THE MAGAZINE OF THE SCHOOL
OF OPTOMETRY AT THE UNIVERSITY
OF CALIFORNIA, BERKELEY

Berkeley Optometry

Magazine

Coming Epidemic

The rise of myopia and strategies for controlling it.

page 10

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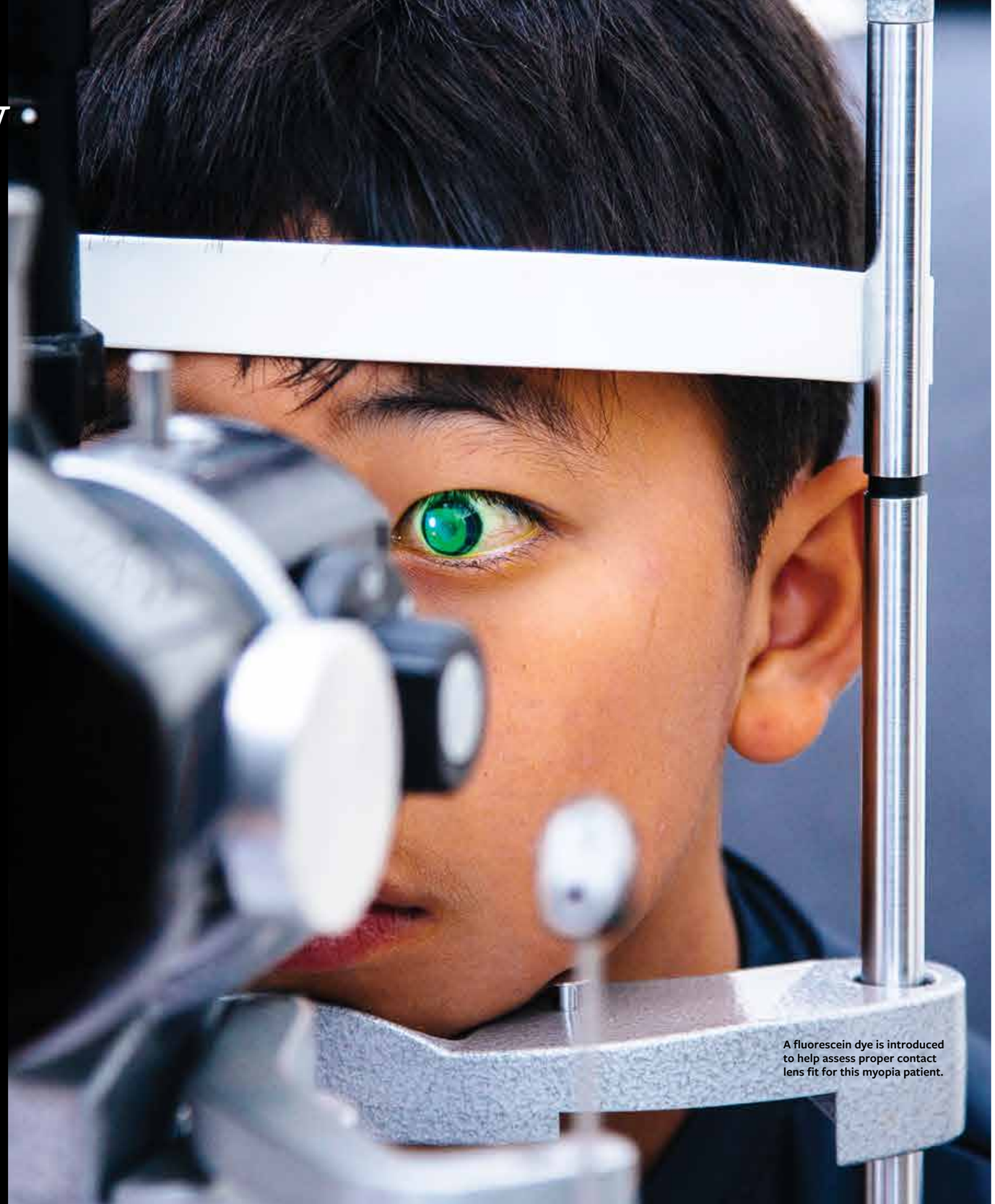


A fluorescein dye is introduced to help assess proper contact lens fit for this myopia patient.

Features

IN VIEW

TRAVEL

STUDENTS

LOOKING BACK

On the cover: Our cover illustration, by Alex Williamson, captures the many facets of the rise of myopia.

OptometryNews

News from the School of Optometry and beyond.

Our Man In Azerbaijan

Together, the Kanai family saw 3,066 people—many of whom have never had an eye exam—and donated 2,792 pairs of glasses.

Berkeley Optometry's Dr. Kuniyoshi Kanai recently traveled to Azerbaijan where he joined his father, Dr. Akio Kanai, and his brother, Dr. Hiromasa Kanai, in a volunteer effort to provide eyeglasses to displaced citizens who have suffered from the longtime conflict between Azerbaijan and Armenia. Many of the refugees they saw had been relocated from Chechen, Afghanistan, Iran, Syria, Pakistan, and Yemen. Together, the Kanai family saw 3,066 people—many of whom have never had an eye exam—and donated 2,792 pairs of glasses. The family runs a program in partnership with United Nations Refugee Agency (UNHCR), that has helped tens of thousands of refugees and other displaced people around the world to improve their vision.

Seminar Heroes

Berkeley's Freshman and Sophomore Seminar Program gives lower-division students a rare opportunity to learn from and get to know faculty on a level that is nearly impossible in the typical 500 person lecture halls. The small class size—20 or fewer students—allows for a spontaneous flow of dialogue and ideas that is often more conversation than lecture. Since the program began in 1992, Berkeley Optometry and Vision Science faculty have taught over 122 seminars—that's 4.7 seminars per faculty member; more than any other professional program on campus and two-and-a-half times as many as the next closest. In absolute numbers, only Engineering (437 total seminars taught) and Natural Resources (427 taught) offered more seminars than did the School of Optometry (122), and they have 437 and 427 full-time faculty, respectively, compared to Optometry's 26. Among Optometry and Vision Science faculty, Professor Richard Van Sluyters leads the pack, with a whopping 38 seminars taught.

20 Maximum students in a seminar

1992 Date of program inception

4.7 Seminars taught per Berkeley Optometry faculty

122 Seminars taught since inception

Farewell Sharon!

This summer, Dr. Sharon Joyce resigned her position as the Assistant Dean of Admissions and Student Affairs. She's now settling into a new life in Park City, Utah, where her husband, Dr. Mark Rollins, has accepted a position as Director of Obstetrical Anesthesiology at the University of Utah School of Medicine.

Sharon joined Berkeley Optometry in 2005 and due to her vision and dedication, the Admissions and Student Affairs Office (ASAO) is the envy of professional schools everywhere. Recruiting, outreach, advising, financial aid, registration, orientation, graduation, and volunteerism have all been intensified, streamlined, upgraded and vastly improved during her tenure here. She will be greatly missed as a colleague, friend, and "Opto-Mom."

ODs That Fix Stuff

When Nia Sayady (OD, '15) settled into her first job after graduation, little did her new employers know what a versatile OD they had hired. This became wonderfully obvious the day an exam chair stopped working. Fortunately, Nia, in addition to being a supremely well-trained optometrist, is a former member of Berkeley Optometry's E-Team—an assemblage of students practiced in the art of fixing stuff. Stuff in this case includes phoropters, slit lamps, BIOs, exam chairs and other optometric equipment.

Without hesitation, Nia opened up the back of the chair, did some troubleshooting and soon discovered a loose fuse. Easy fix—bring in the next patient!

The E-Team program began in the early 1990s under the direction of Dr. Ed Revelli (retired) and has most recently been managed by Tom Michelsen, former Administrative and Facilities Manager for the Berkeley Optometry clinic. Each year about 8 or 9 students are chosen to join the team, where they get on-the-job training on how to fix and maintain the clinic's equipment.

The team gets an assist from Facilities Coordinator and former carpenter Dennis McCullah, who grew up in western Nebraska and brings a unique pioneer practicality to the E-Team.

Dennis often hears from former E-Teamers, such as Cynthia Musante (OD, '15), who is currently working at a practice in Ft. Collins, CO. "The E-Team taught me how to problem solve," says Cynthia. "If the BIO is not working, I can take it apart, and put it back together again. If a headrest isn't working, I can tighten it. When a slit lamp goes down, I can check to see if a fuse went out."

"It's a win-win situation," says Michelsen. "We get our equipment fixed right away without needing to call an outside repair person, and the students learn how to fix the equipment they'll have in their own practice when they go out into the world."

>OVERHEARD

"I am super grateful to get this opportunity. It's run by amazing individuals who are well respected around the world in their field. The fact that they set this up for the four of us blows my mind!"

Second year student **Dorothy Hsu** on the new summer exchange program between Berkeley Optometry and the University College of Southeast Norway. Optometry students from both universities engage in hands-on research related to myopia and refractive error development in Kongsberg, Norway and in Berkeley.

Welcomes

Please welcome Monica Porter, who joins us as the assistant dean of operations. We are delighted to re-introduce Anna Lim as assistant dean of finance, and Lyuda Martello as the director of events and continuing education. Stepping into Lyuda's former role as executive assistant is Annie Yeh.

Dr. Sarah Arneal is our newest clinical faculty member, and Anthony White and Ella Piflaks join our Eyewear Center team of opticians. Joshua Burt joins us as the new patient services manager for the clinic. And finally, please also welcome development associate Oriel Nolan-Smith, the newest member of our alumni relations team.

Welcome all!

DEAN'S MESSAGE

Berkeley Lives Translation

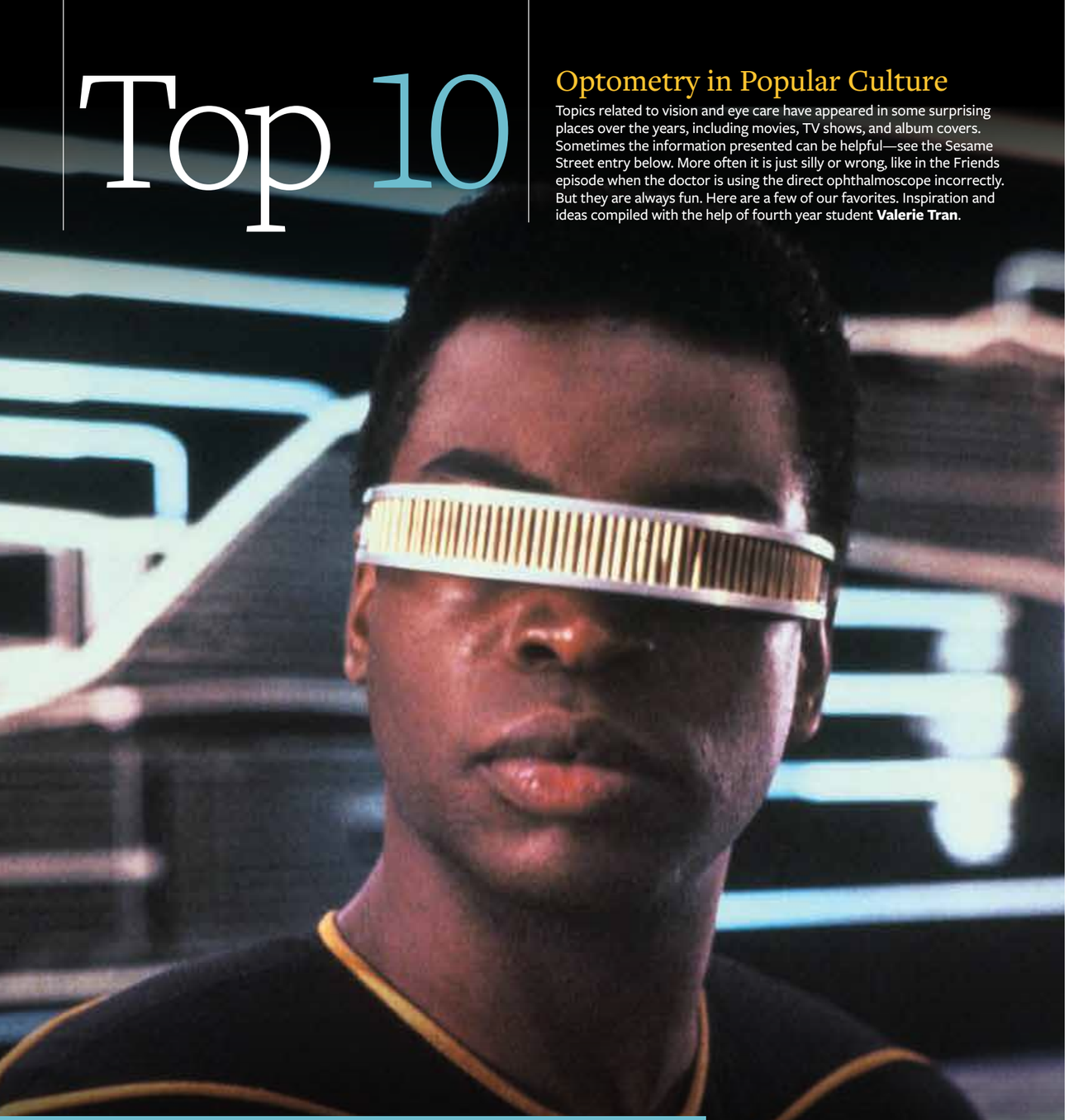
As I sit and contemplate the achievements of Berkeley Optometry, our exceptional students, faculty and staff, and our distinguished history, I am struck by our relevance and vibrancy, and our essential contributions to society. There has been much talk over the last 25 years or so of the importance of translational research, a simple concept but a complex reality. At Berkeley Optometry, we live translation; even as many struggle to bring their science to the people. Current Berkeley Optometry faculty have published and patented discoveries that could provide the next generation of antibiotics, help the cornea survive insult and ensure transplants thrive, image human retinal function at a cellular resolution, realize the potential of virtual and augmented reality, cure genetic and degenerative eye disease, and relieve the common burden of dry eye disease. In our feature story on myopia you will read about our Pamela and Kenneth Fong Chair in Optometry and Health Care, Dr. Maria Liu, who, along with colleagues and students involved in myopia research, has taken on the challenge of controlling the development and progression of myopia for future generations. Maria's story is inspirational and touches upon an exponentially growing public health crisis. It is a refractive condition close to my heart. I first required myopic correction at the age of six, an appointment with my optometrist I remember still to this day, and an experience that over a 50-year period led to my appointment as Dean at Berkeley. My wife and life partner, Dr. Kathy Dumbleton, is not only myopic but is anisometropic with a 2D difference between eyes. I never progressed beyond -3D, and Kathy is a -5D in her worse eye. However, our daughters are both -10D myopes. If only we'd met Dr. Liu 30 years ago!! Berkeley Optometry translates to hope. Read the stories, visit our amazing new website, learn how our school is changing the world, and be proud.

—John G Flanagan

Top 10

Optometry in Popular Culture

Topics related to vision and eye care have appeared in some surprising places over the years, including movies, TV shows, and album covers. Sometimes the information presented can be helpful—see the Sesame Street entry below. More often it is just silly or wrong, like in the Friends episode when the doctor is using the direct ophthalmoscope incorrectly. But they are always fun. Here are a few of our favorites. Inspiration and ideas compiled with the help of fourth year student **Valerie Tran**.



1 Star Trek: Lt. Cmdr. Geordi La Forge

Lieutenant Commander La Forge serves as helmsman of the USS Enterprise in the first season, then is promoted to the role of the chief engineer for the rest of the TV series. La Forge is naturally blind and wears a visor that allows him to explore planets and fight aliens. Is that a Blake Kuwahara ('86) design?

CREDIT: PARAMOUNT TELEVISION

2 Justin Timberlake, The 20/20 Experience Album

The third studio album by singer-songwriter Justin Timberlake. It gets high marks for the coolest use of a phoropter.

CREDIT: RCA RECORDS

5 Book of Eli with Denzel Washington

In a post-apocalyptic America, Eli fights to protect the sacred manuscript—a Bible—that could hold the key to the survival of the human race. We love that you don't find out Eli is blind until the end of the movie when someone steals the bible—the last known copy—and realizes it's a braille book.

CREDIT: SILVER PICTURES

3 Parks and Recreation: "The Time Traveler's Optometrist"

Leslie Knope goes on a talk show and pitches a book that is "a heartwarming story about a caveman eye doctor who travels to present-day Cincinnati and can see everything but love." The book is now required reading for first years.

CREDIT: "PARKS AND RECREATION," (NBC)

6 Foreigner: Double Vision Album

Maybe the best album ever made—just saying! This seven times platinum record features the hit singles, Hot Blooded, Double Vision and I Have Waited So Long.

CREDIT: ATLANTIC RECORDS

4 Bart Simpson Has Lazy Eye

Marge takes Bart to see an OD at the Hibbert Moneymaking Organization where he receives a pair of large glasses that he has to wear for two weeks. Bart is a hipster!

CREDIT: 20TH CENTURY FOX TELEVISION

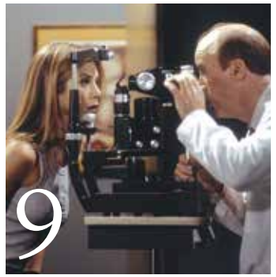
7 The Dress. Is it blue or white?

A photo of this dress became an internet sensation in 2015 when almost no one agreed whether the dress was blue and black or white and gold. The disagreements revealed differences in human color perception. Ironically, both Taylor Swift and Kanye West saw it as blue and black.

8 Sesame Street: Dr. Judy

Prince Charming mistakenly believes a fire hydrant and a pineapple are a princess, but then admits his vision has been blurry lately. Dr. Judy examines his eyes and then places him at the phoropter. She provides the prince a pair of glasses and he is amazed at how much better everything looks, and so breaks into a song—"Eye Doctors Are Amazing"—praising Dr. Judy and all other eye doctors. We agree with the Prince!

CREDIT: CHILDREN'S TELEVISION WORKSHOP



9 Friends: Rachel Gets An Eye Infection

Rache's eye is a little itchy and red. Monica wants her to see an eye-doctor. When Rachel is prescribed eye drops, but refuses to take them, Monica sits on her and pins her down, holding the water bottle in her mouth and spraying Rachel with the drops. Students: don't try this in pre-clinic!

CREDIT: BRIGHT/KAUFFMAN/CRANE PRODUCTIONS

10 Seinfeld: The Glasses

George loses his glasses at the health club and becomes upset when Kramer later points out that his new glasses are women's-style glasses made by Gloria Vanderbilt. Paired with the flannel shirt, we think they look great!

CREDIT: CASTLE ROCK ENTERTAINMENT

Clinics Around the World

We've collected photos of optometry clinics and eyewear shops from faculty, students, and friends as they travel the world. Have a photo to share? Send it to us!

Send your images to us at optweb@berkeley.edu

Valencia Street, San Francisco | USA

York Street, Los Angeles | USA

Upper Street, London | ENGLAND

Kraków | POLAND

Ise | JAPAN

Madrid | SPAIN

Copenhagen | DENMARK

Prague | CZECH REPUBLIC

QuickFacts

A look at the class of 2021: who they are, where they come from and how they got here.

Class of 2021

Applicants

244
Applications

117
Interviews

66
Students matriculated

Academics

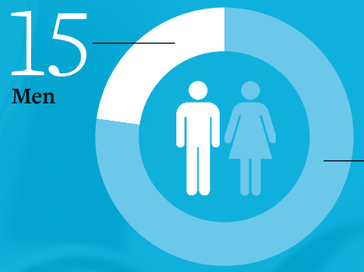
3.96-2.77
Overall GPA range

3.47
Average GPA in Bio, Chem & Physics

3.53
Undergraduate GPA

358
Average Score on the OAT

Student Profile



21-33
Age Range

15
Opt-Camp Alums

Undergraduate Institutions

10 University of California–Los Angeles

9 University of California–Davis

8 University of California–Berkeley

6 University of California–San Diego

5 University of California–Irvine

2
California Polytechnic State University –San Luis Obispo
University of California–Santa Barbara

1
Brigham Young University
Brown University
California Institute of the Arts
California State University–Chico
California State University–East Bay
California State University–Fresno
California State University–Long Beach
George Washington University
Kenyon College
Loyola Marymount University
Miami University–Oxford
Mills College
Moravian College
Princeton University
San Francisco State University
University of Florida
University of Georgia
University of Hawaii–Manoa
University of Michigan–Ann Arbor
University of Nevada–Reno
University of San Diego
University of Southern California
University of Washington
Western Washington University

Coming Epidemic

The rise of myopia and strategies for controlling it

BY ZAC UNGER

When Sylvia Chin noticed that her son Jared was squinting to see things at a distance, she knew exactly what was going on. Both Chin and her husband are myopic, and even when Jared was a toddler, Chin's own optometrist told her, "you can't beat your genes," and that she would need to monitor her kids closely. Jared's first exam, during kindergarten, indicated that he had 20/20 vision. But things began to slide from there. On his second visit a year later, Jared's nearsightedness was measured at a fairly mild -1.00 diopter. "But then he went from -1.00 to -2.00 and then from -2.00 to -2.75 the year after," Chin recalls.

All this felt unsettlingly familiar. As a five year old, Sylvia Chin was one of the first kids in her Hong Kong classroom to wear glasses, and she has a distinct, uncomfortable memory of all the students and teachers turning to stare at her when she first wore them to school. Her myopia progressed, so much so that just last year she was forced to undergo surgery for "oil droplet" cataracts, a procedure usually performed on people decades her senior. Needless to say, Chin did not want her son to suffer the same life-long vision problems that she's experienced.

To say that the Chins are not alone is to vastly understate the scope of the myopia problem in the world today. Even calling it an epidemic might be too mild, and yet the enormity of the problem has largely gone unremarked upon by the general public, especially in the United States. "When I started out in the field and I would give a talk," says Dr. Maria Liu, Chief of Berkeley Optometry's Myopia Control Clinic, "I needed to start out by convincing other optometrists that this was an important problem to study." When a patient begins becoming myopic, the eye elongates more than normal, so preventing further physical change is critical. "Once the eye grows to a certain size, we can only slow it down," says Dr. Liu. "You can't turn a 24 millimeter eyeball back into a 23, so starting treatment early is key."

Today, statistics suggest that half the world's population will be myopic by 2050. In Asia, the numbers are even more staggering. A study in Seoul, South Korea, where all teenage boys undergo medical screening prior to national service, showed that 96.5% of 19 year-olds are myopic. In China, says Dr. Liu, "the prevalence is so high that it's becoming a problem for military recruitment. People are having premature refractive surgery because they want to become enlisted." Moreover, early myopia can lead to complications like glaucoma, macular degeneration, and retinal detachment later in life. Dr. Liu says that statistics show that "myopia is now the leading cause of blindness in the world across all ages, ethnicities, and demographics."

So what's causing this rapid spike in nearsightedness? Sylvia Chin's optometrist was partly correct in blaming genetics. "But if it was all genetics, we wouldn't have this rapidly climbing prevalence," says Dr. Christine Wildsoet, Professor of Optometry and Vision Science at UC Berkeley. The epidemic has taken root over just a handful of generations, far too quickly to pin on evolutionary mutations. Instead, the problem appears to be strongly associated with "close work," indoor activities like reading, typing, and long hours in front of screens. "We all know that smart kids are myopic," Wildsoet says. "In

Michael Tan, student and soccer player, is fitted with an Ortho K contact lens by Dr. Sarah Kochik.

Dr. Maria Liu, Chief of the Myopia Control Clinic, and Dr. Sarah Kochik manage a fast-growing patient base at Berkeley Optometry's Eye Care Center.

fact, in our own population here [at Berkeley] we have a hard time finding students who are not myopic to use in our studies." In many Asian countries the average age of onset is during elementary school, and in countries like Singapore, which has a culture of rigidly academic pre-school, it can be even earlier. "The younger we are, the more plastic the eyeballs are," says Dr. Liu, "and now, even babies are being introduced to electronic games and apps, so we see a very fast progression of myopia."

Fortunately for Jared Chin and the 650 other patients who are seen every year at the Myopia Control Clinic, Berkeley Optometry is not only one of the world's leading research institutes but also a top-notch treatment facility. "Myopia is irreversible," says Dr. Liu. "So we work to achieve a temporary correction and also slow down or prevent further progression." Think of the eyeball as shaped like a hard-boiled egg, lying on its side as it would if you placed it on a table. As the eye grows accustomed to focusing on near objects, it physically elongates along the horizontal axis. With the physiological proportions askew, light entering the eye focuses too far in front of the retina, causing distant objects to appear blurry even while near objects remain clear. Treatment at the Myopia Control Clinic, therefore, is a process of encouraging the eye to maintain its natural shape, slowing the elongation rate during the high-risk childhood and teen years. "Kids don't necessarily understand the long term benefit of reducing complications, but they do understand not having to wear glasses," says Dr. Liu. "Parents understand both the short- and long-term benefits." The major goal of the clinic is slowing further eyeball growth. "We are essentially trying to prevent or minimize that axial elongation in order to reduce the risk of bad complications in the future," says Dr. Liu.

Myopia is irreversible, so we work to achieve a temporary correction and also slow down or prevent further progression.

There are three main treatment modalities: atropine eye drops, multifocal soft contact lenses for daytime wear, or orthokeratology, also known as ortho-k, which is the use of rigid contact lenses at night only. Importantly, all three of these treatments have been shown to slow eye elongation in young myopes. For the initial consultation, every patient is seen by Dr. Liu or her colleague, Dr. Sarah Kochik, who completed both her Doctor of Optometry degree and a pediatrics residency at Berkeley Optometry. (As if that wasn't enough time at Cal, Kochik also did her undergraduate work at Berkeley and is currently pursuing a PhD here.) Dr. Kochik makes a point to discuss the pros and cons of all three options with patients and their parents. "We don't have strong evidence to suggest that one is much better," she says. Whatever actually works for each patient is what's better." No matter the treatment, getting to a patient early is critical. Childhood is a high-risk period where the eyeball is subject to rapid elongation, so the clinicians work to ensure that a patient's prescription stays as stable as possible for the long haul.

For twelve-year-old Michael Tan, who had myopia in only one eye, ortho-k was the right choice. He and his parents both liked the idea of only having to wear the contact lenses at night. "Ortho-k works by temporarily changing the curvature of the cornea," Dr. Liu says. "And the cornea has a very good memory, so during the daytime the patient will have clear vision without any lenses." To keep the eye "trained" the patient must wear the lenses every night, at least until young adulthood when the eye becomes less prone to rapid change.

For Michael the results were dramatic. "It was incredibly quick," says his father, Thomas. "Within a week he could basically see with perfect parity between both eyes during the day." Jared Chin experienced similar results, quickly ditching the glasses he had worn on the basketball court and the corrective goggles he'd worn for swim practice. Incredibly, dramatic effects like this are the norm, says Dr. Liu. "For overnight ortho-k we should see fifty percent of the corrective effect after one night and the full effect after seven to ten days."

Which is not to say that the process works for everyone or that it is without difficulty. Learning proper lens placement technique—not to mention care and cleaning—can be challenging for an adult, let alone the average school-age kid who might forget to brush his teeth every night. "It was always easy when he was with the doctor in the office," recalls Thomas Tan. "But when we got home, my god, it was such a struggle." Fortunately, the doctors at the Myopia Control Clinic are well practiced at helping kids adjust. "Some kids get it right away and some kids have to come back multiple times," says Dr. Liu. Throughout the process, the emphasis is on the patient's ability to effectively comply with treatment. "Parents ask me at what age their kid can get ortho-k," Dr. Liu continues. "But it's about the maturity, not the age. That can happen at six or it might not be the case with someone who is eighteen." Patients must be self-motivated, independent, and vigilant enough to monitor their own care and report any problems that arise. "What I appreciate about Dr. Liu," remembers Sylvia Chin, "was the way she talked directly to Jared instead of just to me. He got the chance to make the decision for himself rather than having it be forced on him." As a result, many parents report that the experience of maintaining an ortho-k regimen actually helps their kids take more responsibility in other areas of their lives.

As the incidence of myopia continues to rise, the Myopia Control Clinic is poised to lead the way both in terms of treatment and with prevention-based research. The collaboration between researchers and clinicians is essential, and each side of the equation prods the other towards improved patient outcomes. "I like to describe our clinic as systematic, comprehensive, and cutting edge," says Dr. Liu. "We understand myopia at a level far beyond your average practitioner." While patients respond enthusiastically to improved eyesight, the clinicians understand that the long-term benefits of treatment are even more important. "Once your prescription is at a minus-three," explains Dr. Liu, "the risk of retinal detachment is ten times higher than for someone who is not nearsighted." Taking off the glasses is nice, but reducing the incidence of major complications—even blindness—is absolutely imperative.

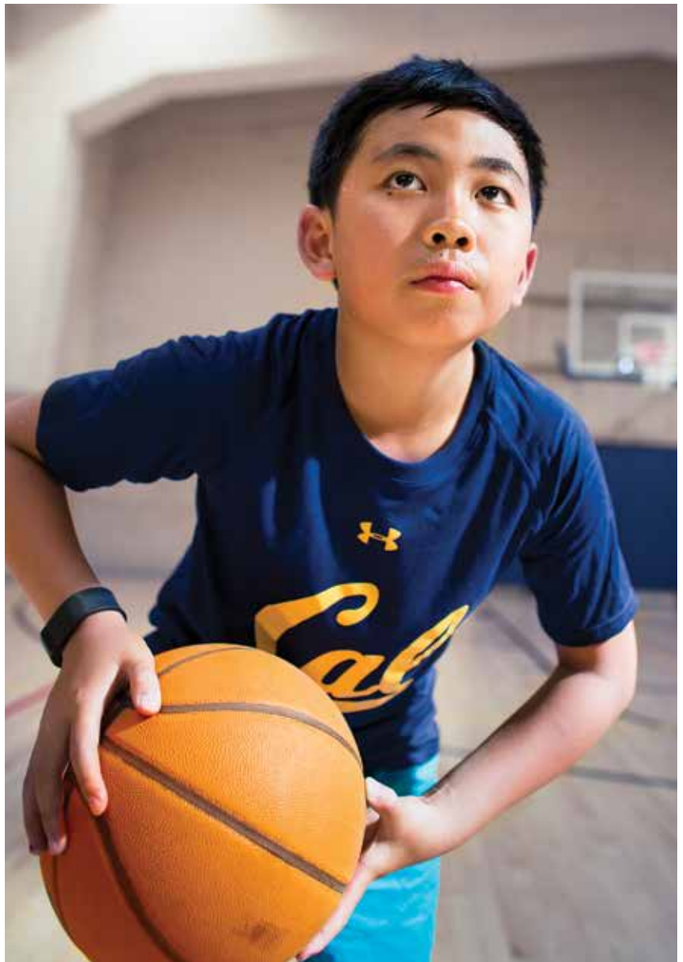
One factor that fascinates clinicians and researchers alike is the strong evidence that suggests that time outdoors has a protective effect on young children. "We don't have an exact dose-response level for how much outdoor time you need," says Dr. Wildsoet, "but this is a very interesting area for further study." During China's cultural revolution, for example, the prevalence of myopia nosedived as intellectuals were sent out into the fields. When they came back to the cities and resumed an indoor lifestyle, myopia took an upward turn. Similarly, kids in one study who were encouraged to take recess outside were less likely to become myopic; when the classroom doors were locked shut so kids couldn't sneak back in, the prevalence declined still further. "Once a child becomes nearsighted," says Dr. Liu, "they tend to become a lot more indoorsy and so you've got a really bad downward cycle."

Because of this, the doctors at Berkeley Optometry emphasize early consultation and early treatment, stressing lifestyle changes and proper visual hygiene. This necessitates a high degree of individual attention given to each patient, which the clinicians and students enthusiastically provide. "I got into medicine because I wanted to spend a lot of time with people, which is actually pretty rare now," says Dr. Kochik. "But here I really get to know my patients on a personal level."

"There's no such thing as nine to five when you're working with kids," says Dr. Liu. "You must have timely triage for any problems. Other schools ask me for tips on setting up a clinic like this and I tell them that they have to have weekend clinics like we do, and they tell me that their doctors would never do that." Significantly, the Clinic's fee structure is such that patients pay for an entire year, all-inclusive, no matter how many visits they end up using. "When you're fitting kids with contacts, you need to be pretty conservative," says Dr. Kochik. "We never want finances to be a reason for not bringing a kid in for a consultation."

While being a little nearsighted might seem like no big deal—just put on a pair of glasses, right?—the long-term effects on kids can be profound. Late-life complications like glaucoma aside, just being myopic changes the way kids interact with their peers and their environment. "He can be more aggressive on the basketball court," says Sylvia Chin about her son. "He can wear cool sunglasses. He doesn't have to deal with the stereotypes of wearing thick glasses. I feel like Jared is more free now."

And for the clinicians at Berkeley Optometry, there's nothing more satisfying than watching a patient gain better eyesight literally overnight. "It's not just about giving a patient good vision," says Dr. Liu. "It's about transforming them into a different, more confident person."



Treatment provides patients such as Jared Chin the long term benefits of reducing complications later in life, as well as the nearly immediate bonus of improved vision and freedom from glasses.

Repairing the Retina

The Flannery lab is developing gene therapies that could one day cure blindness

BY NICOLE HALOUPEK

A mouse, soaking wet, is scooped up in the warm hands of a researcher. It has just paddled its way through a tub of water and climbed onto a platform, getting a welcome break from swimming. The researcher had trained it to associate the hidden resting spot with a nearby flickering light, and if this were any other mouse, the fact it could remember how to find the platform using visual cues would be a testament to the animal's ability to learn. But this isn't a typical rodent: this mouse used to be blind.

The mouse's sight had been restored by gene therapy developed in the lab of John Flannery, UC Berkeley Professor of Optometry and Vision Science. The lab's goal is to understand mechanisms underlying retinal degenerations and use that information to develop rational treatments for blinding diseases. Before treatment, the mouse was blind due to a genetic mutation that causes a condition mimicking retinal disease in people. Genetic retinal degeneration disorders are a common cause of complete blindness in humans, affecting one in three thousand people worldwide.

Over 250 mutations that cause genetic types of blindness such as the one affecting this mouse have been found, and more continue to be discovered. Curing the rodent is a proof of concept: the fact that the treatment works for mice with one mutation means that it might be possible to adapt the therapy to treat similar problems in people.

And many blinding diseases have a lot in common. According to Flannery, "Almost all the known genes [that cause blindness] cause vision loss by initially killing rod photoreceptors. And they appear to do so by every possible mechanism." Rods, found in the retina, are tuned to respond to dim light, helping us find our way as we stumble to the kitchen in the middle of the night for a glass of water. In bright light, these photoreceptors are fully saturated; they turn off, leaving the cone photoreceptors to assume the task of sight.

With cones taking over in daylight, it might seem odd that rod defects cause people to lose their vision completely: they should instead suffer from night blindness. But healthy rods secrete a protein called rod-derived cone viability factor (RdCVF) that regulates sugar uptake in cones—and when the rods die or stop producing the protein, the cones starve. The fact that rods hold the key to the cones' food makes evolutionary sense. As lighting changes when day meets night, it could be deleterious to have the rods and cones fighting over fuel. Flannery says Thierry Léveillard—a researcher at the Institut de la Vision in Paris, a colleague of his, and one of the discoverers of RdCVF—put it this way: "A long time ago, the rods and cones married for life, and the cones gave the car keys to the rods."

Leah Byrne (a former neuroscience graduate student in Flannery's lab) and others in the group have shown that by delivering RdCVF to the cones using gene therapy, the cones can be saved even as the rods are lost. The process involves encapsulating the gene

that contains the instructions for making RdCVF in the outer shell of the virus, then using the virus to transfer the gene into other retinal cells by injecting the virus into the eye, near the retina. That way, when the rods die, other retinal cells can produce enough RdCVF to save the cones.

The solution isn't perfect. Not all patients will benefit; it wouldn't work for people with advanced retinal diseases, whose cones have already died. And since the treatment wouldn't preserve the supremely light-sensitive rods, patients would be left unable to see in dim conditions. Still, this approach could mean a big improvement for people that aren't able to see at all. "If you live in the city and you don't walk around at twilight, you could do pretty well," Flannery says.

Flannery's group has other ideas for patients with advanced retinal diseases. One technique is to repurpose some of the remaining retinal cells, called second- and third-order neurons, by making them sensitive to light. Normally, these neurons respond to chemical signals by firing off an electrical impulse. But a team in Flannery's lab led by neuroscience graduate student Benjamin Gaub is using gene therapy to get them to produce a protein on their surfaces that's sensitive to light instead of chemicals—an approach that falls under the umbrella of a field called optogenetics. Interestingly, Flannery says, "It looks like almost none of the patients seem to have any problems that cause loss of the second-or third-order neurons," making these cells the best candidates for this approach.

Researchers are also exploring the use of stem cells derived from affected individuals' own eyes to create new photoreceptors. Stem cells are the progenitors of all other types of cells, and as such, they have the potential to be turned into any kind of cell. To manufacture the stem cells, the researchers manipulate glial cells in the eye. Glia are well-suited to this purpose because during development, glial cells are the last of the eye's cells to take on their specific roles. This means it should be easier to get them to revert to undeveloped stem cells. In a project headed by Jonathan Jui, a graduate student in neuroscience, researchers are trying to get these stem cells to grow into rods, which could directly replace lost photoreceptors in patients with advanced retinal diseases.

The Flannery group's work on stem cells and optogenetics could lead to life-changing treatments for people with late-stage blinding diseases. But in an ideal future, such diseases would be caught when they're just beginning —before severe damage to the eyes takes place and before patients' lives are disrupted. Treating blinding diseases before they wreak havoc on the eyes is simplest when the genetic cause of a patient's disease is known. That's becoming easier and easier to achieve, since a patient's genetic constitution can be determined—a process called genotyping—in about 30 days for only $1,000. Ten years ago, the cost would probably have been closer to a million dollars and taken an entire year.

In the best cases, a patient's genotype reveals a defect in a single gene that causes the gene to code for a protein that doesn't work—for example, a protein that's supposed to give a cell structure might be too flimsy. Emilia Zin, a Vision Science graduate student in Flannery's lab, is using gene therapy to treat mice that have the gene for progranulin completely deleted from their genomes. In addition to causing blindness, lack of one copy of the gene for progranulin causes frontotemporal dementia, and without both copies of the gene, a type of neuronal ceroid lipofuscinosis (NCL)—which causes dementia and seizures, among other problems—results. NCLs are a group of conditions that affect one in ten thousand children, and if left untreated, they can be fatal. The normal copy of the gene for progranulin, delivered via gene therapy, could compensate for the faulty copy of the gene. If Zin's method works in eyes, it might be possible to get it to work in the brain; preventing these devastating neurological problems.

Numerous clinical trials based on supplying the normal copy of a defective gene, like what Zin is doing with progranulin, are currently underway. But the solution to genetic blinding diseases isn't always as clear-cut as giving patients back something they're missing. Some patients have genetic problems that don't just result in nonfunctional protein—their retinal cells produce something that's actively harmful. In situations like these, it's not enough to simply give patients a correct copy of the gene—the flawed gene's ability to make a toxic product also needs to be removed. That's where the budding technique of genome editing comes in. Using a system called CRISPR/Cas9, researchers can actually slice out a sequence of DNA and replace it with something else. Flannery's group is collaborating with Maureen McCall, Professor of Ophthalmology and Visual Sciences at the University of Louisville, to try to use this method on blinding diseases in pigs.

The idea of using gene therapy in the early stages of blinding diseases to halt their progress, whether it involves supplying a correct copy of a dysfunctional gene or requires removing a gene that hurts retinal cells, is a promising one—as clinical trials have begun to demonstrate. But it's not yet possible to say what the long-term outcomes will be and how long the therapies' effects will last.

Any therapy that maintains its results over time would be an improvement over current options. For example, antibody-based therapies have been developed for neovascular ("wet") macular degeneration, a disease that causes new, leaky blood vessels to grow in the back of the eye. They work, but the treatments only last a month or two. Gene therapies for retinal diseases, it seems, will be stable over time. While it's true that in most cells of the body gene therapy could eventually lose effectiveness as cells turn over and are replaced—causing the therapeutic gene to disappear—retinal cells do not turn over, so any therapeutic genes will stick around and continue to function.

These treatments for early-stage blinding diseases require that the genetic cause of the problem is known—but it's not always possible to genotype a patient. Cécile Fortuny, a Vision Science graduate student in Flannery's lab, is trying to find ways to treat blinding diseases with murkier origins. She's developing a more general solution: instead of adding a missing gene or repairing a faulty one, she's targeting a mechanism of cell death that seems common to a group of retinal diseases. By using gene therapy to get glial cells in the eye to release more of certain growth or survival factors, she hopes to prevent other retinal cells from dying.

If all goes well, the technique could also provide a solution to a perennial obstacle to developing new treatments: money. Gene therapies targeting individual mutations aren't always cost-effective for the companies that would clinically test and produce them. This is a particular concern for diseases that only affect a small group of people, since companies could actually end up losing money in the end if not enough people need the treatment. Considering these practical hurdles means that the techniques the lab is developing aren't just academic exercises—they could eventually make it as treatments.

To that end, Flannery's group is taking steps to ensure that the gene therapies they develop are as safe and effective as possible. Part of that work lies in the delivery of gene therapies to their targets. Getting the virus into the right cells isn't as simple as just injecting it where it's meant to go: injections underneath the retina are risky, having a chance of causing damage or inflammation. In collaboration with the lab of David Schaffer, Professor of Bioengineering, Chemical Engineering, and Neuroscience at UC Berkeley, Flannery's group has made great strides in targeting the virus to the retina from the vitreous of the eye, where it's safer to inject.

In pursuit of this goal, the Flannery and Schaffer groups are using a technique called directed evolution. The process begins by creating a set of genetic variants—in this case, hundreds of millions of versions of the virus, all with alterations to the three proteins that make up its outer shell. The variants are then tested for a desired function, which for this project was how well they moved through the retina from the vitreous and latched onto the rod and cone cells. The final step in directed evolution is to amplify the best variants and repeat the process until a handful of clear winners—those that could move to and bind with the right retinal cells the tightest—emerge. After narrowing down the list, the group showed that gene therapy using one of their chosen viruses was able to reverse disease characteristics in the eyes of mice with mutations that mimic human conditions (Leber's congenital amaurosis and X-linked retinoschisis) that cause blindness in infants and children.

All this provides strong evidence that these treatments are worth pursuing in people. According to Zin, knowing that her research could one day make a difference in a patient's life makes her challenging project worthwhile. "Even if gene therapy isn't capable of fully curing blindness or completely restoring vision, just being able to improve someone's life for a few years or give them back the ability to walk on the street without a cane or a dog is really a big deal," she says. "I think that's the most exciting aspect of this for me."

Genetic retinal degeneration disorders are a common cause of complete blindness in humans, affecting one in three thousand people worldwide.

Professor John Flannery, with vision science graduate student Emilia Zin, at work in the lab.

Care and Creativity

Vicki talks about early influencers, the role that optometry schools can play in delivering eyecare to underserved communities, embracing the element of surprise, and making history.

A member of Berkeley Optometry’s alumni board and the former president of the National Optometric Association, Dr. Hughes is an optometrist at Kaiser Permanente in Union City, CA.

Q What led you to a career in Optometry?

A I was very good in math and science and I loved physiology. When I first applied to Berkeley I wanted to be a brain surgeon and choreographer.

I then met some Black optometry students and since they knew I wanted to go to medical school, they suggested I consider optometry. I didn’t know there were Black optometrists even though everyone in my family wore glasses. About this same time, I met Dr. Marvin Poston. He was the first Black optometrist I’d ever met, as well as the first one to graduate from UC Berkeley. I went to him to get my eyes examined. When he found out I was majoring in physiology, he said, “Young lady? Have you thought of being an optometrist?” He also hired me as a work/study student in his private practice. I thought about it, applied and got accepted in the school of optometry.

Q Who were your early influencers in life? Who inspired you?

A My parents and aunts. My mother was a music, science and math teacher, my father a contractor as well as a restaurant owner. It was drilled in me to get my education. Being the oldest girl—even though I have an older brother—I was told I had to be the responsible one. I don’t remember hearing “if” you go to college, it was “when” you go to college. My dad always said to be able to use your brain as well as your hands—to have a skill. He was the unofficial Black Mayor of Amarillo, Texas. Everyone came to him with their problems. He was very active in the civil rights movement back in the sixties. He and his sister integrated the golf courses. My brother and I integrated the swimming pools.

I was also inspired when I met Maya Angelou in college. Listening to her talk and speak her words of wisdom left an indelible print on me. She, and one of my first cousins, who was a professional dancer were lifelong friends. I became a friend of hers too, and was invited to her house for Thanksgiving for many years as well as to parties given by Oprah Winfrey every five years of Maya’s life.

Q What do you enjoy most about working at Kaiser?

A The element of surprise wrapped up in a routine package. So many diverse people, cultures, eyeball shapes and diseases. I learn something everyday from my colleagues and the different people I come in contact with. Knowing that I’m making a difference and contributing my knowledge and expertise to help others is a good thing.

Q What would you tell students weighing career options about the benefits of working in an HMO setting?

A Be prepared for anything and everything. Learn to multitask. Be flexible. Be kind. Cut to the chase. What does the patient really need? Some days will be challenging. In addition to being a doctor, you may need to take on the role of parent, psychologist, friend.

Q As the former president of the National Optometric Association (NOA)—whose mission in part is to enhance the delivery, effectiveness and efficiency of eye and vision care services in communities with little or no eye care presence—what role do you think optometry schools can play achieving those goals?

A Have the students rotate in underserved communities giving eye exams in part to increase the students’ cultural awareness and sensitivities of different populations. Similarities and differences exist between people. Also adding classes to the curriculum to effectively deliver eye and health services to improve the quality of care—including the social, cultural and linguistic needs of the patients.

Q What are the challenges to meeting these goals?

A Finding competent and qualified faculty proficient in teaching courses on eliminating ethnic and racial health disparities. Also, budgetary constraints can affect students participating in outreach communities.

Q What do you see as the biggest threats to eye health in populations with limited access to eye health care?

A The majority of this population of people have chronic illnesses that also need to be addressed. The “three silent killers,” hypertension, glaucoma, and diabetic retinopathy are some of the results of these chronic illnesses. Treating the whole patient from smoking prevention, to better food choices, to increasing physical activities, mental and emotional stability also need to be included in the overall eye health curriculum.

> “Be prepared for anything and everything. Learn to multitask. Be flexible. Be kind. Cut to the chase.”

Q When you’re not seeing patients, what do you like to do?

A I design and make jewelry, clothes and other decorating projects. Gardening. I post photographs of flowers, scenery and people on Facebook and Instagram. I read the NY Times newspaper and books, and edit articles for the NOA. Travel. Collect art. Shop.

Q What is your favorite Berkeley Optometry memory?

A My first view of a person’s retina with an ophthalmoscope. It was so pretty to look at, like a piece of abstract art. To this day I enjoy looking in someone’s eyes. The orangy-pink, reddish color is my favorite!

Q What are you most proud of?

A My perseverance to finish what I set out to do; hurdling obstacles that were in my way. Making history by becoming the second Black woman optometrist to graduate from the UC Berkeley, School of Optometry. That I contribute to the science of health as well as to the art of creativity.

Q What advice would you give to current optometry students?

A Become proficient in a new language. Learn how to say, “Is it better, one or two” in a few different languages. Build your interpersonal/people skills and increase your empathy for different cultures. Learn new skills. Be open-minded to new ways to practice your profession. Invest in yourself in the beginning.

Q What is your spirit animal (if you have one)? And why?

A A giraffe. They’re tall and move with grace. They have a deadly kick if provoked.

WhereAreTheyNow

Our young alums are doing big things! We're so proud of them that we had to brag. Here are a few of their stories.

Christopher Jovez, OD '15

WORK: Southern Oregon Rehabilitation Center and Clinics
HOME: Medford, OR
WEB: www.southernoregon.va.gov

Dr. Jovez reports that optometry in the VA is disease heavy; diabetic retinopathy, macular degeneration, and glaucoma are frequent diagnoses among veterans. Coordinating consults and surgeries for cataracts, macular edema, or retinal tears happen multiple times a week. Christopher describes it as, "my dream job."

Advice for current students: "Choose rotation sites where you might want to live after graduation. Show them that you have what it takes to be a permanent and significant part of their team. Even if there are no openings, their recommendation of you will be indispensable. Also, try to find a healthy way to de-stress everyday— dance, play an instrument, exercise, laugh, steam vegetables, etc."

Tiffany Chan, OD '10

WORK: California Pacific Medical Center
HOME: Grass Valley, and San Francisco, CA
WEB: www.cpmc.org

Dr. Chan recently moved back to California to join her parents (Dr. Jerry Chan, Berkeley Optometry class of 1975 and Dr. Lisa Moon, Berkeley Optometry class of 1976) at their private optometric practice in Grass Valley, CA. The practice provides full-scope optometric care including ocular disease management, contact lenses, pediatrics and low vision rehabilitation. Tiffany also has a faculty position at California Pacific Medical Center in San Francisco. And yes, that's a real panda on Tiffany's lap!

Advice for current students: "Never underestimate the power of great mentors. Be proactive in seeking people of various interests and specialties. Be prepared with questions or discussion topics when you meet with him/her and bring a notepad!"

Esther Nakagawara, OD '10

WORK: Brier Creek Vision Care
HOME: Raleigh, NC
WEB: www.briercreekvision.com

Dr. Nakagawara provides comprehensive eye exams, specialty contact lens fittings, and ocular disease management. Esther is also the co-coordinator of Young ODs events for the local optometric society and has acted as mentor for American Academy of Optometry fellowship applicants.

Advice for current students: "Enjoy your time at Berkeley! Cultivate great relationships; your classmates and professors will become some of your best friends. I always look forward to seeing everyone socially and meeting up at conferences. These connections have enriched both my life and career, and I am so grateful to have made them through Cal."

Amber Egbert, OD '16

WORK: United States Navy
HOME: Evanston, IL
WEB: www.lovell.fhcc.va.gov

Dr. Egbert is an active duty optometrist for the US Navy. She works at a unique command, known as the Federal Health Care Center (FHCC), where veteran care is combined with active duty care.. This past fall, she had the opportunity to travel to Guantanamo Bay for a couple weeks to provide eye care to both military personnel and inmates. Soon, she hopes to complete a full three year tour overseas.

Advice for current students: "Study to learn the material as a doctor, and not to pass the test. Also keep an open mind as you work with a variety of professors and attendings, because there are often multiple methods for clinical skills and having a toolbox full of options will come in handy as you work with a wide range of patients."

Gary Walker, Phd '98

WORK: Executive Director at Allergan
HOME: Fremont, CA
WEB: www.allergan.com

Most of Dr. Walker's career since Berkeley has been focused on treatment for acute ischemic stroke, but he recently made his way back into vision. Since 2013, he has led the clinical research program at an eye care startup called ForSight VISION 5, working on an ocular ring, which is a non-invasive device that can deliver medicine to the ocular surface with a sustained-release for up to 6-months.

Advice for current students: "I think of my training in the Vision Science program as including two type of knowledge: 1) a collection of facts, equations, and theories; 2) learning how to think critically about difficult problems. The facts and equations can certainly be useful, but it is the critical thinking skills that will set you apart and allow you to branch out beyond your lab work and take on a much wider range of challenges."

Elise Piazza, PhD '15

WORK: Associate Research Scholar, Princeton Neuroscience Institute
HOME: Princeton, NJ
WEB: elisepiazza.com

Elise's dissertation research, with Professors Michael Silver and Martin Banks, investigated how factors like recent context and multisensory learning impact what we consciously perceive in the visual world. As a postdoc at Princeton she is studying how the brain extracts crucial patterns from complex sounds to facilitate communication, especially in the context of early language learning.

Advice for current students: "For PhD students: Take your time when choosing a research question. You'll likely end up working on a given study for several years, so think carefully about which ideas are most likely to interest you and bear fruit for the long haul."

AlumniNotes

Our Alumni do amazing things—in and out of the clinic! Here's a sampling of what they're up to.

Hey Alumni!

Do you have a story to tell? About your career or your life? We'd love to hear from you! Send us pics and details.

optoalumni@berkeley.edu

Please visit our website to see more updates from our alumni!

optometry.berkeley.edu/alumni-notes

1952

1 | Still practicing one morning a week, **Saul Levine, BS '51, OD '52**, and his wife Joyce recently celebrated their 60th wedding anniversary with their three children and eight grandchildren. Family, travel, and golf—in that order—have been their pleasures. Dr. Levine says that "the changes in optometric scope of practice from graduation in 1952 to the present has been awesome and it's not finished yet."

1961

6 | **Jerry Keyes, BS '60, OD '61**, and his family live in Washington, Utah, next to St. George, Utah, and have six kids and 19 grand kids, which keeps them hopping. They lived for two years "in the great down under country" of Australia. "Life is good and good on ya."

1967

7 | **William Dorrance, BS '66, OD '67**, retired in 2011. He and his wife are happily retired in Anacortes, WA. Optometry, he says, "was a good career choice for me, with many wonderful memories."

1968

Philip Mill, BS '67, OD '68, passed away on September 2, 2016, with his wife and daughters by his side. See obituary at http://philip-richard-mill.lastingmemories.com.

1971

8 | **Don Sarver, BS '69, OD '71,** has retired after 46 years in practice at Rockridge Optometry with fellow alumni **Larry Sarver BS '78, OD '80,** (shown in photo with brother Howard Sarver), **Cindy Sakai BS '96, OD '02, Scott Yokoi BS '82, OD '86,** and **Jazzi Junge BA '09, OD '14.** He plans to make more time for hobbies including grandparenting and photography.

1975

3 | **Richard Hom, BS '73, OD '75,** is currently a Trustee of California Optometric Association and National Optometric Director for Anthem, Inc. He is currently working on his dissertation on the implications of food insecurity on vision impairment and disability.

1978

2 | **Judy Riley, BS '76, OD '78**, has joined New View Oklahoma in their Tulsa Clinic to provide low vision services.

1984

5 | **Kathleen Low Ding, BS '82, OD '84**, retired her license at the end of 2016 after 33 years, and plans to start a new chapter in her life. She has much faith in the future of the profession, as her daughter **Jennifer Ding, OD '17**, graduated in May after winning the William Feinbloom Low Vision Award. Jennifer is engaged to be married this summer.

1993

Laurie Chaikin, BS '76, OD '93 , sold her practice, Wild Iris Optometric Group in 2008, and took some time off to develop a mobile practice for neuro-optometric rehab patients, which she did for 5 years. Laurie later opened a specialty clinic in Alameda and completed a research project looking at use of microcurrent to slow the progress of AMD, which was published in Journal of Clinical Ophthalmology. In her spare time, she developed her sailing skills in the Caribbean and SF Bay.

1997

4 | **Maxwell Cheng, BS '95, OD '97**, does humanitarian work all around the world. He recently completed a medical mission to Jamaica where he led a team of 35 volunteers who performed 70 surgeries on people blinded from cataracts. They treated nearly 200 glaucoma patients, conducted 1600 eye exams and provided 1500 pairs of glasses and 1000 pairs of sunglasses. Nine of the 14 optometry students who went Jamaica this year were from Berkeley Optometry!

9 | To celebrate the 40th anniversary of the practice that **Cindy Szeto, OD '97**, has worked at since she was the high school file clerk, and to mark her 20th year in optometry, she flew the entire staff for an all-expenses paid trip to Disneyland. Cindy says that "40 years in San Francisco's financial district has been challenging, but never dull!"

2007

Since earning a PhD under Dr. Marty Banks in 2007, **Ahna Girshick, PhD '07**, is now a computational research scientist at Ancestry DNA in San Francisco, doing machine learning and genomics research to help people learn more about where they come from.

2013

10 | **Sabrina Graziano Shively, OD '13**, started her own practice, BeSpectacled, in Bakersfield, CA, next door to her father-in-law's dental office. Her husband **Kyle Shively, OD '10,** also practices nearby at the Bakersfield Eye Institute.

2016

Meredith Turner, OD '16, purchased a practice in Redding, CA

Local Leaders: Congratulations to our alumni that are leading organized optometry at the state levels: **Sage Hider, BS '92, OD '94**, COA President (California); **Christopher Sween, OD '06**, HOA President(Hawaii); **Paul Jensen, BS '84, OD '86**, OPW President (Washington)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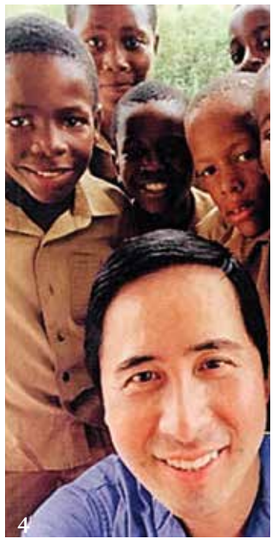
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The Year in Numbers

For the Big Give—Berkeley's day of giving—Berkeley Optometry won the #1 spot on the Participation leader board AND had the highest number of graduate student donors, doubling the student participation since 2015. Go Opto-Bears!

Total Giving $1,418,564

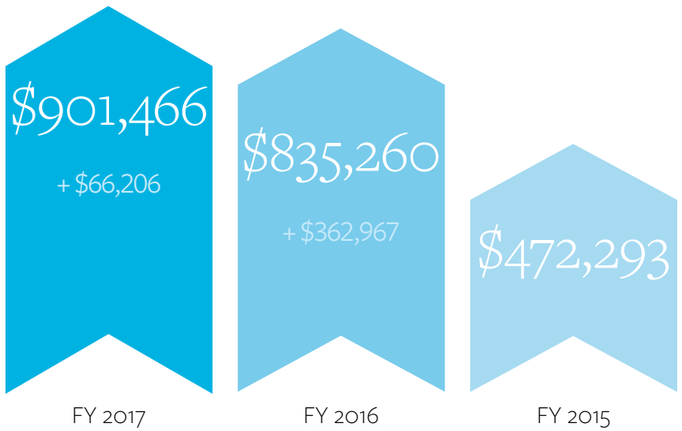
BIG GIVE
$516,437
RAISED IN 24 HOURS

2901
Alumni Population

471
Alumni Donors

111
Student Donors

Total Unrestricted Giving



857
Number of Donors

177
New Donors

Total $ from New Donors: $127,830

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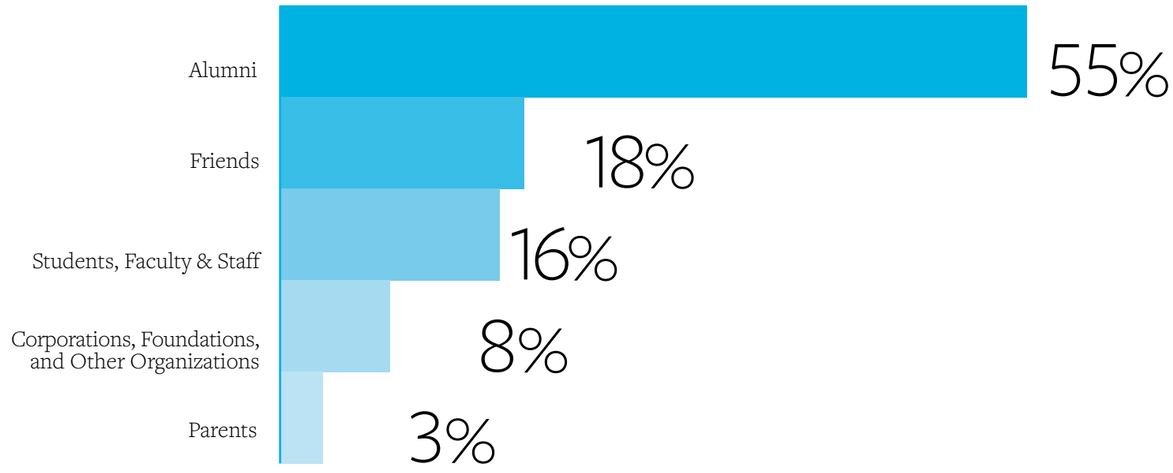

What You Supported

64%
Dean's Initiatives (Annual Fund)

19%
Research

12%
Learning Environment (Facilities)

5%
Student Scholarship (PSSF)

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Invest In Our Vision

Andrew Do

CLASS OF 2018

Andrew, who will be graduating this year, exemplifies the tenacity and commitment of Berkeley Optometry students. Diagnosed with cancer after his first year, he returned home for treatment, but returned a year later; healthy, happy and well-prepared to join a community of alumni who share a passion for delivering vision care that is unequaled. Good work Andrew, we're proud of you!

For Andrew—and all of our students—the path to outstanding patient care and vision science research begins with our classrooms, labs and clinics.

Learn more and make your gift online.
optometry.berkeley.edu/give

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