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*This report covers the period July 1, 2012, through June 30, 2013

Looking to the Future of Ophthalmology
University of Michigan Kellogg Eye Center Annual Report 2013

Front cover: Top row: Ryan Fante, M.D., Stephanie Chu, M.D., Jennifer Weizer, M.D. Bottom row: Maho Shibata, M.D., Ph.D., Jason Miller, M.D., Ph.D.

Back cover: Top row: Lindsey De Lott, M.D., Philip Gage, Ph.D. Bottom row: Julia Richards, Ph.D., Rajesh Rao, M.D.
We are fortunate to be part of the University of Michigan and its Health System, whose leaders place great value on discovery and innovation. Within our Department and across the Michigan campus, forward-looking thinkers are taking a new look at how we care for our patients, educate our trainees, and accelerate exciting new areas of research.

This year’s annual report offers a glimpse at some of the advances we believe will significantly contribute to the future of ophthalmology. Our growing faculty is leading us in new directions with collaborative initiatives in areas such as telemedicine, vision regeneration, delivery models influenced by best practices from around the world, and new training approaches.

Applying technology to health care. When we follow traditional models of care focusing on “one size fits all” solutions, we miss opportunities to deliver personalized health strategies to help patients at earlier stages of disease when the payoff may be greater. For example, the risk of vision loss is high when patients are not able to follow instructions for taking glaucoma medications. To help mitigate this issue, Dr. Paula Anne Newman-Casey, along with colleagues from the School of Public Health, the VA’s Health Services Research Group, the Institute for Health Policy and Innovation, and the College of Pharmacy, is investigating the use of personalized educational technologies to help patients manage their medications over a lifetime. Other faculty, like Drs. Maria Woodward and Lindsey De Lott, see telemedicine as a means to extend the reach of specialty care for patients who live far from medical centers where complex ophthalmic conditions are often treated. With increasing interest in the health of populations as a whole, such approaches will help maintain high quality care for individuals as well as for groups.

Encouraging our colleagues to pursue their interests. Our new residency career development awards encourage trainees to initiate and conduct research and academic projects they are passionate about, providing them with the opportunity to be leaders, with support and mentoring from experienced scientists. In this report, we highlight three of the six awardees’ projects: a survey of safety standards established by the United Kingdom’s National Health System, a study of protein changes that occur in various types of macular edema, and an investigation of the feasibility of using the femtosecond laser for glaucoma surgery.
Kellogg also emphasizes training and mentoring for our early career clinician-scientists. Dr. Thomas Gardner led the Department’s effort to obtain a National Eye Institute K12 Training Grant that provides protected research time and mentoring for faculty who wish to develop a major research program in tandem with their practice. In addition to our two K12 faculty, four more Kellogg faculty have received individual NIH clinician-scientist training awards this past year. Our patients will benefit from having doctors who are able to connect their research efforts with patient problems observed in the clinic.

**Ophthalmology is a global enterprise.** We are learning from colleagues in other countries, while providing unique training opportunities here at Kellogg. A team comprised of members from Kellogg, U-M, Aravind, and Dr. Alan Robin, the first Visiting Scholar to our Center for International Ophthalmology, worked with U-M medical student Hong-Gam Le to better understand the uniquely efficient process for cataract surgeries at the Aravind Eye Hospitals in India. Back in our clinics, the Center has arranged for physicians from other countries to receive training in low vision and specialty contact lens care.

**Advancing new fields of research.** For years, physicians have strived for the day we could offer patients targeted, customized treatments, such as gene and stem-cell based therapies. Our scientists are bringing these hopes closer to reality, with their progress in regenerative medicine through the study of eye development and eye tissue regeneration. One of our newest faculty members, Dr. Rajesh Rao, is investigating the concept of reprogramming cells to repair diseased eye tissue. And recently, our research faculty met with other leading scientists at an international symposium to discuss strategies for moving advanced therapies for eye disease forward into clinical trials.

**Collaborating for innovation.** New ideas often come from working with colleagues in other disciplines and with other institutions. Our faculty has initiated collaborative projects with a range of programs including engineering, rheumatology, and mathematics.

Dr. Robin Ali, noted for his work in gene and cell-based therapies, will become a Visiting Professor at Kellogg, sharing his knowledge with faculty and trainees in our Department. And we continue to cultivate relationships with other leaders from institutions worldwide.

**Friends of the Eye Center are helping us find new ways to support novel ideas.** Many generous donors have contributed to the Paul R. Lichter, M.D., Research Discovery Fund to provide seed funding for innovative, high-risk, high-reward research. This support allows scientists to test potentially revolutionary new ideas and to collect data needed to ultimately translate these ideas into improved patient care. Over the years, our friends have been steadfast supporters of our research program and our Department.

**The patient is the center of our world.** Any concept—from telemedicine to gene therapy—must translate to improved and compassionate care for our patients. In this report, you can read about Drs. Terry Smith and Raymond Douglas’ success in launching a large clinical trial to evaluate a treatment for Graves’ eye disease that is the direct result of their years of research on this autoimmune disorder. Their patients who struggle with this difficult disease are grateful for their progress.

From our vantage point, the future of eye care is full of promise, thanks to the shared goals and efforts of our faculty, staff, alumni, and friends of the Eye Center. Together we are summoning the best of our innovative and sometimes “audacious” thinking to improve lives by curing, treating, and preventing eye disease. As you read about the achievements and activities in this report, I hope that you will be inspired by the dedication of all who contribute to the Kellogg Eye Center.

— Paul P. Lee, M.D., J.D.
Health Information Technology Helps Personalize Eye Care

Dr. Newman-Casey wants to make it easier for every patient to adhere to medication regimens

“Medications have been shown to stop the progression to blindness in glaucoma, but their effectiveness is often decreased by poor adherence,” says assistant professor Paula Anne Newman-Casey, M.D., M.S. “Research has shown that at least 30 percent of glaucoma patients do not adhere to their daily medication schedules.” The same problem occurs in many chronic diseases.

“One of the unique challenges of glaucoma therapy is that patients do not always know how to properly instill drops into their eyes,” says Dr. Newman-Casey. “Added to this, most of these medications are administered on a daily basis, often twice a day. As physicians, we are trying to convince our patients to do something that disrupts their daily routine—all without any immediate benefit or gain—so that ten to twenty years from now they will still have good vision.”

— Paula Anne Newman-Casey, M.D., M.S.

“As physicians, we are trying to convince our patients to do something that disrupts their daily routine—all without any immediate benefit or gain—so that ten to twenty years from now they will still have good vision.”

under a training grant from the National Eye Institute, Dr. Newman-Casey plans to create technology-based educational programs that could make it simpler for patients to follow their medication regimens. Such interventions will be personalized and take into consideration patient perceptions about their disease and its treatment. “We want to impact not only medication adherence, but also self-efficacy—in helping patients to have the confidence to successfully take their medication regularly,” says Dr. Newman-Casey.

Dr. Newman-Casey will collaborate with experts at the U-M Center for Health Communication Research to bring their expertise into the realm of eye care. “The Center has created a wide range of educational programs using innovative models of technology to improve chronic disease management in such areas as smoking cessation and diabetes, but these programs are rarely used in ophthalmology,” says Dr. Newman-Casey. “Our long-term goal is to develop additional tools with health information technology to improve chronic disease management and outcomes in ophthalmology.”

Dr. Newman-Casey joined the Department of Ophthalmology and Visual Sciences under the National Eye Institute K12 Michigan Vision Clinician-Scientist Development Program, an award that provides training and mentorship to young ophthalmologists planning to develop careers as clinician-scientists. The Department is one of only six in the nation to receive this award.
Dr. De Lott will analyze patterns of care with an eye toward telemedicine solutions

One of Kellogg’s newest faculty members wants to improve care for patients with neuro-ophthalmic conditions. Lindsey B. De Lott, M.D., who completed her residency in neurology and a fellowship in neuro-ophthalmology, has observed that non-specialists are often the first to see patients with neuro-ophthalmic diseases. As such, one of her goals is to help our colleagues make faster diagnoses and promote appropriate testing and care.

Part of the challenge lies with the complexity of these disorders, often the result of neurologic conditions affecting the visual pathways, such as stroke or traumatic brain injury. Specific disorders are not easy to diagnose, given the array of symptoms, from headache and blurred vision to double vision.

“The situation is further complicated when patients do not have access to specialty care,” says Dr. De Lott. “Neuro-ophthalmologists tend to practice in academic medical centers or in big cities, which means that patients in rural areas or some urban areas may have more difficulty receiving advanced care.”

Dr. De Lott has been awarded a National Institutes of Health T32 Training Grant from the U-M Department of Neurology to investigate where patients are first seen for neuro-ophthalmologic conditions and how that affects resource utilization. Drawing on two large national databases that meticulously detail patient visits to clinics and hospital emergency rooms, Dr. De Lott will analyze the number of patient visits, types of providers caring for these patients, diagnoses rendered, testing ordered, and how these parameters are changing over time. That information, along with geographic data, will allow her to evaluate how care may differ in certain areas, particularly in regions where there is little neuro-ophthalmic support.

The resulting report will provide the basis for developing new programs to aid physicians in the triage, diagnosis, and management process. Dr. De Lott envisions telemedicine applications to help providers identify and treat common neuro-ophthalmic conditions and to improve patient access to specialty care.

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“These kinds of applications could also help us make more effective use of resources,” says Dr. De Lott. “But most important, we can help patients by providing quality care whether they live in this country or anywhere in the world.”
Telemedicine to Extend Eye Care in the Era of Information Technology

Patients who lack access to health care will benefit most from new technologies.

Over the next five years, cornea specialist Maria A. Woodward, M.D., will investigate how telemedicine can be used to extend affordable and accessible eye care to individuals in underserved communities. This technology will also improve care by allowing providers to detect eye conditions earlier in their course. Dr. Woodward has been awarded a National Institutes of Health K23 grant for her research project entitled, Telemedicine for Anterior Eye Diseases.

According to the National Eye Institute (NEI), the majority of visits to eye care providers nationally are the result of diseases that affect the anterior, or front part of the eye, such as cataract or corneal diseases. While the NEI has emphasized the need to develop telemedicine technologies to diagnose and monitor patients with eye diseases from afar, less attention has been focused on anterior segment conditions.

Telemedicine, telehealth, and e-health generally refer to the sharing of medical information between a geographically distant clinic and a physician, with images and other data sent via telecommunication technology. Given the growing number of people with cell phones and their increasing comfort with all kinds of electronic communications, Dr. Woodward believes that, with proper training, medical staff and patients could capture usable images of corneal and external eye diseases. “The technology is here today—and it will only get better,” she says.

The focus of the work is to not only validate the ability of telehealth to promote high-quality care, but to also develop a system to implement care that can be directed by ophthalmologists.

“Validating telemedicine for eye diseases is critical so we maintain the highest standards of patient care while moving in the ‘digital’ health care era.”

— Maria A. Woodward, M.D.

Once developed, high quality telehealth systems will help prevent a shortage of eye care services as our population grows and ages.
In the public debate on health care, pundits and patients are talking more and more about quality of care. But what does “quality” mean and how can it be measured? The University of Michigan Kellogg Eye Center is continuously collecting data to help patients better understand the indicators of quality eye care.

Under the leadership of Jennifer S. Weizer, M.D., associate professor and glaucoma specialist, Kellogg has measured its performance for nearly ten years. In partnership with the University of Michigan Health System’s Quality and Safety group, Kellogg recently published its first set of quality outcome measures, including rates of unplanned reoperations, postoperative infections, and success of specific procedures. These data measure the quality of care for all patients treated for specific eye diseases (e.g., cataracts, retinal detachment, and strabismus) and for those who have had eye surgery (such as corneal transplants; and glaucoma, retinal, refractive and oculoplastic surgery) at Kellogg.

Only a few ophthalmology departments in the country have such an extensive program, making Kellogg a leader, at both the state and national levels, in measuring and improving patient care.

“Our program is broad and deep in that it covers all of our subspecialties, which is unusual for ophthalmology departments,” says Dr. Weizer. “We measure our outcomes quarterly and then share the results with our faculty. This information helps us to improve how we teach our residents and how we care for our patients.”

At the state level, Dr. Weizer is leading the Collaborative Glaucoma Quality Initiative (CGQI), a study to report and improve how physicians follow glaucoma patient visit guidelines provided by the American Academy of Ophthalmology (AAO). If physicians can improve how well they follow these guidelines, they could help delay the progression of glaucoma and thus improve outcomes, quality of life, and reduce health care costs.

For the CGQI, Kellogg is partnering with the Grand Traverse Ophthalmology Clinic and the Henry Ford Department of Ophthalmology to look at new glaucoma patient visits. Each group reviews and records — on a checkbox form void of patient information — whether these visits included the major exam aspects recommended by AAO guidelines. Results will then be compiled, averaged, and reported back to the groups.

Nationally, Dr. Weizer is a member of the AAO’s Registry Measure Development Workgroup, which is using electronic health records to develop the nation’s first comprehensive eye disease clinical database — the Intelligent Research in Sight (IRIS) Registry. IRIS will report data to help validate the quality of care provided by ophthalmologists and highlight areas for improvement — all with the goal of improving the delivery of eye care.

Kellogg outcomes are online at www.uofmhealth.org/quality-safety
Kellogg Faculty Develop Training Programs for International Physicians

Stephanie Chu, M.D., National Taiwan University Hospital, was the first international physician to complete a new course on specialty contact lens fitting offered at the Kellogg Eye Center. The course was developed by clinical instructor Sherry H. Day, O.D., and thirteen other faculty members.

“I was fortunate to spend two months at the Kellogg Eye Center. My overall experience was outstanding,” says Dr. Chu. “During my stay, I studied comprehensive contact lens fitting and low vision assessment. This helped me to understand the long-term results of a variety of specialty lenses, and will assist me in handling difficult ocular surface diseases or postsurgical corneal conditions.”

While at Kellogg, Dr. Chu was introduced to new low vision aids and low vision services offered in the United States. “I was impressed with the efficiency and collaboration between social workers and medical professionals in this area who combined their resources to help visually-impaired patients,” says Dr. Chu.

Dr. Chu also had the opportunity to observe Kellogg’s residency training program. “The program is flexible and accommodating to the needs of residents—providing an abundance of resources such as lectures, clinics, and surgical procedures,” says Dr. Chu. Based on the model she observed at Kellogg, Dr. Chu will make recommendations on modifying the resident training program at the National Taiwan University Hospital.

Kellogg Resident Compares Ophthalmic Quality Measures

As the United States evaluates how it delivers health care, there are lessons to be learned from the United Kingdom’s long-standing National Health System (NHS) and, specifically, from the Royal College of Ophthalmologists (RCOphth).

Monica Michelotti, M.D., a second-year resident, recently completed a research rotation at the Royal Bolton Hospital (RBH) in Bolton and Moorfields Eye Hospital (MEH) in London. She conducted a compara-
tive analysis of health care delivery systems in the U.K. and the U.S. through the prism of ophthalmology.

Dr. Michelotti collaborated with Simon P. Kelly, MB BCh, one of the U.K.’s leading specialists on quality and safety in ophthalmology. She also studied patient safety and quality assurance with Declan W. Flanagan, MB BCh, medical director at MEH. Dr. Michelotti reviewed the World Health Organization’s universal checklist for safer surgery, and compared quality measures in different countries. She will present her work at the upcoming World Association of Eye Hospitals meeting at Aravind.

“This rotation allowed me to focus on research that could help shape the future of health care,” says Dr. Michelotti. Her work comparing existing standards and measures of quality of care among ophthalmology units around the world will help harmonize these standards and accelerate our ability to determine what works best for patients.

**U-M Team Works with Aravind to Assess Cataract Surgery**

Under the guidance of Kellogg glaucoma specialist Joshua D. Stein, M.D., M.S., and colleagues from Aravind and Michigan, second-year medical student Hong-Gam Le compared the Aravind Eye Hospitals’ high-volume, high-quality, low-cost system of cataract surgery with ours.

Ms. Le completed an eight-week research rotation at the Aravind Eye Hospitals in both Madurai and Pondicherry, India, jointly sponsored by the U-M Medical School Student Biomedical Research Program and the Kellogg Center for International Ophthalmology. By taking a detailed clinical, work-flow, and resource-based perspective, the study team suggested how we might make our system of cataract surgery more efficient.

**Center Collaborates with First Visiting Scholar**

Alan L. Robin, M.D., Professor of Public Health and Ophthalmology of the Bloomberg School of Public Health and the Wilmer Eye Institute, Johns Hopkins University, is collaborating with the Kellogg Center for International Ophthalmology to address vision problems in the United States and abroad. “We are working with the Aravind Eye Care Hospital in Tamil Nadu, India, and the Tilganga Eye Hospital in Kathmandu, Nepal, to develop systems, through telemedicine, to screen with high sensitivity and specificity individuals at early stages of glaucoma, so that we can prevent needless blindness,” says Dr. Robin, the first Visiting Scholar to the Center for International Ophthalmology. “Strategies that we develop together with Michigan and our global partners might well be used in both developing nations and in underserved areas of our countries such as big cities or rural sections of America.”
To fuel new ideas in vision research: The Paul R. Lichter, M.D.,
RESEARCH DISCOVERY FUND

Thanks to dedicated contributors, endowment exceeds initial goal and keeps growing

When an ophthalmologist imagines a new approach to solving a patient’s eye problem or a scientist begins to follow a discovery in an unintended direction, that’s where progress begins—but only if the resources are in place to test whether the hunch has potential.

“The process for developing a research project that can advance treatments for eye disease starts with gathering data and studying the initial idea,” says Paul R. Lichter, M.D. “So it is imperative that we support innovation at its earliest stages. Then the project can compete for traditional funding. But it has to get that far. We don’t want to leave any good ideas behind.”
Detroiter Makes Lasting Gift to Vision Research

Edward Berger, a native Detroiter who worked for the city in tax collections, was the last of four siblings, three of whom never married. None had children.

“He survived all of his siblings, and his assets grew as a result,” explains Jon B. Gandelot, a Grosse Pointe Farms attorney who assisted Mr. Berger with his estate plans. “He suffered from age-related macular degeneration, and supporting the Kellogg Eye Center struck a chord with him.”

When Mr. Berger passed away in 2012, Mr. Gandelot had U-M establish the Edward Berger Endowed Research Fund, part of the Paul R. Lichter, M.D., Research Discovery Fund. A portion of the estate was also designated for Alzheimer’s disease research at U-M.

“Ed wanted to leave a legacy,” Mr. Gandelot says. He wanted to make sure that the world was better off as a result of him being here.”

That’s the purpose of the Paul R. Lichter, M.D., Research Discovery Fund, which is providing grants to faculty whose early-stage work has the potential to advance vision science. The first round of grants will be distributed in early 2014.

The Fund, which has topped more than $4 million in gifts and pledges, was created in honor of Dr. Lichter when he stepped down as chair of the Department of Ophthalmology and Visual Sciences in 2012, a post he held for 34 years. He is also the Founding Director of the W.K. Kellogg Eye Center, which was established under his leadership in 1985. During his tenure, Dr. Lichter built a robust, world-class vision research program.

“It means a great deal to me that this Fund will ensure the future of such important work, and I am grateful for the wide support it has received,” says Dr. Lichter.

Contributors to the Fund include patients, alumni, colleagues, friends, and family, as well as Dr. Lichter and his wife, Carolyn. The Lichter Discovery Fund also serves as an umbrella fund for named endowments that share its goals (see list above). The Kellogg Eye Center has committed to making the Lichter Discovery Fund an ongoing fundraising priority due to our commitment to supporting high-reward, high-risk research.
By winning awards from the National Eye Institute (NEI), Kellogg scientists Rajesh C. Rao, M.D., and Julia E. Richards, Ph.D., are helping to set the national vision research agenda.

In 2013, the NEI challenged scientists from around the world to develop ideas that would help steer vision research for the future. Proposals from Drs. Rao and Richards for the Audacious Goals in Vision Research competition were two of only 10 selected from several hundred submissions.

The winning proposal from Dr. Rao — who won the award during his vitreoretinal surgery fellowship at Washington University in St. Louis before joining the Kellogg faculty in 2013 — is Reprogramming the Retina. His research involves reprogramming easy-to-isolate skin or blood cells and transplanting them into the retina as well as reprogramming surviving retinal cells into specific cell types to replace those that are damaged.

“Kellogg—and the University as a whole—are great places to pursue this work because of their interest in regenerative medicine, their collaborative environment, and their expertise with epigenetics and stem cells,” he says.

Dr. Richards, the Harold F. Falls Collegiate Professor of Ophthalmology and Visual Sciences and professor of epidemiology in the U-M School of Public Health, won for her proposal, Fountains of Youth for the Eye.

Serious late-onset problems like macular degeneration and glaucoma result from a complex combination of many different genetic and environmental risk factors. Dr. Richards proposes that instead of developing multiple treatments targeting many complex causes, we could delay onset of these diseases by intervening in the one thing the diseases have in common—the aging process.

“The interconnection of clinical and basic sciences at Kellogg offers an excellent environment for the evolution of interdisciplinary ideas,” she says.

The NEI drew from the 10 winning proposals to develop one single goal—regenerating neurons and neural connections in the eye and visual system—along with two high-priority research areas—molecular therapy for eye disease and the intersection of aging and biological mechanisms of eye disease.
Now in its second year, the Michigan Ophthalmology Trainee Career Development Award (MOTCDA) has provided six residents with the opportunity to pursue research projects that spark their interest. Read about two of our winners for the 2013–14 academic year.

Ryan J. Fante, M.D., third-year resident, received grant funding for his research on macular edema (ME), or swelling in the back of the eye, that can be the result of diabetes or radiation treatment. Dr. Fante is working to better understand the protein changes that accompany different types of ME and to identify potential new therapeutic targets. He also plans to characterize the normal and pathologic composition of the vitreous in various disease states. The vitreous is thought to contain signaling molecules that lead to ME or are markers for response to certain treatments for this condition.

“The MOTCDA is an award that provides support for residents who are aspiring clinician-scientists,” says Dr. Fante. “In this case, it provided the funding to initiate a basic science project to develop some of my ideas about diabetic retinopathy. The unique collaboration between our ophthalmology department and the medical school also allowed us to run assays that would not have otherwise been possible.”

Ira H. Schachar, M.D., M.Sc., third-year resident, received grant funding for his research on the use of the femtosecond laser for glaucoma treatment. Open-angle glaucoma is characterized by high intraocular pressure (IOP). When topical medications and laser trabeculoplasty have been ineffective in lowering IOP, the next step is typically surgery directed at the anterior chamber of the eye. Clinician-scientists work to find alternatives to minimize surgical complications and maintain lower IOP in the long term.

Dr. Schachar’s research assessed if the femtosecond laser is an effective alternative for glaucoma surgery.

“The opportunity to collaborate with the U-M College of Engineering through MOTCDA has taken this project from an idea to a reality,” says Dr. Schachar. “With preliminary work from the MOTCDA funding, we have applied for a larger developmental grant aimed at understanding how best to use this technique.”

Read about the MOTCDA award of second-year resident Monica Michelotti, M.D., on page 8.
What happens when aging retinal cells stop
“Taking Out the Trash?”

Live-cell imaging techniques could reveal where disruptions occur

One of Kellogg’s newest postdoctoral fellows is using live-cell imaging techniques to understand what happens when the retinal pigment epithelium (RPE) falls down on its job of removing waste from the retina.

Photoreceptors shed 10 percent of their outer segments every day, which are then engulfed and digested by the RPE. The breakdown products are either recycled back to the photoreceptors or disposed of via another layer of the eye, the choroid. A single RPE cell carries out this waste disposal function day-in and day-out; however, as the cell ages, its ability to handle the “trash” diminishes, resulting in the accumulation of fatty waste byproducts (lipofuscin and drusen). The RPE’s declining function likely plays a major role in dry age-related macular degeneration (AMD), a leading cause of vision loss.

Postdoctoral fellow Jason M. Miller, M.D., Ph.D., is investigating which steps in this disposal process are disrupted as the RPE ages. Dr. Miller’s research includes the use of automated live-cell imaging techniques first developed in his graduate lab at the University of California, San Francisco. A long-term goal of his research at Kellogg is to identify drugs that improve the recycling capacity of the RPE, which then could be developed as therapeutic candidates for dry AMD.

Dr. Miller, who conducts research in the labs of Kellogg’s Debra A. Thompson, Ph.D., and David N. Zacks, M.D., Ph.D., will collaborate with new U-M faculty member Sami J. Barmada, M.D., Ph.D., assistant professor of neurology, who shares expertise in advanced microscopy techniques.

Among the reasons he chose to pursue research at Michigan, says Dr. Miller, is the University’s degree of interdepartmental collaboration and support of young faculty members. “However,” he adds, “it was the ophthalmology department’s wholehearted embrace of innovative training models, supporting academic interests ranging from education to policy to international development to engineering to basic research, that made Kellogg singularly unique for a young physician-scientist such as myself.”
Donald G. Puro, M.D., Ph.D., professor of ophthalmology and visual sciences and molecular and integrative physiology, recently had his National Institutes of Health research grant (R01) renewed for his project, *Retinovascular Pathophysiology: Focus on Proliferative Retinopathy*. Through his continued research, Dr. Puro hopes to better understand the pathophysiological changes that accompany the abnormal growth of retinal blood vessels, which is a serious complication of diabetes and premature birth. He hopes this knowledge will lead to new therapies for these major sight-threatening disorders.

“This research is relevant because it may lead to new pharmacological approaches for treating this dreaded complication of diabetes,” says Dr. Puro. “Despite the benefits of currently used therapies, the complication of proliferative retinopathy continues to be a leading cause of blindness. Findings of this research could also extend to advances in the treatment of retinopathy of prematurity and other serious eye disorders in which aberrantly growing blood vessels cause sight-threatening damage to the retina.”

Cagri G. Besirli, M.D., Ph.D., assistant professor and pediatric retina specialist, received a National Institutes of Health K08 grant for his project, *Neuroprotection in Pediatric Retinal Detachment*. Pediatric retinal detachment is a significant cause of childhood blindness in developed countries. One of the common characteristics of inherited or acquired pediatric retinal detachments is leakage of fluids—including blood and fat-like substances—under the retina that causes photoreceptors to separate from the retinal pigment epithelium (RPE) and eventually die. However, once the retina is re-attached, many children regain limited vision, which indicates that some photoreceptors are able to survive separation from the RPE. Dr. Besirli plans to use both animal model and human samples to identify the protective mechanisms on a cellular level that keep photoreceptors alive. “The goal of the five-year study,” says Dr. Besirli, “is to develop novel therapies to prevent vision loss in our youngest patients with retinal disorders.”
Finding the Pathways to Regenerative Medicine

What we can learn by studying how the eye develops and how it responds to injury

In the years ahead, regenerative medicine could spawn a new class of therapeutics to treat eye disease and restore vision. New cell-based therapies might promote healing by inserting new cells into diseased tissue or reactivating stem cells that proliferated during the eye’s development.

Scientists at the Kellogg Eye Center are pursuing two broad avenues of research to realize the promise of regenerative medicine. Some are studying the fundamentals of eye development to understand more completely how the structures of the eye are formed and what happens when things go awry. Others are investigating mechanisms of tissue and cell regeneration in the mature eye.

In their experimental models, our scientists have observed populations of stem cells that they believe could be harnessed for therapeutic uses. Zebrafish, for example, have the unique and fascinating capacity to generate new cells in response to injuries to the retina and to muscles of the eye.

Here are a few examples of how Kellogg scientists are laying the groundwork to advance the field of regenerative medicine:

**How the drainage channel develops and how errors can lead to glaucoma in children**
Understanding how the eye develops is the starting point for regenerative medicine. Brenda L. Bohnsack, M.D., Ph.D., whose clinical specialty is pediatric glaucoma, studies how the front (or anterior) part of the eye develops, using the zebrafish as her model. Missteps in development in this area can result in eye diseases like congenital glaucoma.

One of the unique aspects of eye development in both zebrafish and humans is the role of the neural crest, a population of stem cells that exist in the embryo for a short time and then differentiate—or change—into cells that form structures all through the body, including the eye.

These neural crest cells give rise to a structure central to Dr. Bohnsack’s research and clinical practice. “I am interested in the angle at the junction of the iris and cornea that allows fluid to drain from the eye,”
she says. “When the drainage channel is not properly formed in the embryo, the result can be elevated eye pressure, damage to the optic nerve, and congenital glaucoma.”

According to Dr. Bohnsack, “Once we understand at the genetic level how the healthy eye develops, we can study what goes wrong when disease occurs and intervene either by rebuilding or repairing these essential channels.”

Dr. Bohnsack has been awarded a National Institutes of Health K08 grant to study regulation of the neural crest and its implications in congenital eye disease.

**Studying a gene that influences the development of structures in the front of the eye**

Building the fine structures of the front of the eye requires coordination and communication among embryonic cell tissues, a process that is “quite an engineering feat,” says developmental geneticist Philip J. Gage, Ph.D.

The way his lab “listens in” on the process, says Dr. Gage, is to study PITX2, a gene whose function is to control the activity of other genes. Dr. Gage has identified the gene as a key regulator at multiple stages of eye development. A mutation in PITX2 is a cause of Axenfeld-Rieger syndrome, a condition marked by abnormalities in the front of the eye. About half of those with this syndrome will develop glaucoma, usually in childhood or adolescence.

Dr. Gage has also shown that PITX2 is essential in developing both the cornea, the clear front of the eye, and the angle structure. And most recently he reported that the gene is required to maintain the health of the mature eye. When it is withdrawn in experimental models, the optic nerve deteriorates — and glaucoma is induced.

The discovery is significant because it now appears that Dr. Gage has an “inducible” glaucoma model that allows scientists to observe how the disease develops over a narrow timespan. “The rapid onset of optic nerve change in our model, as compared to others, makes this a useful resource for our lab and for the larger glaucoma community,” says Dr. Gage. “The model could also be used to test the effectiveness of new therapies for preventing glaucoma and vision loss often associated with the disease.”

**Understanding eye muscle regeneration and the path to new therapies**

Alon Kahana, M.D., Ph.D., scientist and oculoplastics surgeon, is interested in the orbit of the eye, the bony structure that protects the eye, and the muscles that control eye movement. When eye muscles do not develop properly, one result can be congenital strabismus, a disorder in which the child’s eyes are not aligned, resulting in compromised vision.

New therapies for strabismus and other eye muscle disorders could emerge from Dr. Kahana’s unique zebrafish model. In a recent study, he found that zebrafish can regenerate new eye muscle tissue even after 50 to 80 percent of the muscle has been removed.

Dr. Kahana has been awarded a National Institutes of Health R01 grant to identify the biological mechanisms that underlie repair and regeneration of eye muscle tissue in response to injury. “Understanding more about this remarkable capacity for regenerating
healthy tissue will certainly contribute to the broader fields of stem-cell biology and regenerative medicine,” says Dr. Kahana, the Helmut F. Stern Career Development Professor.

Studying the regenerative process is leading the Kahana lab to investigate changes in the brain that occur when eye muscles are injured. “Because the brain controls neural activity related to vision, we are beginning to ask how the brain remodels and regenerates in response to injury to the eye muscle,” says Dr. Kahana.

And, he adds, “the timing is fortuitous.” The National Eye Institute has issued its key “audacious” research goals. Number one on that list involves remodeling neural connections in the visual system.

Investigating development of the retina and regeneration after injury to the adult retina

Research in the lab of neurobiologist Peter F. Hitchcock, Ph.D., spans the biological spectrum. Using the zebrafish model, his lab studies the molecular and cellular processes that govern both the development and regeneration of retina cells.

Among these cells are photoreceptors, light-sensing cells essential for vision that are part of the central nervous system. When these cells do not form properly or become damaged later in the adult eye, diseases such as age-related macular degeneration and retinitis pigmentosa can occur.

“We are interested in the early events that give rise to the mature retina: the proliferation of embryonic cells and their differentiation into functional cell types,” says Dr. Hitchcock, professor of ophthalmology and visual sciences and cell and developmental biology.

Dr. Hitchcock’s lab also investigates mechanisms in the mature retina that govern stem-cell-based regeneration of photoreceptors after injury. “In a broad sense,” says Dr. Hitchcock, “we hope to answer the question: ‘What does a stem cell require to make a photoreceptor?’ And, we’re looking at this in a model where regeneration occurs in a very robust way when photoreceptors are destroyed.”

This vigorous action is not unlike the proliferation of cells in cancer. “One of the themes that is clear to everybody working in these fields is that developmental, regenerative, and cancer biology are mechanistically linked,” says Dr. Hitchcock. “Significantly, however, cell proliferation in cancer is unregulated, which is a hallmark of that disease. By contrast, regenerative processes are tightly controlled — exquisitely controlled — and it’s this exquisite control that we have to understand.”

The zebrafish’s capacity to repair tissue could be an apt model for stem-cell-based therapies. “We hope some part of our work informs that approach to treating brain and retinal injuries,” says Dr. Hitchcock.

“Regenerative processes are tightly controlled — exquisitely controlled — and it’s this exquisite control that we have to understand.”

— Peter F. Hitchcock, Ph.D.
Is It Possible to Reprogram Cells to Repair Eye Tissue?

Epigenetics provides insight into how genes function and the mechanisms that control them—and could pave the way for regenerative therapies.

One of the most fascinating therapies being discussed today is the possibility of reprogramming cells to repair damaged tissue. Retina specialist Rajesh C. Rao, M.D., points to several studies in which skin-derived cells have been coaxed to become brain and heart cells in a petri dish. While it will be some years before the technology can be applied to treating disease, Dr. Rao is joining U-M and Kellogg scientists in applying knowledge from the field of epigenetics to advance regenerative therapies in the eye.

Epigenetics, meaning “after or beyond genetics” refers to modifications in genes that lead to variations in expression of those genes. The modifications, some of which are passed from one generation to the next, can be induced by environmental factors such as diet and smoking that can activate or silence genes.

“Gene expression is regulated by chemical modifications to DNA and its associated proteins,” says Dr. Rao. “DNA is wrapped around proteins to form a structure called chromatin. Chromatin can be opened and closed. When chromatin around specific genes is open or relaxed, gene expression can proceed. When chromatin is closed or tightly wound, the gene cannot be expressed and is silenced.”

Under a National Eye Institute K12 grant, Dr. Rao will investigate the mechanisms that turn our genes “on” and “off,” and, ultimately, either lead to a diseased state, or to health in the eye and retina. “Epigenetics explains why a skin cell is different from an eye cell. While both cells contain the same DNA, their genes are expressed differently, which creates distinct cell identities,” says Dr. Rao. “Using small molecules that can manipulate chemical modifications in chromatin in the laboratory, a skin cell could be reprogrammed to become a functioning retinal cell.”

Dr. Rao will study specific types of epigenetic regulators associated with gene expression and repression, but whose function is not yet understood in the retina. “A better understanding of chromatin-modifying enzymes may one day allow reprogramming of diseased or scar-associated fibroblast cells (as in macular degeneration) into functional, light sensing cells,” says Dr. Rao.

Dr. Rao is collaborating with researchers involved in epigenetics and drug discovery across the University. “We want to use stem-cell biology and epigenetics as languages to better understand disease mechanisms in blinding retinal diseases, with the goal of developing novel pharmacologic gene and cell-based therapies for our patients.”

Dr. Rao has joined the Department under the National Eye Institute (NEI) K12 Michigan Vision Clinician-Scientist Development Program, an award that provides training and mentorship to young ophthalmologists planning to develop careers as clinician-scientists. The Department is one of only six in the nation to be able to offer this award.
Findings provide inroads into novel therapies with potential to safely minimize severity and duration of disease

Individuals suffering from Graves’ eye disease (GED), also known as thyroid eye disease (TED), have had very few treatment options available to them—without the risk of significant side effects and safety concerns. Now a clinical trial evaluating the efficacy and safety of a new therapy for TED has begun, the result of over 25 years of research led by the Kellogg team of Terry J. Smith, M.D., an endocrinologist and Frederick G.L. Huetwell Professor of Ophthalmology and Visual Sciences, and Raymond S. Douglas, M.D., Ph.D., a specialist in Graves’ eye disease and renowned oculoplastics surgeon.

TED is a visually debilitating and potentially disfiguring condition associated with Graves’ disease, an autoimmune disorder that causes the overproduction of thyroid hormones, or hyperthyroidism. Approximately one million Americans have been diagnosed with TED. Symptoms include swelling of the eyelids and tissue around the eye, a constant stare, bulging eyes, eyelid retraction, and loss of vision. In severe cases, the cornea may ulcerate, or the optic nerve may be damaged. Either complication may result in permanent loss of vision if not treated appropriately. Approximately 25 to 50 percent of individuals with Graves’ disease will develop TED.

“The eyes are particularly susceptible to Graves’ disease because the autoimmune attack often targets the eye muscles and connective tissue surrounding the eye,” says Dr. Douglas. “This occurs as a consequence of the disease process.”

Fluorescent imaging of Graves’ disease fibroblasts treated with insulin growth factor-1 (IGF-1) with or without the steroid, dexamethasone (Dex).
of these tissues containing proteins that are shared with the thyroid gland.”

The team’s findings point to the apparent involvement of the insulin-like growth factor 1 (IGF-1) receptor in Graves’ disease and other autoimmune diseases. “Specifically, we have found that there is an unusually high presence of IGF-1 receptors on cells surrounding the eye in TED,” says Dr. Smith, widely recognized for his groundbreaking research on treatments for TED and related autoimmune disorders.

Building on this discovery, an outgrowth of basic science research conducted at the University of California, Los Angeles, and then at the Kellogg Eye Center, Drs. Smith and Douglas have initiated the largest multi-center clinical trial for TED in the United States, called the Graves’ Eye Disease Study.

The study will examine the potential therapeutic benefit of a monoclonal antibody known as RV 001 that blocks the IGF-1 receptor, originally developed as a cancer drug. Although the drug failed to exhibit efficacy in patients with cancer, the team believes it may be a useful therapy in interrupting the TED disease process, given its specific targeting of the IGF-1 receptor.

“The goal of this trial is to determine whether administering RV 001 early in the active phase of TED will safely minimize the severity and duration of the disease, have a favorable effect on long-term outcome, and lessen the need for corrective surgeries,” says Dr. Smith. “This investigative drug has worked in the test tube and now it could work in the human being.” Moreover, the team has emerging evidence that RV 001 might be at least as useful in treating rheumatoid arthritis and type 1 diabetes.

Sponsored by River Vision Development Corporation, the clinical trial will enroll approximately 84 individuals who have had symptoms of TED for less than six months and who have not received any treatment, with the exception of lubricating eye drops. Drs. Smith and Douglas are the principal investigators of the study encompassing 22 study centers throughout the country that will participate in the trial, which is expected to run through 2014.

To learn more about the trial visit: https://umclinicalstudies.org/HUM00073174
Neuroscientist Kwoon Y. Wong, Ph.D., has been awarded a National Institutes of Health R01 grant for his project, *Physiology of Intrinsically Photosensitive Retinal Ganglion Cells.*

Intrinsically photosensitive retinal ganglion cells (ipRGCs) are recently discovered retinal nerve cells that drive subconscious physiological responses to light — such as regulating hormone secretion, enhancing alertness, and synchronizing sleep timing to the light/dark cycle. “Recent discoveries have shown that the eye supports not only conscious vision but also various subconscious physiological responses to light that are crucial to our well-being,” says Dr. Wong. Under the five-year study, Dr. Wong will investigate two aspects of ipRGCs: the molecular mechanisms that enable such cells to respond to light, and the communication between these cells and other cells in the retina.

Dr. Wong has also received a Department of Defense Army Research Office grant for another project, *Modeling Subconscious Vision,* in which he serves as a co-principal investigator. In this project, Dr. Wong has teamed up with Daniel B. Forger, Ph.D., University of Michigan Department of Mathematics, to construct mathematical models that explain the inner workings of ipRGCs and related retinal cells. These models will enable Drs. Wong and Forger to predict how these cells would respond to any kind of light stimulus.

The long-term goal of these projects is to help develop light therapies for depression and sleep disorders, novel lighting technologies that enhance productivity at work and school, and better diagnostic tests for eye disorders. In addition, these studies could lead to new strategies for restoring vision in the blind. “Interestingly, ipRGCs remain light-responsive in many people who are blind,” says Dr. Wong. “A better understanding of the physiology of ipRGCs should help us devise new ways to enhance their photosensitivity, which could help improve the visual capability of people who are blind.”
Roger W. Kittendorf, a Genesee County attorney and businessman who passed away in late 2012, was a thoughtful investor in organizations he believed would make a difference in people’s lives. His generous support of the Kellogg Eye Center, which included gifts to research and to a new resident education center, culminated with the news that Kellogg would be the primary beneficiary of his estate.

As a long-time Kellogg patient and supporter, Mr. Kittendorf became a partner in the work that is done here. He engaged his physician, glaucoma specialist Sayoko E. Moroi, M.D., Ph.D., in conversations about research, which led to his support of specific projects. As a former teacher, he was intrigued that Kellogg has one of the top programs in the country for training physicians who want to specialize in ophthalmology. Mr. Kittendorf learned that Kellogg hoped to build a state-of-the-art education center, and he made construction of the facility possible. It opened on the sixth floor of the original Kellogg Eye Center tower in 2011.

“As a student and an adult, I have always admired the University of Michigan’s quest for excellence.”

— Mr. Roger Kittendorf

Born in Detroit in 1937, Mr. Kittendorf moved with his family to Sebewaing, Michigan, where he graduated from high school in 1955. He earned a bachelor’s degree at Michigan State University and served for two years in the U.S. Army. When he returned, he enrolled in the Detroit College of Law, joining the State Bar of Michigan’s Master Lawyers Section in June 1967.

He spent time as an assistant prosecutor for Genesee County and as a lawyer for Vienna Township in Clio before opening a private office. He built a robust practice and invested in real estate throughout his career. In his free time, he enjoyed golfing and international travel. He continued working until he passed away at the age of 75.

Mr. Kittendorf said he felt privileged to be able to share his success with others, and while he requested anonymity for the gifts he made during his lifetime, the Kellogg Eye Center is now able to thank him publicly, naming the Roger W. Kittendorf Resident Education Center.

“Our patients have an incredible understanding of how precious eyesight can be—and how fragile,” says Paul P. Lee, M.D., J.D., F. Bruce Fralick Professor and Chair of the Department of Ophthalmology and Visual Sciences. “When they are able to help us help others, our impact is multiplied many times over. We are very grateful for Mr. Kittendorf’s commitment to vision.”

To support vision research, you can make the University of Michigan a beneficiary of a 401K or other savings or insurance plan. You can also designate funds through a will. For information, please contact Becky Spaly at 734.763.0874 or at bsp@umich.edu.
When more than two dozen physicians and scientists from around the world gathered in Tuscany this fall to discuss innovative treatments for blinding retinal dystrophies, hosts Celeste and Bruno Piperno realized a long-held dream. They often help individuals with eye conditions navigate the health care system in Rome, where they own a business consulting firm and Mr. Piperno seeks care for an inherited retinal condition. Yet they have always wanted to do more. By partnering with the Kellogg Eye Center and providing researchers with the ideal location for an international scientific meeting — Tenuta di Monaciano, a resort and vineyard that has been in their family since the early 20th century — they made a unique contribution to the field.

“This is a crucial time in retinal degeneration research, and the need for us to work together as an international community has never been greater,” says meeting coordinator Debra A. Thompson, Ph.D., Professor of Ophthalmology and Visual Sciences and Professor of Biological Chemistry at the University of Michigan. “We are making great strides in gene and stem-cell therapies, but pursuing key research imperatives could make us all more successful. Discussing those potential next steps as a group was important and very inspiring. The Pipernos made that possible.”

The Monaciano Symposium was designed to foster collaboration and the development of shared policy and research agendas. Participants defined five consensus goals needed to move the field forward in the next decade and eight actions that could be undertaken collaboratively to achieve those goals. The group aims to publish their findings in the coming year.

That outcome is exactly what the Pipernos had in mind. Diagnosed with a retinal dystrophy many years ago, Mr. Piperno has a deep appreciation for the progress that is being made toward treatments and for
the importance of global cooperation among scientists. With strong ties to U-M—he earned a master’s degree in business administration at U-M, and his children have attended programs at the Ross School of Business—he and his wife approached Paul R. Lichter, M.D., with the idea for a conference.

The Pipernos provided lodging and meals for the Monaciano Symposium, while the agenda was set by an organizing committee that included Mr. Piperno’s ophthalmologist, Alessandro Iannaccone, M.D., M.S., who has a practice in Rome and is Associate Professor of Ophthalmology and Director of the Retinal Degeneration and Ophthalmic Genetics Service at the University of Tennessee Health Science Center. Researchers attended from eight states and seven countries.

“This is a crucial time in retinal degeneration research, and the need for us to work together as an international community has never been greater.”
—Debra A. Thompson, Ph.D.

Researchers and physicians from seven countries participated in the Monaciano Symposium. Tenuta di Monaciano (photos compliments of Richard Weleber, M.D., Casey Eye Institute)

Robin Ali, BSc, PhD, FMedSci, internationally known for his research in gene and cell-based therapy, will join the Department as a Visiting Professor. Dr. Ali, professor of human molecular genetics, directs the Department of Genetics at University College London and Moorfields Eye Hospital. While in residence at Kellogg, Dr. Ali will collaborate with faculty and trainees to advance research toward treatments for inherited retinal disease.

As just one example of his groundbreaking research, Dr. Ali led the team that carried out the first successful transplant of light-sensitive photoreceptor cells taken from a synthetic retina and grown “in a dish” from embryonic stem cells. The study, published in the August 2013 issue of Nature Biotechnology, suggests that embryonic stem cells could one day provide a potentially unlimited supply of healthy photoreceptors for retinal cell transplantations to treat blindness in humans.

In addition to collaborating with faculty on research associated with retinal degenerations and inherited ocular diseases, Dr. Ali will mentor new faculty, trainees, and research staff in gene and cell therapy techniques. He will work with our faculty to generate sponsored research grants, and to bring the most promising research forward into clinical trials with the goal of developing new therapies for patients with retinal disease.
Endowed Professorship
Honors Christine Nelson, M.D.

Award provides Dr. Nelson the opportunity to advance her research in anophthalmia, a congenital eye birth defect in which one or both eyes do not develop

Oculoplastics surgeon Christine C. Nelson, M.D., has been named the first Bartley R. Frueh, M.D. and Frueh Family Collegiate Professorship in Eye Plastics and Orbital Surgery. Dr. Nelson is Professor, Ophthalmology and Visual Sciences, and Professor, Department of Surgery, Plastic Surgery Section.

Dr. Frueh and his wife, Cheryl, established the Lloyd and Virginia Frueh Research Professorship in Eye Plastics and Orbital Surgery in May 2007. This title was later changed to include Dr. (Bartley) Frueh’s name in 2010, after he unexpectedly passed away.

Establishing a professorship in his parents’ names meant a great deal to Dr. Frueh, as it created a lasting tribute to the values of education, hard work, and beneficence that they instilled in him.

“Bartley was very passionate about research in the field of oculoplastics. He wanted to make sure that this arena remained vital and strong at Kellogg.”

—Mrs. Cheryl Frueh

Dr. Nelson will have more resources to devote to teaching, mentorship, and her research in anophthalmia, a condition in which one or both eyes do not develop. Through her study of a seven-generation family, Dr. Nelson and her colleagues have identified a new gene for this eye birth defect. Her research findings suggest that the combination of the gene mutation and deficiencies in the mother’s diet during pregnancy may be responsible for the disorder.

“When the mother and fetus carry the gene, we believe that treatment with vitamin A early in the pregnancy could promote normal fetal ocular development,” says Dr. Nelson. “This is an exciting development with a relatively simple treatment that could have a global impact, improving the lives of individuals with a genetic history of anophthalmia.”

Dr. Nelson also studies the related conditions of microanophthalmia, in which one or both eyes are abnormally small, and coloboma, in which segments of tissue are missing from various eye structures. Moreover, she is known for her clinical expertise in the evaluation and treatment of adult and pediatric patients with tumors and other disorders of the eyelid and orbital disease.

“I am very humbled to be named the first Bartley R. Frueh, M.D. and Frueh Family Collegiate Professorship in Eye Plastics and Orbital Surgery, an honor that will keep Dr. Frueh’s memory alive,” says Dr. Nelson. “He was a great teacher and mentor to all of us at the Kellogg Eye Center. It was a privilege to know and work with him. His unmatched clinical and surgical skills, compassion, keen scientific intellect, and wonderful spirit will not be seen again soon.”

Dr. Nelson was also the first female recipient of the prestigious Wendell Hughes Lectureship Award from the American Society of Ophthalmic and Plastic Reconstructive Surgery in 2012, and she joins a roster of distinguished contributors to the advancement of ophthalmic plastic and reconstructive surgery.
Annual Honor Roll of Donors

With heartfelt thanks to donors who made gifts from July 1, 2012, through June 30, 2013. Included in this listing are contributors whose donations are part of multi-year pledges.

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“Contributions from Annual Fund donors will help us maintain our state-of-the-art confocal and multi-photon microscopes. Nearly every scientist at Kellogg uses these high-resolution instruments to obtain precisely detailed images of cells and tissue that are needed to advance our research on eye disease and treatment.”

—David A. Antonetti, Ph.D.
Professor
We are extremely grateful for donor support that has enabled us to develop “RetDegenDx,” a computer model to help us identify more precisely the causative mutations for patients with inherited retinal degenerations. By providing our patients with a genetic diagnosis, we can offer genetic counseling on the probable course of their disease and the likelihood that their siblings or children may be affected. And as gene therapies are developed, we can alert patients to clinical trials with treatments that target their specific mutation.”

— Thiran Jayasundera, M.D.
Assistant Professor
Due to the generous support of the W.K. Kellogg Foundation, we have the potential to decrease disparities in children’s eye care across Michigan. The active collaborations we now have with the childhood vision screening programs conducted by the State of Michigan and the Lions Clubs of Michigan simply would not have happened without the Foundation’s pivotal and generous support. This serves to emphasize the impact of private donor support.

— David C. Musch, Ph.D., M.P.H. Professor
“Generous support from a donor has aided my research on rare, life-threatening eye cancers that might not otherwise receive sufficient public or federal grant support. With research findings to help us better understand and manage these eye cancers, we have the opportunity to improve patient outcomes.”

— Hakan Demirci, M.D.
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Victors for Michigan, Victors for Vision

Friends and supporters of the W.K. Kellogg Eye Center gathered to learn more about Victors for Michigan, the largest fundraising effort in University of Michigan history. The Kellogg Eye Center will play a key role in the U-M Health System’s campaign, which will be formally rolled out in April.
In Memory Of

The Kellogg Eye Center is honored to have received gifts in memory of the following individuals:

Mathew Alpern, Ph.D.
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The following individuals were honored through gifts to the Kellogg Eye Center:

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It is with deep gratitude that we recognize the following individuals for making the Kellogg Eye Center a part of their estate plans:

Frank J. and Helga Arnold
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Robert D. Biggs, M.D.
Dr. Robert W. Browne
Mrs. Andrea Clark
Gloria P. and William E. Dean, Jr.
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Bruce A. Furr, C.O., Ph.D.
Editorial Board, American Orthoptic Journal
Executive Committee and Board of Directors, American Association of Certified Orthoptists

Christopher Gappy, M.D.
Bylaws and Rules Committee, American Association for Pediatric Ophthalmology and Strabismus

Thomas W. Gardner, M.D., M.S.
Best Doctors in America
Associate Editor, Diabetes
Director, Michigan Vision Clinician-Scientist Development Program Reviewer, Diabetes Complications Consortium, National Institutes of Health

John R. Heckenlively, M.D.
Best Doctors in America
J. Donald Gass Award and Lecture, Ophthalmic Photographer Society
Associate Editor, EYE, Journal of the Royal College of Ophthalmologists, U.K.

Peter F. Hitchcock, Ph.D.
Editorial Board, Academic Editor, PLoS ONE

K. Thiran Jayasundera, M.D., FACS, FRCSC, FRANZCO
Associate Editor, BMC Ophthalmology

Denise A. John, M.D., FRCSC
Representative, Association of American Medical Colleges
Minority Faculty Career Development Seminar
Mark W. Johnson, M.D.
Best Doctors in America
64th Proctor Lecture, University of California San Francisco, San Francisco, CA
Gass Fluorescein Club
Keynote Speaker, North Coast Retina Symposium, Cole Eye Institute, Cleveland, OH
Chair, Committee on Programs, American Ophthalmological Society
Treasurer and Executive Committee, The Retina Society
Editorial Board, American Journal of Ophthalmology
Editorial Board, Retina
Editorial Board, Retinal Physician

Alon Kahana, M.D., Ph.D.
Best Doctors in America
American Academy of Ophthalmology Achievement Award
Editorial Board Member, Ocular Surgery News
American Academy of Ophthalmology, Editorial Committee for the Basic and Clinical Science Course, Section 2 Book Revision

Paul P. Lee, M.D., J.D.
Best Doctors in America
John Aure Buesseler, M.D., Visiting Professorship, Mason Eye Institute, University of Missouri
Joseph Bowlds Lecture, Lahey Hospital and Medical Center, Burlington, MA
Focus on Eye Health National Summit, Prevent Blindness America
Doheny Society of Scholars Award
Board of Directors, American Board of Ophthalmology
Board of Governors, Association for Research in Vision Ophthalmology Foundation
Board of Directors, Doheny Eye Institute
Editorial Board, JAMA Ophthalmology
Advisory Board, American Academy of Ophthalmology, Hoskins Center for Patient Safety and Quality

Shahzad I. Mian, M.D.
Best Doctors in America
Program Director’s Council, Association of University Professors in Ophthalmology
Board of Directors, Cornea Society
American Academy of Ophthalmology, Councilor, Cornea Program Committee
Ophthalmology Leadership Advocacy Group
Medical Director, Michigan-Eye Bank
Editorial Board, Cornea Journal
Policy and Position Review Committee Chair, Accreditation Board, Eyebank Association of America
Ralph & Sophie Heintz Lecture, The 38th Annual H. Bruce Ostler Association of Proctor Fellows Meeting and Graduation
Albert D. Frost Memorial Lecture, The 56th Annual Postgraduate Symposium in Ophthalmology, Columbus, Ohio

Sayoko E. Moroi, M.D., Ph.D.
American Academy of Ophthalmology Achievement Award
Editorial Board, Ocular Surgery News
American Academy of Ophthalmology, Editorial Committee for the Basic and Clinical Science Course, Section 2 Book Revision

David C. Musch, Ph.D., M.P.H.
Secretariat Award, American Academy of Ophthalmology
Member, Preferred Practice Patterns Committee, American Academy of Ophthalmology
Member, Ophthalmic Technology Assessment Committee, American Academy of Ophthalmology
Study Section (clinical trials special emphasis panel), National Institutes of Health/National Eye Institute
Grant reviewer, Health and Medical Research Fund, Government of Hong Kong
Editorial Board, Ophthalmology
Editorial Board, Retina

Christine C. Nelson, M.D., FACS
Best Doctors in America
Beard Award Lecturer, American Society of Ophthalmic Plastic and Reconstructive Surgery
Wendell Hughes Lecturer Award, American Society of Ophthalmic Plastic and Reconstructive Surgery
Media Advisory Task Force, American Academy of Ophthalmology
Basic and Clinical Science Course, Book 7, American Academy of Ophthalmology Committee
Donald G. Puro, M.D., Ph.D.
Best Doctors in America

Julia E. Richards, Ph.D.
Winner, National Eye Institute Audacious Goals Challenge.
Proposal: Fountains of Youth for the Eye
Editorial Board, G3: Genes/Genomics/Genetics
Member, National Eye Institute-funded Glaucoma Human
Collaboration Consortium
Member, African-American Study Group Consortium
Member, Scientific Advisory Board, The Glaucoma Foundation,
New York, NY

Roni M. Shtein, M.D., M.S.
Best Doctors in America
American Academy of Ophthalmology Achievement Award
Resident Retreat Faculty Mentor, Heed Ophthalmic Foundation

Terry J. Smith, M.D.
Best Doctors in America
Board of Scientific Advisors, Guthy-Jackson Foundation
Board of Directors, National Graves’ Disease Foundation
Chief Medical and Scientific Officer, National Graves’ Disease
Foundation

Michael W. Smith-Wheelock, M.D.
Best Doctors in America

H. Kaz Soong, M.D.
Best Doctors in America
Assistant Editor, Cornea
American Academy of Ophthalmology Lifetime
Achievement Award
Medical Director, Michigan Eye Bank
Keynote Speaker, Taiwan Ophthalmological Society

Joshua D. Stein, M.D., M.S.
Best Doctors in America
American Ophthalmological Society
American Academy of Ophthalmology Achievement Award
American Glaucoma Society Health Care Policy and
Reimbursement Policy Subcommittee
Member-at-Large, American Glaucoma Society Board of Directors
Research Committee, American Glaucoma Society
Membership Committee, American Glaucoma Society
Committee Member, American Academy of Ophthalmology,
Glaucoma Preferred Practice Patterns
Research to Prevent Blindness Physician-Scientist Award

Alan Sugar, M.D.
Best Doctors in America
Editor-in-Chief, Cornea, Journal of the Cornea Society
National Institutes of Health Study Section, Ad Hoc,
Bioengineering of Neuroscience, Vision and Low Vision
Technology
Editorial Board, Ophthalmology
Medical Director, Michigan Eye Bank
Eye Bank Association of America Research Committee,
Paton Award Committee

Debra A. Thompson, Ph.D.
Executive Editor, Experimental Eye Research
Fellow, Association for Research in Vision and Ophthalmology

Susan S. Thoms, M.D.
Best Doctors in America

Jonathan D. Trobe, M.D.
Best Doctors in America

Joshua P. Vrabec, M.D.
Best Doctors in America

Jennifer S. Weizer, M.D.
Member, American Academy of Ophthalmology Cataract
Registry Workgroup, San Francisco, CA
Member, American Academy Ophthalmology Committee
on Resident Education, San Francisco, CA

Maria A. Woodward, M.D.
Basic and Clinical Science Course Committee,
American Academy of Ophthalmology

David N. Zacks, M.D., Ph.D.
Best Doctors in America
Member, Retina/Vitreous Knowledge Base Panel,
American Academy of Ophthalmology

* Listings are limited to national and international awards,
named lectures, and roles in professional societies or
editorial boards. Only national peer-selected “Best Doctors”
and “Top Doctors” rankings are noted


Krom MM, Zacks DN, Vrabec JP. Late-onset cystoid macular edema as a presenting symptom of anca-negative pauciimmune crescentic glomerulonephritis. Retinal cases & brief reports. 2012 Fall;6(4):368-70.


Mizrachi IB, Trobe JD. [Cavernous hemangioma of anterior visual pathways—a rare cause of visual loss]. Harefuah. 2013 Feb;152(2):92-7, 123.


Musch DC, Gardner TW. Diabetes and nonrefractive visual impairment: The young have it. JAMA. 2012 Dec;308(22):2403-4.


<table>
<thead>
<tr>
<th>FACULTY NAME</th>
<th>SOURCE</th>
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<tr>
<td>S. Abcouwer, Ph.D.</td>
<td>NIH</td>
<td>R01-EY020582-05</td>
<td>Regulation of Retinal Cell Death in Diabetes; Co-PI</td>
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<td>NIH</td>
<td>R01-EY007739</td>
<td>Bone Marrow Neuropathy Drives Diabetic Retinopathy, Subcontract with University of Florida; PI: Maria Bartolomeo Grant, M.D.</td>
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<td>JDRF</td>
<td>JDRF Center for Mechanisms and Intervention of Diabetic Retinopathy; Project 2 Co-PI</td>
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<td>NIH</td>
<td>Testing the Role of A3AR in Diabetic Retinopathy Pathologies</td>
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<td>D. Antonetti, Ph.D.</td>
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<td>Mechanisms of Retinal Vascular Permeability in Diabetes</td>
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<td>The Retinal Microenvironment in Diabetic Retinopathy Subcontract with Northwestern University; PI: Robert Linsenmeier, Ph.D.</td>
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<td>Structural Studies of Tight Junction Proteins, Subcontract with Pennsylvania State University; PI: John M. Flanagan, Ph.D.</td>
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<td>JDRF</td>
<td>Targeting aPKC as a Therapy for Diabetic Retinopathy</td>
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<td>PolyChromatic Angiography for Grading Retinal Vascular Leakage</td>
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<td>Jules and Doris Stein RPB Professorship</td>
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<td>B. Bohnsack, M.D., Ph.D.</td>
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<td>K08-EY022912-01</td>
<td>Regulation of Ocular Neural Crest and Its Implications in Congenital Eye Diseases</td>
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<td>A Zebrafish Model for Congenital Eye Diseases</td>
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<td>G. Comer, M.D., M.S.</td>
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<td>JDRF</td>
<td>A Natural History Study of Macular Telangiectasias — The MacTel Study</td>
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<td>Structural and Functional Relationships of the Retina in Diabetic Macular Edema</td>
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<td>M. Del Monte, M.D.</td>
<td>Alcon Laboratories, Inc.</td>
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<td>A 3-month, Multi-Center, Double-Masked Safety and Efficacy Study of Travoprost Ophthalmic Solution, 0.004% Compared to Timolol (0.5% or 0.25%) in Pediatric Glaucoma Patients</td>
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<tr>
<td>Alcon Laboratories, Inc.</td>
<td>An Open-Label, Pharmacokinetic and Safety Study of Travoprost Ophthalmic Solution, 0.004% in Pediatric Glaucoma or Ocular Hypertension Patients</td>
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<td>H. Demirci, M.D.</td>
<td>Midwest Eye-Banks</td>
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<td>Roles of Inflammation and Angiogenesis in Conjunctival Melanoma: Progression and Metastasis</td>
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<td>R. Douglas, M.D., Ph.D.</td>
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<td>R01-EY211197-03</td>
<td>Role of CD40+ Fibrocytes in Thyroid-Associated Ophthalmopathy</td>
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<td>R. Douglas, M.D., Ph.D.</td>
<td>River Vision LLC</td>
<td>(cont.)</td>
<td>A Multicenter, Double-Masked, Placebo-Controlled, Efficacy and Safety Study of RV001, an Insulin-like Growth Factor-1 Receptor (IGF-1R) Antagonist Antibody (fully human), Administered Every 3 Weeks (Q3W) by Intravenous (IV) Infusion in Patients Suffering from Active Thyroid Eye Disease (TED) Lew R. Wasserman Merit Award</td>
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<td>S. Elner, M.D.</td>
<td>NIH/Clinical Trial</td>
<td>U01-EY014660-06</td>
<td>Multicenter Uveitis Steroid Treatment (MUST) Trial Coordinating Center: Johns Hopkins University Intravitreal Injections of DE-109 for the Treatment of Active, Non-Infectious Uveitis</td>
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<td>P. Fort, Ph.D.</td>
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<td>Progressive Impact of Diabetes on Retinal Neuroprotection by α-Crystallins Characterization of Crystallin Proteins Expression in Human Retina: Effect of Diabetes Detailed Analysis of Crystallins Cellular and Sub-cellular Upregulation during Diabetic Retinopathy</td>
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<td>P. Gage, Ph.D.</td>
<td>NIH</td>
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<td>Pitx 2: Molecular Mechanisms in Eye Development and Disease</td>
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<td>T. Gardner, M.D., M.S.</td>
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<td>R01-EY020582-05</td>
<td>Regulation of Retinal Cell Death in Diabetes; Co-PI Metabolic Reprogramming in Diabetic Complications; Co-PI Subaccount with Frank C. Brosius, M.D., Department of Nephrology, University of Michigan</td>
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<tr>
<td>J. Heckenlively, M.D.</td>
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<td>R21-EY022172-02</td>
<td>Investigation of Autoimmune Anti-Retinal Antibodies in Diabetes Center for the Study of Retinal Degenerative Diseases X-Chromosome Inactivation Ratios and Variable Expressivity in Heterozygotic Female Carriers of RPGR Mutations Award for Abigail Fahim, M.D., Ph.D.</td>
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<td>J. Heckenlively, M.D.</td>
<td>NNRI</td>
<td>NNSP-CL-0212-0061-MICH-NER</td>
<td>A Phase II Multiple Site, Randomized, Placebo-Controlled Trial of Oral Valproic Acid for Retinitis Pigmentosa</td>
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<td>P. Hitchcock, Ph.D.</td>
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<td>Neuronal Development, Injury and Repair in Retina Vision Research Training Program</td>
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<td>P. Hitchcock, Ph.D.</td>
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<td>NRSA Postdoctoral Fellowship for Scott Taylor, Ph.D.</td>
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<td>P. Hitchcock, Ph.D.</td>
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## External Grants and Funding

**July 1, 2012—June 30, 2013**

<table>
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<th>Faculty Name</th>
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<td>B. Hughes, Ph.D.</td>
<td>NIH</td>
<td>P30-EY007003-26</td>
<td>Core Center for Vision Research (five core modules)</td>
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<td>NIH</td>
<td>R01-EY008850-22</td>
<td>Ion Conductances in the Retinal Pigment Epithelium</td>
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<td>T. Jayasundera, M.D.</td>
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<td>Quantification of Macular Autofluorescence in Dry Age-Related Macular Degeneration</td>
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<td>Fight for Sight</td>
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<td>Quantification of Changes in Macular Autofluorescence in Dry Age-Related Macular Degeneration</td>
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<td>Midwest Eye-Banks</td>
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<td>Novel Quantification Methods for Fundus Flavoprotein Fluorescence and Lipofuscin Fluorescence to Detect Progression in Stargardt Disease</td>
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<td>A. Kahana, M.D., Ph.D.</td>
<td>NIH</td>
<td>R01-EY022633-01A1</td>
<td>A Zebrafish Model of Extraocular Muscle Regeneration</td>
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<td>Biological Signals Controlling Extraocular Muscle Regeneration</td>
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<td>Chemical Genomic Screen for Modifiers of Axenfeld-Rieger Syndrome: A Pilot Study to Identify Novel Therapeutics of Anterior Segment Dysgenesis</td>
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<td>Investigating the Role of Extracellular Matrix Factors and Collective Cell Migration in Extraocular Muscle Repair and Regeneration Using a Zebrafish Model</td>
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<td>Investigating the Roles of Retinoic Acid and Thyroid Hormone in the Pathogenesis of Thyroid Eye Disease</td>
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<td>Investigating the Roles of Twist1 and Twist2 in Extraocular Muscle Biology and Orbital Rhabdomyosarcoma</td>
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<td>Regulation of Extraocular Muscle Response to Injury by Autophagy and Extracellular Matrix Remodeling, Possible Targets for Therapy</td>
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<td>Thyroid-Related Eye Disease: A Preclinical Study Investigating the Role of Retinoid Receptors in Mediating Orbitopathy</td>
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<td>Chemical Genomic Screen for Modifiers of Axenfeld-Rieger Syndrome</td>
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<td>P. Lee, M.D., J.D.</td>
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<td>K12-EY022299-01A1</td>
<td>Michigan Vision Clinician-Scientist Development Program; Co-PI Vision Health Initiative - IPA with CDC</td>
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<td>P. Lichter, M.D.</td>
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<td>S. Mian, M.D.</td>
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<td>Ocular Findings after Hematopoietic Stem Cell Transplantation Treatment of Ocular Graft-versus-Host Disease (GVHD) with Topical Loteprednol Etabonate 0.5%</td>
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<td>Bausch &amp; Lomb, Inc.</td>
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<td>Eye Bank Preparation of Donor Tissue for Descemet’s Membrane Endothelial Keratoplasty</td>
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<td>Tissue Processing Techniques for Ultra-Thin Descemet’s Stripping Endothelial Keratoplasty, Award for Maria Woodward, M.D.</td>
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<td>S. Moroi, M.D., Ph.D.</td>
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<td>R01-EY022124-02</td>
<td>Aqueous Humor Dynamic Components that Determine Intraocular Pressure Variance</td>
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<td>D. Musch, Ph.D., M.P.H.</td>
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<td>Clinical and Quality of Life Insights on Glaucoma from Analyses of CIGTS Data</td>
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<td>Statins To Prevent Glaucoma Trial (STOP Glaucoma Trial) Planning Grant</td>
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<td>R21-EY023452</td>
<td>Factors Predictive of Rapid Visual Field Loss in Early Glaucoma, Subcontract with Washington University, Co-PI: Feng Gao, M.D., Ph.D., Mae O. Gordon, Ph.D.</td>
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<td>H. Pawar, Ph.D.</td>
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<td>Defining the Anatomical Mechanism of Canaloplasty Angle Surgery</td>
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<td>H. Petty, Ph.D.</td>
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<td>Evaluating the Toxicity of Novel Anti-Tumor Nanoparticles in Animals</td>
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<td>Mechanistic Studies of a New Light-Activated Nanoparticle for Managing Ocular Cancer</td>
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<td>Elsa U. Pardee Foundation</td>
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<td>Pilot Studies on the Anti-Tumor Capacity of Novel Catalytic Nanoparticles</td>
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<td>D. Puro, M.D., Ph.D.</td>
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<td>Retinovascular Pathophysiology: Focus on Proliferative Retinopathy</td>
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<td>Retinopathy of Prematurity: A New Experimental Approach</td>
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<td>Molecular Genetics of Primary Open-Angle Glaucoma</td>
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<td>R21 EY021000-02</td>
<td>Ocular Effects of Metformin Senior Scientific Investigator Award</td>
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<td>R. Shtein, M.D., M.S.</td>
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<td>K23-EY017885-04</td>
<td>Neovascularization Patterns in Corneal Graft Rejection In Vivo Corneal Confocal Microscopy for Non-invasive Assessment of Diabetic Peripheral Neuropathy; Subaccount with Michigan Diabetes Research and Training Center, University of Michigan, Co-PI</td>
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<td>Trends in Utilization of Endothelial and Penetrating Keratoplasty for Treatment of Corneal Endothelial Disease</td>
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<td>Regulation of Retroocular Connective Tissue</td>
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<td>NIH</td>
<td>R01-EY011708-16</td>
<td>Functional Diversity of Orbital Fibroblasts Physician-Scientist Award</td>
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<td>Metabolic Syndrome and Periodontitis in Postmenopausal Women, Subcontract with State University of New York at Buffalo, PI: Michael J. LaMonte, Ph.D., M.P.H.</td>
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<td>The Role of Vitamin D in Retinal Diseases in Aging, Subcontract with State University of New York at Buffalo, PI: Amy E. Millen, Ph.D.</td>
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<td>A Diabetic Retinopathy Progression Risk Calculator</td>
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<td>Mentoring for Advancement of Physician-Scientist Enabling Award Program</td>
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<td>Blue Cross Blue Shield of Michigan</td>
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<td>Longitudinal Rates of Postoperative Adverse Outcomes after Glaucoma Surgery among Medicare Beneficiaries 1994–2005</td>
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<td>A. Sugar, M.D.</td>
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<td>K. Wong, Ph.D.</td>
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<td>Cross-Talk between Ganglion-Cell Photoreceptors and Other Neurons in the Retina</td>
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<td>Ameliorating the Condition of the Blind through Melanopsin</td>
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<td>Functional Characterization of Developmental Changes in NMDA Receptor Subunit Composition of Retinal Ganglion Cells</td>
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<td>D. Zacks, M.D., Ph.D.</td>
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<td>Autophagy and Control of Photoreceptor Apoptosis</td>
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<td>Feasibility Study of ONL-101 for Photoreceptor Neuroprotection Prevention of Photoreceptor Cell Death with Intravitreal Fas-receptor Antagonist, Subcontract with ONL Therapeutics, PI: Jeffrey A. Jamison, Ph.D.</td>
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<td>Autophagy and Age-Related Macular Degeneration</td>
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<td>Sybil B. Harrington Special Scholar Award for Macular Degeneration</td>
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**Source Abbreviations**

- FFB .......... Foundation Fighting Blindness
- JDRF .......... Juvenile Diabetes Research Foundation International
- NIH .......... National Institutes of Health
- NNRI .......... National Neurovision Research Institute
- NSF .......... National Science Foundation
- RPB .......... Research to Prevent Blindness
César A. Briceño, M.D., assistant professor, has joined the faculty of the Eye Plastic, Orbital and Facial Cosmetic Surgery section. Dr. Briceño received his medical degree from Johns Hopkins University and then completed his residency at the Doheny Eye Institute at the University of Southern California. In 2013, Dr. Briceño completed a fellowship in oculoplastics at Kellogg. He sees patients in our Ann Arbor and Canton offices.

Lindsey B. De Lott, M.D., clinical lecturer, has joined the faculty of the Neuro-Ophthalmology section. She earned her medical degree from Ohio State University and completed her residency in neurology at the University of Michigan. In 2013, Dr. De Lott completed a two-year fellowship in neuro-ophthalmology at Kellogg. Dr. De Lott sees patients in Kellogg’s Ann Arbor office and in the Neuro-Ophthalmology suite at U-M Hospital. Read about Dr. De Lott’s research interests on p.5

Blake V. Fausett, M.D., Ph.D., clinical lecturer, has joined the faculty of the Comprehensive Ophthalmology and Cataract Surgery section and sees patients in Kellogg’s Ann Arbor office. Dr. Fausett earned his medical degree and a Ph.D. in biochemistry from the University of Michigan and completed his residency at Kellogg. In addition to seeing patients, Dr. Fausett serves as the residency program’s first Graduate Chief Resident.

Vanitha I. Jeyaraj, M.D., clinical instructor, has joined the faculty of the Comprehensive Ophthalmology and Cataract Surgery section and sees patients in Kellogg’s Milford office. Dr. Jeyaraj earned her medical degree from the University of Chicago in 2009 and completed her residency at the Baylor College of Medicine in 2013.

Paula Anne Newman-Casey, M.D., assistant professor, has joined the faculty of the Glaucoma, Cataract, and Anterior Segment Disease section and sees patients in Kellogg’s Canton office. Dr. Newman-Casey earned her medical degree at the University of Michigan and went on to complete her residency and a fellowship in glaucoma at Kellogg. Read about Dr. Newman-Casey’s research interests on p.4

Rajesh C. Rao, M.D., assistant professor, has joined the faculty of the Retina and Uveitis section and sees patients in Kellogg’s Ann Arbor office. Dr. Rao earned his medical degree at Yale University and completed his residency at the Massachusetts Eye and Ear Infirmary. He completed a fellowship in vitreoretinal surgery at Washington University. Read about Dr. Rao’s research interests on p.19

Anjali Shah, M.D., clinical instructor, has joined the faculty of the Retina and Uveitis section and sees patients in Kellogg’s Ann Arbor and Brighton offices. Dr. Shah earned her medical degree from the University of Michigan and completed her residency at the Baylor College of Medicine. She then completed a medical retina fellowship at the Tufts/New England Eye Center.

Jonathan B. Greene, M.D., assistant professor, has joined the faculty of the Comprehensive Ophthalmology and Cornea sections. Dr. Greene earned his medical degree from the University of Michigan and completed his residency at the University of California, San Francisco. In 2013, Dr. Greene completed a fellowship in cornea and refractive surgery at Kellogg. He sees patients in Ann Arbor.

Linda Zhang, M.D., clinical lecturer, has joined the faculty of the Glaucoma, Cataract, and Anterior Segment Disease section and sees patients in Kellogg’s Ann Arbor and Brighton offices. Dr. Zhang earned her medical degree at the University of Michigan and then went on to complete her residency and a fellowship in glaucoma at Kellogg.

To request an appointment with our new clinicians, please call 734.763.8122. Referring physicians can reach these clinicians through M-LINE at 800.962.3555.
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<tbody>
<tr>
<td>Blake V. Faustett, M.D., Ph.D.</td>
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<tr>
<td>M.D. University of Michigan</td>
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<th>1ST YEAR RESIDENTS</th>
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<td>David DeMill, M.D.</td>
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<td>M.D. University of Utah</td>
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<td>Neil Farbman, J.D., M.D.</td>
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<td>M.D. University of Pennsylvania</td>
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<td>Michelle Kron-Gray, M.D., Ph.D.</td>
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<td>Ph.D. Neuroscience, University of Michigan</td>
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<td>Stephen Smith, M.D.</td>
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<td>Maxwell Stem, M.D.</td>
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<td>Grace Wang, M.D., Ph.D.</td>
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<tr>
<td>Courtney Kauh, M.D., M.S.</td>
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<td>M.S. Ohio State University</td>
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<td>M.D. University of Toledo</td>
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<td>Mehnaz Khan, M.D., M.S.</td>
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<td>M.D. Vanderbilt University</td>
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<td>Lee Kiang, M.D., Ph.D.</td>
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<td>M.D. Weill Cornell Medical College</td>
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<td>Ph.D. The Rockefeller University</td>
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<td>Monica Michelotti, M.D.</td>
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<td>Melissa Nika, M.D.</td>
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<td>M.D. University of Colorado Denver</td>
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<td>Patricia A. Ple-plaekon, M.D.</td>
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<td>Ira H. Schachar, M.D., M.Sc.</td>
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<td>M.D. Washington University</td>
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<td>M.Sc. Oxford University</td>
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<tr>
<td>Alexandra Apkarian, M.D.</td>
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<tr>
<td>Pediatric Ophthalmology and Adult Strabismus</td>
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<td>M.D. University of Michigan</td>
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<td>Residency University of Michigan</td>
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<td>Surbhi Bansal, M.D.</td>
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<td>Dane Breker, M.D.</td>
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<td>Michael Bullard, M.D.</td>
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<td>Steven Cohen, M.D.</td>
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<td>Vitreo-Retinal Surgery</td>
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<td>Angela Elam, M.D.</td>
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<td>Joshua Grant, M.D.</td>
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<td>Chirag Gupta, M.D.</td>
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<td>Residency William Beaumont Hospital</td>
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<td>Lauren Harris, M.D.</td>
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<td>Nieraj Jain, M.D.</td>
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<td>Allison N. McCoy, M.D., Ph.D.</td>
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<tr>
<td>Eye Plastic, Orbital and Facial Cosmetic Surgery</td>
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<td>M.D., Ph.D. Duke University</td>
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<td>Residency Wilmer Eye Institute</td>
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<td>Dolly Padovani-Claudio, M.D., Ph.D.</td>
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<tr>
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<td>M.D., Ph.D. Case Western Reserve University</td>
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<td>Fatemeh Rajaii, M.D., Ph.D.</td>
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<tr>
<td>Rashmi Verma, MS Ophth.</td>
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<tr>
<td>Fellowship Pediatric Ophthalmology, Akron Children’s Hospital</td>
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<tr>
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