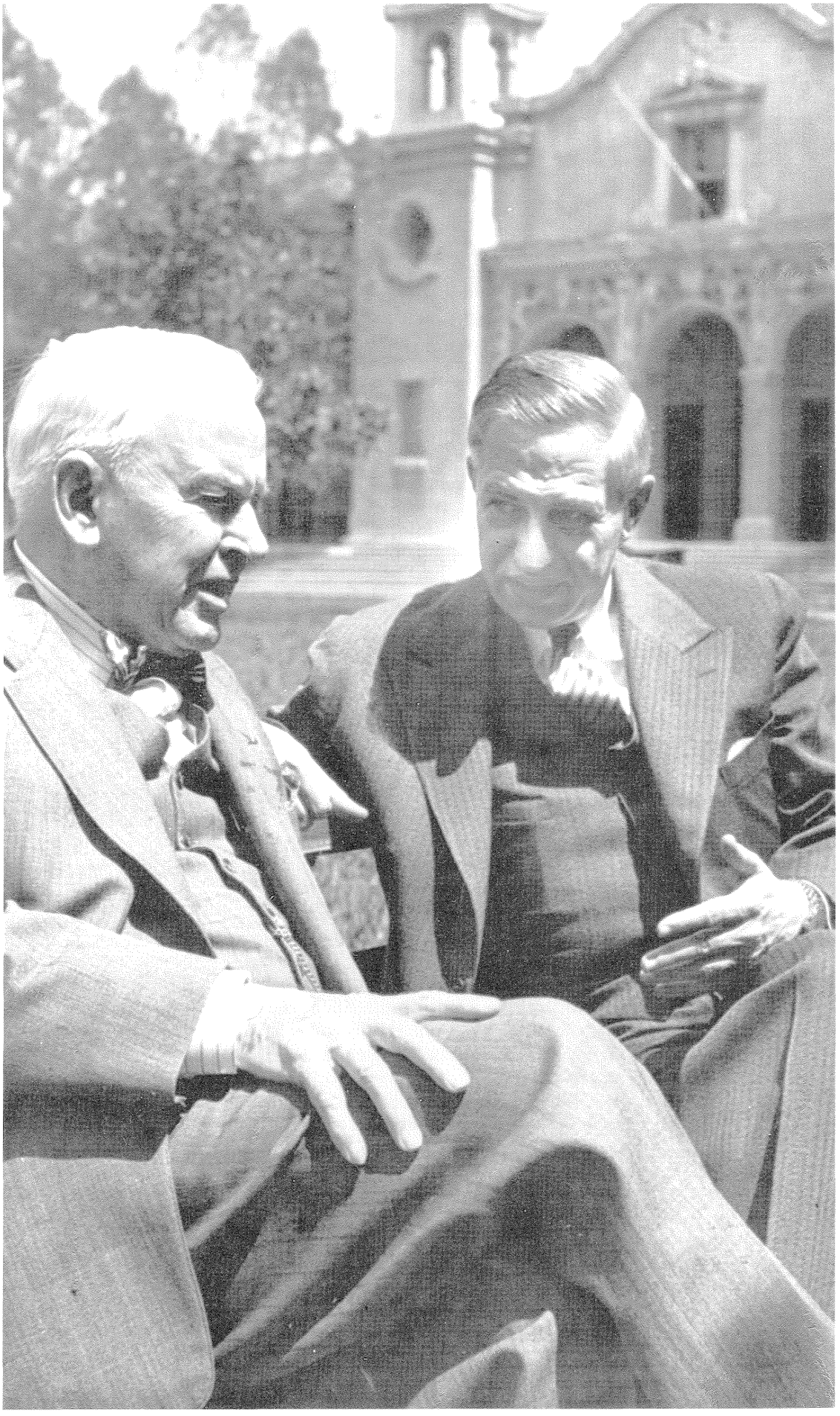


Lee A. DuBridge 1901–1994

Above: Lee DuBridge in 1981 at his 80th birthday party. Left: DuBridge and his predecessor, Robert A. Millikan (left), in front of Throop Hall in 1951. Millikan died in 1953.

Lee A. Dubridge, president of the California Institute of Technology from 1946 to 1969, died January 23, 1994. At the memorial service on February 15 in Beckman Auditorium, five men who had known him well during the various stages of his long and distinguished career recalled with warmth and affection his impact on their own lives.

Joseph B. Platt
Retired President, Harvey Mudd College

Lee DuBridge was a very important person in my life. I first heard of Lee DuBridge in the spring of 1934, when I was a freshman at the University of Rochester, in New York State. I wasn't sure what I wanted to do when I grew up; I was interested in all sorts of things. Physics looked like it might be an exciting field. Both the neutron and the positron had been discovered in my last year of high school, and who knew what might come next? Then I learned that a 33-year-old physicist from Washington University in St. Louis, Lee DuBridge, was coming to Rochester in the fall as full professor. He had quite a research record in photoelectricity. I decided I would major in physics.

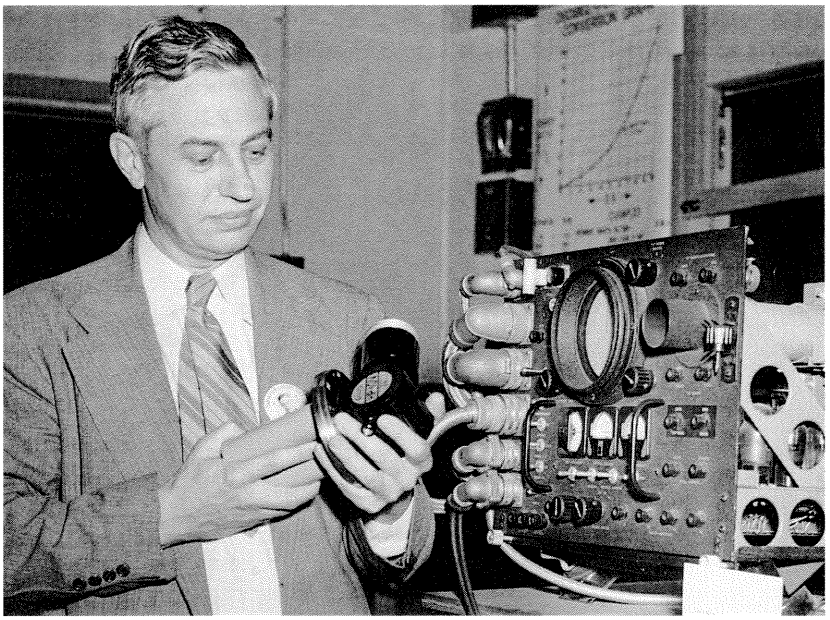
Indeed Rochester turned out to be a great place to study physics. In my sophomore year Lee had the department building a cyclotron, the third one in the United States. By the middle of my junior year our cyclotron was accelerating protons to an unheard of seven million electron volts. There was a big table of isotopes on the wall of the control room, with cup hooks in every slot where an unstable isotope could be expected. As a new radioisotope was discovered, a tag went on the appropriate cup hook: blue for Berkeley, orange for Princeton, and yellow for Rochester. In my senior year a good portion of the wall was in Rochester's dandelion yellow. That was heady stuff.

My senior thesis involved making an electrometer to measure short half life radioactivities, and then actually measuring one. I did these things. On my senior oral it turned out I didn't understand what I had measured; I had found a beta activity of a few minutes, but what was it? I could balance the equation, but I couldn't believe I had been measuring positrons—after all, not long ago they had been discovered by Carl Anderson in the cosmic radiation, and I didn't know we had them on the East Coast. Lee DuBridge pointed out that they were as "common as snakes in the grass."

By the time I graduated, I knew that Lee was a warm and generous person, an excellent teacher and scientist, and a man who got things done. These are precisely the things for which he became internationally famous.

I did my graduate work at Cornell. When I had nearly completed my doctoral work, Lee offered me an appointment at Rochester as instructor in physics, and I accepted. But that was September 1941. Lee was already gone much of the time, setting up the MIT Radiation Laboratory. Over the next 18 months my other senior colleagues disappeared to Los Alamos, Berkeley, the Naval Research Lab, and the like. By the summer of 1943 I was an instructor in physics and the acting department chairman, teaching introductory physics to Navy and Marine officer candidates with the help of what high school teachers I had been able to assemble. The I, too, left for a war-lab job, working for Lee at the MIT Rad Lab.

The MIT Rad Lab was a busy and exciting place. The laboratory developed the techniques for producing, detecting, and manipulating microwaves. The magnetron, a British invention, was developed there from a bench demonstration to a production item, and the wavelengths available were extended from ten to three centimeters, and then to one. All the detecting and modulating equipment, plumbing, and the like had also to be invented or developed. From this came a plethora of radars: there were radars for detecting aircraft or submarines or ships at a distance, radars for controlling air traffic or air interceptions, radars for making air interceptions at night, radars for gunlaying, radars for blind bombing, and much else. Most of the develop-



At the MIT Radiation Laboratory in August 1945, DuBridge, holding a magnetron, explains radar to the press during the first public release of information about the lab (Associated Press photo).

ments of the Rad Lab were transferred to commercial corporations for manufacture, and along with the hardware there were also training programs to run, training manuals to write, and much else to do—including introducing these new gadgets into combat. Some 4,000 of us were employed by the Rad Lab, of whom I estimate at least 400 (including some of our best) were unaccustomed to taking orders from anyone. In his soft-spoken and persuasive way, Lee had us all working as a team.

In 1991, at the 50th anniversary of the Rad Lab's founding, Norman Ramsey traced the postwar applications of the wartime Rad Lab radar work. These include, of course, air traffic control, microwave communications, and microwave ovens. Norman himself used his newly learned microwave techniques to invert the electron populations of molecules, which led to the maser, which led to the laser, which now seems to be an essential link in all kinds of optical communications. The medical people are finding nuclear magnetic resonance to be a useful diagnostic tool. Meanwhile, the radio astronomers used some of the same technology to measure the temperature of outer space. All sorts of timing circuits developed for radar were at hand when they were needed, first for television, and then for computers. Lee and his team left quite a legacy.

At the end of the war Lee returned to Rochester and invited me along. I was overjoyed. There had been many rumors of corporate or university presidencies that might have lured him elsewhere. Lee promptly got us all involved in building a synchrocyclotron. But Lee and Doris left in June 1946; Caltech was too much to resist!

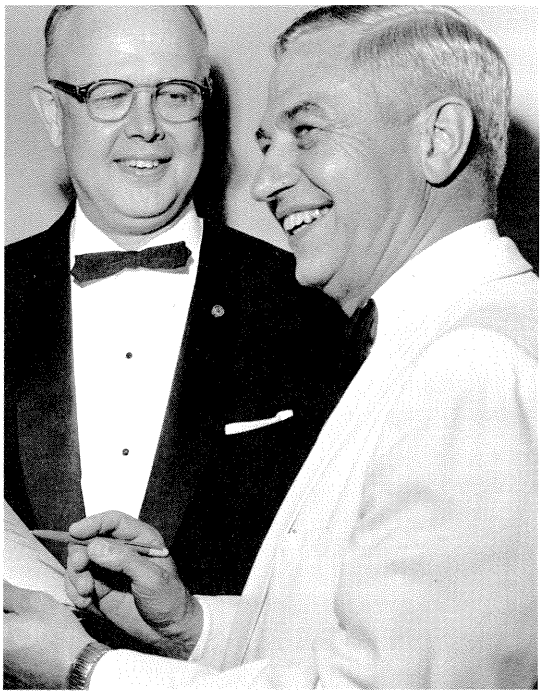
Ten years later, in 1956, I was approached about becoming president of a nonexistent college in Claremont. My wife and I knew very little about Southern California, but we had two families of former mentors at Caltech: the DuBridges, and Jean and Bob Bacher. Both couples encouraged us to give the move very serious thought, and both had volunteered any personal help they might be able to give. As most of you know, we did come. There is no official connection whatsoever between Harvey Mudd College and Caltech, but there are many interpersonal ones. We opened our doors in September 1957. Our first commencement came in June 1959, when we graduated two students who had been upper-class transfers—both mathematicians, since we did not yet have any upperclass laboratories. Our commencement speaker was Lee DuBridge, president of the California Institute of Technology. We had a burst of applications the next month from prospective freshmen who had seen our commencement on television.

Lee was a very good scientist, a great administrator, and a warm friend to everyone. Our lives, and those of thousands of others, are the richer for him. I thank you for this opportunity to tell a little of the part of his life I had the good fortune to share.

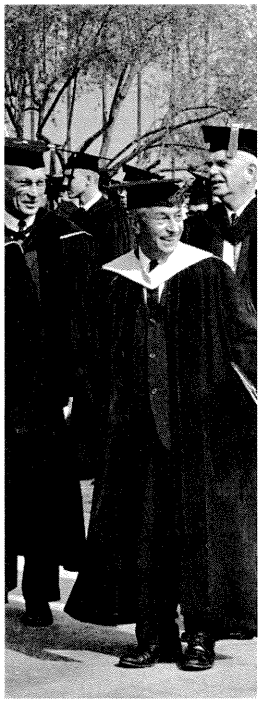
William A. Fowler
Institute Professor of Physics, Emeritus

Lee Alvin DuBridge made a creative change in the administration of the California Institute of Technology in 1946. It is true that Robert Andrews Millikan had transformed the Throop Institute of Technology into Caltech in 1921. But Millikan never became president of Caltech. From his knowledge of the experiences of the president of the University of Chicago with the board of trustees at that university, he preferred the position of chairman of the executive council of the board of trustees at Caltech. Thus it came about that Lee DuBridge was the first president of Caltech.

I first came to know Lee DuBridge in 1946. Charles Christian Lauritsen, my PhD professor, and I attended a meeting that Lee chaired of the American Physical Society at the University of Rochester. DuBridge was a professor of physics at Rochester from 1934 to 1946, where he supervised the construction of a cyclotron that produced the highest energy proton beam at that time. On leave of absence from Rochester he



Right: Willy Fowler and Lee DuBridge in 1958.
Below: Commencement 1960.



headed the Radiation Laboratory at the Massachusetts Institute of Technology, Caltech's East Coast branch, and led the development of radar for the military. Without radar we probably would not have emerged victorious from World War II.

Lee spotted Charlie and me in the audience, and at the end of the meeting he came off the platform and extended his arms to us. His spirit, his charm, made me realize that Caltech would never be the same. What Caltech is today, is in large measure the result of his spirit and charm as well as his administrative ability and devotion to making Caltech the great institution it was when he retired in 1969 and as it has continued to this day under his successors as president. Like many of you, I generally do not like administrators, but I loved Lee Alvin DuBridge.

DuBridge's book, *Photoelectric Phenomena*, coauthored with Arthur Llewelyn Hughes at Washington University and published in 1932, was the first book I ever purchased in the form of a brand new copy. All of my previous textbooks I had borrowed or purchased secondhand at the bookstores in Columbus, Ohio, or in Pasadena. A library copy of the book fascinated me, and I decided I wanted a brand-new copy of my own. Permit me to read to you from the preface:

"The output of theoretical and experimental results in physics grows at an ever increasing rate. The task of keeping abreast of recent developments becomes correspondingly more and more difficult. There is therefore ample justification for the publication of any book whose purpose is to give a concise yet comprehensive survey of one of the many fields of physics. For those merely wishing to obtain a general idea of the recent progress in a particular field, a book of this kind should save many a tiresome search through a voluminous literature. For those actually working in the field such a book justifies itself if it provides a fairly complete summary of the experimental methods and results, and of the prevailing theories, as well as a time-saving sign post to the original papers in the subject. For those interested in the technical branches of the subject, the book should serve as a guide to the fundamental physical principles which underlie the engineering and commercial applications. It has been our aim to prepare such a book covering the field of photoelectricity."

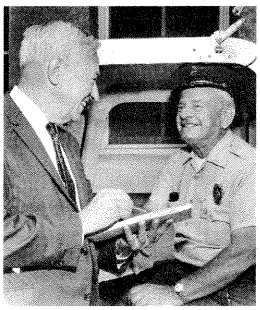
Finally, permit me to mention Lee DuBridge's impact on my own life and career. At the beginning of his presidency our teaching load was reduced to one three-hour teaching course per quarter. There never had been teaching during the summer quarter, and in fact many of us taught only two quarters. I taught only during the fall and winter quarters so that I could go in the spring and summer to Cambridge University in England to collaborate in research with Fred Hoyle. The research with Hoyle and that which I did on my own brought me many rewards, including the Nobel Prize in physics in 1983, which I shared with Subrahmanyan Chandrasekhar.

So, I do indeed owe very much to Lee DuBridge, and I told that to Lee many times. He always replied: "Keep it up, Willy, I'm on your side." He still is on my side and on the side of everyone at Caltech. His memory stimulates and renews us, and we shall never, never forget him.

Harry B. Gray
Arnold O. Beckman Professor of Chemistry
Director of the Beckman Institute

It was the spring of 1965, and Shirley and I and our children had come to Pasadena to look at Caltech. We'd heard a lot about Caltech. We had heard that the students were smarter than other students, and the faculty smarter than faculty at other places. Full of enthusiasm, I started interacting with the chemists and I discovered immediately that the people at Caltech weren't smarter than other people. The students weren't any smarter than the students I'd encountered at other places and the faculty didn't seem any smarter. Perhaps that's because I hadn't met any *physicists* yet; I'd met only chemists.

Right: The president talks with students at Freshman Camp in 1956.
Below: DuBridge congratulates A. G. "Fig" Newton on his retirement in 1968 after 20 years as campus security officer.

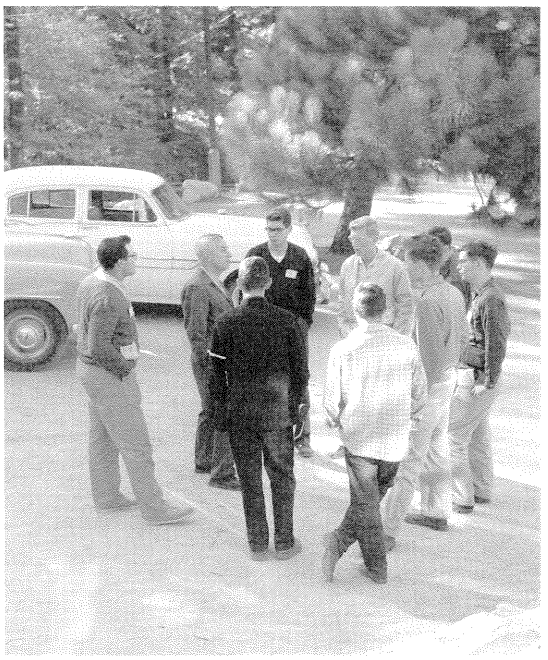


But we discovered that there was something else about this place—there was a wonderful spirit here. There was a tremendous friendliness about the place; it was really quite un-university-like, the spirit and the friendliness. And we naturally wondered what in the world this could be due to. It was so friendly that Jack Roberts offered me a job—that's what I call friendly—and said that we might want to stay here in Pasadena and at Caltech. When I went in to talk to him about it, he suggested that I'd want to talk to Lee DuBridge about this prospect. I looked at Jack and I said, "Jack, isn't Lee DuBridge the president of Caltech?" And he said, "Yes, yes," in his usual way. I didn't say anything to him at the time, but I was thinking, "Jack, you don't *talk* to presidents, at least where I've been. Presidents are people you read about in the paper, hobnobbing with the trustees. Faculty members don't talk to the president." But he kept talking, and then I realized as he was talking that apparently at Caltech you *could* talk to the president. You could talk to the president regularly. And I walked out of Jack's office thinking, "Well, maybe I will call Dr. DuBridge and talk this over with him."

I never did call Dr. DuBridge, because he called me first. He wanted to talk to me. He said, "I've heard something very exciting—that you might move and do your chemistry at Caltech." So I made a beeline over to Throop Hall to see him. When I walked into his office I realized immediately why the chemistry department was so friendly. *Everybody in the president's office was friendly.* I wasn't used to this.

I'll never forget my first meeting with Lee DuBridge. His eyes were sparkling and his smile was infectious. There was that spirit that Willy was talking about. He made me feel at home immediately. He was interested in what *I* was doing. I learned he was a physicist, which was very peculiar—for a physicist to be interested in what I was doing—because where I had come from, Columbia University, the physicists were always putting the chemists down. They were always telling us how inferior we were. And I was always having to fight back at Columbia. I think during that conversation Lee DuBridge also told me that he thought physics was better than chemistry, but he did it in such a nice way that I felt good about it. I felt so good that I thought I could tell him one of my Columbia physics stories.

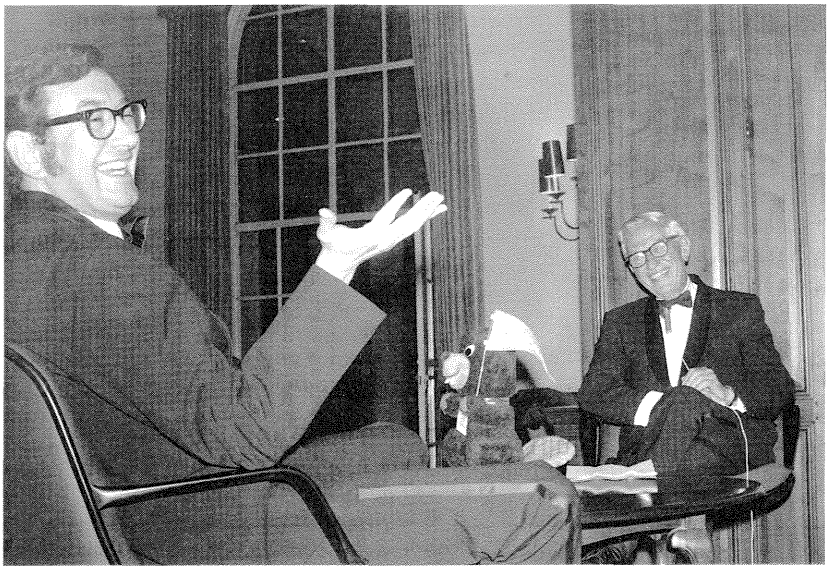
I don't think I'd ever spoken to the president of Columbia, Grayson Kirk, but I had sent him a memo once when I'd learned that he was planning to build a physics building on the lovely



Barnard tennis courts that I played on. I said, "Dear President Kirk: In my opinion a good set of tennis is worth at least six physicists." And Lee DuBridge laughed at that with that wonderful laugh of his—you all remember that wonderful laugh of his—and he said, "Harry, if you'll come to Caltech and do your chemistry here, I'll promise you right here and now that I'll never build a physics building on the Athenaeum tennis courts." And I walked out of that meeting with him feeling great. I felt so much better about my science and about Caltech than I did before I talked to him.

Over the next few weeks while we were visiting here, I had many occasions to talk to Lee and get to know him. And I observed how he dealt with people on this campus. This was his campus; these were his people. He cared about everybody. He cared about staff, students, faculty; he wanted to know what *they* were doing, what *they* were interested in. And he talked to them. I observed the phenomenon that I had experienced myself, that when Lee talked to people he pumped them up. You always felt better about science, about Caltech, about whatever, after you talked to Lee. He lifted our spirits. And he showed us how to act by his example.

He was enthusiastic about science; he loved science; he loved to talk about science. He loved to communicate science, not only to scientists on campus but to nonscientists. He taught us that that was a good thing to do. It was OK to be enthusiastic about your science, to talk to your colleagues; it was even better than OK to be



At a 1976 dinner celebrating the 50th anniversary of the founding of the Associates, Harry Gray and Lee DuBridge reminisce about Gray's early days at Caltech. In the *E&S* account of the occasion, Gray said he told the Columbia president that a good set of tennis was worth "at least *12* physicists." Apparently Gray's memory has accounted for some inflation in the value of physicists since then.

enthusiastic about your science in communicating it to nonscientists. I think that Lee felt that one little bit of good science was much better than six good memos. He had his priorities straight and he taught us how to get our priorities straight. We were enormously proud that he was our president.

He was a lucky man, a very lucky man. He was able to share his life with two wonderful women, Doris and Arrola. How lucky can you be? After a life with one beautiful lady, he was lucky enough to marry a lady like Arrola. Her eyes sparkled more than his—particularly after she came out a winner in their afternoon Scrabble game. And her smile always has been infectious. Lee loved Arrola very much.

I last saw Lee just a few weeks ago at the Athenaeum. I never gave up trying to sell him the greatness of chemistry and trying to get him to admit that chemistry was almost as good as physics. I tried it one more time. We made small talk and then I said, "Lee, you know, I think we're doing pretty well here in chemistry. There are a lot of exciting things going on; don't you think so?" And he said, "Harry, you're doing OK, but you still have a ways to go to catch up with physics." He was a lot slower than he'd been 30 years before, when I'd first met him. He was slower, but his eyes were still sparkling and his smile was still the same. And when I walked out of the Athenaeum I felt good, as I'd always felt after I'd talked to Lee. I felt better about Caltech, and I felt better about science.

Lee DuBridge lifted our spirits. He showed us how to act. We shall miss him very much.

Ruben F. Mettler
Chairman Emeritus, Board of Trustees

Lee DuBridge was a great American, and he leaves a great legacy. His personal research, his successful institutional leadership and management, and his warm personality had a national impact that was profound in many dimensions—science and university research; engineering and technology; national security; university administration and entrepreneurship; national science and technology policy; spokesman for the role and significance of science and technology in society; and more.

In this context, I wish to speak from personal experience as one who first met Lee almost 50 years ago, and then had the good fortune of subsequent association in a variety of circumstances during those years. I want in this way to highlight some of the exceptional abilities of this remarkable man.

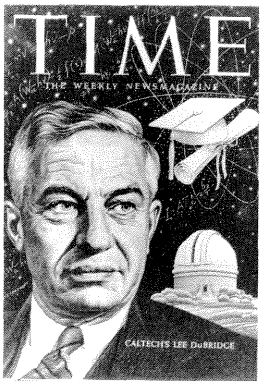
Lee was persuaded, in 1940 when he was a professor of physics and the chairman of the physics department at the University of Rochester, to become the founding director of the MIT Radiation Laboratory. The Laboratory's mission was to invent, develop, and put into production, airborne, shipborne, and land-based radar. The Battle of Britain had begun, and the United States was moving toward war.

With brilliant leadership, he recruited leading scientists and engineers on a crash basis as the start-up staff of the Radiation Laboratory, which then grew to become the nerve center of an immense national enterprise involving many other organizations. Radar systems were successfully developed, put into industrial production, and installed in combat aircraft, ships, and ground equipment. Military personnel were trained for radar operations and maintenance, and logistic support systems were established. Throughout the war, the Radiation Lab provided direct on-the-spot operational advice and support to the forces in both the European and Pacific Theaters.

I was one of a group of Navy officers who were sent to the Radiation Laboratory for a crash training program in the operation and maintenance of shipborne radar systems, before shipping out to the Pacific. Despite all his other duties, Lee visited and talked to us several times. His ability to describe our task in a national context, his warm personality, and his straight-arrow responses to sensitive questions made an indelible impression on me.

When I came to Caltech as a graduate student in 1946, Lee was the new president. His dynamic and entrepreneurial qualities were highly

Right: Richard Nixon, then vice president, visits the Caltech campus in 1958. A decade later DuBridge became special assistant to the president for science and technology during Nixon's administration. Below: In its cover article in 1955 *Time* called DuBridge the "Senior Statesman of Science." Opposite page: DuBridge takes a curtain call after the faculty production of "Lee and Sympathy," a surprise to honor his 20th anniversary as Caltech president.



visible in the transition that Caltech was making from wartime to peacetime conditions and in his efforts to position Caltech for leadership in newly emerging opportunities in research and teaching. Lee met with graduate students individually and was an inspirational source of advice and encouragement for me.

The 1940s and 1950s were a critical turning point for federal support of science and technology. The dramatic contribution of science and technology to the war effort, and the famous paper by Vannevar Bush, led, after some fierce political battles, to the establishment of the National Science Foundation. Science and technology began to assume a new and permanent place in national policy with respect to national security, foreign affairs, and the domestic economy.

Appointed by President Truman to his newly formed Science Advisory Committee, and continuing as chairman of the committee in the Eisenhower administration, Lee became an active participant in helping to shape national science and technology policy, an interest he continued for two decades.

In 1954 I spent about a year in Washington working in the Pentagon and traveling often to the White House to meetings concerning various projects of interest to the Science Advisory Committee. When Lee was in a meeting, his analytic and persuasive manner in discussing complex and difficult policy issues gave him a highly productive leadership role.

In early 1969, Lee was asked by President Nixon to be his special assistant for science and technology and then a member of the President's Science Advisory Committee. One day he called me and asked if I would respond favorably if the president asked me to chair a task force on national science policy with a focus on issues of significance in that time period. I was pleased to accept that task with Lee's support and guidance. Once again I could observe Lee's wisdom and experience, and his deep understanding of how science and technology affect policy design and policy outcomes.

Finally, I'd like to say a few words about Lee from the perspective of one who has been a Caltech trustee for about 25 years and chairman of the trustees in recent years. When Lee returned to Pasadena after serving in the Nixon administration, he was honored with the title of president emeritus and served as a lifetime trustee of Caltech. He continued as an active participant in Caltech affairs generally, and in trustee meetings in particular, often with penetrating observations and questions. He was an active participant in a meeting of the trustees just two weeks before his death. Presidents Brown, Goldberger, and Everhart all benefited from his experience and wisdom and dedication to Caltech, as did the trustees, the faculty and students, and all parts of the greater Caltech community.

Lee DuBridge was a towering figure in Caltech's history and in the world of science and engineering. He was also a kind and compassionate man, with a strong love of family and friends. All of us are fortunate to have known such a man. His devotion to Caltech was complete. He often said he thought Caltech was the most wonderful place in the world. All of our lives have been enriched by Lee DuBridge, and we will all miss him very much.

Thomas E. Everhart
President

When Lee Alvin DuBridge was born in 1901, most physicists then living thought that almost everything had been discovered about their field. They were wrong. Lee DuBridge participated in and lived through one of the most exciting periods in physics, his chosen field. Louis deBroglie showed the relationship between particles and waves when Lee was a graduate student, and Lee worked on the photoelectric effect, in which the energy of a photon of light is transferred to an electron, allowing it to escape from a solid. He came to Caltech as a National Research Council Fellow in 1926 to work with

All of our lives have been enriched by Lee DuBridge, and we will miss him very much.

Robert A. Millikan, who had made a major contribution by studying this effect.

He learned more than physics from Millikan. In some "Memories" he recorded for the Caltech Archives, he mentions conversations with Millikan: "These were entrancing introductions to the larger world of science and scientists." In addition to Lee's own research, this period of time was exciting for him "because of all I learned in lectures, seminars and personal associations with the many fine scientists who were at Caltech at that time." He specifically mentions Richard Tolman, Paul Epstein, Robert and Clark Millikan, and Clinton Judy (who was in English literature). He liked the breadth of these faculty, and enjoyed luncheon with them and others at the "round table at the old faculty club." He commented that to hear these and others "freely and learnedly discussing topics in literature, art, music, and other fields was an education in itself."

Following Caltech, Lee started up the academic ladder at Washington University in St. Louis, and then was called to be professor of physics and chairman of the physics department at Rochester in 1934. His talents were soon noted there, when he was appointed dean of the faculty of arts and sciences in 1938. In 1940, he was called to be head of the Radiation Laboratory at MIT, and as you have heard, recruited and led a large number of scientists in an important effort that undoubtably helped to save many lives and win World War II. Lee showed a remarkable ability to keep a diverse and independent group of academic scientists focused and working together.

Following the war he returned to Rochester, where he was active in helping to organize new laboratories for high-energy physics. When Lee stepped down as head of the Rad Lab, he said he did not want another administrative job. Yet, on returning to Rochester, he found himself behind in his own field. While he had led the Rad Lab, focused on radar and associated electronics, great progress had been made in nuclear physics at Los Alamos. In his own words, "Catching up would be tough. I slowly realized that, after all, I had enjoyed administrative work in a scientific atmosphere. Hence, though I at first declined to accept Max Mason's urgent plea that I come to Caltech as president, I finally came to the realization that it was the right thing to do. I never regretted the decision."

Because of his background, he was excellent at explaining the exciting developments in physics to the public. He became a spokesman for science on the national scene, and helped the public appreciate what science could do for the nation. But especially here at Caltech, he was appreciated as a warm human being who helped others mature and become more than they might have otherwise. It is for these qualities, as well as for his courage, his decisiveness, and his leadership that we remember him today.

Recently, an asteroid was named in Lee's honor. I understand from Eleanor Helin that No. 5678 DuBridge is some 15 kilometers in diameter, and inclined some 34° to the ecliptic. Ted Combs fortunately let Lee know this shortly before he died. Lee was touched. Earlier he had had a mountain named for him in Antartica, and was pleased to have another mountain flying around in space carrying his name. This seems to me a fitting memorial to the man who had overseen the Jet Propulsion Laboratory as it entered the space age.

Lee was an extremely supportive person, especially when it came to Caltech. After I was named president, his was one of the first letters of welcome and congratulations that came, and Doris received a wonderful letter of welcome from Arrola. I learned from him here, too. He could give an extemporaneous talk that made everyone present feel special—a significant talent for a college president. When I would visit him sometimes, to bring him news of the Institute, he was always interested, always constructive, always supportive. He was truly a great president of Caltech, and after he retired, a great supporter, trustee, and friend. We will all miss him. Our world is a better place because of Lee DuBridge, and we are better people for having known him. □