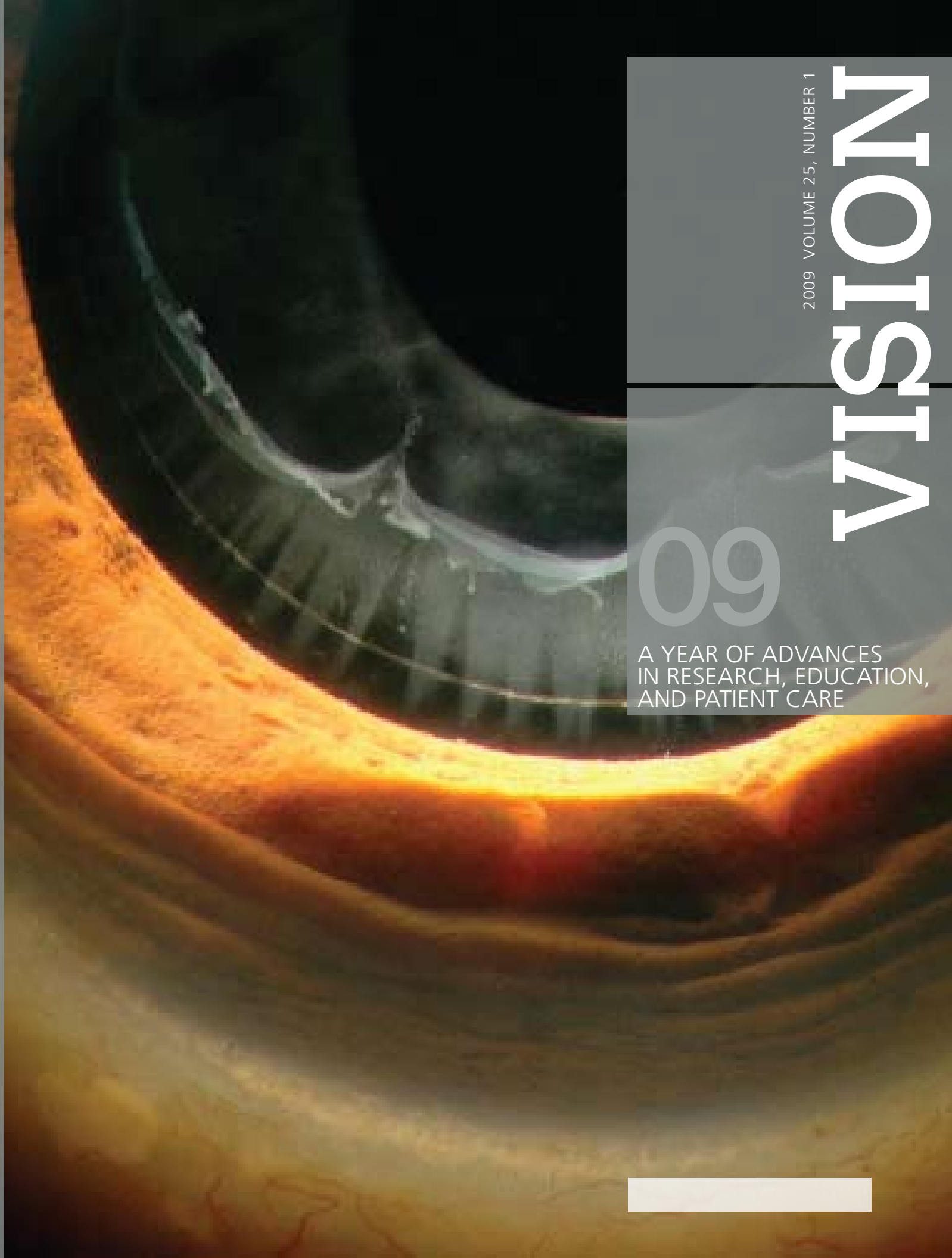

2009 VOLUME 25, NUMBER 1

VISION

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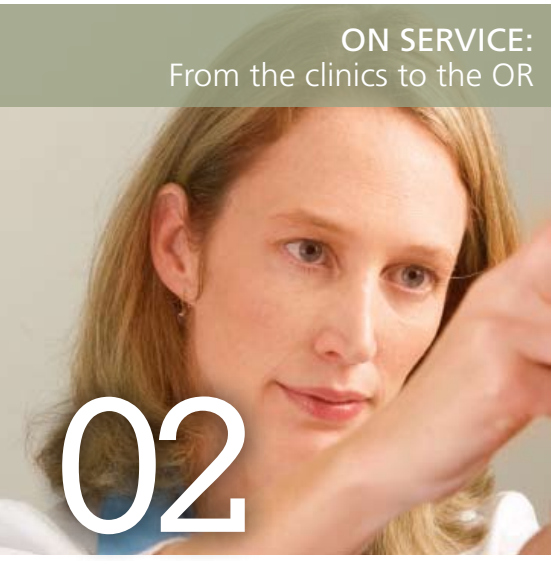
A YEAR OF ADVANCES
IN RESEARCH, EDUCATION,
AND PATIENT CARE



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ON THE COVER

In pseudoexfoliation syndrome, flakes of lens material peel off and can eventually clog the eye's drainage system, causing a build up of pressure within the eye—and eventually leading to glaucoma. See page 19.
Image by Michael P. Kelly, CPT

Q&A with David L. Epstein

WE SEEK TO BRING THE LATEST RESEARCH ADVANCES DIRECTLY TO **OUR PATIENTS**.

WHAT EXCITING DEVELOPMENTS HAVE YOU SEEN THIS PAST YEAR?

The faculty at the Eye Center has continued its longstanding tradition of ground-breaking innovations in our labs, clinics, and the operating room. Just a few examples are the layered approaches to corneal transplants, which have transformed this type of surgery—you'll read on page 2 about the first successful deep anterior lamellar keratoplasty (DALK) of a child in the nation, which was performed here at Duke; the ground-breaking work at Duke Advanced Research in SDOCT Imaging Laboratory (DARSI) is helping us take a closer and earlier look at the progression of diseases like age-related macular degeneration; and working with the Center for Human Genetics, Duke ophthalmologists are coming closer to identifying the source of devastating congenital eye diseases. Meanwhile, in the clinics our faculty members are exploring patient education and new innovations in care that will help improve outcomes for patients of any age, with any eye disease.

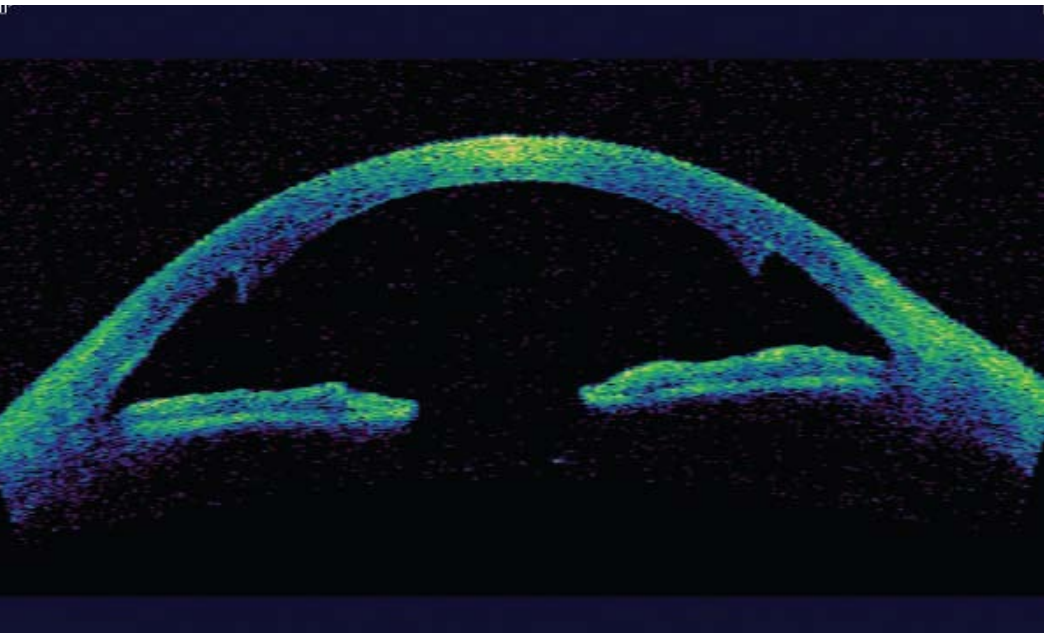
HOW WOULD YOU DESCRIBE THE CULTURE AT THE DUKE EYE CENTER?

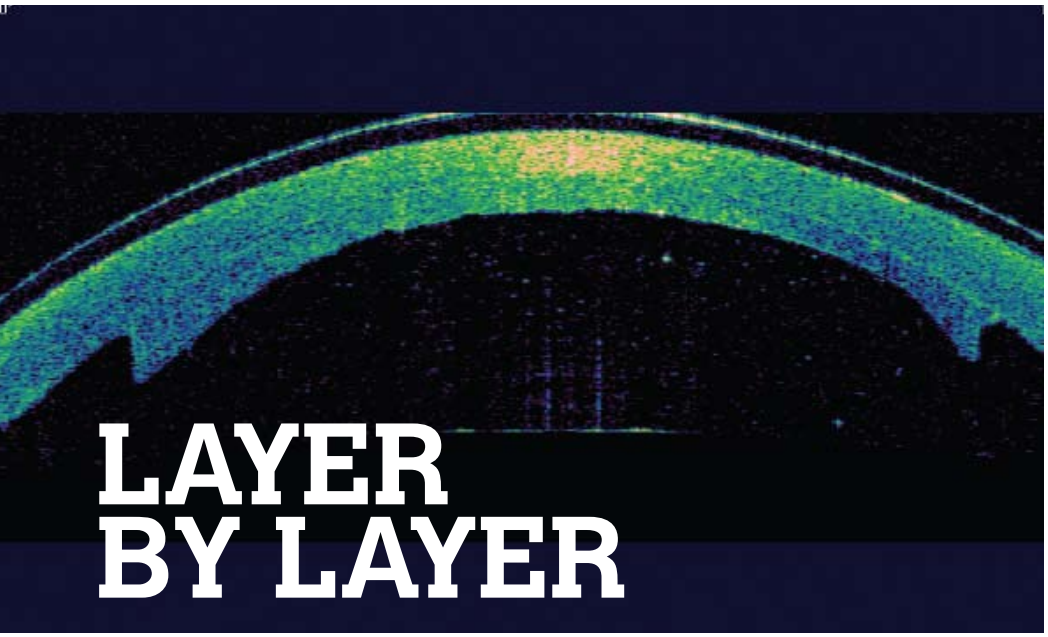
At Duke, we encourage openness and communication between our educational programs, research laboratories, and clinics. We seek to bring the latest research advances directly to our patients. We also seek to train the next generation of ophthalmology leaders and innovators. It's an interdisciplinary approach that benefits everyone. You see it everywhere from imaging research that flows seamlessly from the clinic to the laboratory, to the innovative program that allows young ophthalmology residents to choose a rotation tailored to their particular interests. That's why we excel at providing quality patient care, exposing residents and students to unsurpassed educational opportunities, and leading ground-breaking research that will impact how ophthalmologists diagnose and treat eye disorders all around the world.

WHAT IS YOUR VISION FOR THE COMING YEAR AT THE DUKE EYE CENTER?

We've been developing partnerships around the country and around the world. I hope to continue work on these and develop new ones that will help bring cutting-edge patient care to the people who need it most.

David L. Epstein, MD, MMM
Chair, Department of Ophthalmology





LAYER BY LAYER

New advances in corneal transplants

A YOUNG PATIENT WITH Hurler syndrome became one of the nation's first successful cases of deep anterior lamellar keratoplasty (DALK) performed on a child by Duke ophthalmologist Terry Kim, MD. The procedure is a benchmark in a new, layered approach to corneal transplants—which could hasten the trend away from full-thickness corneal transplants for almost every patient with corneal disease.

Until recently, doctors performed full-thickness transplants for any disease in the cornea, even if the disease affected only some of the corneal layers. A now widely performed procedure known as Descemet's stripping endothelial keratoplasty (DSEK) offers a more nuanced approach by replacing the back layer of the cornea. DALK takes it a step further—it removes only the front 95 percent of the cornea, leaving the rest (including the Descemet's membrane and endothelium) intact.

This new procedure presents significant advantages for pediatric patients, who face special challenges after corneal transplantation. In the case of Kim's Hurler syndrome patient, the child's genetic disorder was causing clouding in the cornea, requiring surgery to clear the clouded areas. Since everyone's endothelial cells degenerate over time, a donor cornea's endothelial cells would not have lasted for this child's lifetime. By leaving the Descemet's membrane and endothelial cell layer intact, Kim says the DALK corneal transplant could last indefinitely.

Layered corneal transplant approaches such as DALK and DSEK could eventually replace full-thickness transplants altogether, according to Kim. "We're going through a revolution in corneal transplantation techniques and approaches," he says. "DALK alone has the potential to replace 30 to 40 percent of the transplants we're doing with conventional full-thickness transplant surgery."

Both procedures offer faster recovery time, and they retain more structural integrity in the eye, since only the diseased portion of the cornea is replaced. DALK in particular offers a much lower risk of rejection because the body generally doesn't sense the donor tissue in the outside layers of the cornea. In addition, since there's no need to penetrate into the eye, there's less chance of complications such as bleeding, scarring, and glaucoma. And while DALK is still a delicate and difficult procedure, it's not an all-or-nothing proposition. "Right now surgeons can try these techniques, and if they don't work out intraopera-

tively, they can convert over to a regular full-thickness transplant with relative ease," says Kim.

Duke researchers and ophthalmologists are working in the laboratory to find ways to refine the technique by employing new imaging modalities such as SDOCT (read more on page 4) as well as other innovative devices that may help delineate the different layers of the cornea.

Together, surgical advances like DALK and DSEK, along with the new generations of adhesives, offer promise to patients suffering from a wide variety of eye diseases and conditions including corneal scarring, keratoconus, corneal ulcers, and corneal dystrophies. "It's been a really exciting time for corneal surgeons," says Kim. "We are currently witnessing major advances in corneal transplantation surgery that should help ophthalmologists provide patients with better outcomes, faster recovery, and fewer complications."

TERRY KIM IS also researching new **adhesives and sealants** that may offer an alternative to sutures, not only for corneal transplants but also for other surgeries, including repairs of cataract incisions, corneal lacerations and LASIK flaps. Compared to conventional sutures, these new adhesive materials may offer potential advantages including greater patient comfort, less risk for infection, and faster healing and visual recovery.

Terry Kim

GLAUCOMA OUTCOMES

Is communication the key to compliance?

ALTHOUGH THERE ARE NEW and exciting surgical options for treating glaucoma, most patients are still treated with eye drops. These drops, though effective when used as directed, aren't always used properly. "Drops may burn or sting or blur patients' vision. It's not surprising that people don't want to use them," says ophthalmologist Kelly Muir, MD.

Muir is exploring the use of new educational pamphlets and scripted DVDs to help patients understand the importance of their medication, measuring health literacy levels and seeing how educational materials tailored to patients' needs improve compliance. In addition, Muir hopes to take a look at how offering education in non-clinical settings can help. "We don't always communicate to our patients why their glaucoma medications are important—even if they can't tell that the drops are helping," she says. She hopes this study will have a measurable effect on clinical outcomes for glaucoma patients. "I think there's a group of patients who could have better outcomes—who would be less likely to lose their vision, less likely to need surgery—if we could help them better use their medication."

Kelly Muir is studying whether improving patient education improves compliance in medical glaucoma therapies.

The speed and clarity of SDOCT imaging is opening new opportunities for disease diagnosis and research, especially in pediatric populations.

CLEARER, FASTER, BETTER

The impending impact of imaging

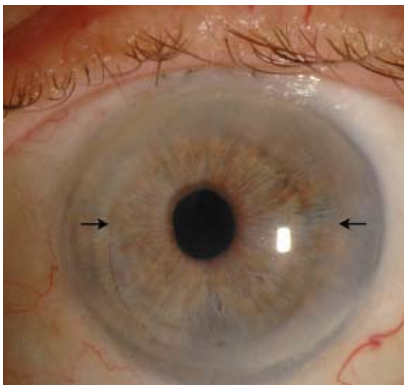
PHOTOGRAPHY OF THE INNER workings of the human eye dates back to 1886, but today's imaging studies are opening a new level of insight to mechanical function—and malfunction—of the eye. Ophthalmologist and biomedical engineer Cynthia Toth, MD, is studying how new imaging technologies such as spectral domain optical coherence tomography (SDOCT) can enhance diagnosis and treatment of age-related eye diseases in children and adults.

SDOCT allows doctors to obtain clearer, faster images of the eye than ever before. That means they're better able to monitor disease progression and develop analyses that could be predictive. Toth, who specializes in research on age-related macular degeneration (AMD), is leading a multi-year, multi-center clinical trial to identify whether changes in AMD seen over time with SDOCT can be used to predict vision loss and ultimately slow the progression of the disease. The Duke Advanced Research in SDOCT Imaging Laboratory (DARSI), which is directed by Toth, grades and analyzes images for the study, helping to identify markers for disease.

Toth is optimistic that the new technology, by allowing researchers to see diseases at smaller levels, will have real clinical impact. "I believe we'll be able to see inside the drusen to identify the earlier processes in AMD so that we can treat it before they ever need the current drugs," she says. "So this would be stopping the disease before there's a risk of the more serious vision loss."

In children, SDOCT lets doctors take images that just weren't possible in the past. Since the scanning device is hand-held, it can be taken directly to a baby in a nursery. This gives researchers an opportunity

GENETIC CLUES TO FUCHS DYSTROPHY



Natalie Afshari, MD, FACS, is working on a study to isolate the genes that cause Fuchs corneal dystrophy, a disease that is a leading cause of disability and responsible for a large percentage of the 40,000 corneal transplants performed in the United States annually.

With the support of an NIH grant, Afshari and colleagues have collected genetic samples from more than 400 families, representing more than 700 individuals with the disease. Working with Gordon Klintworth, MD, PhD, and Duke's Center for Human Genetics, the research team has identified five chromosome areas that may be associated with the condition. "We're on our way to slowly finding what's causing this," says Afshari. "It's a complex disorder, so it won't be overnight."

Although the isolation of the gene and an ultimate genetic therapy that might treat the disease are a long way off, Afshari says the cornea is an ideal location for treatment, because of its accessibility and avascular status.

to see the macula actually develop in very young babies. "Every week we go to the neonatal intensive care nursery and we can observe characteristics of the retina not observed with conventional examination," Toth says. "We go back the next week and we can see how that eye grows and changes."

Already, Toth is finding that they're able to see all kinds of things with SDOCT that they haven't previously been able to see. "Our initial observation was 'Wow!' We see all these holes and cysts and things that we haven't seen before when we looked in their eyes," she says. "The current study intends to figure out the normal characteristics of children's eyes and differentiate this from abnormalities caused by retinopathy of prematurity."

Toth says that the pediatric applications of SDOCT are particularly valuable. "Kids haven't had the access to diagnostic instruments that we've been using for over 10 years in adults," she says. "I just thought it wasn't fair." Now SDOCT may help doctors identify problems that they've been unable to in the past. "Before we just said, 'The child has a vision problem and I'm not sure why.' If we can identify problems, we can treat with surgery or medicine and prevent vision loss," she says.

"I think we've already seen how OCT can show us things that are at the limit of what we're able to see as humans," Toth says. "I think in the future this is going to change a lot of our decision-making in surgery."

PEDIG: STREAMLINING CLINICAL TRIALS

LAURA ENYEDI, MD, AND DAVID WALLACE, MD, MPH, are active in the Pediatric Eye Disease Investigator Group (PEDIG), a group formed in 1997 to organize randomized clinical trials in pediatric ophthalmology. Wallace has served as protocol chair for several studies, and is now also vice chair of PEDIG. Enyedi is the principal investigator for the Duke group.

"The nice thing about PEDIG is that the studies we do are things that you can use immediately in your clinic to change the way you practice and get kids better treatment," says Enyedi. The group seeks to answer important questions in pediatric ophthalmology, such as identifying the most effective treatment for amblyopia and finding the normal values for central corneal thickness in children.

"The key to having a good site that recruits patients and provides the necessary data to do these trials is having a great principal investigator like Laura Enyedi and a terrific coordinator—in our case, Sarah Jones," Wallace says. "Duke in many ways has been a model site."

Prithu Mettu used his rotation to research the applications of statin drugs in glaucoma patients.

Yassine Daoud worked in Beirut to help patients with little or no access to health services, such as correcting the vision of this young girl, whose amblyopia was previously treated improperly.

PROFESSIONAL PASSIONS

Duke's special third-year rotation helps residents clarify, explore, and expand their careers

SOME MAY CHOOSE the laboratory and some may choose the refugee camp, but all residents who participate in Duke's innovative special interest rotation have a unique opportunity to pursue something they feel passionate about.

The elective rotation lets third-year residents spend 10 weeks on any ophthalmology work that fuels their interests. Two of this year's residents, Prithu Mettu, MD, and Yassine Daoud, MD, chose two very different paths—and they both report the same enthusiastic results.

Mettu worked at Duke with Eye Center researcher Vasanth Rao, PhD, and chair David Epstein, MD, MMM, on a glaucoma research project. In this case, they were looking at how statins, medications that many patients take for cardiovascular disease, might benefit people with glaucoma. They theorized that statins might alter the function of the trabecular meshwork, the eye's internal "drain" that can stop working properly in glaucoma. Mettu examined how the drug lovastatin affected the expression of genes in cultured trabecular meshwork cells as compared to untreated cells.

"If we could understand how statins affect the tissue, and which molecules and pathways are altered, then we might be able to understand how these medications might lower eye pressure and benefit patients with glaucoma," Mettu says. "It's a great opportunity to take a clinical observation and understand more about it in the laboratory."

Yassine Daoud, MD, spent his rotation in Lebanon, working at the American University of Beirut (AUB), where he got firsthand exposure to the dichotomies in today's health care systems. "Lebanon has infrastructure, it has resources," he says. "It just happens to not be equally distributed. It's a situation where if you're very well-to-do, you're afforded the best care the world has to offer. If you don't, you're stuck." His work concentrated on bridging this gap by building community-based access to health care.

For Daoud, it was a homecoming of sorts. "I happened to grow up in one of those refugee camps in one of those areas," he says. "My grandmother was blind and had cataracts, and we didn't know what she had. Now I know that cataract surgery takes 10 minutes. There are people who spend a good quarter of their life blind from preventable diseases, things that we treat routinely." He spent time with other AUB residents in clinics there and in the surrounding community, and helped lead additional community outreach efforts to bring health care to unserved areas.

Both Daoud and Mettu believe the rotation is an important benefit to the program at Duke. "It's a huge advantage to our program that not many other programs around the country have," says Daoud. "The curriculum in medical school is shoved down our throats in residency. You finish and you're really good at the technical things, but you might not have a good grasp on that one thing that might spark your interest."

Mettu agrees. "It really gives the individual resident the freedom to pursue something he or she feels passionate about," he says, "whether that's in the lab, the clinic, abroad, or something completely different. Particularly as a third-year, it just gives you a chance to really reflect on your training experiences and try to put those to use in something you hope will open doors for the future."

"There's so much more to ophthalmology than shadowing in a clinic or reading theory," says Daoud. "We're treating human beings who have stories and hopefully having a positive impact on their lives. This rotation helps you harness and nail down how you want to help people based on the best of your ability and your interests—the things that make you wake up in the morning."

REDEFINING THE CARE CONTINUUM

Low vision training curriculum

PATIENT CARE DOESN'T END in the operating room or the exam room—and neither should ophthalmology training. As boomers age over the next 20 years, the number of visually impaired people is expected to double; the American Academy of Ophthalmology is working to create a uniform curriculum to train ophthalmology residents in low vision rehabilitation (LVR).

Diane Whitaker, OD, a member of a small working group of LVR directors who are developing the curriculum, believes it will help ophthalmologists see LVR as part of a continuum of care they can offer patients. "Traditionally, ophthalmologists have viewed patients with permanent vision loss as suboptimal outcomes," she says. "Loss of vision is the reality of our limitations as eye care providers. Now trainees are learning a more holistic approach to care."

Duke is among only a quarter of U.S. academic medical centers that offer low-vision rehabilitation services, and it is unique in incorporating special geriatrics training. With the support of a grant from the Hartford Foundation, residents learn about the care requirements of elderly patients from geriatricians, orientation and mobility specialists, geriatric pharmacists, anesthesiologists, occupational therapists, and LVR specialists like Diane Whitaker, who is helping develop a new national curriculum for this growing branch of ophthalmic care.

As the LVR curriculum is reviewed and adopted, the governing bodies of the ACGME (Accreditation Council of Graduate Medical Education) and the AUPO (Association of University Professors in Ophthalmology) will be included in the process. Eventually, the working group will write board certification questions on LVR.

More than 90 percent of all patients who need LVR have residual usable vision. The practical application of vision science and the technology that magnifies, improves contrast, and increases peripheral awareness help people stay active and engaged in life. But only a quarter of academic ophthalmology programs in the United States currently offer LVR services—something that Whitaker hopes will change as this new curriculum is disseminated and the demand for services increases.

"We deliver life-altering diagnoses all day long every day," says Whitaker. "Sometimes we fail to realize the emotional impact this has on the patients and their families. When you can soften the blow by informing them that there's help, it makes the adjustment to their loss a little easier and a little faster."

By offering services that can make such a profound impact on patients' quality of life, ophthalmologists can create a new definition of success—one that moves beyond the number of lines a patient can read on the eye chart. "We're redefining success into something more global, more functional, and ultimately more meaningful," says Whitaker.

Sharon Freedman has conducted extensive research on therapies for aphakic glaucoma.

APHAKIC GLAUCOMA

Saving the sight of a small Seattle scientist

SARAH SMALE IS A BRIGHT, energetic, intense six-year-old child who loves science and adventure stories. Born with cataracts and now dealing with a rare eye condition called aphakic glaucoma, Sarah has also lived an adventure of her own, which has taken her from her home in Seattle, Washington, to Duke, where ophthalmologist Sharon Freedman, MD, has been treating her.

Sarah's eyes and corneas were small at birth, which in addition to her congenital cataracts put her at high risk for future complications. She underwent cataract surgery at seven weeks, and then developed aphakic glaucoma—a condition, says Freedman, that commonly afflicts patients like Sarah. It's not yet known whether glaucoma results from the cataract surgery or whether eyes with these congenital problems are simply predisposed to develop cataracts; the condition is most commonly seen among patients with congenital or nucleus cataracts, microcorneas, or PHPV [persistent hyperplastic primary vitreous].

A total retinal detachment in Sarah's left eye caused her to lose all sight in that eye. When she was diagnosed with glaucoma in her right eye, Sarah's family went in search of an ophthalmologist who could help preserve the sight in her remaining eye. Says her mother, Angela Smale, "I wanted someone who really specializes

> "I wanted someone who really specializes in high-risk cases. We decided that Dr. Freedman was going to be the right choice for us."
>
> ANGELA SMALE,
> SARAH'S MOTHER

in high-risk cases. We decided that Dr. Freedman was going to be the right choice for us."

The Smales began what have now become regular trips to Duke to take advantage of Freedman's expertise. "There are some things about children with glaucoma that are more challenging than the average case in adults," says Freedman. "There's the small size of the eye and the rapid healing response. You need a dedicated family and a cooperative child. Sarah's just a remarkable kid." Sarah's optic nerve, retina, and intraocular pressure (IOP) were carefully monitored—the Smales even obtained a tonometer to measure Sarah's IOP themselves, as often as 3 times a day. Says Freedman, "It's usually used only by physicians. But they were so interested and so dependable that I supported their desire to obtain one."

Freedman tried a number of medications, working in conjunction with Sarah's pediatric ophthalmologist in Seattle. But in time the medications weren't helping enough—Sarah's IOP was hovering between the low 20s to around 40mm Hg. Freedman and the Smales decided it was time to try surgery—a drainage implant that would allow for the release of built-up fluid in the eye. In a joint surgery with Duke vitreoretinal specialist Cynthia Toth, MD, Freedman inserted the implant—farther back than usual to avoid harm to Sarah's cornea. Six weeks after the surgery, the Smales returned to Duke so Freedman could carefully monitor Sarah during the vulnerable period when the absorbable suture dissolved, the drainage implant became functional, and the eye pressure began to drop.

The surgery was a big success. "She's doing great. Her pressure is normal for the first time in her life," Smale says. "And having Dr. Freedman, I don't have to worry. When I have a question or concern, I get as much support as if I lived next door."

"As long as the implant is working, we're in great condition," says Freedman. "If it should cease to work, we would need to redo the surgery or try another type of surgery." Such a scenario is a strong possibility—Freedman says surgeries like this tend to work for around 10 years. "The Smales realize this is an ongoing process, and that some time in the future, Sarah's going to need to have additional surgery."

It's a reality that Sarah seems well-prepared to face. She attends a school for gifted children and is in the top group for reading and doing very well in math despite missing 30 days this past school year for medical reasons. "She doesn't know that she has a disability," Smale says. "She's behind in gross motor skills, but it doesn't hold her back. If you met her, you wouldn't realize what she has gone through."

MACULAR DEGENERATION

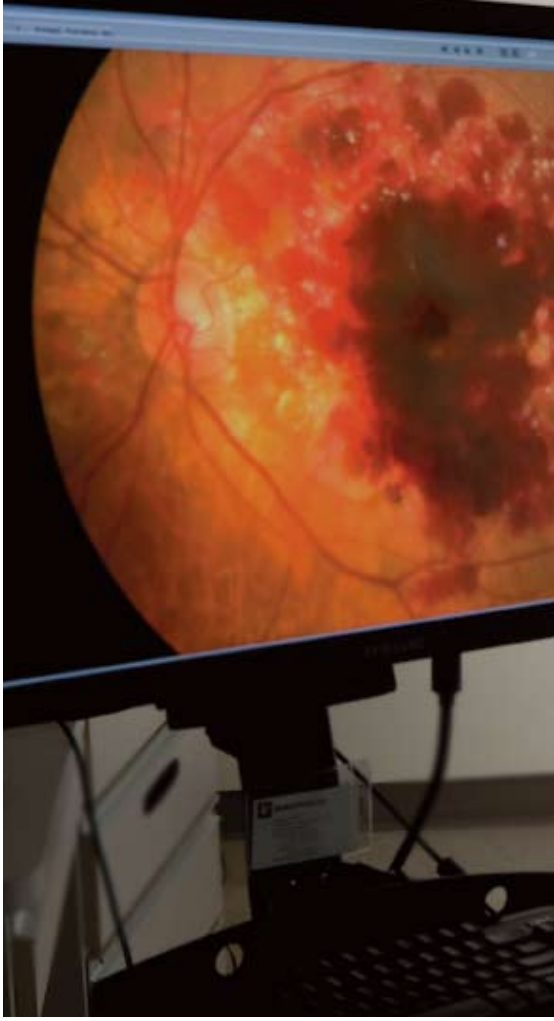
Personalized approaches to preserving sight

A CHANCE MEETING STARTED IT ALL. Harvey DesVeaux's youngest son, Darren, ran into an old friend, Russell Burns, who works at the Duke Reading Center. He mentioned that his father, a retired court officer living in Maine, had been told by his doctor that his bilateral wet macular degeneration (AMD) would cause him to go blind. While Burns said that doctors at Duke had no magic pill or shot, Darren DesVeaux was impressed enough with Duke's reputation to convince his father to come down for a second opinion. Little did the DesVeauxs know that Duke ophthalmologist Scott Cousins, MD, would be able not only to stabilize one eye, but also actually to improve the vision in the other.

When Harvey DesVeaux arrived for his appointment in October 2008, Cousins immediately recognized that he had two sub-types of AMD that didn't respond well to standard treatment. "When you look at the real-world results with ranibizumab (Lucentis) and bevacizumab (Avastin) injections, it controls the leakage in about 90 percent of people and it makes the vision better in about 30 percent of people. But it doesn't work very well in about 10 percent of people," says Cousins. "He unfortunately was one of those 10 percent."

Cousins was able to determine this through dynamic ICG angiography, a technology he says Duke excels at using. This imaging test allowed him to identify the blood vessel type in the eye so he could determine the most appropriate treatment. "This technology has been around for 20 years," he says, "but it fell out of fashion because it's difficult to interpret and people didn't know how to use the information. Over the last four years, we've tried to resurrect the technology and understand it better. With the technology, we now understand the actual flow and size of new blood vessels forming in wet AMD."

He recommended immediate photodynamic therapy to dry out DesVeaux's right eye, the worse one, and a more frequent course of anti-VEGF injections in his left eye. DesVeaux's right eye, which was previously completely unresponsive, is now dry; though the vision is not great, at least it's stable. His left eye, however, now boasts 20/30 vision.

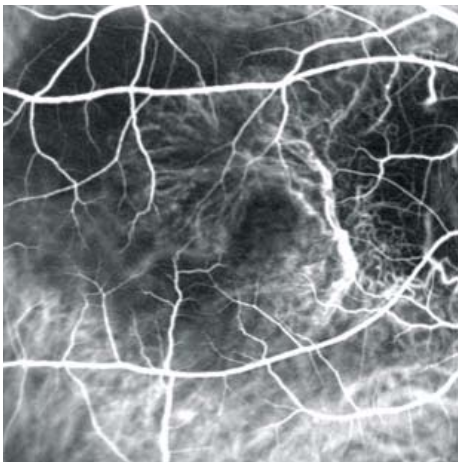


Harvey DesVeaux has two subtypes of AMD that don't respond well to standard treatment. Scott Cousins has helped stabilize his vision and bring one eye back to 20/30.

"His left eye bounced back to spectacularly good vision, where he's reading and driving again," says Cousins. "Before, he was essentially legally blind because the drugs weren't working in him."

DesVeaux continues to fly back from Maine every four to five weeks for injections. These trips have a happy bonus—he and his wife get extra time with their son and daughter-in-law, and their two young grandchildren. Although each appointment can last hours, the treatment he gets is worth it, DesVeaux says. "They've done a lot for me here. If they can keep my vision where it is, I'm happy."

DesVeaux is also doing a lot for patients like him—by participating in research



ICG angiography may be out of vogue in some centers, but Duke ophthalmologists use it to their advantage in determining treatment strategy for AMD patients.

Cousins is doing in the lab. By analyzing blood samples from patients such as DesVeaux, Cousins is hoping to predict who will get the types of AMD that don't respond well to conventional treatment. He says that specific types of circulating stem cells in the blood and an inappropriately activated immune system seem to contribute to the growth of the big blood vessels that are harder to treat conventionally.

Cousins's goal is to pair findings from that analysis with clinical outcomes data to help personalize current AMD treatment protocols. Doctors typically guess at AMD treatment regimens based on their own experience, Cousins says. "No one really has a regimen that's designed specifically for an individual patient's disease activity. That's what we're trying to develop," he says.

DesVeaux's case is a good example of the difference that such personalized approaches can make. "The ideas that we're coming up with are the result of cross-fertilization between what we study in the test tube, what we study in rats, and what we study in the patient as a living laboratory. The goal is to make patients better by coming up with better tests and better treatments."

READING THE RETINAS

AT THE DUKE READING CENTER, doctors and researchers are on the cutting edge of imaging technology, interpreting images and helping direct protocols for new technologies to ensure that doctors get as much information as possible out of imaging instruments.

One of a handful of such centers in the country, the Duke Reading Center interprets images from multi-site clinical trials around the world. In addition to reading optical coherence tomography (OCT) scans, it has branched out into other types of imaging including fundus autofluorescence—a technology that helps doctors evaluate the health of the retinal pigment epithelium—and spectral domain optical coherence tomography (SDOCT).

Staff at the center work together to certify study sites, manage incoming images, assign them to readers on- and off-site, interpret and grade images, and analyze the results. The center is a leader in teaching ophthalmologists, ophthalmic photographers, and technicians how to use imaging technologies and interpret the images with precision.

The Duke Reading Center also develops software that can help automate measurements that would otherwise be tedious, such as the size of the drusen area, which is useful in determining the extent of age-related macular degeneration.

Says Glenn Jaffe, MD, the founder and director, "On the one hand, our work is daunting, but on the other hand, it's exciting. We're able to help drive the use of these machines for clinical trials and patient care."

KERATOCONUS

Revealing old myths and new relationships

THE FIRST TIME a patient hears the word keratoconus, it is usually at the time they are given the diagnosis. Naturally, this is followed by a number of questions such as: "What is it?" and "How did I get it?" But the question Alan N. Carlson, MD, chief of the corneal and refractive surgery service, has been asking is: "Why haven't we cured it?"

Keratoconus is a degenerative process of the cornea that manifests as central corneal thinning with increased steepness and irregular corneal curvature. This leads to progressive nearsightedness, astigmatism, and reduced vision. "The impact of keratoconus is profound—it seriously affects the vision of a large number of individuals throughout their lifetime, beginning at a young age," Carlson says, estimating that around 400,000 in the United States have been diagnosed with it and another half million are likely undiagnosed. "These are usually young, often successful individuals, and when you start to talk about performing full thickness corneal transplantation on these patients, you are talking about a significant impact on a lifetime of vision."

Advanced cases of keratoconus require surgery, including Intacs intracorneal rings or corneal transplant surgery (shown below, using the newly developed Carlson Troutman Titanium Needle Driver). Diagnosis, treatment, and reducing eye rubbing is key, says Alan N. Carlson, to slowing the progression of the disease. "The corneal degradation seems to stabilize by the time patients turn 40," he says. "If we can get these people to stop eye rubbing sooner, there'd be a lot more people who might be correctable with glasses and contacts alone."

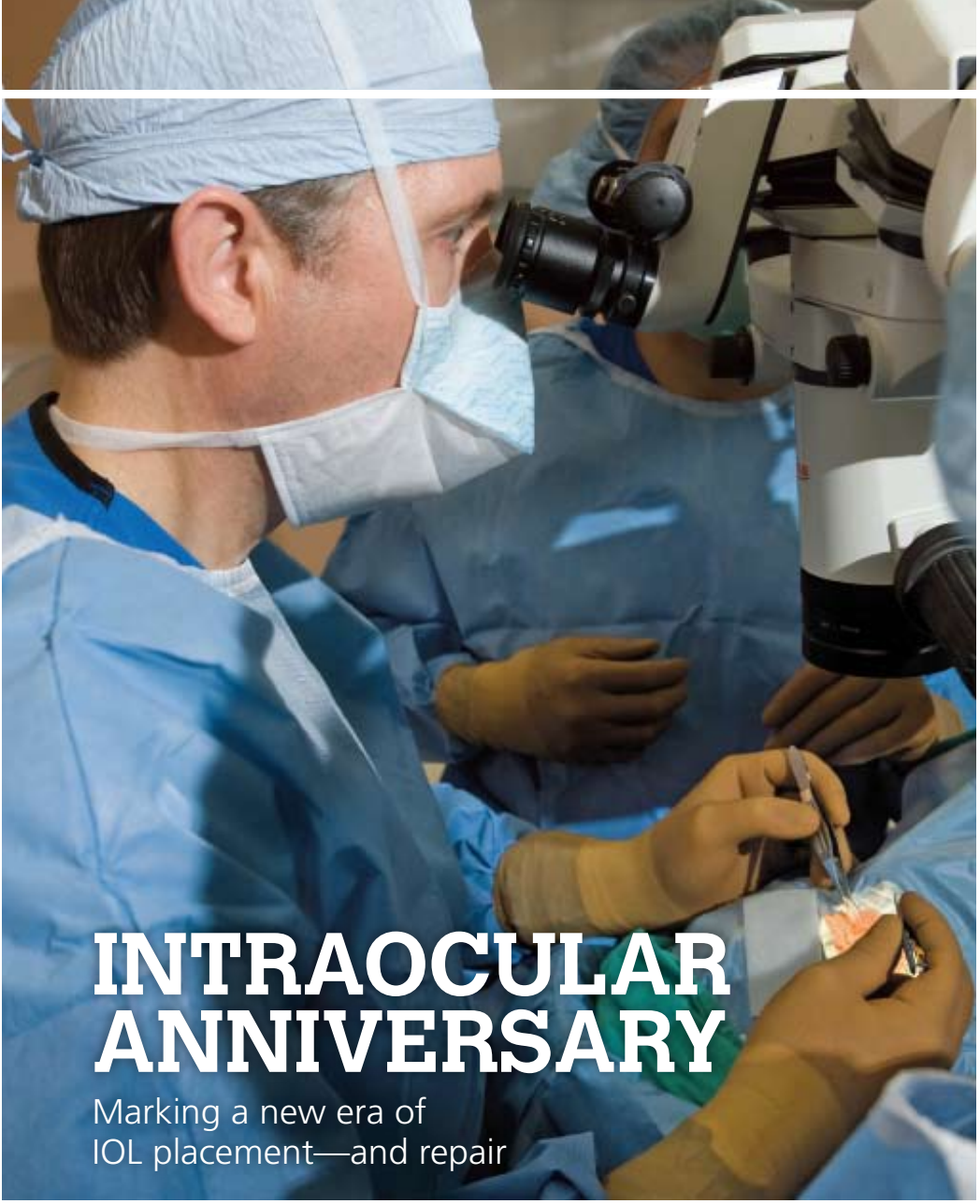
Corneal collagen cross-linking is gathering interest as a treatment strategy that could strengthen the cornea; however, Carlson's research seeks out contributing factors that could be controlled to slow or prevent disease progression. "I've always had a hunch that keratoconus represents something other than a disease purely confined to the cornea," he says. "I wanted to ask the questions that nobody else is asking and cause others to look at this condition from a completely fresh perspective," he says.

One discovery that has come out of Carlson's research has debunked a common misconception: the notion that keratoconus patients rub their eyes primarily in response to a higher incidence of allergies. "The pattern of the eye rubbing, the intensity, the duration, and even the motivating reason behind eye rubbing is distinctly different in keratoconus patients compared to patients with allergic problems," he says. "This is not simply genetics at work in patients who also happen to have allergies and a tendency toward eye rubbing." He notes that in rare cases, the external trauma can be so severe that the corneal response may be like the wrestler who winds up with "cauliflower ear."

Additionally, one previously unrecognized phenomenon is the number of patients who put pressure on or around their eyes during sleep with their hands or pillow in a manner that likely contributes to disease progression. "Prior to this discovery, we were unaware of this potential source of mechanical trauma," Carlson says. He believes eye rubbing and nocturnal pressure on the eye has much greater significance on the progression of keratoconus than previously recognized. This research has also opened the door to a better understanding of a condition called ectasia after LASIK surgery, noting comparable eye rubbing tendencies in patients who develop changes similar to keratoconus.

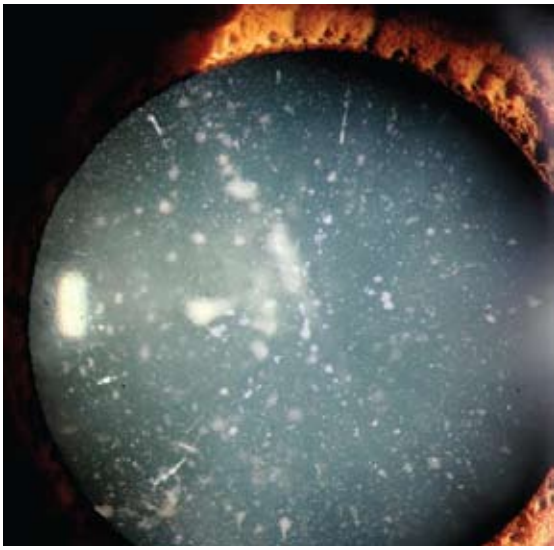
And though the disease has long been considered a disease of the cornea, Carlson's observations also suggest that the pathophysiology surrounding keratoconus may involve other parts of the body as well: he has found that obstructive sleep apnea (OSA) occurs in keratoconus patients at a rate several times higher than what is reported in the general population. OSA has been linked to high blood pressure and cardiovascular diseases, and additional studies are under way to better understand this relationship.

Carlson says that most keratoconus research is focused on diagnosis and better surgical treatment. But he's interested in prevention, too—and he is collaborating with Duke sleep researchers Andrew Krystal, MD, and Mugdha Thakur, MD, to further investigate this apparent relationship between keratoconus and OSA. "I'd also like to better understand eye pain and why people respond with different methods of eye rubbing," he says. "Right now, I am asking a lot more questions than I'm answering—and I'm hoping that will change in the near future."



INTRAOCULAR ANNIVERSARY

Marking a new era of IOL placement—and repair

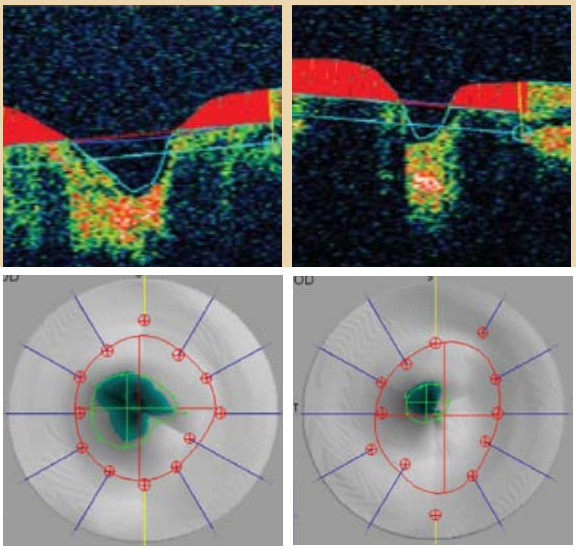


Alan N. Carlson (left) says that more than one million IOLs are inserted every year—meaning that even a small percentage of complications can lead to a significant number of additional surgeries, which require expertise beyond the typical IOL case.

2009 MARKS the 60th anniversary of the first successful use of an intraocular lens (IOL) implant during cataract surgery, a procedure that many have since come to consider routine—even take for granted, says Duke ophthalmologist Alan N. Carlson, MD. Cataract surgery is the most commonly performed surgical procedure covered by Medicare and Medicaid, with more than a million IOLs inserted annually. Carlson, known as an expert in the area of complex cataract surgery and for his work on repairing IOL problems, says patients undergoing cataract surgery understandably have high expectations. "The advances in IOL technology and the procedure itself make cataract surgery one of the truly great advances in modern medicine," he says. "Almost everyone has a relative or knows somebody who raves about their outcome after cataract surgery."

As a result, some patients may develop expectations that are not realistic for their particular case. Additionally, some patients may encounter problems during surgery. According to Duke ophthalmologist Robin Vann, MD, the IOL can be damaged during insertion, or affected by subsequent trauma or disease that can cause it to fail. In some patients, the IOL can cause side effects such as visual aberrations that can be intolerable. Sometimes a mistake in the power of the lens sends patients back to the operating room. In other cases, the patient may not be happy with the lens itself—most are only sharp at one particular distance—and although the newer accommodative and multifocal lenses offer terrific advantages for patients wanting to preserve their near vision, these lenses are not for everyone. In some cases the tradeoffs are not worth the added expense or side effects.

This new technology is still evolving and Duke eye surgeons are seeing more patients desiring these lenses, but also more patients coming for second opinions regarding some of the potential side effects. When something goes wrong during or after cataract surgery, the removal of an IOL is not a simple procedure. "Eye surgeons are well trained at injecting lenses," says Vann, "but we're not all very well trained in removing them." Carlson is one of only a handful of eye surgeons in the world who has removed more than 1,000 IOL implants in patients referred for a wide variety of reasons. "Our reputation continues to grow," Carlson says. "Patients have high expectations and are willing to travel longer distances. Referring doctors also appreciate our willingness to work closely with them as well as their patients toward an end result that delivers the best vision and ideally meets the expectations they had going into cataract surgery."



In the January 2009 issue of *Archives of Ophthalmology*, El-Dairi published initial findings from her normative database of OCT measurements of macular thickness, retinal nerve fiber layer (RNFL) thicknesses, and optic nerve tomography in the healthy eyes of 286 children ages 3 to 17. One of the more striking findings was that these measurements vary not only with age but also by race: black children have smaller macular volume and foveal thickness, larger RNFL thickness, and larger cupdisc area ratios (images on the right) when compared with white children. El-Dairi says that the data from her research will help make OCT a valuable tool for assessing pediatric eye diseases, particularly glaucoma.

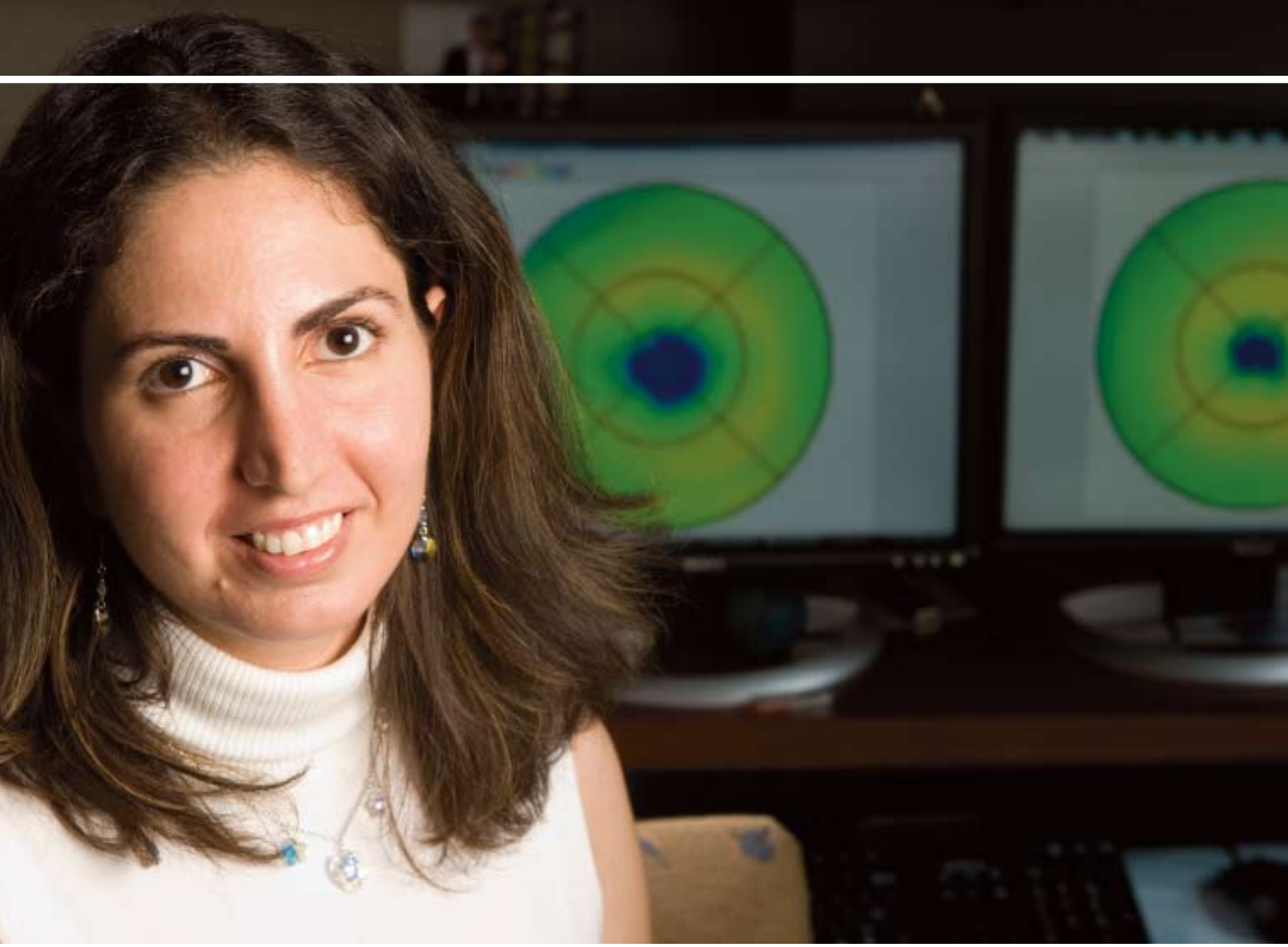
Other Eye Center researchers on the study were Sanjay Asrani, Laura Enyedi, and Sharon Freedman.

NEW APPLICATIONS FOR OCT

OPTICAL COHERENCE TOMOGRAPHY (OCT) offers promise for diagnosing and monitoring eye disease, and it is especially handy for working with children, many of whom can't concentrate long enough for a visual field test. But though the OCT machine has an integrated normative database for adults, it lacks one for children. This is because the eyes of children are still in the process of active growth, so their normal values are different from those of adults.

Duke ophthalmologists Mays El-Dairi, MD, and Sharon Freedman, MD, have been using OCT technology to develop a normative database of healthy children, to be used as a tool when identifying and grading the severity of various eye conditions afflicting this young patient population. They have already enrolled around 300 children in the database, and they plan to bring back some of the children who were originally scanned for the normative database to see how their eyes have changed over time. In time, they hope to use spectral domain optical coherence tomography (SDOCT) for both normal children and those children with glaucoma or other ocular anomalies.

The database is currently being used to monitor children with glaucoma in a way that's more objective than was possible in the past. In addition, the technology has proven useful when a child has an optic neuropathy, which El-Dairi says can be hard to assess without a visual field. "In certain cases, the OCT confirmed an optic nerve anomaly and prompted us to get an MRI, which confirmed an optic nerve tumor," she says. "We wouldn't have been able to monitor them or tell where the problem was without the OCT, since the child could not sit for a visual field test."



In adults, El-Dairi says OCT is valuable when trying to decide the source of a problem—be it the macula or the optic nerve—and they can ultimately save time and money. They're also used to monitor adults with idiopathic intracranial hypertension—where high pressure in the brain causes the optic nerves to swell which may cause vision loss—both clinically and for research purposes. "OCT can tell us pretty objectively how swollen the optic nerve is," says El-Dairi. "It can also tell us if there's atrophy in the optic nerve."

When it comes to swollen optic nerves, El-Dairi says the current grading system is subjective, which can present problems for ophthalmologists who aren't specialists in these conditions. "What we're trying to do is use OCT to help community ophthalmologists tell if the nerve is swollen or not—to better evaluate the severity of the problem," El-Dairi says. She wants to take a closer look at patients with such mildly swollen optic nerves that it's difficult to even identify them, and see if OCT can help doctors determine if a nerve is swollen or not, and whether that patient needs further testing.

OCT is also helping identify promising new areas of study. For example, when looking at the eyes of healthy children, El-Dairi says researchers saw that there were structural differences between black and white children's eyes. Since conditions like age-related macular degeneration and glaucoma differ by race, doctors may be able to trace these differences back to differences in the architecture of the eye from birth.

"What we're trying to do is use OCT to help community ophthalmologists tell if the nerve is swollen or not—to better evaluate the severity of the problem."

MAYS EL-DAIRI

REBUILDING BLOWOUTS

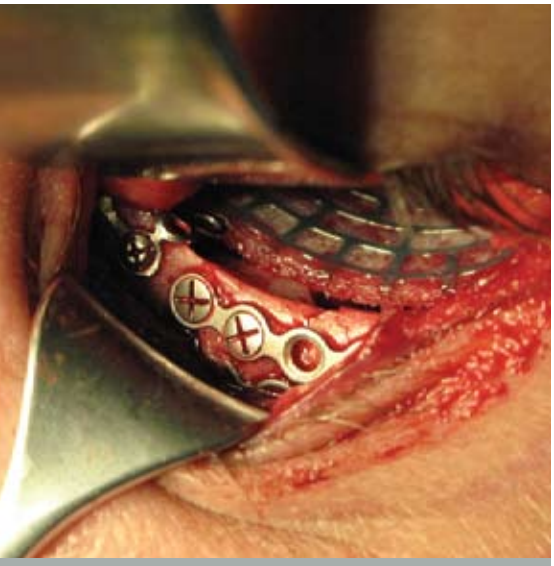
New implants offer hope for challenging orbital fractures

IN THE PAST, repairing very large orbital floor "blowout" fractures has been a dilemma for oculoplastic surgeons. The fractures are a challenge to repair when much of the floor support and surrounding bone ledge are damaged, making the anchoring of implants difficult. If a floor repair implant isn't well-secured, there is a risk that the implant will shift within the orbit or drop towards the maxillary sinus below. On the other hand, if the orbital floor defect is not repaired, or is incompletely repaired, there is a risk of diplopia, enophthalmos, and lower eyelid malposition.

A new class of orbital reconstruction plates offers a promising advance for the care of these complex cases. Duke ophthalmologist and oculoplastic surgeon Parag Gandhi, MD, has led one of the test sites for SynPOR implants, combined titanium and porous polyethylene plates made by SynthesCMF. SynPOR plates can be easily cut and contoured to fit whatever stable bone remains, and then fixated anteriorly with low profile titanium screws that integrate with existing plating systems.

Gandhi, who practices at the Duke Eye Center of Winston-Salem, has been evaluating orbital reconstruction plates for SynthesCMF since 2006. Many non-absorbable implant options exist for the repair of orbital floor blowout fractures, including smooth non-porous plastic sheeting, porous polyethylene, and titanium mesh, among others. SynPOR implants are among the few that combine the advantages of all three—and the resulting flexibility of use makes them applicable to a wide range of orbital fracture patterns involving the floor and medial wall.

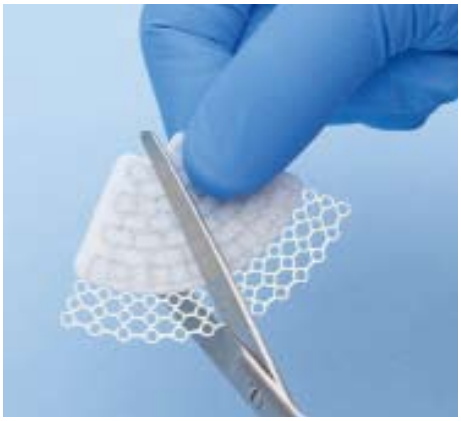
In July 2008, Gandhi was the first surgeon in the country to implant the smooth-barrier SynPOR combined titanium and polyethylene plate. This version of the reconstruction plate is much



New orbital reconstruction plates anchor anteriorly and cantilever over the orbital floor.

"He had probably one of the more complicated orbitozygomatic fractures I've seen."

PARAG GANDHI



Synthes USA / 1301 Goshen Parkway / West Chester, PA 19380

Top: Combined SynPOR implants can be cut and contoured by the surgeon to fit the specific area affected in each orbital blowout fracture case.

Above: The implants can stabilize large defects of the orbital floor, adding support to complex trimalar fracture repairs without exposing the orbital soft tissues to titanium mesh. The post-operative 3D orbital CT shown here illustrates placement of the SynPOR implant and trimalar repair plates.

less likely to adhere to any soft tissues or fat near the fracture site. The patient, a 25-year-old man, had sustained significant trauma to the left orbit and had developed a large floor fracture with loss of all of the surrounding bony support, along with a cheek bone (trimalar) fracture. His eye had developed enophthalmos and sunk back into the left orbit due to the volume expansion, and he was experiencing pain as well as double vision on his up- and downgaze.

"The floor fracture component was very large. He had probably one of the more complicated orbitozygomatic fractures I've seen," says Gandhi. Intraoperatively, Gandhi contoured the titanium at the front of the plate so that he could fix it anteriorly to the sound part of the bone and cantilever it over the orbital floor up to the base of the medial wall. The patient did well after the operation, and with time the double vision, enophthalmos, and pain resolved.

The SynPOR plate offers advantages over other implants. "It has more bells and whistles," Gandhi says. "It has the ability to support from out front because you have the titanium that you can cut to any shape you want and cantilever along the floor. For most patients with a large floor defect with or without medial wall involvement, this is a very good solution."

Gandhi has performed 10 procedures using these special implants both with and without the smooth barrier for unusually large orbital floor fractures, all with excellent results. He presented his research and findings, the first such report on SynPOR implants at any major international meeting, during the International Orbital Society Symposium in September 2008.

AESTHETICS UPDATE

Dysport enters the arena

A new competitor to Botox, called Dysport, came on the market in mid-July. According to Julie Woodward, MD, an oculoplastic and reconstructive surgeon and cosmetic laser surgeon, Dysport may offer a greater diffusion area, faster onset, and perhaps be priced slightly lower than Botox. Woodward will be a regional trainer for ophthalmologists who are interested in adding Dysport to their aesthetic practices. "There's definitely going to be a learning curve as there are different ways to dilute it and to inject it," Woodward says; it was developed in Europe and uses a different processing than Allergan's Botox. She adds that it takes most physicians about 30 days to get used to using the new product.

Julie Woodward

STAYING ALIVE

The quest to protect retinal ganglion cells and prevent glaucoma

IN GLAUCOMA, a neurodegenerative process believed to be similar to Alzheimer's disease causes the destruction of the retinal ganglion cells that transmit visual information from the retina to the brain. Stuart McKinnon, MD, PhD, is researching the mechanism behind retinal ganglion cell death—and how neuro-protective therapies might protect against the disease.

Studies of specific proteins present in glaucoma and Alzheimer's disease have found important similarities. For example, when a membrane-bound protein important in the maintenance of neural synapses (amyloid precursor protein, or APP) degenerates, amyloid beta is formed, which is a primary component of plaques found in the brains of Alzheimer's disease patients. McKinnon has found amyloid beta present in retina ganglion cells in glaucoma retinas and optic nerves, and this suggested that a similar process is occurring in both diseases.

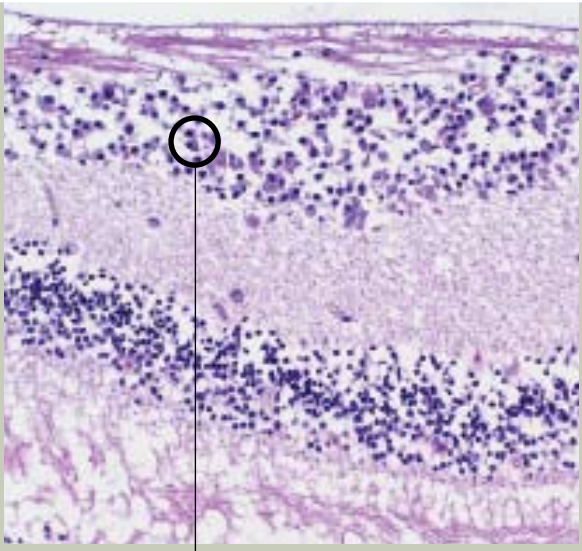
"That provided a potential link between molecular mechanisms of Alzheimer's disease and that of glaucoma," says McKinnon. "The eye is basically an extension of the brain, so it makes sense that these types of processes would be similar." McKinnon is currently testing mouse models to see whether blocking the production of amyloid beta through the use of various compounds protects against glaucoma.

McKinnon also says he's interested in the role of neuro-inflammation in glaucoma. "There appears to be interplay in immune processes," he says. "This picture is coming together of a more chronic type of neuro-inflammation." Researchers including McKinnon are looking

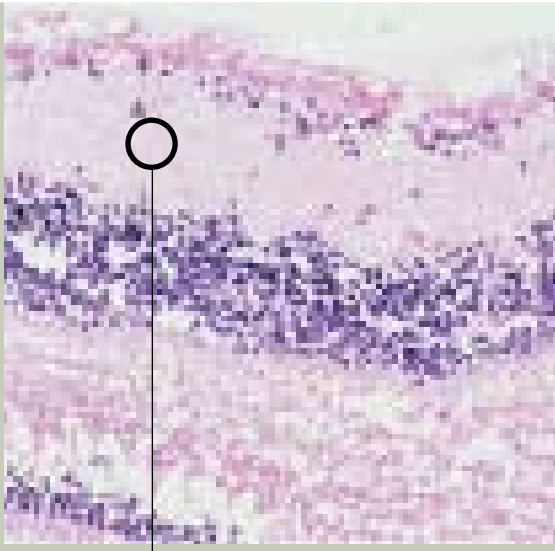
specifically at TNF-alpha, an inflammatory protein involved in rheumatoid arthritis. "It turns out that a number of receptors for TNF-alpha seem to be important in glaucoma, so targeting the TNF-alpha pathway is of real interest," he says. McKinnon has shown that mice with deletions of genes for these receptors are more resistant to glaucoma's degenerative process.

If these studies bear out, McKinnon believes a new class of therapies may not be far behind. Researchers studying macular degeneration have paved the way for intraocular injections for the treatment of eye diseases. "So if we can find the target—and I think we're closing in on one—we can use the same general approach to treat glaucoma."

McKinnon notes that the climate for neuroprotective trials in humans hasn't been great in recent years, following a large, expensive, five-year study of memantine (conducted by Allergan) that showed no real impact on amyloid plaque formation. But he says that rodent models have a significant role to play in demonstrating improvement or prevention of damage to the optic nerve. "These mouse glaucoma models are relatively new to the research field," McKinnon says. "The great advantage in using mice is that the genes in mice can be manipulated and you can create transgenic mice or genetic knock-out mice and determine whether the mutation or absence of a protein would affect the glaucoma process. It really is a tremendous test-bed for looking at molecular and cellular processes in glaucoma."



Both amyloid beta and TNF-alpha have been implicated in the degenerative process that destroys retinal ganglion cells in glaucoma patients.



Stuart McKinnon believes that scientists are closing in on cellular therapeutic targets that could prevent this ganglion cell death.

GLAUCOMA RESEARCH NOTES:

// **PRATAP CHALLA, MD**, is looking at genes involved in pseudoexfoliation syndrome [see cover image], a major cause of glaucoma throughout the world. He'll take samples from participants and identify which genes are different in patients who develop the syndrome. Challa also is studying outcomes of different types of glaucoma treatments, including lasers and delivery systems that promise to help drugs work more efficiently, thereby decreasing dosages and side effects.

// **PEDRO GONZALEZ, PhD**, is studying how a new class of regulatory elements known as microRNAs work to modulate the levels of intraocular pressure in the eye—and the involvement of these microRNAs in the pathogenesis of glaucoma. Gonzalez also investigates new gene and cell therapeutic approaches to develop more effective glaucoma treatments.

// **HENRY TSENG, MD, PhD**, is using his K12 clinician-scientist grant from the National Eye Institute to explore the molecular and cellular basis of glaucoma. He's working to understand what happens early in the disease process so that novel diagnostic techniques and therapeutic targets can be developed to catch the disease and treat it before vision is irreversibly lost.

// **THE DUKE GLAUCOMA GENETICS PROJECT** has been studying glaucoma in African patients for more than 10 years, and eye clinics in Ghana are continuing to enroll new patients for the project. R. Rand Allingham, MD, says the study has helped Duke researchers identify a strong candidate gene that may play an important role in the development of glaucoma in people of African decent.

GENETIC OPHTHALMOLOGY

Comprehensive care for congenital eye conditions

"FIND THE GENE, save the world" is the whimsical rallying cry of researchers at Duke's Ophthalmic Genetics Program—and considering the importance of their work to families who have children with devastating congenital eye conditions, it's not much of an overstatement.

Terri Young, MD, director of the Ophthalmic Genetics Pediatric Program, founded the program in 2006. Its goal, she says, is to provide directed and focused counseling and multidisciplinary care for patients with genetic disorders that affect vision. These disorders can be specific to the eye or a component of a syndrome that may involve other aspects of the body.

Young sees the development of such programs as an extension of the Human Genome Project. "In sequencing the entire human genome of about 30,000 genes and the technology that accompanied that, we're able to look in more detail at specific inherited eye disorders," she says. "Ophthalmic genetics, in particular, has exploded as a consequence."

Still, the Duke program is one of only a handful of ophthalmic genetics programs. "It's a relatively unusual program," says Young. "We know of only about 15 genetic counselors in the country dedicated solely to eye disease." Which is unfortunate, says Young, because there's a real need for this kind of coordinated care. "Often, parents come away from other facilities with a diagnosis—that may or may not be correct—and a handshake," she says. "But they're Internet-savvy. They recognize that more information and focused eye care can be provided for their child and family. They need a program that has the infrastructure already in place to care for them."

Duke's program offers families genetic

Terri Young has published more than 50 clinical and research studies for a variety of ophthalmic genetic conditions.

Many researchers and clinical ophthalmologists at the Duke Eye Center also act as investigators on a research protocol that, in part, collaborates with the National Eye Institute to provide genetic testing at no cost to patients and families with genetic eye diseases. These patients' clinical and genetic information can be contributed to a national repository of inherited eye disease—part of the National Ophthalmic Genotyping and Phenotyping Network, or eyeGENE, a service for patients and practitioners and a research base for those studying specific disorders. As part of eyeGENE, Duke clinicians such as genetics counselor Erica Burner (above) can facilitate enrollment of their patients in the latest clinical treatment trials.

counseling through a dedicated eye genetic counselor. "It's really important that the patient meet with the genetic counselor," says Young. "It can take many hours of information exchange and diagnostic test planning over an extended period of time. Most doctors cannot provide that kind of time. There may be multiple back-and-forth discussions with the gene screening lab about DNA findings. And there's high interchange with other physicians that the patient might be involved with."

Certified genetic counselor and clinical research coordinator Erica Burner, MS, offers families support and facilitates coordination with doctors and researchers. "We link patients and families to the resources and the support they need to help them function as fully as possible in everyday life," she says. "A large part of genetic counseling for patients is education, helping them understand the condition and its implications for the entire family."

Genetic counseling is about more than just dealing with the patient's diagnosis. "It's not just a patient issue, it's a family issue," says Young. "It's an issue in terms of who else may be affected or be a carrier for the condition, as well as providing recurrence risk information for those interested in family planning."

BUCKLEY IS PERMANENT VICE DEAN FOR EDUCATION

For the last two years, Edward Buckley, MD, has served the Duke University School of Medicine as interim vice dean for medical education. As of late 2008, Buckley assumed this role permanently. The vice dean for medical education is responsible for the educational quality of the medical doctor program, the physician assistant program, and the doctor of physical therapy program. "Ed has done a superb job and I feel fortunate that he will continue to be part of our team. He also will continue to oversee the admissions office, the curriculum office, student affairs, the medical center library, and anatomical gifts," says Nancy Andrews, MD, PhD, dean of the School of Medicine.

BHATTI IS NEURO-OPHTHALMOLOGY SERVICE CHIEF

M. Tariq Bhatti, MD, was recently named Duke Eye Center neuro-ophthalmology service chief. He succeeds Edward Buckley, MD, who had served as service chief of the neuro-ophthalmology and pediatrics services for the past several years. "I have been tremendously impressed with the neuro-ophthalmology clinical expertise and leadership as well as teaching performance of Dr. Bhatti; this is a most deserving appointment," says David Epstein, MD, MMM, chair of the Duke Eye Center.

COUSINS, LEE RECEIVE VICE CHAIR APPOINTMENTS

Scott Cousins, MD, and Paul Lee, MD, JD, were recently named vice chair of research and managing partner vice chair, respectively. Lee has served as vice chair under David Epstein, MD, MMM, for the past several years. This announcement reaffirms his position. "As my single VC, [Lee] has performed at the very highest level and helped me in so many ways to try to lead the department, and his VC position has really morphed into a needed VC (managing partner) leadership role," says Epstein. "His analytical, financial problem solving, conceptual and strategic skills have truly been at play at the most impressive level."

Cousins's appointment came out of a need to bridge between and integrate further the roles of Lee and scientific director Vadim Arshavsky, PhD. Cousins will be charged with overseeing and catalyzing the growth of the Eye Center's overall research program, including the various forms of translational research. "We have outstanding opportunities—starting with this year's federal stimulus plan but also involving industry, foundations, global health and philanthropy—to truly set Duke Ophthalmology as number one in ophthalmology research leadership," says Epstein.

FREEDMAN NAMED PEDIATRICS SERVICE CHIEF

Sharon Freedman, MD, was recently named pediatrics and strabismus service chief after Edward Buckley stepped down to fill the role of vice dean for medical education. Freedman has served in the pediatrics department since 1995 and is a world-renowned expert on pediatric glaucoma. "We have all held Dr. Freedman in the very highest regard as a department leader, and I believe this appointment will continue the growth of an already highly regarded service," says chairman David Epstein, MD, MMM.

Edward Buckley

M. Tariq Bhatti

Scott Cousins

Paul Lee

Sharon Freedman

Sheila Baker

Mays El-Dairi

Sina Farsiu

Tatiana Rebrik

NEW FACULTY

The research division continues its growth with three new basic science researchers. Sheila Baker, PhD, Sina Farsiu, PhD, and Tatiana Rebrik, PhD, have recently joined the Eye Center as assistant professors of ophthalmology:

Baker will focus her research on the cellular and molecular mechanisms that govern the trafficking of proteins that build and maintain photoreceptors. "There are many examples where a disruption of these trafficking processes ultimately causes the photoreceptor and its neighboring cells to die. Identifying all of the cellular trafficking mechanisms, as well as understanding how they are regulated, is important for making progress in the treatment of devastating blinding diseases such as retinitis pigmentosa," she says.

Farsiu, who is also an assistant professor in the Department of Biomedical Engineering, is collaborating with Cynthia Toth, MD, director of the Duke Advanced Research in Spectral Domain OCT Imaging (DARSI—see page 4) laboratory, investigating how to improve early diagnostic methods and find new imaging biomarkers for both age-related macular degeneration (AMD) and retinal diseases in children. Along with Toth and Joseph Izatt, PhD, director of the Laboratory for Biophotonics, they are focused on applying SDOCT systems to the study of retinal diseases at the bedside or in the operating room.

Rebrik has focused her research on the mechanisms of phototransduction and light adaptation in cone photoreceptors. Her research has already yielded significant findings: "In electrophysiological experiments on isolated cone photoreceptors, we have discovered and characterized a cone-specific Ca2+-dependent modulation of the cGMP-gated channels, an important molecular mechanism involved in the light adaptation in cones, but the molecular identity of this protein remains unknown," she says.

Mays El-Dairi, MD, joined Duke Eye Center as an assistant professor in both neuro-ophthalmology and pediatric and strabismus services. She specializes in the diagnosis and medical treatment of various types of neurological conditions affecting the eyes of both adults and children. Her clinical interests include pediatric and adult strabismus, multiple sclerosis, and idiopathic intracranial hypertension. El-Dairi's research interest lies in ocular imaging technologies, particularly OCT. She will see patients at the main Duke Eye Center location. (Read about El-Dairi's work on page 14.)

FRESH EYES ON THE VA

AFTER STARTING as the new chief of ophthalmology at the Veterans Affairs (VA) Medical Center in January 2009, Sharon Fekrat, MD, has wasted no time making changes to help the VA eye clinic work as efficiently as possible.

Many of the recent changes focus on efficiency and quality patient care. For example, Fekrat quickly discovered that the front desk staff was overwhelmed with ringing phones and was unable to focus attention on the patients in the office. Within 24 hours, the VA had installed an automated voice prompt system. Between that and hiring an additional staff member, the phones

are manageable and patients at the clinic itself get the full attention of the staff.

To keep up with continuing education needs, Fekrat presented the Allergan Access e-learning program to the staff. It's a program that's been well received and purchased by the VA. And in the new eye clinic space that is projected to open in fall 2009, Fekrat's been working on adding a patient education feed to all the televisions in the waiting areas.

"I am enjoying my new role," Fekrat says. "I've been able to come in and hear firsthand from the staff there what issues need to be fixed—and then I actually have the authority and responsibility to fix it. It's refreshing!"

EYE CENTER GRADUATES OPHTHALMIC TECHNICIAN CLASS

In June the Duke Eye Center's Ophthalmic Medical Technician Training Program graduated its second class since the revamping of the program. Eight students from across the United States completed the one-year program. Graduates receive a certificate from Duke University Medical Center and qualify to apply for the Certified Ophthalmic Technician national examination administered by the Joint Commission on Allied Health Personnel in Ophthalmology (JCAHPO). Two graduates, Renee Hinesley and Summer Stevens, joined the Eye Center staff.

Standing from left to right: Shirlon Williams, Lora Rees, Firuza Tursunova, Chelsea Ray, Summer Stevens, Jo Legacki, COMT
Sitting from left to right: Julie Woodward, MD, Renee Hinesley, Christopher Forbes, Geeti Mandal

EYE CENTER HOSTS GLOBAL BLINDNESS SYMPOSIUM

In November 2008, the Duke Eye Center co-hosted, along with the Duke Global Health Institute, an inaugural symposium called Global Blindness: Integrated Approaches to a Cure. The day-long symposium brought together a distinguished faculty of 13 speakers from four countries, who outlined key components that are needed to better understand and address specific blinding eye conditions but also challenges to implementing strategies designed to combat these conditions. The keynote speaker was Gullapai Nag Rao, Distinguished Chair of International Ophthalmology at the LV Prasad Eye Institute in Hyderabad, India. Rao headed the International Agency for the Prevention of Blindness and is a key voice in the Vision 2020 program, which is charged with eradicating preventable blindness by the year 2020. The program brought together students, clinicians, and researchers from diverse fields of medicine. The Symposium was co-sponsored by the Multicultural Resource Center from the School of Medicine and through a prestigious award secured by Eye Center chair David Epstein from the Pfizer Medical and Academic Partnerships Visiting Professor program, which also funded a special lecture given by Rao on November 12.

TRAINING SEMINAR HOSTS NORTH CAROLINA SERVICES FOR THE BLIND

Some of North Carolina's top minds in optometrics, ophthalmology, and services for the blind gathered recently on the Duke University Medical Center campus as the Duke Eye Center hosted the North Carolina Division of Services for the Blind for a two-day training seminar.

Fifteen Duke physicians, clinicians, and other experts in eye health gave presentations in July 2008 to an audience that included 75 of the division's staff members. The Division of Services for the Blind works around the state to help people who are blind or visually impaired reach their goals of independence and employment.

Kathy Harrison, rehabilitation program specialist at the division, said the training gives social workers and other division employees a crucial understanding of the medical issues facing their clients.

"It helps us when our clients tell us about what they're going through. It's good for us if we better understand where they've been and where they're going," Harrison says.

The seminar was a unique collaboration between several Duke departments and the state agency. In addition to the Duke AHEC Program and the Duke Eye Center, Duke University Health System's Clinical Education and Professional Development also participated.

BUILDING RELATIONSHIPS IN GHANA

The Duke Eye Center recently donated a Humphrey visual field unit to Accra, Ghana, to help eye clinic personnel diagnose and follow glaucoma—a major cause of blindness in African countries—in their patients. The machine will also be used as part of the Duke Glaucoma Genetics project, which enrolls patients in Ghana as well as the United States to help explore and identify genetic causes for glaucoma (see page 19).

ETTER WINS RESIDENT WRITER'S AWARD

Eye Center resident Jonathan Etter, MD, won first-place honors in the sixth annual *Ophthalmology Times* Resident Writer's Award program. Etter placed first among 14 entries received from participants representing ophthalmic teaching institutions from across the country and, for the first time, a Canadian institution, the University of Toronto. His presentation was titled "Fungal keratitis: enhancing antifungal delivery with femtosecond laser-assisted keratectomy." The win marked the second consecutive year that a resident working under Alan N. Carlson, MD, earned the top spot in the competition.

YOUNG RECEIVES MENTORING AWARDS

Terri Young, MD, was named a top physician mentor by the American Medical Association Women Physicians Congress, through their Physician Mentor Recognition Program. The award recognizes physician mentors who make a difference in the professional life of another physician.

TOTH WINS $300,000 BIOMEDICAL RESEARCH AWARD

Cynthia Toth, MD, won a Hartwell Individual Biomedical Research Award worth $300,000 over three years, for her work on "Spectral Domain Optical Coherence Tomography Imaging of Infant Eyes: A Practical Diagnostic Tool and Methodology."

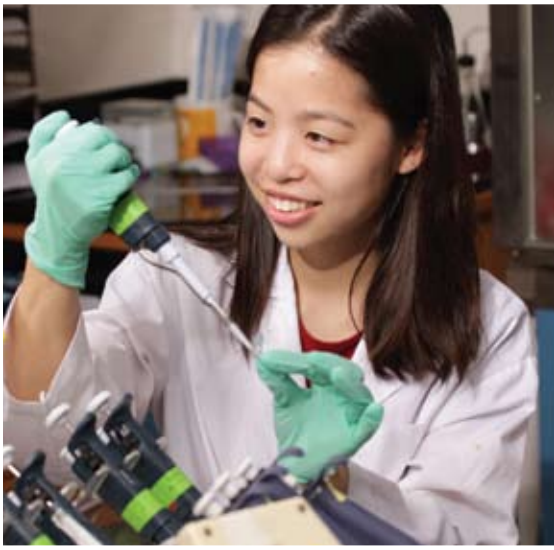
DECROOS WINS MACHEMER AWARD

Char DeCroos, second-year resident, received the prestigious Robert A. Machemer Research Award at the Annual Residents' and Fellows' Day program in June.

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

FACULTY HONORED FOR LEADERSHIP

Several Duke Eye Center faculty members were honored in May by the Association for Research in Vision and Ophthalmology (ARVO) for their accomplishments, leadership, and contributions to the association. There are two levels of fellows (gold and silver), which are determined by a rigorous point system. David L. Epstein, MD, MMM, chair of the Duke Eye Center, was named a gold fellow. Scott W. Cousins, MD, a retina-trained ophthalmologist who specializes in the diagnosis, treatment, and research of macular diseases, and Terri Young, MD, a specialist in pediatric eye disorders, were named silver fellows. As fellows, the association anticipates these three will continue to advance vision disorder research, prevention, and cure. They are also expected to continue to serve as role models and mentors of individuals pursuing careers in vision and ophthalmology research.



CHRISTINE SHIEH RECEIVES RPB FELLOWSHIP

CHRISTINE SHIEH, a third-year medical student, was selected as the recipient of a Research to Prevent Blindness (RPB) Medical Student Fellowship. The $30,000 grant will support Shieh's ophthalmic research efforts in 2009 at the Duke Eye Center.

Shieh is conducting research on age-related macular degeneration (AMD) with Glenn Jaffe, MD, professor of ophthalmology. She is investigating the role of membrane-bound complement regulatory proteins in human retinal pigment epithelial (RPE) cells.

"I feel fortunate to have a wonderful mentor and to have this set-aside time to conduct research during medical school," she says. "Hopefully, by understanding the function of these complementary regulatory proteins, we can ultimately better protect the RPE cells from cell death."

Shieh is the latest fellowship recipient from Research to Prevent Blindness, the leading voluntary health organization supporting eye research directed at the prevention, treatment or eradication of all diseases that threaten vision. RPB supports nearly a quarter of all current foundation-funded research at the Duke Eye Center.

FACULTY LEADERSHIP

David Epstein, MD, MMM	Chairman, Department of Ophthalmology
Paul Lee, MD, JD	Vice Chairman, Department of Ophthalmology
Scott Cousins, MD	Vice Chairman, Department of Ophthalmology
Leon Herndon, MD	Medical Director, Department of Ophthalmology
Eric Postel, MD	Director, Eye Center Perioperative Services
Vadim Arshavsky, PhD	Scientific Director, Research Ophthalmology
Robin Vann, MD	Service Chief, Comprehensive Ophthalmology
Alan N. Carlson, MD	Service Chief, Cornea and Refractive Surgery
R. Rand Allingham, MD	Service Chief, Glaucoma
M. Tariq Bhatti, MD	Service Chief, Neuro-Ophthalmology
Julie Woodward, MD	Service Chief, Oculoplastic and Reconstructive Surgery
Sharon Freedman, MD	Service Chief, Pediatric Ophthalmology and Strabismus
Glenn Jaffe, MD	Service Chief, Vitreoretinal Diseases and Surgery
Sanjay Asrani, MD	Chair, Education Program
Jill Bryant, OD	Director, Contact Lens
Edward Buckley, MD	Director, Appointments, Promotion, and Tenure Vice Dean of Medical Education
Scott Cousins, MD	Director, Translational Research Program Director, Center for Macular Diseases
Paulo Ferreira, PhD	Assistant Director, Translational Research Program
Sharon Freedman, MD	Director, Pediatric Low Vision Program
Glenn Jaffe, MD	Director, Duke Reading Center
Prithvi Mruthyunjaya, MD	Director, Continuing Medical Education
William Rafferty, OD	Director, Optometry Education
Sharon Fekrat, MD	Chief, Division of Ophthalmology at the Durham VA Medical Center
Cynthia Toth, MD	Liaison, Duke BioEngineering
David Wallace, MD, MPH	Assistant Director, Site-Based Research (SBR) Program
Diane Whitaker, OD	Director, Vision Rehabilitation Program
Julie Woodward, MD	Director, Public Education Program
Terri Young, MD	Director, Pediatric Genetics Program Faculty Liaison, Singapore
Catherine Bowes Rickman, PhD	Director, Third-Year Medical Student Program
Pratap Challa, MD	Director, Duke Ophthalmology Residency Program
Terry Kim, MD	Director, Duke Ophthalmology Fellowship Program
Jo Anne Legacki, COMT	Director, Ophthalmic Technician Program
Tina Singh, MD	Director, Second- and Fourth-year Medical Student Program

ADMINISTRATION

Charles Mansfield, MBA	Chief Administrative Officer
Michael Howard, MBA, FAHEC	Director of Operations
Justin Hammond, BA, BS	Marketing Manager
Nick Hernandez, BS	Senior IT Manager
Mary Walter, BA	Director, Development
Renee Dawson	Coordinator, Continuing Medical Education Director, Education Program Staff

COMPREHENSIVE OPHTHALMOLOGY

Jill Bryant, OD	Assistant Professor of Ophthalmology
Thomas Hunter, MD	Assistant Professor of Ophthalmology
Philip McKinley, MD, MPH	Assistant Professor of Ophthalmology
John Petrowski, III, OD	Assistant Professor of Ophthalmology
Laurie Pollock, MD	Assistant Professor of Ophthalmology
Tina Singh, MD	Assistant Professor of Ophthalmology
Robin Vann, MD	Assistant Professor of Ophthalmology Service Chief

CORNEA AND REFRACTIVE SURGERY

Natalie Afshari, MD	Associate Professor of Ophthalmology
Christopher Boehlke, MD	Assistant Professor of Ophthalmology
Alan N. Carlson, MD	Professor of Ophthalmology Service Chief
Terry Kim, MD	Associate Professor of Ophthalmology
Anthony Kuo, MD	Assistant Professor of Ophthalmology
William Rafferty, OD	Assistant Professor of Ophthalmology
Terry Semchyshyn, MD	Assistant Professor of Ophthalmology

GLAUCOMA

R. Rand Allingham, MD	Richard and Kit Barkhouser Professor of Ophthalmology Service Chief
Sanjay Asrani, MD	Associate Professor of Ophthalmology
Pratap Challa, MD	Assistant Professor of Ophthalmology
David Epstein, MD, MMM	Joseph A.C. Wadsworth Clinical Professor of Ophthalmology Chairman
Leon Herndon, MD	Associate Professor of Ophthalmology Medical Director
Jill Koury, MD	Assistant Professor of Ophthalmology
Paul Lee, MD, JD	James Pitzer Gills, III, MD & Joy Gills Professor of Ophthalmology Vice Chairman
Stuart McKinnon, MD, PhD	Associate Professor of Ophthalmology Associate Professor in Neurobiology ++
Frank Moya, MD	Assistant Professor of Ophthalmology
Kelly Muir, MD	Assistant Professor of Ophthalmology
Henry Tseng, MD, PhD	Assistant Professor of Ophthalmology
Molly Walsh, MD, MPH	Assistant Professor of Ophthalmology
Carol Ziel, MD	Assistant Professor of Ophthalmology

NEURO-OPHTHALMOLOGY

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

OCULOPLASTIC AND RECONSTRUCTIVE SURGERY

Parag Gandhi, MD	Assistant Professor of Ophthalmology
Michael Richard, MD	Assistant Professor of Ophthalmology
Julie Woodward, MD	Assistant Professor of Ophthalmology Assistant Profesor in Medicine ++ Service Chief

PEDIATRIC OPHTHALMOLOGY AND STRABISMUS

Edward Buckley, MD	Banks Anderson, Sr. Professor of Ophthalmology Professor in Pediatrics ++
Mays El-Dairi, MD	Assistant Professor of Ophthalmology
Laura Enyedi, MD	Assistant Professor of Ophthalmology Assistant Professor in Pediatrics ++
Sharon Freedman, MD	Professor of Ophthalmology Professor in Pediatrics ++ Service Chief
David Wallace, MD, MPH	Associate Professor of Ophthalmology Associate Professor in Pediatrics ++
Tammy Yanovitch, MD	Assistant Professor of Ophthalmology
Terri Young, MD	Professor of Ophthalmology Professor in Pediatrics ++

VITREORETINAL DISEASES AND SURGERY

Srilaxmi Bearelly, MD	Assistant Professor of Ophthalmology
Scott Cousins, MD	Robert Machemer, MD, Professor of Ophthalmology Vice Chairman Professor in Immunology ++
Sharon Fekrat, MD	Associate Professor of Ophthalmology
Glenn Jaffe, MD	Professor of Ophthalmology Service Chief
Brooks McCuen, II, MD	Robert Machemer Professor of Ophthalmology
Prithvi Mruthyunjaya, MD	Assistant Professor of Ophthalmology
Eric Postel, MD	Associate Professor of Ophthalmology
Cynthia Toth, MD	Professor of Ophthalmology Professor in Biomedical Engineering ++
Diane Whitaker, OD	Assistant Professor of Ophthalmology

RESEARCH OPHTHALMOLOGY

Vadim Arshavsky, PhD	Professor in Ophthalmology Professor of Pharmacology & Cancer Biology ++ Scientific Director
Sheila Baker, PhD	Assistant Professor in Ophthalmology
Catherine Bowes Rickman, PhD	Associate Professor of Ophthalmology Associate Professor in Cell Biology ++
Sina Farsiu, PhD	Assistant Professor of Ophthalmology Assistant Professor in Biomedical Engineering ++
Paulo Ferreira, PhD	Associate Professor in Ophthalmology Associate Professor of Molecular Genetics & Microbiology ++
Pedro Gonzalez, PhD	Associate Professor in Ophthalmology Associate Professor of Pathology ++
Gordon Klintworth, MD, PhD	Professor of Pathology Joseph AC Wadsworth Research Professor of Ophthalmology ++
Paloma Liton, PhD	Assistant Professor in Ophthalmology Assistant Professor in Pathology ++
Goldis Malek, PhD	Assistant Professor in Ophthalmology Assistant Professor in Pathology ++
Vasantha Rao, PhD	Associate Professor in Ophthalmology Associate Professor in Pharmacology & Cancer Biology ++
Tatiana Rebrik, PhD	Assistant Professor of Ophthalmology
Dennis Rickman, PhD	Assistant Professor in Ophthalmology Assistant Research Professor of Neurobiology ++
Nikolai Skiba, PhD	Assistant Professor in Ophthalmology
Sandra Stinnett, DrPH	Assistant Professor of Biostatistics & Bioinformatics Assistant Professor in Ophthalmology ++
Fulton Wong, PhD	Professor of Ophthalmology Professor in Neurobiology ++ Assistant Professor in Pathology +++

++ Secondary appointment +++ Tertiary appointment

Duke Eye Center

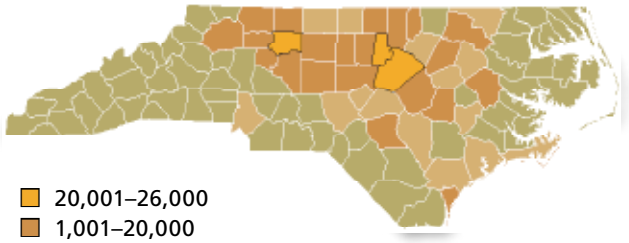
Ranks in the Top Ten
U.S.News & World Report

Ophthalmology #7

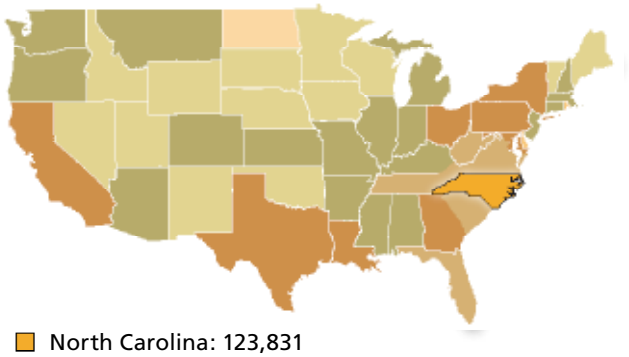
TOTAL PATIENT VISITS IN FY 2009: **135,498**

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

WHERE OUR PATIENTS COME FROM



- 20,001–26,000
- 1,001–20,000
- 501–1,000
- 2–500



- North Carolina: 123,831
- 201–8,156
- 51–200
- 11–50
- 1–10

DUKE EYE CENTER LOCATIONS:

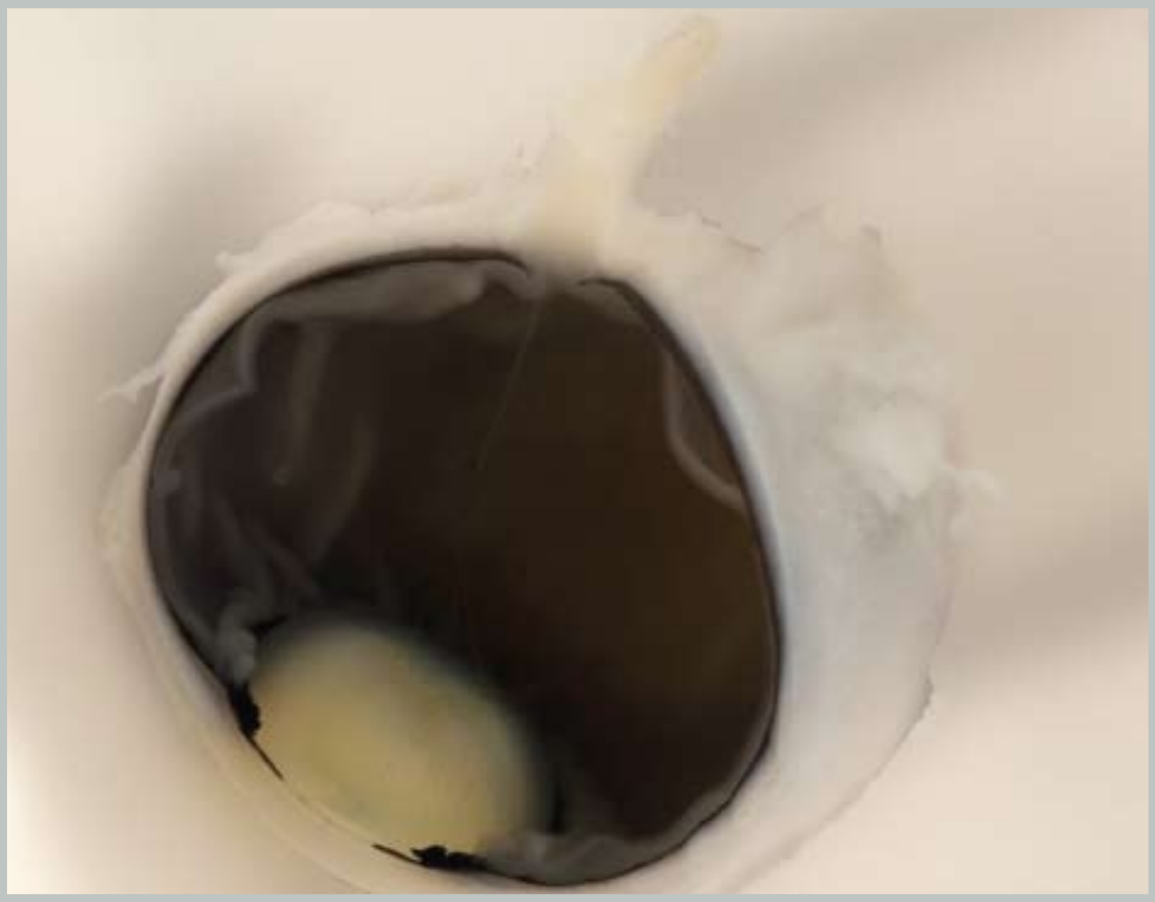
Duke Eye Center of Cary
Duke Eye Center at Duke University Medical Center
Duke Eye Center of North Durham
Duke Eye Center of Raleigh
Duke Eye Center of Southpoint
Duke Eye Center for Vision Correction
Duke Eye Center of Winston-Salem

RETINA CLINICS:

Danville, Virginia
Fayetteville
Wilmington
Wilson

HOW TO CONTACT THE EYE CENTER:

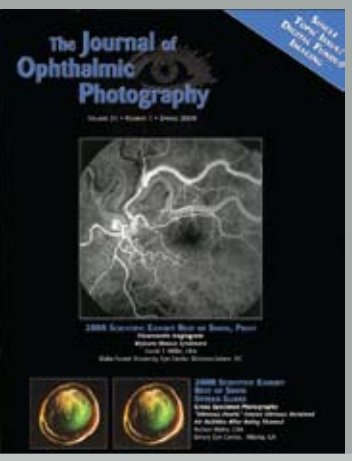
// online at dukeeye.org
// patients call: 1-888-ASK-DUKE (275-3853)
// physicians call: 1-800-MED-DUKE (633-3853)
// info@dukeeye.org



"28-WEEK FETAL EYEBALL"
Duke ophthalmic photographer Marriner Skelly won second place in the 2008 Ophthalmic Photographers' Society competition for gross specimen photography with this image.

OPHTHALMIC PHOTOGRAPHY AT DUKE

In ophthalmology, you can't treat what you can't see. Duke's ophthalmic photographers image all tissues of the eye using a variety of lighting techniques, high-magnification cameras, filters, dyes, and creativity to make eerily beautiful images that reveal important diagnostic information about each patients' ocular disorder. These images are key to establishing diagnosis, following disease progression, and in training the next generation of ophthalmologists.



Michael Kelly, manager of clinical imaging for the Eye Center, was appointed this year to the editorial board of *The Journal of Ophthalmic Photography*, the biannual peer-reveiwed publication of the Ophthalmic Photographers' Society.

"DETACHMENT"
Jeanne Queen won first place in the monochromatic photography category for this image.

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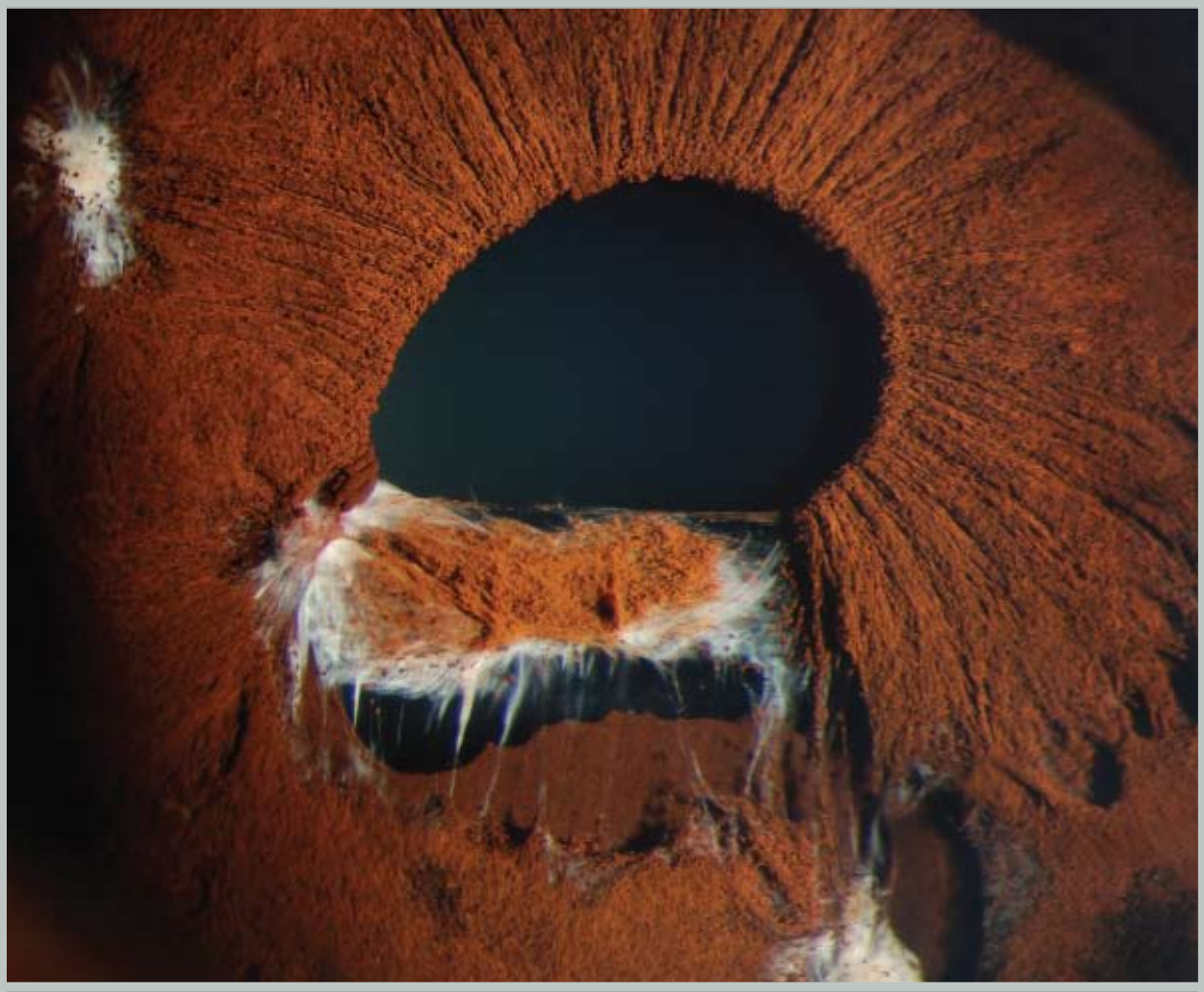

"IRIS TRAUMA" Duke ophthalmic photographer Jeanne Queen won second place in the 2008 Ophthalmic Photographers' Society awards for this slit lamp photograph.