Improving the lives of people who experience vision loss is the focus of everything we do at the USC Eye Institute and USC Department of Ophthalmology and at the Keck School of Medicine. As we educate tomorrow’s medical leaders, we work together to provide excellent patient-centered clinical care and the most advanced vision research.

Our success is built on an unconventional approach that drives innovation:

**PLACING PATIENTS FIRST.** The customary research path for developing new therapies is “from bench to patient.” Instead, we start with an unmet medical need and move from patient to bench and then back to the patient. By seeing the process differently, we develop innovative therapies that improve lives.

**CROSSING BOUNDARIES.** Interdisciplinary medical research and development thrive because we cross typical boundaries between various disciplines, as well as those between outside institutes and organizations, in pursuit of the common goal of maximizing the benefit to patients.

In this report, we highlight how the USC Eye Institute and USC Department of Ophthalmology at the Keck School of Medicine work to alleviate the suffering caused by vision loss and blindness.

Sincerely,

Rohit Varma, MD, MPH
Incoming Chair, Department of Ophthalmology
Incoming Director, USC Eye Institute
Incoming Associate Dean, Keck School of Medicine of USC

Mark S. Humayun, MD, PhD
Interim Chair, Department of Ophthalmology
Co-Director, USC Eye Institute
Keck School of Medicine of USC
Leadership Profiles

Rohit Varma, MD, MPH

Announced in Feb. 2014, Dr. Varma will serve as Director of the USC Eye Institute; Chair of the Department of Ophthalmology; Professor of Ophthalmology; and will hold the Grace and Emery Beardsley Chair in Ophthalmology. In addition, he will serve as Associate Dean for Strategic Planning and Community Network Development in the Keck School of Medicine to expand the health care network.

As one of the world’s leading experts in the epidemiology of eye diseases, Dr. Varma is the principal investigator of many major NIH-funded studies, including the Los Angeles Latino Eye Study (LALES), Multi-Ethnic Pediatric Eye Disease Study (MEPEDS), African-American Eye Disease Study and the Chinese-American Eye Study. He also serves as principal investigator for studies on blindness and vision impairment for the World Health Organization.

Because of the importance of his work to protect and promote vision health for all Americans, Dr. Varma has been funded for the past 19 years by the National Eye Institute, part of the National Institutes of Health. Dr. Varma’s research also focuses on changes in the optic nerve in glaucoma, and includes the development of new imaging techniques to aid in the early diagnosis of glaucomatous optic nerve damage. He also is involved in the development of novel implantable intraocular pressure sensors and drainage devices that hold the promise for controlling or curing glaucoma.

Returning to USC after serving as chair of the department of ophthalmology and visual sciences and associate dean for strategic planning at the University of Illinois at Chicago College of Medicine, Dr. Varma will assume his positions at Keck Medicine of USC on Aug. 16, 2014.

Professional Leadership
Institute of Medicine Roundtable on Health Disparities Chair, American Academy of Ophthalmology Public Health Committee
Editorial Board of Ophthalmology, the Journal of the American Academy of Ophthalmology
Board of Scientific Counselors of the National Eye Institute National Eye Health Education Planning Committee

Honors and Awards
Research to Prevent Blindness Career Development Sybil B. Harrington Scholar
American Academy of Ophthalmology Senior Achievement Award
Glaucoma Research Foundation President’s Award
Association for Research in Vision and Ophthalmology Fellow Silver Award
Best Doctors in America

Mark S. Humayun, MD, PhD

Currently serving as interim Chair of the USC Department of Ophthalmology and Inaugural Director of the USC Eye Institute, Dr. Humayun is Director of the Institute for Biomedical Therapeutics; Director of Sensory Science Initiatives; Combes 2. Pings Chair in Biomedical Sciences; and University Professor of Ophthalmology, Biomedical Engineering, and Cell and Neurobiology. He will serve as Co-director of the USC Eye Institute in Aug. 2014.

As an internationally recognized leader in ophthalmology and biomedical engineering and research, Dr. Humayun led the 20-year development of Argus II, the world’s first artificial retina, recently approved by the U.S. Food and Drug Administration. Dr. Humayun heads a team of 15 different institutes that is dedicated to developing novel therapies for retinal degenerations such as retinitis pigmentosa, macular degenerations, retinovascular diseases, diabetic retinopathy and glaucoma. He also is the director of the National Science Foundation Biomimetic MicroElectronic Systems Engineering Research Center, as well as the director of the U.S. Department of Energy Artificial Retina Project.

Dr. Humayun came to USC in 2001 after serving as associate professor at Johns Hopkins University School of Medicine. He has joint faculty appointments at Keck School of Medicine of USC and USC Viterbi School of Engineering.

Professional Memberships
Member, Institute of Medicine of the National Academies
Member, National Academy of Engineering
Board of Scientific Counselors for National Space Biomedical Research Institute
IEEE-EMBS, the Biomedical Engineering Society
Association for Research in Vision and Ophthalmology
American Society of Retinal Specialists
Retina Society
American Ophthalmological Society
American Academy of Ophthalmology

Club: Jules Gorin

Awards and Honors
U.S. News & World Report Top Doctor
Fellow of the American Institute for Medical and Biological Engineering
Innovator of the Year Award from R&D Magazine
Best Doctors in America
2004 Senior Honor Award from the American Society of Retina Specialists
Jules Stein Living Tribute Award — The Vision Awards
Greve Scholars Award
Richard S. Ross Clinical Scientist Award

About the Cover
By developing advanced technologies, USC clinician-scientists now measure the molecular properties of eye tissue to reveal early pathological changes, without invasive procedures. The image shows concentrations of oxygenated blood around the normal optic nerve head. (Red represents higher; blue represents lower) These oxygen tissue maps can help identify the advent of diabetic retinopathy and other diseases to enable earlier treatment.
A dynamic relationship that fosters innovation makes USC Eye Institute and USC Department of Ophthalmology unique.

USC Department of Ophthalmology physicians provide excellent care in the full spectrum of specialties and subspecialties to our patients, establishing relationships that inform and enhance research. USC Eye Institute scientists drive fundamental and translational research to advance patient care.

Together, these clinician-scientists conduct 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.

Beyond connections within the Keck School of Medicine, the USC Eye Institute connects our clinician-scientists to experts at other leading USC schools, such as the Viterbi School of Engineering and its Information Sciences Institute, Dornsife College of Letters, Arts and Sciences; USC School of Cinematic Arts; and to dozens of industry partners.

USC Department of Ophthalmology connects our clinician-scientists at the Keck School of Medicine to other large, USC-affiliated clinical practice sites such as Children’s Hospital Los Angeles and the VA Greater Los Angeles Health System.

USC Eye Institute and USC Department of Ophthalmology Accolades and Achievements

- Ranked among the nation’s top 10 Ophthalmology programs for more than 10 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 (NEI)
- António Champalimaud Vision Award in 2012 for outstanding scientific research in the field of vision science — Carmen A. Puliafito, MD, MBA dean of 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 2013 by Pasadena Magazine — 16 USC ophthalmologists
- Ten current United States ophthalmology chairs are former faculty members and graduates of Keck School of Medicine of USC Department of Ophthalmology training programs
- Headquarters of two California Institute of Regenerative Medicine (CIRM) grants to develop a translational stem cell based treatment for age-related macular degeneration. CIRM funds stem cell 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 (BMES) for the past 10 years. NSF funds science and engineering research and education through grants and cooperative agreements throughout the United States. BMES is a 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 for the past 10 years, a consortium whose goal is to develop a bioelectronics retinal implant to restore sight to the blind. DOE provides funding to support U.S. science and engineering as a cornerstone of economic development and leadership in strategic areas.
To protect vision and prevent blindness, the USC Eye Institute and USC Department of Ophthalmology conduct comprehensive research about the prevalence and impact of eye diseases in many vulnerable populations.

Informing public health policies that protect vision

The Los Angeles Latino Eye Study (LALES), conducted between 2000 and 2014, is the nation’s largest and most comprehensive study of vision in Latinos. The study demonstrated that adult Latinos have a higher rate than the general population for developing visual impairment and blindness: Of those age 80 and older, almost 20 percent were visually impaired and almost 4 percent were blind.

As a result of LALES, the government changed its Medicare program in 2006 to extend the glaucoma screening benefits to Latinos age 65 and older. In 2010, the American Academy of Ophthalmology and its partners conducted the first “Eye Smart Eye Check” vision screening to combat undetected eye disease and visual impairment in the Latino community.

By gathering data from defined patient groups, Dr. Varma and his colleagues identify risk factors and help set the government’s goals for preventive eye care and treatment.
Identifying vulnerable groups and risk factors

The prevalence of vision problems differs among Americans. By understanding the commonality and severity of eye disorders in various groups, vision-care providers can take more effective steps to detect and treat problems early to avoid vision loss and prevent blindness.

Through a series of major studies, principal investigator Rohit Varma, MD, MPH, an ophthalmologist and professor of preventive medicine at Keck School of Medicine of USC, has greatly expanded the body of knowledge in the epidemiology of eye disease. Funded by the National Institutes of Health, his studies include the Los Angeles Latino Eye Study (LALES); the Multi-Ethnic Pediatric Eye Diseases Study (MEPEDS); African-American Eye Disease Study; and the Chinese American Eye Study (CHES), which began in 2013. Most studies were the first of their kind ever conducted.

• The vast majority of African-American and Latino children who were found to have either strabismus (crossed eye) or amblyopia (lazy eye) were undiagnosed and had not received care. Both disorders can be diagnosed and treated by age three to prevent future visual impairment.

• The risk of myopia (nearsightedness) and hyperopia (farsightedness) varied widely among children of different ethnic groups. For example, African-American children were most likely to have myopia but least likely to have hyperopia compared to Latino children and non-hispanic white children.

• Maternal smoking and lack of health insurance increased the risk of vision problems.

Community health research such as MEPEDS continues to illuminate dire needs that require the attention of the government, schools, physicians and families. Research also serves as a springboard for guiding vision research and developing health policy.
In 2013, Keck School of Medicine of USC Department of Ophthalmology had a total of nearly 100,000 patient visits and surgeries. This volume not only provides treatment and access to clinical trials to individual patients and their families, but also serves as a foundation for delivering new technologies and treatments.

Examples of the dozens of ophthalmology clinical trials in progress include:

- **A Phase 2, Multi-Center, Randomized, Double-Blind, Placebo-Controlled, Parallel-Group Study to Investigate the Safety, Tolerability, Efficacy, Pharmacokinetics and Pharmacodynamics of GSK33776 in Adult Patients With Geographic Atrophy Secondary to Age-related Macular Degeneration**
  - **Principal Investigator:** Srinivas Sadda
  - **Sponsor:** GlaxoSmithKline

- **A Multicenter, Paired-eye Comparison, Dose-escalation, Single Dose, 24-Month Study of Safety and Efficacy of Bimatoprost Preservative Free Intracameral Drug Delivery System (Bimatoprost PF IC DDS)**
  - **Principal Investigator:** Brian Francis
  - **Sponsor:** Allergan

- **A Prospective, Multicenter Clinical Trial to Evaluate the Safety and Performance of the AqueSys Implant in Patients with Refractory Glaucoma**
  - **Principal Investigator:** Brian Francis
  - **Sponsor:** AqueSys

- **Chronic and Acute Implant Human Clinical Trials**
  - **Principal Investigator:** Lisa Olmos
  - **Sponsor:** Second Sight

- **Nidek Advanced OCT/ILO System, RS-3000 Normative Data Collection Study**
  - **Principal Investigator:** Srinivas Sadda
  - **Sponsor:** Experien Group

- **Argus II Retinal Stimulation System Feasibility Protocol**
  - **Principal Investigator:** Lisa Olmos
  - **Sponsor:** Genentech

- **A Phase III, Multicenter, Randomized, Double-Masked Study Comparing the Efficacy and Safety of 0.5mg and 2.0mg Ranibizumab Administered Monthly or on an As-Needed Basis (PRN)**
  - **Principal Investigator:** Srinivas Sadda
  - **Sponsor:** Genentech

- **National Ophthalmic Genotyping and Phenotyping Network, Stage 1—Creation of DNA Repository for Inherited Ophthalmic Diseases**
  - **Principal Investigator:** Lisa Olmos
  - **Sponsor:** National Eye Institute

- **Multicenter Uveitis Steroid Treatment (MUST) Trial**
  - **Principal Investigator:** Narsing Rao
  - **Sponsor:** National Eye Institute

- **Cornea Preservation Time Study (CPTS)**
  - **Principal Investigator:** Neda Shamie
  - **Sponsor:** National Institutes of Health

To learn more about our clinical trials, please visit eye.usc.edu or call (800) USC-CARE (800-872-2273).
INTERDISCIPLINARY RESEARCH: JOINING FORCES

In October 2003, the National Science Foundation awarded USC $17 million to create research centers that are now part of the USC Eye Institute. They include the Biomimetic MicroElectronic Systems Engineering Research Center (BMES) and the Institute for Biomedical Therapeutics (IBT).

BMES

BMES is dedicated to the coordination of groundbreaking research into the development of biomimetic devices, which are designed and engineered to drive innovation by mimicking structures and functions found in nature. These devices are being developed to treat ophthalmic and neurological diseases, such as blindness and memory loss.

Having grown into a leading research center, BMES works with many academic institutions, government research labs and other industry partners — all passionately committed to the creation and advancement of novel, cutting-edge medical technologies.

BMES will be at the heart of Institute for Biomedical Therapeutics (IBT).

IBT

IBT’s mission is to increase the understanding of neurological diseases and impaired neurological systems to revolutionize the diagnosis and treatment of patients. It interfaces with eight USC schools and 14 distinct disciplines such as biomedical engineering, medicine, materials engineering, biology, biochemistry, biophysics, pharmacology, physiology, electronics and business.

USC schools contributing to IBT research include Keck School of Medicine; Viterbi College of Engineering; Dornsife College of Letters, Arts and Sciences; Marshall School of Business; Rossier School of Education and USC School of Cinematic Arts. Each academic entity plays a vital role in the process of developing innovative approaches to patients’ vision problems — from ideation of possibilities through the practical application and delivery of new techniques and technologies.

Establishment of the IBT enabled the development of the world’s first artificial and implantable retina for the blind and continues to drive breakthroughs such as the ability to bring light sensitivity to cells that normally would not respond to light. Beyond applications to vision science, this development has the potential to help patients with epilepsy and depression.

IBT is working to develop biomedical solutions to vision problems through novel approaches such as:

• Neuroelectronics — enhancing the interface between the nervous system and electronic devices to develop neural prostheses such as retinal and cortical implants;
• Neurophotonics — applying genetically coded photosensitive tools to further research in optical switches and nanoreceptors; and
• NeuroRx — developing systems to deliver drugs across the blood-brain and blood-ocular barriers.

An estimated 21.2 million Americans have significant vision loss. The USC Eye Institute and USC Department of Ophthalmology have a goal to reduce that number to zero.

INTERDISCIPLINARY COLLABORATION DRIVES FURTHER ADVANCES IN VISION SCIENCE

When the U.S. Food and Drug Administration approved the first artificial retina in 2013, it was the climax of more than 20 years of interdisciplinary collaboration among USC institutes, colleges, foundations, research centers and start-up companies. In addition to the successful debut of this Argus II, the effort yielded more than 400 publications, inventions, disclosures and other developments that are invaluable in the quest to alleviate human suffering by advancing medical science.

James D. Weiland, PhD, Associate Professor of Ophthalmology and Biomedical Engineering, Keck School of Medicine, is deputy director of the Biomimetic MicroElectronic Systems Engineering Research Center.

Scott Fraser, PhD, is a world leader in using advanced imaging techniques to capture biological processes. He is Provost Professor of Biological Sciences and Biomedical Engineering and the Director of Science Initiatives at USC Dornsife and USC Viterbi School of Engineering.
Restoring Sight to the Blind

In a major first step toward a medical solution for blindness, the world’s first implant of an artificial retina received approval by the U.S. Food and Drug Administration (FDA) in 2013 and its European counterpart in 2011, following more than 20 years of research and development.

The Argus II Retinal Prosthesis System was developed by Mark S. Humayun, MD, PhD, professor of Ophthalmology, Biomedical Engineering and Neurobiology, and his colleagues at USC. They worked in collaboration with Second Sight Medical Products Inc. to conduct a successful international clinical trial.

In 2013, the FDA approved Argus II for patients who have lost sight due to retinitis pigmentosa (RP), an inherited disease affecting one in every 4,000 Americans. This remarkable breakthrough works by converting video images, captured by a small eyeglass-mounted camera, wirelessly to an array of microelectrodes implanted onto a patient’s damaged retina. Small electrical pulses are transmitted by the microelectrode array to stimulate the retina’s remaining cells. This results in visual patterns of light, which patients learn to see and interpret as a visual image.

Argus II can help people who are completely blind locate objects, detect movement, improve orientation and mobility — and even recognize shapes and large letters. Since initial approval in the United States and Europe, the Argus II retinal implant has restored partial sight to more than 5,040 people.

Dr. Humayun and his colleagues are working to advance the artificial retina from the 60 electrodes used in the Argus II to 1,000 electrodes, vastly improving visual function, providing higher resolution and a larger visual field, and enabling color vision. It would go beyond the ability to discern light and shapes to provide a closer approximation to vision, including the ability to read.
Revolutionizing Diagnosis

The ability to detect major vision diseases before serious damage can take place is becoming a reality through a metabolic camera being developed by Amr H. Kazhmi, MD, PhD, assistant professor of ophthalmology, Dr. Humayun, and an interdisciplinary team of ophthalmologists, engineers and physicists.

The Metabolic Camera

Although current imaging of the retina provides detailed structural information, it is unable to assess retinal function. Retinal tissue has among the highest metabolic activity per area and the inability to assess it is a challenge for clinicians who are trying to treat retinal problems.

The few cameras that are in development to assess retinal function will not have the capability of the metabolic camera because their proposed ability to study retinal function is limited to just a few wavelengths.

The metabolic camera being developed at USC uses wavelengths across the electromagnetic spectrum to capture much more information from the retina. This non-invasive hyperspectral-imaging camera detects the abnormal changes in retinal metabolism that precede the irreversible changes of blinding diseases such as age-related macular degeneration (AMD), diabetic retinopathy, retinal vein occlusions and other ischemic retinal diseases.

Advancing Pediatric Ophthalmology

The Vision Center at Children’s Hospital Los Angeles (CHLA) provides expertise and treatment in virtually every pediatric ophthalmologic subspecialty. Each year at the Vision Center, Keck School of Medicine faculty, fellows and residents see more than 15,000 patients and perform more than 1,500 surgeries.

USC clinician-scientists also conduct research into diagnosis, treatment and prevention of vision loss in children. Their landmark achievements include:

• Identifying the gene that causes retinoblastoma (Rb), an eye cancer that most often occurs in children under five years of age
• Pioneering the concept of chemoreduction Rb treatment using systemic chemotherapy followed by focal laser or freezing heat
• Implanting the first artificial cornea in a pediatric patient in the United States
• Directing the largest-ever clinical research study in the treatment of optic nerve hypoplasia (ONH)

By developing new technologies and techniques, Keck School of Medicine of USC Eye Institute and USC Department of Ophthalmology specialists continue to advance children’s vision care.

Other Major Research Programs at the Vision Center of CHLA

Cornea Institute investigates the use of adult normal and refractive techniques in treatment of anisometropia and corneal scarring in children, the epidemiology of refractive disorders and anterior segment development.

Eye Birth Defects Institute is known worldwide for its extensive research program and successful outcomes for children with extraordinary eye disorders.

It is the leading research center in eye birth defects conditions of aniridia, coloboma, hydrophthalmus, hypopituitarism, morning glory syndrome, aphakic cataracts, optic nerve hypoplasia and septo-optic dysplasia.

Eye Technology Institute is a leader in discovering new advances in ophthalmic medical equipment and holds several patents throughout the United States, Canada and Mexico. It works with technology partners such as the world-renowned Jet Propulsion Laboratory and The California Institute of Technology to improve treatments for visual complex diseases.

Orbit & Eye Movement Institute is dedicated to studying the most effective methods for detecting ocular and muscle conditions, such as the usefulness of red reflex testing to find eye disease in children.

Retina Institute conducts research to expand knowledge about retinoblastoma, retinopathy of prematurity and other disorders, and developed new solutions for the children affected by them.

Vision Development Institute is dedicated to helping children with conditions that affect the normal development of vision by studying interactions between both eyes at the level of the brain’s visual areas and finding better ways to recognize which children are at greatest risk for future vision problems.
Regenerating Lost Vision

Age-related macular degeneration (AMD) is the leading cause of vision loss and blindness for nearly 2 million Americans over the age of 55. Estimates indicate that by 2020, more than 450,000 people in California alone will suffer vision loss or blindness because of this disease.

In 2013, David Hinton, MD, Keck School of Medicine associate dean for vision science, and Dr. Humayun received a $19 million grant from the California Institute for Regenerative Medicine’s (CIRM) Disease Team awards to develop a stem cell-based treatment for AMD.

Within the retina, the central portion called the macula has a high percentage of photoreceptor cells called “cone cells,” which are responsible for sharp, central, color vision. Macular degeneration leads to the decline of the cone cells and the cells supporting them, called retinal pigment epithelial (RPE) cells. Without RPE cells, the cone cells die and vision is lost.

By implanting human embryonic stem cells (hESCs), Drs. Hinton and Humayun hope to replenish the RPE cells, which will then keep the photoreceptor cone cells alive and functioning. The novelty of this breakthrough treatment is that the USC team is collaborating with CIRM and will soon lead to clinical trials that hopefully will restore sight in currently untreatable cases of dry AMD.

USC research centers influencing the advancement of vision science and clinical ophthalmology include:

- Alfred Mann Institute for Biomedical Engineering
- Alzheimer Disease Research Center
- Biomimetic MicroElectronic Systems (BMES)
- Brain and Creativity Institute
- Center on Biodemography and Population Health
- Center on Communication Leadership
- Center for Craniofacial Molecular Biology
- Center for the Digital Future
- Center for Economic and Social Research
- Center for Excellence in Research
- Center for Quantum Information Science and Technology (CQIST)
- Center for Urban Education
- Communication Sciences Institute
- Eli and Edythe Broad Center for Regenerative Medicine and Stem Cell Research at USC
- Energy Institute
- Hamovitch Social Work Research Center
- Information Sciences Institute
- Institute for Creative Technologies
- Institute for Health Promotion & Disease Prevention Research
- Institute for Multimedia Literacy
- Integrated Media Systems Center
- Leonard D. Schaeffer Center for Health Policy and Economics
- Loker Hydrocarbon Research Institute
- Roybal Institute on Aging
- Saban Research Institute at Children’s Hospital
- Southern California Clinical and Translational Science Institute
- Spatial Sciences Institute
- Systems Engineering Research Center
- USC Institute for Global Health
- Zilkha Neurogenetic Institute
Toga and Thompson have decades of expertise in developing revolutionary ways to study and map the human brain. With the help of powerful, high-speed computers and brain-imaging equipment, their work focuses on analyzing huge quantities of brain imaging, medical and genetic data to better understand how the brain functions. Their work on neural connections, such as the Connectome Project, may help advance the development of new types of visual prostheses.

CONNECTOME

Toga and Thompson are authors in The Human Connectome Project that aims to provide an unparalleled compilation of neural data to develop a navigable map of the connections in the human brain.

Arthur Toga, PhD
Professor and Chair, Department of Neurology and Pharmaceutical Sciences, Zilkha Neurogenetic Institute, Keck School of Medicine of USC

Jeanie Chen, PhD
Professor, Department of Cell & Neurobiology, Department of Ophthalmology, J. Zinkin Neurogenetic Institute, Keck School of Medicine of USC

Sarah F. Hamm-Alvarez, PhD
Professor, Department of Biophysics, and Ophthalmology, Keck School of Medicine of USC

Dr. Hamm-Alvarez research includes targeted drug delivery to facilitate the uptake of proteins, peptide and DNA-based drugs into the lacrimal gland to treat diseases, and using imaging techniques to investigate changes in the tissues of the eye surface that contribute to disease development.

Dr. Chen’s research focuses on rod and cone photoreceptor cells, the light sensitive neurons in the retina that initiate the first step in vision. She is investigating how signaling generated following photon absorption is regulated to enable the detection of dim and bright light, and how defects in this process result in retinal degeneration.

Paul Thompson, PhD
Associate Director, USC Institute of Neuroimaging and Informatics; Provost Professor of Ophthalmology, Neurology, Psychiatry and the Behavioral Sciences, Radiology and Engineering, Associate Dean for Research; Keck School of Medicine of USC

CONNECTOME

Toga and Thompson are leaders in the Human Connectome Project that aims to provide an unparalleled compilation of neural data to develop a navigable map of the connections in the human brain.
PARTNERING TO ACCELERATE PROGRESS

To create devices, treatments and therapies that enhance and cure vision loss requires interweaving medicine, biology, research, engineering and technology. The USC Eye Institute collaborates with many leading industries to advance vision science, economic development, societal improvement and clinical care.

Many companies collaborate with the USC Eye Institute in research and development.

- Abbott Medical Optics
- Advanced Bionics
- Alcon
- Allergan
- AqueSys
- Bausch & Lomb
- BioPhan
- Boston Scientific
- Carl Zeiss Meditech
- Cell Traffic
- Eli Lilly
- Genentech
- Harvest Precision Technologies
- Iridex
- MCNC
- Medtronic
- Morgan Technical Ceramics
- NOCO
- Nanodynamics
- National Semiconductor
- OProbe
- Premitec
- Product Development Technologies
- Quallion
- Reichert Technologies
- Replenish Inc.
- Santen, Inc.
- Second Sight
- St. Jude ANS
- Stryker
- SurModics
- Synergetics
- Texas Instruments
- Ventrex
- Virginia Technologies
Total Cumulative Dollars Contributing to BMES Research Programs

Biomimetic MicroElectronic Systems Engineering Research Center (BMES) faculty work closely with industry partners to capture additional research grants to further drive emerging technologies to translation. Over the past 10 years, BMES-born technologies have led to more than $13 million in additional translational research dollars and industrial contributions. This funding further strengthens the ability of USC Eye Institute and USC Department of Ophthalmology to drive further innovation.

The work has also been a catalyst for many entrepreneurial efforts and no fewer than 10 startup companies. Most of these companies also have joined forces with the USC Eye Institute researchers and vision scientists to develop exciting new innovations to cure vision disorders and blindness.

Bringing Students and Industry Together

Through the integrated efforts of multidisciplinary research groups at the USC Eye Institute and BMES, students have the opportunity to participate in internship programs and mentoring activities across biology, medicine and engineering. These industrial education opportunities involve students from grade school to graduate school (including medical school) in living, teaching laboratories, integrating both research and education.

Helping students make the transition from academia to the workforce has led to nearly 30 students who have been hired by BMES industry partners or other firms in the medical device industry.

Opportunities for Students

Industry Partner Tours — hosted by local companies to provide insight into biomedical manufacturing and services for students interested in careers in medicine

Student-Industry Mentorship Program — provides a forum for students to present their research activities and projects to industry members

Student-led Conference — designed to engage industry partners and students in discussion of high-level technical discoveries and their future impact

Student Elevator Pitch Competition — gives students 90 seconds to present new commercialization ideas with the possibility to see their winning ideas brought to fruition

Circulation of Industry Relevant Materials — makes online articles and editorial pieces available to students at no cost
PATIENT CARE: EXPERTISE WITH COMPASSION

The USC Eye Institute and USC Department of Ophthalmology place patients and their families at the center of care and surround them with the complete spectrum of diagnostic, treatment and preventive eye-care services.

Our quest to enhance vision and end blindness begins with understanding patient needs and developing new treatments that are needed most.
A Highly Accomplished Faculty

The nationally and internationally renowned ophthalmologists at Keck School of Medicine of USC Department of Ophthalmology represent every specialty and provide consultation, specialized testing and advanced treatment. USC Eye Institute ophthalmologists are Keck School faculty members, and some are members of the National Academy of Science Institute of Medicine and Engineering.

Our specialists collaborate closely with referring physicians, optometrists and other medical professionals to help achieve the best possible result for every patient. In an effort to ensure appropriate follow-up, we return patients to their referral source for ongoing vision care.

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 papilledema and orbital trauma, our physicians provide consultations, and medical and surgical services. Available diagnostic testing includes fluorescein angiography, ultrasonography, visual fields and electroophthalmology.

Ocular Oncology
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 cytogenetic 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.

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 Keck School of Medicine of USC Department of Ophthalmology or the USC Eye Institute, or to schedule appointments, please call (800) USC CARE (800-872-2273).
Established in 1885, the Keck School is the oldest medical school in California. It provides resources that enable the USC Eye Institute to be ranked among the nation’s top-rated programs and to deliver clinical education second to none.

The dean of the Keck School of Medicine, Carmen Puliafito, MD, MBA, is an ophthalmologist who is recognized as co-inventor of optical coherence tomography (OCT), a technology that revolutionized the study of the human eye’s macula in health and disease. He was awarded the 2002 Rank Prize for Optoelectronics and 2012 António Champalimaud Vision Award in recognition of his work in developing OCT.
RESIDENCIES AND FELLOWSHIPS

Outstanding Residents

U.S. News & World Report and Ophthalmology Times consistently rank the USC Department of Ophthalmology residency program among the top 10 nationwide.

USC Department of Ophthalmology residents are among the best and brightest. Most have graduated from top 10 medical schools and more than 25 percent are members of the Alpha Omega Alpha Honor Medical Society (AOA). Our recruitment efforts focus on identifying future leaders, and the number and quality of our ophthalmology residents continues to grow.

Some of our graduates are now department chairs, such as James C. Tsai, MD, MBA, FACC, at Yale School of Medicine. Others are program directors and principal investigators of large national clinical trials. The current cohort of 18 ophthalmology residents is talented, diverse and preparing to advance vision science and clinical care.

Accomplished Fellows

Fellows participate in cutting-edge research projects under the direction of the department’s nationally and internationally distinguished faculty, and strive to publish results in major academic publications. Many present findings at the Association for Research and Vision and Ophthalmology (ARVO), American Academy of Ophthalmology (AAO) and other major national meetings.

In addition to formal clinical fellowships, the USC Eye Institute offers a larger number of less formal but equally prestigious research fellowships. These are awarded by each service and laboratory independently. USC attracts hundreds of promising academic ophthalmologists around the world who spend one or two years at USC participating in a variety of research programs. Many return to their home countries where they often assume positions of national or international leadership.

The USC Department of Ophthalmology Clinical Fellowship Program provides advanced training to 10 physicians in six subspecialty areas, including:

- Cornea and external disease
- Glaucoma
- Neuro-ophthalmology
- Plastic surgery, including functional, reconstructive and aesthetic ophthalmic plastic surgery
- Retina
- Uveitis, with an emphasis on ocular inflammatory disease and the function of the immune system within the body

A group of USC Department of Ophthalmology residents pause from their busy clinic schedules with Harvard A. Rao, MD, Professor of Ophthalmology, Director of the Inflammation, Uveitis, and AIDS Service and Director of the A. Ray Irvine, Jr. Ophthalmic Pathology Laboratory at USC, who works closely with their program.
Keck School of Medicine faculty, residents and fellows provide care for more than 1.5 million patient visits each year. They practice at Keck Hospital of USC, USC Norris Comprehensive Cancer Center, Children’s Hospital Los Angeles, LAC+USC Medical Center and the VA Greater Los Angeles Healthcare System. Additionally, they see patients at more than a dozen satellite clinics and practices, as well as at 11 affiliated hospitals throughout Southern California.

Keck Medicine of USC
Keck Medicine of USC is the University of Southern California’s medical enterprise, one of only two university-owned academic medical centers in Los Angeles County. Encompassing academic, research and clinical entities, it consists of:

- Keck School of Medicine of USC, the region’s oldest medical school.
- USC Norris Comprehensive Cancer Center, one of the original comprehensive cancer centers established by the National Cancer Institute.
- USC Care Medical Group, the faculty practice that includes more than 1,500 physicians.
- Keck Medical Center of USC, which includes two acute care hospitals: 401-bed Keck Hospital of USC and 60-bed USC Norris Cancer Hospital.
- USC Verdugo Hills Hospital, a 158-bed community hospital.
- Outpatient facilities in Beverly Hills, downtown Los Angeles, La Cañada Flintridge, Pasadena and the USC University Park Campus.
- Keck Medicine of USC Medical Foundation for physicians affiliated with Keck Medicine of USC.

MAJOR CLINICAL PRACTICE SITES

Children’s Hospital Los Angeles (CHLA)
The Vision Center at CHLA is the only program in the United States with expertise in virtually every pediatric ophthalmologic subspecialty. USC pediatric ophthalmologists diagnose and treat diseases and problems with eye muscle alignment, glaucoma, optic nerve, tumors, cornea, retina and visual development.

LAC+USC Medical Center
Founded in 1878, LAC+USC Medical Center has been affiliated with Keck School of Medicine of the University of Southern California since 1885. The new state-of-the-art LAC+USC Medical Center opened in 2008 and provides world-class medical care to the underserved populations of Los Angeles County and a home for the clinical education of our ophthalmology residents.

USC Eye Institute Locations

USC Eye Institute
Keck Medical Center of USC Healthcare Consultation Center IV
1450 San Pablo St., 4th Floor
Los Angeles, CA 90033
(323) 442-6335

USC Eye Institute - Arcadia
621 W. Duarte Rd., Suite 301
Arcadia, CA 91007
(626) 446-3123

USC Eye Institute
Keck Medicine of USC - Beverly Hills
9033 Wilshire Blvd., Suite 360
Beverly Hills, CA 90211
(310) 601-3366

USC Eye Institute - Orange County
1811 Brookhurst St., Suite 6400
Fountain Valley, CA 92708
(714) 628-2966

USC Eye Institute
Keck Medicine - Pasadena
625 S. Fair Oaks Ave., Suite 400
Pasadena, CA 91105
(626) 395-0778

CLINICAL
Our vision research, physician education and, more importantly, patient care—result in medical discoveries and revolutionary treatments that bring new hope to patients with debilitating eye disease.

USC EYE INSTITUTE
USC DEPARTMENT OF OPHTHALMOLOGY