



Clinical Insight:

Latest Lasers Under One Roof at New Vision Correction Center

Pilots who need optimum vision in both eyes. Soldiers who face a serious risk of facial injuries. Baseball catchers who must be able to spot a ball coming at them at 90-plus miles per hour from a floodlit pitcher's mound at night. And men and women who

access to leading-edge vision correction technology in a welcoming new 1,000-square-foot space that brings diagnostics and treatment under one roof.

"Previously, we were not able to accommodate all this instrumentation under one roof," says Richard Braunstein, M.D., the Miranda Wong Tang Professor of Clinical Ophthalmology at the Edward S. Harkness Eye Institute and Director of Refractive Surgery. "Our patients are amazed at the technology available."

Among the three surgical lasers in use at the new center is a state-of-the-art IntraLase Femtosecond Laser System. The IntraLase allows surgeons to use the laser instead of a blade to create the flap in the LASIK procedure. "This means a much lower complication rate and a higher degree of patient safety," says Dr. Braunstein. "There are also reports suggesting that it may have better visual outcomes as well."

The center also has two excimer laser systems, the AMO Star S4 and a WaveLight Allegretto system, which are among the most advanced in the industry today. "We believe that having this selection of lasers will allow us to expand the range of patients we can treat and tailor

▶ *continued on page 2*



Richard Braunstein, M.D. using one of the new lasers.

just want to be able to read the newspaper or drive without glasses.

Whether their optical requirements are mundane or extraordinary, people who want the best in surgical vision correction have long been seeking out the pioneers in the field at Columbia's Department of Ophthalmology. Now, with the July opening of the new Columbia Vision Correction Center, these patients have

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Research Corner:

New Core Grant Builds Essential Foundation for Vision Research

The Department of Ophthalmology, in collaboration with the Mahoney Center for Brain and Behavior and the Center for Theoretical Neuroscience at Columbia, has received a five-year Core Grant for Vision Research from the National Eye Institute. The core grant, which provides \$500,000 in funding (\$500,000 in direct costs and \$310,000 in indirect costs) each year for the next five years, will support essential elements of infrastructure for Columbia's vision research

program that would be impossible to provide in a piecemeal fashion through individual research grants.

The very word "infrastructure" isn't exactly dramatic or exciting. It does not connote glamorous, groundbreaking research that many donors and foundations like to put their names

on. But with a core grant, pathways to discovery can be expanded. Core grants are highly competitive and

difficult to come by; the department applied for this core grant twice, unsuccessfully, over the past two years before being awarded this one, the first it has received in at least 15 years.

"This new core grant will be extraordinarily valuable, not only to faculty within the

Ophthalmology Department, but also to others throughout our institution who wish to do vision research—especially to younger faculty who often have fewer resources," says Rando Allikmets, Ph.D., William and Donna Acquavella Professor in the Departments of

▶ *continued on page 5*

L to R: Carol Mason, Ph.D., Rando Allikmets, Ph.D., Michael Goldberg, M.D., Janet Sparrow, Ph.D.



Dear Friends,

I am delighted to announce that, for the first time in more than a decade, Columbia's Department of Ophthalmology has received a Core Grant for Vision Research from the National Eye Institute. These coveted, highly competitive grants – ours provides over two million dollars of additional support during the course of the next five years – provide a stable foundation for an institution's ongoing research. The core grant will support the essential infrastructure that may not generate headlines, but without which we couldn't analyze genes or build new laboratory models. Congratulations goes to Rando Allikmets, Ph.D., Michael Goldberg, M.D., Carol Mason, Ph.D., and Janet Sparrow, Ph.D., Columbia scientists who organized this successful effort.

Two of the nearly two dozen scientists whose work will be aided by the core grant are Srilaxmi Bearelly, M.D., M.H.S. and Ronald Silverman, Ph.D. In this issue, you'll learn about Dr. Bearelly's research into geographic atrophy, the end stage of dry-type macular degeneration, and Dr. Silverman's quest to develop early detection tools for keratoconus, a degenerative disorder of the eye that causes structural changes in the cornea.



Charles Marney

Over the summer, we opened a new Vision Correction Center, which is now home to all of the latest diagnostic and treatment technologies for laser vision correction, including three state-of-the-art lasers. At this center, people with a wide variety of vision impairments can achieve a level of optical clarity they may never have dreamed possible, under the care of pioneers in the field including Richard Braunstein, M.D. and Stephen Trokel, M.D., who offer a tour of the facility in this issue. Dr. Braunstein also shares his insights on the latest premium intraocular lenses, which provide previously unheard-of options for correcting vision while removing cataracts.

This issue of *Viewpoint* also highlights the work of four extraordinary young ophthalmology fellows. Two native New Yorkers, a Louisianan by way of Chicago, and an immigrant from Taiwan, they all were drawn to Columbia by the opportunity to train with some of the world's top clinicians and scientists in the field of ophthalmology, bringing with them fresh insight, vigor, and commitment.

Each time new fellows join our ranks, I am reminded of how bright the future is in our field. Just as so many of the seminal accomplishments in ophthalmology over the past several decades have taken place here at Columbia, we anticipate that many more milestones in the science of vision care will be made possible by the work that we do here now.

While I am very optimistic about the future of ophthalmology at Columbia, I would like to share with you my decision to step down as chairman of the department. I will still be a member of the faculty and continue taking care of my patients. Relief from administrative responsibilities will also provide more time for research and teaching. However, the time has come for new leadership in the department. A search to identify my successor is underway, and I look forward to welcoming him or her to this uniquely rewarding position.

During my time here, our department has enjoyed the extraordinary support of so many in the New York area and around the world. None of the achievements chronicled in this issue – or in any issue of *Viewpoint* – would be possible without your continued commitment, for which I remain always grateful.

With all best wishes,

A handwritten signature in blue ink that reads "Stanley Chang". The signature is fluid and cursive, with a long, sweeping underline.

Stanley Chang, M.D.
K.K. Tse and Ku Teh Ying Professor
Edward S. Harkness Professor
Chairman, Department of Ophthalmology

Latest Lasers Under One Roof *continued from page 1*

the selection of the laser based on ocular conditions," says Dr. Braunstein. "Some patients may do better with one type of laser than another."

"Each of our patients is evaluated and treated based on an individual biological and optical profile," says laser vision correction pioneer Stephen Trokel, M.D., Vice Chair of the Department of Ophthalmology, Professor of Clinical Ophthalmology and Director of the new center. "A *London Times* article last year referred to it as 'bespoke vision.' We tailor the surgical procedure to the immediate needs of the patient, and if we don't think we can do it super-safely, we don't do it."

In one of the two fully-equipped exam rooms, the slit-lamp (the binocular microscope used to provide a 3-D view of all the structures of the

eye) also can record the entire examination on video. "It brings together our ability to treat patients and to teach medical students, residents and fellows the latest in laser vision correction," says Dr. Braunstein. "The air filtration, humidity, and temperature control allow us to provide the optimal operating environment."

For now, only LASIK procedures are available at the center, but that may change soon. The IntraLase can also be used to perform corneal transplants, accurately cutting both donor and host corneas in order to create "mated" tissues. "It's a way to get exact sizing, and one of the reasons we acquired this technology," says Dr. Braunstein. "Once we're comfortable using the IntraLase for LASIK, then we'll begin offering the corneal procedures."

Several research studies are also underway at the center. Patients who have had complications after undergoing LASIK surgery elsewhere can receive care here under an investigational protocol. Departmental researchers are also exploring the use of a procedure called corneal cross-linking to treat the corneal disease keratoconus. (For more on keratoconus and cross-linking, see pages 3 and 7.)

"This center is dedicated to providing the best tools and treatment available in the present, based on work we've done in the past, looking forward to the future, as technology gives us different ways to alter the visual status of the human eye," says Dr. Trokel. ■

Science Insight:

Developing Early Detection Tools for Keratoconus

Imagine a young man in his 20s who notices that his vision isn't as great as it used to be. When he has trouble reading road signs, especially at night, he makes an appointment with an ophthalmologist and gets a prescription for contact lenses.

But after a while, he finds that the corrective lenses aren't helping as much as they should. He's once again having trouble with his vision; in fact, it seems to be getting worse. He gets a new prescription, but after a short time, his vision begins to deteriorate again. He returns to the ophthalmologist, and only then is he diagnosed with keratoconus, an insidious disease of the cornea that occurs in about one in 2,000 Americans.

"The cornea should have a nice spherical shape, but in keratoconus, it becomes rather pointed and 'cone-like,' hence the name," says Ronald Silverman, Ph.D., Assistant Professor of Ophthalmic Sciences, who recently joined the

Department of Ophthalmology after more than 25 years as a leading researcher at Weill Cornell Medical College.

The etiology of keratoconus is not well understood, but it is thought to have a genetic component, since it is more common among relatives of an affected person than in the general population. "It's progressive and may advance either quickly or slowly, and up until recently, there were no good treatments for it," notes Dr. Silverman. "In the end stage, the patient may require a corneal transplant, because the cornea has become so weakened and fragile."

That end stage can be hastened by misdiagnosis of the disease. "A patient who has unsatisfactory vision correction with glasses or contact lenses may seek LASIK eye surgery," Dr. Silverman says. "But keratoconus can be very subtle in its early stages, and if it is not detected in the pre-surgical workup, the surgery will actually weaken the cornea and cause the disease to progress more rapidly. Refractive surgeons are therefore very cautious in screening LASIK candidates and will not operate if there is any doubt."

A key component of Dr. Silverman's research is aimed at finding ways to detect keratoconus in its earliest stages. Currently, the disease is diagnosed using standard corneal topography, but together with his colleague, Dan Z. Reinstein, M.D., Director of the London Vision

Clinic, Dr. Silverman discovered that a compensatory mechanism in the epithelium can confound this tool until the disease is more advanced.

"Using high frequency ultrasound, or 'ultrasound biomicroscopy,' we have been able to differentiate and measure the surface layer, the epithelium, from the cornea as a whole," he explains. "The epithelium is usually about 50 microns thick, about 1/10 the overall thickness of the cornea. But we saw that in patients who had had LASIK surgery, the epithelium thickened over the area where surgery had removed some of the underlying stroma. It appears that the epithelium partially compensates for the tissue that has been removed so as to smooth out the corneal surface."

In patients with keratoconus, Drs. Silverman and Reinstein found that the opposite process happens: during the early stages of the disease, as the stroma bulges forward, the epithelium thins out over the point of the stromal "cone" to try to maintain the spherical shape of the corneal surface. "So if you are examining the cornea with just surface topography, you won't see



Ronald Silverman, Ph.D.

anything," he points out. "The cornea would appear normal, even though the stroma is slightly cone-shaped, because the epithelium is masking the deformation of the underlying stroma. Only when the epithelium can't compensate anymore would you start to see topographical changes."

Dr. Silverman's team is now using very high-frequency ultrasound to help identify these ambiguous early-stage keratoconus cases, detecting changes in the conformation of the epithelium.

He is also exploring early detection techniques based on the elastic properties of the cornea. "There's a general consensus that in keratoconus the stroma itself has altered elastic properties, and that's why it bulges forward, but there's no good way to measure that *in vivo*," he says. "You can't remove the stroma and put it in a vice to see how it deforms. But we're exploring a technique where we 'palpate' the cornea by directing an ultrasound beam at it; some of the beam is absorbed and converted to momentum, which gives the cornea a little 'push.' This work is at an earlier stage, but if we can better measure these tiny displacements, it could give us some independent information in addition to what we get from epithelial mapping and optical topography. That would allow us a higher probability of detecting ambiguous keratoconus cases in their earliest stages."

Avoiding unnecessary and ultimately damaging refractive surgery is one important reason for detecting keratoconus early. But in addition, there is finally promising research into a way to effectively treat keratoconus. Called cross-linking, it strengthens the stroma by increasing the binding of molecules within it. "If you're able to catch the condition at an early stage and perform cross-linking, you can prevent further progression," Dr. Silverman says. "But the longer you wait, the more damage is done." ■

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Third Spector Lecturer: Dr. Inder Verma

What's the connection between breast cancer and eye disease? The answer to that question is part of the pioneering research conducted by Inder Verma, Ph.D., a leading authority on gene therapy. He is an American Cancer Society Professor and holds the Irwin and Joan Jacobs Chair in Exemplary Life Science at the Salk Institute for Biological Studies in La Jolla, CA.

Dr. Verma discussed his work at the third Abraham Spector Lecture, presented at the Harkness Eye Institute on May 27. The Spector Lecture Program was established in 2006 with a generous gift from Abraham Spector, Ph. D. and his wife, Mitzi Filson, to bring world-renowned scientists to the campus to discuss their work.

"For these lectures, we seek an unusual kind of scientist: a person who is doing highly original work of Nobel Prize caliber that will have an effect on almost everything that is going on in medical research, not only in ophthalmology," says Dr. Spector, Malcolm P. Aldrich Research Professor Emeritus of Ophthalmology.

Dr. Verma is certainly such a scientist. His work, in studying the BRCA1 and BRCA2 genes, well known for their involvement in hereditary breast cancer, has resulted in producing a mouse model for human cancer that Dr. Spector explains has implications for eye disease.

"The same genes are implicated in a lot of different reactions, and it wasn't initially realized that breast cancer is only one of the diseases with which the BRCA1 and BRCA2 are involved. Dr. Verma recently demonstrated that BRCA1 functions by protecting the integrity of heterochro-

matin, which is involved in the viability of many tissues, including the retina," observes Dr. Spector. "These genes are also involved with inflammation, which is a very important aspect of retinal degeneration. Inflammation is associated with oxidation, and many years ago I demonstrated that oxidation is an important component in the development of eye disease. If you were able to eliminate inflammation and oxidation, this would help in controlling maturity-onset retinal degeneration."

Prior to Dr. Verma, the Spector Lecture Program featured two other, equally notable scientists. In 2006, the first Spector Lecture was presented by Arne Holmgren, M.D., Ph.D., a distinguished biochemist from the Medical Nobel Institute for Biochemistry at Sweden's Karolinska Institute. In 2008, Stephen McKnight, Ph.D., Distinguished



Inder Verma, Ph.D.

Chair in Basic Biomedical Research and the Sam G. Winstead and F. Andrew Bell Distinguished Chair in Biochemistry at the Graduate School of Biomedical Sciences at Southwestern Medical School in Dallas, delivered the second Spector Lecture.

Lecturers are selected by a committee composed primarily of ophthalmology faculty along with one outside member, an expert on eye biochemistry and molecular biology. For each lecture, a rotating representative from one of the basic science departments within the medical school also participates as co-host of the Prize Lecture event.

"I wanted to make these lectures a focus for the interaction of ophthalmology with other departments," explains Dr. Spector. "I think we have succeeded. These lectures draw attendees not only from the ophthalmology community, but from throughout the university, because they present truly stimulating ideas." ■



L to R: Stanley Chang, M.D., Abraham Spector, Ph.D., Janet Sparrow, Ph.D., Inder Verma, Ph.D.



Dr. Spector's family. L to R: Carol Pledger, Joslyn Spector, Paul Spector, Abraham Spector, Ph.D., David Spector, Mitzi Filson, Paul Filson.

Not Your Grandfather's Lens Implant

In 1981, the Food and Drug Administration approved the first intraocular lens implant for cataract surgery. An intraocular lens is an artificial lens that replaces a person's natural one. Prior to their development, patients who had their clouded natural lens removed were forced to either wear very thick eyeglasses or a special type of contact lens.

But today's intraocular lenses are almost as far removed from the first-generation lenses of three decades ago as those early lenses were from the eyeglasses they replaced. Premium intraocular lenses give surgeons the ability not only to remove cataracts, but at the same time to correct other vision problems that the patient may also have had, such as nearsightedness, farsightedness, astigmatism and presbyopia. These lenses allow many patients to walk away from their cataract surgery with vision that is better than they have had in years, since well before the cataract developed.

"The toric lenses are designed to be aligned with the patient's axis of astigmatism along the steep axis of their cornea," explains Richard Braunstein, M.D., the Miranda Wong Tang Professor of Clinical Ophthalmology. "They have different powers depending on the degree of vision correction needed."

Approximately 90% of patients who have astigmatism can achieve significantly better vision with toric intraocular lenses than with traditional lenses. "In fact, more than 95% of the patients for whom we placed these lenses had 20/25 or better vision, without glasses," says Dr. Braunstein.

Lenses are also available that correct simultaneously for distance and near vision. These multi-focal lens implants allow patients to rely less on glasses—about 80% less, in fact. "This doesn't mean that they don't ever need glasses," Dr. Braunstein cautions. "The multifocal lens has a distance focal point and a reading focal point, but sometimes there are things we do at an intermediate distance, like painting or working on the computer. So although many patients do end up not needing any glasses at all, some will still require them for certain tasks."

Dr. Braunstein and his team use several different types of premium intraocular lenses, including toric and multifocal models. "The wide variety of lenses available allows us to determine which type of premium lens best fits a patient's particular needs," he says.

The multifocal lenses are not for every patient. "You really have to have a very healthy eye, without any other eye disease," Dr. Braunstein explains. "Even minor eye problems such as dry eye can alter the ability of this lens to improve visual function.

And with these lenses, if you do have other problems, you can end up with worse vision than when you started. In the right patient, the results can be spectacular, but in the wrong patient, they can result in new problems for the patient.

That's why patient selection is very critical, and it's important that people seeking this surgery look for a doctor who is very conservative in the use of these lenses."

"Dr. Braunstein is very thorough in his investigation before using any premium intraocular lens," notes corneal fellow Anu Gupta, M.D. "Our patients are very satisfied with their results; they have clear vision and no distortions from underlying astigmatism, which they often have struggled with prior to cataract surgery." ■



L to R: Peter Gouras, M.D., Abraham Spector, Ph.D.



Richard Braunstein, M.D.

New Core Grant *continued from page 1*

Ophthalmology and Pathology & Cell Biology, and Research Director at the Edward S. Harkness Eye Institute.

The core grant supports three primary modules: an instrumentation design and fabrication module with a machine shop and skilled machinist, a computer module with three shared servers and outside backup, and a microscopic imaging module with a histology unit and an *in vivo* microscopy imaging unit.

"The computer core stores and helps implement the usage of vast amounts of data," explains Dr. Allikmets. "For example, with next-generation sequencing approaches, we can now sequence the entire genomes of our patients, which create huge amounts of data that we need to store and

to analyze. The computer core is an incredible support for many laboratories involved in vision research."

The histology/imaging core will provide a trained histological technician, a number of sophisticated fluorescence microscopes, and state-of-the-art *in vivo* imaging technology, all supporting the need for histological preparations of the retina and visual pathways in the brain.

And the fabrication core, with its in-house instrumentation facility, allows for the development of specialized equipment in a way that is very efficient for visual neuroscientists. Rather than having to seek out a university technician which would require a long wait, these scientists can have the tools they need created by an on-site expert.

In fact, the idea for pursuing the core grant was originally sparked by the impending loss of the machine shop, which had been developed after Michael Goldberg, M.D., David Mahoney Professor of Brain & Behavior Research in the Departments of Neuroscience, Neurology, Psychiatry, and Ophthalmology and Director of the Mahoney Center, arrived at Columbia from the National Institutes of Health in 2001. "Systems neuroscience requires custom 'widgets' that are breaking all the time," says Dr. Goldberg. At the NIH, I was used to having two machinists at my beck and call. Columbia has a good machine shop, but with a very long waiting list of projects."

So Dr. Goldberg pursued a facilities infrastructure grant from the NIH, and was able to

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Clinical Spotlight:

A Different View of Progression in "Dry Type" AMD

Approximately 1.75 million Americans are slowly losing their vision to advanced age-related macular degeneration (AMD). Caused by the deterioration of the macula – the central portion of the retina, which allows us to see fine detail – this condition damages and can ultimately destroy the sharp, clear central vision required for tasks like reading and driving. AMD is the leading cause of loss of vision in people 60 and older.

AMD occurs in two forms: wet and dry. All cases of AMD start out as dry, involving fatty deposits known as drusen under the light-sensitive cells in the macula. As those cells subsequently begin to break down, people with dry AMD begin to notice blurred spots in the center of their vision, which get worse with time.

In about 10% of cases, dry AMD progresses to wet AMD. In this type of the disease, abnormal, often fragile new blood vessels start to grow beneath the retina, leaking blood and fluid and causing the macula to degenerate swiftly. Wet AMD causes rapid vision loss, and because it is so much more severe and quickly progressive, much of the treatment for AMD has focused on this form.

But many cases of dry AMD can also progress to a different, but equally devastating form of the condition, known as geographic atrophy of the central retina (GA). In GA, the deepest cells of the central retina degenerate, leading to the death of the rods and cones of the eye and the loss of central vision. Geographic atrophy is approximately as common as is wet type macular degeneration, and it's this vision-destroying condition that is the research focus of Srilaxmi Bearely, M.D., M.H.S., assistant professor of ophthalmology. Dr. Bearely recently joined the faculty from the Duke University Eye Center, where she served as Director of Grading of the SDOCT (spectral domain optical

coherence tomography) Reading Center, as well as Director of Grading of Fundus Autofluorescence.

Up until recently, there have been no known treatments for GA. But now there are at least four clinical trials recruiting patients for the study of drugs that may help slow



Srilaxmi Bearely, M.D., M.H.S.

the progression of the disease. Stratifying patients in upcoming trials by their risk of progression could lead to more precise results, and new imaging technologies will also help scientists to monitor the onset and progression of GA much more accurately.

"Some cases of geographic atrophy will progress rapidly, while others advance more slowly. As treatments for the disease are studied in clinical trials, we need a more reliable means of monitoring and predicting progression," says Dr. Bearely. "So I've been examining imaging techniques to predict the progression of geographic atrophy in macular degeneration."

Dr. Bearely's work, being conducted in collaboration with department faculty members R. Theodore Smith, M.D., Ph.D., Professor of Clinical Ophthalmology (in

Biomedical Engineering), Janet Sparrow, Ph.D., Anthony Donn Professor of Ophthalmic Science and Pathology & Cell Biology, and Rando Allikmets, Ph.D., Acquavella Professor of Ophthalmology (in the Ophthalmology and Pathology & Cell Biology Departments), focuses on fundus autofluorescence imaging

measure a key element in the disease, known as RPE lipofuscin. When lipofuscin accumulates in the retinal pigment epithelium (RPE), it can interfere with those cells' essential job, to nourish the visual cells of the retina. Ultimately, too much lipofuscin accumulation will kill RPE, and in turn, destroy the visual cells that RPE once nourished.

If the trials of new drugs aimed at treating GA are to accurately determine the effectiveness of these treatments, they must be able to more precisely define the scope of the existing atrophy, and compare progression of the disease while under treatment to what might be expected in the same patient without treatment. FAF imaging, says Dr. Bearely, may be able to do just that.

"We have an article in the upcoming issue of the journal, *RETINA*, showing that FAF imaging can help to distinguish between those whose GA is progressing slowly and those whose condition is moving more rapidly. This result may help to predict further progression," Dr. Bearely says. "Another paper that's been accepted by the same journal compares FAF imaging to traditional color fundus photos in measuring GA, and shows that FAF is a more reproducible way of assessing atrophy sizes and may be better in the future for clinical trials."

Dr. Bearely, who plans to see patients in the Flanzer Center starting early next year, says that her aim is to approach scientific questions from the patient's perspective. "I'm interested in helping to develop innovative early-phase clinical trials by using the advances established by basic scientists," she says. "Cases of AMD are expected to double by 2030, so the public health impact of this condition is huge. We need new approaches to management and treatment." ■

(FAF), an advanced method of imaging to measure the extent of geographic atrophy.

"The traditional method for assessing the extent of geographic atrophy (GA) is stereoscopic color fundus photography," Dr. Bearely explains. This technique is essentially a very high-resolution form of standard color photography. Although it has been used in several clinical trials, this technology has its limitations: it can be difficult to distinguish between dead or dysfunctioning epithelial cells of the retina, cells that are living but have lost their pigmentation, and yellowish discoloration caused by the drusen accumulating under the retina.

FAF, on the other hand, is particularly well suited for evaluating the progression of AMD, including geographic atrophy, because it can

Rising Talent

"I'm a 'lifer' at Columbia!" declares retinal fellow **Joseph Tseng, M.D.** After completing both his medical education and residency at Columbia, Dr. Tseng couldn't imagine pursuing a fellowship anywhere else. "The retinal specialists here really inspired me to pursue ophthalmology, and particularly retina, as a profession," he says.

Dr. Tseng's research focuses primarily on proliferative vitreoretinopathy (PVR), the most common cause of failure of retinal detachment repair. PVR is estimated to occur in some 5-10% of patients with retinal detachment. "It's essentially an exaggerated wound healing response from the detachment itself or from the surgery."

Under Columbia's top retinal specialists, including Gaetano Barile, M.D. and William Schiff, M.D. as well as department chair Stanley Chang, M.D., Dr. Tseng is studying ways to improve outcomes for patients who have undergone surgery for this complication. "We are exploring surgical techniques to both improve retinal reattachment rates and maintain the function of the eye," he explains. "At the Eye Institute, we now think that aggressive, yet meticulous surgical management of these problems can improve physiologic and anatomic outcomes in these patients."

Dr. Tseng is also conducting research on neovascular or "wet" macular degeneration, in which leaky new blood vessels grow beneath the retina. Many patients report rapid improvement with Lucentis or Avastin, two drugs that inhibit these abnormal blood vessels. There have been reports that patients who have received regular, long-term injections of this drug may develop glaucoma. "We're trying to determine if there really is a risk of this complication, and if so, what factors might contribute to it," he says.

Born and raised in Lafayette, Louisiana, cornea fellow **Anu Gupta, M.D.** was forced to evacuate hundreds of miles away to Texas when Hurricane Katrina hit as she was in her fourth year of medical school at Louisiana State University. "We had to evacuate several times a year in previous years, but Katrina was the time when it really affected us all. My whole way of life was gone," she recalls.

After completing medical school, Dr. Gupta relocated again, moving with her husband to Chicago. "In my residency training at Cook County Hospital there, I was exposed to a vast amount of pathology in a diverse and busy setting. That's where I really became interested in the cornea. My attendings, Drs. Philip Dray and Suri Dwarakanathan, were such innovative surgeons, and I found our cornea cases to be incredibly fascinating, and rewarding to both physicians and patients."

Her desire to train at an institution that offered the latest in refractive surgical technology

brought her to Columbia. "I'm fortunate to work with several members of the cornea faculty, particularly Richard Braunstein, M.D.," says Dr. Gupta. "I'm honing my corneal transplant skills, learning more about endothelial keratoplasties, and working with the residents on ruptured globes and traumatic eye injury cases."

Dr. Gupta is also collaborating with Drs. Stephen Trokel and Richard Braunstein on research into the potential of riboflavin cross-linking to stabilize the cornea in patients with certain conditions, including keratoconus and corneal ectasia (see page 3 as well as the spring/summer 2009 edition of *Viewpoint*). "We currently have four cross-linking protocols underway," she says. "This technique has been shown to improve outcomes in many patients, but it's still a fairly new approach. We hope to find more about how this process works, and in what areas it can be successfully and usefully applied to improve visual outcomes in our patients."

After her fellowship, Dr. Gupta plans to rejoin her husband in Chicago, where he still lives. "Ultimately, I would like to divide my time between private practice and academics. While I like the idea of having my own practice, I also enjoy teaching residents in both clinical and surgical settings."

Native New Yorker and retinal fellow **Ketan Laud, M.D.** received his undergraduate degree at New York University, completed medical school at New York Medical College, and did his residency at a Brooklyn-Queens medical center affiliated with NYMC. So when the time came to pursue a fellowship, he knew all about the leaders in the field at Columbia. "It's such an honor to train with Dr. Chang and the entire retinal team at the Harkness Eye Institute," he says. "Their contributions have altered the management of complex vitreoretinal pathology."

Dr. Laud's research focuses on diabetic patients who are undergoing internal limiting membrane (ILM) peeling, a technique sometimes used in surgery to repair a hole in the macula (the area of the retina that provides the clearest, most distinct vision). This technique requires injecting a small amount of dye to stain the ILM, improving its visualization and minimizing collateral damage during peeling.

"The different stains used to visualize the ILM are relatively new, and there have not been large, prospective studies on their use in ILM peeling in diabetic patients," Dr. Laud observes. "The two primary stains are known as brilliant blue and indocyanine green. Our prospective study will assess functional and anatomical outcomes of diabetic patients with macular edema who have had staining with brilliant blue and subsequent peeling of the internal limiting membrane. It is particularly important to evaluate the safety and efficacy of brilliant blue since indocyanine green is thought to have potential toxicity to the retina."

After completing his fellowship, Dr. Laud hopes to find a hybrid opportunity enabling him to

continue his involvement in clinical research while at the same time helping to train the next generation of retina specialists. "I hope to spend my time focused on clinical practice tackling complex medical and surgical retinal disorders while making meaningful contributions to the field through research and training," he says.

Glaucoma fellow **Melissa (Wen-Jeng) Yao, M.D.** grew up in Taiwan and immigrated to the United States at the age of 10. She came to Columbia from George Washington University School of Medicine and Health Sciences, where she was the chief ophthalmology resident. She received her medical degree from the University of Medicine and Dentistry of New Jersey-Robert Wood Johnson Medical School.

Prior to entering medical school, Dr. Yao worked for several years at a pharmaceutical company, where she conducted micromanipulative studies on *Xenopus* Frog oocytes. These studies helped to identify key receptors that are current targets for pharmacological agents. But after some time in that field, she began to yearn for the opportunity to make a more direct impact on people's lives.

"After medical school, I knew I wanted to become a surgeon. Ophthalmology was the clear choice since it was the perfect combination between surgery and medicine," she explains.

Columbia was Dr. Yao's top choice for a fellowship. "I knew that I would be getting the best clinical and surgical training with Drs. Scott Smith and Lama Al-Aswad, and that after completing the year-long program, I would be equipped to deal with any situations that may arise," she says. "Columbia also offers so many opportunities for all of the subspecialties to collaborate."

Dr. Yao's research focuses on the use of ultrasound biomicroscopy (UBM) in patients with narrow angle glaucoma, the most serious form of the disease. "Pupillary block is the primary cause of elevation of intraocular pressure with narrow angle glaucoma," she says. "These sudden increases in pressure happen as a result of fluid buildup behind the iris. They must be promptly recognized to prevent permanent vision loss. When patients are in the face down or prone position, there should theoretically be more of a risk of pupillary block and narrowing of the anterior chamber depth. We would like to see if we can produce that result with UBM." If this theory proves correct, patients with narrow angle glaucoma can be warned to avoid these positions.

After leaving Columbia, Dr. Yao hopes to find an opportunity that will allow her to stay involved with a residency program. "I really do enjoy staffing resident clinics and teaching residents in the operating room," she observes. "I learn so much from my interactions with them, and I hope to continue to be a part of an academic environment." ■



Joseph Tseng, M.D.



Melissa Yao, M.D.



Ketan Laud, M.D.



Anu Gupta, M.D.

New Core Grant *continued from page 5*

acquire a lathe and a milling machine and support the salary of a skilled machinist. The grant lasted for five years, but then the NIH discontinued that particular program. With temporary support from the Zegar Foundation, Dr. Goldberg was able to keep the machine shop open while Drs. Allikmets, Janet Sparrow and Carol Mason joined him in writing the core facilities grant.

Three groups of researchers will be using the core grant facilities: those involved in systems neuroscience, which studies how the brain processes visual information; scientists working on the molecular and cellular development of the visual system; and those studying the normal and diseased eye.

Each of the 17 principal investigators, 26 postdoctoral fellows, and 21 graduate students involved in the 20 NEI-funded grants that are part of the overall core grant will have priority access to these facilities and their staffs. "Core grants are a way for people working in related research to have a common resource that they wouldn't otherwise be able to support or pay for themselves. The premise of the core grant given out by the NEI is that anyone and everyone working on the visual system, in some way or shape or form, can be a user of the shared facilities," explains Carol Mason, Ph.D., Professor of Pathology & Cell Biology, Neuroscience, and Ophthalmology. But in addition, students and postdoctoral fellows supported by a NEI-sponsored Vision Sciences Training Grant will particularly benefit from instruction in the approaches represented in each core.

"People with NEI grants have first priority, but the second priority is for young scientists who are gathering data to be able to apply for their first R01," says Dr. Goldberg. (Highly competitive and prestigious, R01 grants are five-year, renewable awards for specific research projects.) "With the core grant-supported facilities, they won't have to do their own histology. They can get a piece of equipment built with relatively high priority. And everyone within the core user group will have access to an in-house computer expert, as well as off-site archival storage for all their data."

"The core grant provides facilities that are tremendously important to everyone's research, that enhance cooperation and interaction amongst different departments, both uptown and downtown, and between basic researchers and clinical faculty," says Janet Sparrow, Ph.D., Anthony Donn Professor of Ophthalmic Science in the Departments of Ophthalmology and Pathology & Cell Biology, noting that the grant's benefits extend well beyond the department.

"It's not just about the vision community: there is also a big push to make core facilities available to everyone, and advertise them and centralize them."

At many institutions, including Columbia, core facilities that

once were reserved for only the oncology faculty, or only the neurology faculty, are being opened up to the institution as a whole, with university support. "Having this core fits into the university's plan to make core facilities more available to the community," says Dr. Sparrow. "The vision people get free, priority access to the core facilities from this grant, but everyone at Columbia can use them. It's like a gift to the vision community, but it adds to the wealth of infrastructure Columbia has in other areas as well." ■



A researcher examines a retina with diabetic eye disease.

Important Patient Care Information

Specialties: Cornea/External Ocular Disease
Glaucoma
Pediatric Ophthalmology and Strabismus
Refractive Surgery/LASIK
Vitreoretinal and Uveitis

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