MCPHERSON EYE RESEARCH INSTITUTE

2016 ANNUAL REPORT
2017 CALENDAR

MERI
UW–MADISON

Dear Friends,

During the 2015-2016 academic year, the McPherson Eye Research Institute passed its first ten-year milestone, and did so in our customary way – by looking towards the future as well as the past. The Institute's growth over the past ten years, outlined on the page below, has been remarkable and full of individual and collaborative research achievements. All of us who have worked to establish and grow the McPherson ERI know full well, however, that much work remains to be done in finding cures for the most intractable blinding diseases, such as age-related macular degeneration and retinitis pigmentosa. We celebrate our successes – and there are important new discoveries each year, as you'll see outlined in the research pages of this report – but we keep our eyes focused on building the Institute and its path ahead.

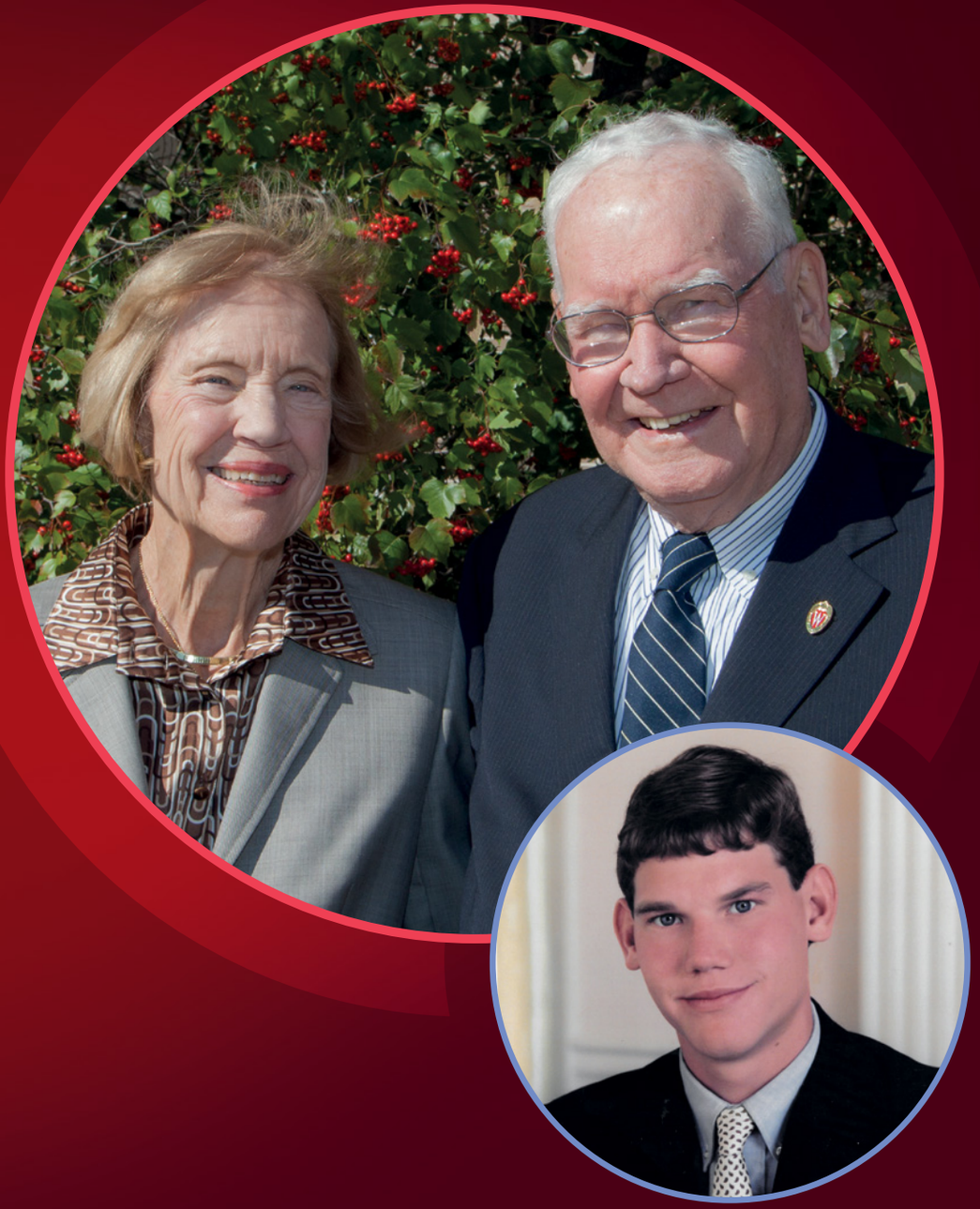
The people who form the community around the Institute are the foundation for the work that we do. Collaborative research is the Institute's goal and core belief, but we know that extraordinary collaborative teams are composed of extraordinary individuals. This is true of the world-class scientists who form our unparalleled lab research teams. It's also true of our dedicated donors and other supporters – from the teams of blind and sighted riders who participate in Cycle for Sight each year, to our Advisory Board, to connected individuals and families who support the Institute with both resources and advice.

Sandra and Dr. Monroe Trout have been true friends of the McPherson ERI since we were introduced to them in 2012. Drawn to the Institute by the age-related macular degeneration research taking place at UW-Madison, the Trouts quickly became strong supporters of its work. In 2013, they endowed the Sandra Lemke Trout Chair in Eye Research. At the start of 2017, the Trouts will fully endow the Timothy William Trout Professorship in Eye Research, named for their younger son who passed away in May 2016. Tim Trout was a championship college basketball player, a successful investment fund manager, a loving partner and the caring father of two sons. We are proud to help honor his memory through this named professorship, which will link the Trout name with future advances in vision research.

As you look through this report, please keep in mind that we are inspired and enabled to move forward by your interest in our work, and by the need that exists for all of us to break new ground in vision research and cures. Thanks for moving along with us.

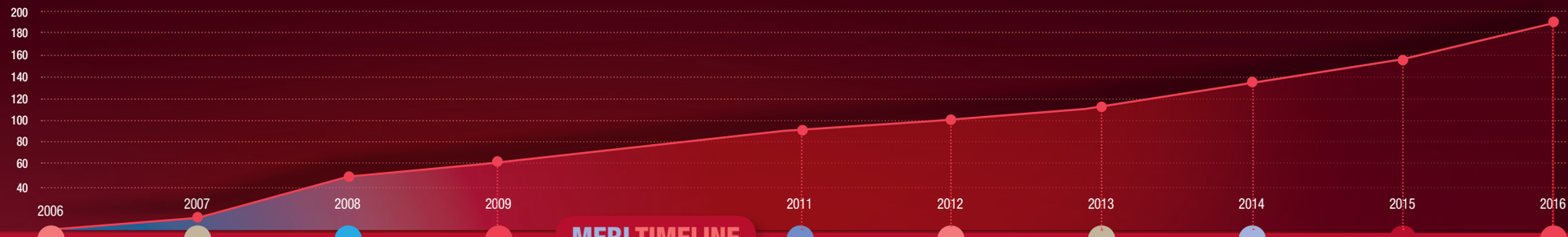
David M. Gamm, MD, PHD

RRF Emmett A. Humble Distinguished Director
Sandra Lemke Trout Chair in Eye Research



Sandra and Monroe Trout, and Timothy Trout (inset)

MEMBERSHIP GROWTH



MERI TIMELINE

2005

The UW Eye Research Institute is activated as a unit by UW-Madison Chancellor John Wiley, and placed under purview of the Provost. This formal establishment was preceded by ten years of discussion among Founding Director Daniel M. Albert, Dr. Alice McPherson (graduate of the UW School of Medicine and the first woman retinal surgeon in the United States) and others, including first Associate Director Arthur Polans.

2006

The Leadership Committee of the Eye Research Institute, comprised of nine faculty members engaged in vision research in multiple UW-Madison Schools and Colleges, is formed with the mission of steering the Institute's growth and direction.

2007

Dr. Alice McPherson revises an earlier agreement in order to provide extensive future endowment funding for the research mission of the Eye Research Institute.

2007

The Eye Research Institute assembles its external Advisory Board, first chaired by David M. Walsh (currently chaired by Rose Barroilhet). Advisory Board members give essential advice and support to the Institute's Director and staff.

2008

The Eye Research Institute is placed within, and soon receives operational support from, the UW-Madison School of Medicine and Public Health.

2009

A monthly academic-year seminar series is initiated, which continues to the present. This forum gives member researchers opportunities to share recent findings in vision research. Also in 2009, the first annual Eye Research Institute vision science poster session is held, featuring research findings from dozens of affiliated laboratories.

2006-2007

The Retina Research Foundation (RRF), Dr. Alice McPherson's vision research foundation in Houston, establishes four chairs and professorships at the Eye Research Institute. Among these positions is the RRF/Emmett A. Humble Distinguished Directorship, endowed by Advisory Board member Emmett Humble and first held by Founding Director Daniel M. Albert. In 2010 and 2012, three additional endowed faculty positions are gifted to the Eye Research Institute by the Retina Research Foundation. These seven RRF-endowed positions continue to support research by McPherson ERI members in multiple departments.

2011

David M. Walsh Research Travel Awards are initiated, allowing selected trainee researchers to present results at academic conferences.

2012 FEBRUARY

Cycle for Sight, the Eye Research Institute's primary fundraiser, is held for the first time on the UW-Madison campus.

2012 JUNE

The Institute takes a new name! In recognition of Dr. Alice McPherson's support of vision research at UW-Madison, the Institute is renamed the McPherson Eye Research Institute at a ceremony hosted by Interim Chancellor David Ward.

2012 JULY

Dr. David M. Gamm is appointed as Institute Director, as Dr. Daniel Albert retires from the position.

2013 JANUARY

Dr. Monroe & Mrs. Sandra Trout establish the Sandra Lemke Trout Chair in Eye Research.

2013 APRIL

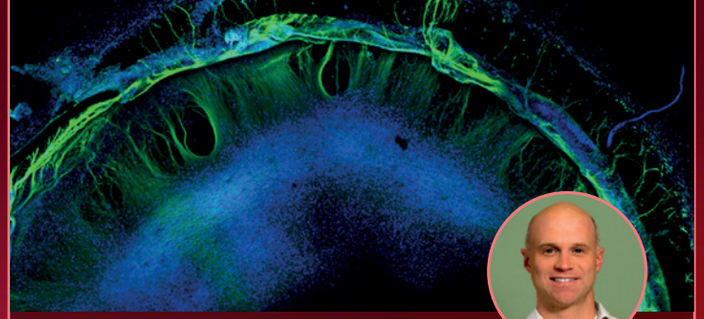
The first annual McPherson Eye Research Institute Endowed Lecture is delivered on campus by Dr. Jean Bennett of the University of Pennsylvania, focusing on retinal gene therapy. In succeeding years, the lectures are given by Dr. David Williams, Dr. Sheila Nirenberg, and Dr. Pawan Sinha.

2014

New space! The McPherson ERI moves to the top floor of the Wisconsin Institutes for Medical Research Tower II. In addition to three McPherson ERI member research labs and the Institute's headquarters, the space includes a long-envisioned art gallery. In MAY 2014, the gallery is dedicated as the Mandelbaum & Albert Family Vision Gallery in honor of Dr. Albert and his family members David and Nathan Mandelbaum, early and generous supporters of the Institute.

2016

McPherson ERI Advisory Board members, researchers, and supporters celebrate the 10th anniversary of the Eye Research Institute at a lively dinner at The Madison Club. In only 10 years, the McPherson Eye Research Institute has more than doubled in member-researchers, working collaboratively to understand vision and ultimately to cure blinding diseases. The groundwork has been laid for further significant research advances in years to come.



RESEARCHER

William L. Murphy, PhD

Harvey D. Spangler Professor, Biomedical Engineering, College of Engineering
Orthopedics & Rehabilitation, School of Medicine and Public Health
Co-Director, Stem Cell and Regenerative Medicine Center
Director, Human MAPs Center

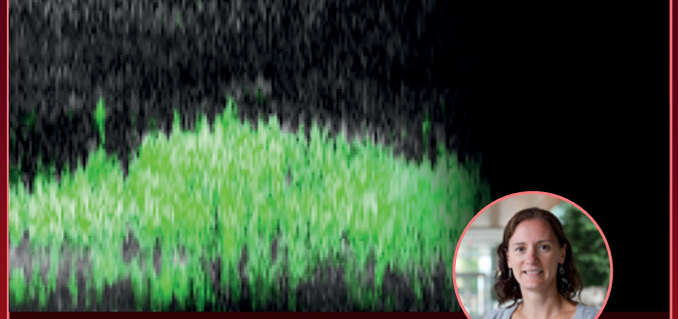
Focused on creating innovative biomaterials inspired by the materials found in nature, Professor William Murphy and his research group—the Bioinspired Materials Lab—are using them to understand stem cell behavior and to induce tissue regeneration. In one example, his lab has used customized biomaterials to control diverse stem cell behaviors, including adhesion, proliferation, migration, phenotypic transformation, and lineage-specific differentiation. They have recently used "arrays" of hundreds of biomaterials to find the conditions that make stem cells assemble into human tissues outside the body. They are now using human tissues assembled in bioengineered devices to predict the effects of new drugs on the human body.

Biomaterials developed by the Murphy group are progressing toward use in clinical applications, pharmaceutical applications, and as tools for fundamental biological discovery. In the eye research area, new bioinspired materials are being used to assemble microscale human ocular tissues on a chip to model ocular diseases, discover new drugs, and screen for potential toxins. The biomaterials are also being used as more efficient delivery systems for cells (e.g., RPE and photoreceptor cells) and tissues (e.g., endothelial membranes) to treat eye diseases.

RESEARCH NOTE

In a paper published in November 2016, **Dr. Akihiro Ikeda** (Medical Genetics) identified a particular gene that appears to regulate retinal aging processes; the mutation of this gene accelerates the retinal aging process as well as particular pathologies that go along with retinal diseases. The discovery has important implications for age-related macular degeneration research.

Lee WH, Higuchi H, Ikeda S, Macke EL, Takimoto T, Pattnaik BR, Liu C, Chu LF, Siepka SM, Krentz KJ, Rubinstein CD, Kalejta RF, Thomson JA, Mullins RF, Takahashi JS, Pinto LH, Ikeda A. Mouse Tmem135 mutation reveals a mechanism involving mitochondrial dynamics that leads to age-dependent retinal pathologies. eLife, 2016; 5 DOI: 10.7554/eLife.19264



RESEARCHER

Melissa Skala, PhD

Biomedical Engineering, College of Engineering
Morgridge Institute for Research

The McPherson ERI has rich connections with investigators who arrive at vision science from a primary or initial interest in other body systems. In many cases, this is because the eye provides a complex system that is relatively easily accessed from outside the body. Associate Professor Melissa Skala and her lab group develop new optical imaging techniques to study cell metabolism, vascular remodeling, and molecular expression. Skala, who typically focuses her techniques on the detection and treatment of cancer, is greatly interested in using these techniques to monitor drug response in the eye.

In work on both cancer and the eye, Dr. Skala has advanced new molecular imaging methods that combine the power of optics and nanotechnology for high-sensitivity deep-tissue imaging. These methods make use of a wide range of recently developed imaging techniques: optical coherence tomography to monitor blood flow and microvessel morphology, multiphoton and fluorescence lifetime microscopy to image cellular metabolism, photothermal microscopy with nanoparticle contrast agents for molecular imaging, and optical spectroscopy to quantify tissue blood content and oxygenation. These tools are under development to guide personalized treatment decisions in cancer patients. Dr. Skala has also integrated these methods with computational models to fully exploit structural and functional relationships between cell types, making for a more rounded picture of metabolic changes in both cancer cells and the eye.

RESEARCH NOTE

Inspired by the superposition compound eyes of lobsters and the retinal structure of elephantnose fish, Lynn H. Matthias Professor in Engineering **Hongrui Jiang** (Electrical & Computer Engineering) and his collaborators derived a groundbreaking artificial eye with the ability to acquire images under low-light conditions.

Liu H, Huang Y and Jiang H. Artificial eye for scotopic vision with bioinspired all-optical photosensitivity enhancer. Proceedings of the National Academy of Sciences of the United States of America (PNAS), 2016 April; 113(15); pp. 3982-3985.

From left: Tim Reese, Theresa Selzer, David Gamm, Ruchira Singh

HOPEFUL PATIENT

Tim Reese

Tim Reese knew that he had Best disease, an early-onset type of macular degeneration, from childhood. He is one of seven siblings; four have inherited the disease, which also affected his late mother, Dorothy. Children have a 50% chance of inheriting the Best gene if one of their parents carries it. Reese remembers watching his mother struggle with the disease. "Losing your sight is the slowest death in the world," he says. His own vision loss has accelerated, but he continues to work for a construction company in suburban Chicago. Tim Reese and his wife of 38 years, Daphne, have two grown children, Violet and William, and two grandsons. Their children inherited the Best gene mutation but have not shown symptoms of the disease.

"Several years ago," Reese remembers, *"I received a telephone call that truly changed my life and gave me hope, renewed dedication, and respect for research. Dr. David Gamm had learned of my family's disease through our numerous visits to Dr. Fishman at the University of Illinois at Chicago. Dr. Gamm contacted me to see if I would be interested in a research program studying Best disease. I was delighted that after many years of my eyesight getting progressively worse, someone was interested in halting or reversing the process through stem cell studies."*

Reese and his sister, Theresa Selzer, donated samples of skin cells which the Gamm Lab reverse-engineered into induced pluripotent stem cells (iPSCs) and then forward-engineered into retinal cells. Theresa notes that all of the Reese siblings are excited about the progress of the research and eager to help. These cells have been used in a variety of tests for drug and other potential therapies for Best disease, the majority of which could not be run with human patients. (Selzer does not carry the Best gene mutation, but her cells function as a control group for testing purposes.) In an emotionally moving visit to Madison several years ago, the siblings were able to hold their own retinal stem cell lines in their hands.

"I'm thankful that somebody is doing something and is committed to trying to find a cure," says Reese. "It is gratifying, maybe not so much for me, but for my children, grandchildren and others. I'm confident and hope the research continues…I'm doing this for the future."

RESEARCH NOTE

In a noteworthy study, Assistant Professor **Aparna Lakkaraju** (Ophthalmology & Visual Sciences) and her lab team pinpointed how immune abnormalities beneath the retina result in age-related macular degeneration, and identified several common drugs that can potentially be repurposed to treat the disease.

Tan LX, Toops KA, and Lakkaraju A. Protective responses to sublytic complement in the retinal pigment epithelium. Proceedings of the National Academy of Sciences of the United States of America (PNAS), 2016 August; 113(31); pp. 8789-8794.

From left: Campbell, Chip, Christy, and Clay Kaufman

HOPEFUL PATIENT

Chip and Christy Kaufman

Chip and Christy Kaufman are regular participants in the annual McPherson ERI fundraising ride, Cycle for Sight. Their team, Out of Sight, has consistently raised thousands of dollars to support vision research. Chip Kaufman has a cone-rod retinal dystrophy, a progressive condition in which loss of function in cone photoreceptor cells (color vision and visual acuity) is followed by loss of function in rod photoreceptor cells (causing night blindness and eventually peripheral vision loss). Chip was diagnosed with cone-rod dystrophy in his late thirties. Now 48, he has lost his central vision; but his peripheral vision is quite good and he still bikes to work at TDS Telecom, where he is a product manager, every day—winter included. "I can see a lot…I just can't see what I'm looking at!" is how he characterizes his vision. The Kaufmans, who have been married for almost 15 years, have two sons, Clay and Campbell.

Christy rides for Chip. She explained why on her Cycle for Sight web page:

I used to complain about my commute to work when Chip and I lived in Chicago, not realizing how easy I had it. When Chip's vision deteriorated to the point he had to surrender his driver's license, he committed to riding his bike to work regardless of weather conditions. I used to beg him not to ride because I worried for his safety, and I was extremely frustrated with him for refusing to give it up. It took me a while to realize that for Chip, this is not about being stubborn. This is about maintaining independence and showing courage in the face of adversity. It is about maintaining control over a senseless disease. When I hop on my indoor bike to support the University of Wisconsin McPherson Eye Research Institute, I will be envisaging Chip who rides in the wind, snow and rain, proving to our children that you never, ever, ever give up.

RESEARCHER

Melanie Schmitt, MD

Ophthalmology and Visual Sciences
School of Medicine and Public Health

Although most McPherson ERI researchers focus on the basic science behind vision function and health – essential for future clinical advances – some are accomplished clinicians in addition to their research work, often finding ways to merge the two interests. Dr. Melanie Schmitt is a fellowship-trained pediatric ophthalmologist with a research emphasis that reflects her strong interest in inherited ophthalmic conditions.

Dr. Schmitt's research focuses on the clinical aspects of inherited retinal conditions, a passion which began in her undergraduate years as a genetics major at the University of Wisconsin-Madison. She has developed the first specialty retinal dystrophy clinic in Wisconsin for adult and pediatric patients with inherited retinal conditions, such as retinitis pigmentosa, Stargardt disease, Usher syndrome, Leber congenital amaurosis, and albinism. As the first Director of Ophthalmic Genetics within the Department of Ophthalmology and Visual Sciences, Dr. Schmitt leads a group of accomplished clinicians and researchers in investigating the genetic bases, and potential therapies, for these and other diseases. She also studies rare genetic eye conditions within the Wisconsin Amish and Mennonite populations; in the coming year she will conduct the first genetic eye disease clinic for Amish and Mennonite patients, on a biannual basis in conjunction with the La Farge Medical Clinic.

RESEARCH NOTE

Bas Rokers, Associate Professor in Psychology, published groundbreaking papers in 2016 on visual perception, including an important study of agnosia – the failure of the brain to properly interpret sensory information[1]—and an examination of how the brain interprets motion in 2D and 3D.[2]

[1] **Barendregt M, Dumoulin SO, Rokers B. Impaired velocity processing reveals an agnosia for motion in depth. Psychological Science, 2016 Nov;27(11):1474-1485. Epub 2016 Sep 27**
[2] **Cooper E, van Ginkel M, Rokers B. Sensitivity and bias in the discrimination of two-dimensional and three-dimensional motion direction. Journal of Vision, 2016** Aug 1;16(10):5, 1–11. doi: 10.1167/16.10.5.

RESEARCHER

Terri L. Young, MD, MBA

Peter A. Duehr Endowed Professor of Ophthalmology, Pediatrics and Medical Genetics
Chair, Department of Ophthalmology and Visual Sciences
School of Medicine and Public Health

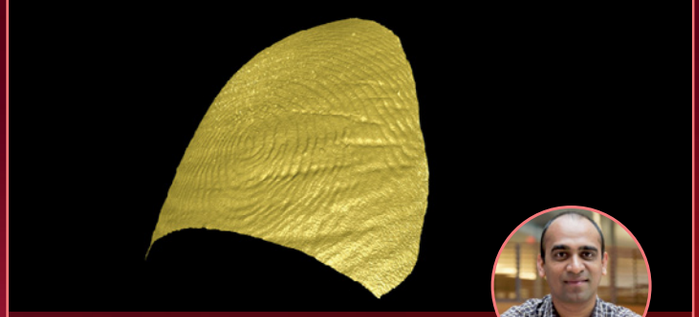
Dr. Terri Young is a clinician-scientist (pediatric ophthalmologist) whose research specializes in determining the genetic and biological basis for a diverse array of heritable ocular conditions. In particular, her research focuses on the molecular and structural mechanisms underlying childhood glaucoma and ocular developmental disorders such as high-grade myopia and microphthalmia (small eye) — all with increased risks of blindness.

Families are recruited to study correlations between inherited variants in their genomes and their disease status. For this, the latest in next-generation sequencing technology is employed to discover an individual's entire exome sequence – the protein-coding component of their genome. To validate whether an identified sequence variant is the cause of the family's disease, the laboratory studies gene expression and protein function, performs cellular assays, and models the gene variation in animal systems. Dr. Young's research has led to improved diagnostics, focused genetic counseling, and informed therapeutic strategies.

RESEARCH NOTE

Professor Curtis Brandt (Ophthalmology & Visual Sciences) and his collaborators analyzed the genetic locations of factors that determine the virulence of disease phenotypes in herpes simplex virus type 1 – the leading cause of infectious blindness in the United States – in an important paper published in March 2016.

Kolb AW, Lee K, Larsen I, Craven M, Brandt CR. Quantitative trait locus based virulence determinant mapping of the HSV-1 genome in murine ocular infection: Genes involved in viral regulatory and innate immune networks contribute to virulence. PLoS Pathology 2016 Mar 10;12(3):e1005499. doi:10.1371/journal.ppat.1005499.



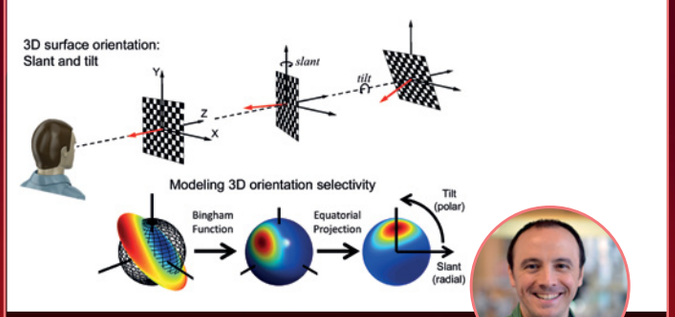
RESEARCHER

Mohit Gupta, PhD

Computer Sciences
College of Letters and Science

We are in the midst of a 3D revolution. Robots enabled by 3D cameras are beginning to autonomously drive cars, perform surgeries, and manage factories. However, when deployed in the real-world, these cameras face several challenges that prevent them from measuring 3D shape reliably. These challenges include large lighting variations (bright sunlight to dark night), presence of scattering media (fog, body tissue), and optically complex materials (metal, plastic).

In his WISION (Wisconsin Imaging Optics and Computer Vision) Lab, Assistant Professor Mohit Gupta is developing extreme 3D cameras based on time-of-flight and active triangulation that address these long-standing problems. This includes designing 'all-weather' cameras that can perform high-speed 3D scanning in harsh outdoor environments, as well as cameras that can measure detailed (<100 microns resolution) 3D scans at large (>100 meter) stand-off distances. A new research direction with Dr. Andreas Velten is to develop 3D cameras that can image objects around the corner, which would normally be completely invisible to conventional cameras.



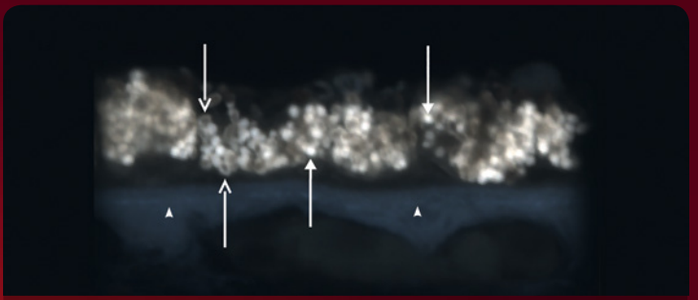
RESEARCHER

Ari Rosenberg, PhD

Neuroscience
School of Medicine and Public Health

How do we perceive the three-dimensional (3D) structure of the world when our eyes only sense 2D projections like a movie on a screen? Estimating the 3D scene structure of our environment from a pair of 2D images (like those on our retinae) is mathematically an ill-defined problem plagued by ambiguities and noise. Given these complexities, it is remarkable that the visual system can construct accurate 3D representations of our surroundings.

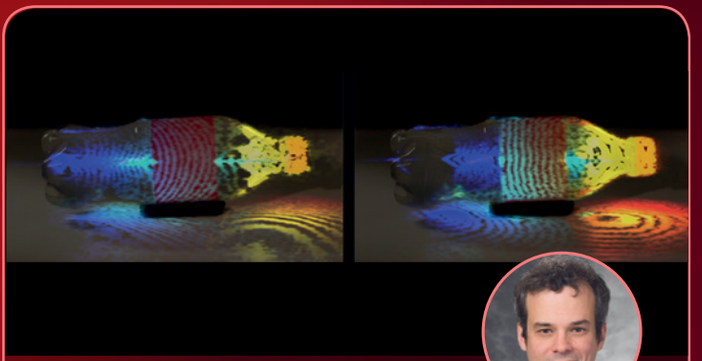
Assistant Professor Ari Rosenberg and his lab focus on understanding how the brain achieves accurate and reliable 3D visual percepts, such as how an object one wants to grasp is oriented. By adapting a mathematical model called the Bingham Function, which is used to analyze geomagnetic data, Dr. Rosenberg's group developed the first methods for quantifying how neurons represent 3D object orientation. To understand how we perceive the 3D world, their research employs a synergistic, multifaceted approach combining computational modeling, neurophysiological studies, and human psychophysical experiments.



RESEARCH NOTE

In order to improve treatment options for age-related macular degeneration (AMD), new methods for early detection and screening are needed. Using donor eyes in this imaging study, Assistant Professor **Jeremy Rogers** (Biomedical Engineering) published promising results demonstrating a potential solution by using data analysis to detect a spectral shift in retinal autofluorescence associated with AMD.

Kaluzny J, Purta P, Poskin Z, Rogers JD, Fawzi AA. Ex vivo confocal spectroscopy of autofluorescence in age-related macular degeneration. PLoS ONE 2016 Sept 15;11(9): e0162869. doi: 10.1371/journal.pone.0162869



RESEARCHER

Andreas Velten, PhD

Biostatistics and Medical Informatics, School of Medicine & Public Health
Electrical and Computer Engineering, College of Engineering

Assistant Professor Andreas Velten's research in ultrafast computational imaging focuses on developing new forms of vision that make use of cameras fast enough to image light in motion—e.g., able to record the nanosecond speed of a laser pulse moving through a soda bottle. These time-of-flight cameras, combined with new imaging algorithms, can utilize captured time information to see around corners or through scattering media such as fog or human tissue. They can also create accurate three dimensional representations of an imaged scene, which is important for virtual and augmented reality applications.

Imaging and augmented vision in difficult environments is a key challenge in many applications. Dr. Velten and colleague Dr. Gupta are exploring ultrafast methods for imaging through fog for self-driving cars, imaging into human tissue for medical diagnoses, and imaging around corners.

RESEARCH NOTE

A UW-Madison research team led by **Dr. David Gamm** has been selected to work on one of six projects funded by the National Eye Institute and aimed at restoring vision by regenerating light-sensing photoreceptor cells in the eye. Part of the NEI Audacious Goals Initiative, their project is a targeted effort to restore vision by regenerating neurons and their connections in the eye and visual systems. The UW team consists of four McPherson ERI-affiliated investigators in addition to Dr. Gamm and scientist **Joe Phillips**, who heads photoreceptor production in the Gamm Lab for this effort; they will also collaborate with researchers at Johns Hopkins University. Neuroscientists **Tim Gomez** and **Xinyu Zhao** and biomedical engineers **Justin Williams** and **Bill Murphy** will play critical roles in this effort to coax photoreceptor cells – which are generated from human pluripotent stem cells – to become fully developed, connected and functioning photoreceptor cells.

RESEARCH NOTE

In an exciting collaboration, a multidisciplinary group of McPherson ERI member researchers is building a model of the retina that will help doctors better diagnose and develop treatments for age-related macular degeneration (AMD). **Kristyn Masters** and **Pam Kreeger**, both associate professors of Biomedical Engineering, in conjunction with **Aparna Lakkaraju** (Ophthalmology & Visual Sciences), recently received a two-year, $435,569 grant for their project, "Identification of novel therapeutic targets for age-related macular degeneration via a combined tissue engineering and systems biology approach." By making a tissue-engineered model of the retina, the team will be able to study how various changes in the eye at different ages can regulate the occurrence of angiogenesis.

RESEARCH NOTE

Assistant Professor of Pediatrics **Bikash Pattnaik** has recently published important work on Leber congenital amaurosis, a childhood-onset inherited retinal disease. Dr. Pattnaik, whose work is funded in part by a recent four-year, $1.5 million grant from the National Eye Institute's Audacious Goals Initiative, has identified several potentially significant therapeutic approaches to combating LCA.

Pattnaik BR, Shahi PK, Marino MJ, Liu X, York N, Brar S, Chiang J, Pillers DA, Traboulsi EI. A novel KCNJ13 nonsense mutation and loss of Kir7.1 channel function causes Leber congenital amaurosis (LCA16). Human Mutation, 2015 Jul;36(7):720-7. doi: 10.1002/humu.22807. Epub 2015 May 20.

HOPEFUL PATIENT AND MCPHERSON ERI MEMBER

Annika Konrad

Annika Konrad is a PhD Candidate in Composition and Rhetoric at the University of Wisconsin-Madison. After spending a decade communicating with almost no one about her degenerative retinal disease (rod-cone dystrophy/Retinitis Pigmentosa), at the age of 25 she found community at the Wisconsin Council of the Blind and Visually Impaired (WCBVI). Since then, she has developed an intellectual and political curiosity toward the ways our society makes life inaccessible to people with disabilities. Annika uses her skills as a scholar and teacher of writing and rhetoric to support disability advocacy efforts. Her doctoral research focuses on the self-advocacy experiences of people who are blind and visually impaired and the social norms that obstruct the success of their efforts. The results demonstrate an alarming phenomenon she calls "access fatigue," or the exhaustion that disabled individuals feel from having to advocate for their own access day in and day out. She uses the results to make data-driven arguments about the pressing need for more collective responsibility for access.

In 2013, Annika launched a statewide community writing project in partnership with WCBVI. She continues to collaborate with WCBVI staff to publish stories about living with blindness and visual impairment on a blog called *The Outlook From Here* (www.theoutlookfromhere.wordpress.com). Over seventy stories written by people who are blind and visually impaired and their sighted allies have been published on the blog. Topics range from challenges shopping for groceries, parenting, hunting, and dating to seeking accessible voting formats and negotiating accommodations in the workplace.

Annika plans to pursue a career as a university professor to continue her work on the lived experiences of people with disabilities and the inaccessible environments that disable them. Annika lives with her husband, Andy Van Pay, who is a medical student at the UW-Madison School of Medicine and Public Health. You can find out more about her academic and community work at **www.annikakonrad.com.**

RESEARCHER

Yuri Saalmann, PhD

Psychology
College of Letters and Science

There is too much information in our cluttered environments for us to simultaneously process it all in detail. Because of this processing capacity limit, we only process the behaviorally relevant information in detail and filter out the irrelevant information. Such selective attention involves increasing the activity of brain cells representing behaviorally relevant information and reducing the activity of other cells. Assistant Professor Yuri Saalmann and his lab group investigate how our visual system implements selective attention.

Using neuroimaging methods, the Saalmann group maps neural networks in the brain. Next—working with human and animal subjects performing visual attention tasks—they use electrophysiology methods to target electrodes to interconnected network sites and simultaneously record electrical activity from cells across the network. Finally, they decode the activity in this neural network, revealing the patterns of brain activity that support visual perception, selective attention, and visually-guided actions. This work advances our understanding of visual attention, which, when impaired, has devastating consequences on human health, such as in schizophrenia, attention-deficit hyperactivity disorder, and spatial neglect after stroke.

RESEARCH NOTE

Glaucoma is a leading cause of blindness in animals as well as humans. In an exciting paper published in July, **Dr. Gillian McLellan** (Ophthalmology & Visual Sciences) and her collaborators reported a genetic mutation that causes primary congenital glaucoma (PCG) in domestic cats.

Kuehn MH, Lipsett KA, Menotti-Raymond M, Whitmore SS, Scheetz TE, David VA, McLellan GJ, et al. A mutation in LTBP2 causes congenital glaucoma in domestic cats (Felis catus). PLoS ONE 2016 May 5;11(5): e0154412.doi:10.1371/journal.pone.0154412.

RESEARCH NOTE

Macular edema, the build-up of fluid in the macula, is a major complication of diabetes and vision impairment – but the detailed mechanisms of this are poorly understood. An important study led by RRF/Alice R. McPherson Chair Professor **Nader Sheibani** (Ophthalmology & Visual Sciences) in collaboration with McPherson ERI members **Mitra Farnoodian**, **Bikash Pattnaik**, **Chris Sorenson**, and additional researchers, identified how high glucose conditions affect the function of retinal pigment epithelial (RPE) cells. The study showed that high glucose results in increased oxidative stress within the cells, leading to changes in multiple factors that contribute to compromised RPE cell barrier function and edema.

Farnoodian M, Halbach C, Slinger C, Pattnaik BR, Sorenson CM, Sheibani N. High glucose promotes the migration of retinal pigment epithelial cells through increased oxidative stress and PEDF expression. American Journal of Physiology - Cell Physiology, 2016 Sep 1;311(3):C418-36. doi: 10.1152/ajpcell.00001.2016. Epub 2016 Jul 20.

RESEARCHER

Ender Tekin, PhD

AVIATR Lab, Waisman Center
Office of the Vice Chancellor for Research and Graduate Education

Scientist Ender Tekin runs A Visual Impairment and Accessibility Technology Research (AVIATR) Lab at the Waisman Center. His work involves developing new technological solutions to accessibility problems encountered by individuals with vision loss. Dr. Tekin points out that loss of vision can frequently lead to a loss of independence and a reduction in quality of life for an individual. As mobile devices and wearable technologies proliferate, there are new avenues to interact with the constant mesh of devices and appliances in the environment, opening up new possibilities to improve independence and self-sufficiency for someone who is blind or visually impaired. His research ranges from developing software to improve access to graphical materials in textbooks for students with print disabilities, to finding indoor signs using wearable cameras, to developing hearing aids that incorporate visual information for persons with both vision and hearing loss, a significant portion of older adults.

ENDOWED CHAIRS AND PROFESSORSHIPS AT THE MCPHERSON EYE RESEARCH INSTITUTE

DAVID M. GAMM, MD, PHD
DIRECTOR, MCPHERSON EYE RESEARCH INSTITUTE

Retina Research Foundation Emmett A. Humble Distinguished Directorship
Modeling and Treating Retinal Disease with Human Induced Pluripotent Stem Cells (hiPSCs)

Sandra Lemke Trout Chair in Eye Research
Applications of stem cell technology to the study and treatment of age-related macular degeneration

T. MICHAEL NORK, MD, MS

Retina Research Foundation Kathryn and Latimer Murfee Chair
Functional and Cellular Mechanisms of Ischemic Retinal Injury

CHRISTINE M. SORENSON, PHD

Retina Research Foundation Daniel M. Albert Chair
Apoptosis in Retinal Vascular Development and Disease

AKIHIRO IKEDA, DVM, PHD
ASSOCIATE DIRECTOR, MCPHERSON EYE RESEARCH INSTITUTE

Retina Research Foundation Walter H. Helmerich Research Chair
Identification of Genetic Factors Affecting Aging of the Retina

JEREMY ROGERS, PHD

Retina Research Foundation Edwin and Dorothy Gamewell Professor
Optical Instrumentation and Technology Platforms for the Study and Screening of Retinal Disease

BIKASH PATTNAIK, PHD

Retina Research Foundation M. D. Matthews Research Professor
Vision Loss Due to Ion-Channelopathy

APARNA LAKKARAJU, PHD

Retina Research Foundation Rebecca Meyer Brown Professor
Insight into the Cellular Basis of Retinal Degenerative Diseases

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4TH ANNUAL MCPHERSON ERI ENDOWED LECTURE

held April 28, 2016

Pawan Sinha, PhD
Professor of Vision and Computational Neuroscience
Department of Brain and Cognitive Sciences
MIT (Cambridge, MA)

In his lecture "Learning to See Late in Life", Dr. Sinha shared an inspiring illustration of how ongoing basic research can yield tangible societal benefits. Project Prakash is an initiative that provides sight to blind children on the one hand and helps address questions regarding brain plasticity and learning on the other. Through a combination of behavioral and brain-imaging studies, the effort has provided evidence of visual learning late in childhood and has illuminated some of the processes that might underlie such learning.

NEXT SPRING
5TH ANNUAL LECTURE
APRIL 27, 2017
DR. JOSÉ-ALAIN SAHEL

MANDELBAUM & ALBERT FAMILY VISION GALLERY

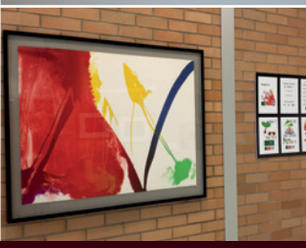
SHARED VISION: TALES OF SCIENCE ILLUSTRATION
JANUARY – MAY 2016

Exhibiting the transformation of 'raw' scientific data into artwork that communicates scientific ideas—artistic works by UW-Madison-associated scientific illustrators Kate Baldwin, Kandis Elliot, H. Adam Steinberg, and Laura Vanderploeg

CATCHING THE EYE of McPherson Eye Research Institute Members
JUNE – AUGUST 2016

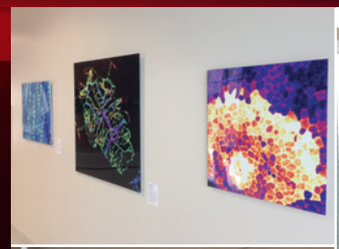
Exploring how vision research and the artistic eye align in artworks created or collected by members of the McPherson ERI

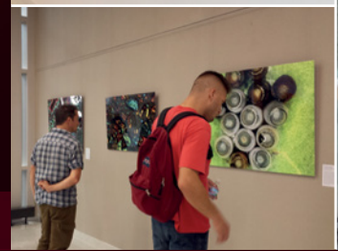
Members exhibiting works, L to R: Suzanne Peyer, Jeremy Rogers, Maria Rodriguez, Adam Steinberg, Rodney Schreiner, Deri Cattelino, Leandro Teixeira, Doris & Dick Dubielzig, Tony Cattelino.
Not pictured: Martha Glowacki, Zafer Gurel, Shiela Reaves, Ahna Skop.



2016 COOL SCIENCE IMAGE COMPETITION
SEPTEMBER - DECEMBER 2016

Showcasing winning images from UW Communications' annual all-campus science image contest





CYCLE FOR SIGHT 2017

Sign Up!

Cycle for Sight

SATURDAY MARCH 11th, 2017

Cycle for Sight continues to be a fun, exciting and rewarding event for the Institute and for the many riders who hop on spinning bikes at the Princeton Club, and at the Nat and the SERF on the UW-Madison campus. In March 2016, well over 200 riders and walkers participated in the event, raising $35,000 for vision research. We're very grateful to these participants and to our many donors.

SPECIAL THANKS TO OUR 2016 SPONSORS:

Rec Sports at UW-Madison, the Princeton Club, Cellular Dynamics International, the Shopko Foundation, Flyght Cycle, Direct Fitness Solutions/Precor, and Saris Cycling.

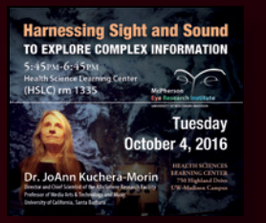
PLEASE JOIN US FOR THE 2017 RIDE!

www.cycleforsight.wisc.edu

Princeton Club · Cellular Dynamics International · Shopko Foundation · Rec Sports · Flyght · Direct Fitness Solutions · Precor Fitness Made Personal · Saris

8TH ANNUAL VISION SCIENCE POSTER SESSION

HELD OCTOBER 4, 2016



100 attendees; 37 posters presented;
18 trainee award competitors

2017 2016

MCPHERSON ERI RESEARCH EVENTS

Sharing vision-related findings and insights and fostering communications and connections

MERI-AT-A-GLANCE SHORT RESEARCH PRESENTATIONS

HELD FEBRUARY AND OCTOBER 2016

16 short vision-focused research talks by members and trainees from 15 departments; at 2 events, each with 65 – 75 attendees

WITH THANKS AND APPRECIATION

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