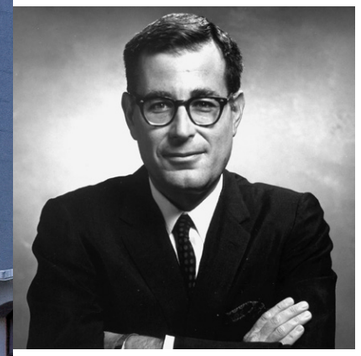
Caltech

The Broader Context

Caltech at the Intersection of Science and Society

Caltech creates knowledge for the ages, yet is also an institute that meets the moment, one with enduring achievements rooted at the intersection of science and society.

Today, Caltech continues to take advantage of this opportunity to fuel discovery and innovation while seeking answers to discipline-defining scientific and technological questions.

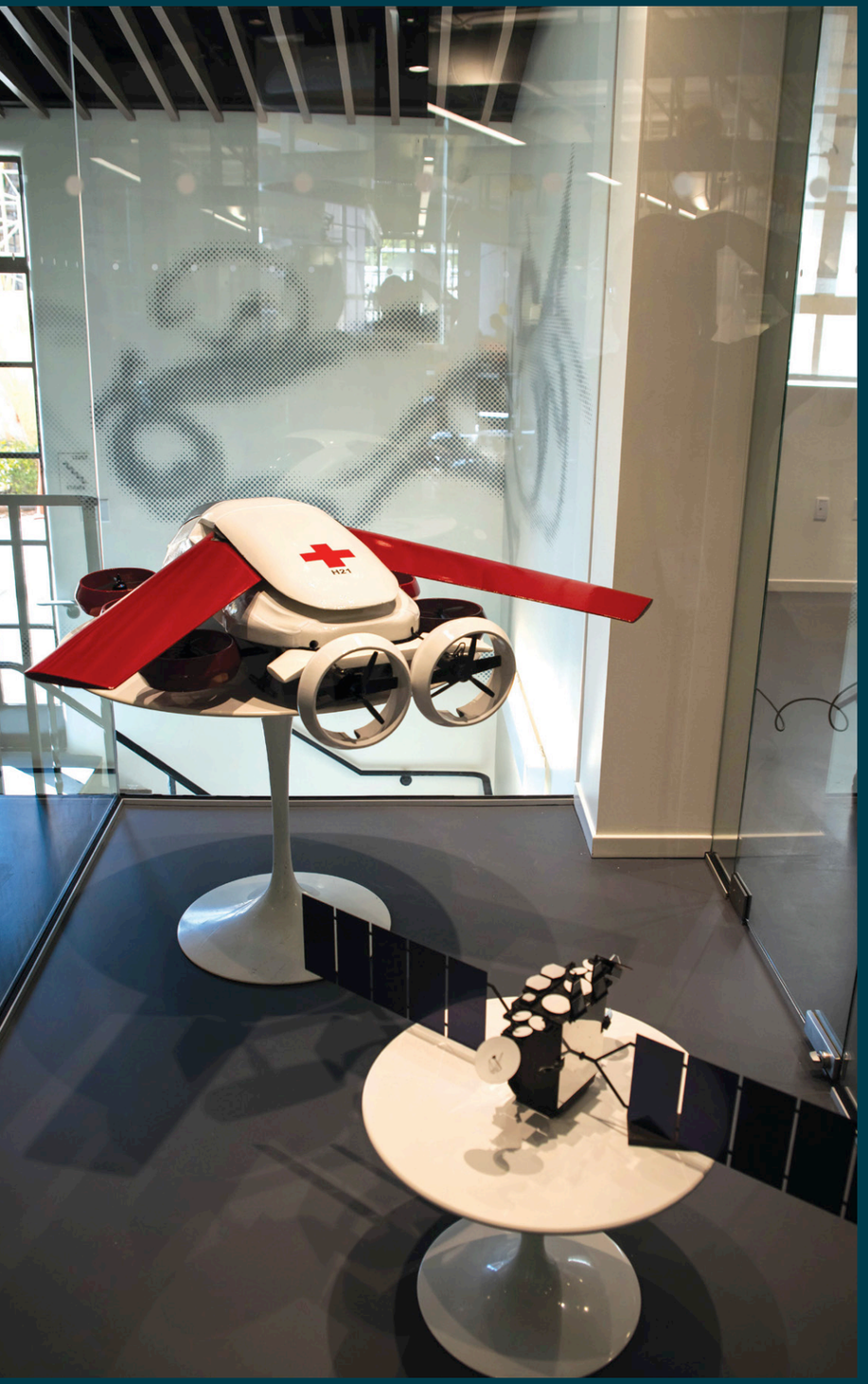


On October 30, 1969, Harold Brown was inaugurated as Caltech's third president. In his inauguration speech, "Caltech: A Singular Opportunity," he argued that the Institute had both an opportunity and a responsibility to make a far-reaching contribution to society by connecting its activities and goals to the broader world.

"[O]ur great institutions of learning present an unequaled opportunity to make a long-range contribution to society. In my view, this is particularly true at Caltech. By producing new knowledge and new leaders, we in the universities can grapple with the problems not only of today but of the next decade, and of the next century. I have found before, and find now, a particular challenge in working to relate the activities and goals of a highly professional, effective institution—on its own terms, the best in the world—to the larger perspectives and aspirations of the world of which it is a part. This opportunity, and this challenge, are what have brought me to Caltech."

"An institution of higher education is by its nature dedicated to the humane values and also to rationality, whose offspring are science (the knowledge of ourselves and the universe) and technology (the ability to change ourselves and to influence our surroundings). These are the central concern of this particular institution, and together they constitute the essence of our modern civilization."

"I believe that mankind can find an acceptable existence only by proper understanding of science and utilization of technology, not by their rejection. And I believe that Caltech's particular qualities and potential demand that we create not only new discoveries and applications, new sciences and technologies, but new ways of seeing nature, man, and society. These views convince me that Caltech presents a singular opportunity to me and to all of us who are a part of the Institute community."



Morteza (Mory) Gharib (PhD ’83)

Mory Gharib is the Hans W. Liepmann Professor of Aeronautics and Bioinspired Engineering and the Booth-Kresa Leadership Chair and director of the Center for Autonomous Systems and Technologies as well as director of Caltech's Graduate Aerospace Laboratories. He is recognized for his accomplishments as an entrepreneur and founder of several successful technology companies and has led efforts at Caltech to establish the bioengineering and medical engineering departments. Gharib served as vice provost for research from 2010 to 2016. He received his bachelor’s degree in mechanical engineering from Tehran University, his master’s degree in mechanical and aerospace engineering from Syracuse University, and his doctorate in aeronautics from Caltech. Gharib is a member of the National Academy of Engineering and a fellow of the American Academy of Arts and Sciences.

“CAST is the Center for Autonomous Systems and Technologies at Caltech. It’s a place where Caltech and JPL faculty, scientists, and engineers come together in order to define the future of the autonomous systems technologies.”

“In the tradition of Caltech, we are in the business of taking the high-risk challenges: from LIGO to landing a crane on Mars, these are challenges that we have always taken. So CAST is, in the same tradition, going to really embark on solving challenges in autonomous systems technologies, from driverless cars to reducing the risk of conducting scientific research, to medicine and helping communities to basically survive or be less at risk.”

“This is the time to have a mission.

We believe that it’s important to do basic research and develop basic understanding of different systems as they regard autonomous systems;

also it’s important to think of applications and where this can be implemented. That by itself brings new challenges, and those challenges cannot be understood until you have interfaced with the real world.”

“This is an environment where we can actually observe and learn, and we hope that it helps us in the future to develop better educational tools for future generations. Problems that we cannot solve, perhaps they can solve. That’s the important and exciting part of CAST.”

—in a video celebrating CAST’s opening, 2017

Sharon Long (BS ’73)

Sharon Long, now Stanford University’s William C. Steere, Jr.–Pfizer Inc. Professor in Biological Sciences, transferred to Caltech from Harvey Mudd in 1970 as one of the first four female undergraduates admitted to modern-day Caltech. She went on to earn her doctorate at Yale and joined Stanford’s faculty in 1982. A Caltech Distinguished Alumna, Long was named a MacArthur Fellow in 1992.

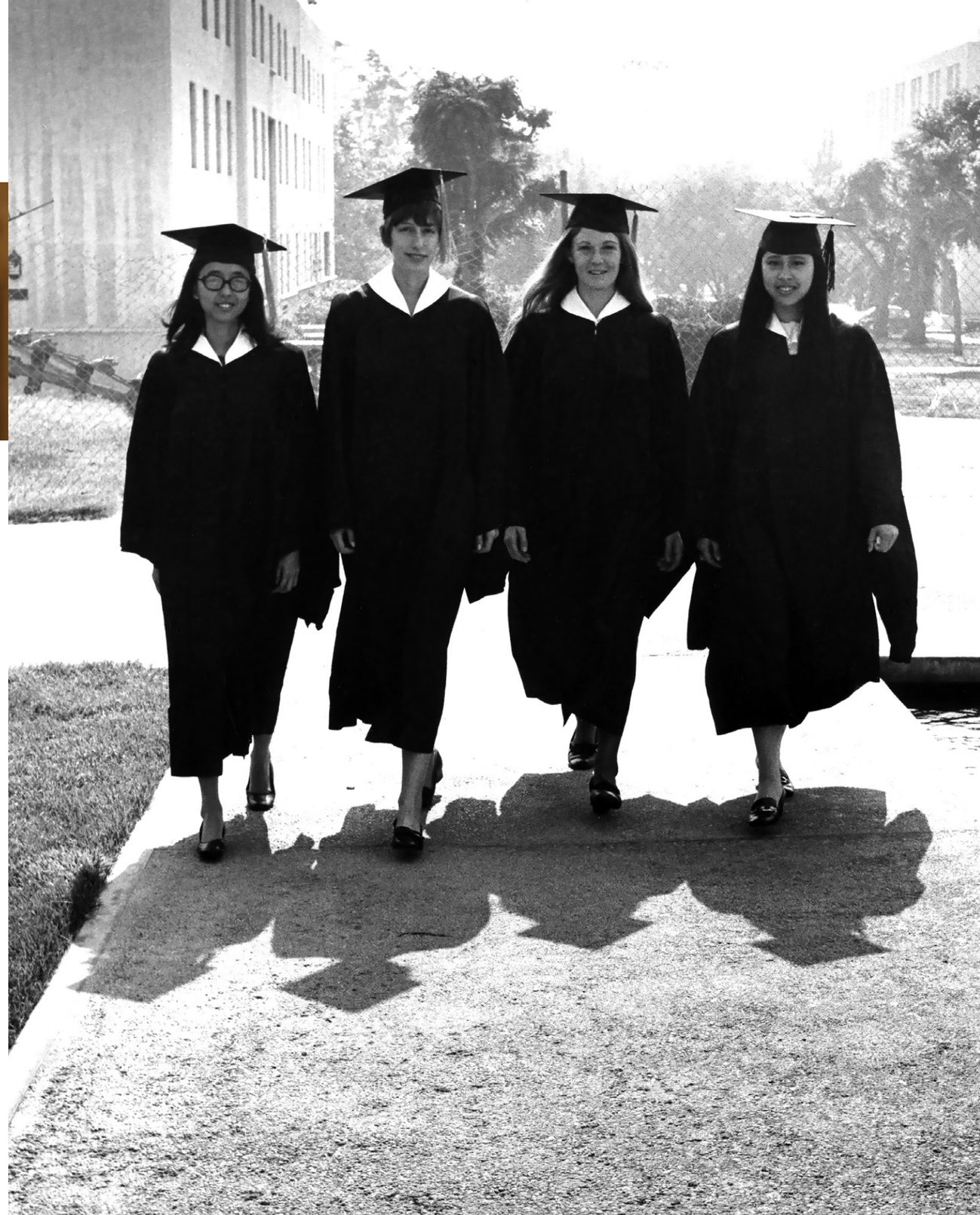
“What was special about Caltech was the people. The students and the faculty; the extraordinary quality of mind of the other students, and the experience and accessibility and brilliance of the faculty.”

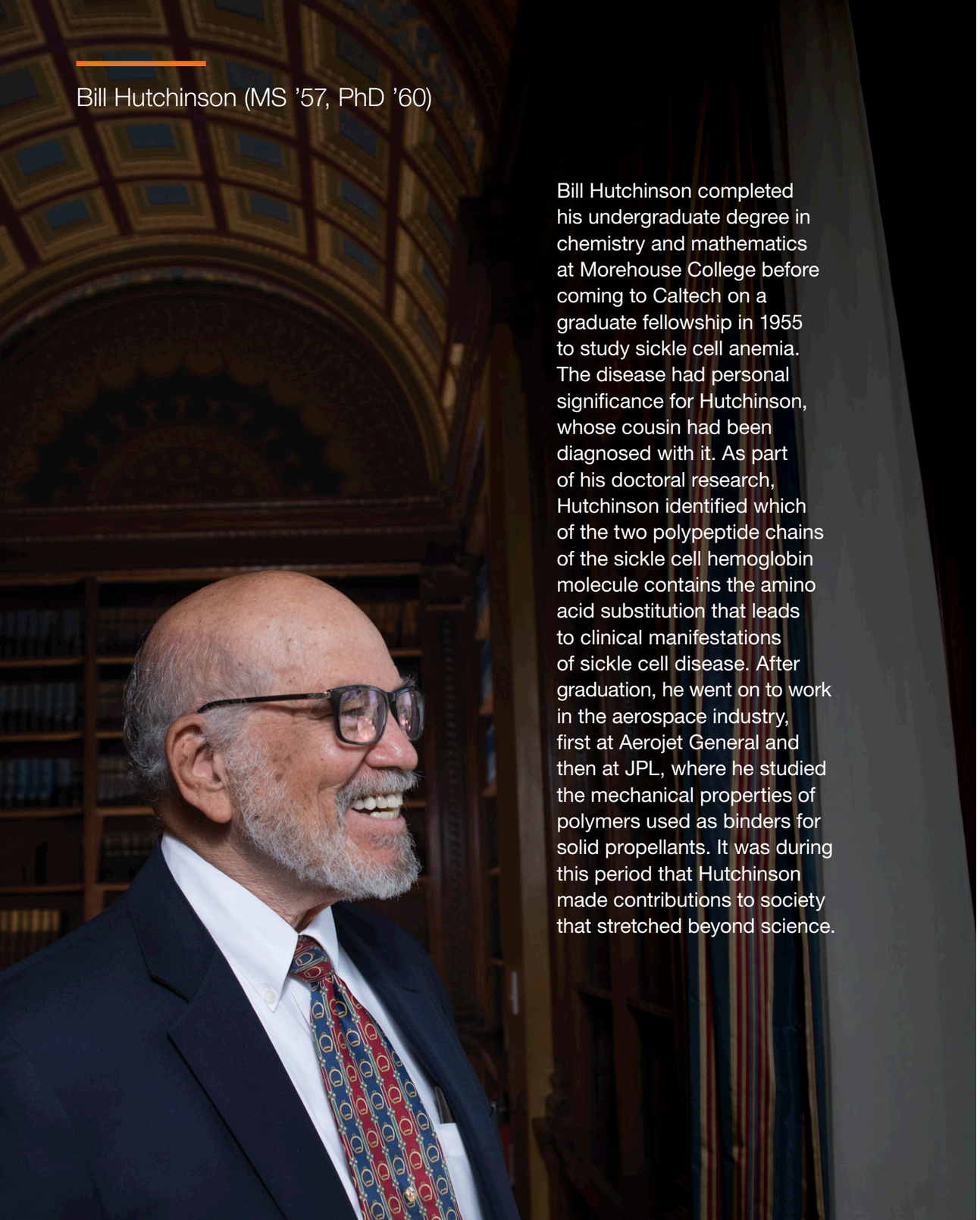
“If there’s a question that’s really important, and there’s no way to answer it, the Caltech attitude is ‘invent a way to answer it’ or ‘learn the way to answer it,’ not ‘we can’t do it.’ I think this is part of the atmosphere. It may not be something you are directly taught—no one puts it in words like that—but the excitement and enterprise and ingenuity that students bring to so much of what they do creates this atmosphere. That has been invaluable to me in my research career.”

“I also found so many faculty mentors setting a great example. That definitely has affected my own work as a faculty member at Stanford, because I recognize how much it meant to me when Caltech faculty gave me a boost when I was discouraged, helped me see past a problem, or communicated their love and enthusiasm for the science they were doing.”

“For example, when I was a junior, I took Bill Wood’s course in biochemistry, and I just fell in love. I became a biochemist instead of a chemist because of that course. Then, when I was a senior, he asked if I would be a TA for that same course. That was such a great boost to my confidence, to see that I had a skill that he recognized. That was such a gift.”

—in a personal interview, 2017





Bill Hutchinson (MS ’57, PhD ’60)

Bill Hutchinson completed his undergraduate degree in chemistry and mathematics at Morehouse College before coming to Caltech on a graduate fellowship in 1955 to study sickle cell anemia. The disease had personal significance for Hutchinson, whose cousin had been diagnosed with it. As part of his doctoral research, Hutchinson identified which of the two polypeptide chains of the sickle cell hemoglobin molecule contains the amino acid substitution that leads to clinical manifestations of sickle cell disease. After graduation, he went on to work in the aerospace industry, first at Aerojet General and then at JPL, where he studied the mechanical properties of polymers used as binders for solid propellants. It was during this period that Hutchinson made contributions to society that stretched beyond science.

“The launching of Sputnik by Russia in 1957, and the ensuing space race, changed everything. Job opportunities until then unavailable to blacks suddenly appeared in the new aerospace industry. ... First, I took a job at Aerojet General in Azusa, California, developing solid propellants for the Polaris missile.”

“To shorten my commute..., I moved from Pasadena to an apartment in Monrovia. For a month, I lived there without a problem, until a friend—a fellow who had attended Morehouse with me—stopped by for a visit one evening. While he was there, the manager of the apartment building came to my apartment and told me that my next-door neighbor had seen a ‘n----r’ enter my apartment and that he wanted my friend to leave.”

“I then asked the question, ‘What if I’m a Negro?’ to which he responded that I would have to leave. I told the apartment manager that I would fight any effort to evict me. In the following weeks and months, I was harassed. ... After several months of my refusal to move, I was sued under California law in an unlawful detainer action [a legal procedure to evict someone from the place where they live]. The case was heard in the municipal court in Monrovia. I was allowed no defense against the eviction and the unlawful detainer, and was ordered to vacate the apartment.”

“I appealed the eviction with the argument that the apartment owner had used the court system and the resources of the State of California to deny my right to equal protection under the law as accorded me by the 14th Amendment of the U.S. Constitution. ... The appeal moved to higher appellate courts of California, where I won.”

“My case, *Abstract Investment Company v. Hutchinson*, remains the controlling case in current housing litigation in California. I continued to fight racism and discrimination over the years—coming along when I did before affirmative action, I often had to fight battles for myself and others. But to protect my family, I tried not to draw attention to those efforts. I’m not claiming heroics or anything like that, but as a black man I could get myself into trouble almost without even thinking about it. And I’d have to figure my way out of it. So, this was just my way of coping with the situation.”

—*from an interview in* Caltech *magazine, 2018*

Arati Prabhakar (MS ’80, PhD ’85)

Arati Prabhakar, whose family immigrated from New Delhi, India, to the United States when she was 3, was the first woman to earn a doctorate in applied physics at Caltech. After graduation, she became a congressional fellow at the Office of Technology Assessment before serving as a program manager and office director at the Defense Advanced Research Projects Agency (DARPA), where she would later serve as the agency’s director from 2012–2017. In 1993, President Bill Clinton appointed her director of the National Institute of Standards and Technology; she was the youngest individual, the first engineer, and the first woman to hold the role. In 2018, she founded Actuate Innovation, a Silicon Valley-based nonprofit organization supporting innovation that tackles society’s challenges.

“The progress that we’ve made over the last generation or two is pretty interesting. ... In the environment that [my children] live in, girls talk about being engineers and no one gasps and thinks it’s remarkable. It’s changed pretty dramatically since my time. The broader involvement you have across society in our profession, the healthier it is for what engineers really care about, which is coming up with solutions that solve problems for our society.”

“[W]e’re living in a dynamic environment. Geopolitics change. Energy supplies change. New technologies come online. How do you deal with all of those factors? We need to exercise judgment based on the dynamics of what’s happening right now. So, how do you do that? You nurture the ability to adapt and listen to what’s going on in the world and implement programs in a way that is going to achieve the right objective. I feel a great privilege in having worked in organizations such as DARPA and National Institute of Standards and Technology [NIST] that can do this. This doesn’t happen by accident. It happens by building organizations with people who are able to interact with the outside world—people who are given the autonomy to think and listen and then exercise judgment and who are held accountable for what comes out of that judgment. If you don’t have that, you don’t get the caliber of judgment that you really need to deal with these complex dynamic issues.”

“[T]here are so many things you can do with the foundation that you get at a place like Caltech. I really am grateful that I had the experience. Both the learning and the Caltech experience, which is very personal. When you live in an academic environment, there’s a tendency to think that what you see around you is all there is, but it’s not. It’s just one small piece of a much bigger world, and it’s a world in which you can take that foundation and do a lot of different, interesting, and impactful things.”

—*from an interview in* ENGenious, *2011*

Barbara Wold (PhD ’78)

Barbara Wold is Caltech’s Bren Professor of Molecular Biology and a former director of the Beckman Institute. She graduated from Caltech with a doctorate in molecular developmental biology and returned to the Institute three years later as an assistant professor of biology. Active in national and international science policy, Wold served as an advisor to the Human Genome Project.

“Most of us biologists would like our work to have more and faster impact in the real world, if we can do that without completely changing our basic research enterprise.”

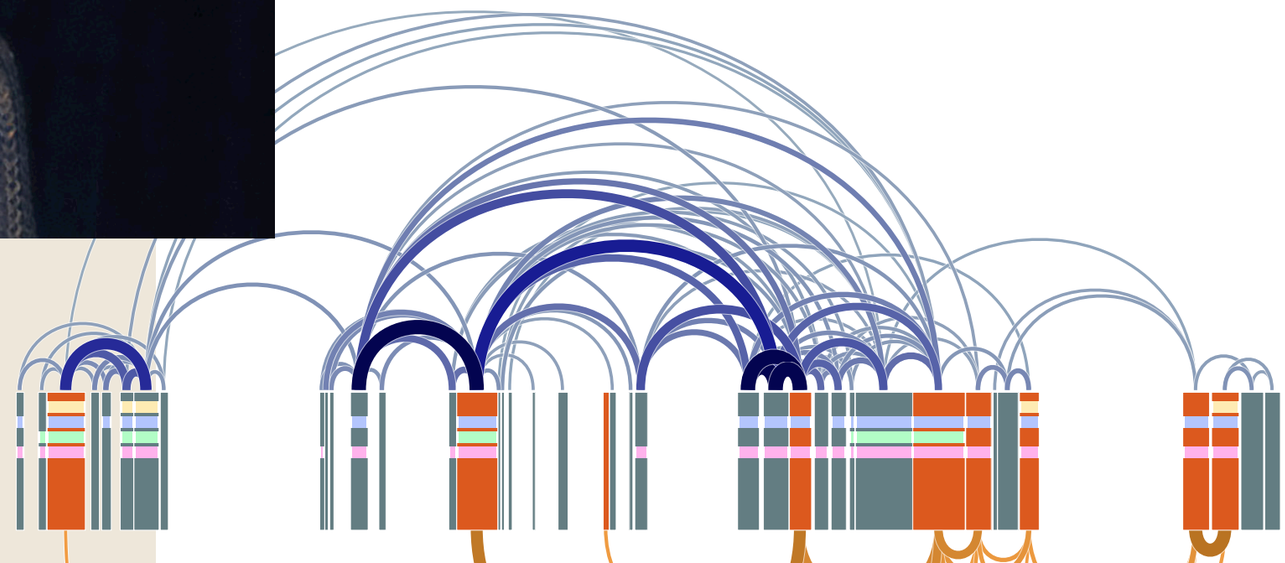
“In the old days, human biology was very hard to do because the technology was relatively primitive. So, really fundamental discoveries were most often made by studying a yeast, a worm, or a fruit fly, the so-called ‘model’ organisms. Now, you can study a fruit fly and, through knowledge of DNA sequence similarities and evolutionary relationships, you can often relate what you have learned in such systems to human biology and vice versa.”

“With the growing opportunity to mine big complex data, the idea of translation as a vector from lab bench to bedside is turning into a much more exciting ‘translational cycle.’ You do something in basic science, you make a discovery, then you find a way to translate that to biomedicine or to environmental biology. But it does not end there.”

“Now, we have the ability to mine data from the outcome to influence new basic research.”

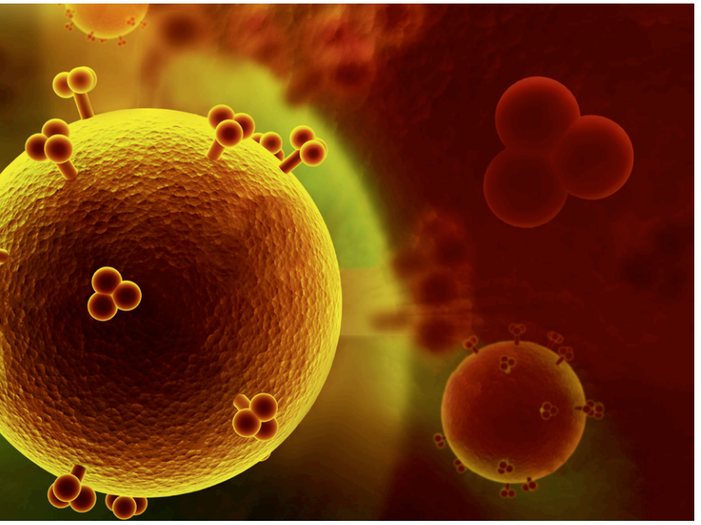
“The increasingly routine ability to work from human patient and clinical data to make discoveries and build hypotheses to test in basic biology is revolutionary.”

—in a personal interview, 2019



David Ho (BS ’74)

Born in Taiwan, David Ho moved to the United States with his family when he was 12. He arrived at Caltech in the early 1970s and, after graduating with a bachelor’s degree in biology, went on to Harvard Medical School. Later, as a resident at Cedars-Sinai Medical Center, Ho began to encounter patients with symptoms that suggested a compromised immune system but whose origins were a mystery. Eager to understand this illness, Ho joined the infectious-disease group at Harvard, becoming one of the country’s earliest AIDS researchers and eventually proposing a combination antiretroviral therapy to slow the virus and prolong the lifespan of millions. Today, Ho is CEO of the Aaron Diamond AIDS Research Center in New York and an outspoken advocate for extending treatments to developing nations.



“As a young immigrant high school student growing up in Los Angeles, I was truly awed by this institution. I found it both intimidating and inspiring. I have that same feeling today.”

“[I]n 1981, back in Los Angeles, [I] had a chance encounter with some of the initial cases of what we now call AIDS. Those cases piqued my interest, and my scientific curiosity led me to pursue a rare disease at the time without ever knowing that it would ultimately turn into a global pandemic that is arguably the worst plague in human history.”

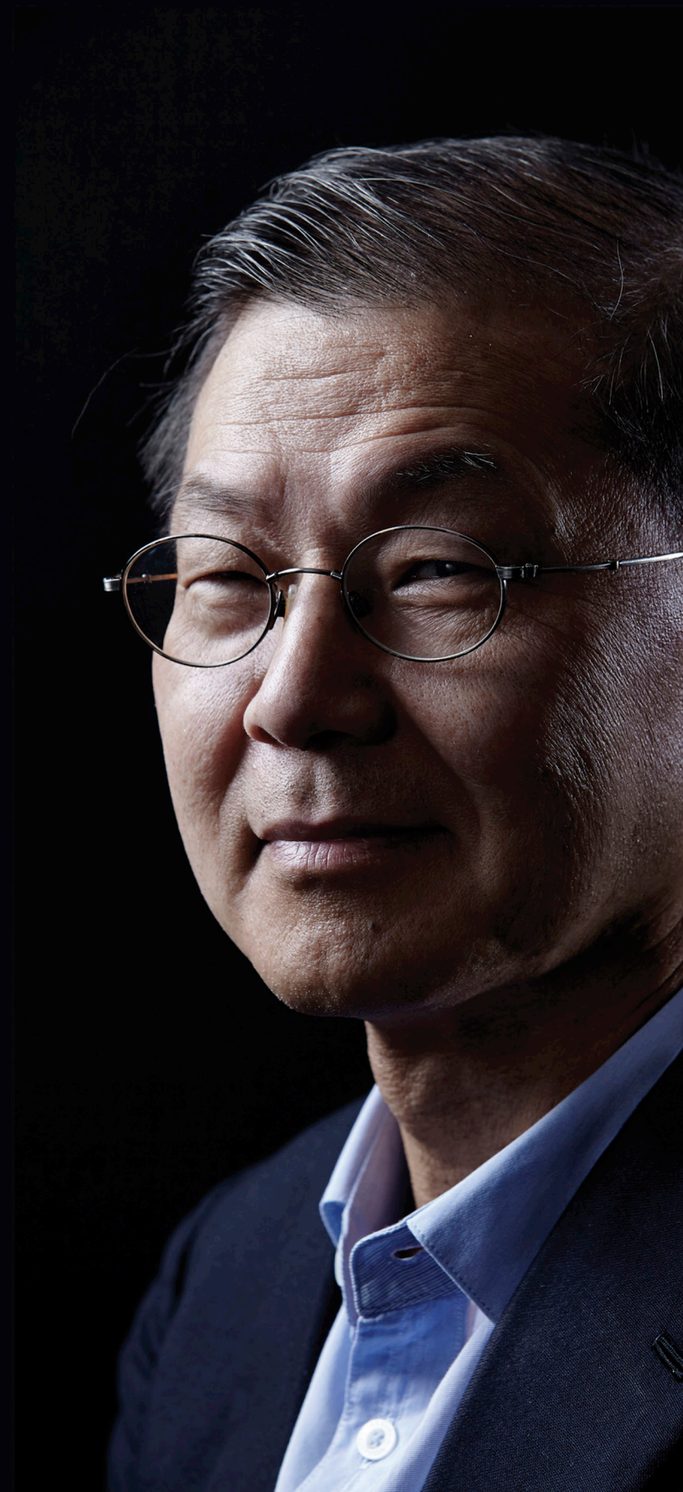
“After devoting about 34 years to research on the subject, I have reflected on the fact that, in fact, the Caltech education was critical in forming my scientific career. It was here where I learned to think critically. It was here I learned how to solve problems.”

“We weren’t given so many tests in the classroom. In fact, we were given challenges to take home and solve them, and that really was instrumental in teaching me problem solving and critical thinking. Also, the emphasis on being very, very quantitative, while stressful at the time, I think was extremely helpful as I thought about the challenges that I faced with HIV infection and trying to understand the dynamics of HIV replication.”

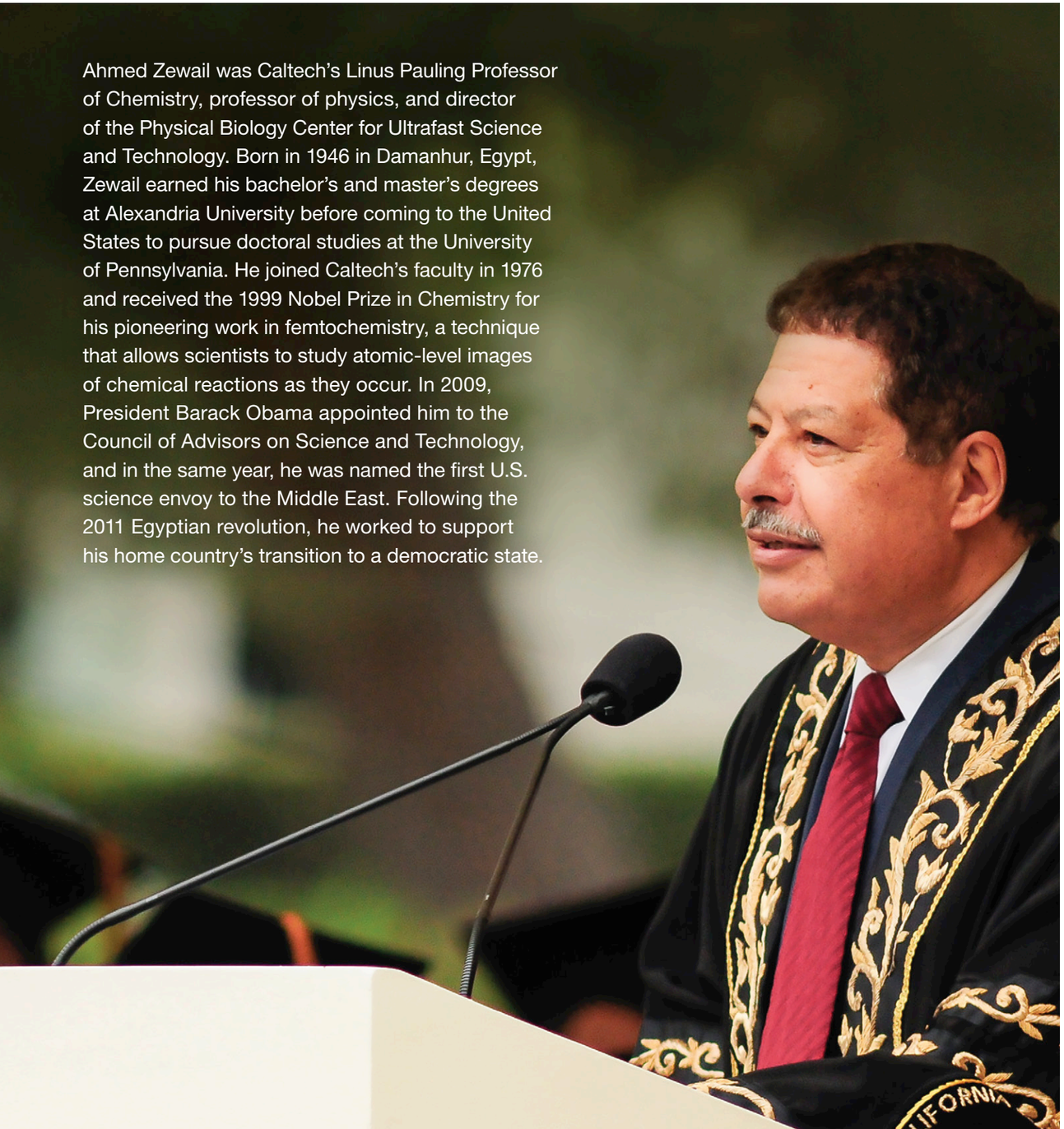
“Without that Caltech education, I don’t think I would have gotten to the point of revealing the dynamic nature of that virus.”

“So, in fact, the foundation in science was formed here, and to me it is much more important than all the facts that I had to memorize in medical school.”

—in a speech accepting Caltech’s Distinguished Alumni Award, 2015



Ahmed Zewail



Ahmed Zewail was Caltech's Linus Pauling Professor of Chemistry, professor of physics, and director of the Physical Biology Center for Ultrafast Science and Technology. Born in 1946 in Damanhur, Egypt, Zewail earned his bachelor's and master's degrees at Alexandria University before coming to the United States to pursue doctoral studies at the University of Pennsylvania. He joined Caltech's faculty in 1976 and received the 1999 Nobel Prize in Chemistry for his pioneering work in femtochemistry, a technique that allows scientists to study atomic-level images of chemical reactions as they occur. In 2009, President Barack Obama appointed him to the Council of Advisors on Science and Technology, and in the same year, he was named the first U.S. science envoy to the Middle East. Following the 2011 Egyptian revolution, he worked to support his home country's transition to a democratic state.

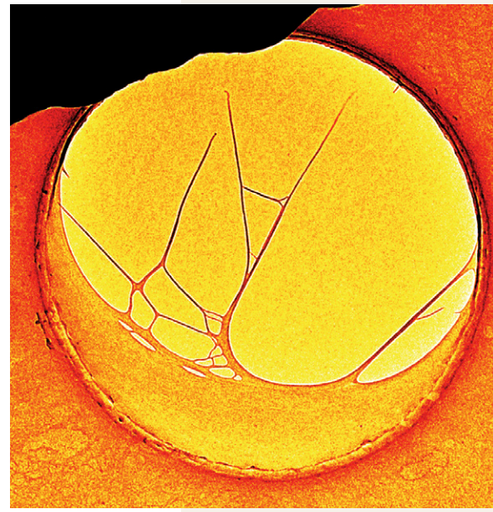
"Today I was reading the latest issue of *Nature*, and somebody had written an editorial that said scientists should be basically directing their work to the service of society by making the discoveries that are relevant. The problem is I don't know what's relevant! I think that 90, and maybe 100, percent of the best scientists I know don't know what's 'relevant' either. What's great about unpredictability is that your mind is free to think."

"If I already know where everything that I'm thinking about is going, then why do the research? It is in the beauty of unpredictability that we find things that we did not anticipate."

"Of course, you have to have the research in the hands of intelligent and good scientists—all of this goes without saying."

"In 2010, I had a piece in *Nature* about managing research too heavily, which is my concern about where we're going in this country. I think if you manage it—if you say, for instance, 'nanotechnology is where we're going'—it's not good for the greatest minds. ... It worries me that funding is going more and more into mission-oriented-type research. This country had the great vision to divide mission-oriented research from curiosity-driven research. ... And that's what we really have to keep. So, to me, unpredictability is really the core, or the vehicle, for making discoveries, because it's curiosity about the unknown, and it leads you in different dimensions than you have thought of before."

—from his Caltech Archives Oral History, 2015



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