USC Eye Institute

ACCOLADES AND ACHIEVEMENTS

• Ranked among the nation’s top 10 ophthalmology programs for 20 years by U.S. News & World Report.

• Ranked among the nation’s top 10 ophthalmology programs by Ophthalmology Times.

• Ranked in the top 10 for research funding by the National Eye Institute.

• Headquarters of two California Institute of Regenerative Medicine (CIRM) grants since 2012. USC leads the development of a translational stem cell-based treatment for age-related macular degeneration. CIRM funds stem cell-based research at institutions throughout California with the goal of developing new therapies for diseases and disorders.

• Headquarters of the National Science Foundation (NSF) Biomimetic MicroElectronic Systems Engineering Research Center since 2003. USC leads an NSF-funded national center for developing electronic devices that can be implanted to treat diseases, conditions and injuries.

• Headquarters of the Department of Energy (DOE) Artificial Retina Project since 2002. USC leads a DOE-funded consortium whose goal is to develop a bioelectronic retinal implant to restore sight to the blind.

• António Champalimaud Vision Award in 2012 for outstanding scientific research in the field of vision science — Carmen A. Puliafito, MD, MBA, dean of the Keck School of Medicine of USC.

• One of the nation’s top 1 percent of Ophthalmologists in 2012 by U.S. News & World Report — Mark S. Humayun, MD, PhD.

• Top Doctors for 2014: USC ophthalmologists named America’s Top Doctors - Los Angeles 8; Pasadena Magazine 17; Hollywood Reporter 8.

• 17 current United States ophthalmology chairs are former faculty members and graduates of Keck School of Medicine of USC Department of Ophthalmology training programs.
Vision is Our Mission

Although the research, care and education we deliver is complex, our mission is very simple. Our physicians and researchers come to work every day with a single goal: to transform the lives of people who experience — or are threatened by — vision loss.

History has honed our skill and capabilities. This year, we celebrate 40 years of life-changing research, skilled, compassionate care, and leadership in education.

The future inspires hard work and compassion. We envision a world where one of humankind’s greatest fears — losing sight — is a thing of the past.

How will we get there? With insights we have learned over four decades:

**Insight in Research:** An outside-the-box, innovative research program that tackles the toughest of challenges — from diagnosing and treating imperiled eyesight in utero to putting stem cells to work to solve age-related macular degeneration to building a working artificial retina that will restore sight to the blind.

**Insight in Patient Care:** A commitment to taking care of people, to listening, to crafting the very best solutions to the challenges our patients face. Good enough is never good enough. Bench scientist, front-line physician, staff — we all collaborate across disciplines to deliver the gift of sight.

**Insight in Education:** More than 400 young physicians applied for six spots in our residency program. Our program is widely known as among the toughest in the country. We attract the best, the brightest and the fiercely dedicated. Little wonder that USC Eye Institute thrives in supplying the world with the next generation of leaders.

After 40 years, these are our insights. And like true Trojans, we will fight on until we achieve our mission: Vision for all. We invite you to join our mission. With your support and your advocacy, we see a clear path to success.

Sincerely,

Rohit Varma, MD, MPH
Grace and Emery Beardley Professor Chair,
Department of Ophthalmology, Keck School of Medicine of USC;
Director, USC Eye Institute
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Vision is Our Mission

PROTECTING
USC Eye Institute is an international leader in studying the epidemiology of eye disease among diverse populations.

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

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

Fulfillment of our mission is best expressed in the remarkable triumphs of our patients. Read their stories in the pages ahead.
When a wine glass shattered and sent a shard slicing into his left eye, Abe Spigner was sure he would lose his vision.

Abe was rushed to USC Verdugo Hills Hospital and then transferred to LAC+USC Medical Center for primary surgical repair of his eye. Two days later at the USC Eye Institute, retinal specialist Lisa Olmos de Koo, MD, and cornea surgeon J. Martin Heur, MD, PhD, planned and performed successful surgery to save Abe’s left eye.

A month later, the vision in Abe’s left eye suddenly worsened and he returned to the USC Eye Institute. Diagnosed with a retinal detachment, he underwent surgery that included inserting a gas bubble into his eye to hold the retina in place as it healed.

Required to remain face down for seven days following surgery to keep the bubble in the proper position, Abe occupied himself by building a radio-controlled truck. In the process, he contributed to a very positive outcome — and rekindled a hobby from his childhood.

In the months since surgery, Abe’s left eye has healed fully and he now has 20/30 corrected vision.

Abe Spigner
Ocular Laceration, Retinal Detachment

OCULAR HISTORY
3/16/14 Ocular laceration OS resulting in open globe, traumatic cataract and vitreous hemorrhage. Presented with LP vision and at risk for permanent blindness.

TREATMENT
• 3/16/14 Primary closure surgery.
• 3/18/14 Evaluation revealed hyphema, traumatic cataract and vitreous hemorrhage.
• 3/11/14 Planned surgery: vitrectomy and lensectomy and AC washout to clear blood.
• 4/28/14 Sudden vision change. Diagnosed with macula-on retinal detachment.
• Emergency surgeries: retinal detachment repair with scleral buckle vitrectomy and gas tamponade wound revision.

OUTCOME
20/30 best corrected vision (aphakic with contact lens) in left eye.
Since its founding 40 years ago, the Department of Ophthalmology of the Keck School of Medicine of USC has pioneered many discoveries that contribute to the advancement of vision science and clinical ophthalmology.

Our faculty has a long tradition of seeking and sharing knowledge to help protect, preserve and restore precious eyesight.

In the pages that follow, we highlight significant achievements by current and former USC Department of Ophthalmology faculty members.

**Major Breakthroughs by USC Department of Ophthalmology Faculty**

**2000–2014**

2014 Implanted a programmable micropump smart device that delivers precise small doses of medications into the eyes of patients with diabetic macular edema, in the first-in-man clinical trial

2014 Discovered which retinal cells mutate to become retinoblastoma

2013 Received Argus II Retinal Prosthesis System approval by the United States Food and Drug Administration for patients with retinitis pigmentosa

2011 Began first clinical trials for an experimental therapeutic agent to treat Leber’s Hereditary Optic Neuropathy, a mitochondrial disease

2010 Developed a Web-accessible visual field test and analysis system for multicenter studies and touchpad device access

2009 Identified the unique mechanism of uptake in lacrimal gland for adenovirus 5 that may facilitate drug delivery

2005 Pioneered use of ultra-high speed Fourier domain optical coherence tomography (OCT) to improve glaucoma diagnosis

2002 Implanted the first artificial retina in a patient after beginning collaboration with the U.S. Department of Energy Office of Science in 1999

2000 Began the Los Angeles Latino Eye Study, the world’s largest investigation into eye disease in Latinos

**Optical coherence tomography (OCT)**, pioneered by Carmen A. Puliafito, dean of the Keck School of Medicine of USC, is an essential diagnostic tool used worldwide.

**Hyperspectral imaging**, being developed by USC Eye Institute researchers, is providing images of the retina that reveal its spectroscopic features in unprecedented detail.
Major Breakthroughs by USC Department of Ophthalmology Faculty

1978-1999

1999 Developed a noninvasive glucose-monitoring system using Raman spectrum signals from the aqueous
1998 Developed the Baerveldt® glaucoma implant for preserving vision in glaucoma patients by reducing eye pressure
1992 Addressed vision complications from AIDS by diagnosing and developing treatments for opportunistic eye infections and Kaposi’s sarcoma
1991 Pioneered Optical Coherence Tomography (OCT)
1987 Identified the gene that causes retinoblastoma
1987 Implanted the first artificial cornea in a pediatric patient
1979 Developed a laboratory model of choroidal neovascularization now widely used to study pathogenesis and treatment of subretinal neovascularization
1978 Developed a laboratory model of penetrating eye injuries that influences the management of trauma in humans

The Baerveldt® glaucoma implant, developed at USC, has become the global standard for glaucoma surgery.

The gel stent, developed by USC Eye Institute researchers, is implanted through a minimally invasive injection and has been shown to reduce intraocular pressure from glaucoma.

INSIGHT

Patient Care

In 2014, we had the privilege of treating many thousands of patients and families who were facing the possibility of loss of vision or blindness. People from all walks of life with a full spectrum of eye conditions relied on us to provide the most advanced care possible.

PIONEERING BREAKTHROUGHS, THEN AND NOW
Clinically Targeted, Culturally Personalized Care

Linda Lam, MD, specializes in medical and surgical treatment of retinal diseases. She also specializes in ensuring that the USC Eye Institute reaches patients where they live and addresses their very specific needs.

As medical director of the recently relocated and expanded ophthalmology clinic in Arcadia, CA, Lam is attuned to the clinical and cultural nuances of the predominantly Asian city.

The composition of the team of specialists and subspecialists in Arcadia reflects the residents’ greater susceptibility to myopia, narrow angle glaucoma, cataracts, dry eye, diabetic retinopathy and age-related macular degeneration.

The team can also address patients fluently in Mandarin, Cantonese, Vietnamese, Korean and Hindi, as well as Spanish and German.

To make it easier for patients to see eye specialists and keep their appointments, the new clinic is located in the center of the city, adjacent to a soon-to-be-built Metro station.

Effective, personalized care is based on welcoming patients, meeting their needs and removing barriers to care. The Arcadia location expansion is the latest example of how the USC Eye Institute is achieving this goal.

Comprehensive Clinical Services

Our team of ophthalmologists and technicians provide highly specialized eye care for patients of all ages.

CORNEAL AND EXTERNAL DISEASES
Comprehensive corneal evaluations, medical diagnostic services and computerized topography can often be performed during a single visit. Available diagnostic services include pachymetry, potential acuity measurement, microbiological studies and assessment of corneal topography using computerized corneal modeling technology.

GLAUCOMA
Glaucoma specialists provide comprehensive consultative, diagnostic, medical and surgical services. Faculty members are involved in an NEI-sponsored, multicenter clinical trial studying the efficacy and safety of early surgery in the treatment of glaucoma.

NEURO-OPHTHALMOLOGY, ORBITAL AND ADULT STRABISMUS
Specializing in disorders of the optic nerve, chronic papillodema and orbital trauma, our physicians provide consultations, and medical and surgical services. Available diagnostic testing includes fluorescein angiography, ultrasonography, visual fields and electrophysiology.

OCULAR ONCROLOGY
Specialists provide a broad range of diagnostic, medical and surgical services with access to cancer specialists from USC Norris Comprehensive Cancer Center as needed. We specialize in the treatment of choroidal melanoma and other ocular tumors in adults, treatment of retinoblastoma and other ocular tumors in children and new treatment methodologies for intraocular tumors.

OPHTHALMIC PATHOLOGY
We provide macroscopic, microscopic and ultrastructural analysis of diseased eye tissues to aid in diagnosis. Advanced genomic, proteomic, and cytokentic techniques are also used to diagnose diseases at a molecular level.

OPHTHALMIC PLASTICS, ORBITAL AND RECONSTRUCTIVE SURGERY
Our physicians specialize in tissues surrounding the eyeball that affect the appearance or function of the eye. This includes diseases of the eyelids, the lacrimal system, the orbit and the facial areas adjacent to the eye. Ophthalmic plastic surgeons are board-certified ophthalmologists who have completed several years of additional, highly specialized training in plastic surgery.

PEDIATRIC OPHTHALMOLOGY
A full range of diagnostic and treatment methodologies are available through Children’s Hospital Los Angeles, including the ability to measure visual acuity in infants and preverbal children. Our specialists have expertise in diagnosis and treatment of ocular oncology, neuro-ophthalmology, retinal disorders and strabismus.

REFRACTIVE SURGERY
We were one of the few ophthalmic centers in the country involved in the FDA-supervised clinical trial testing of the efficacy of the excimer laser, and continue to be at the forefront of developments in refractive surgery.

UVETIS AND OCULAR INFLAMMATION
Our specialists evaluate the functional status of the immune system and detect infectious causes or neoplastic processes. Electron microscopic and immunohistochemical techniques often lead to diagnosis of rare diseases. Highly specialized services dealing with AIDS-related cytomegalovirus (CMV) retinitis are also available.

VITREORETINA SURGERY AND RETINAL DISEASE
We specialize in the repair of complex retinal detachments, offering advanced techniques such as silicone oil, perfluorocarbon liquids and SF6 and C3F8 gases. Our specialists have the surgical and research experience to repair penetrating trauma. Laser treatment of the retina for diabetic retinopathy can be performed with the argon, krypton, diode, or double frequency YAG laser.

FOR REFERRING PHYSICIANS
To consult with an ophthalmologist from the USC Eye Institute, or to schedule appointments, please call (800) USC-CARE (800-872-2273).
Ruby Chan
Bilateral Retinoblastoma

MEDICAL HISTORY
Premature birth. Diagnosed with retinoblastoma before she was barely term.
Germline mutation places her at greater risk for cancers.

OCULAR HISTORY
Bilateral retinoblastoma, the right eye involves the macula.

TREATMENT
Chemotherapy and laser therapy every 3-4 weeks since birth.

OUTCOME
Both eyes saved from cancer. Near normal vision expected in the left eye.

Ruby Chan was born prematurely and diagnosed with cancer in both of her eyes. She began treatment at Children’s Hospital Los Angeles with Jesse L. Berry, MD, USC Eye Institute specialist in ocular oncology. Ruby’s parents, Michael and Nellie, have taken Ruby for chemotherapy and laser therapy every 3 to 4 weeks since she was born. Ruby has made great progress. Both of Ruby’s eyes were saved, and her left eye is expected to have good vision.
Research

USC Eye Institute clinician-scientists drive fundamental and translational research to advance patient care by establishing relationships that foster innovation. Our clinician-scientists conduct bench clinical trials and train the next generation of ophthalmologists at clinical locations where patient-centered collaboration improves vision and fuels the development of new therapies.

Our research moves from patient to bench to bedside to meet the real needs of patients and enhance their lives.

Delivering Precise Drug Therapy for Retinal Disease

Effective treatment for eye diseases often depends on adherence to a carefully planned regimen of eye drops. Unfortunately, many patients are unable to stay on schedule or provide the correct dosage.

To improve patient compliance, researchers at USC Eye Institute developed a “smart” device to control medical dosing. A tiny, implantable pump delivers precise amounts of medication as required at the proper intervals directly into the eye. It is refillable, and is programmed and recharged wirelessly.

Originally developed for treating glaucoma, the second-generation micropump system is designed for retinal disease. It is smaller, has a greater reservoir volume and offers the possibility of multiple chambers for more than one medication. For retinal patients, localized delivery of medications into the eye has the advantage of eliminating possible systemic side effects.

In 2014, USC Eye Institute performed noninvasive surgery for the first-in-man implant of the novel ophthalmic medication-delivery system in patients with diabetic macular edema. The device is to verify the device’s feasibility for controlled drug delivery for chronic diseases of the retina. Further investigations will evaluate its effectiveness and be used to fine-tune its operation.

The micropump is practical and convenient to use. The medication reservoir can be refilled with up to 100 microliters within two minutes via a thin 31-gauge needle. It holds up to 12 months of medication before requiring a refill. The device has been shown to function effectively for up to seven years.

This second-generation micropump holds the promise of delivering microdoses of medication to an exact schedule so patients with diabetic macular edema experience optimal outcomes from therapy — without concerning themselves about putting drops in their eyes.

The World Health Organization estimates that only half of patients in developed countries follow treatment recommendations. This tiny pump has the potential for a huge impact.
Sheila Papayans
Age-related Macular Degeneration (AMD)

OCULAR HISTORY
Family history and long personal history of dry AMD in both eyes. Presented emergently after 1 day of distorted vision of left eye. Diagnosed with early wet macular degeneration of the left eye.

TREATMENT
Treated with intravitreal injections of anti-VEGF therapy to her left eye (Ranibizumab then aflibercept). Initial treat & extend protocol soon switched to PRN therapy. Had 8 injections in left eye over approx. 2.5 years. Took AREDS formula antioxidant eye vitamins to reduce the chances that the right eye would convert from dry to wet.

OUTCOME
Maintains excellent vision in both eyes, despite developing a potentially blinding retinal disease. Right eye has remained dry. Annual therapy of 3 injections per year is far below the national average. Vision is currently 20/25 in each eye.

Sheila Papayans watched helplessly as AMD took away her sister’s eyesight. Sheila had the same condition and was anticipating the same outcome. Attuned to any changes in her vision, Sheila noticed a sudden distortion in what she saw with her left eye. Wasting no time, she came to the USC Eye Institute. Lisa Olmos de Koo, a retinal specialist, confirmed that Sheila had early wet macular degeneration of the left eye and prescribed a regimen of therapeutic injections. Sheila agreed to start that very same day.

Treatment was highly successful, most likely because Sheila noticed symptoms early and responded immediately. Sheila also began taking age-related eye disease formula vitamins to reduce the risk of developing wet AMD in her right eye.

Two years later, Sheila has no further symptoms of wet AMD in her left eye. Her right eye, highly susceptible to wet AMD, remains dry. Now enjoying good vision in both eyes, Sheila remains vigilant and grateful.

Initial OCT image shows wet macular degeneration of the left eye. Second image taken 17 months later shows marked improvement after treatment.

Lisa Olmos de Koo, MD, MBA, assistant professor of clinical ophthalmology, specializes in medical and surgical treatment of complex retinal diseases. She is also the primary investigator on clinical trials for the Argus artificial retina.
Currently Active Fundamental Research Funding: Department of Ophthalmology, Keck School of Medicine of USC
as of January 2015

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<th>PROJECT</th>
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<td>Snapshot Retinal Imaging Mueller Matrix Polarimeter</td>
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<td>Molecular Remedy of Mitochondrial Defects</td>
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<td>Restoring vision by sheet transplants of retinal progenitors and retinal pigment epithelium (RPE) derived from human embryonic stem cells (hESCs)</td>
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<td>An Experimental Approach to Maculopathy</td>
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<td>Zebrafish Model of Human Corneal Development and Disease</td>
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<td>Phase 1 Safety Assessment of CPCB-RPE1, hESC-derived RPE Cell Coated Paraffin Membrane Implants, in Patients with Advanced Dry Age Related Macular Degeneration</td>
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<td>Los Angeles Latino Eye Study</td>
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Implanting Stem Cells to Overcome AMD

Researchers at the USC Eye Institute are working to restore vision to patients with advanced age-related macular degeneration (AMD). By growing thin sheets of stem-cell derived cells and surgically implanting them into the eye, they plan to replace diseased sheets in hope of restoring the retina’s critical light-sensitive cells.

USC stem cell researchers identified a stem cell line that contains the characteristics of normal adult retinal pigment epithelium (RPE) cells. USC bioengineers developed a material that can act as a supporting platform for RPE cells to allow them to function normally. Their collaborative advancements will be at the center of Phase I clinical trials expected to begin within two years.

Retinal-cell implants have the potential to improve the lives of an estimated 1.75 million people in the United States who have AMD — the leading cause of vision loss and blindness among the elderly.
Protecting Vision through Community Health Research

Through an ongoing series of comprehensive studies, principal investigator Rohit Varma, MD, MPH director of the USC Eye Institute, is defining important differences in eye disease among different ethnic groups.

Many of the studies, the first of their kind ever conducted, are identifying major risk factors. This new knowledge leads to improvements in vision care and informs the government in setting effective goals for preventive eye care and treatment.

LATINOS
Among Latinos with Type 2 diabetes, Native-American ancestry is a significant risk factor for diabetic retinopathy, the leading cause of blindness in working-age adults in the United States, affecting more than 4 million Americans age 40 and older.

AFRICAN-AMERICANS
African-Americans bear heavier burden of diabetic macular edema (DME), one of the leading causes of blindness in diabetic patients in the United States. Although Latinos have the highest incidence of diabetes, more African-Americans suffer from its vision complications.

CHINESE-AMERICANS
Study is underway to obtain prevalence estimates of visual impairment, refractive error, diabetic retinopathy, open-angle and angle-closure glaucoma, lens opacities, and age-related macular degeneration in Chinese-Americans.

CHILDREN
Myopia (nearsightedness) and hyperopia (farsightedness) vary widely among children of different ethnic groups. For example, African-American children are most likely to have myopia but least likely to have hyperopia, compared to Latino and non-Hispanic white children.

Major Studies of Minority Populations
USC Eye Institute research about the prevalence and impact of eye diseases in many vulnerable populations includes:
- Los Angeles Latino Eye Study (LALES), 1999 – 2014
- Multi-Ethnic Pediatric Eye Disease Study (MEPEDS), 2003-2011
- Chinese-American Eye Study (CHASES), 2008-2011
- African-American Eye Disease Study (AFEDS), 2013-2018

Identifying the Cause of Retinoblastoma
Retinoblastoma is an eye cancer that usually affects children one to two years of age. Although rare, it is the most common malignant tumor of the eye in children. Left untreated, retinoblastoma can be fatal or result in blindness.

USC Eye Institute faculty researcher David E. Cobrinik, MD, PhD, and his colleagues made a major breakthrough in 2014 by identifying the type of cell and signaling pathways that lead to the development of retinoblastoma.

Cobrinik’s research discovered that retinoblastomas originate in immature cone photoreceptor cells that have not fully differentiated. When the RB1 gene in those cells mutates, it no longer encodes a tumor suppressor protein (Rb) that prevents excessive cell growth, resulting in the development of retinoblastoma tumors.

These findings significantly advance our understanding of cancer because they more generally imply that cancers can develop through the collaboration between a cancer-causing mutation — in this case, inactivation of the RB1 gene — and the circuitry of the cell of origin that sensitizes Rb protein loss.

Ultimately, Cobrinik and his research team aim to characterize the cell type-specific signaling pathways that collaborate with RB1 inactivation, as a means to identify therapeutic targets for retinoblastoma and other cancers.
Harry Svoboda
Advanced Glaucoma

MEDICAL HISTORY
Advanced primary open-angle glaucoma, right eye. Unaffected left eye.

OCULAR HISTORY
Elevated intraocular pressure to 40 mmHg in the right eye despite maximum medical therapy including Diamox. No evidence of ocular ischemic syndrome (carotid duplex negative). No CNS pathology. No evidence of trauma. No inflammation or steroid use.

TREATMENT
Trabeculectomy with subconjunctival injection of Mitomycin-C prior to surgery, resulting in less trauma and greater diffusion.

Harry Svoboda’s glaucoma went undiagnosed for many years because it presented in just one eye and had not caused any discomfort. When Harry’s right eye became irritated consistently, she sought help and was finally was diagnosed with glaucoma.

Wanting the best of care, Harry drove more than two hours to the USC Eye Institute for an appointment with glaucoma-specialist Alena Reznik, MD. Initially, Dr. Reznik prescribed a regimen of eye drops. When that proved ineffective, she performed a specialized procedure that included injection of an anti-scarring agent.

Harry’s eye pressure soon decreased to normal levels. Dr. Reznik now keeps an eye on Harry’s eye pressures, so Harry can continue to enjoy life to its fullest.

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<th>Date</th>
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<td>39</td>
<td>Initial presentation</td>
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<td>9/12/14</td>
<td>24</td>
<td>All topical drops, oral Diamox</td>
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<td>10/13/14</td>
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<td>Despite all topical drops</td>
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<td>Unable to tolerate Diamox</td>
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<td>POD 1 after trabeculectomy with</td>
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<td>subconjunctival injection of Mitomycin C</td>
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<td>11/17/14</td>
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Alena Reznik, MD, assistant professor of clinical ophthalmology, notes that Harry’s last name, Svoboda, which means “freedom” in Russian, fits well with the preservation of Harry’s sight and her freedom to enjoy life to its fullest.
TOP 10 PUBLICATIONS BY USC EYE INSTITUTE FACULTY PRIMARY INVESTIGATORS


5. Amir Kashani, MD, PhD


9. Rohit Varma, MD, MPH


For glaucoma patients who no longer respond to medications or laser trabeculoplasty, trabeculectomy and tube shunt procedures are the most effective treatments because they lower intraocular pressure (IOP) rapidly. For decades, they have been the most-performed glaucoma surgeries worldwide.

Despite their proven effectiveness, trabeculectomies and tube shunts are highly invasive and have a one-year complication rate as high as 50 percent for high-risk glaucoma patients. Outcomes also have shown a high degree of variability that can lead to too little or too much intraocular pressure reduction (IOP). Over time, shunts can become less effective and require replacement.

Researchers at USC Eye Institute have developed a more effective alternative — a soft stent made of permanent, collagen-derived gelatin. Approximately the width of a human hair, the stent is injected into the eye through a small, self-sealing corneal incision. It creates a gentle outflow of fluid from the eye’s anterior chamber into the surrounding subconjunctival tissue. This pathway for drainage has been proven effective and is preferred by physicians worldwide.

The gel stent is pliable, non-inflammatory and conforms to eye tissue, which is likely to minimize issues with migration, erosion and corneal endothelial damage often seen with synthetic materials. The presoaked injector enables standardized minimally invasive insertion of the stent. International clinical trials have shown that the gel stent significantly and safely lowers intraocular pressure.

The gel stent is approved in Europe for primary open angle glaucoma where other treatment methods have failed. In the United States, it is an investigational device, awaiting approval by the U.S. Food and Drug Administration. This breakthrough holds the promise to prevent glaucoma-related vision loss through a broadly adaptable 10-minute procedure. Glaucoma is the world’s No. 2 cause of blindness and affects more than 60 million people worldwide.
Emily Mangel
Complex Corneal Disease

MEDICAL HISTORY
Fetal varicella affected right eye, right leg, and left arm/hand.

OCULAR HISTORY
Keratoconjunctivitis sicca, neurotrophic keratitis, perforated cornea, penetrating keratoplasty and tarsorrhaphy.

TREATMENT
Prosthetic replacement of the ocular surface ecosystem (PROSE.)

OUTCOME
SVx VA improved from 20/200 OD to 20/30 OD. Enhanced ocular surface protection.

Emily Mangel was born with congenital varicella syndrome, a rare disease that causes various abnormalities of the body. For Emily, the disease affected her right eye, right leg, and left arm and hand. Over many years of treatment at Children’s Hospital Los Angeles (CHLA), Emily made tremendous progress in overcoming her challenges.

For her right eye, she began treatment at CHLA with Mark Borchert, MD, and Jonathan Song, MD, corneal specialist at USC Eye Institute, when she was five years old. As Emily grew up, she underwent a variety of surgeries and procedures to preserve the vision in her right eye. In 2013, she experienced dramatic improvement in her vision when she took advantage of an innovative treatment — prosthetic replacement of the ocular surface ecosystem, or PROSE.

Gloria Chui, OD, fitted Emily with the specialized lens and helped her learn how to insert and remove it, despite having use of only one hand. Emily mastered the use of PROSE and the vision in her right eye improved from 20/200 to 20/30 with correction.

A trio of USC Eye Institute specialists have provided 18 years of continuous care for Emily’s complex vision challenges. Mark Borchert, MD, (left), Gloria Chui, OD, (center), Jonathan Song, MD (right)

The gas-permeable PROSE lens creates a smooth optical surface above the cornea and floats on a reservoir of sterile saline solution.

Emily began treatment with Jonathan Song, MD, when she was 5 years old, shown here in a Peter Pan costume for Halloween.
Advancing Imaging of the Retina

Clinician-scientists at the USC Eye Institute, long-time innovators in ocular imaging, continue to develop new technologies to advance diagnosis and treatment of eye disease.

OCT angiography eliminates need for dye injection

To assess the health of blood vessels in the retina, physicians commonly use fluorescence angiography by injecting dye into a patient’s arm vein and taking photographs of the eye with a special camera that highlights the dye as it circulates in the retinal vessels.

OCT angiography can reveal the changes that occur in diseases such as diabetic retinopathy and retinal vein occlusion much like fluorescence angiography, but without the risk or discomfort of any injection procedure. Once FDA approved, it is likely that OCT angiography will become an important diagnostic tool to help diagnose and treat retinal diseases in the future.

Hyperspectral imaging provides unprecedented detail

The information available from hyperspectral imaging holds great promise for expanding the understanding of retinopathy, retinal vein occlusions, choroidal neovascularization, and melanoma, leading to advancements in diagnosis and treatment.

USC Eye Institute researchers have built a camera that can measure the spectroscopic features of the retina in unprecedented detail. The camera acquires images in seconds without injections or other discomfort of any injection procedure.

Using hyperspectral imaging, studies have demonstrated that patients with advanced forms of diabetic retinopathy have significant changes in the amount of oxygen in the retinal blood vessels. This may suggest that the retina is not receiving the appropriate amount of oxygen in this disease.

The information available from hyperspectral imaging holds great promise for expanding the understanding of retinopathy, retinal vein occlusions, choroidal neovascularization, and melanoma, leading to advancements in diagnosis and treatment.
Margaret Hanopulus was born with strabismus. The alignment of her eyes was corrected with surgeries when she was a toddler and a teenager. Since then, her eyes gradually drifted out of alignment, and it really didn’t matter.

After suffering a stroke and then successfully undergoing surgery for an aneurysm, Margaret decided that the idea of corrective eye surgery was not a big deal. She consulted Vivek Patel, MD, a neuro-ophthalmology specialist at the USC Eye Institute.

Dr. Patel performed strabismus surgery using an adjustable suture technique that enables exceptional precision and long-term maintenance of correct position. Now Margaret’s eye alignment is the same as it was in her teenage years, and so is her outlook on life.

The adjustable suture technique affords remarkable precision and safety even for patients who have experienced multiple strabismus surgeries in the past.
USC Eye Institute Collaborators

To advance vision science and clinical ophthalmology, USC Eye Institute collaborates with many other research organizations. We are grateful for their partnership and acknowledge their efforts in a variety of major initiatives.

INDIVIDUALS

**Bioengineering Initiative**

**COLLABORATOR**

- Theodore Berger, PhD
- John Van Horn, PhD
- Leroy Hood, MD, PhD
- Scott Holland, PhD
- Kristina Tarczy-Hornoch, MD
- Joanne Katz, ScD
- James Duncan, PhD
- Ian Foster, PhD
- Jerome Engel, MD
- Jeromy Angell, PhD
- Scott Holland, PhD
- Verny Hood, MD, PhD
- John Van Horn, PhD

**ORGANIZATION**

- University of Pittsburgh, PA
- University of Chicago, IL
- Seattle Children’s Hospital, WA
- National Eye Institute
- Arizona State University
- Oklahoma Medical Research Foundation

**COMPANIES**

- Abbott Medical Optics
- Advanced Bionics
- Alcon
- Allergan
- Aquasys
- Bausch & Lomb
- Biotheranostics
- Carl Zeiss Meditec
- Carl Zeiss Meditec
- Genetech
- Harrow Precision Technologies

**USC EYE INSTITUTE COLLABORATORS**

- 90% U.S. Research Institutions within California
- 8% U.S. Research Institutions outside California
- 10% International Research Institutions
- 6% University of Southern California

**Factors Contributing to Vision Science and Research**

- USA 41%
- California 46%
- California 9%
- International Research 04%

**Ocular Epidemiology**

**COLLABORATOR**

- Stanley Azen, PhD
- Darryl Song, MD
- Thomas Gauderman, PhD
- Jeanne Katz, PhD
- Ronald Klein, MD
- Roberta Richter-Cooper, PhD
- John M. D’Antonio
- Jeremy Robson, PhD
- Kristina Tarczy-Hornoch, MD
- Tan Weng, MD, PhD

**ORGANIZATION**

- USC (Preventive Medicine)
- University of Illinois at Chicago
- USC (Ophthalmology)
- USC (Preventive Medicine)
- USC (Preventive Medicine)
- USC (Permanente Medical Group)
- University of Pennsylvania
- USC (Preventive Medicine)
- Southern California

**Fulfilling the Promise of the Blind**

The world’s first retinal prosthesis reached another milestone in 2014, Lisa Kulik, blinded by retinitis pigmentosa, became the first person on the West Coast to be implanted with the recently FDA-approved Argus II. Lisa Olmos de Koo, MD, MBA, performed the four-hour procedure at the Keck Medical Center of USC.

On the first day of activation, Kulik was already ahead of expectations as she was able to see spots of light. At a 4th of July celebration, she was thrilled to see the light and movement of fireworks. Progress continues as Kulik learns to interpret the signals sent by Argus II. Confident that her participation in Argus II research is leading further development of Argus II.

**RESEARCH**

- 35% University of California
- 20% National Institutes of Health
- 10% Department of Defense
- 5% Other Departments

**Argus II** is comprised of an eyeglass-mounted camera that sends signals to an implanted 60-electrode receiver, which transmits them to the retina. Signals travel the optic nerve to the brain where they can be interpreted as a visual picture.

During months of follow-up testing, Kulik will train her brain to see in a new way, interpreting the signals sent by Argus II.
Clinical Education

Priority is on training, mentoring and inspiring future leaders in four diverse and highly acute clinical and surgical settings:

- USC Eye Institute at Keck Medical Center of USC, ranked as a top 10 program by U.S. News & World Report for 20 years
- Children’s Hospital Los Angeles (CHLA), ranked among the top five children’s hospitals in the U.S.
- Los Angeles County (LAC) + LAC Medical Center, one of nation’s largest public hospitals
- VA Downtown Los Angeles Medical Center, serving the needs of generations of veterans.

As one of the most funded eye institutes in the world, the USC Eye Institute collaborates across disciplines with a wide variety of industries and institutions. It is an ideal interdisciplinary environment for physicians who have a passion to be an important part of internationally recognized, cutting-edge vision science.

Medical Education

Keck School of Medicine of USC has 27 basic science and academic departments with more than 1,500 full-time faculty members. Future physicians receive comprehensive training from an ophthalmology faculty that has been ranked in the top 10 nationally by U.S. News & World Report for 20 years.

Exceptional Clinical Education

The USC Eye Institute provides a residency and fellowship training experience with unique clinical and research opportunities.
UVEITIS

OCULAR HISTORY
Referred for 2 weeks of uveitis of unclear etiology, found to have a multifocal serpiginoid pattern of chorioretinal inflammation in both eyes thought to be of herpetic origin.

TREATMENT
Treated with antivirals with dramatic improvement in 2 days then started on oral steroids.

OUTCOME
20/30 best corrected vision (aphakic with contact lens) in left eye.

Without warning, both of Stan Bard’s eyes suddenly became red and his vision began to blur. He thought the problem was temporary irritation that would go away, but it became worse. Stan consulted several eye specialists, but none was able to offer lasting relief. He became increasingly alarmed when he could neither focus on objects at an arm’s length, nor read.

After two weeks, Stan’s search for an answer led him to Narsing Rao, MD, a specialist in eye inflammation and pathology at USC Eye Institute. Although unable to determine the exact cause, Dr. Rao had the solution. He placed Stan on antiviral medications, followed a course of oral antibiotics.

Stan’s eye showed marked improvement after several days. Redness disappeared and his vision returned to near normal.
Residents

Each year, the USC Eye Institute recruits exceptional residents. The incoming cohort of six residents for 2014-15 was accepted from more than 400 applicants.

Fellows and Clinical Instructors

The USC Eye Institute offers clinical fellowship training in six subspecialty areas, including cornea and external disease, glaucoma, neuro-ophthalmology, ophthalmic plastic surgery, retina and uveitis.

Informal research fellowships are also awarded by each service and laboratory independently. USC attracts promising academic phthalmologists from around the world who spend one or two years participating in research programs. Many return to their home countries where they assume positions of national or international leadership.


