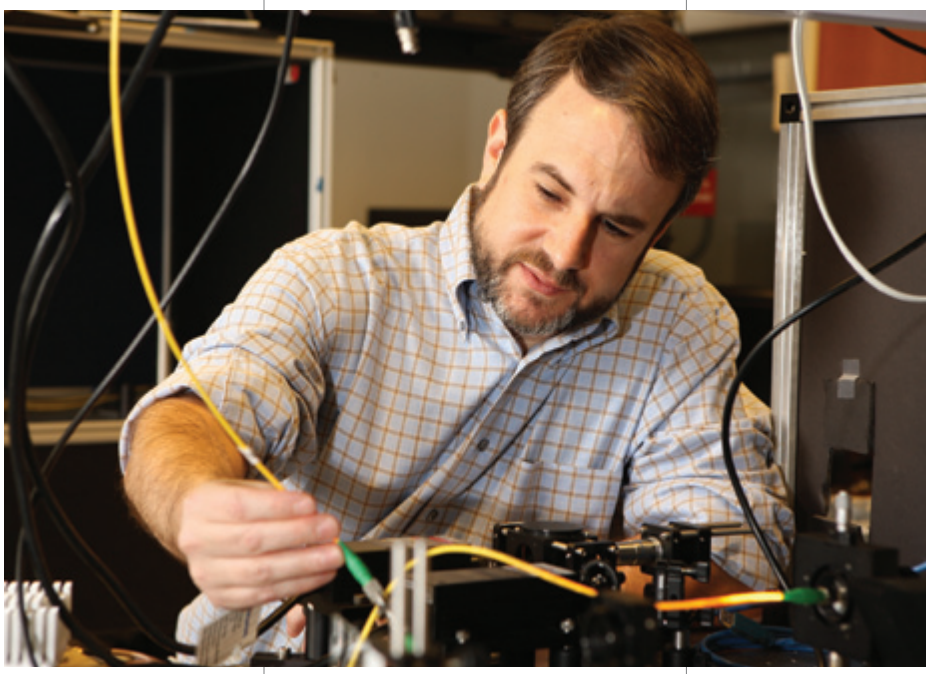
Kratz is clinical professor of ophthalmology, emeritus, at the University of Southern California, Los Angeles, and the University of California, Irvine. He continues being active at UC Irvine on the Ophthalmology Department Steering Committee and on the Beckman Laser Institute's Board of Directors.

Several awarded RPB grants

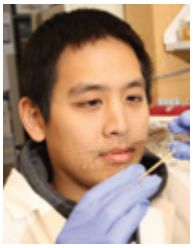
Daniel Saban, PhD, was awarded a $250,000 Research to Prevent Blindness (RPB) Career Development Award. The RPB Career Development Award Fund was established in 1990 to attract young physicians and basic scientists to eye research. To date, the program has given awards to 171 vision research scientists in departments of ophthalmology at universities across the country.

A $110,000 RPB grant was awarded to Duke Eye Center to support research into the causes, treatment, and prevention of blinding diseases. The research will be directed by David Epstein, MD, chair of the Department of Ophthalmology.

Adam Wax, PhD, of the Duke University Pratt School of Engineering, has been granted a $100,000 RPB Innovative Ophthalmic Research Award. The award, established in 2011, provides flexible funding to basic scientists engaged in collaborative research with an ophthalmology department, with the goal of understanding the visual system and the diseases that compromise its function. New technologies and cutting-edge research that apply to blindness, yet developed outside of a department of ophthalmology, will be supported through this award. Wax is one of six researchers at six institutions who have received this award since it was established.



Adam Wax



Terry Singhapricha

Darryl Overby

Medical student Terry Singhapricha was awarded a $30,000 RPB Medical Student Eye Research Fellowship. This award will enable Singhapricha to take a year off from medical school and to devote that time to the pursuit of a research project within the Duke Department of Ophthalmology.

Duke University School of Medicine received an RPB International Research Scholar Award in the amount of $1,800 to support Darryl Overby, PhD, in researching the causes, treatment, and prevention of blinding diseases. RPB's International Research Scholar Awards enable foreign scientists to collaborate with their American counterparts in eye research. Upon returning home, investigators are expected to apply their new knowledge to the prevention and treatment of eye diseases.

RPB is the world's leading voluntary organization supporting eye research. Since it was founded in 1960, RPB has channeled hundreds of millions of dollars to medical institutions throughout the United States for research into all blinding eye diseases. To date, the organization has awarded grants totaling $6,398,350 to the Duke University School of Medicine.

Arshavsky, Epstein honored at ARVO

Vadim Arshavsky, PhD, the Helena Rubinstein Professor of Ophthalmology at Duke University and scientific director at Duke Eye Center, received the 2013 Proctor Medal, the top award from the Association for Research in Vision and Ophthalmology (ARVO), recognizing his outstanding research in the areas of experimental ophthalmology and visual sciences. Arshavsky has been studying signal transduction in the vertebrate retina for more than 25 years. A large body of his work has been devoted to addressing one of the most fascinating properties of vision: the ability to rapidly follow the ever-changing visual environment, so that the entire visual scene can be "refreshed" within a fraction of a second. He received the Proctor Medal jointly with Theodore Wensel, PhD, from the Baylor College of Medicine, for demonstrating how this phenomenon is achieved at the molecular level.

David Epstein, MD, chair of the Department of Ophthalmology at Duke University, was chosen for the Mildred Weisenfeld Award for Excellence in Ophthalmology, presented annually to an individual in recognition of distinguished scholarly contributions to the clinical practice of ophthalmology. Epstein has been widely considered to be one of the most influential leaders in the world of glaucoma and glaucoma research for the past 30 years. He has developed novel drugs for the treatment of glaucoma, leading to 10 patents that involve all aspects of ophthalmic patient care and treatment.

Arshavsky and Epstein were presented with their awards at an ARVO awards banquet in May 2013.

Ophthalmic Technician Program Graduation

The 2013 class of the Duke Ophthalmic Technician Training Program included 11 graduates, all of whom passed their required credentialing tests on the first attempt.

CORRECTION

In the 2012 issue of VISION, we incorrectly identified Parag Gandhi, MD, as the recipient of the 2011 ASOPRS Merrill Rhee Pathology Award. The correct recipient was Alan Proia, MD. Gandhi was a coauthor on the paper that was recognized. Gandhi served as the proxy recipient of the award on behalf of Proia as he could not attend the meeting. We apologize for any confusion.

Journal Club meets

Eye Center learners gather at the home of chair David Epstein, MD, for dinner and discussion about the latest in glaucoma research.

Toth receives Award of Merit in Retina Research and WIO Mentorship Award

Cynthia Toth, MD, received the coveted Award of Merit in Retina Research from the Retina Research Foundation (RRF). The award was established in 1978 by RRF to recognize outstanding vision scientists whose work contributes to knowledge about the retina and retinal diseases. Funding for the Award of Merit in the amount of $50,000 is provided by RRF through a series of endowed gifts that are dedicated to the award. The recipient is chosen by the Awards Committee of the Retina Society based on the selection criteria of a single outstanding achievement in retina research, or a potentially significant contribution to new knowledge about the retina, its role in the visual process, and/or vitreoretinal diseases or disorders.

Toth was also honored by Women in Ophthalmology (WIO) with the Mentorship Award. In recognition of the value WIO places on mentorship, the WIO Mentorship Award was created to reward outstanding mentors in the ophthalmology community. Awardees have had a sustained career commitment to mentoring, a significant positive impact on their mentees' careers, research, and patient care in the field of ophthalmology.

Glenn Yiu

Yiu honored as Michels Fellow and by AUPO/RPB

Glenn Yiu, MD, PhD, a Duke Eye Center retina fellow, has been selected by the Ronald G. Michels Foundation as the 2013 Michels Fellow. The Ronald Michels Fellowship Foundation Award is granted annually to outstanding second-year vitreoretinal fellows currently training in the United States. The foundation was established in 1991 to honor the memory of Dr. Michels, who trained more than 40 surgical fellows and was renowned for his work and research on vitreoretinal disorders.

Yiu was also chosen to present at the 2014 Association of University Professors of Ophthalmology/ Research to Prevent Blindness (AUPO/ RPB) Resident and Fellow Research Forum in January 2014. His abstract is titled "Characterization of the choroid-scleral junction and supra-choroidal layer in healthy subjects on enhanced-depth imaging optical coherence tomography."

Dianna Seldomridge

Dianna Seldomridge, MD, returns to Duke

Dianna Seldomridge, MD, former Eye Center resident, has returned to Duke as a clinical associate. After finishing her residency at Duke, she completed fellowship training at Chicago Cornea Consultants. Seldomridge then worked in both private practice and academic settings. Now at the Duke Eye Center of Winston-Salem, she practices comprehensive ophthalmology with focus on cornea and cataract care. She has a particular interest in patient education and preventive care. Seldomridge also serves or has served on multiple committees and boards for the American Academy of Ophthalmology and the American Society of Cataract and Refractive Surgery.

Intense Pulsed Light Therapy: **Relief for Dry Eyes**

A new procedure frees patients from artificial tears and improves their quality of life

Evaporative dry eye is a disease that drastically affects the lives of millions of people, causing chronic pain, discomfort, and loss of vitality. With few treatments available for evaporative dry eye disease—which is caused by meibomian gland dysfunction (MGD)—those who suffer from it often have to deal with an hourly regimen of artificial tears to moisten their eyes, combined with other therapies such as frequent hot compresses and eyelid scrubbing.

Duke Eye Center's Preeya K. Gupta, MD, offers new hope for longer-lasting relief in the form of intense pulsed light (IPL) therapy.

The light therapy targets the fine blood vessels called telangiectasias and shuts them down, helping relieve the inflammation.

Patients should consider IPL if they have symptoms such as chronic redness in the eyes, irritation, blurry or fluctuating vision, fatigue in the eyes, and not being able to read or use a computer for long periods.

Learn More

Learn more about IPL and other dry eye treatments offered at Duke at **dukeeye.org**

IPL is well tolerated by patients. If patients are interested in IPL, Gupta begins with a comprehensive evaluation of the eyes and dryness to determine if they will likely respond well to the therapy. Good candidates have telangiectasias, dysfunction or thickening of the oil secretions, poor flow of the oil secretions, or any signs of chronic inflammation.

The procedure itself takes 15 minutes or less. The eyes are protected with a shield. A cool ultrasound gel is placed over the skin of the treatment areas, since the light therapy feels similar to the sensation of mild sunburn. Most patients need four treatments (one treatment every three to six weeks) to see the full benefit of IPL.

"These procedures don't require patients to do anything differently after they go home," says Gupta. "For busy, active people, it really improves their quality of life, and many patients become less dependent on artificial tears and other dry eye therapies."

However, IPL isn't for everyone. Because the light is also absorbed by melanin, the pigment molecules in skin, the treatment works best for fair-skinned people.

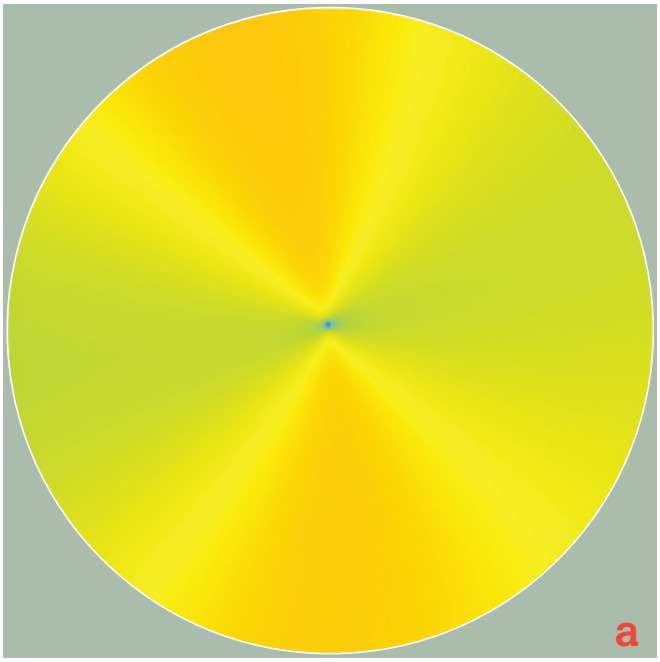
IPL is also not a permanent cure. The blood vessels grow back, and the glands can become dysfunctional again. On average, after the initial four visits, patients will need treatment once a year.

A related dry eye therapy, Lipiflow, can also relieve gland obstruction, but it works differently than IPL. The two treatments can be complementary or synergistic, and some of Gupta's patients receive both.

In addition to relieving evaporative dry eye and eliminating the need for constant artificial tears, IPL also appears to help slow the progression of MGD and ocular rosacea. MGD worsens over time with chronic untreated inflammation that can result in the glands scarring, and can become very difficult to treat. Likewise, untreated ocular rosacea can cause scarring of the cornea, which results in loss of vision.

Gupta sees the rapid changes that IPL produces and is glad to be at the forefront of evaporative dry eye treatment.

"IPL relieves the burden of dry eyes," she says. "Patients don't have to think about their eyes as much and can better enjoy their lives."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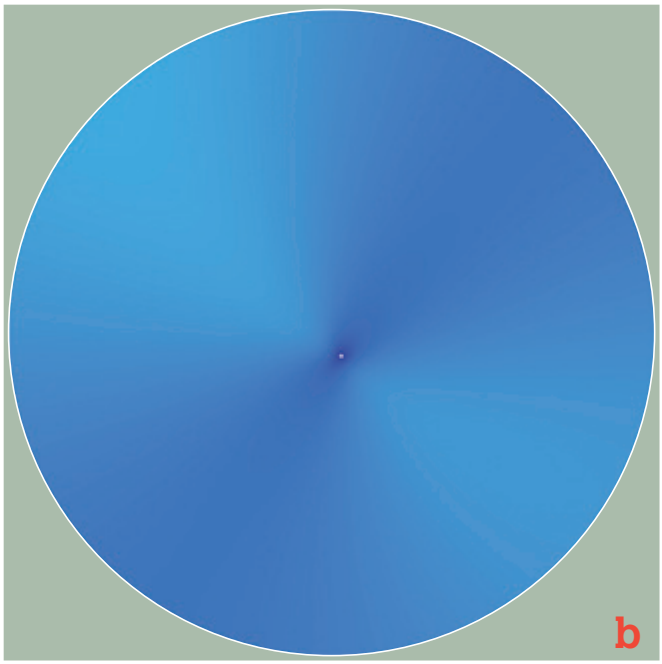
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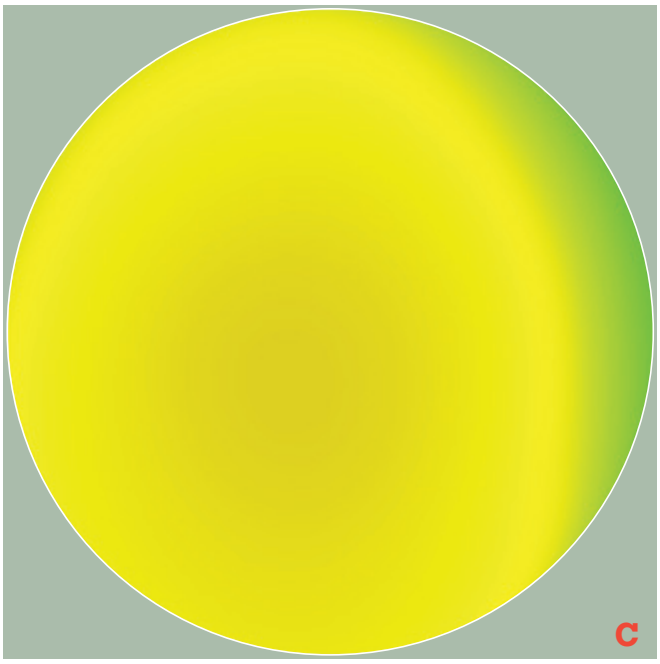
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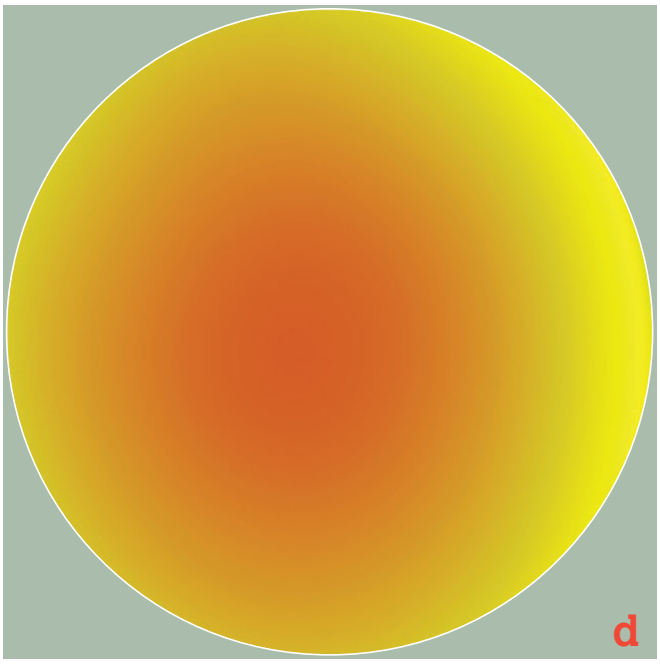
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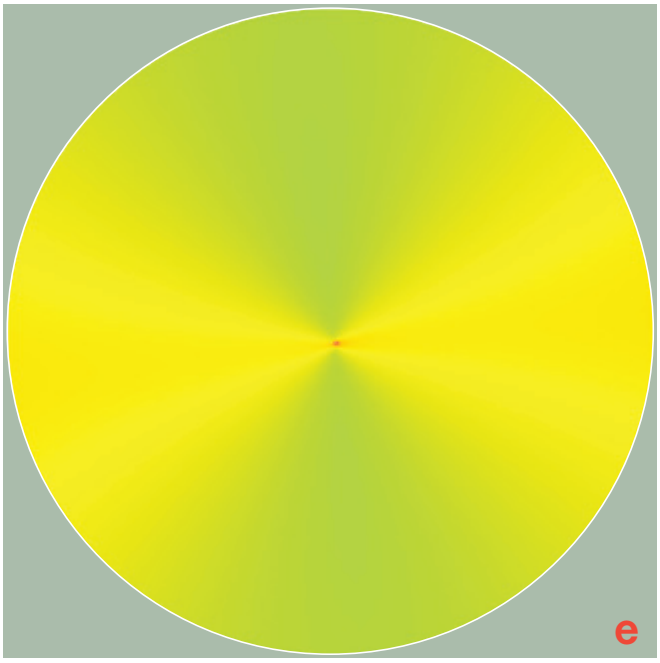
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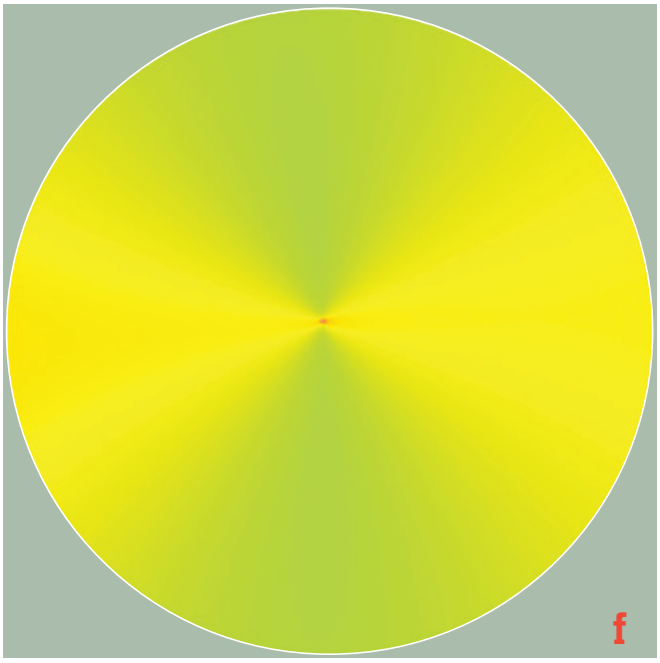
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Revealing Details:
Corneal Measurement with OCT

In ophthalmology, exact measurements can make all the difference in improving vision. But physicians don't always have the tools they need to make accurate assessments. That's where research from Duke Eye Center physician-scientists like Anthony Kuo, MD, comes in.

The problem facing Kuo: Corneal keratometry and topography are the current clinical standards for corneal power measurement, which is essential for correcting vision surgically. However, these measurements can break down—notably in patients who have had laser refractive surgery.

Patients who choose laser refractive surgery such as LASIK reap the immediate benefit of better vision without the need of corrective lenses. But many years later, when these patients age and need cataract surgery to replace the lens of their eye, physicians have trouble measuring the power of their LASIK-corrected cornea. Because corneal power is used to select the artificial lens power in cataract surgery, a successful glasses-free cataract surgery outcome in someone who has had LASIK becomes very difficult.

Kuo is tackling the problem with an innovative approach. With Duke Biomedical Engineering professor Joseph Izatt, PhD, he is pioneering the use of optical coherence tomography (OCT) as a tool for corneal power measurement, and their findings show great promise.

OCT is an imaging technology that works similarly to ultrasound. But instead of sound, it measures how long it takes light to bounce off tissues. Because light travels faster and at a higher frequency than sound, OCT can quickly produce extremely detailed images. The device scans across the eye and the images are stitched together to form a composite picture of the eye. The technology was developed in the early 1990s by researchers at MIT, and today it is mainly used for retinal imaging for diseases such as macular degeneration, diabetic retinopathy, and glaucoma. Izatt developed the earliest cornea OCT systems in the 1990s while he was at MIT.

Kuo believes OCT offers the potential for full tomographic imaging of the cornea with micron-scale measurement of the anterior and posterior surfaces, both of which are crucial components in solving the LASIK and cataract surgery issue.

OCT introduces depth at a higher resolution into the picture, allowing much finer corneal measurements than has been possible before.

"The cornea is not just the front of the eye. There's a thickness and a back curvature to it. Those affect its optical properties," says Kuo. "Keratometry can't determine the thickness or the posterior curvature directly. Our goal is to get OCT to measure those."

The technology also has the advantage of being easy on patients. OCT uses infrared light, so patients hardly notice it. The device only needs seconds to capture an image and is already in most clinics.

But OCT technology does present challenges for use in corneal power measurement. Kuo, Izatt, and graduate student Ryan McNabb

Micron-scale measurements

a OCT measured front corneal curvature before LASIK showing astigmatism (orange regions).

b Same cornea after LASIK showing substantial decrease in astigmatism.

c OCT measured corneal thickness before LASIK of cornea in A.

d Same cornea after LASIK showing expected thinning from laser treatment.

e OCT measured back corneal curvature of cornea in A before LASIK showing additional astigmatism of this back surface.

f Same cornea after LASIK showing no change in this back surface as would be expected as only the front surface is treated in LASIK.

have worked to address these problems. Distortion is the biggest obstacle they are working to overcome. Light bends as it moves through the different tissues of the eye. That means the image of the eye produced by OCT is distorted. The team developed algorithms to correct the images into accurate representations of the eye, which then can be used for measuring.

To test the correction algorithms, they began first by using OCT on glass balls, then on multi-surface contact lens, before finally moving to human subjects.

Actual eyes presented additional difficulties during OCT image capture, since they move due to activities like breathing. Even the slightest movement adds additional distortion in the image. Izatt, Kuo, and McNabb developed a method to filter out movement distortion as well as correct for optical distortion.

With the algorithms in place, the team has achieved power measurement differences comparable to the current standards in both normal corneas and corneas that have had LASIK, while offering the depth information that other methods lack.

Scientists at other academic medical centers are researching related technologies for improving corneal imaging and measuring. One such technology, called Scheimpflug photography, also provides a 3-D corneal image, but it can't match the resolution of OCT.

"We believe the higher resolution of OCT will produce a superior image to the photographic technique, resulting in more precise measurement," Kuo says.

OCT is being used for more than just measurements at Duke. In a collaboration led by Izatt and Duke Eye Center's Cynthia Toth, MD, Kuo is also using OCT for real-time assessments during cataract and corneal surgery so that in the future, surgeons can determine if any adjustments are needed before the patient leaves the operating room. With an OCT device integrated into the surgical scope, surgeons can capture images without interrupting the procedure and make instant decisions based on the results of the images.

Kuo says he has always been interested in how technology can improve medicine; his research into OCT continues to reveal more about the promise of technology and the difference it can make in patients' lives.

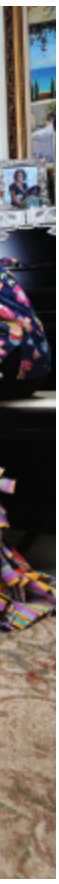
Low Vision

New relationship

Low vision patient Josephine Correia (left) learned how to "sew" without needles through specialized in-home occupational therapy with Tomeico Faison of Therapeutic Solutions. Correia sells the blankets she makes with all proceeds going to local charities and community centers.

Occupational Therapy

with Therapeutic Solutions makes it possible



LOW VISION AND OLDER DUKE EYE CENTER patients can now enjoy the benefits of specialized occupational therapy (OT)—the recent fulfillment of a seven-year objective of Diane Whitaker, OD, chief of the Low Vision Rehabilitation Service.

"Occupational therapy, especially OT designed for vision-impaired individuals, can help people with low vision perform everyday activities with more ease, and remain independent longer. We are very excited to make it available to our patients," says Whitaker.

One problem: The demand for OTs specializing in low vision is higher than the supply. Since traditional OT training does not include low vision specialization, occupational therapists must seek postgraduate certificates to gain expertise in this area.

Whitaker searched for the most efficient and effective way to bring a full-time, specially trained OT into Duke. She contacted Tomeico Faison, an OT who earned her low vision rehabilitation graduate certificate and rotated through Whitaker's clinic several years ago. "We started talking about collaborating to provide these special low vision OT services at Duke and felt like a partnership would be a win-win for all, especially our patients," says Whitaker.

Faison said she sought out Whitaker because she was the first optometrist she met who understood OT. "I had worked in a psychiatric hospital and noticed that many of these patients had impaired vision. I wanted to do something more preventative to keep folks with low vision from landing in a hospital. After my certification, I added low vision services to my company, Therapeutic Solutions, which provides specialty OT across North Carolina."

The two resumed their communications last winter, and the opportunity arose for a collaboration between Duke and Therapeutic Solutions. As a result, the Duke Eye Center began offering low vision OT to patients this spring, starting at the main clinic, and with the goal of providing services in the homes of Duke patients throughout the state.

With professional services provided by Therapeutic Solution's Ailse O'Neill, Faison works to support patients to live where they want to live and participate in what they love to do, be it cooking, sewing, reading, fishing, or anything else. O'Neill, who has been at Duke three to four days a week since early April, focuses on lighting, assistive technology, falls prevention, and environmental modifications to help patients return to a higher level of independence and participation.

"We get people back to doing the things that are meaningful in their lives by focusing on their strengths. We can make environmental changes and use new technology to problem solve together," says O'Neill.

O'Neill loves being part of this important initiative. "Dr. Whitaker has such a vision about how OT can really benefit Duke patients, and it's so rewarding to be in on the beginning of something big."

> **"Comprehensive low vision rehabilitation proactively promotes successful aging by utilizing a multidisciplinary team of providers."**
>
> Diane Whitaker

Not atypical, Duke is on the cutting edge of a pivotal trend.

"With baby boomers aging, everyone is looking at the growing elderly population," says Whitaker. "People are experiencing declines in their hearing, cognition, physical abilities, and vision. Comprehensive low vision rehabilitation proactively promotes successful aging by utilizing a multidisciplinary team of providers. Occupational therapists bring unique skills to the mix, such as functional mobility assessments to prevent falls, driving evaluations, and numerous techniques and devices to maximize safety and functional ability."

A future goal is to have additional OT specialists train at Duke, so they can provide home visits to patients. Since Therapeutic Solutions hires OTs all over North Carolina, patients far from the Triangle could save hours of driving and receive in-home training. OT training is frequently done in a series for maximum benefit, so home visits will make this kind of support more conveniently available to Duke patients.

According to Whitaker, only the top ophthalmology programs in the country offer comprehensive low vision rehabilitation services. "It's exciting and very rewarding to see this model finally become a reality at Duke," she says.

If ROP is detected early enough, the risks of retinal detachment and subsequent blindness can be decreased.

Screening for **Retinopathy** of Prematurity in **Developing Countries'** infants

As health care improves throughout the world, new challenges arise for ophthalmologists. And Duke Eye Center's S. Grace Prakalapakorn, MD, MPH, is at the forefront of meeting one of those challenges.

Retinopathy of prematurity (ROP) can occur in premature infants because the retina has not fully formed in utero. After birth, ROP can result in a detached retina and blindness. With improving neonatal care available throughout the world to help premature babies survive, ROP is now appearing in areas where it was not previously seen.

If ROP is detected early enough, the risks of retinal detachment and subsequent blindness can be decreased. But early detection in developing countries poses a challenge. Not only is there a shortage of ophthalmologists available in areas of Africa, Asia, Latin America, and even remote areas of the United States, but there is also a general worldwide shortage of experts who are trained to screen for the disease.

Prakalapakorn believes she and her colleagues have found an effective and cost-efficient way to offer screening in remote areas, while training providers how to screen at the same time.

"Ophthalmology is very visual by nature," she says. "The imaging modalities we use transcend cultures and time." She wants to take advantage of imaging opportunities—and existing ophthalmologic practices—to improve screening for ROP.

Through a project she began in September 2011 with her Duke Eye Center colleagues David K. Wallace, MD, MPH, and Sharon F. Freedman, MD, Prakalapakorn is examining whether images taken during routine indirect ophthalmoscopy exams can be used to screen for ROP remotely. They believe that anyone performing the exam can capture an image of the back of the eye using a camera integrated into the indirect ophthalmoscope. The image can then be sent to trained graders for screening.

For her preliminary research, Prakalapakorn used images taken by indirect ophthalmoscopy and collected over years of routine ROP examinations to see if they could be used to accurately detect plus disease, one of the characteristics of ROP.

She had graders compare the exam images to the reference standard image for plus disease. Her initial findings are positive: Graders who looked at the images showed good sensitivity and specificity for identifying babies with worrisome disease. Next she plans to see if the images can also be used to accurately detect zone and stage, the other two elements in ROP screening.

Images acquired during indirect ophthalmoscopy offer an affordable alternative to other telemedicine technologies in consideration to solve this growing problem. Many researchers are testing RetCam to screen for ROP, but RetCam is bulky, expensive, difficult for a novice to use, and requires contact with the front surface of the infant eye. Indirect ophthalmoscopy, on the other hand, is less expensive and is a routine skill that ophthalmologists acquire as part of their training.

In addition to immediately improving outcomes for babies with ROP, Prakalapakorn sees long-term improvement possible with the novel method. In the process of working with remote graders, health providers in developing countries could also be trained to screen for ROP.

Prakalapakorn presented her initial findings at the American Association for Pediatric Ophthalmology and Strabismus annual conference in April. If research continues to be promising, she plans to takes steps to implement in the field.

AMD

Exploring a Complex Disease

Age-related macular degeneration (AMD) affects more than 15 million people in the United States—and that number is expected to double by 2030. An even more startling fact: 80 percent of people over the age of 80 will develop AMD in some form. But despite its prevalence, the disease remains a mystery in many ways. With few treatment options available, AMD represents an unmet need in ophthalmology and a major area of focus for the Duke Eye Center.

Nora Lad, MD, PhD, is one of the researchers at Duke leading the charge to better understand AMD and, ultimately, find more treatments.

"There are a lot of pieces of the puzzle in this very complex disease," Lad says.

AMD is a multifactorial disease that shows up in different forms in different people. In general, it's a degenerative retinal disease that results in loss of central vision. Dry AMD, the initial form of the disease, can result in either advanced dry AMD or become wet AMD, in which blood vessels behind the retina can leak.

"There's a lot of variability within AMD," she says. "We wonder if there's a single golden bullet that can treat all forms."

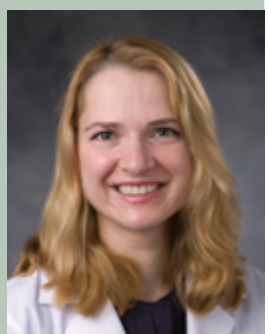
> "We wonder if there's a single golden bullet that can treat all forms."
>
> Nora Lad

Lad and her colleagues at the Duke Eye Center offer the latest treatments for wet AMD and are engaged in several research efforts to develop therapies for dry AMD.

WET AMD TREATMENTS

Recent advancements in wet AMD treatments show promise in helping to stop leaks in the eye and repair damaged vision. The latest therapies target the protein vascular endothelial growth factor (VEGF) and stop the blood vessels from growing behind the retina.

Treatments—such as Macugen, Lucentis, and Avastin—are injected into the eye and can help stabilize patients with wet AMD. However, not all patients respond to them. Clinical trials have shown that Eylea, a new treatment for



Nora Lad, MD, PhD
Assistant Professor
Ophthalmology
DIBS Faculty

wet AMD, could be more effective, Lad says, though more real-world results are needed to show if that turns out to be true.

DRY AMD RESEARCH

Other than a vitamin and mineral supplement known as AREDS formula, no dry AMD therapies are available. The first step to developing effective treatments is learning more about the disease.

"We don't understand the mechanism of dry AMD enough," Lad says. Together with her mentor, Scott Cousins, MD, Lad is conducting translational research with the goal of developing drugs that target specific pathways involved in dry AMD.

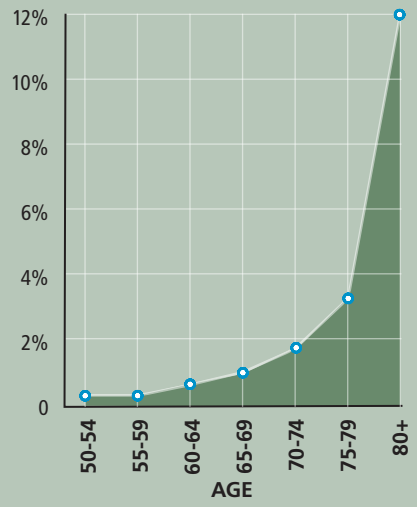
Duke is involved in two concurrent clinical studies that aim to better understand dry AMD. Lad is leading a Duke-initiated study to evaluate visual function impairments in patients with early dry AMD; meanwhile Cynthia Toth, MD, is the site principal investigator at Duke for an NEI-initiated multicenter study into AMD phenotype and genotype.

"These studies will give us detailed information about the visual function and health of [patients'] retina in dry AMD as compared to normal retina. These visual function measures will become important research tools in the development of ocular drugs for this important disease," Lad says.

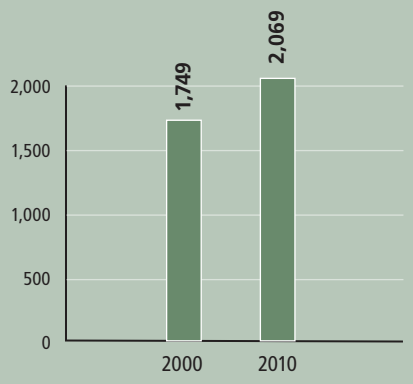
In addition, Lad is leading research into how providers treat wet AMD with existing anti-VEGF drugs. Using data from the Medicare database, the Duke team is looking for treatment patterns across the United States. Their initial findings suggest that the disease is undertreated. The goal of the effort is to understand why that is and how to improve the outcomes.

With these efforts and others in the pipeline, Duke remains dedicated to finding ways to treat AMD—and even stop its progression—for the millions who suffer from it, and the millions more who will face the disease as they age.

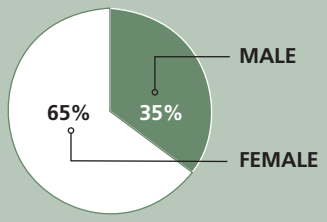
By the Numbers: Age-Related Macular Degeneration (AMD)



PERCENTAGE RATES OF AMD BY AGE
U.S. Population in 2010



ACTUAL CASES OF AMD
(in thousands)



PERCENTAGE OF CASES BY GENDER

source: National Eye Institute, National Institutes of Health

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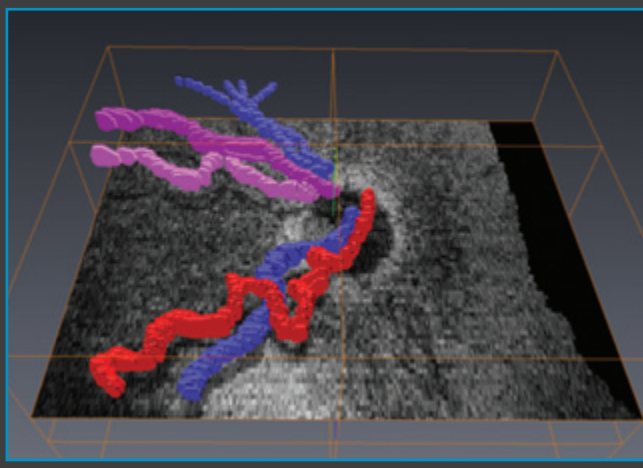
Through the Eyes of Babes: SDOCT Technology & 3-D VESSEL VISUALIZATION at DARSI Lab



IMAGINE TAKING A TRIP INSIDE THE EYE, where you could touch the vessels of the retina and see abnormalities like macular edema up close. Thanks to technology pioneered by Duke, ophthalmologists can study eye diseases—in a virtual environment.

In collaboration with the Duke Immersive Virtual Environment (DIVE), members of Duke Eye Center created a way to use high-resolution spectral domain optical coherence tomography (SDOCT) scans to create 3-D visualizations of the vessels within the eye.

The effort, led by Cynthia Toth, MD, and Ramiro Maldonado, MD, from the DARSI (Duke Advanced Research in Spectral Domain Optical Coherence Tomography) Lab, is just one manifestation of OCT developments coming from the lab. OCT is similar to ultrasound; it shows highly magnified depth in the eye, so layers of the retina can be seen, for example. The lab focuses on improving the diagnosis and care of eye disease through new applications of OCT.

For the past few years, the lab has specifically delved into how to use OCT to enhance the understanding of eye diseases in children. The technology, as it developed over the years, wasn't suited for newborn infants because the machines were designed for adults who could be still and hold their head upright in front of the tabletop-mounted OCT "camera." But the benefits of OCT images for newborn infants hold great promise, especially in helping to evaluate diseases like retinopathy of prematurity, a disease that can result in blindness in premature babies.

To that end, the lab, with participation from Duke Eye Center's Sharon Freedman, MD, and David Wallace, MD, enrolled more than 100 newborn infants and children into the research program after first obtaining approval and consent from parents. The results have helped shape how OCT is used in children. For the research, the team initially used an investigational OCT system developed by a North Carolina company, Bioptigen Inc., in Research Triangle Park. That system was not available for pediatric use, but in 2010, Maldonado, Toth, and colleagues showed how OCT imaging with such a system could be achieved in babies.

The research findings included changes to OCT methods for adults to adjust for the smaller infant eyes. The team's research also showed that OCT imaging could be achieved without needing to touch the eye with an instrument. Many guidelines they developed are now in use by doctors throughout the world.

As a result of the changes, physicians looking at OCT images could see features in the eye that they could not find with a traditional ophthalmoscope. One of the most important discoveries was that with OCT, physicians could see macular edema (swelling in the center area of the retina) in premature babies. Since babies can't explain their symptoms, an OCT scan appears to be the only way to find the swelling.

"The severity of the macular edema we found was impressive. This gives us motivation to continue investigating the significance of this new finding," says Maldonado. The team continues to research this area.

The DARSI Lab is hardly resting on its laurels. Maldonado, using novel 3-D volume rendering techniques, provided new insights into the nature of abnormal vessels that occur in premature infants. These visualizations allow ophthalmologists to see microvessels in ways they haven't before, hopefully providing a greater level of sensitivity to identifying problems. The DARSI Lab is currently using the technology to study the different features of these abnormal vessels versus the normal vessels in premature infants.

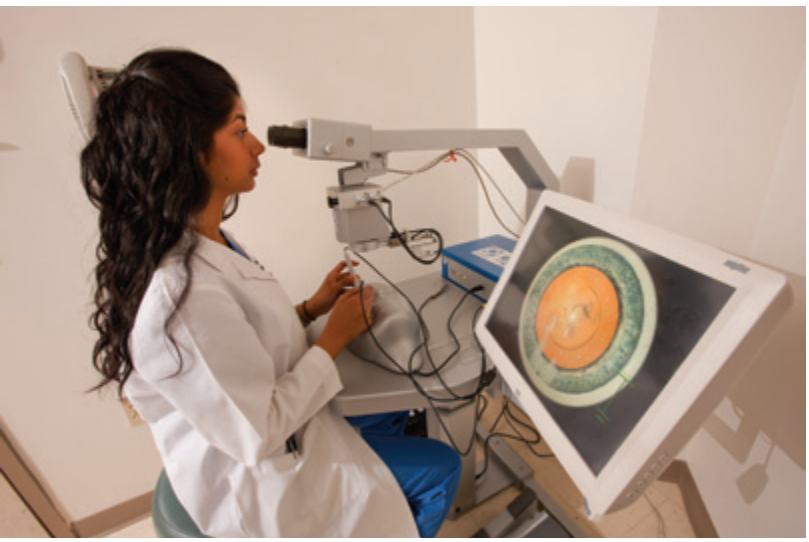
> **"This new view, immersed in the eye, changed our understanding of the healthy and diseased tissue. It was beautiful and educational."**
>
> Cynthia Toth

In February at DIVE, Maldonado demonstrated his 3-D visualization technology during a conference that brought together an international audience of pediatric imaging experts. The technology left quite an impression on leaders in the field.

"People were amazed to see these features as though they were inside the eye," says Maldonado. Toth, who also participated in DIVE, notes, "This new view, immersed in the eye, changed our understanding of the healthy and diseased tissue. It was beautiful and educational."

Toth says she and Maldonado are grateful to Duke Eye Center donors such as The Andrew Family Foundation, The Hartwell Foundation, Research to Prevent Blindness, and the National Institutes of Health, who all supported this work. She points out that support from individuals and foundations were the lifeblood for the earliest advances made by this group.

MATLAB Revolutionizes Training for Ophthalmology Surgery Residents and Fellows



Duke Ophthalmology residents and fellows can now train with MATLAB at the Durham VA Medical Center with no risk to patients.

In early 2013, a virtual reality eye surgical simulator made its debut at the Durham VA Medical Center and has since revolutionized training for Duke ophthalmology residents and fellows. Developed by VRmagic, the eye surgery simulator or "Eyesi," housed in the center's MATLAB (Microsurgical Advanced Technique Lab), now provides the opportunity to train on a multitude of diagnostic and surgical skills, especially cataract and vitreoretinal surgery procedures, without risk to patients.

The debut of the MATLAB was a dream of Sharon Fekrat, MD, associate professor of ophthalmology and vitreoretinal surgeon at Duke Eye Center, director of the Duke Retinal Vein Occlusion Center, and chief of ophthalmology at the Durham VA Medical Center. "Until now, we could only offer a wet lab experience, where trainees could gain practice suturing pig eyes and creating cataract incisions," says Fekrat. "But there are so many other fine motor skills that are essential in surgery, especially in ophthalmology. I envisioned a new wet lab training environment that was always stocked with supplies, available for our trainees, and which offered a variety of options." The MATLAB is now a reality, with administrative director Kuruvilla Kurian, nursing director Grace Worthington, and Fekrat serving as faculty director.

The 100-square-foot MATLAB is divided into two sides, referred to as the "dirty" side and the "clean" side. The dirty side includes "old school" microscopes, expired and disposable lens implants, and instruments such as blades, as well as pig eyes used for suturing practice and wound creation. It also includes an outdated cataract surgery machine and a retinal vitrectomy machine. On the clean side is the surgical simulator, which is used for learning maneuvers for cataract and vitreoretinal surgery that cannot be replicated on the dirty side. "It is used almost every day," adds Fekrat. "Cataract surgery is the bread and butter of the residents' training. Most spend their time on the cataract module and some focus on the vitrectomy modules before their retinal surgery rotation."

The simulator evaluates specific skills, such as tremor control and precision, which the trainee must perform and master, before moving to the next level. Does this mean that the need for the dirty side has become obsolete? Far from it—it remains a key component of training. "The clean and dirty sides need to stay together in the MATLAB," emphasizes Fekrat. "With both perspectives, residents will be better prepared and will have actually performed maneuvers, instead of just observing surgical techniques, before applying them in surgery. Now they can observe, practice, and then apply.

"The ultimate impact for patients is hopefully lower complication rates, but most certainly the fact that residents come to surgery with more experience under their belts," adds Fekrat. "As more and more eye centers see the value of this type of training, it is possible it could become a standard for training ophthalmic surgeons." Pratap Challa, MD, associate professor of ophthalmology and residency program director, is currently finalizing surgical simulator requirements for new and future residents in the program at Duke.

THE BIONIC EYE

Duke Offers a Return to Vision for the Blind

20

DUKE UNIVERSITY HOSPITAL HAS BEEN NAMED one of only 13 facilities in the United States to offer bionic eyes to patients with near total blindness. Developed by Second Sight, the bionic eye will allow patients with end-stage retinitis pigmentosa (RP) to gain improved functioning in their daily lives through restored visual impulses. In February 2013, the FDA approved the device. After a thorough and lengthy selection process, Second Sight selected Duke as one of its providers.

Learn More

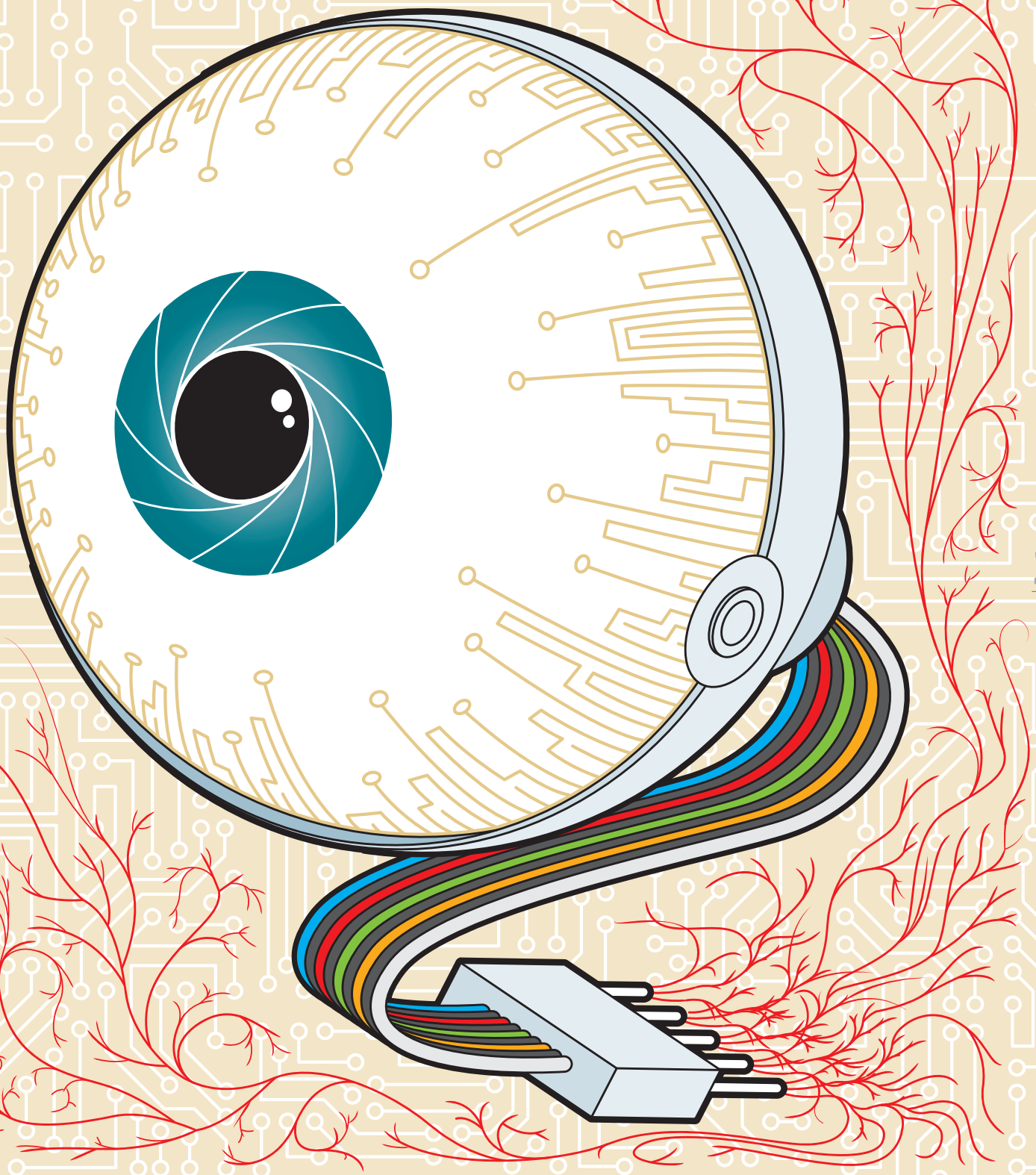
About the **Argus II bionic eye implant**, call patient coordinator Teikko Artis at **919-684-5631**.

According to the National Institutes of Health, RP is an uncommon condition affecting about 1 in 3,000 people—or approximately 100,000 Americans. RP is an inherited disease causing retinal degeneration. Those with RP experience a gradual decline in vision as photoreceptor cells die, leading ultimately to profound blindness. Of those diagnosed with the condition, roughly 10,000 patients experience the level of vision loss that will make them eligible for the bionic eye retinal prosthesis.

Paul Hahn, MD, PhD, assistant professor of ophthalmology and vitreoretinal surgery and diseases, is heading the project at Duke. "The bionic eye has dramatic outcomes for profoundly blind patients," he explains. "For example, a patient with the device may be able to function independently with daily activities, such as following the lines of a crosswalk or sorting laundry." Although the bionic eye does not restore normal 20/20 vision, it does provide improved vision that can transform an individual's life.

Branded as the Argus® II Retinal Prosthesis System, the bionic eye is a retinal implant, which provides electrical stimulation of the retina to induce visual perception. Following the implant surgery, the bionic eye recipient is given glasses with an attached camera and a portable video processor to wear. A miniature video camera, housed in the patient's glasses, captures a scene. That video is then sent to the small wearable computer, where it is processed and transformed into instructions that are sent back to the glasses. The instructions are transmitted wirelessly to an electrode array implanted on the retinal surface, which emits small pulses of

Illustration by CHRIS PHILPOT



electricity. These pulses bypass the damaged photoreceptors and stimulate the retina's remaining healthy cells, which then transmit the visual information along the optic nerve to the brain, creating the perception of patterns of light. With training, patients learn to interpret these visual patterns with their retinal implant. "The chip itself has 60 pixels," explains Hahn. "So when the chip is stimulated, the patient can see flashes of light of high contrast items and may be able to differentiate certain colors, see large letters, and locate and sort objects."

The debut of the bionic eye is truly revolutionary. Before its advent, there was no treatment for RP. Research and development of the bionic eye technology began more than 20 years ago with Mark Humayun, MD, PhD, who conducted the first initial electrical stimulation of the retina during his residency at Duke. Today, Humayun is professor of biomedical engineering and cell and neurobiology, and associate director of research at the Doheny Retina Institute at the University of Southern California. "There is a lot of excitement about this device," says Hahn. "Many people were looking forward to its approval. I expect this device, which provides the first means of artificial vision, to be a milestone in our approach to retinal diseases."

Many at Duke were working hard to ensure its selection by Second Sight as a Center of Excellence facility. Together with Stefanie Schuman, MD, assistant professor of ophthalmology and director of the Center for Retinal Degenerations, including Retinitis Pigmentosa and Stargardt's disease, and Diane Whitaker, OD, assistant professor of ophthalmology and chief of Low Vision Rehabilitation Services, Hahn led the effort to

Paul Hahn, MD, PhD
Assistant Professor of Ophthalmology and Vitreoretinal Surgery and Diseases

"Many people were looking forward to its approval. I expect this device, which provides the first means of artificial vision, to be a milestone in our approach to retinal diseases."

Paul Hahn

ARGUS® II RETINAL PROSTHESIS SYSTEM

After a thorough and lengthy selection process, Second Sight Medical Products Inc. selected Duke as one of its providers.

Time magazine named the Argus system as one of the **25 Best Inventions of the Year 2013**

1. A camera on the glasses frame "sees" the view to be transmitted to the patient.
2. The camera is connected to a video processor via a cable. The processor returns electrical signals to a round transmitter on the side of the glasses.
3. The transmitter wirelessly sends the electrical signals to the receiver on the implant. The prosthesis implant fits around the patient's eye.
4. An antenna receives signals from the transmitter that is attached to the patient's glasses frame.
5. Electrodes send impulses to the patient's optic nerve. The patient perceives a black and white image.

The target group is patients who suffer from retinitis pigmentosa.

demonstrate that Duke could provide a top-notch group of surgical implantation experts and surgical facilities of the highest quality. In addition, Duke's extensive team of low vision and rehabilitation specialists could identify, train, and work with RP patients following surgery. According to Whitaker, "The Argus II is unique and exciting because visual function is being restored in persons that see absolutely nothing or bare light perception without it. For the first time, we can equip and train totally blind individuals to make useful and meaningful sense of electronically engineered photo stimulation."

Now that the bionic eye is a reality, the Duke team is preparing for its initial recipients. The first step is identifying eligible patients and then educating these patients about the surgery, training, and rehabilitation services associated with the device. Once a patient elects to have the surgery, the device is implanted by Hahn. The Low Vision and Rehabilitation team with Whitaker programs it and then provides the patient with initial training and ongoing rehabilitation services. The time from surgical implantation to post-surgery training and rehabilitation is roughly one month. However, "due to the cutting-edge nature, recent FDA approval, and expense of this implant, insurance reimbursements are lagging," says Hahn. "We are working hard to find ways to bring down patient costs through both internal and external fund-raising." The cost for the device and implant surgery plus training and rehabilitation services is approximately $200,000.

Despite these hurdles, says Hahn, "We hope to offer this device to four to five patients within the next year here at Duke. Being selected as a Center of Excellence confirms that Duke continues to provide superior care and cutting-edge technology to our community. We will continue to collaborate to serve our patients and help to transform lives."

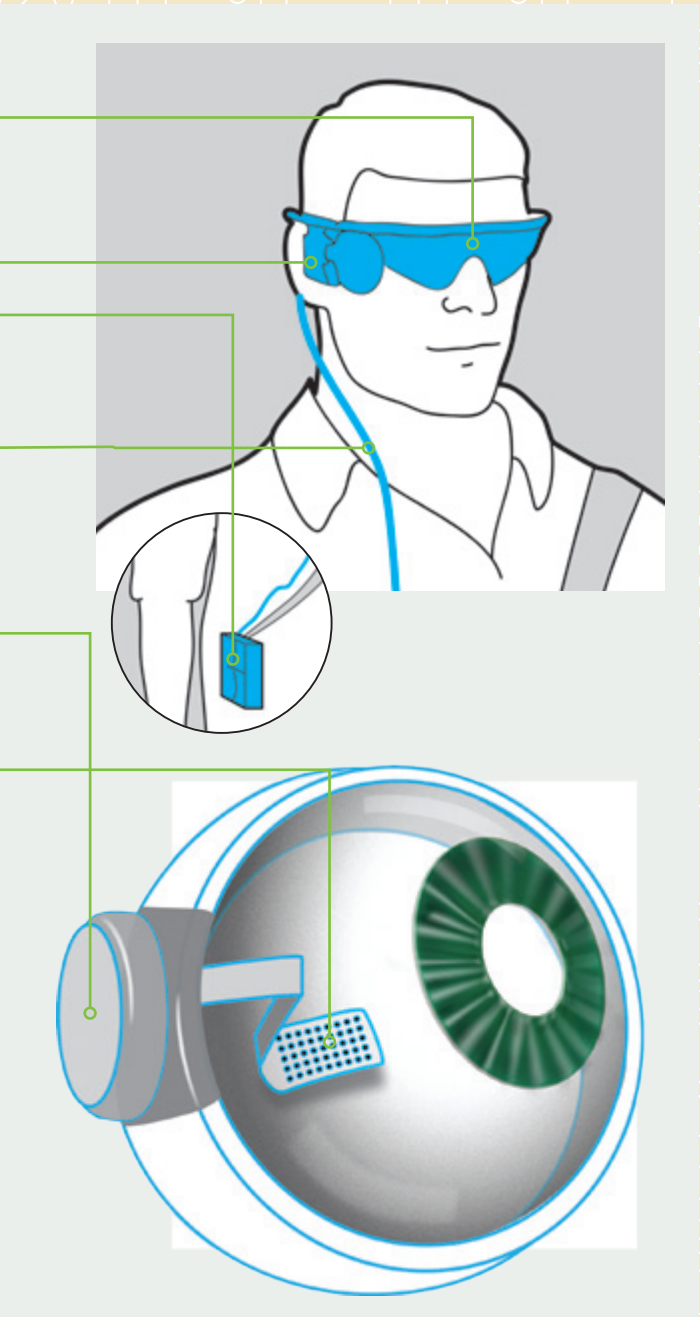
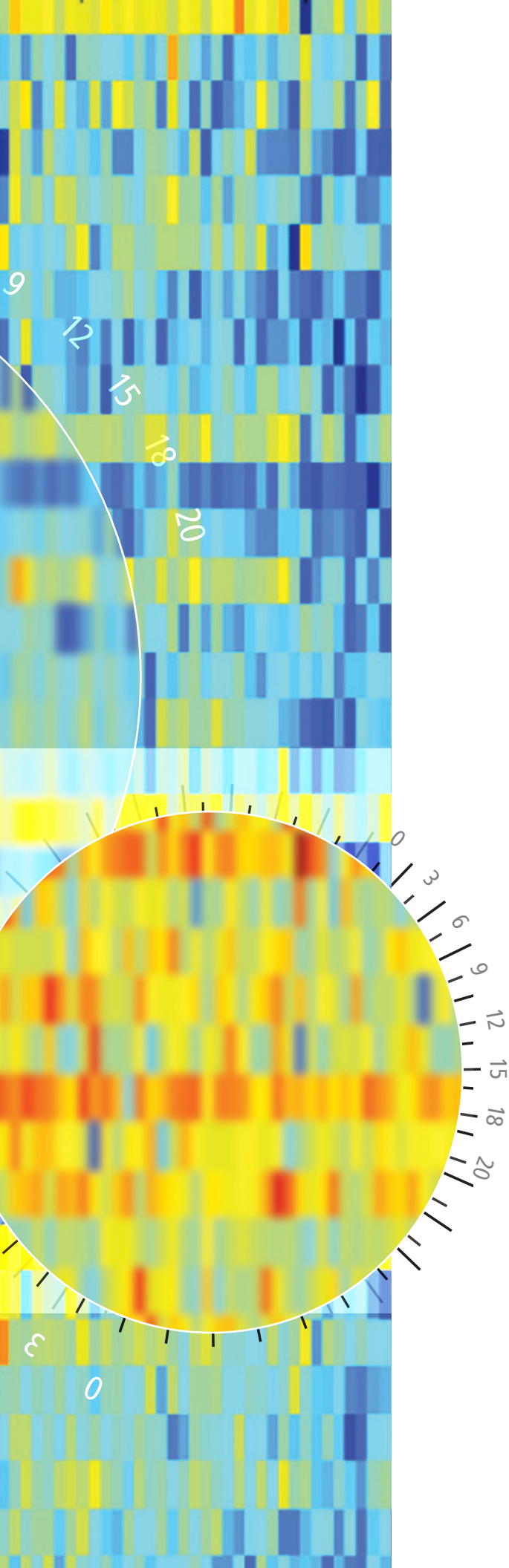


Illustration by David Pickel

FOCUS ON THE GENETIC ROOTS OF MYOPIA

DUKE EYE CENTER
2014



In the Genes: Ophthalmic Genetic Discovery May Help Myopia

Myopia, or nearsightedness, is the most common eye disease in the world—and it is becoming more common. Researchers estimate that 35 percent of Americans suffer from myopia, up from 20 percent in previous generations. While the exact causes of myopia have not been determined, studies show a genetic connection, which makes it a perfect area of focus for Duke Eye Center's Terri Young, MD.

As the director of Duke's Ophthalmic Genetics Pediatric Clinic, Young leads Duke's efforts to identify genomic factors affecting eye diseases. Her recent findings about the genetic roots of high-grade myopia may open the door to better treatments for the disease in the future. But in many ways, her latest research can be seen as a continuation of work that she began in the 1990s.

HIGH-GRADE MYOPIA GENE MUTATION DISCOVERY

In a study published in May's *American Journal of Human Genetics*, Young's Duke team and her colleagues at Duke-NUS, the Singapore Eye Research Institute, and the Singapore Bioinformatics Institute found that mutations in a gene that helps regulate copper and oxygen levels in eye tissue are associated with high-grade myopia, a severe form of the disease.

High-grade myopia affects up to 2 percent of Americans and is especially common in Asian populations. People with high-grade myopia are at an increased risk for other serious eye problems, including retinal detachment,

Terri L. Young, MD
Professor of Ophthalmology and Pediatrics

cataracts, and glaucoma.

Analyzing DNA extracted from blood and saliva, Young identified mutations in the SCO2 gene common among family members with high-grade myopia, but absent in those family members with no myopia.

The findings may point to ways that the disease can be mitigated before serious problems develop, perhaps with vitamins and minerals that facilitate different enzymes in cells to act more efficiently.

"There may be ways that we can shift diet or make copper more accessible to relevant tissues so we can change exaggerated eye growth," says Young.

LOOKING BACK: THE HUMAN GENOME PROJECT

While this particular study began three years ago, Young says her work in ophthalmologic genetics dates back to the Human Genome Project, which started in 1990 and was completed in 2003.

"The Human Genome Project enabled us to find areas of particular chromosomes where these genes lived," she says. While the project enabled researchers to learn much more about genetics, technologies hadn't developed to the point that Young and her colleagues could take the next step. "We weren't able to drill down to the point where we could actually find the gene," she says.

That has changed thanks to next generation DNA sequencing. Instead of getting one copy of a person's genome, researchers receive multiple copies, which allows better veracity of data. Young says that increase helps determine whether there is some sequence variant that is connected with a disorder.

With next-gen sequencing, Young was able to pursue new leads, but her team needed to pioneer the way the data was analyzed. In collaboration with Stephen Rosen, PhD, of Duke-NUS Graduate Medical School Singapore, they designed a computerized filtering and analytical process to find meaning in the data. This step enabled them to isolate the mutation to the SCO2 gene.

"We now have the technologies and analytical tools to digest information that match our aspirations to find these genes," Young says.

FAMILY AFFAIR

In addition to the latest sequencing technology, Young relied on a project she began in 1996 to supply the basis for her latest research findings.

"In my clinic, I saw patients who had severe issues with their high levels of myopia, like retinal detachments, and who also had family histories of this in other relatives. I really felt like directed research and care were needed," Young says. "I wanted to find a way we could go upstream and figure out what genes were involved, so we could understand the biology behind the problems."

> "I wanted to find a way we could go upstream and figure out what genes were involved, so we could understand the biology behind the problems."
>
> Terri Young

With that goal in mind, Young started collecting DNA from families in which members have high-grade myopia. She collected samples from members within a family who showed the disease and those who didn't. She now has more than 300 families in her collection.

She used data from these families to discover the gene that helps regulate copper and oxygen levels in eye tissue. The team performed next-gen sequencing on four relatives from an 11-member American family of European descent. After identifying the SCO2 gene as the likely culprit, they confirmed four mutations in the gene in an additional 140 people with high-grade myopia. They also verified that the SCO2 gene was expressed in human eye tissue connected to nearsightedness. They also used a mouse model to support their findings.

SEARCHING FOR NEW CONNECTIONS

Young continues to search for new revelations about eye disorders hidden in genes. Among several research efforts, she is looking—in collaboration with Pedro Gonzalez, PhD, at the Duke Eye Center—at non-coding genomic elements that may also cause eye growth issues. And she's working with zebra fish and mouse models to look for eye disorders.

In the Ophthalmic Genetics Clinic, she sees patients with a variety of heritable disorders, such as retinal dystrophies, corneal dystrophies, and glaucoma. Caring for these patients drives her to find answers about the causes of their diseases and develop new therapies.

"We're trying to put more energy, resources, and effort into enabling families to get into clinical trials, to obtain genetic-based treatments that have not been available before," she says.

More information

To participate in Young's research, please contact Quitin Degroot, study coordinator, at **919-684-8798**.

DUKE A PROMINENT PLAYER IN LATEST AMD RESEARCH EFFORTS

Duke Eye Center and its patients played a key role in the National Eye Institute (NEI)-sponsored research study called the Age-Related Eye Disease Study 2, known as AREDS2. This study confirmed some findings of the landmark first AREDS study and delivered a few surprises, too.

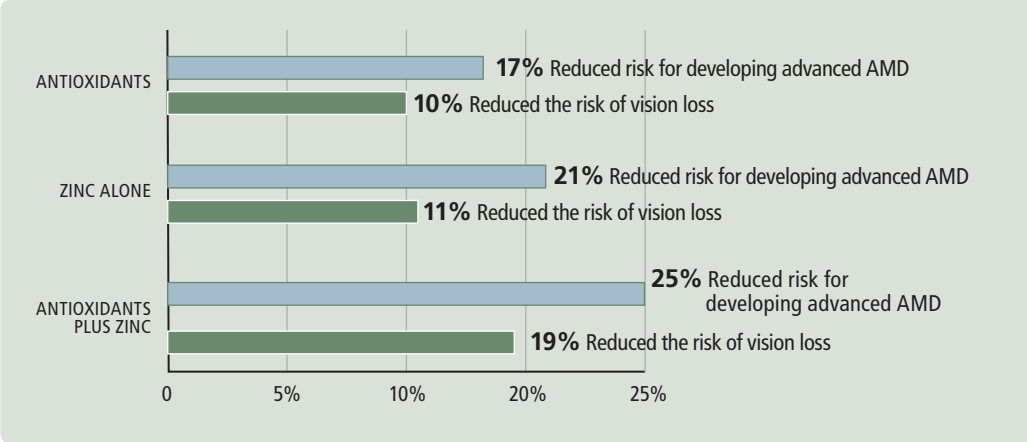
Duke was one of 82 sites that participated in AREDS2. The original AREDS study helped to identify that the AREDS supplement can help slow the progression of age-related macular degeneration (AMD) to advanced stages of AMD, where there is greater likelihood of vision loss. Lasting five years, AREDS2 expanded on those findings.

First, the surprise: AREDS2 showed that, contrary to some previous findings, adding omega-3 fatty acids to the original AREDS formulation didn't help stop the progression to advanced AMD. The study also showed that removing beta-carotene from the current recommended formulation did not lessen the effectiveness of the supplement. High doses of beta-carotene have been linked to a higher risk of lung cancer in smokers, so removing it from AREDS may be of value.

Duke Eye Center's Cynthia Toth, MD, and Stefanie Schuman, MD, led Duke's participation in the study, with coordination assistance from Neeru Sarin, MD. Toth says that based on the findings, she will advise most of her patients to move to the new AREDS2 formulation, though she advises caution.

"Every patient's decision on whether to take a supplement should be made with their eye doctor and with information also provided to their medical doctor. If these supplements have an impact on eye disease, they may have impact elsewhere on their health," Toth says. "Make sure your health team is aware of the medications and supplements that you take."

Since the study brought together so many AMD patients, Toth took advantage and initiated a companion research trial to look at how advanced imaging could provide better information about the disease. Her AREDS2 Ancillary Spectral Domain Optical Coherence Study (A2A SDOCT) examined how well SDOCT could show details about drusen that occur behind the retina. OCT is an imaging technology that works similarly to ultrasound and shows depth that a traditional ophthalmoscope can't. This five-year multicenter clinical trial drew on participants from the Duke Eye Center; the National Eye Institute in Bethesda, Maryland; Devers Eye Institute in Portland, Oregon; and Emory University Eye Center in Atlanta, Georgia. The study also recruited age-matched controls without AMD from Duke and Emory. Advanced image analysis necessary for this study was performed under the direction of Sina Farsiu, PhD, and his research team. The study follow-up has been extended into 2014 to gather additional data.



AREDS2 and the ancillary study, under the leadership of Toth and Farsiu, show that Duke remains a leader in AMD research and treatment.

"At Duke, we not only participate in national studies that answer questions about AMD, but our researchers are taking the next step," Toth says. "Faculty members like Scott Cousins, MD, and Nora Lad, MD, PhD, are developing new treatments, from bench to bedside."

Cynthia Toth, MD
Professor of Ophthalmology

DUKE EYE CENTER PHOTOGRAPHY AND IMAGING

IT'S SAID THAT BEAUTY is in the eye of the beholder. At Duke Eye Center, the best diagnosis and treatment is in the beholder of the eye—particularly since ophthalmologic specialists utilize state-of-the-art eye imaging provided by Duke Eye Imaging (DEI).

DEI photographers are advancing the revolutionary work of looking deeply into the human eye, using the most sophisticated imaging and photographic equipment available. Today, ophthalmic photography and imaging play a critical role in the diagnosis and care of patients with eye disease. Only through these images can Duke ophthalmologists clearly see the condition of the eye from the inside out. And with these images, accurate diagnoses are made and cutting-edge treatments are administered.

ROOTS OF EYE IMAGING

While the human retina has been documented photographically since 1886, it wasn't until 1959 when a breakthrough in eye imaging forever changed the course of ophthalmic photography. A landmark paper described fluorescein angiography, a revolutionary photographic technique for documenting the circulation of blood in the human retina using sodium fluorescein dye, injected into an arm vein, and a retinal fundus camera.

This groundbreaking technique transformed the way ophthalmologists and scientists viewed, studied, and treated the innermost layer of the eye. Propelled by widespread enthusiasm at possibilities for better diagnoses and treatments, ophthalmic photography departments began offering this new technique in the early 1960s, and an early version of DEI dawned.

IMAGES OF THE EYE SPARK PERSONAL INSPIRATION, GLOBAL INNOVATION

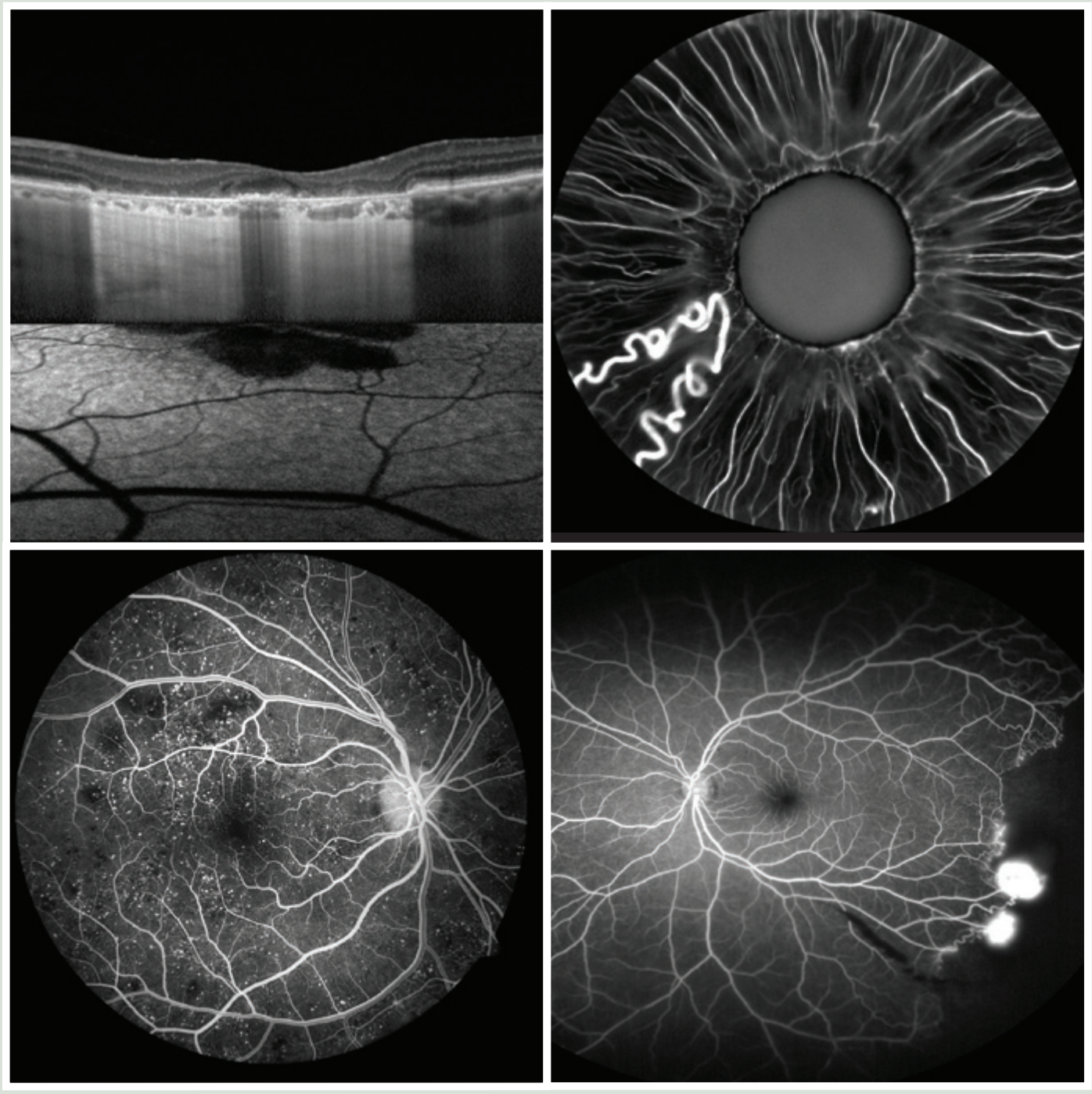
Roughly a decade later, Michael Kelly, FOPS, director of Duke Eye Imaging, was eight years old when his father received the devastating diagnosis of a retinal detachment, which eventually stole his vision in one eye. "I was with my father when the ophthalmologist

A simultaneously acquired SDOCT/ autofluorescence image of age-related macular degeneration and geographic atrophy.

Iris fluorescein angiogram of an anomalous vessel.

A 50-degree fluorescein angiogram of diabetic retinopathy.

Ultrawide angle fluorescein angiogram of sickle-cell retinopathy. Note the far peripheral leakage.



explained that the eye is like a camera, and the retina is the film. The analogy translated onto the color fundus photographs the doctor showed us, comparing a normal retina to that of a detached retina. The idea that one could actually photograph the inside of the human eye fascinated me."

This experience inspired Kelly to pursue a career in imaging, and 15 years after seeing his first retinal photographs, he discovered that they were only one small application of the art and craft of rapidly evolving ophthalmic photography. In 2005, after managing the imaging departments of several prestigious eye institutes, Kelly took on the directorship of DEI, where he and his colleagues have been instrumental in keeping Duke on the cutting edge of the field.

Although fluorescein angiography remains an important part of the DEI armamentarium, other advanced imaging technologies, such as high-speed indocyanine green angiography and spectral-domain optical coherence tomography (SDOCT), have emerged as indispensable imaging tools for patient care. OCT, developed in the early 1990s, is similar to ultrasound, but instead uses light to create a virtual biopsy of the retina. And because every retina is unique like a fingerprint, the camera remembers it. When patients return and are re-photographed, their image is scanned against the previous photo to provide an exact comparison.

In addition, Kelly's team has successfully applied the original technique of fluorescein angiography to other tissues of the eye, including the iris and sclera. They have done the same with OCT, creating virtual biopsies of the cornea and iris.

With advances in ophthalmic photography, the practice of ophthalmology has dramatically changed and saved the vision of millions of people around the world. Using fluorescein angiography, abnormal retinal blood vessels are located, then sealed off with laser photocoagulation or injections of anti-VEGF medication, thus preserving vision. The first ultrawide angle imaging device came into the picture in 1992, capturing 82 percent of the retina in one image. This angle allows retina specialists to detect peripheral retinal disease that may not be seen using standard retinal cameras, which record only 10 percent of the retina in a single image. "We immediately recognized the potential of this technology and worked with the company Optos to refine their device, and now most universities are using it," says Kelly.

"During an ophthalmology conference, we had medical students come through the Imaging Center. One volunteered to have her retina photographed with the Optos camera, and to all of our surprise, we detected an early retinal detachment. Timing is everything—she received immediate treatment and is not only doing well but also considering a career in ophthalmology," Kelly notes. Eight years ago, without this technology, she could have lost her vision.

DUKE EYE IMAGING: A LEADER IN THE FIELD

DEI has a wide range of ocular imaging devices located on the Erwin Road campus. They include multiple instruments capable of 3-D SDOCT, fluorescein and indocyanine green angiography, infrared and 3-D retinal imaging, corneal topography, fundus autofluorescence, high-resolution slit lamp imaging, and ultrawide angle retinal imaging.

When complete, the new Duke Eye Center Hudson Building (see page 40) will provide much-needed space for DEI, which will be embedded in the core of the facility as part of the diagnostic suite. "It's designed entirely around the patient experience—maximally efficient, logically constructed—and

our senior patients will have less steps to walk," Kelly says.

VISIONARIES IN THE FIELD

Highly regarded as leaders in the field, DEI photographers have won awards for their superior and innovative ocular imagery. Often asked by prestigious ophthalmology journals for publication cover images, DEI is considered the go-to place for ophthalmic imaging and training.

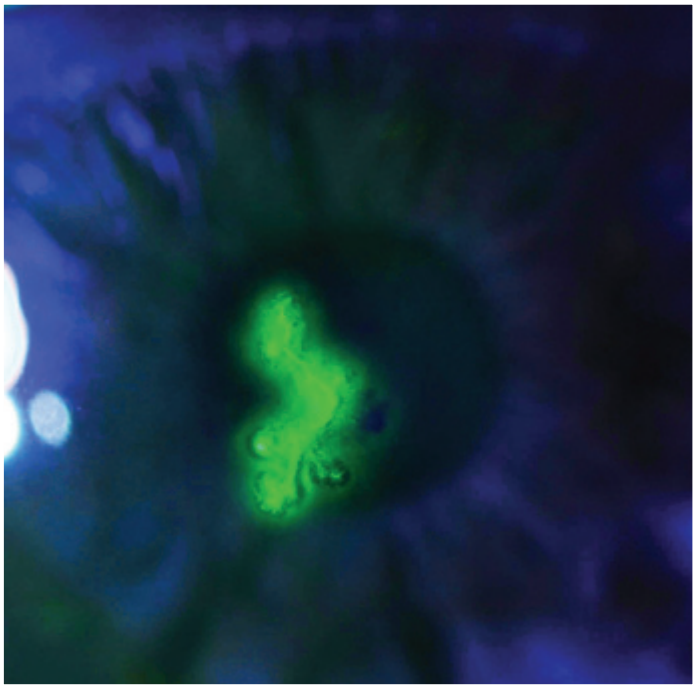
Ophthalmic photography and imaging have become such a vital part of the diagnosis and care of patients with eye disease that Duke Eye Center is now planning its third-annual Essentials of Ocular Imaging course and workshops; last year it was standing-room only.

LOOKING INTO THE FUTURE

"As even faster and higher resolution technology, such as photoacoustic imaging, optical microangiography, polarization sensitive, swept source, full-field and Doppler OCT, are developed, the role of DEI expands with the ability to resolve greater detail in higher magnification," says Kelly. A wide variety of emerging imaging technologies is going to enhance the physician's ability to diagnose disease earlier and monitor the effectiveness of treatments more closely.

Kelly adds, "Our passion is central to our ability to help ophthalmologists best treat our patients. Without our imaging equipment, we'd be back in the 1950s. Yesterday we perfected imaging the top layer of the retina; today we can create 3-D virtual biopsies of the living tissues that lie beneath it; tomorrow we will be able to image on a cellular level, identifying diseased tissue before it affects vision."

Seeing clearly, and looking deeply into the human eye, is everything in the treatment of vision. Without the capacity to see inside the human eye—to look closely at the retina, optic nerve, iris, and cornea and photograph what's happening—the sophisticated and vision-saving treatments available today wouldn't be possible.



Corneal dendrite highlighted for better documentation using topical fluorescein sodium.

Duke Eye Imaging staff members // Director: **Michael P. Kelly, CPT, FOPS**
DEI Ophthalmic Imaging Specialists: **Ryan Imperio, OCTC; Tiffanie Keaton; Christopher Kennedy, CPT; Brian Lutman, CRA, CPT**; **Lauren Welch, CPT**

Klintworth Donates Personal Book Collection

In the spring of 2011, Gordon Klintworth, MD, PhD, Joseph A. C. Wadsworth Research Professor of Ophthalmology and Professor of Pathology, donated 185 titles from his own medical history book collection to the Duke University Medical Center Library & Archives.

This spring, Klintworth made his second generous, yet much more personal, donation to the library. He carefully selected 80 titles for this donation, which he has authored or to which he has personally contributed over the 51 years he has served at Duke.

"Dr. Klintworth has generously given our library two very important collections," says Pat Thibodeau, associate dean for library services and archives at Duke. "The first gift of medical classics [is] a wonderful set of beautifully bound reproductions of seminal works in medicine and related sciences. The originals of these rare and valuable works, many of which are in Duke's History of Medicine Collections, are too fragile for regular use, limiting who can use them," she says. "But the donation of Dr. Klintworth's history book collection allows students and scholars to use these important materials and observe what the original illustrations, plates, and printing looked like, truly experiencing older works without risking damage to fragile volumes.

"In addition, Dr. Klintworth has shared his lifework with us through the donation of materials that he authored. This second gift has allowed us to capture his contributions to the field for current and future scholars. His books have been added to our Duke Authors collection, which preserves Duke faculty contributions to biomedicine and health care," says Thibodeau.

One of the prominent books in this collection is the two-volume *Garner and Klintworth's Pathobiology of Ocular Disease*, which serves as a major text in the field and has more than 100 contributors, many of them hailing from Duke. Klintworth served as senior editor, and the book is now in its third edition.

Also among the donated collection are other notable titles, including *Pathology*, the first edition of a textbook on pathology to include a chapter on diseases of the eye, as well as *Anderson's Pathology* and *Diagnostic Surgical Pathology*, both classic pathology textbooks in which Klintworth wrote chapters on diseases of the eye. In addition, Klintworth's collection includes his PhD thesis, "An Anatomical and Clinicopathological Study of the Notch Area of the Tentorium Cerebelli," and *From Apes to Angels: Essays in Honor of Phillip V. Tobias*, in recognition of Klintworth's PhD adviser.

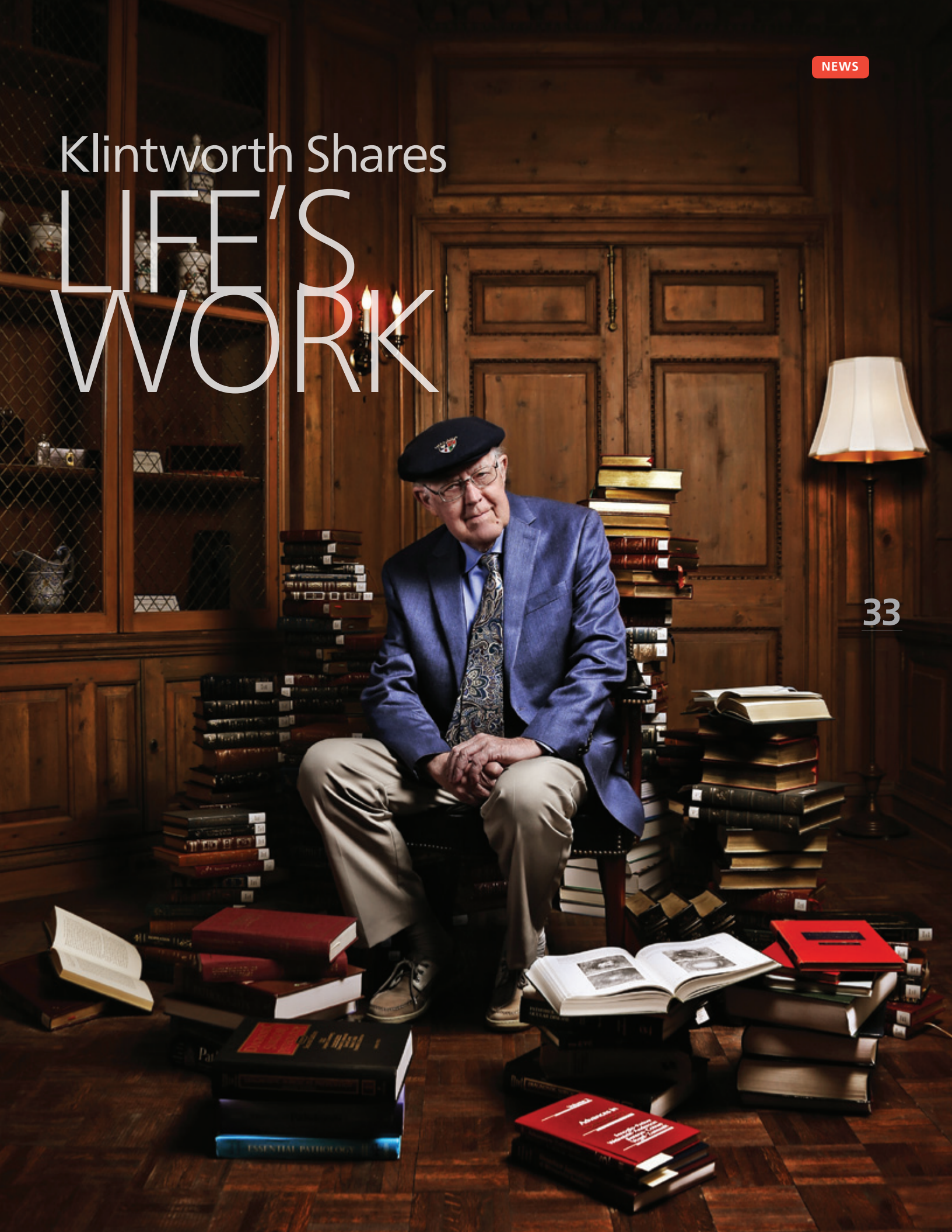
Klintworth accumulated the books over decades as he wrote or contributed to them. "I've gained an incredible amount of knowledge and experience at Duke over the years, and now I feel I should give that back. I know Duke will care for and cherish these books and look after them so that many others, especially those in the Pathology and Ophthalmology departments, can peruse and enjoy them through the years."

> ""I've gained an incredible amount of knowledge and experience at Duke over the years, and now I feel I should give that back."
>
> Gordon Klintworth

For people who think Klintworth is merely a generous medical history bibliophile, take note: He is apparently a collector by nature and is harnessing 21st-century technology to share and extend his expertise on a global level. Klintworth has also created a "colossal database of diseases of the eye." This online portal, **eyepathologist.com**, is a Web-based instructional site on the anatomy and pathology of the eye, which has been designed to emulate one-to-one interaction with an expert eye pathologist. According to site data, users from more than 200 countries have registered.

Clearly, Klintworth's assembly of knowledge on eye pathology will have a lasting impact, whether on the page or online. All students, residents, faculty, and visitors to Duke are invited to visit the Duke University Medical Center Library & Archives to view Klintworth's personal collections.

Klintworth Shares LIFE'S WORK



Melissa Daluvoy, MD

Melissa B. Daluvoy is a fellowship-trained, board-certified ophthalmologist with expertise in the medical and surgical treatment of cornea and anterior segment diseases. She performs routine and complex cataract surgeries and offers astigmatism- and presbyopia-correcting intraocular lenses. She specializes in advanced corneal transplantation procedures, including PK, DSEK, DALK, and keratoprosthesis. She also performs refractive surgeries, including custom bladeless Intralase LASIK, PRK, PTK, and phakic intraocular lenses (implantable contact lenses).

Originally from Mount Carmel, Pennsylvania, Daluvoy previously served at the Veterans Hospital in Washington, D.C., and in private practice in Durham before joining the Duke Eye Center. She attended Jefferson Medical College in Philadelphia and completed her ophthalmology residency at George Washington University Hospital. She returned to Philadelphia to complete a fellowship at the Wills Eye Institute, where she concentrated on corneal and external eye diseases.

Daluvoy made the transition to Duke because she wanted to be challenged and sought to put her professional experience and education next to experts in the field. In her new role, she will focus on routine cataract and refractive surgery and comprehensive cornea care, as well as treating ocular cicatricial pemphigoid (OCP) disease. According to Daluvoy, she is most excited about the surgical opportunities available at Duke and admits to a passion for the OR, especially with complicated cases. "There is nothing more incredible than helping patients to see again," she says.

Jeremy Kay, PhD

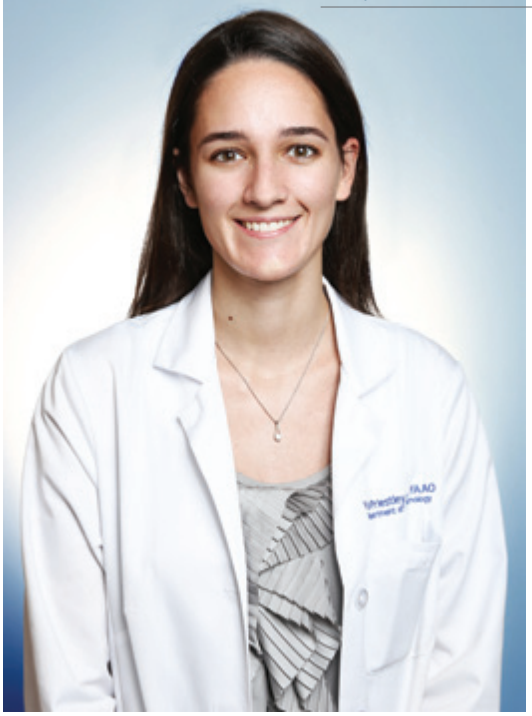
Jeremy Kay began a joint appointment in the departments of Neurobiology and Ophthalmology as assistant professor on December 1, 2012. Kay is investigating how neurons in the retina connect with each other during development to form circuits that enable vision. By working in tandem with the two departments, he looks forward to the synergy of collaboration between the basic science and clinical aspects of retinal development.

Kay earned his bachelor's degree in neuroscience from Columbia University and his PhD in neuroscience at the University of California, San Francisco. Kay completed his postdoctoral fellowship at Harvard University under the guidance of Joshua Sanes, professor of molecular and cellular biology.

"The neuroscience research community at Duke has lots of new energy and is applying cutting-edge techniques," Kay explains. "Duke also has given me a unique opportunity to be part of a second community by placing my lab in the ophthalmology department, where I can exchange ideas and learn from experts on eye disease."

He adds, "It is a huge opportunity to work with faculty who are studying disease mechanisms. I hope we can connect their work to what is happening with the circuitry of the retina and then learn how we can apply this knowledge to our understanding and treatment of certain diseases. Through this understanding, we can ultimately provide better understanding and care for our patients."

Yos Priestley, OD, FAAO



Yos Priestley began her new role as assistant professor of ophthalmology in the Comprehensive and Contact Lens services in June. Priestley will work at the main clinic in Durham as a comprehensive primary care optometrist with specialization in adult and pediatric eye care, and will also offer pediatric optometry services at the Page Road satellite clinic. She is trained in the diagnosis and management of chronic ocular conditions such as diabetic retinopathy, glaucoma, cataracts, and macular degeneration. She also provides care for acute ocular emergencies and participates in co-management of surgical patients. Her special interests include treatment of amblyopia, binocular vision management, and contact lens fittings, including pediatric contact lenses.

Priestley earned her bachelor's degree in biology from Lehigh University in Pennsylvania, then graduated from the New England College of Optometry as valedictorian. While in optometry school, she took the opportunity to travel to Nicaragua, as part of the FADCANIC organization, where she provided eye exams to underserved patients on the Atlantic coast. "The experience really opened my eyes to the importance of primary eye care and the impact it can have on a person's quality of life," she says. "It has really resonated with me, and I hope to be able to participate in more trips in the future."

Priestley finished her pediatric optometry residency at the New England Eye Institute in Boston, where she received the national Terrance N. Ingraham Pediatric Optometry Residency Award from the American Optometric Foundation.

Lejla Vajzovic, MD

Lejla Vajzovic completed her surgical vitreoretinal fellowship at Duke on July 5; the next day, she officially joined the Duke Eye Center as assistant professor of ophthalmology. "It was an honor to stay on as faculty," she explains. "The Eye Center is one of the top in the country, known for its excellent medical care and outstanding research. The faculty are truly amazing and care deeply about their patients."

Vajzovic, originally from Bosnia and Herzegovina, earned her undergraduate degree in biological sciences from the University of Missouri at Columbia, attended medical school at the Mayo Clinic College of Medicine in Rochester, Minnesota, and completed an internship at the St. Louis University Hospital. She finished her ophthalmology residency at Bascom Palmer Eye Institute in Miami before beginning her two-year surgical vitreoretinal fellowship at Duke.

In her new role at Duke Eye Center, she will pursue her interest in pediatric and adult vitreoretinal surgery and pediatric OCT imaging research, with Cynthia Toth, MD. Vajzovic is excited about starting Duke's Pediatric Retinal Center with Toth. "The new center will allow us to be much more focused on pediatric patients and provide advanced clinical care," says Vajzovic.

Vajzovic looks forward to working with fellow vitreoretinal ophthalmologists at the main Duke clinic as well as several times a month at Cape Fear Eye Associates in Fayetteville.

DUKE EYE CENTER'S CME PROGRAM COMMITTED TO IMPROVING PATIENT CARE

The Continuing Medical Education (CME) program at Duke Eye Center has three key goals: to advance and disseminate medical knowledge; to create courses relevant to a professional's practice; and to deliver content from expert teachers. "It's our obligation as a leading university to provide an environment for continued training and practical information that is accessible and convenient to ophthalmology professionals," says Renee Wynne, CME program director at the Duke Eye Center.

For more information

about Duke's **Continuing Medical Education** (CME) program in Ophthalmology, contact CME program director Renee Wynne at **919-684-6593 or walla023@mc.duke.edu.**

The goal of the CME program is to share and incorporate practical information, novel findings, and advances in literature so that attendees walk away with defined knowledge and the skill set to apply that knowledge to how they care for patients.

"We want our educational courses and lectures to have an immediate impact so that professionals can apply what they have learned as soon as they return to their practice," explains Prithvi Mruthyunjaya, MD, associate professor of ophthalmology and radiation oncology, and director of education at Duke Eye Center.

"We offer multiple programs in ophthalmic specialties to ophthalmologists, optometrists, and eye care specialists," says Mruthyunjaya. "The scope and appeal of our program is broad. Our attendees mainly come from North Carolina and throughout the Southeast, but we also have national and international guests as well as presenters."

The biggest draws to date have been the biannual Advanced Vitreous Surgery Course, now in its 18th year, and the Annual Glaucoma Symposium, now in its 25th year. Other popular and well-attended programs include the Controversies in Cornea and Cataract Surgery Symposium, which covers such topics as the latest techniques in cataract surgery, corneal transplants, and laser refractive surgery, as well as the Chairman's Guest Lectures and the monthly Grand Rounds. Additional programs include the Duke Eye Contact Lens Symposium, Duke Community Educational Series, and the McKinley Conference, which has been held in Winston-Salem for more than two decades.

Two endowed lecture series, the quarterly Bryan Lecture Series and the annual Stephen and Francis Foster Lecture, feature national and international speakers who are chosen through a faculty nomination process and serve to recognize a distinguished ophthalmologist and highlight his or her current research.

This spring, the CME program will continue several new programs, including the Essentials Course. The Essentials Course will address a variety of specific topics such as ocular imaging. In addition, the Duke Eye Community Education Series will present up-to-date news on ophthalmic diseases to optometrists and other eye care professionals in the Wake County area. The series will be held in an interpersonal, relaxed atmosphere, fostering discussion and networking opportunities. In the coming 2013–14 year, the Duke Eye Center will offer a total of approximately 60 hours of CME/CE credits.

"One of our goals is to keep the cost of the educational program low for our attendees," explains Mruthyunjaya. "It might be fun to go to Key West for a seminar, but it's more practical and economical to attend CME functions that are close to home. Doctors have to leave their patients and practice when they travel out of town for training. We do our best to plan our courses on evenings and weekends and make them cost-effective as well. Ultimately, we want our guests to keep coming back for more."

The next step for the CME program at the Duke Eye Center is to develop a more robust online portal for CME training. "We are also planning to expand the Community Education Series to engage with more of the practitioners in the region," says Mruthyunjaya. "We hope to expand our range of topics as well so that they continue to be relevant, novel, and up to date. We are motivated by our duty and obligation to the professionals in our field and are committed to the ultimate goal of helping them to improve their level of patient care."

Renee Wynne
CME Program Director

Prithvi Mruthyunjaya
Associate Professor of Ophthalmology and Radiation Oncology, and Director of Education at Duke Eye Center

DUKE OPENS RETINAL VEIN OCCLUSION CENTER OF EXCELLENCE

The Retinal Vein Occlusion (RVO) Center of Excellence opened on March 1 at the Duke Eye Center to evaluate patients with the diagnosis of either branch, central, or hemiretinal vein occlusion. Directed by Sharon Fekrat, MD, associate professor of ophthalmology on the Vitreoretinal Surgical Service and chief of ophthalmology at the Durham VA Medical Center, the center is dedicated to providing RVO patients with a comprehensive workup, a personalized treatment plan, and education for themselves and their family members.

In eyes with a retinal vein occlusion, a blockage occurs in one of the veins that takes blood from the retina back to the heart. Retinal vein occlusion is the second leading cause of blindness after diabetic retinopathy. Retinal vein occlusion can occur at the level of the optic nerve, referred to as a central retinal vein occlusion. The blockage can also happen at a branch of the vein, which is called a branch retinal vein occlusion.

For Fekrat, the opening of the RVO Center has been a long time coming. "My research interest in retinal vein occlusion began in the 1990s when I worked with [my] mentor, Dr. Daniel Finkelstein, at the Wilmer Eye Institute. Our research involved using laser surgery to create a bypass around the blocked retinal veins in baboons," she says. Since then, Fekrat has continued clinical research, participated as site principal investigator in many multicenter clinical trials, and published numerous articles and book chapters on RVO. She is considered the RVO specialist at Duke Eye Center and has a long-standing interest in finding a way to prevent the disease and treat its underlying cause.

> "But we are still in our infancy. We simply need further support to grow, so we can provide more outreach."
>
> Sharon Fekrat

New patients to the center initially meet with administrative director Nakia Hawley, who welcomes them for a visit and provides information. "Nakia always strives to make a very personalized connection with our patients," adds Fekrat. Next, patients typically spend a generous hour with Fekrat to discuss the diagnosis, risks, and treatment plan options that take into account other eye conditions and lifestyle modifications. "Our intention is that patients leave the same day with plenty of information and have been educated about the disease and treatment options to help them make an informed decision on how to manage this disease," explains Fekrat. Some patients can even begin treatment that same day.

More Information

About the **Duke Retinal Vein Occlusion Center of Excellence,** visit **dukervo.com**

There are currently several injectable RVO medications called anti-vascular endothelial growth factor (anti-VEGF) injections, which can be administered monthly. Patients can continue with ongoing injections indefinitely, depending on their individual cases. The injections can also be combined with laser treatments in some cases.

The center also emphasizes patient education, including how to live with and manage RVO. Patients are counseled on making lifestyle modifications, which are key to managing and possibly even preventing the disease in the second eye. Retinal occlusions are more likely to occur in patients with conditions such as atherosclerosis, diabetes, high blood pressure, and glaucoma. A patient with RVO in one eye has a 1 to 10 percent risk of developing the disease in the other eye. "While there is no known method of preventing RVO, we encourage our patients to take control of their lifestyle choices and make modifications to follow a healthier way of living," stresses Fekrat. "We believe that patient lifestyle choices should work in tandem with treatment at the center."

Sharon Fekrat, MD
Associate Professor of Ophthalmology

MAESTRO CARE STREAMLINES PATIENT INFORMATION, IMPROVES CARE

Maestro Care is now live at the Duke Eye Center (DEC). After a two-year, painstakingly planned product selection and transition to this upgraded, standardized electronic medical record (EMR) system, Duke Eye Center recently flipped the switch for Duke Maestro Care as part of the final conversion taking place across Duke University Health System (DUHS).

Maestro Care is a seamless, integrated EMR system that covers all aspects of clinical care. It is transforming the Duke Eye Center's ability to deliver the very best in quality health care services to patients throughout the Duke network, according to Robin Vann, MD, chief of the Comprehensive Ophthalmology Service and ophthalmologic champion for Maestro Care.

Meet our new computer system

EMR // Electronic medical record

EPIC // An EMR system used by many other academic medical centers

Maestro Care // Duke University Health System version of EPIC, implemented on June 22, 2013

Kaleidoscope // The Duke Eye Center's customized version of Maestro Care

Fulfilling the current and future needs of the overall health system, Maestro Care was created as a customized version of EPIC, an EMR system used by many other academic medical centers. However, special considerations needed to be made to fit the unique requirements of Duke Ophthalmology.

UNIQUE EYE CENTER NEEDS

"Ophthalmology is a different bird with very specialized needs," says Vann. "Eight years ago, two programmers and I, together with an outside vendor, created a product, Eye Chart, which acted like an EMR. Having built it from the ground up, we knew exactly what ophthalmologists need and want. We understood the precise needs of glaucoma, retina, and cornea specialists. It was a labor of love; I did this in my off hours because I was driven to find a better way. I knew that paper records caused errors in our clinic, and I wanted better records for my patients—for all patients at the Eye Center."

Because of Vann's deep understanding of what DEC needed in an EMR system from both a physician and an IT perspective, Maestro Care transition leaders asked him to be the official "ophthalmology champion." As part of his responsibilities, he was tasked to help customize Kaleidoscope, the ophthalmologic application for Maestro Care.

"It's rewarding to facilitate this crucial transition and to have this work be part of my job description," says Vann. Now, 25 percent of his time is dedicated to Maestro Care.

The phased transition began in July 2012 in 30 Duke clinics. In October, 50 more clinics went live, and in February, 80 clinics came on board. On June 22 of this year, the Duke Eye Center and all remaining clinics, plus scheduling, billing, documenting, charting, routing, labs, and radiology, went live.

Training took place close to the go-live date so people could better retain their new knowledge. Prior to the training, which included everyone—surgeons, technicians, the front desk, doctors, secretaries—there was a mixed response among staff. "Some people were nervous. Others were excited to modernize and get rid of paper, information silos, and lost charts," says Vann.

PATIENT EASE

For patients, Maestro Care means seamlessly making appointments, requesting medication refills, receiving lab and diagnostic information, sending secure and

private messages directly to their doctors, verifying all information, and paying bills—all from the comfort of a computer. Before setting foot in any of the five Duke clinics, patients know what's needed for appointments, such as preparing for a fasting lab. Upon leaving appointments, patients receive a visit summary notifying them of upcoming health maintenance issues, diagnoses, and prescribed medications.

PHYSICIAN ACCESS

For physicians and medical staff, Maestro Care provides access to patients' entire medical and surgical history. Current medications are listed; all diagnostic and photographic records, including MRIs and x-rays, are in one place. The cardiology and primary care histories are right there with the ophthalmologic history.

"Before Maestro, we couldn't communicate between DUHS departments, much less with physicians outside of the Duke system. Now, we can communicate with a patient's entire health care team," says Vann.

While Vann is the project lead from a physician's perspective, Evelyn Kelly, health care administrator, is project lead for all Maestro Care and Kaleidoscope administrative functions. She has led this kind of transition before and appreciates the culture of Duke Eye Center's collaborative, supportive atmosphere.

> "It was a labor of love... I knew that paper records caused errors in our clinic, and I wanted better records for my patients..."
>
> Robin Vann

"My role has been to keep everyone updated about what's going on amidst this huge change and to help coordinate the training of hundreds of staff members. It's an exciting transition, and we are optimistic that we'll be more efficient and be able to improve care as well as reduce patient wait times," says Kelly.

With Maestro Care and Kaleidoscope up and running, the Duke Eye Center team is living up to the motto for Maestro Care: one patient, one record, one health system.

NEW DUKE EYE CENTER CLINICAL BUILDING ON TRACK

Construction is in full swing at the site of the new Duke Eye Center Clinical Building at the main Eye Center campus in Durham. The temporary patient entrance and drop-off area are complete and opened in November 2013.

The finished building will be four stories tall, including one floor underground, and house 127,000 square feet of clinical, office, and shell space for future expansion. The facility will welcome patients and their families under a covered canopy for drop-off, with valet parking, and easy garage access. Flow of the building was designed to be patient-friendly and to ensure the fewest number of steps will be needed to get patients from the waiting areas to the various exam and treatment rooms.

The entire building floor plan revolves around patients, including more seating, shorter check-in and checkout times, and a centralized diagnostic suite surrounded by flexible treatment, exam, and consultation rooms that streamline and enhance compassionate care for Duke Eye Center patients.

The new Duke Eye Center Clinical Building is projected to open in winter 2015.

JAFFE NAMED ROBERT MACHEMER PROFESSOR OF OPHTHALMOLOGY

Glenn Jaffe, MD, was named the Robert Machemer Professor of Ophthalmology in the Duke University School of Medicine in May 2013. He is an internationally recognized researcher and clinician with a focus on vitreoretinal diseases and uveitis (a group of blinding inflammatory eye diseases). He also serves as the service chief for the Vitreoretinal Service at Duke Eye Center.

As a surgeon and professor of ophthalmology, Jaffe has been actively engaged in clinical research for over 25 years. Recognized as a pioneer in posterior segment sustained drug delivery systems, he was the first to show that a fluocinolone acetonide sustained drug delivery system could be used to effectively manage patients with severe uveitis who had no other treatment options. Jaffe's laboratory has also made important discoveries related to cytokines and survival proteins and their role in macular degeneration and proliferative vitreoretinopathy.

Jaffe has been actively engaged in clinical research for over 25 years. He is a pioneer in posterior segment sustained drug delivery systems.

Jaffe is the founder and director of the Duke Reading Center, an internationally recognized unit that interprets ocular images for multicenter observational and interventional clinical trials. He is also director of the Uveitis Service in the Duke Eye Center and is actively involved in mentoring, educating, and training the next generation of ophthalmologists and clinician-scientists. His groundbreaking work has and will continue to have great impact on patients around the world.

Glenn Jaffe, MD
Professor
of Ophthalmology

Jaffe received his medical degree and trained as an ophthalmology resident at the University of California, San Francisco. He completed a vitreoretinal fellowship at the Eye Institute at the Medical College of Wisconsin before joining the Duke faculty in 1989.

ABOUT ROBERT MACHEMER, MD

Throughout his life, former Duke Eye Center chairman Robert Machemer, MD, was dedicated to restoring vision by advancing ophthalmic surgery through teaching and research. He was best known for the invention of vitrectomy surgery, which revolutionized the treatment of eye diseases and allowed vision recovery for hundreds of thousands of people who would have otherwise been blind. He not only developed a host of instruments and techniques that enabled elegant surgery inside the closed eye but also taught these new skills to retinal surgeons. This generous educator shared his knowledge with ophthalmologists on every continent and hosted hundreds of visiting doctors who learned firsthand in the operating room with Machemer. As chairman of the Duke Eye Center, he established a program of true excellence across all three missions of patient care, research, and education. He gave generously of his time and knowledge to fellows and residents, who moved on to establish their own successful careers. In 1991 Machemer stepped down as chairman of Duke Eye Center, but remained professor of ophthalmology and continued to address eye diseases that might be amenable to surgical therapy, including surgery for macular degeneration. In 1998 he retired from practice and remained emeritus professor of ophthalmology. In 2009, Machemer died after a battle with cancer but remains a powerful figure within the Duke and ophthalmology communities.

STUDY SHOWS MORE DUKE EYE CENTER PATIENTS WOULD DONATE EYES IF THEY KNEW THEY COULD

A Duke University research team recently surveyed 200 Duke Eye Center (DEC) patients waiting for appointments and found that 90 percent of them would donate their eyes after death.

Eye tissue from donated eyes can be used for cornea transplants and also for research. Chuck Pivoney, CEO of Midwest Eye-Banks, an independent not-for-profit group dedicated to restoring sight, says demand for eye tissue for research is high. "Last year, the Midwest Eye-Banks had 5,000 donors for surgical intent, but only 313 patients donated eyes for research," he says. According to Pivoney, people simply don't realize they can donate their eyes.

Some 55 percent of DEC patients surveyed said they would sign up for a research registry, which is one solution to the scarcity of tissue available to study. Patients with eye disease said they would sign up to donate their eyes to research after death, providing doctors valuable additional time to study their eye conditions.

Studying diseased eyes via donation can help researchers discover cures and treatments for ailments such as macular degeneration or glaucoma, according to Pivoney.

One reason patients choose not to donate their eyes is a fear of disrupting funeral arrangements and thinking the procedure is grotesque, according to Andrew Williams, a Michigan State University medical student and member of the Duke survey research team.

The survey asked patients how they would like to receive information about donating their eyes: 41 percent of them preferred learning from their eye doctor.

Kelly Muir, MD, assistant professor of ophthalmology at DEC and member of the survey team, says, "As eye doctors, we hesitate to have these kinds of conversations with our patients. This survey is a wake-up call for me, that my patients want to have this conversation with me." The survey team found that 95 percent of families would support their relative's choice to join the research registry.

To Donate Eyes

In North Carolina, visit donatelifenc.org or visit the Eye Bank Association of America, restoresight.org Midwest Eye-Banks, midwesteyebanks.org or your state organ and tissue donor registry organdonor.gov

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Vadim Arshavsky, PhD	Scientific Director of Research
Sanjay Asrani, MD	Practice Chief, Duke Eye Center of Cary
S. Jill Bryant, OD, FAAO	Director, Contact Lens
Edward G. Buckley, MD	Director, Appointments, Promotion, and Tenure Vice Dean of Medical Education, Duke University School of Medicine
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Pratap Challa, MD	Director, Residency Program
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Paulo Ferreira, PhD	Assistant Director, Translational Research Program
Sharon F. Freedman, MD	Director, Pediatric Low Vision Program
Preeya Gupta, MD	Practice Chief, Duke Eye Center at Page Road
Glenn J. Jaffe, MD	Director, Duke Reading Center
Terry Kim, MD	Director, Fellowship Program Duke Sports Vision Center of Excellence
Prithvi Mruthyunjaya, MD	Director of Education Director, Ocular Oncology
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William Rafferty, OD	Director, Optometry Education
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Jullia A. Rosdahl, MD, PhD	Director, Patient Education
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Tina Singh, MD	Director, Second- and Fourth-Year Medical Student Program
Cynthia A. Toth, MD	Liaison, Duke BioEngineering
Robin R. Vann, MD	Faculty Liaison Director, Information Technology
David K. Wallace, MD, MPH	Director, Site-Based Research (SBR) Program
Julie A. Woodward, MD	Director, Public Education Program Faculty Liaison Director, Ophthalmic Technician Program
Terri L. Young, MD	Director, Pediatric Genetics Program Faculty Liaison, Singapore

ADMINISTRATION

Michael Howard, MBA, FAHEC	Chief Operational Officer
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Heidi Campbell, COT	Health Center Administrator
Renee Wynne	Coordinator, Continuing Medical Education Director, Education Program Staff
Justin Hammond, BA, BS	Director, Marketing and Communications
Laura Jensen, MBA	Research Finance Manager
Evelyn Kelly, OCA	Health Center Administrator
Erin McKenzie, MBA	Director, Development
Julia Perry, COT, OCS	Health Center Administrator
Suzanne Simmons, COT	Health Center Administrator
Martha Wilson, MBA	Health Center Administrator

COMPREHENSIVE OPHTHALMOLOGY

Anna Bordelon, MD	Assistant Professor of Ophthalmology
S. Jill Bryant, OD, FAAO	Assistant Professor of Ophthalmology
Anupama Horne, MD	Assistant Professor of Ophthalmology
Thomas Hunter, MD	Assistant Professor of Ophthalmology
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John T. Petrowski III, OD, FAAO	Assistant Professor of Ophthalmology
Laurie K. Pollock, MD	Assistant Professor of Ophthalmology
Yos Priestley, OD, FAAO	Assistant Professor of Ophthalmology
Tina Singh, MD	Assistant Professor of Ophthalmology
Robin R. Vann, MD	Assistant Professor of Ophthalmology Service Chief

CORNEA AND REFRACTIVE SURGERY

Christopher S. Boehlke, MD	Assistant Professor of Ophthalmology
Alan N. Carlson, MD	Professor of Ophthalmology Service Chief
Melissa Daluvoy, MD	Assistant Professor of Ophthalmology
Derek Del Monte, MD	Assistant Professor of Ophthalmology
Preeya Gupta, MD	Assistant Professor of Ophthalmology
Terry Kim, MD	Professor of Ophthalmology
Anthony Kuo, MD	Assistant Professor of Ophthalmology
William Rafferty, OD	Assistant Professor of Ophthalmology
Terry Semchyshyn, MD	Assistant Professor of Ophthalmology

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Pratap Challa, MD	Associate Professor of Ophthalmology
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Sharon F. Freedman, MD	Professor of Ophthalmology Professor in Pediatrics ++
Leon W. Herndon, MD	Professor of Ophthalmology
Jill B. Koury, MD	Assistant Professor of Ophthalmology
Stuart J. McKinnon, MD, PhD	Associate Professor of Ophthalmology Associate Professor in Neurobiology ++
Frank J. Moya, MD	Assistant Professor of Ophthalmology
Kelly W. Muir, MD	Associate Professor of Ophthalmology
Jullia A. Rosdahl, MD, PhD	Assistant Professor of Ophthalmology
Henry Tseng, MD, PhD	Assistant Professor of Ophthalmology
Molly M. Walsh, MD, MPH	Assistant Professor of Ophthalmology
Carol Ziel, MD	Assistant Professor of Ophthalmology

HEREDITARY RETINAL DISEASES

Stefanie Schuman, MD	Director, Center for Hereditary Retinal Diseases

LOW VISION REHABILITATION SERVICE

Diane Whitaker, OD	Assistant Professor of Ophthalmology Service Chief

NEURO-OPHTHALMOLOGY

M. Tariq Bhatti, MD	Associate Professor of Ophthalmology Associate Professor of Medicine ++ Service Chief
Edward G. Buckley, MD	Banks Anderson, Sr. Professor of Ophthalmology Professor in Pediatrics ++
Mays El-Dairi, MD	Assistant Professor of Ophthalmology

OCULOFACIAL SURGERY

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Jason Liss, MD	Assistant Professor of Ophthalmology
Michael J. Richard, MD	Assistant Professor of Ophthalmology
Julie A. Woodward, MD	Associate Professor of Ophthalmology Associate Professor in Dermatology ++ Service Chief

PEDIATRIC OPHTHALMOLOGY AND STRABISMUS

Edward G. Buckley, MD	Banks Anderson Sr. Professor of Ophthalmology Professor in Pediatrics ++
Mays El-Dairi, MD	Assistant Professor of Ophthalmology
Laura B. Enyedi, MD	Associate Professor of Ophthalmology Associate Professor in Pediatrics ++
Sharon F. Freedman, MD	Professor of Ophthalmology Professor in Pediatrics ++ Service Chief
S. Grace Prakalapakorn, MD, MPH	Assistant Professor of Ophthalmology
David K. Wallace, MD, MPH	Professor of Ophthalmology Professor in Pediatrics ++
Terri L. Young, MD	Professor of Ophthalmology Professor in Pediatrics ++ Professor of Medicine ++

VITREORETINAL DISEASES AND SURGERY

Scott W. Cousins, MD	Robert Machemer, MD, Professor of Ophthalmology Professor in Immunology ++
Sharon Fekrat, MD, FACS	Associate Professor of Ophthalmology
Paul Hahn, MD, PhD	Assistant Professor of Ophthalmology
Glenn J. Jaffe, MD	Robert Machemer, MD, Professor of Ophthalmology Service Chief
Eleonora Lad, MD, PhD	Assistant Professor of Ophthalmology
Tamer Mahmoud, MD, PhD	Associate Professor of Ophthalmology
Priyatham Mettu, MD	Assistant Professor of Ophthalmology
Prithvi Mruthyunjaya, MD	Associate Professor of Ophthalmology
Eric A. Postel, MD	Professor of Ophthalmology
Stefanie G. Schuman, MD	Assistant Professor of Ophthalmology
Cynthia A. Toth, MD	Professor of Ophthalmology Professor in Biomedical Engineering ++
Lejla Vajzovic, MD	Assistant Professor of Ophthalmology

RESEARCH OPHTHALMOLOGY

Vadim Arshavsky, PhD	Helena Rubinstein Foundation Professor of Ophthalmology Professor in Pharmacology & Cancer Biology ++ Scientific Director
Sina Farsiu, PhD	Assistant Professor of Ophthalmology Assistant Professor of Biomedical Engineering ++
Paulo Ferreira, PhD	Associate Professor of Ophthalmology Associate Professor in Pathology ++
Pedro Gonzalez, PhD	Associate Professor of Ophthalmology Associate Professor in Pathology ++
Jeremy Kay, PhD	Assistant Professor of Neurobiology Assistant Professor in Ophthalmology
Gordon K. Klintworth, MD, PhD	Professor of Pathology, Joseph A.C. Wadsworth Research Professor of Ophthalmology ++
Paloma Liton, PhD	Assistant Professor of Ophthalmology Assistant Professor in Pathology ++
Goldis Malek, PhD	Assistant Professor of Ophthalmology Assistant Professor in Pathology ++
P. Vasantha Rao, PhD	Associate Professor in Ophthalmology Associate Professor in Pharmacology & Cancer Biology ++
Tatiana I. Rebrik, PhD	Assistant Professor of Ophthalmology
Catherine Bowes Rickman, PhD	Associate Professor of Ophthalmology Associate Professor in Cell Biology ++
Daniel Saban, PhD	Assistant Professor of Ophthalmology
Nikolai Skiba, PhD	Assistant Professor in Ophthalmology
W. Dan Stamer, PhD	Professor of Ophthalmology
Sandra Stinnett, DrPH	Assistant Professor of Biostatistics & Bioinformatics Assistant Professor in Ophthalmology ++
Fulton Wong, PhD	Professor of Ophthalmology

Secondary appointment ++

Ophthalmic Medical Technician Training Program

The Duke Ophthalmic Technician Training Program enters the 2013–14 academic year with new expanded and upgraded classroom and lab space.

Duke's Ophthalmic Medical Technician Training Program has temporarily relocated from Duke Eye Center's Wadsworth Building in preparation for the facility's renovation.

Now located in School of Medicine space in the Duke Clinic, the program has a fully equipped lab and classroom space, providing students with a rich educational environment. Also located there is the office of program director Deborah Smith, COMT, BSBA.

"In a field that is highly equipment oriented, our students enjoy working extensively with the technology and tools in our new lab, getting hands-on experience in preparation for their clinical rotations," says Smith. "During their clinical rotations, they will use their skills, under the guidance and supervision of skilled clinical staff and Duke physicians, to help our physicians see patients at the Duke Eye Center and the Duke satellite offices."

"We pack as much as we can into our time together. It's a fantastic learning environment."

Deborah Smith

Students are also required to attend resident and faculty lectures. "Our accelerated program is the only one-year ophthalmic medical technician training program in the nation. We pack as much as we can into our time together. It's a fantastic learning environment," says Smith.

Upon successful completion of the program, graduates qualify to apply for the Certified Ophthalmic Technician national exam.

With a maximum enrollment of 15 students every year, this highly demanding program sees most of its students being offered jobs prior to their graduation. "Our graduates launch a career that is growing in demand, offers good salaries, is challenging, and is extremely rewarding," says Smith.

RESIDENTS

Chief Resident, Mark Hansen, MD

Third-Year Residents

Brian Goldhagen, MD
Kim Jiramongkolchai, MD
Pradeep Mettu, MD
Paula Pecen, MD
Christine Shieh, MD
Laura Vickers, MD

Second-Year Residents

Varsha Manjunath, MD
Milica Margeta, MD, PhD
Nisha Mukherjee, MD
Veena Rao, MD
Lakshmi Sonbuchner, MD, PhD
Bozho Todorich, MD, PhD

First-Year Residents

Jaya Badhwar, MD
Sidney Gospe, MD
Ramiro Maldonado, MD
Patrick Oellers, MD
Brad Wainright, MD
Wendy Zhang, MD

FELLOWS

CORNEAL/EXTERNAL DISEASE
Ladan Espandar, MD
Gary Legault, MD
Gargi Vora, MD

GLAUCOMA DISEASE
Ninita Brown, MD, PhD
Shane Havens, MD
Wei Huang, MD, PhD
Anita Vin, MD
Joanne Wen, MD

OCULOPLASTIC & RECONSTRUCTIVE SURGERY
Betsy Colon-Acevedo, MD
Andrew Munro, MD
Esfandiar (Jason) Sabet-Peyman, MD

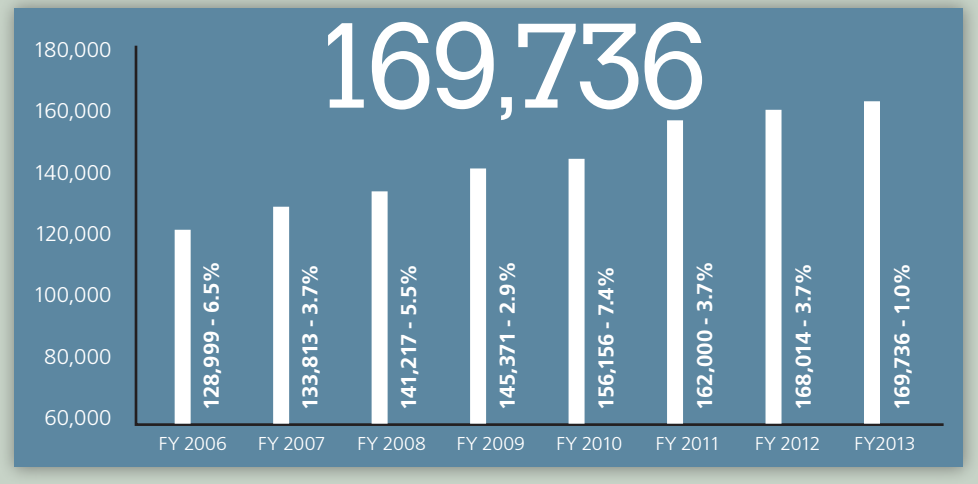
PEDIATRICS
Jared Duncan, MD
Amanda Ely, MD
Elliot McKee, MD

MEDICAL RETINA
Michael Allingham, MD, PhD
Ambar Faridi, MD
Tushar Suthar, MD

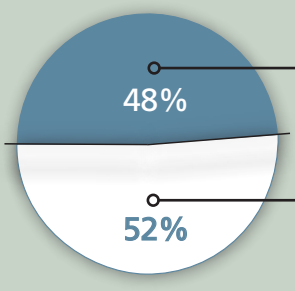
VITREORETINAL DISEASES & SURGERY
Francisco Folgar, MD
Eric Schneider, MD
Sumit Sharma, MD
Glenn Yiu, MD, PhD

ADMINISTRATION
Peter Nicholas, MD

TOTAL PATIENT VISITS IN FY 2013:
Percentage of patient volume increase year over year



Duke Eye Center
Ranks #8 in the country by *U.S.News & World Report*



FY 2013 AWARD FUNDING:

Federal	$7,874,619
Non-Federal	$8,454,566
Total:	$16,329,185

THE EYE CENTER HAS **11** LOCATIONS IN NORTH CAROLINA AND VIRGINIA.

HOW TO CONTACT THE EYE CENTER:

// online at dukeeye.org
// facebook: facebook.com/dukeeye
// patients call: 1-888-ASK-DUKE (275-3853)
// physicians call: 1-800-MED-DUKE (633-3853)
// info@dukeeye.org

DUKE EYE CENTER LOCATIONS:

Duke Eye Center of Cary
Duke Eye Center at Duke University Medical Center
Duke Eye Center of North Durham
Duke Eye Center of Raleigh
Duke Eye Center of Southpoint
Duke Eye Center at Page Road
Duke Center for Vision Correction
Duke Eye Center of Winston-Salem

RETINA CLINICS:

Danville, Virginia
Fayetteville
Wilmington

Duke Eye Center
Marketing and Public Relations Office
DUMC 3802 Durham, NC 27710
dukeeye.org

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Medicine that Changes the World

Eighty years of our history have prepared us for this moment.
Eighty years of pushing the frontiers of research.
Of raising the bar in patient care.
Of setting new standards in education.

And now it's time to take this spirit of relentless innovation to the next level.

Will you join the Duke Eye Center?

For more information contact us at
919-684-0404
or by e-mail: erin.g.mckenzie@duke.edu

gifts.duke.edu/dukeeye