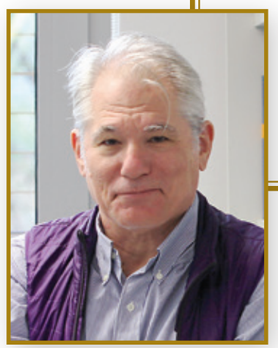
The 2023 Distinguished Alumni



Caltech's annual Distinguished Alumni Awards—the highest honor the Institute bestows upon its graduates—recognize "a particular achievement of noteworthy value, a series of such achievements, or a career of noteworthy accomplishment." The 2023 luminaries include an optics expert who invented near-zero-index optics, optical nanocircuits, and wave-based analog computing based on nanomaterials; a leader in obstetric and gynecological care who broke barriers at Caltech; a bioinformatics pioneer who managed a team that mapped the fly, human, and mouse genomes; and a trailblazing chemist who helped develop the cancer-treatment drug Abraxane.

By Katie Neith

Nader Engheta

MS ’79, PhD ’82, Electrical Engineering;
Electrical Engineer and Physicist

For his pioneering advancements in optics, including optical nanocircuits and metamaterials, which have brought a new understanding to how light and materials interact at the nanoscale.

Nader Engheta has long been intrigued by waves. When Engheta was a teenager in the 1970s in his native Iran, his older brother taught him how a battery-operated transistor radio worked. “I instantly became fascinated with the waves we cannot see,” remembers Engheta, the H. Nedwill Ramsey Professor at the University of Pennsylvania. “That fascination and curiosity really pushed me into trying to find out what waves are and what properties they have.”

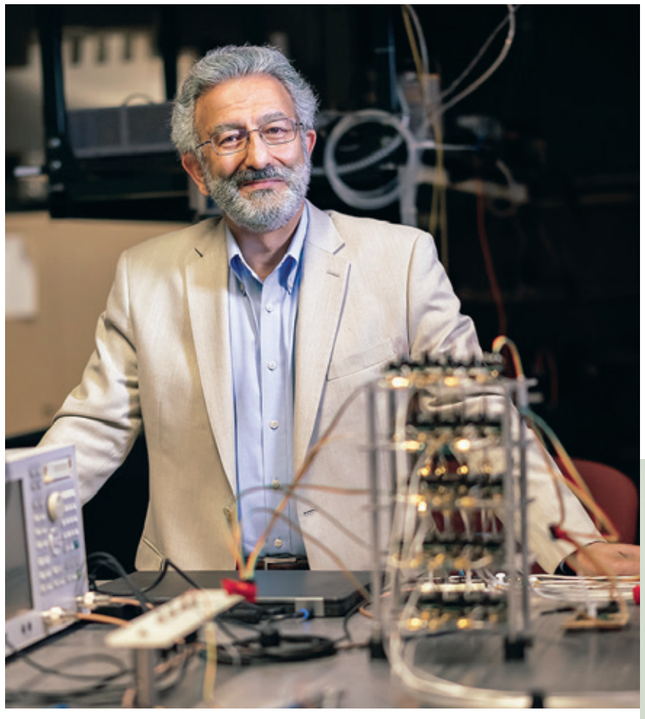
His wave quest led him to pursue a bachelor’s degree in electrical engineering at the University of Tehran. He continued his studies at Caltech and, for his doctorate, earned a degree in electrical engineering with a minor in physics. Now, with decades of groundbreaking research to his name, Engheta is still energized to discover more about what scientists can build with waves. “I’m passionate about the physics and engineering of waves because to utilize waves in order to achieve new and useful functionalities, we need to manipulate and control them,” Engheta says. “And for that we need materials.”

Engheta has spent his academic career at the University of Pennsylvania, where he holds a primary appointment in electrical and systems engineering, and secondary appointments in physics and astronomy, materials science and engineering, and bioengineering. His work has revolutionized how specialized materials can sculpt light, which has led to numerous novel phenomena and technologies such as near-zero-index photonics, wave- and material-based analog computing, and invisibility cloaks.

His research has also led to fundamental and transformative contributions to the electrodynamics of light–matter interactions including the development of optical nanostructures that are analogous to microelectronic circuit elements, and it has assisted in the creation of many other innovations in optics, electromagnetics, and materials science. These include optical structures that can bend light in unusual ways and have applications in photovoltaics and spectroscopy. In addition to optics and nano-optics, his current work also spans photonic computation and more. For example, Engheta has been working on a system that uses light waves instead of electric currents to perform analog computations.

“Doing analog computations with light waves at the nanoscale can bring us to another paradigm of information processing that can be done much faster than the current information processors and at a much smaller volume and lower power,” he says.

Engheta traces his many achievements—and how he arrived at them—to his time at the Institute. “Caltech taught me the way of doing science: how to be curious, how to think critically and creatively,



how to be courageous and go down different paths,” he says. “I am indebted to Caltech, because I learned how to push the frontiers of knowledge and how to explore and develop new scientific domains.”

This willingness to break boundaries bore fruit at Penn when he collaborated with a colleague in the psychology department to examine the retinas of green sunfish to find out if they have photoreceptors that allow them to see the polarization of light, a visual aspect imperceptible to the human eye. “Together, we actually created a new research field we called bioinspired polarization imaging,” Engheta says. “I’m not a biologist, but I was able to read and learn from that field and apply what I know about light waves in my field to a different one. And this type of philosophy—not being afraid to go into a new field—I learned from Caltech.”

Karen Maples, MD

BS ’76, Biology; Physician

For her trailblazing role as one of the first Black female undergraduates at Caltech, and for her outstanding accomplishments as an obstetrician, which include delivering the world’s first surviving octuplets.

Karen Maples does not shy away from a challenge. Her math skills were so advanced in high school that she tutored her peers. As a teenager, she helped her mom canvass in Berkeley during the political upheaval of the 1960s and early ’70s. When it came time for college, Maples chose Caltech without visiting campus and without knowing what to expect when she got there, including that there were only a few women enrolled, and that she would be in the first class of Black undergraduate women. “When you come from a place where you’re at the top of your class and find out that college is quite different, that was an eye-opener,” Maples says.

Maples was recruited to Caltech by the late Lee Franke Browne, a Caltech employee and lecturer who dedicated his career to efforts that expanded students’ access to STEM. “I didn’t know a thing about Caltech, but my mother, who was an educator, thought it sounded like a great opportunity,” Maples says.

While Maples intended to pursue math, the late Ray Owen, professor of biology, emeritus, helped set her on the path toward medicine. “Ray was an incredible teacher and a wonderful mentor,” she says. “He really supported me through my years at Caltech.”

With no pre-med option at Caltech, she studied for the MCAT without much guidance and was accepted to the UCLA School of Medicine. Thanks to the foundation for learning she had built at the Institute, Maples says the world of professional medicine “clicked” for her when she got the chance to interact with patients. “Caltech taught me the value of critical thinking and how to put the whole picture together, which helped guide me in patient care so that I don’t just evaluate the individual details of a case,” she says. “That thinking process helped me become very successful as a physician.”

It also earned her the residency of her choice, first at Los Angeles County Women’s Hospital, then at Harbor-UCLA Medical Center, where she did a rotation at Kaiser Bellflower. Maples spent 39 years with Kaiser Permanente as an obstetrician and gynecologist, retiring recently after nearly four decades that included safely delivering Nadya “Octomom” Suleman’s octuplets. “As chief of the department, Suleman was my patient for the duration of her care,” she says. “It was quite a feat—I think they are still the only surviving octuplets in the world.”

Maples’s contributions at Kaiser Permanente include establishing a teen obstetrics clinic, promoting laparoscopic gynecological surgery, and creating obstetric content for the electronic medical record. As chief of service, Maples managed 40 physicians, 20 nurse practitioners and midwives, and 15 rotating OB/GYN residents. She oversaw the opening of a high-risk labor and delivery unit and provided staff training that led to a significant improvement in patient safety outcomes. Maples has also served on the Food and Drug Administration’s Obstetrics and Gynecology Devices Panel and as an advocate for the American College of Obstetricians and Gynecologists.

However, Maples is most proud of her time as the assistant area medical director of Kaiser’s Downey Medical Center from 2011 to 2019 as well as her mentorship of countless medical professionals and young women pursuing a STEM career. “I try to talk to any woman interested in medicine or the sciences,” Maples says. “Similar to being a lifelong learner, I like to think I’ve become a lifelong mentor.”

Eugene Myers

BS ’75, Mathematics; Computational Biologist

For his transformative impact on the field of bioinformatics. Myers created the Basic Local Alignment Search Tool (BLAST) that revolutionized biological sequencing and continues to be used by scientists throughout the world, and he later developed a whole-genome shotgun method that helped map the human genome.

Although he was born in Idaho, Eugene Myers traveled the world as a child due to his father’s career with ExxonMobil. One of the main constants in his life, he notes, was access to books. “Probably the most influential thing in my life is that my parents had a volume of *Gray’s Anatomy,*” Myers says. “At 12 years old, I already knew about mitochondria and the endoplasmic reticulum.”

After finding one of his dad’s college textbooks on linear algebra, he gravitated toward math, earning his bachelor’s degree from Caltech in the subject. But those early lessons in biology stayed close to his heart throughout his professional career, including his most recent tenure as director of the Max Planck Institute of Molecular Cell Biology and Genetics in Germany.

Myers became interested in electrical engineering—which he would eventually apply to computational biology—as an undergraduate at the Institute, where, he says, he missed out on earning a dual bachelor’s degree because he refused to take a public speaking class. He went on to earn a PhD in computer science from the University of Colorado and then held faculty positions at the University of Arizona and UC Berkeley and served as a group leader at the Janelia Research Campus of the Howard Hughes Medical Institute.

It was at the University of Arizona in the late 1980s that Myers helped create the Basic Local Alignment Search Tool (BLAST)—now one of the most widely used bioinformatics programs—which uses an algorithm to compare biological sequence information with a database of sequences. This kind of information allows researchers to trace genes across multiple species.

Building on what he learned creating BLAST, Myers helped lead Celera Genomics’ successful quest to map the fly, human, and mouse genomes in just three years (1999–2002) while serving as the company’s vice president of informatics research. Using computer programs to help decipher the chemical makeup of the human genetic code and those of other animal models has helped make many major biological research and medical advancements possible, he says.

“I went into the job with a complex and difficult mission to build a system with a lot of moving parts—thank God I was one unit away from having an engineering degree,” says Myers, who credits his undergraduate education for guiding his path. “Caltech helped me view things with a beginner’s mind and learn how to be very creative and resourceful in terms of looking for solutions.”

Myers retired earlier this year, but he has not stopped working. In fact, he has set up an independent research project to sequence the genomes of every species of bat on Earth. “Bats are fascinating,” he says. “There are bats that live 50 times longer than they’re supposed to and bats that never get sick. Fruit bats eat sugar all day and never get diabetes. What’s going on there?”

Myers says if his team can develop all the sequences and look for differences at the molecular level in bats, they will potentially discover ways to help people live longer. “I’m not going to stop solving problems,” he says. “I still write code every morning. I write programs that I think are going to be useful and interesting to other people.”

Kenneth Suslick

BS ’74, Chemistry; Chemist and Medical Entrepreneur

For profound contributions to sonochemistry (the study of chemical reactions powered by high-frequency sound waves) and chemical sensing, which have advanced the field of medical imaging and facilitated life-saving treatments for cancer and sepsis patients.

Listening to the radio played a key role in the life of Ken Suslick, who grew up in Chicago in the early 1960s, in much the way it did for Distinguished Alumni Awardee Nader Engheta (MS ’79, PhD ’82).

“It was the era of space exploration, and I still remember begging my dad for a little transistor radio, so I could listen to the NASA launches,” Suslick says.

A few years later, a high school teacher turned him on to chemistry, the field he studied as a Caltech undergraduate and later for his PhD at Stanford. He is now the Marvin T. Schmidt Professor of Chemistry, Emeritus, at the University of Illinois at Urbana-Champaign. But when he arrived at Caltech, Suslick figured he would study math.

“After a week, I realized I was definitely going to be a chemist,” he says with a laugh. “There were huge differences between a math major at Caltech and somebody who was at the top of his class in high school calculus.”

As a first-year student, he worked with analytical chemist Fred Anson (BS ’54)—now the Elizabeth W. Gilloon Professor of Chemistry, Emeritus—and then joined the lab of Bob Bergman, an organic chemist who later moved to UC Berkeley. “The lab is where I learned to think critically and creatively,” Suslick says.

Creative approaches to research wound up driving his career. After his doctorate, Suslick accepted a position in his home state at the University of Illinois, where he has been for 45 years. During that time, he has worked as a scientist, inventor, and serial entrepreneur, tackling subjects as far ranging as the chemical effects of ultrasound (sonochemistry), the mechanochemistry of inorganic solids, drug delivery, and chemical sensing (most notably of bacteria). “I’ve always been interested in doing things that others aren’t,” Suslick says. “The important question for me is: ‘Is your research interesting or boring?’ Not ‘Is your research basic or applied?’ And that’s one of the reasons why I like going off the beaten path.”

His investigations into sonochemistry led to breakthroughs in the development of the first echo contrast agent for medical sonography, allowing physicians to see ultrasonic images in much greater detail. Suslick’s sonochemical research also helped him co-invent the nanopharmaceutical Abraxane, a chemotherapy agent used to treat breast and pancreatic cancers.

Another company launched by Suslick called Specific Diagnostics developed an array-based chemical-sensing platform that can rapidly test for antimicrobial susceptibility. “We discovered that we could rapidly tell bacteria apart based on their smell,” Suslick explains, noting the sensors consist of multiple different chemically responsive dyes that change color when exposed to odors. “The pattern of color changes is a molecular fingerprint. We can now use this technology to diagnose sepsis [a dangerous and fast-acting blood infection] in a few hours when it used to take two or three days.”

At age 70, Suslick started a company called Iridescent Sensors that makes a handheld, portable “optoelectronic” nose for use by first responders, hazmat workers, and chemists, which can swiftly detect toxic gasses at low concentrations.

“Every step I’ve taken I trace back to Caltech,” Suslick says. His son, Benjamin, is now following in those footsteps: Benjamin earned a bachelor’s degree in chemistry from Caltech in 2014 and works as a polymer chemist.