

Vision *for the* Future

UNIVERSITY OF ROCHESTER

FLAUM EYE INSTITUTE

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SEEING THE DETAILS

“In my optical business I can see differences in resolution that others can't see when we test new products and compare items,” Navitar CEO and FEI Advisory Board member **Julian Goldstein** said. “As my jeweler friend pointed out, I could be a diamond grader because I can see the small differences from one stone to another. The ability to see what others can't is a distinct trait of mine that I feared I was going to lose forever. I was scared.”

Goldstein is a long-time patient of FEI's **Ronald Plotnik, M.D.** His only real issue with vision until last year had been a high degree of near-sightedness, which is corrected by glasses. In recent years, he had joined FEI's Advisory Board at the urging of his friend and former FEI Board Chair, **Danny Chessin**.

During a recent period, he was frequently lifting and moving some heavy items while he helped clean out his mother's house. After helping his daughter move all her belongings into her college room

one weekend last August, he was driving his rental car home at night. When he turned his head to the left, he noticed a flash of light.

“I thought it was strange, but I figured it was only a reflection from the rental car's display bouncing off the edge of my glasses,” he said. “When I got home, it hadn't gone away and I thought it was something to watch. A few days later, my left eye was

hurting and I started to see microscopic floaters. Weeks later I saw a larger dark, dark 'snake' in my vision. At that moment, I knew I had a problem and called to see a doctor.”

He was first examined by retina fellow **Daniel Simhaee**. He then saw retina specialist **Rajeev Ramchandran, M.D.**, who confirmed that Goldstein had a

JULIAN GOLDSTEIN & AJAY KURIYAN, M.D., M.S.

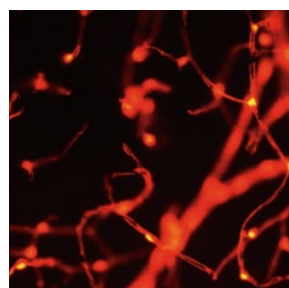


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Novel imaging technique may open new windows in studying eye disease and diagnosing vascular health

Doctors use dozens of tests to determine the relative health of our circulatory systems. Vascular physiology is best studied noninvasively inside the living body, but out of all the imaging modalities available, none can describe the details of the interactions between blood cells and our blood vessels. This is unfortunate, because here is where the first signs of diseases such as diabetes may occur.

FEI Assistant Professor of Ophthalmology **Jesse Schallek, Ph.D.**, and his research team may have overcome this challenge. In the journal *eLife*, Schallek, **Aby Joseph, Ph.D.**, and **Andres Guevara-Torres, Ph.D.**, describe a new, noninvasive approach to visualize how single blood cells flow through vessels of the eye using adaptive optics imaging. FEI is a world leader in applying this technology borrowed from astronomy that is used to see deep into the cosmos by correcting for terrestrial atmospheric aberrations. Unlike astronomers, FEI researchers turn the technology inward, into the living eye, and are able to observe



life at the cellular level in unprecedented detail.

Coupled with adaptive optics, Schallek's team developed an ultra-fast camera that captures single-cell blood flow dynamics. Seeing how microscopic blood cells interact within the vasculature in such minute detail has not been possible with current tools such as fMRI – or some microsurgical detection techniques unsafe to humans.

The camera has the sensitivity to see single blood cells – or masses of them – coursing through vessels at incredible speeds. But the real ingenuity of the system is the sophisticated computer algorithm that characterizes blood flow in real time. Previous processes required hours, or days, of labor-intensive data manipulation to describe what was occurring in retinal blood vessels, making them impractical for clinical applications.

“We're able to image single blood cells and measure their speed. Remarkably, this can be achieved in vessels of all sizes, from the smallest capillaries to the largest retinal vessels,” Schallek said. “This approach may eventually provide a view of patient vascular health without the need for blood draws or dyes.”

(CONTINUED PAGE 3)

As the end of my tenure as Director of the Flaum Eye Institute and Chair of the Department of Ophthalmology draws nearer, I wanted to update you about the continued progress we are making.

First, we received an incredible number of inquiries about the Chair's position. A search committee led by University of Rochester and UR medicine senior staff assembled an impressive list of candidates who traveled to Rochester and met with FEI faculty and staff, as well as other non-departmental stakeholders. All the candidates are incredibly accomplished and the finalists capable of guiding us to new heights. We hope to announce the new Chair in our next issue of *Vision for the Future*.

FEI researchers continued to pave the way in searching for innovative ways to diagnose and treat blinding diseases. This includes ground breaking publications. In the laboratory of **Jesse Schallek, Ph.D.**, new technology has been developed to not only better understand eye disease but also help clinicians to detect cardiovascular disease throughout the body (cover). James V. Professor of Ophthalmology and FEI Research Director, **Krystel Huxlin, Ph.D.**, recently reported a discovery that improves the performance of visual training in patients suffering from neurological injury (Page 8). We also welcome **Collynn Woeller, Ph.D.**, as our 10th full-time research faculty member. We look forward to supporting his efforts in treating Thyroid Eye Disease.

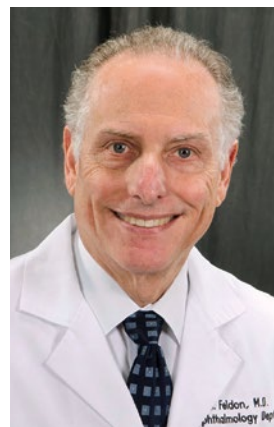
Kristen Bowles-Johnson, O.D., M.S., also joined us as a post-doctoral researcher. She will spend her time collaborating with **Jennifer Hunter, Ph.D.**, and will bring her clinical skills to our hospital and Brighton locations.

Graduation saw the departure of four residents and two fellows (Page 10). Some will begin sub-specialty clinical fellowships and others will enter private practice. **Sana Idrees, M.D.**, will remain at

FEI and begin her training in retina. On the heels of graduation, we welcomed an impressive group of trainees who joined us in July and are already hard at work. We look forward to helping them realize their clinical and research goals as ophthalmologists.

Our mission to promote eye health and provide the highest standard of care is evidenced by work championed by retina specialist **Rajeev Ramchandran, M.D.** He has marshalled resources to lay the foundation for a population-based eye care model that seeks to reduce the impact of eye disease by detecting problems earlier and encouraging us to adopt new behaviors that reduce risk (Page 6). Interwoven with community outreach, the potential to save sight and improve wellness is great.

I am deeply appreciative for the recent reception celebrating my service as Chair and FEI Director. I wish that all of you who read this could have been there. What has been created here is the work of thousands. From faculty and staff to Advisory Board members – like **Julian Goldstein** (cover) and to annual fund donors, and to our patients who place the ultimate trust in our hands, this is truly a team effort. I am forever grateful to be part of the journey – and the journeys to come.



Sincerely,

Steven E. Feldon, M.D., M.B.A.

Director, David and Ilene Flaum Eye Institute
Chair, Department of Ophthalmology
University of Rochester School of Medicine & Dentistry

FEI in the Community

FEI continues to provide important information about eye care and community services through live educational programs, support groups and screenings. Future events can be found on our Friends of The Eye Institute Web page at www.foei.urmc.edu or by visiting our Facebook page.

Winter and spring were busy for FEI's outreach team and doctors. The focus was to continue to educate the general public on general eye health, prevention, and eye-related diseases:

Jan. 28: David DiLoreto, M.D., Ph.D., highlighted an FEI macular degeneration support group. This organization helps to inform people about current best practices for treating both dry and wet age-related macular degeneration. It also provides patients a forum to share what is happening with their eye health and to offer them a shoulder to lean on as they face challenges caused by their disease.

Jan. 31, Feb. 16, Mar. 19, Apr. 27 & May 22: Retina specialist **Rajeev Ramchandran, M.D.**, and his team of medical students and FEI staff, partnered with area Lions clubs for "Know UR Numbers". The program provides vision and health screenings related to diabetes and diabetic eye disease and gives out information about general wellness.

March 13 & 14: Outreach Director **Meghan King** and a team of technicians traveled to Autumn Lane Elementary and Greece Arcadia Middle School to help school nursing staff deliver vision screenings to elementary and middle school students.

March 22: Well eye care provider **Brooke Donaher, O.D.**, gave a community lecture about diabetic eye health at the Westside YMCA.

Feb. 9, Mar. 16, Apr. 13 & May 18: The Glover-Crask sponsored *Eyeglasses for Kids* program continued to provide free Saturday screenings for children. The program's mission is to improve the confidence and academic performance of school-aged children who have routine vision problems, like nearsightedness or farsightedness, by providing them with free eyeglasses. If other vision problems are detected during the screenings, children are appropriately referred to FEI's pediatric ophthalmology team for care. Special thanks go to the faculty and residency program physicians, who perform the screenings, and to the opticians and staff who make the glasses and make the families welcome.

*IF YOU ARE INTERESTED IN... inviting one of our faculty members to speak about eye health topics, starting a support group related to eye disease or scheduling a screening, please contact **Meghan King** at 585-276-7311. We'll do our very best to accommodate your request.*

Event celebrates seventeen years of leadership and endows Feldon Scholar Program

Nearly 150, colleagues, friends and family recently gathered to celebrate the accomplishments of **Steven Feldon, M.D.**, outgoing Chair of Ophthalmology and Director of the Flaum Eye Institute. There the establishment of the Feldon Scholar Fund was announced. This endowed fund will grow in perpetuity in order to provide newly recruited clinician scientists or basic scientists with a financial boost to acquire laboratory equipment and supplies and hire personnel.

Supporting the careers of junior faculty has always been a mission of Feldon. During his tenure at FEI, he has tirelessly lobbied for resources from the University of Rochester, industry and private foundations, like Research to Prevent Blindness, to help the nascent efforts of vision scientists as they unraveled the causes of eye disease and looked for solutions to prevent vision loss or restore sight. His efforts have resulted in recruiting some of the most talented vision researchers in the world who lead the charge in the effort to prevent blindness.

Guests at the event reminisced about the dramatic transformation Feldon led that changed the department from what Catherine Aquavella Distinguished Professor in Ophthalmology, **James Aquavella, M.D.**, labelled as a “three member parochial department,” into one of the major ophthalmic facilities in the country.



FACULTY, FRIENDS AND ALUMNI SURROUND STEVEN FELDON, M.D.

Speakers specifically noted Feldon’s achievements in FEI’s clinical, educational and outreach missions. University of Rochester Vice Dean for Clinical Affairs **Michael Rotondo, M.D., F.A.C.S.**, remarked that, “Steve is the quintessential quadruple threat in academic medicine: master clinician, superb educator, insightful investigator and visionary leader. Few, if any, could have done what he accomplished in building the Flaum Eye Institute – a world class center for the treatment and study of eye disease. His legacy at the University of Rochester will live on for decades to come.”

Other speakers included FEI Advisory Board Chair, **John Harris**, University of Rochester Dean for Research, Arts,

Engineering and Science, **David Williams, Ph.D.**, and Feldon’s longtime friend and Vice Chair of Doheny Eye Institute, **Alfredo Sadun, M.D., Ph.D.**

Also in attendance were Feldon’s wife, Diane, and their children David, Amanda and Gary.

To date, the Feldon Scholar Fund campaign has raised \$451,000 of its \$500,000 goal. Contributions may be accepted via the donor envelope in this edition of *Vision for the Future* or online. To donate online, please visit www.eyeinstitute.urmc.edu. Click “WAYS TO HELP” on the top navigation bar, then click the “GIVING” button. Look for the “Make a gift with your credit card donation over the internet via a secure connection” button and make sure to designate your donation to the Feldon Scholar Fund.

(CONTINUED FROM COVER)

Novel imaging technique may open new windows in studying eye disease and diagnosing vascular health

Krystel Huxlin, Ph.D., Associate Chair for research in the Department of Ophthalmology adds, “This method has the potential to enable early diagnosis of cardiovascular disease and diabetic neuropathy, and will also be of interest to investigators studying blood flow in the context of stroke and neurodegenerative diseases like Alzheimer’s.”

“My research interest involves using my physics/optics background to provide insights into biological questions,” Joseph said. “This paper provides a novel and noninvasive imaging approach that may advance our understanding of blood flow dynamics in brain and retinal vessels smaller than the width of a human hair.”

Schallek’s team, part of the Advanced Retinal Imaging Alliance (ARIA), is now deploying the method in healthy human eyes to establish metrics that will enable researchers to better understand the events that initiate and propagate disease. A pre-clinical investigation, funded by the Dana Foundation, is beginning to use this powerful approach to compare what happens in normal and diabetic retinas of human subjects.



DOCTORS SCHELLEK, GUEVARA-TORRES AND JOSEPH.

The David and Ilene Flaum Eye Institute is most grateful to its donors for their generous gifts and ongoing support. We are especially appreciative to the friends, patients, alumni and faculty who contributed to our Annual Fund. The Annual Fund is an essential source of support that helps us to continue our groundbreaking work in vision care and research. This year, your donations had a direct impact on our mission, helping us recruit new faculty and purchase new equipment for our clinic and research laboratories. The following donors have contributed in meaningful ways to FEI between **October 1, 2018 and April 15, 2019**. Gifts can be designated to the Ophthalmology Annual Fund and mailed to: FEI, 300 E. River Road, PO Box 278996, Rochester, NY 14627.

Or make a gift online by going to eyeinstitute.urmc.edu and clicking on **"Ways to Help"**.

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Changing how we look at eye care

According to experts from the National Academies of Sciences, Engineering and Medicine, more than 142 million Americans over the age of 40 experience vision vision impairment. The causes of this are wide ranging and include everything from needing glasses to blinding diseases. Some are preventable or are treatable, but some are not.

Vision impairment has many social, economic and quality of life consequences. Examples include impaired learning in school-age children, increased the risk of injury, social isolation, loss of productivity, and depression.

Addressing these issues has become a big part of a new concept called population health science, an area of research seeking ways to prevent, diagnose and treat propensity of disease or early onset disease before it worsens. The expected result is a healthier populace with lowered cost of medical care and an improved quality of life.

Many governmental agencies, universities, and private enterprises have recently applied this approach to vision, which could have a huge impact on society. FEI is at the vanguard of this movement. Associate Professor of Ophthalmology, Rajeev Ramchandran, M.D., M.B.A., directs a multi-pronged program that seeks to improve vision health throughout the region and serve as a model for other institutions.

Q: What is population based eye health?

Ramchandran: Population health is ensuring the eye and vision health and well-being of a group of people preferably before they become patients. It involves proactively identifying and assessing those at risk for the development of eye disease, deploying primary, secondary, and tertiary prevention strategies to prevent vision loss, and assessing the outcomes of such interventions.

Q: How did the initiative get started at FEI?

Ramchandran: I had seen population based models of eye care in India during my early years as a trainee, one being that of our sister institute's – the L. V. Prasad Eye Institute – and the other being Sankara Nethralaya, a leader in deploying telemedicine and mobile units to improve the eye health of populations. Both were using the promotion of eye health to improve the general health and wellness of populations by also including diabetes, hypertension, infection control, vaccination, and hygiene education. In 2014, I attended an American Public Health Association conference where I came to learn about U.S. population eye health.

Q: What is the long-term mission of population eye health?

Ramchandran: To achieve optimal eye and vision health for the U.S. population using a multifaceted strategy including partnership building (such as those between industry, academics, and community), the use of technology, systematic surveillance, and outcomes assessment.

Q: What are the goals of the FEI project?

Ramchandran: First is to create a local system to identify and assess populations at risk for developing eye diseases and suffering vision loss across the lifespan using tools such as telehealth, artificial intelligence,

and methodology from epidemiology and data science. Special emphasis should be placed on:

- Children, especially those under age of 9
- People with diabetes
- Smokers
- People with a family history of eye diseases like glaucoma and age-related macular degeneration
- People with cardiovascular diseases, such as hypertension and atherosclerosis

Secondly, we want to create education about the importance of eye and vision health and how to achieve and maintain such health to key stakeholders.

We also aim to collect local data regarding vision health of the Greater Rochester Community to understand the prevalence of eye disease and vision loss (and to be able to track changes in prevalence), that will hopefully lower over time.

Our ultimate goal is to take all this information and understand the data and outcomes for our local population-based interventions in order to promote eye health and prevent vision loss.

Q: Who are the regional partners in the project?

Ramchandran: The list is growing and includes:

- The Association for the Blind and Visually Impaired
- Local school districts like Rochester City and Greece Central Schools
- Regional Lions Clubs
- A database company called Comet
- UR Medicine's Primary Care Network and Highland Family Medicine
- Strong Internal Medicine.

Q: What are the benefits of population eye health?

Ramchandran: To get to the root of problems and promote holistic health.

Q: What are the biggest challenges towards its success?

Ramchandran: It may be more difficult working in the current fee for service health care environment vs. value-based care as seen in national health systems (think Europe or Canada). The value-based model allows us to better address social determinants of health, which is not done in traditional fee for service care that pays the health care system more if people are sick. Currently, we physicians get paid more by doing more and treating complex diseases needing surgical interventions. This raises the cost of health care.

Q: What does the future look like?

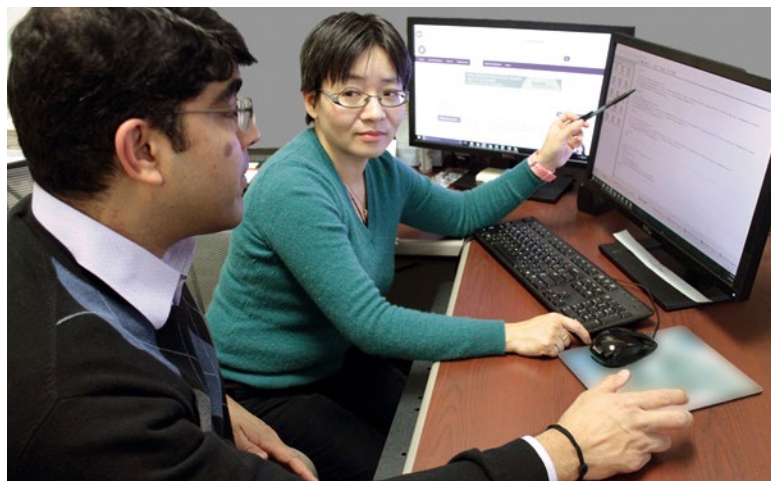
Ramchandran: This year we will continue to focus on community screening; developing tools and collaborations with community, technology, industry, and research/academic partners. In 2020, we hope to raise community awareness with monthly events while continuing to build and grow population based screening and triage.

Eventually we plan to have robust community-wide screening for at risk groups across the lifespan to develop an understanding of prevalence of eye disease and vision loss in the Greater Rochester area. Through interventions, we think we can achieve a decrease in the prevalence of eye disease and vision loss – resulting in seeing less people in our specialty care clinics. The effect will be to lower cost the of eye care by providing care in lower cost settings. This will increase access to such care, preventing disease and mitigating disease severity, and thereby preventing vision loss and blindness.

Q: Where can people search for more information about population eye health?

Ramchandran:

- The National Academies of Sciences, Engineering & Medicine (search "population eye health") www.nationalacademies.org
- Prevent Blindness (search "population eye health") or (search "vision program resources for head start") www.preventblindness.org
- The Centers for Disease Control and Prevention (search "vision health initiative") www.cdc.gov
- NORC at the University of Chicago (search "population eye health") www.norc.org



RAMCHANDRAN AND DATA SCIENTIST XUEYA CAI.

Population health puzzle: Putting the pieces together

Community outreach: FEI reaches thousands through events, screenings and partnerships. Included are health fairs, community screenings, educational presentations, vision-disease support groups and FEI's signature Glasses for Kids program. A current goal involves developing a mobile unit for pop-up screening events throughout the region.

Collaboration: FEI partners with organizations, other health care providers, school districts, regional, national and international vision groups to develop eye health standards and logistical structures to ensure that populations receive complete and appropriate coverage.

Information: Creating a robust information architecture allows for understanding where resources can best be deployed and what effects interventions have. Powerful computing resources and health statisticians help FEI better understand patterns related to health risks, behaviors, and utilization as de-identified data from multiple sources is examined.

Technology: FEI's initiatives use technologies, from simple vision charts to sophisticated cameras, that interlink with a telemedicine infrastructure called Tele-I-Care, to decentralize the detection of eye disease and facilitate treatment before it reaches debilitating levels.

Education: Teaching populations how eye disease and related vision loss happens empowers people about how to reduce their risks and where to go when they have problems. Professional education encompasses everything from FEI's residency program to the nation's first eye ECHO, which democratizes information and improves the skills of regional providers.

Partnership cares for kids

For 70 years, Mary Cariola Children's Center has provided innovative programs in their schools and residences serving thousands of children with complex disabilities and their families. Founder Mary Cariola held the belief that every child regardless of the disability has life-long potential. That belief holds true today.

Recently Mary Cariola cemented an agreement with FEI to provide on-site eye exams to kids for whom travel to the Eye Institute, or any eye doctor, is difficult. The initial spark leading to the program began with FEI Advisory Board Chair, **John Harris**, who is an ardent supporter of Mary Carolia. He wanted to bring FEI's *Glasses for Kids* program – which provides children with free eye screenings and glasses – to the agency for a one-time visit.

Mary Cariola President and CEO, **Karen Zandi**, had a different idea: Bring FEI to the school on a more permanent basis.

"A founding principle of our organization is to provide services to special needs kids and their families," Zandi said. "This makes it easier for family members, our teachers, and staff to work toward the common goal of enriching the lives of their children. Like many children in our community, a number of our students have visual impairments. These can be a barrier to learning. We thought bringing in FEI would be a great opportunity to improve our services."

Prior to the agreement between FEI and Mary Cariola, students received vision screenings at the school. Parents of children with questionable results were subsequently referred to outside optometrists or ophthalmologists. Zandi noted that this caused some difficulties.

"The frequency of getting children to the eye doctor for follow up appointments was not great," she said. "There are many reasons for this, but the end result was that that lots of these kids weren't getting the care that they needed."

With help from FEI Business Development Director, **Meghan King**, Pediatric Ophthalmologist **Ben Hammomd, M.D.**, comes to Mary Cariola once a month to see children who are identified during initial vision screenings. Mary Cariola provides exam space that is private and familiar to the children. Hammomd brings equipment allowing for a dilated eye exam.

"We evaluate each child's refractive needs and how well they use their eyes together," Hammond said. "We also look for more serious problems and then make decisions appropriate to helping them function to the best of their abilities. Having parents and Mary Cariola staff in the room at the same time is very helpful to me. They are with the kids all the time and give great perspective on each one's visual ability and needs."

Zandi notes that these exams provide important information to her staff of therapists and teachers because it lets them gain a better understanding of each child's vision, allowing them to adapt learning plans appropriately. It also a great benefit to parents.

"Everyone is over the moon about it," Zandi said. "At least half of the exams involve a parent on-site. During these interactions we can have a deeper discussion with them about the conditions that exist for their child and what interventions or strategies might be most effective."

Any conditions requiring further examination can be referred to FEI where Hammond can perform specialized testing. Eventually FEI hopes to be able to send an optician over to measure for, fit and adjust glasses.



Brain stimulation speeds up visual learning in healthy adults and helps patients re-learn how to see

Practice results in better learning. Consider learning a musical instrument, for example: the more one practices, the better one plays. The same holds true for cognition and visual perception: with practice, a person can learn to see better – and this is the case for both healthy adults and patients who experience vision loss because of a traumatic brain injury or stroke.

The problem with learning, however, is that it often takes a lot of training. Even more time is needed for patients with brain injuries who may, for instance, need to re-learn to process visual information.

But what if the learning process could be accelerated?

That's what Professor **Lorella Battelli** of the Italian Institute of Technology, together with University of Rochester researchers **Duje Tadin**, a professor of Brain and Cognitive Sciences, and **Krystel Huxlin**, the James V. Aquavella, M.D. Professor in Ophthalmology at the University's Flaum Eye Institute, set out to determine. Motivated by emerging evidence that brain stimulation might aid learning, Battelli, Tadin and Huxlin examined how different types of non-invasive brain stimulation affect visual learning and retention in healthy individuals and those with brain damage. Their results, published in the *Journal of Neuroscience*, suggests enhanced learning efficacy for both populations and improved vision recovery for cortically blind patients.

"Learning is difficult and often takes a long time," Tadin said, "because after early childhood our brains become less plastic. The brain's ability to change and reorganize itself decreases as a person ages, so learning new tasks, or re-learning tasks after experiencing a brain injury, becomes more challenging."

To test if and how visual perceptual learning might be accelerated, researchers presented study participants with a computer-based task. Participants were shown clouds of dots and were asked to determine which way they moved. The task measured the participants' motion integration threshold, which is important in enabling people to navigate and interact with moving objects.

Participants were then asked to perform the task while sub-groups were given different types of brain stimulation, each involving a non-invasive electrical current applied over the visual parts of the brain. The researchers found that one particular type of brain stimulation, called transcranial random noise stimulation (tRNS), significantly improved participants' motion integration thresholds when they performed the task.

"All groups of participants got better at the dot motion task with practice, but the group that also trained with tRNS improved twice as much and was able to learn the motion task better than other groups," Tadin said.

Surprisingly, the researchers also found that when they re-tested the participants six months later, the boosts in performance were still there: participants in the tRNS group had retained what they had learned and were still able to do better on the motion task compared to the groups that were given other stimulation techniques or training alone.

Tadin, Huxlin, and Battelli then extended their findings to patients who had suffered a stroke or traumatic brain injury affecting the visual cortex, rendering them partially blind.

Huxlin had previously developed a training system to assist stroke patients with recovering vision, which uses computer-based exercises to stimulate undamaged portions of the visual system. Through this visual training, the undamaged areas learn to process visual information that would normally be processed by the damaged parts.

The team coupled Huxlin's visual training therapy and the tRNS brain stimulation applied to both damaged and undamaged parts of the patients' brains. The result was a marked improvement in visual processing and function after only 10 days.

"This fast improvement is something we've never seen in this patient population," Huxlin said.

As such, the research offers new promise for overcoming key hurdles in vision therapy for patients who have experienced a stroke or traumatic brain injury.

Singh, Ph.D., develops model to study debilitating childhood disease

Juvenile neuronal ceroid lipofuscinosis (JNCL), a form of Batten Disease, is a rare genetic disorder that causes vision loss and neurodegeneration. Besides blindness, it results



RUCHIRA SINGH,
PH.D.

in speech problems, behavioral and cognitive issues, and motor skills decline.

Children with the disease usually lose their sight by age 10. In the eye, JNCL affects multiple retinal cell types including both the light-sensing photoreceptor cells

and the retinal pigment epithelium (RPE) cells. Importantly, RPE cells nourish the photoreceptor cells and are necessary to maintain photoreceptor cell health. In fact, loss of vision can be caused by either primary loss of photoreceptor cells or primary loss of RPE cells that leads to secondary loss of photoreceptor cells. Thus far, little is understood about the disease mechanism of JNCL except that it involves the CLN3 gene.

FEI Associate Professor of Ophthalmology **Ruchira Singh, Ph.D.**, recently received funding totaling more than \$500,000 per year from the National Eye Institute (RO1EY030183-01) to study the role of RPE dysfunction in JNCL. Through using human induced pluripotent stem cells – derived from skin cells of patients who have JNCL – and turning them into living retina tissue, Singh's laboratory has developed a cell culture model of JNCL that displays important pathological features of the disease in a dish. Using this patient-derived JNCL cell model, Singh will study the impact of disease-causing mutations in CLN3 on RPE structure and function. Furthermore, collaborating with **Mina Chung, M.D.**, Singh will correlate the cellular findings in the patient-derived JNCL cell model to the structural changes occurring in the retinas of JNCL patients. This knowledge has the potential to develop drug treatments that could prevent blindness in JNCL.

RESEARCH UPDATE

University of Rochester and FEI faculty, residents, medical students and graduate students continue to distinguish themselves at the Association for Research in Vision and Ophthalmology meeting (ARVO). The world's premiere conference in vision research, ARVO presents cutting-edge information related to the detection, prevention and curing of eye disease. Among the presentations were:

Geunyoung Yoon, Ph.D., Phase perception altered by long-term neural adaptation to habitual optics reduces neural binocular summation

Stephanie Syc-Mazurek, Ph.D., Endothelin signaling in glaucomatous neurodegeneration

Rajinder Nirwan, M.D., Endophthalmitis after intravitreal injection at an academic center

Sana Idrees, M.D., Outcome reporting bias in industry versus non-industry-funded studies evaluating intravitreal steroid therapy for macular edema due to retinal vein occlusion

Faraaz Khan, M.D., Pediatric keratoprosthesis with implementation of a conjunctival flap: outcomes, complications, and future directions



Sam Butler, M.S., Next generation diffractive multifocal contact lenses for presbyopia correction using LIRIC

Ruchira Singh, Ph.D., Structural and functional alterations at the photoreceptor-RPE interface lead to disease-associated pathological changes in a hiPSC-derived model of an inherited retinal degenerative disease

Andres Guevara-Torres, Ph.D., Red blood cell flux measured in the same retinal capillaries from seconds to months

Gabriela Rifkin, M.D., Exposure challenges with vismodegib treatment for basal cell carcinoma

Jack Tian, M.D., Pattern ERG as an objective outcome measure of contrast sensitivity in patients with multifocal intraocular lenses

Andrew Chen, M.D., Assessing the level of evidence for the benefit of commercially-available "cell therapy" treatments in the U.S. for ocular diseases

PUBLICATIONS:

FEI faculty and residents share their findings with colleagues across ophthalmology and vision science. Scholarly publication is at the heart of the academic mission. A recent sampling of FEI publications include:

"Environmental stress impairs photoreceptor outer segment (POS) phagocytosis and degradation and induces autofluorescent material accumulation in hiPSC-RPE cells." S. Dalvi, et. al. Cell Death Discovery, Volume 5, May 2019

"Gfi1-GCE inducible Cre line for hair cell-specific gene manipulation in mouse inner ear." Q. Tang, et al. Genesis, 2019; e23304, April 2019

"Watching Photoreceptors at Work: Two-Photon Ophthalmoscopy in the Living Eye." C. Schwarz, et. al. Latin America Optics and Photonics Conference, November 2018

"High-Resolution Adaptive Optics in Vivo Autofluorescence Imaging in Stargardt Disease." H. Song, M. Chung et al. JAMA Ophthalmology, March 2019

"SOX2 is Required for Inner Ear Growth and Cochlear Nonsensory Formation Prior to Sensory Development." A. Stevens et. al. Development, May 2019

"Assessing 'Cell Therapy' Clinics Offering Treatments of Ocular Conditions using Direct-to-Consumer Marketing Websites in the United States." A. Kuriyan et. al. Ophthalmology, March 2019

"Cellular-scale evaluation of induced photoreceptor degeneration in the living primate eye". M. Weiss, et. al. S. Walters, et. al. Biomedical Optics Express, January 2019

"Retinal vessel detection in wide-field fluorescein angiography with deep neural networks: A novel training data generation approach." L. Ding, et. al. IEEE Explore, 06 September 2018

CLINICAL TRIALS:

Volunteering for a clinical research study is one of the greatest things a person can do to advance medicine. Clinical trials allow doctors and scientists to evaluate new ways to prevent, detect, or treat disease. Although these studies offer no guarantee for cure, they are one of the cornerstones for nearly every single breakthrough in medicine. Each is rigorously conducted, following the highest patient safety protocols. FEI offers participation in the following studies:

- ⦿ Biotrue ONEday for astigmatism soft contact lens protocol 885. A study to evaluate the safety and effectiveness of the Biotrue ONEday for astigmatism soft contact lens when worn on a daily basis. (*M. DePaolis, O.D.*)
- ⦿ A Phase 3 Randomized, Placebo-Controlled, Double-Masked, Multicenter, Safety and Efficacy Study of Brimonidine Tartrate Nanoemulsion Eye Drops in Patients with ocular Graft-vs-Host Disease (oGVHD). (*J. Aquavella, M.D.*)
- ⦿ A phase III, multicenter, randomized, double-masked, active comparator-controlled study to evaluate the efficacy and safety of RO6867461 in patients with diabetic macular edema. (*A. Kuriyan, M.D.*)
- ⦿ A multicenter, partially-masked, randomized, controlled study of medical therapy vs. medical therapy plus optic nerve sheath fenestration vs. medical therapy plus stereotactic ventriculo-peritoneal cerebrospinal fluid shunting in subjects with idiopathic intracranial hypertension and moderate to severe visual loss surgical idiopathic intracranial hypertension treatment trial ("SIGHT"). (*Z. Williams, M.D.*)

Research day highlights graduation weekend

In June, more than 75 attended a presentation showing clinical and scientific activities conducted during the recent academic year by FEI faculty, residents, research fellows and alumni. Research topics ranged from the exciting prospect of vision restoration to new forms of optical vision correction. Clinical presentations included the latest insights into ocular infection control and optimizing visual outcomes from eye surgery. A highlight of the program was **Seth Pantanelli's M.D., R'13**, presentation about cataract surgery refractive outcomes.



Pantanelli is currently an Associate Professor of Ophthalmology at Penn State's Hershey Medical Center.

Later in the day, nearly 100 gathered at the annual dinner to celebrate the completion of studies for four residents and two fellows.

Ajay Kuriyan, M.D., M.S., received the resident teaching excellence award and **Angela Bessette, M.D.**, was given a service award for her contributions to resident education at Rochester General Hospital.

The evening concluded with a presentation of this year's graduates and a humorous skit prepared by them. As of July 1, they began the next phase of their careers in ophthalmology and FEI wishes them success in their endeavors:

Andrew Chen, M.D., traveled to Los Angeles to begin a glaucoma fellowship at UCLA's Jules Stein Eye Institute

Brian Harrow, M.D., went to North Carolina where he is entering private practice.

Sana Idrees, M.D., is remaining at the University of Rochester and began her retina fellowship at FEI.

Rajinder Nirwan, M.D., went to Alberta, Canada, where he began his retina fellowship at the University of Calgary.

Farraz Khan, M.D., (*cornea fellow*) is now a member of Carolina Vision Center in Fayetteville, North Carolina, where he will perform cornea, refractive surgery and general ophthalmology.

Daniel Simhae, M.D., (*retina fellow*) is joining Advantage Care Physicians, a multi-specialty healthcare practice based in New York, practicing primarily in Manhattan.

New Residents

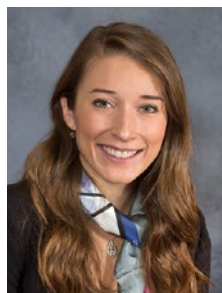
FEI's four new residents went straight to work, guided by faculty preceptors and the third- and second-year residents.

They were welcomed at a reception where they were presented with the thirteen volumes of the American Academy of Ophthalmology's Basic and Clinical Science Course, a gift from the Alumni Endowed Fund. This year's group is distinguished by the fact that all four graduated from medical college with Alpha Omega Alpha Honors (AOA):



Christina Douglas, M.D., received her undergraduate degree in Neuroscience and Behavior from Barnard College. She completed her medical degree at the Jacobs School of Medicine and Biomedical Sciences at SUNY Buffalo. She did her internal medicine internship at Mt. Sinai Beth Israel Hospital before coming to Rochester. Douglas has an interest in working with children and hopes

to become a pediatric ophthalmologist. She performed numerous volunteer activities during her undergraduate and medical school years and tutored figure skaters in Harlem.



Alaina Geren, M.D., is a biochemistry graduate from the University of Tulsa. She remained in Oklahoma, completing her medical training at University of Oklahoma Health Science Center where she helped triage patients in the emergency room. During medical school, Geren also completed ophthalmology rotations at Bascom Palmer and Moran Eye Institutes. She got a jump

on Rochester winters by doing her medicine internship at the University of Rochester School of Medicine and Dentistry. Geren is an avid runner and enjoys ceramics and playing violin.



Tony Kang, M.D., received a Bachelor's in Neurobiology and Behavior from Cornell University before attending medical school at the Sidney Kimmel Medical College at Thomas Jefferson University. His numerous public service activities include international medicine in Central and South America. Kang completed his transitional year medicine rotation at Regional Medical Center

in Newport News, VA. He enjoys running and hiking, including summiting California's highest peak, Mt. Whitney.



Our final AOA resident introduction is

Mohammad Yazdanie, M.D. A Biochemistry Major from New York University he went on to earn his medical degree at Stony Brook University School of Medicine. He completed his medicine internship at Winthrop Hospital in Mineola, NY, before coming to Rochester. Yazdanie has completed medical missions to Ecuador, where he

assisted cataract surgeons in restoring sight, and has a keen interest in research, completing a summer program at the National Eye Institute. He sometimes relaxes by playing clarinet or cricket.

SEEING THE DETAILS (CONTINUED FROM COVER)

retinal tear in his left eye. A procedure called a barrier laser was performed to prevent his retina from detaching. The retina is the part of the eye that converts light images to nerve impulses and sends them to the brain where they are processed as vision. A detachment can result in temporary and/or permanent loss of sight.

“Laser is typically the first line of treatment for a tear,” FEI retinal specialist **Ajay Kuriyan, M.D., M.S.**, said “You can also do a procedure called cryopexy, where you freeze the retina. The goal of both is to cause a scar between the retina and the layer below the retina – called the choroid – to prevent a retinal detachment.”

“I was surprised by the diagnosis,” Goldstein said. “But the laser made an immediate improvement in my overall vision and my follow-up visit showed that my eyesight was good.” With glasses he still saw 20/20.

Thinking he was cured, Goldstein went back to doing what he needed to do at home and in cleaning out his mother’s house, claiming that he was “moving heavy stuff all the time.” Fortunately, he had become highly attuned to the slightest changes in his vision.

Within a few weeks he returned to Ramchandran describing light sensitivity and some discomfort with eye movement. Ramchandran discovered a new problem, the beginnings of a hemorrhagic posterior vitreous detachment. Vitreous is a clear substance with the consistency of egg whites that gives the eye volume. Its detachment from the back of the eye is fairly common with age and may not require treatment. However, it can be more serious in the presence of a retinal tear because as it detaches it may take the retina with it. This was happening in Goldstein’s case. Another barrier laser procedure was performed on this area to shore it up and prevent further detachment.

A week later, Goldstein came back with similar symptoms. Despite the second laser treatment, the second tear was progressing and threatening retinal detachment. Ramchandran performed a third laser procedure.

Within 10 days, Goldstein was back again – this time seeing Kuriyan and requiring more laser work. Ultimately, Kuriyan gave him news he was hoping not to hear: The lasers were not doing enough and retina surgery would be required to maintain his vision.

“The idea of retina surgery really bothered me,” Goldstein said. “It made me think about getting older, and I feared a permanent change to my vision that could affect one of my strengths in business.”

After careful consideration of possible treatment approaches, Kuriyan performed a pneumatic retinopexy. In this procedure, as in

efficacious set up. Upon examining him the next day, it looked like a good result. On subsequent follow-up visits, his retina continued to remain attached.”

Goldstein is now carefully followed, not only because of the repair to the left eye, but, as Kuriyan points out, because he has a greater than normal chance for developing a detachment in the right eye. As a patient Goldstein is very pleased with the outcome.

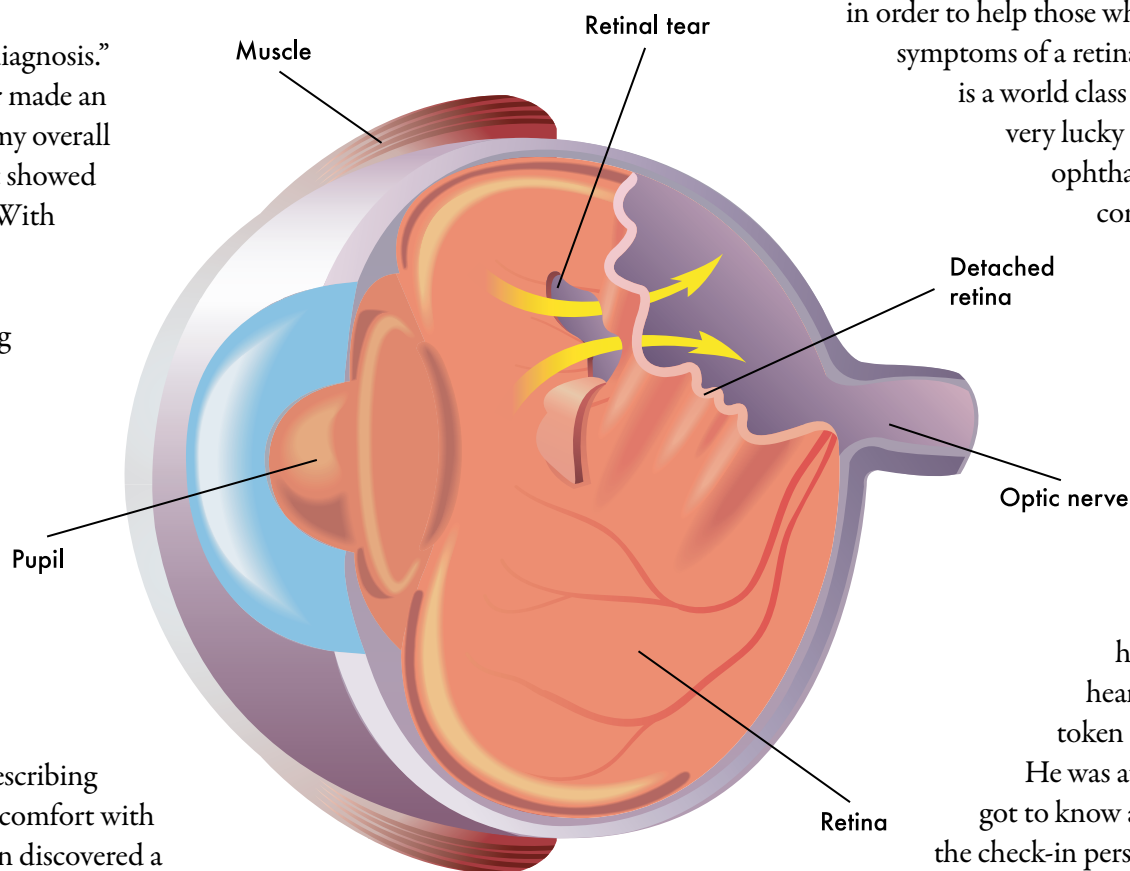
“Dr. Kuriyan and all the doctors and staff at FEI are amazing,” Goldstein said. “My vision is better now and I still have the God given ability to see differences in resolution that others can’t. I tell my story to everyone in order to help those who don’t know the symptoms of a retinal detachment. FEI is a world class resource and we are very lucky to have such great ophthalmic care in this community.”

To express his gratitude for having such a good visual outcome, Goldstein treated the entire FEI retina staff to a holiday luncheon provided by his favorite restaurant.

There he presented his care team with a heartfelt thanks and a token of his appreciation.

He was at FEI so often that he got to know all the people, from the check-in person, to the retina doctors, to the technicians. He wanted them all to know that he appreciated their kindness to him.

Goldstein is back to his duties leading Navitar and sitting on the FEI Advisory Board. Inspired by his experience, he is working to develop a new system of pillows aimed at enhancing patient comfort after retinal surgery with the goal of improving outcomes.



many retina surgeries, a gas bubble is injected into the back part of the eye. The gas helps to reattach the retina by covering up the tear in the retina to prevent more fluid from entering under the retina and allowing the fluid under the retina to reabsorb. This provides time for the laser or cryopexy to work. Depending on the location of the detachment, the patient may have to position his or her head awkwardly for extended periods of time in order to improve the chances of success.

“In Julian’s case, he experienced these difficulties firsthand,” Kuriyan said. “With his wife Marjorie’s help and creativity they fashioned a new style of pillow for him to use that facilitated a more comfortable and

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NEW FACULTY



Kristen Bowles-Johnson, O.D., M.S., recently joined FEI as a Senior Instructor of Ophthalmology and will split her time between post-doctoral research and clinical duties. With a research focus in genetic eye diseases, she will collaborate with FEI's **Jennifer Hunter, Ph.D.**, who uses adaptive optics imaging to better study the genesis of genetic eye diseases.

Bowles-Johnson received a Master's Degree in Vision Science and a Doctorate of Optometry from the University of Alabama at Birmingham. She completed a clinical fellowship in ophthalmic genetics at the National Eye Institute and a retinal research fellowship at Wilmer Eye Institute. She went on to complete a Ph.D. in physiological optics at the University of Houston, where she also performed clinical duties during her studies. She has more than two dozen publications, book chapters and presentations. She sees patients at FEI's Strong Memorial Hospital and Brighton locations.



Collynn Woeller, Ph.D., joined the FEI basic science faculty as Assistant Professor of Ophthalmology. Woeller was formerly a Research Associate Professor in the University of Rochester's Department of Environmental Medicine, where he developed many productive collaborations with FEI. Woeller's expertise is in immunology, toxicology, biochemistry and molecular biology.

His current research interest is understanding the key molecular and cellular pathways involved in eye disease, with a particular focus on Thyroid Eye Disease (TED). In TED, a degenerative autoimmune response results in the formation of unwanted tissue behind the eye. This can cause cosmetic disfigurement as well as ocular dysfunction producing double vision, eyelid retraction and, in some cases, blindness related to excess pressure on the optic nerve. Woeller and his collaborators have already discovered and patented promising new therapies that may arrest this process and could be used in treating other diseases that result in excessive scar formation and/or accumulation of excessive fat tissue. Woeller also has interests related to other vision disorders and the effect of environmental exposures (like airborne contaminants) on the eyes.

Woeller received his undergraduate degree in Biochemistry from SUNY Geneseo and completed his doctorate in the same field at Cornell University. He came to the University of Rochester to complete post-

doctoral studies in Molecular Biology and Biochemistry prior to his appointment as Research Professor. He has authored, or co-authored, nearly 50 publications in scientific journals and is a primary investigator or co-investigator on multiple grants from the National Institute's for health and other funding sources.

64th Rochester Ophthalmology Conference wrap-up

Nearly 250 ophthalmologists, optometrists, nurses and ophthalmic technicians attended the 64th annual Rochester Ophthalmology Conference held March 29-30. Retina specialist, **Daniel Martin, M.D.**, of the Cleveland clinic delivered the 64th Snell Memorial Lecture, "Evolution of Intravitreal Therapy for Retinal Diseases." The inaugural Frederick Dushay Distinguished Visiting Professor, "Potential complications of gene- and cell-based therapies," was delivered by Casey Eye Institute Chair **David Wilson, M.D.** Other guest speakers included **Ramesh Ayyala, M.D.**, **Suzanne Freitag, M.D.**, **Janet Rucker, M.D.** and **John Vukich, M.D.** Special thanks go to all the lecturers, attendees and exhibitors. Save the date: the 65th meeting will be held May 29th and 30th, 2020.

Grand Rounds dates announced

We are busily recruiting speakers for FEI's monthly Visiting Professor Series. These lectures provide excellent opportunities for doctors throughout the region to learn the latest medical, surgical and diagnostic pearls while earning continuing professional education. The dates for the upcoming academic year are as follows:

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| Oct. 26, 2019 | Zoë Williams, M.D. |
| Nov. 23, 2019 | Deepinder Dhailwal, M.D. |
| Dec. 14, 2019 | Steven Yeh, M.D. |
| Feb. 15, 2020 | Peter Setabute, M.D. |
| Mar. 28, 2020 | Carla Seigfried, M.D. |
| May 29 & 30, 2020 | 65th Rochester Ophthalmology Conference |
| June 20, 2020 | Laura Enyedi, M.D. |

Except for the Rochester Ophthalmology Conference, the series is free to attend and begins at 8:00 a.m. in the Eye Institute's third floor reception area.