# TECHNIQUES

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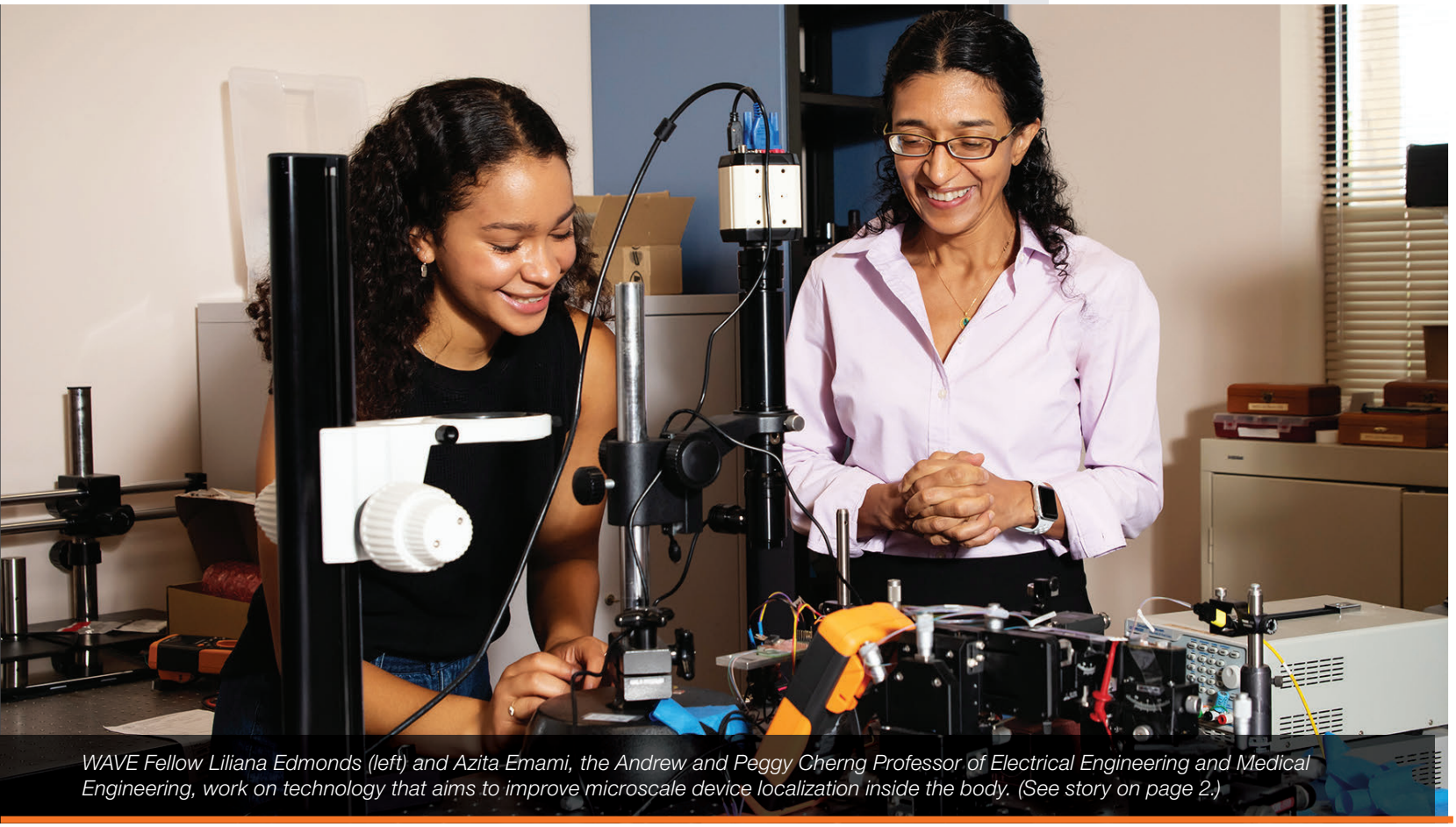

*WAVE Fellow Liliana Edmonds (left) and Azita Emami, the Andrew and Peggy Cherng Professor of Electrical Engineering and Medical Engineering, work on technology that aims to improve microscale device localization inside the body. (See story on page 2.)*

## WHAT'S INSIDE



## RECOGNIZE THIS ALUMNUS?

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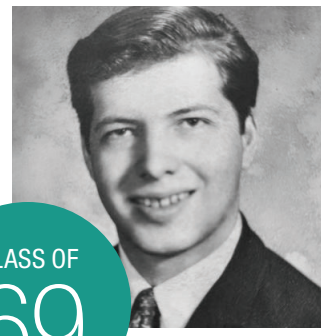


CLASS OF '69

Caltech

# Building a Path to Success at Caltech

## Bringing a Caltech Education to More Students

Growing up in Elverson, a small Pennsylvania borough, Thomas McCord (MS '66, PhD '68) knew more about cornfields and wild game than major research universities. No one in his family had earned a bachelor's degree, and after high school, he spent several years working odd jobs and serving in the U.S. Air Force before enrolling at a four-year university.

Caltech was one of several institutions that admitted Tom when he decided to pursue a doctorate. His wife, Carol McCord, encouraged him to consider the Institute. And when one of his professors told him that the academic experience at Caltech was so challenging he should not bother attending, Tom decided he had to try.

### A LIFE-CHANGING DECISION

So it was that in June 1964, Tom and Carol got into her old Nash Rambler to travel from Pennsylvania to California. As they drove along Route 66, full of youthful caprice and wanderlust, they did not yet understand how profoundly this decision would change their lives.

As a graduate student, Tom learned from pioneering researchers such as planetary scientist and former JPL director Bruce Murray, geologist and then division chair Robert Sharp, and astrophysicists Jesse Greenstein and Gerry Neugebauer. Murray, who was Tom's adviser, invited Tom to work on JPL's Mariner 8 and 9 missions.

As a faculty member at MIT and the University of Hawaii, Tom collaborated with JPL and other international space agencies on more than a dozen missions. His groundbreaking work in reflectance spectroscopy helped transform our understanding of the solar system and enabled the detection of water on the moon. When Tom left academia, he and Carol established the Bear Fight Institute, which enabled Tom to continue working on space missions. In 2013, he was awarded the Distinguished Public Service medal, the highest honor NASA gives to non-governmental employees.

Looking back, Tom and Carol are grateful for the friendship as well as the mentorship Caltech faculty offered them. For instance, Sharp would take the couple on weekend excursions to see California landforms such as the Algodones Dunes and the Panamint Range.

"It set a precedent for how we should interact with our students," says Carol, who worked in education before cofounding the Bear Fight Institute. To this day, Tom and Carol stay in touch with their former mentees and collaborators.

### HELPING OTHERS FIND THEIR WAY TO CALTECH

It is not lost on Tom that he might never have enjoyed his close friendships and influential career had he and Carol not followed their impulse to travel to Pasadena. He believes there are many other students who, like him, do not necessarily know about Caltech but have the intelligence and ambition to succeed

at the Institute. And to tackle the world's most pressing problems, the Institute needs scientists and leaders from all corners of the world—including rural Pennsylvania.

To help ensure that brilliant minds continue to find their way to Caltech, Tom and Carol have made a bequest to establish the Thomas and Carol McCord Fund. When realized, it will help Caltech recruit and retain exceptional students from diverse backgrounds by providing undergraduate scholarships and graduate fellowships, and by supporting programs, such as the First-Year Success Research Institute and the WAVE Fellows program (see cover photo), that identify and serve underrepresented students.

"There is a lot of raw talent out there," Tom says. "We need to find these students and bring them into the Caltech community. With this approach, they can receive a high-quality education and improve their social mobility. In turn, society and the world benefit from their talent."

# Torchbearers Legacy Society

Membership in the Torchbearers Legacy Society is extended to those who have provided for Caltech in their wills or living trusts, designated Caltech as a beneficiary of their life insurance or retirement accounts, or completed deferred gifts for the benefit of the Institute.

In recent months, the following people have joined the Torchbearers.

Mrs. Betty M. Anderson

Dr. Timothy S. Axelrod (BS '69) and Ms. Roberta A. Allsman

Dr. Thomas E. Burton (BS '69)

Mr. Richard G. Campbell (MS '77)

Dr. Frank L. Fernandez (PhD '69) and Mrs. Carmen Fernandez

Dr. David R. Hearn (BS '64) and Mrs. Florence O. Hearn

## ESTATE GIFTS

From the estate of **Eiko Tomiyasu**, $5,300,000 for the Kiyo and Eiko Tomiyasu Discovery Fund and the Tomiyasu Presidential Fund

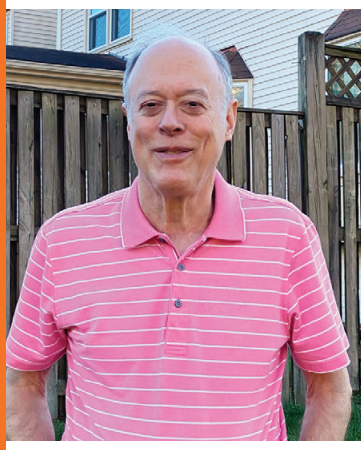
From the estate of **Noel R. Corngold**, $155,700 for the Noel Corngold Graduate Fellowship

From the estate of **Roy W. Gould** (BS '49, PhD '56), $754,600 in unrestricted support

From the estate of **Clelia W. Mallory**, a partial distribution of $830,000 in unrestricted support

From the estate of **Caroline Woodruff**, $4,500,000 in unrestricted support

# Gratitude for Caltech Fellowship Inspires Planned Gift



*Bill Pegram (MS '85, PhD '89)*

By the time William (Bill) Pegram (MS '85, PhD '89) arrived at Caltech, the St. Louis native had already completed a self-designed bachelor's program in computer science, philosophy, and linguistics and obtained an MBA (concentrating in economics and public management), both from Stanford University. He had also spent five years working as an economist for the Environmental Protection Agency and the Congressional Budget Office. He was drawn to Pasadena by the opportunity to study economics under the guidance of Caltech professor Roger Noll (BS '62), who had been a visiting professor for two of his classes at the Stanford Graduate School of Business and had spoken at several conferences Bill had attended in Washington, D.C.

Bill appreciated Noll's narrative ability, which he describes as being "buttressed by an encyclopedic knowledge of government regulation," as well as his sense of humor. Once, for example, Bill was struggling with a task at the blackboard. Noll, on crutches due to an injury he sustained playing basketball, got up with some difficulty to assist. Bill recalls, "After he managed to do this at least twice, he remarked with a laugh, 'Bill, if I have to do this one more time….'"

In 1982, Bill became one of seven students that year to enroll in Caltech's graduate social sciences program, which had conferred its first PhD in 1978. He feels fortunate to have received fellowship support throughout his graduate career, which freed him from teaching responsibilities and allowed him to concentrate on his courses and research.

He remembers afternoon jogs, occasional hikes in the foothills of the San Gabriel Mountains, and a brief conversation with Heather Locklear while she was filming *Dynasty* near campus. He undoubtedly was too focused on his studies when his new girlfriend invited him to join her on an all-expenses-paid trip to Hawaii and he declined, saying, "I'd better work on my thesis." Having never made it to Hawaii, he tells himself, "You fool!" when he thinks about this today.

Even as an economist, Bill was profoundly influenced by Caltech's involvement with JPL. He worked at JPL in summer 1983 on a paper about the investment behavior of defense contractors. From 1986 to 1988, he worked for the same JPL group at NASA's space station headquarters, attempting to bring economic principles to the operation of the International Space Station. He took a leave of absence to complete his thesis on the political economy of the federal photovoltaics program.

His Caltech PhD helped him acquire a position at the Federal Trade Commission, where his responsibilities included economic analyses of proposed mergers and acquisitions. He regards that as one of the best jobs he's had.

Today, Bill is an adjunct associate professor at Northern Virginia Community College, where he has taught courses on web design and development, software tools, and programming since 2000. He has also taught at other local institutions, including George Mason University.

In 2019, Bill designated Caltech as the beneficiary of his defined contribution plan from his community college teaching career. He intends for his planned gift to benefit the Division of the Humanities and Social Sciences, with an eye toward "paying back" the fellowship support he received.

*Sophia Su-Hwei Yen*

# An Employee's Dream of an Education Lives On

The legacy of World War II is incalculable. The war preserved freedom, ignited a Cold War, and changed the trajectories of many lives—like that of Sophia Su-Hwei Yen.

In 1941, Sophia was a bright and ambitious teenager attending an English-speaking school in Singapore. The only daughter in a family with three brothers, she wanted to follow in her father's footsteps and become a physician.

But she would never fulfill that ambition. The day after the attack on Pearl Harbor, the Japanese bombed British-ruled Singapore. Because he had been born in Taiwan, which was occupied by Japan, Sophia's father was considered an enemy. The British sent him to India to serve as a doctor for fellow prisoners of war. Sophia and her two older siblings had to find jobs to support the family.

## A PASSION FOR EDUCATION

At the close of the war, Sophia, her mother, and her brothers were sent to Taiwan in a prisoners' boat. It was about a year before Sophia's father rejoined the family. Although she never stopped working, her passion for education endured. When she emigrated to the United States in 1966 and joined her younger brother I-Kuen "Ike" Yen and his wife, Chen-wan Yen, in Pasadena, she sought a job at Caltech. She soon found one at the Institute's library.

With no other relatives nearby, Sophia, Ike, and Chen-wan stayed close. Chen-wan, an orbital dynamics expert who recently retired after a 45-year career at JPL, was pleased to see Sophia strike out on her own and eventually thrive in her new country. Sophia took night classes at Pasadena City College and earned an associate's degree. She also was committed to her work at Caltech, Chen-wan says.

"She got a lot of compliments from faculty about her work, and she really loved her job," Chen-wan says. "Almost every morning, she would bring flowers into the office to brighten everyone's day. She was really that happy."

## A DESIRE TO HELP STUDENTS

Sophia also grew fond of the students who browsed the bookshelves and asked her questions.

"She would befriend students, talk to them all the time, and even look after them," Chen-wan says. "In retrospect, I think she saw some of herself in them and admired what they were trying to achieve."

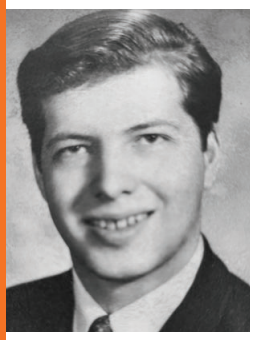
*Sophia Yen (far right) as a child with her family*

Sophia eventually embarked on a new career in Caltech's development office, helping fundraisers identify potential donors. She worked there for several years before retiring in 2002. But she never forgot about the students. The same year Sophia left Caltech, she established a $300,000 endowed undergraduate scholarship through a bequest. Her generosity enables learners just like her, smart and hardworking but lacking financial resources, to achieve their dreams. To celebrate her family history, Sophia's gift also states a preference for gifted undergraduates of Chinese American, Singaporean, or Taiwanese heritage.

Currently, more than half of Caltech undergraduates receive financial assistance, and increasing scholarship support is a top fundraising priority.

"Sophia had a desire to help students," Chen-wan says. "She would be happy to see her gift making a difference in their lives."

*Our alumnus (far right) with colleagues, students, and the robot (Credit: Luna Community College LRC)*



# Recognize This Alumnus?

This alumnus wanted to be a physicist from the moment he learned about the profession in grade school. So, when an uncle who lived in Pasadena told him about Caltech, he knew right away where he wanted to get his education.

During his first year at the Institute, he took a course taught by Richard Feynman. At the outset of the term, Feynman told students about the wonderful and exciting things they would learn. He finished by raising his arms and saying, "Including why the sky is blue!" That promise, met with chuckles, was fulfilled in the lecture on light scattering.

After graduating with a bachelor's degree in physics, this alumnus earned master's and doctoral degrees in the subject from the University of Chicago and the University of Arizona, respectively. In 1973, the year he obtained his PhD, he joined the Air Force and met his future wife on a blind date.

He specialized in elementary particle physics and modeling and simulation. He developed software to evaluate both natural and induced near-earth radiation environments experienced by satellite systems, performing this work for the Air Force and government defense contractors. Along the way, he made major contributions to the understanding of security, vulnerability, and operational capabilities of satellite systems flown by the United States and other countries, and he became a recognized expert in the field.

He also taught an honors computing class at Luna Community College in Las Vegas, New Mexico. One year, to hold students' interest, he borrowed a robot from his employer, Sandia National Laboratories. He asked his students to write programs to make the robot walk, raise its arms, shake hands, and whirl its head.

Their final exam was to teach a class of elementary students to make the robot perform these same functions—to the great enjoyment of all.

In social situations, this alumnus found that most people shied away from physicists, so when he was asked what he did for a living, he would answer, "I bang on computers." People would nod, smile, and stick around.

**Dr. Gary D. Cable (BS '69)** passed away in 2017. The following year, Mrs. Celia A. Cable made a gift to endow the Dr. Gary Dean and Celia Arias Cable Memorial Scholarship at Caltech and documented a bequest intention to augment the fund, which supports physics students.

She says, "It is hoped that future Cable scholars learn the academics to further our knowledge of the world around us and share that knowledge with people of all ages; that future Caltech physicists will learn physics and how to be approachable so as to make physics interesting to all peoples; and that this planned gift makes the wonders of physics, be it magnetics, radiation, light, quantum, or astronomical images of distant celestial bodies, including those dusty places where stars are born, simple enough to be taught and understood in elementary grades to encourage future generations of physicists."

*Dr. Gary D. Cable (BS '69) and Mrs. Celia A. Cable*

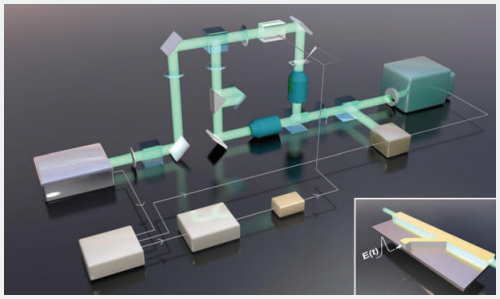
# Good News from Caltech

## THE WONDERS OF JELLYFISH

Deep within the pristine hallways of Caltech's Chen Neuroscience Research Building is a darkened room lined with tanks of gently bubbling water illuminated by dim lights. Disappearing and reappearing as they drift through the liquid are ghostly, translucent jellyfish. Older than the dinosaurs, older even than Saturn's rings, these creatures have survived drastic environmental changes relatively unscathed. Over the past decade, Caltech faculty David Anderson, John Dabiri (MS '03, PhD '05), and Lea Goentoro have been studying these primitive animals to uncover new insights about neuroscience, the deep ocean, and biological regeneration.

## A PLANET-WIDE LOOK AT HUMAN IMPACTS

The Human Impacts Database provides a snapshot of our impact on Earth, from global plastic production (4 x 1011 kilograms/year) to the number of cattle on the planet (about 1.6 billion) to annual mean sea-level rise (approximately 3.4 millimeters/year). Funded in part by the Resnick Sustainability Institute, the project was conducted in the lab of Rob Phillips, the Fred and Nancy Morris Professor of Biophysics, Biology, and Physics, and led by former grad students Griffin Chure (PhD '20) and Rachel Banks (PhD '22). The team hopes the database will help ordinary citizens as well as policymakers make informed decisions.



## PHOTOGRAPHING ULTRAFAST PHENOMENA

Reach out right now and touch anything around you. Whether it was your keyboard or your dog's fur, you felt it instantly—or did you? It happens fast, but it takes time for your brain to register the sensation from your fingertip. The touch signal travels through your nerves at over 100 miles per hour. Now, a team led by Lihong Wang, the Bren Professor of Medical Engineering and Electrical Engineering and holder of the Andrew and Peggy Cherng Medical Engineering Leadership Chair, has developed a camera that captures videos of signals traveling along nerves and even electromagnetic pulses traveling at nearly the speed of light.

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