PRESENTED BY

USC Roski Eye Institute

Keck Medicine of USC

INSIGHT

2018 ANNUAL REPORT

KECK SCHOOL OF MEDICINE OF USC
DEPARTMENT OF OPHTHALMOLOGY

Message from the Chair

WITH GREATER INSIGHT - The USC Roski Eye Institute team continues to be at the forefront of innovation through the convergence of medicine and science, giving us renewed hope in our mission to prevent vision loss and eliminate blindness in our communities and abroad.

It is with great pride to announce that the *U.S. News & World Report* has featured us as a nationally top-ranked ophthalmology program for 25 consecutive years.

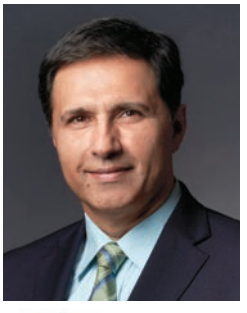
We focus on the unmet clinical needs - Through an integrative and multidisciplinary approach, our extraordinary dedicated team of clinicians, scientists, staff and trainees strives to provide exceptional patient care through state-of-the-art diagnostic services and innovative treatments.

We make translational research breakthroughs - From first-in-kind stem cell-based therapy for dry age-related macular degeneration to novel ultrasonic diagnostic technology for debilitating eye diseases, our vision scientists are leading experts and pioneers in ophthalmology.

We educate our future leaders of tomorrow - With the expansion of our residency, national and international fellowship program, hands-on teaching program and informative grand rounds series, we continue to strengthen our educational mission. Notably, we are grateful to our exceptional alumni who volunteer their time at LAC+USC to teach the next generation of ophthalmologists.

We thank you all for your continued dedication and support of our mission and look forward to the year ahead as we strive to develop new treatments and therapies to preserve, protect and restore the vision of those suffering.

Narsing A. Rao, MD
Professor and Chair
USC Department of Ophthalmology
Keck School of Medicine of USC



Mark S. Humayun, MD, PhD
Cornelius J. Pings Chair in Biomedical Sciences
Co-Director, USC Roski Eye Institute
Director, USC Ginsburg Institute for Biomedical Therapeutics

Cover image: From [Kashani et. al. A Bioengineered Retinal Pigment Epithelial Monolayer for Advanced, Dry Age-Related Macular Degeneration. Science Translational Medicine 04 Apr 2018: 10,435, eaa04097.] Reprinted with permission from AAAS.

YOUR VISION *is* OUR MISSION








PRESERVE

The USC Roski Eye Institute diagnoses, treats and manages the most complex eye conditions, from *in utero* to advanced age.

PROTECT

The USC Roski Eye Institute leads major research in the diagnosis of eye disease with advanced imaging technology to help prevent blindness.

RESTORE

The USC Roski Eye Institute integrates and applies emerging technologies to develop new methods to restore sight to the blind.

SPECIALIZED CARE *for* ADULTS & CHILDREN

The USC Roski Eye Institute treats the full spectrum of eye conditions - from the most common to the most complex.

- CATARACT
- CORNEA & EXTERNAL DISEASES
- GLAUCOMA
- LASER VISION CORRECTION
- LOW VISION REHABILITATION
- NEURO-OPHTHALMOLOGY AND ADULT STRABISMUS
- OCULAR ONCOLOGY
- OCULO-FACIAL PLASTIC SURGERY
- OPHTHALMIC MOLECULAR AND IMMUNOPATHOLOGY
- PEDIATRIC OPHTHALMOLOGY
- SPECIALTY CONTACT LENSES AND PROSE
- UVEITIS AND OCULAR INFLAMMATION
- RETINA, VITREOUS AND MACULAR DISEASES & SURGERY

Notable Accolades & Achievements

HELEN KELLER LAUREATE AWARD

Presented to Dr. A Linn Murphree (left) for his discovery of the RB1 tumor suppressor gene

USC DEPARTMENT OF OPHTHALMOLOGY

#1

RESEARCH FUNDING

2017

by the National Institutes of Health

VOTED BEST OF THE BEST

Los Angeles MAGAZINE
TOP DOCTORS 2018

pasadena MAGAZINE TOP DOCTOR –2018–

Congratulations to Drs. Hossein Ameri, Mark Borchert, Mark Humayun, Jonathan Kim, Linda Lam, Thomas Lee, Karen Morgan, Arlanna Moshfeghi, Bibiana Reiser, and Grace Richter

2018 IEEE Biomedical Engineering Award

Karen Bartelson, past IEEE president, presenting the Award to Dr. Mark Humayun

ASOPRS 2018 JAMES A. KATOWITZ PEDIATRIC AWARD

Dr. Jonathan Kim was honored for his contributions in oculoplastic surgery

LAC+USC OPHTHALMOLOGY RESIDENCY PROGRAM

RANKED #8

by Doximity

GLOBAL CONNECTION
Vision Care *without Borders*

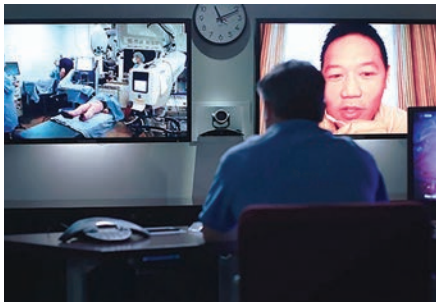
Residency Rotation

India

7th Indo-China Ocular Inflammation Meeting

Mongolia

Armenian Eye Care Project



Armenia

Surgical Skills Training

Myanmar

Earthquake Relief Efforts

Nepal

Clinical Outreach

Jamaica

Restoring Vision with Argus II

South Korea

International Society of Ocular Oncology

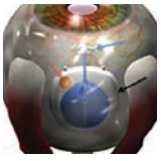
Australia

Advancing Vision Science
with Three New Integrative Cores

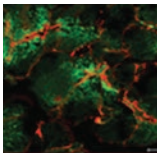
National Eye Institute Funded Center Core Grant for Vision Research

- Cultivating opportunities for inter-disciplinary basic and translational vision research
- Enabling collaboration among outstanding scientists and clinicians
- Providing cutting-edge bioinstrumentation and expert technical personnel

Three Integrative Research Cores

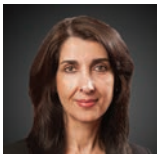


Ophthalmic Therapeutics Engineering Core



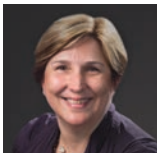
Cell and Tissue Imaging Core

In Vivo Models and Imaging Core

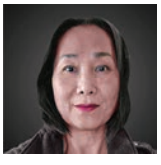


Mahnaz Shahidi, PhD
Principal Investigator

Andrew MacKay, PhD
Director, Ophthalmic Therapeutics Engineering Core



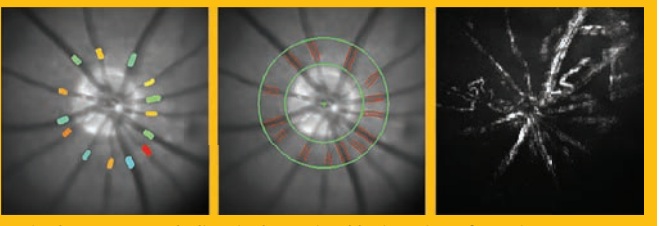
Sarah Hamm-Alvarez, PhD
Director, Cell and Tissue Imaging Core



Jeannie Chen, PhD
Director, In Vivo Models and Imaging Core

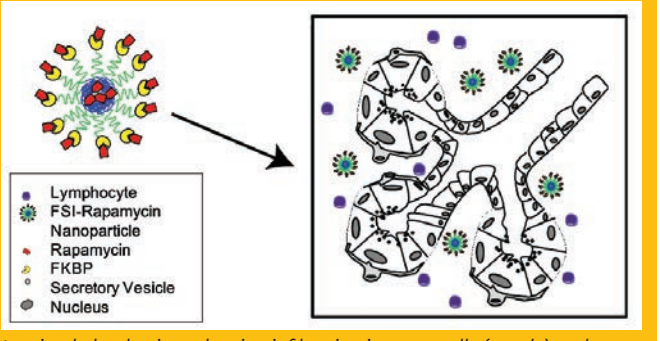
Fostering Innovation in Ophthalmology

R01: "Imaging of Retinal Oxygenation and Metabolism"
Principal Investigator: Mahnaz Shahidi, PhD



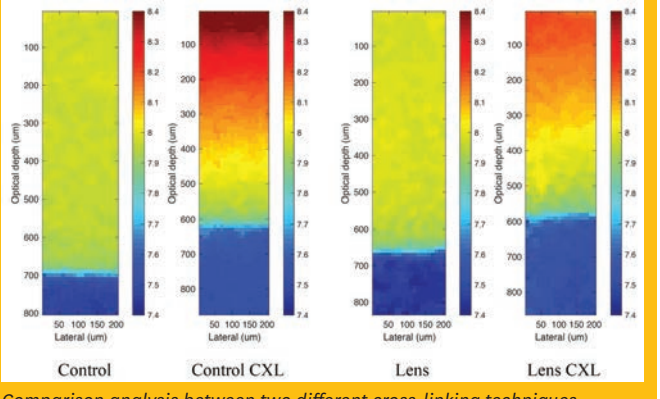
Retinal oxygen metabolism is determined by imaging of arteriovenous oxygen content difference and blood flow. ***Left)*** *Retinal vascular oxygen tension measurements displayed in pseudo color.* ***Middle)*** *Automatically detected retinal vessel boundaries are outlined on a red free image to visualize vessel diameter measurements.* ***Right)*** *A projection image generated from superimposed images of circulating fluorescent microspheres over time to depict blood velocity measurements.*

R01: "Protein-Polymer Nanomedicine for Sjogren's Syndrome"
Principal Investigator: Sarah Hamm-Alvarez, PhD



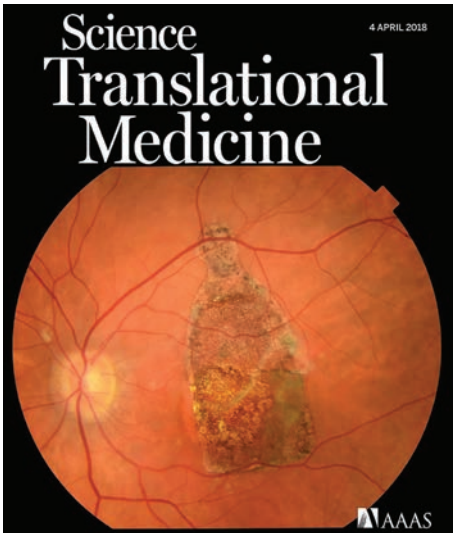
Lacrimal gland acinus showing infiltrating immune cells (purple) and therapeutic nanoparticle micelles.

R01: "Corneal Biomechanical Analysis with Brillouin Microscopy"
Principal Investigator: J. Bradley Randleman, MD



Comparison analysis between two different cross-linking techniques, control and lens.

HOPE *is in* SIGHT *for* Dry AMD



"I got my independence back, and I'm just so happy about it." **- Anna Kuehl**

Anna Kuehl, a USC alumna, was diagnosed with dry age-related macular degeneration (AMD), which caused her to lose the ability to drive, read or even recognize faces over time.

With a diminished quality of life, Anna turned to the USC Roski Eye Institute, where she learned of an opportunity to participate in a **phase I/IIa clinical trial for dry AMD.** Dr. Amir Kashani, principal investigator of the clinical trial and Assistant Professor of Clinical Ophthalmology, replaced the diseased portion of Anna's eye with the first-in-kind retinal implant, a single layer of RPE-derived from stem cells grown on a synthetic scaffold.

"We are grateful to the California Institute for Regenerative Medicine, who supported this initiative and to people like Anna who will help us one day find a cure for this devastating disease", says Dr. Mark Humayun, Director of the USC Ginsburg Institute for Biomedical Therapeutics and Co-Director of the USC Roski Eye Institute, who led the multidisciplinary team that developed the stem cell-based retinal implant at USC.

The results of a subset of subjects were published in April 2018 and featured on the cover of *Science Translational Medicine*. A phase II multi-center trial is on the horizon with the completion of the phase I/IIa trial.

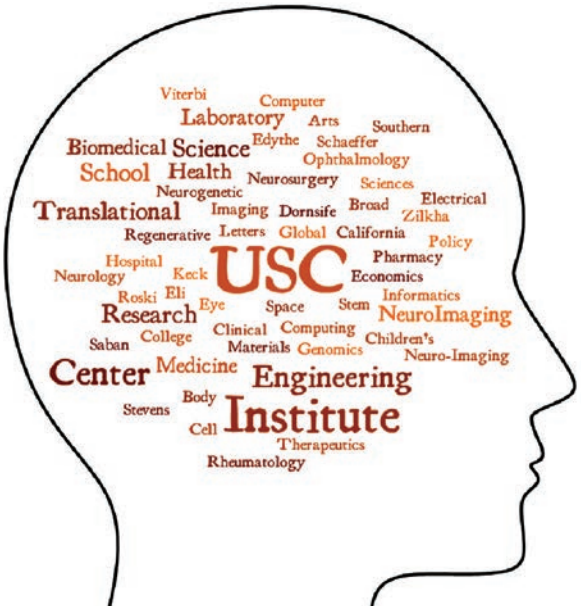
ACTIVE RESEARCH FUNDING - DECEMBER 2018

PRINCIPAL INVESTIGATOR	PROJECT	SOURCE
Amir Kashani, MD, PhD	*3D Angiography for Quantitative Characterization*	NIH/NEI
Amir Kashani, MD, PhD	*Functional Imaging in Hypoxic-Ischemic Retinal Disease*	NIH/NEI
Amir Kashani, MD, PhD	*Imaging Cerebral and Retinal Microvasculature in Cerebral Small Vessel Disease*	NIH/NINDS
Amir Kashani, MD, PhD	*OCT Angiography Research Consortium (OARC)*	Carl Zeiss Meditec
Amir Kashani, MD, PhD	*Study of Subretinal Implantation of Human Embryonic Stem Cell-Derived RPE Cells in Advanced Dry AMD*	CIRM
Benjamin Xu, MD, PhD	*Automated Detection of Gonioscopic Angle Closure Based on Anterior Segment OCT Imaging*	AGS
Benjamin Xu, MD, PhD	*Development and Validation of a Quantitative Anterior Segment OCT-based Method to Evaluate Patients with Primary Angle Closure Disease*	NIH/NEI
Biju Thomas, PhD	*Studies on Functionality of iPS-RPE Transplanted in Immunodeficient RCS Rats*	BrightFocus Foundation
David Cobrinik, MD, PhD	*Human Specific Signaling Circuitry in Cone Precursor Development*	NIH/NEI
David Cobrinik, MD, PhD	*Regulation of NCL and RdCVF in Cone Photoreceptor and Retinoblastoma Development*	RPB
David Hinton, MD	*An Experimental Approach to Maculopathy*	NIH/NEI
Gianluca Lazzi, PhD, MBA	*Connectome-Derived Computational Models of Degenerated Retina for Retinal Prosthetic Design*	NIH/NEI
Gianluca Lazzi, PhD, MBA	*EAGER: Bioelectronic Color Vision*	NSF
Gianluca Lazzi, PhD, MBA	*Predictive Modeling of Bioelectric Activity on Mammalian Multilayered Neuronal Structures in the Presence of Supraphysiological Electric Fields*	NIH/NIBIB
Grace Richter, MD, MPH	*Defining the Relationships of Retinal Microcirculation with Glaucoma, Systemic Disease, and Ocular Anatomic Factors in African Americans*	NIH/NEI
Grace Richter, MD, MPH	*Retinal Microcirculation Changes after Intraocular Pressure Reduction in Glaucoma*	AGS
Grace Richter, MD, MPH	*Role of Optical Coherence Tomography Angiography in Detecting Retinal Microcirculation Changes after Intraocular Pressure Reduction in Glaucoma*	USC
J. Bradley Randleman, MD	*Corneal Biomechanical Analysis with Brillouin Microscopy*	NIH/NEI
Jesse Berry, MD	*Development of a Surrogate Liquid Biopsy from the Aqueous Humor in Retinoblastoma Eyes*	NIH/NCI
Kimberly Gokoffski, MD, PhD	*Electrical Fields Direct Retinal Ganglion Cell Axon Growth by Modulating GTPase Signaling*	NANOS
Kimberly Gokoffski, MD, PhD	*Physiological Electrical Fields Direct Optic Nerve Regeneration*	NIH/NCATS
Kimberly Gokoffski, MD, PhD	*Molecular Signals that Underlie Electrical Field Directed Retinal Ganglion Cell Axon Growth*	USC
Mahnaz Shahidi, PhD	*Center Core Grant for Vision Research*	NIH/NEI
Mahnaz Shahidi, PhD	*Imaging of Retinal Oxygenation and Metabolism*	NIH/NEI
Mahnaz Shahidi, PhD	*Ocular Biomarkers of Microvascular, Neural and Metabolic Function in Diabetes*	NIH/NIDDK
Mark Humayun, MD, PhD	*Phase 1 Safety Assessment of CPCB-RPE1, hESC-derived RPE Cell Coated Parylene Membrane Implants, in Patients with Advanced Dry Age Related Macular Degeneration*	CIRM
Mark Humayun, MD, PhD	*Thermoresponsive Reversible Adhesive for Temporary Intervention of Ocular Trauma - II*	DoD/U.S. Army
Mark Humayun, MD, PhD	*USC Roski Eye K12 Clinician-Vision Scientist Training Program (USC Roski Eye K12)*	NIH/NEI
Narsing Rao, MD	*Research to Prevent Blindness Unrestricted Grant*	RPB
Qifa Zhou, PhD	*Combined OCT/US/PAT System for Intravascular Imaging*	NIH/NHLBI
Qifa Zhou, PhD	*High Resolution Elastographic Assessment of the Optic Nerve Head*	NIH/NEI
Qifa Zhou, PhD	*High Resolution Elastography of Retina Under Prosthetic Electrical Stimulation*	NIH/NEI
Qifa Zhou, PhD	*Large Aperture and Wideband Modular Ultrasound Arrays for the Diagnosis of Liver Cancer*	NIH/NCI
Qifa Zhou, PhD	*Novel Focused Ultrasound (NFU) for Transscleral Drug Delivery*	USC Zumberge
Qifa Zhou, PhD	*Phase Resolved ARF Optical Coherence Elastography for Intravascular Imaging*	NIH/NHLBI
Sandy Zhang-Nunes, MD	*Therapeutic Applications of Ultrasound for the Prevention and Treatment of Dry Eye Disease*	USC Zumberge
Sarah Hamm-Alvarez, PhD	*Identification of Tear Biomarkers for Parkinson's Disease Patients*	Michael J. Fox Foundation
Sarah Hamm-Alvarez, PhD	*Microtubule-Based Transport in Lacrimal Gland Function*	NIH/NEI
Sarah Hamm-Alvarez, PhD	*Protein-Polymer Nanomedicine for Sjogren's Syndrome*	NIH/NEI
Vivek Patel, MD	*Human Connectomes for Low Vision, Blindness, and Sight Restoration*	NIH/NEI
Vivek Patel, MD	*Retinal Prosthesis Neural Imaging: Measuring the Impact of Crossmodal Plasticity on Visual Restoration*	Beckman Foundation
Xuejuan Jiang, PhD	*The Cumulative Effects of Sickle Cell Trait on the Eye Among Older African Americans*	NIH/NEI

AGS (American Glaucoma Society) • **CIRM** (California Institute for Regenerative Medicine) • **DoD** (Department of Defense) • **NANOS** (North American Neuro-Ophthalmology Society) • **NCATS** (National Center for Advancing Translational Sciences) • **NCI** (National Cancer Institute) • **NEI** (National Eye Institute) • **NHLBI** (National Heart, Lung and Blood Institute) • **NIBIB** (National Institute of Biomedical Imaging and Bioengineering) • **NIDDK** (National Institute of Diabetes and Digestive and Kidney Diseases) • **NIH** (National Institutes of Health) • **NINDS** (National Institute of Neurological Disorders and Stroke) • **NSF** (National Science Foundation) • **RPB** (Research to Prevent Blindness)

MULTIDISCIPLINARY COLLABORATIONS

Extending Beyond the Department



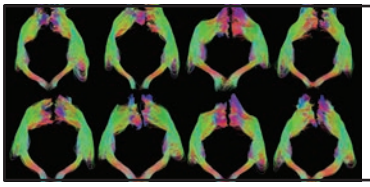
With a multitude of USC departments, schools and institutions, Roski Eye Institute clinicians and researchers continue to advance vision research through dynamic collaborative initiatives.

Combining policy-driven research with clinical insight to develop strategies to improve the health of vulnerable populations

- USC Department of Emergency Medicine
- USC Schaeffer Center for Health Policy & Economics
- Keck School of Medicine


Seth Seabury, PhD

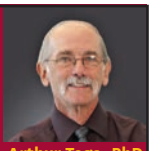

Brian Toy, MD



Measuring topography using data from the Human Connectome Project: Reconstructing the optic radiation bundle

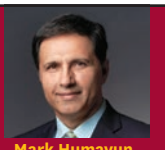
- USC Stevens Neuroimaging and Informatics Institute
- Laboratory of Neuroimaging
- Keck School of Medicine


Yonggang Shi, PhD


Arthur Toga, PhD

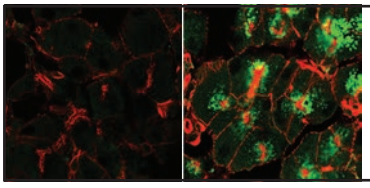
Reversibly adhesive lenses for temporary treatment of corneal laceration

- USC Dornsife College of Letters, Arts & Sciences
- USC Ginsburg Institute for Bio-Medical Therapeutics


Mark Humayun, MD, PhD

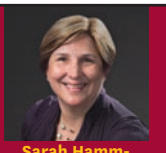

Juan Carlos Martinez, MD


Jack Whalen, PhD

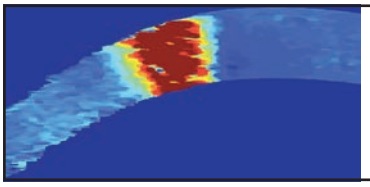


Monitoring biomarkers in tears may lead to early detection in Sjogren's syndrome patients

- USC Department of Medicine (Rheumatology)
- USC School of Pharmacy
- USC Dornsife College of Letters, Arts & Sciences
- LAC+USC Medical Center


Sarah Hamm-Alvarez, PhD

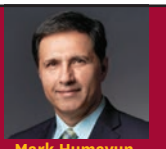

J. Martin Heur, MD, PhD



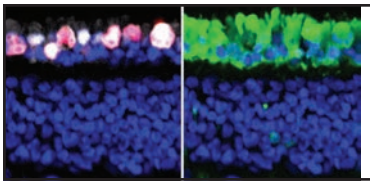
Ultrasonic micro-elastography to image biomechanical properties of the cornea

- USC Viterbi School of Engineering
- USC Ginsburg Institute for Bio-Medical Therapeutics
- Keck School of Medicine


J. Martin Heur, MD, PhD

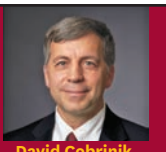

Mark Humayun, MD, PhD

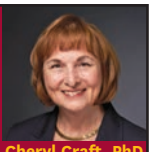

Qifa Zhou, PhD



Insight into retinoblastoma development from maturing cone precursors

- The Vision Center, The Saban Research Institute, CHLA
- USC Cancer Biology & Genomics
- Keck School of Medicine


David Cobrinik, MD, PhD


Cheryl Craft, PhD

RECONSTRUCTING THE BRAIN

Enhancing Retinal Mapping through a Novel Mathematical Model

Through the Human Connectome Project (HCP), scientists developed **advanced state-of-the-art brain mapping technologies allowing them to map the human brain in intricate detail.** Through a multidisciplinary collaboration, led by Arthur W. Toga, PhD and collaborator Yonggang Shi, PhD from the USC Stevens Neuroimaging and Informatics Institute, researchers seek to elucidate brain circuitry as it relates to neurological function. The team has focused on the novel mathematical characterization of topographic regularity, which is the spatial organization of neurons when mapping brain connectivity.

“Detailed retinal mapping of the visual pathways may help scientists further their understanding of eye diseases," said Dr. Toga, Provost Professor of Ophthalmology.

Using the large-scale dataset from 215 HCP subjects, the team quantitatively reconstructed the optic radiation bundle with greater precision relative to other methods.

REVOLUTIONARY FIRST ON THE WEST COAST

FDA-Approved Gene Therapy

After decades of declining vision, 44-year-old Toby Willis received the **first FDA-approved gene replacement therapy to treat an inherited form of vision loss**.

Drs. Thomas Lee and Aaron Nagiel administered treatment by injecting it underneath the retina, the light sensing tissue of the eye. This treatment is for patients with Leber congenital amaurosis, who have mutations in the REP65 gene.

Leber congenital amaurosis affects children at a very young age and may lead to complete blindness over time.

"We are pleased to be able to offer this therapy that can truly impact a patient's quality of life, and potentially, help them see their future through 'new eyes'," said Thomas Lee, MD, Director of the Vision Center at Children's Hospital Los Angeles and Associate Professor of Ophthalmology at the USC Roski Eye Institute.

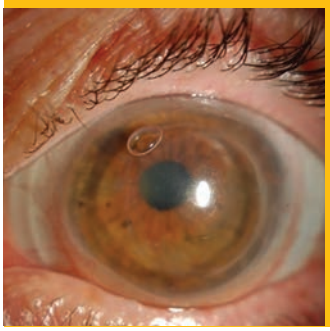
Enhancing Daily Life *with* Vision Rehabilitation & PROSE

1 in 28 Americans over the age of 40 suffer from low vision, according to the National Federation of the Blind. Low vision is comprised of decreased visual acuity, contrast sensitivity, and/or visual field which creates an impingement on an individual's ability to effectively and independently carry out activities such as cooking, cleaning, reading the newspaper or watching television.

Vision rehabilitation services, customized by Dr. Rachel Young, are considered when patients no longer find improvement with prescription glasses, contact lenses, surgical or medical treatment. Those who suffer from low vision experience a dramatic decrease in their overall quality of life.

What Assistive Devices are Available?

- **Hand held pocket magnifiers**
- **Stand magnifiers**
- **Monocular and binocular telescopes**
- **Applications for smart phones and tablets**
- **Solar shields/fit overs**
- **Portable electronic magnifiers**
- **Lighting recommendations**
- **Rehabilitation treatment plans**



Prosthetic Replacement of the Ocular Surface Ecosystem (PROSE) Treatment

The USC Roski Eye Institute is one of only 12 sites in the nation to offer cutting-edge PROSE treatment. PROSE treatment involves specialty, scleral prosthetic devices that are custom-designed to help improve vision, comfort or support of the ocular surface.

Supervised by Dr. Gloria Chiu, PROSE treatment generally involves multiple visits, which include a consultation, training for proper device wear and maintenance, and follow up visits to design and evaluate fitting of custom devices. Literature has demonstrated that patients who have received this pioneering treatment experience a notable improvement in their quality of vision and quality of life as a result.

John Erasmo

Neovascular Age Related Macular Degeneration/ Polypoidal Choroidal Vasculopathy

Ocular History

Acute onset vision loss for three days. Exam showed a significant amount of subretinal hemorrhage and pigment epithelial detachments in the right eye and a vision of 20/125.

Treatment

Underwent surgical procedure to remove the blood and prevent damage to the overlying retina. Patient also received intravitreal injections of anti-vascular growth factor agents that prevent future bleeding.

Outcome

Vision was restored to 20/25.

John Erasmo noticed a dramatic change in his central vision. At the age of only 47, he was almost legally blind with a visual acuity that had deteriorated to 20/125.

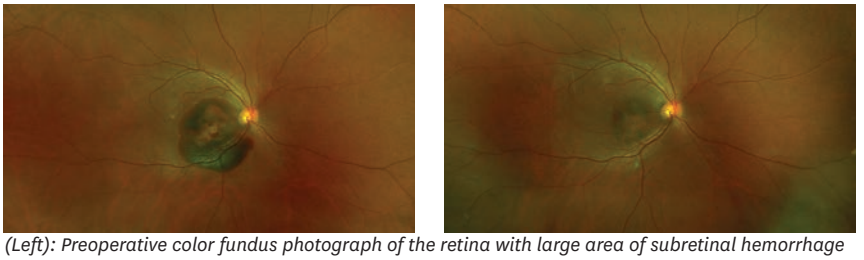
After a comprehensive eye exam and extensive imaging with retina specialist, Dr. Amir Kashani, an expert in the treatment of wet and dry age-related macular degeneration, it was determined that Mr. Erasmo had a variant of macular degeneration called Polypoidal Choriodal Vasculopathy (PCV). PCV is characteristically diagnosed in younger patients, with a higher prevalence in Asian and black populations.

Dr. Kashani surgically removed Mr. Erasmo's subretinal hemorrhage to save his vision from deteriorating further, while starting treatment with an intravitreal anti-VEGF injection to treat PCV. Mr. Erasmo's surgery was a success and his visual acuity improved significantly to 20/25 only several months after treatments.

"Timely treatment of PCV as well as similar conditions like age-related macular degeneration are essential for preserving and restoring vision," says Dr. Kashani.

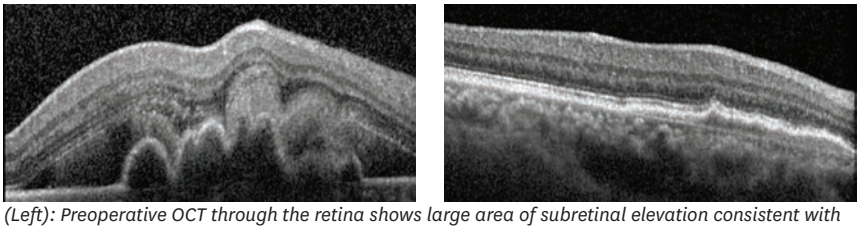
"The professionalism and knowledge of the staff and doctors makes it easy for me to recommend Roski to anyone in need of any sort of eye treatments and care."

- John Erasmo



(Left): Preoperative color fundus photograph of the retina with large area of subretinal hemorrhage involving the macula. (Right): Postoperative color fundus photograph showing resolution of the majority of the subretinal hemorrhage a few weeks after surgery.

Amir Kashani, MD, PhD, performed treatment to help restore Mr. Erasmo's vision and prevent future complications.



(Left): Preoperative OCT through the retina shows large area of subretinal elevation consistent with the subretinal hemorrhage. There are also numerous pigment epithelial detachments. (Right): Post-operative OCT showing resolution of the subretinal blood and pigment epithelial detachments.

Chungja Park

Over the past two years, Chungja Park had noticed a progressive decline in her vision and quality of life. Her right eye had dramatically turned downward and inward towards her nose. Her vision deteriorated to 20/80, as well as constant double vision.

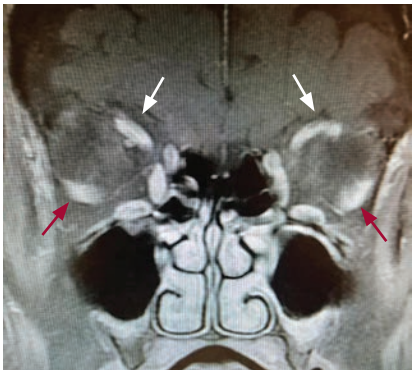
Before procedure, right eye shows severe misalignment, where eye is fixed downward and inward with no capacity for movement.

Post-op day 5, right eye is centrally focused and is now aligned and near-complete range of motion.

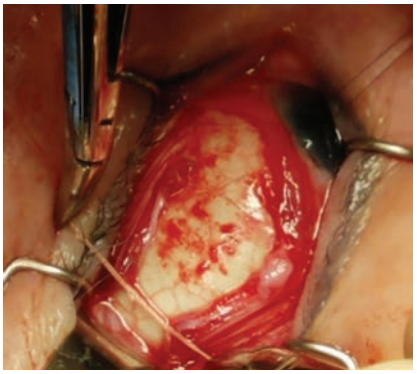
Ms. Park was referred to neuro-ophthalmologist and adult strabismus specialist, Dr. Vivek Patel. Upon examination, Dr. Patel observed that Ms. Park's eye was completely misaligned and fixed in a downward and inward position. Ms. Park underwent a detailed neuro-ophthalmic exam and MRI of the brain and orbits to rule out the possibility of a slow-growing intracranial tumor, which can produce this type of clinical picture.

Fortunately, a mass lesion was never discovered; however, Dr. Patel noted the severe malpositioning of her eye muscles, leading to the diagnosis of "heavy eye syndrome" (HES), a condition that occurs in patients with high myopia. In HES, the eye itself becomes enlarged, causing the muscles that help move the eye, to become displaced from their normal positions over time. Specializing in complex adult strabismus surgery, Dr. Patel developed a unique surgical plan to address Ms. Park's condition. The muscles were surgically brought together to help reposition the eye and allow it to move normally again.

As a result, Ms. Park no longer has double vision and her vision has improved to 20/25 given that it is now positioned centrally within her orbit.



Orbital image; lateral rectus muscle of both eyes (right more than left) have slipped out of position to below the eye instead of at the horizontal level (red arrows). Superior rectus of the right eye also slipped nasally (white arrow).



The lateral rectus and superior rectus are pulled together ("modified loop myopexy") to restore the position of both muscles together to their appropriate positions.

Heavy Eye Syndrome/ Strabismus

Ocular History

Patient noted progressive deviation of her right eye toward her nose and downward, and reduced range of motion. Vision declined to 20/80 given that the eye was severely off axis, and experiencing constant binocular, oblique double vision.

Treatment

To address the strabismus, a surgical procedure was performed to realign the eye by repositioning and joining the lateral and superior rectus muscles. The procedure helped restore position of the globe and improve ocular motility.

Outcome

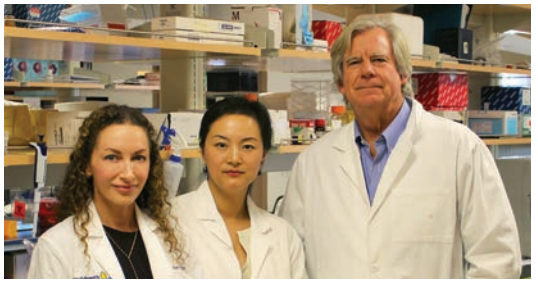
Diplopia was eliminated and vision improved to 20/25.

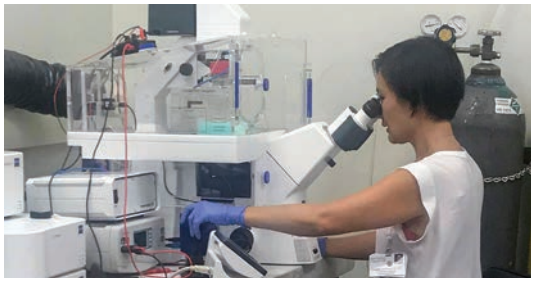
"As neuro-ophthalmologists, we first try to understand why our patient has ocular misalignment, considering all possibilities. At USC we are uniquely experienced and qualified to surgically manage complex misalignments."

- Vivek Patel

Vivek Patel, MD, helped restore Ms. Park's vision and ocular motility, while ultimately improving her quality of life.

MENTORING and INSPIRING Exceptional Clinician-Scientists





When ophthalmologists are trained in both medicine and science, they are **uniquely prepared to advance treatment and open new avenues of discovery**. The USC Roski Eye Institute mentors our clinician-scientists through K-Awards that provide support and protected time for intensive, supervised research-career development.

K-Awards are individualized to the recipients' past training and career stage. The goal is to help our clinician-scientists independently conduct complex research that will earn them increased National Institutes of Health Funding for their work.

By inspiring talented, dedicated researchers to excel to their fullest, we actively pursue the eventual elimination of blindness.

Recent K-Awardees include:

- **Jesse Berry, MD,** *"Development of a Surrogate Liquid Biopsy from the Aqueous Humor in Retinoblastoma Eyes"*
- **Kimberly Gokoffski, MD, PhD,** *"Physiologic Electrical Fields Direct Optic Nerve Regeneration"*
- **Amir H. Kashani, MD, PhD,** *"Functional Imaging in Hypoxic-Ischemic Retinal Disease"*
- **Grace Richter, MD, MPH,** *"Defining the Relationships of Retinal Microcirculation with Glaucoma, Systemic Disease, and Ocular Anatomic Factors in African Americans"*
- **Benjamin Xu, MD, PhD,** *"Development and Validation of a Quantitative Anterior Segment OCT-based Method to Evaluate Patients with Primary Angle Closure Disease"*

LEARNING FROM THE BEST OF THE BEST

The **USC Oculoplastic Surgical Skills Course**, organized by USC's Dr. Sandy Zhang-Nunes, Assistant Professor of Clinical Ophthalmology and Director of the Oculoplastic Surgery Service, was a tremendous success, bringing together the best of the best faculty, fellows, residents in oculoplastics, ENT, and plastic surgery to learn from each other.

ASOPRS (American Society of Ophthalmic Plastic and Reconstructive Surgery) fellows from around the country, as well as visiting scholars from around the world flew in to participate. The meeting of the minds was unparalleled, the equipment and technology available for learning was superb. Participants left the course with increased knowledge and practice to provide the best patient care possible.

EXCEPTIONAL
Residency & Fellowship Programs

RESIDENCY PROGRAM

Each year, hundreds of applicants compete for seven positions. In addition to clinical rotations at the **USC Roski Eye Institute**, training is also provided at **Los Angeles County Hospital (LAC+USC)**, **Children's Hospital Los Angeles (CHLA)**, and the **VA Downtown Los Angeles Medical Center**.

LAC+USC OPHTHALMOLOGY RESIDENCY PROGRAM

RANKED #8

by Doximity

Stavros Moysidis, MD

Philip Storey, MD

► Two of our 2017 residency program graduates were awarded the prestigious Ron G. Michels Fellowship this past year. This is a remarkable accomplishment given that **only five such fellowships are awarded each year, following a competitive nationwide selection process.**

► Our residency program maintains its large volume of clinical material, consistently excellent hands-on training **(our residents have been in the top 5% of programs nationwide for over five consecutive years in total surgeries performed**)

► Next year, our team will be comprised of 21 residents, positioning **LAC+USC Ophthalmology Residency as one of the largest programs in the country**

► Our program continues to maintain one of the highest Accreditation Council of Graduate Medical Education (ACGME) resident survey results across all post-graduate programs at LAC+USC Medical Center

FELLOWSHIP PROGRAM

Fellows at the USC Roski Eye Institute receive training in five subspecialty areas:

- **Cornea, External Disease & Refractive Surgery**
- **Glaucoma**
- **Neuro-Ophthalmology**
- **Oculofacial Plastic Surgery**
- **Vitreoretinal Surgery**

- The fellowship experience spans three institutions: the **USC Roski Eye Institute, CHLA,** and **LAC+USC**
- In addition to working with their clinical and academic mentors, our fellows have the opportunity to run their own clinics and lead resident teaching rounds
- Fellows are given unprecedented responsibility in caring for the needs of patients at LAC+USC Medical Center as well as providing supervision of residents in both clinical and surgical settings

PROGRAM LEADERSHIP

Narsing Rao, MD
Professor and Chairman, USC Department of Ophthalmology

Vivek Patel, MD
Education Director
Residency Program Director
Neuro-Ophthalmology Fellowship Director,
USC Department of Ophthalmology

Benjamin Xu, MD, PhD
Assistant Program Director, USC Department of Ophthalmology

Malvin Anders, MD
Chief of Ophthalmology, LAC+USC Medical Center

USC Roski Eye Institute
Keck Medicine of USC

LAC+USC HEALTHCARE NETWORK

Children's Hospital LOS ANGELES
We Treat Kids Better

DIAGNOSIS
TREATMENT
CURRENT OPINIONS
MODERN APPROACHES

Grand Rounds Case Study

"PUSH FOR A SOLUTION"

CHALLENGING EYE CARE

Sandy Zhang-Nunes, MD
Assistant Professor of Clinical Ophthalmology
Director, Oculofacial Plastic Surgery Service
zhangnun@usc.edu

Meghan Shan, MD, PhD
jingmeghan.shan@med.usc.edu
PGY-3 ophthalmology resident

HISTORY

- 62-year-old male, past medical history of hypertension, presents with binocular diplopia
- First presented to primary MD with left eye discomfort and diplopia; exam found EOM limitations OS
- Seen by neurology seven months later, MRI found sinus disease and mass extending into left orbit
- Seen by ENT; exam found mild-moderate s-shaped septal deviation
- No past ocular, surgical or family history
- Social history: worked as a MBA, former smoker, no alcohol use

EXAM FINDINGS

- BCVA: 20/25 OD, 20/300 OS (was unremarkable at ENT visit)
- Pupils: round and reactive OU, +RAPD OS
- Color plates 10/10 OD, 6/10 OS
- IOP: 14 OD, 14 OS
- EOM:

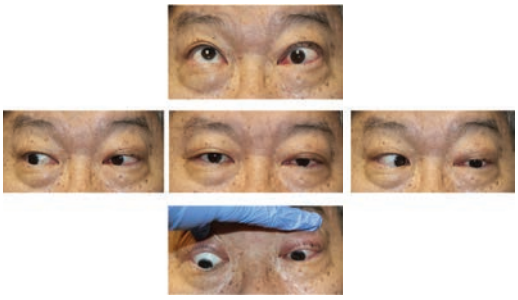


Figure 1: Extraocular motility on initial presentation. -4 abduction, -3 supraduction, -2 infraduction and adduction.

Figure 2: Worm's eye view showing left eye proptosis. Hertel measured 16.5mm OD, 20mm OS.

- Anterior exam: remarkable for left eye proptosis, ptosis and medical conjunctival injection
- Posterior exam: Remarkable for congested and tortuous vessels OS

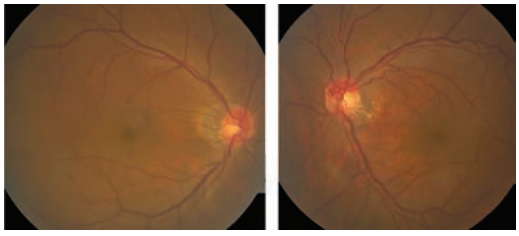


Figure 3: Fundus photos show left eye vessels are congested and tortuous.

DIFFERENTIAL DIAGNOSIS

- Benign growths (e.g. hemangioma)
- Malignancies (e.g. lymphoma)
- Idiopathic orbital inflammatory syndrome
- Infectious (e.g. orbital abscess)
- Cysts (e.g. mucocele)

ADDITIONAL INVESTIGATIONS

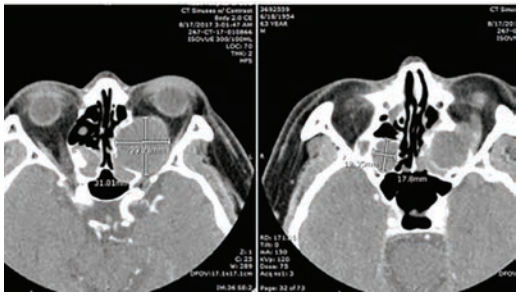


Figure 4: CT scan. Left mass measures 3cm in diameter. Smaller mass present in the right posterior ethmoid sinus. Mass is evident in the left orbit, affecting the medical rectus, inferior muscles as well as the optic nerve.

DIAGNOSIS

- **Ethmoid sinus mucocele**

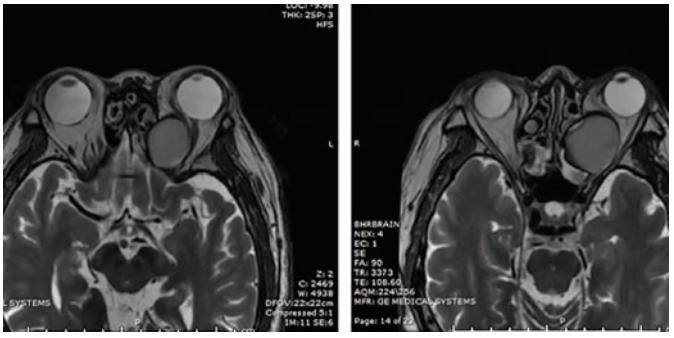


Figure 5: MRI orbit, T2 axial. Left mass is uniform in texture, well contained within regular borders. Signal characteristics most consistent with mucocele. There is appreciable axial displacement of left globe.

PATHOPHYSIOLOGY

- Benign cysts lined with ciliated columnar epithelial cells that secrete mucous
- Typically occurs in 3rd to 4th decades of life
- Commonly due to obstruction of sinus ostium ventilation (e.g. inflammation, allergy, trauma, mass, idiopathic)
- 65 percent frontal sinus, 30 percent ethmoidal sinus and 1-10 percent maxillary or sphenoid sinus

TREATMENT

- Surgical evacuation

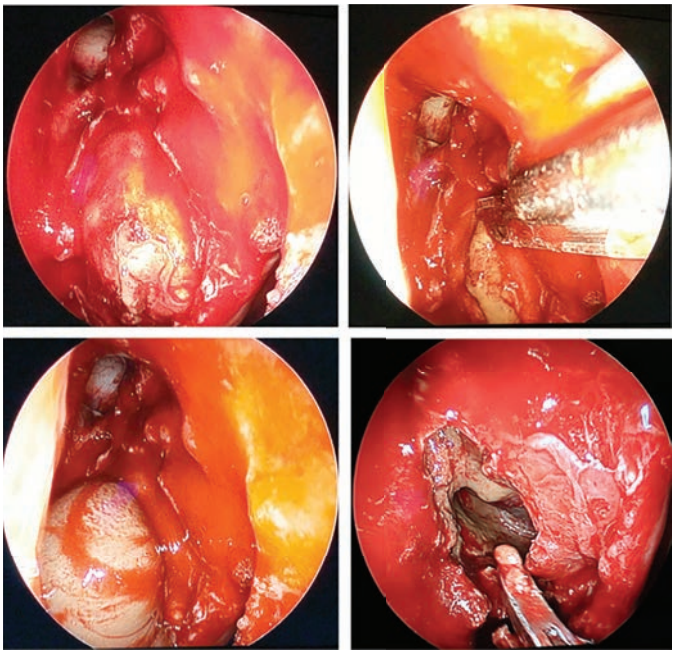


Figure 6: Surgical evacuation. Top left: mucocele wall. Top right: initial incision showing immediate drainage of mucopurulent material. Bottom left: mucocele evacuation. Bottom right: mucocele wall biopsy.

- Biopsied left middle turbinate and mucocele wall: chronic inflammation. No significant eosinophils, fungal organisms or malignancy
- After opening up the mucocele and removing a lot of the lining of the mucocele, the eye and orbit was "pushed" externally to aid in evacuation of the mucocele

PROGNOSIS AND FUTURE DIRECTIONS

- Post-op week 2: visual acuity now baseline at 20/25 OD, 20/25 OS
- We expect long-term good prognosis for this patient

Figure 7: Post-op week 2. Proptosis OS resolved. Extraocular motility intact in both eyes.

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TO EXPLORE OUR ENTIRE CASE STUDY ARCHIVE, PLEASE VISIT: EYE.KECKMEDICINE.ORG/GRAND-ROUNDS

The End to Blindness is in Sight *with a* ***Generous $10 Million Gift***

(L to R): Keck Dean Dr. Laura Mosqueda, Charlotte Ginsburg, Dr. Allen Ginsburg, Dr. Mark Humayun and Interim President Dr. Wanda M. Austin.

Dr. Allen and Charlotte Ginsburg made a historic contribution to vision science research with **a generous $10 million gift to name the USC Dr. Allen and Charlotte Ginsburg Institute for Biomedical Therapeutics (IBT).** Dr. Allen Ginsburg, a retired ophthalmologist, and his wife Charlotte, a philanthropist, share IBT's values of fostering multidisciplinary collaborations to save and restore sight.

Led by Dr. Mark Humayun, USC Ginsburg IBT's foundation is built upon the convergence of ophthalmology and engineering, transforming bioengineered neural interfaces into treatments for patients who suffer from the most debilitating neurosensory disorders. Research breakthroughs by Dr. Humayun and his team of experts include the development of the first FDA-approved artificial retina implant, Argus II, and stem cell-based treatments for devastating eye diseases.

(L to R): USC Provost Dr. Michael Quick, Vice Chair Dr. Martin Heur, Chairman Dr. Narsing Rao, SVP and CEO for USC Health Tom Jackiewicz, USC Ginsburg IBT Director Dr. Mark Humayun, Keck Dean Dr. Laura Mosqueda.

Celebrating 43 Years of PRESERVING, PROTECTING & RESTORING SIGHT

Laureate Awardee
Dr. A. Linn Murphree
Honored for his significant contribution to ocular oncology and retinoblastoma treatment innovations

On Friday, June 15th, USC Roski Eye Institute faculty, staff, residents and fellows came together to celebrate the **department's latest innovations across all subspecialties of opthalmology,** hosted at home on our Health Sciences Campus.

Highlighted topics include: reducing infant blindness through innovative telemedicine, the aqueous humor as a surrogate tumor biopsy for retinoblastoma, gene therapy in ophthalmology, and combating eye injuries with a reversible superglue, to name a few.

This year's speakers consisted entirely of USC ophthalmology faculty and residents, including Hossein Ameri, MD, PhD, Jesse Berry, MD, Jessica Chang, MD, Kimberly Gokoffski, MD, PhD, Thomas Lee, MD, Andrew Moshfeghi, MD, MBA. A. Linn Murphree, MD, Aaron Nagiel, MD, PhD, Vivek Patel, MD J. Bradley Randleman, MD, Alena Reznik, MD and Benjamin Xu, MD, PhD.

TRAINING *the* NEXT GENERATION *at* LAC+USC

The 600-bed **Los Angeles County + USC Medical Center is one of the largest public hospitals in the country and one of the premier academic teaching hospitals in the nation.** The USC Department of Ophthalmology is the exclusive provider of vision care at LAC+USC Medical Center, the hub of a Los Angeles County health system that serves 10 million people. This presents multiple opportunities to provide a wide array of complex, clinical care that profoundly enhances people's lives.

Our voluntary faculty members play an essential role in the education and training of our residents at LAC+USC. Their knowledge and expertise enhances our educational mission, and helps us provide outstanding care.

LAC+USC
HEALTHCARE NETWORK

200 Patients per day

10 Surgeries per day

5 Ophthalmic subspecialties

LAC+USC Ophthalmology
Alumni Pay it Forward

ALUMNI BY THE NUMBERS

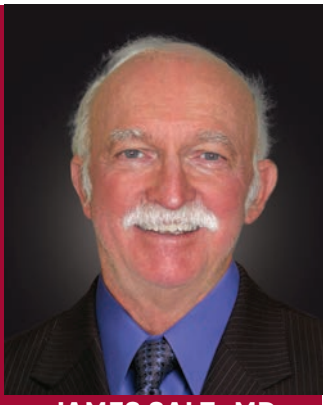
25 VOLUNTARY FACULTY

15 DEPARTMENT CHAIRS

266 RESIDENTS TRAINED

292 FELLOWS TRAINED

"Every time I assist the residents in cataract surgery, I am impressed by their skills, especially in the more difficult cases"



JAMES SALZ, MD

"The training was excellent and the camaraderie was life-changing"

DAVID BOYER, MD

"It is profoundly gratifying to be a part of the resident's training and follow their impressive careers"

DON SCHWARTZ, MD

"One of the great joys is meeting a former resident decades later who reminds me of the time I taught him or her to perform a certain procedure"

ALFRED MARRONE, MD

"I knew that I was training with the best of the best. I felt like it was my duty to pay it forward"

JONATHAN MACY, MD

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The USC Roski Eye Institute sees patients at the following locations:

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Los Angeles, CA 90033
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USC Roski Eye Institute - Arcadia
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For more information, please contact Rebecca Melville, executive director of development, at (323) 442-5396 or Rebecca.Melville@med.usc.edu