Title

UC Berkeley College of Chemistry, Celebrating the First 150 Years

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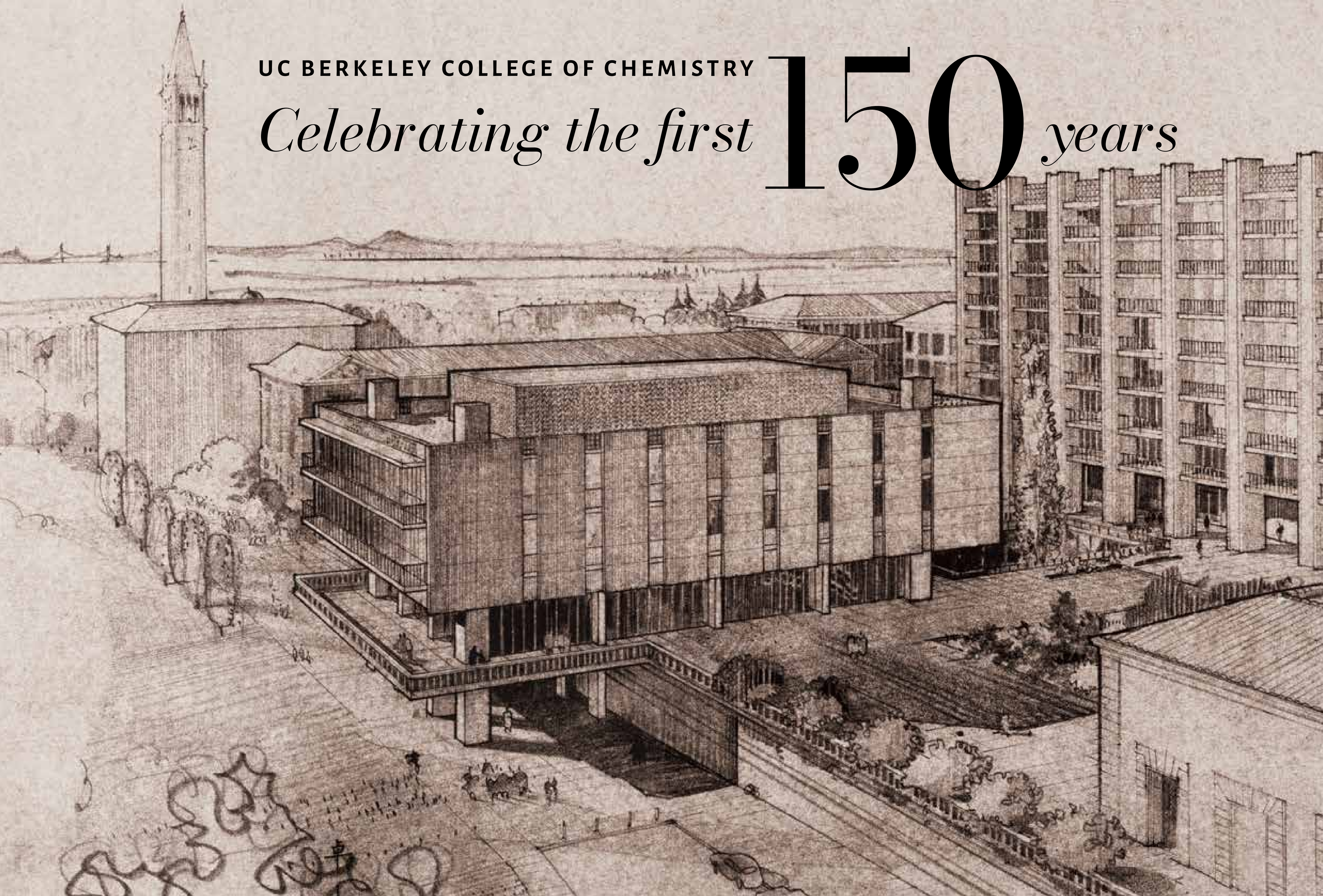
UC BERKELEY COLLEGE OF CHEMISTRY

Celebrating the first 150 *years*



UC BERKELEY COLLEGE OF CHEMISTRY

Celebrating the first 150 *years*

MARGE D'WYLDE, ROBERT BERGMAN, AND C. JUDSON KING

Contents

1986 › *Douglas Clark when he first arrived at the College of Chemistry.*

Dean's message

Throughout the College of Chemistry's extraordinary 150-year history, major chemistry and chemical engineering discoveries, world-renowned and influential faculty, and top national and international rankings have been our hallmark, just as they are today. Since the College's inauguration in March 1872, over 20,000 undergraduate degrees and over 8,000 graduate degrees have been awarded, and there are over 15,000 College of Chemistry alumni living throughout the world. We have produced 18 Nobel laureates, helped discover 16 elements, and made countless other contributions across the spectrum of chemistry, chemical biology, and chemical and biomolecular engineering.

This book is a fascinating journey through the first 150 years of the College of Chemistry's lifetime. In the pages ahead, you will read about the College's founding, the earliest faculty members, the era of G. N. Lewis and the College's rise to fame, the discovery of synthetic elements, the emergence of the chemical engineering program, our Nobel laureates, and much more. The beautiful photographs that accompany the text help put into perspective the College's impact on the world's scientific stage and seem to transport us back to a wooden desk in a crowded lecture in the old chemistry building, South Hall, and to the soapstone countertops in the Gilman Hall laboratory where Glenn Seaborg worked.

The idea for this book was introduced in 2018 by Marge d'Wylde, Director of Marketing and Communications, during UC Berkeley's sesquicentennial celebration. She soon began collaborating on this archival project with C. Judson King, Professor Emeritus of Chemical and Biomolecular Engineering, and later on with Robert Bergman, Professor Emeritus of

Chemistry. Each of them contributed mightily to this exploration of our past, and we are indebted to them for capturing the spirit and essence of the College of Chemistry and delivering it to us in a format that brings our history to life. Along the way in their research for this book, they discovered fun facts about the College that are not widely known. For example, the original plan was for Gilman Hall to be built with two wings (see page 47). Hildebrand Hall now sits where the second wing of Gilman Hall was supposed to be built. It is quite interesting to look back on the record of the College's buildings as we are currently working to break ground on the next one: Heathcock Hall.

The College of Chemistry is one of a kind, and it continues to set the standard for academic excellence. We take pride in knowing that our work in chemistry and chemical engineering education and research has been influential in advancing society and making the world a healthier, better place. We hope you do too – after all, the College of Chemistry's legacy would not be what it is without its community of supporters and builders.

As we look back on our past, we are also mindful of our future. The major challenges facing our world today (and tomorrow) will require innovative solutions born from fundamental advances and engineering applications of the chemical sciences. The College of Chemistry is committed to continuing its leadership in education and research to meet this essential need, for the next 150 years and beyond.

COLLEGE OF CHEMISTRY **DEANS**

1886-1896	Irving Stringham*
1896-1901	Willard B. Rising
1901-1912	Edmond C. O'Neill
1912-1918	Gilbert N. Lewis
1918-1919	Edmond C. O'Neill
1919-1923	Gilbert N. Lewis
7/1932-12/1932	Charles W. Porter
1924-1941	Gilbert N. Lewis
1941-1949	Wendell M. Latimer
1949-1951	Joel H. Hildebrand
1951-1955	Kenneth S. Pitzer
1955-1956	James Cason
1956-1960	Kenneth S. Pitzer
1960-1965	Robert E. Connick
8/1965-6/1966	Richard E. Powell
1966-1970	Harold S. Johnston
1970-1975	David H. Templeton
1975-1977	Norman E. Phillips
1977-1978	Charles W. Tobias
1978-1981	Norman E. Phillips
1981-1987	C. Judson King
1987-1988	Robert E. Connick
1988-1994	C. Bradley Moore
1994-1999	Alexis T. Bell
1999-2005	Clayton H. Heathcock
2004-2007	Charles B. Harris
2008	Clayton H. Heathcock
2008-2013	Richard A. Mathies
2013-present	Douglas S. Clark

*Dean of the Faculty

EXECUTIVE **ASSOCIATE DEANS**

2018-	Richmond Sarpong
2014-2018	Matthew B. Francis
2011-2014	David E. Wemmer
2008-2011	Douglas S. Clark

ASSISTANT DEANS FOR ADMINISTRATION

1982-1987	Dennis Hess
1972-1981	Rollie Myers
1960s-1971	David Lyon

ASSOCIATE DEANS OF UNDERGRADUATE AFFAIRS

2018-	John Arnold
2008-2017	Marcin Majda
1995-2008	Herbert L. Strauss
1986-1991	Scott Lynn
1952-1981	Donald Noyce

ASSOCIATE DEANS FOR DIVERSITY, EQUITY, AND INCLUSION

2020-	Anne Baranger

1917 › *Photo of the chemistry annex when it was first built at the University. This was the first building that the architect John Galen Howard designed for G.N. Lewis. A number of "temporary buildings" quickly followed. Many of them would remain in use until the 1960s.*

Introduction

By William Jolly, Richard E. Powell, C. Judson King, Rollie Myers, and Marge d'Wylde

THE COLLEGE'S FOUNDING

The College of Chemistry has a rich academic and scientific history. In 1868, almost all chemical discoveries were being made in Europe, and the few American chemists of any importance worked in the eastern United States. In wild and woolly California, there was no chemical business other than that which survived the Gold Rush. Thus, there were only a few assayers and some purveyors of soda ash, bone ash, acids, and other chemicals related to gold mining. The first transcontinental railway connecting California to the East would not be completed until the following year. San Francisco was a city of wooden sidewalks, muddy trails, and frequent fires. In this frontier with few cultural advantages, the University of California was created.

When the University of California was founded, the first set of Regents deemed chemistry so important that one of the first ten faculty hired in 1868 was the chemist Robert A. Fisher as the professor of chemistry, mining, and metallurgy. His position was officially in the College of Agriculture. The State act to inaugurate the College of Chemistry was legislated on March 12, 1872. He left the University abruptly in 1870 when the Board of Regents cancelled his faculty position for unexplained reasons.

Fisher was followed by Ezra S. Carr who was hired in 1869 as the professor of agriculture, chemistry, agriculture and applied chemistry, and horticulture. Carr taught at the downtown Oakland campus with his class open to the public. One of his first students was a very young Edmond O'Neill, who later served as dean of the College from 1901 to 1912. O'Neill would recall attending Carr's lectures as a boy, "Although it was fifty years ago, I remember the lectures and experiments as though they occurred yesterday. It fired my imagination and gave me my first insight into the charm and interest of science." Carr was a popular lecturer but was very politically active, trying to sway University policy at the state level. Because of his political activities, he was removed by the Regents from his position in 1873.

THE COLLEGE'S FIRST HOME

By 1873, South Hall, the first building on the Berkeley campus was completed. More than half of the building was dedicated to chemical laboratories which served the College for almost two decades. Chemistry shared the building with physics and the library. When completed, the labs were considered physically superior to any in America and possibly also in Europe.

Willard Bradley Rising arrived in 1872 as the College's first official faculty member and first official dean. Rising spent a total of 36 years on the faculty and was largely responsible for the College's early development. During his tenure, the number of baccalaureate degrees in chemistry went from three per year to 15.

In 1891, chemistry moved out of South Hall into a dedicated chemistry building next to the mining building. Designed by architect Clinton Day the building was updated with additions in 1900, 1902, and 1912. The facility contained a lecture hall, numerous laboratories for instruction and research, and faculty offices.

In Rising's era the principal activity of chemists was analysis, particularly of minerals, drugs, water, and agricultural products. Rising was also the State analyst responsible for testing water samples. By Rising's retirement in 1908, the first four Ph.D. degrees had been awarded in chemistry.

GILBERT N. LEWIS ERA

In 1912, Gilbert Newton Lewis came from the Massachusetts Institute of Technology to serve as dean and to build up the graduate and research programs. Twenty-nine years later, in 1941, when he retired, the number of undergraduate degrees per year had risen to about 60 and additional chemistry buildings had been constructed to keep up with the growing student population. Gilman Hall, the Chemistry Auditorium, the Freshman Chemistry Lab, and “The Rat House” (Chemistry Annex) were all added. 250 Ph.D. degrees were awarded during his time as dean.

Lewis’s scientific reputation was built on his work in chemical thermodynamics, and though he had other interests (e.g., the Lewis electron-pair theory, the Lewis acid-base theory, the discovery of deuterium, and much more), many of his staff were thermodynamicists, and Berkeley became known as a center of thermodynamics.

The Lewis and Randall textbook, Thermodynamics, and the Free Energy of Chemical Substances (1923), was a landmark at the time. It included Wendell Latimer’s work in systematizing the entropies of aqueous ions, William Giauque’s extensive low-temperature program for which he would receive the Nobel Prize in 1949, and Kenneth Pitzer’s work on the thermodynamics of molecules with internal rotation.

The last decade of Lewis’s deanship saw, along with Ernest Lawrence’s development of the cyclotron, the involvement in nuclear chemistry of Berkeley faculty members, particularly of Willard Libby, who received the Nobel Prize in Chemistry in 1960 for his carbon-14 method of dating archaeological specimens, and of Glenn Seaborg who shared the Nobel Prize in chemistry with the physicist Edwin McMillan in 1951 for their discovery of plutonium.

MID 20TH CENTURY GROWTH AT THE COLLEGE

Upon Lewis’s retirement as dean, the post was taken up by Wendell Latimer, who held the College together through the critical eight years that included World War II and the Manhattan Project (1941-49). Latimer was active on National Defense Research Committees from 1941-1945 in the fields of oxygen production, chemical warfare, and plutonium research. He was director of a Manhattan Engineering District project in the Department of Chemistry on the chemistry of plutonium from 1943 to 1947 and was a leader for research in the Radiation Laboratory.

Latimer had a stimulating effect on his colleagues and students. He was mainly responsible for initiating a seminar on nuclear chemistry that interested such men as Willard Libby, Glenn Seaborg, Arthur Wahl, and Joseph Kennedy helping lay the foundation for the discovery of plutonium. The first separation and identification of the new element plutonium depended on the relative oxidation potentials of the heaviest elements, and the fact that Latimer was available for consultation contributed to the discovery of this extremely important element.

During World War II, Berkeley faculty and alumni played a part in the Manhattan Project to build the atomic bombs. After the war, Berkeley went on to become an important center for research in nuclear synthesis and spectroscopy as well as for the tracer applications of radioisotopes. For example, when quantities of carbon-14 became available in 1947, Melvin Calvin began a program of research on the path of carbon in photosynthesis for which he received the Nobel Prize in Chemistry in 1961.

During the second half of the 20th Century, College of Chemistry faculty and researchers at Lawrence Berkeley National Laboratory (Berkeley Lab) would discover ten elements that were added to the Periodic Table: Neptunium (1940), Plutonium (1941), Americium (1944), Curium (1944), Berkelium (1949), Californium (1950), Mendelevium (1955), Nobelium (1958), Lawrencium (1961), and Seaborgium (1974), which was named in honor of Glenn Seaborg.

Latimer’s principal task after the war was to rebuild the staff, which had been depleted by deaths and retirements. He took the opportunity to strengthen the department in radiochemistry, and to bring in a strong staff in chemical technology, starting in 1948, later to become the Department of Chemical Engineering in 1957, and in synthetic and structural organic chemistry.

THE ADDITION OF CHEMICAL ENGINEERING

There are several unique features in the development of chemical engineering at Berkeley: 1) it was comparatively late being added as a discipline, with the eventual sustained chemical engineering program not being launched until 1946; and 2) chemical engineering officially became the College's second department in 1957.

Before the department was finalized, there was a decade-long struggle with a competing Process Engineering program within the College of Engineering for where the department would be located.

In 1942, members of the College of Engineering and College of Chemistry formed a graduate group to offer an M.S. degree in chemical engineering. This program was hampered by lack of dedicated resources, contentions between the two colleges of whose program it was which were reinforced by the involvement of the respective deans. The issue of which college the department should sit in was not resolved until 1957 when it was permanently housed in the College of Chemistry.

As postwar enrollments soared, Lewis Hall was built in 1948. Enrollments would continue to rise throughout the second half of the 20th century. Much of the increase was the result of growth in the chemical engineering area that included such new technologies as the processing of electronic devices and biochemical engineering. Several fields were also added in chemistry most notably structural biology, synthetic chemistry, and chemical physics. In addition, the organic and inorganic groups and the theoretical groups were further developed.

Space, which was a scarce resource at the College, got a boost with new buildings in the 1950s and 1960s. Giauque Hall (the Low Temperature Laboratory) was built in 1954 (renovated in the 1980s for Nobel laureate Yuan T. Lee); Latimer Hall was put into service in 1962. Pimentel Hall, which is a lecture hall that holds 500 students, replaced the Freshman Chemistry Lab in 1964. Hildebrand Hall was built in 1966 replacing the 1890's "Old Chemistry Building" which had continued to function up until that time. With seven floors of research space, Tan Kah Kee Hall was a welcome addition in 1997.

EXAMPLES OF MIDCENTURY RESEARCH

In 1951, Kenneth Pitzer returned from a period as director of research of the Atomic Energy Commission to take up the deanship of the College (1951-60), leaving in 1961 for the presidency of Rice University.

The biophysical faculty became fully established at this time with the addition of Ignacio Tinoco (1956), John Hearst (1962), and Kenneth Sauer (1963). The organic group branched out into full-fledged physical organic with the addition of Andrew Streitwieser in 1952 who also excelled in theoretical chemistry.

The expansion of the inorganic faculty proceeded with Norman Phillips (1955) doing low temperature work on inorganic materials. Leo Brewer (1946) worked closely with the spectroscopic group in Physics, and Robert Connick (1942) was essentially the head of the inorganic group and worked in solution chemistry.

David Templeton (1947) did X-ray crystallography on inorganic salt. William Lee Jolly (Ph.D. '52, Chem) did his Ph.D. work in synthetic inorganic chemistry. Gabor Somorjai (Ph.D. '60, Chem), who studied with Richard Powell, received his Ph.D. for "Small Angle X-Ray Study of Metallized Catalysts". Somorjai joined the faculty in 1964.

Physical chemistry remained a dominate group in Chemistry at this time. George Pimentel (1949) researched infrared spectra of frozen films containing interesting species in a low temperature matrix. Around 1960 he discovered that the photolysis of methyl iodide in a frozen matrix produced iodine atoms in the upper of the two ^2P states. This resulted in an infrared laser, even without mirrors, and this was the invention of the chemical laser. Later he became very interested in building a spectrograph which NASA would use in their Mars Mariner 6 and 7 missions to discover water on Mars.

Pimentel served as Chemistry Chair from 1966-68 and was succeeded by Bruce Mahan (1968-71). Mahan hired the first two physical chemists who only did theory, Robert A. Harris in 1968 and William Hughes Miller in 1969. The Dean at the time was Harold Johnston. They became the foundation of a new theoretical group at the College.

Dudley Herschbach joined the College in 1959. He set up a large molecular beam laboratory which was made possible because of the large-scale machine work done at Lawrence Berkeley Lab. When he left for Harvard in 1963, Mahan carried on his research. Yuan Tseh Lee came to Berkeley and worked with Mahan receiving his Ph.D. in 1965. Lee did postdoctoral work with Mahan for one year and then with Herschbach at Harvard. In 1986 he shared the Nobel Prize with Herschbach and John Polanyl for their contributions to the dynamics of chemical elementary processes.

In the inorganic group, Kenneth Raymond arrived in 1968. His research has focused on metal-ligand specificity as understood through crystallography and solution thermodynamics. Charles Harris (1969) researched the field of condensed phase chemical dynamics, with a focus on the areas of ultrafast and electron dynamics at interfaces and chemical reaction dynamics in liquids. Organometallic chemistry got started with the hiring of Robert Bergman in 1977 and Earl Muetterties in 1978.

Meanwhile, continued growth in the Department of Chemical Engineering saw the arrival of Eugene Petersen (1953) Andrea Acrivos (1954), and John Prausnitz (1955). Petersen focused his research on the principles of chemical reactor analysis and design. He developed a theoretical model for predicting catalyst performance and used Monte-Carlo simulations of transport and chemical reaction within porous catalysts. Acrivos would help transform the field of chemical engineering, especially in the areas of fluid mechanics, heat, and mass transfer. Prausnitz's research developed the field of molecular thermodynamics. His research improved processes by which many of the products on which the world now depends are produced. He was awarded the National Medal of Science in 2003 in recognition of his vast influence on the manufacturing sector.

NEW AREAS OF DISCOVERY SCIENCE

Harold Johnston's (1957) pioneering studies of atmospheric kinetics were basic science contributions that led to extraordinary insights that transformed how we think about the Earth's atmosphere. In the 1970s he would show that supersonic transport could deplete the Earth's ozone layer.

Starting in the 1990s, Paul Alivisatos (1988) would make major breakthroughs in nano chemistry in the synthesis of semiconductor quantum dots and multi-shaped artificial nanostructures. Peidong Yang (1999) would introduce nanoplasmonic structures and Jay Keasling (1992) would develop the process to engineer artemisinic acid. Omar Yaghi (2011) would inaugurate his research into metal organic frameworks leading to the field of Reticular Chemistry.

THE 21ST CENTURY

The 21st century has seen an increased emphasis on interdisciplinary research and scholarship, correlated with tremendous advances in technology. This development is visible throughout the college.

The increasing interest in the relationship of chemistry to biology brought about a new major in the chemistry department in the early 2000s. A chemical biology graduate degree was initiated by Michael Marletta and Carolyn Bertozzi. This followed on from the development of a chemical biology curriculum with contributions from Ken Sauer, Judith Klinman, and Carolyn Bertozzi among other faculty. Bertozzi would be awarded the Nobel Prize in Chemistry in 2022 for her research which created the field of bioorthogonal chemistry.

In 2012, Jennifer Doudna, and her colleague Emmanuel Charpentier discovered CRISPR/CAS9, a biological process that edits genes by precisely cutting DNA and then letting natural DNA repair processes take over. They were awarded the Nobel Prize in Chemistry for their discovery in 2020. Birgitta Whaley established the quantum speed limit in 2015 and Chris Chang determined that copper is key to burning fat.

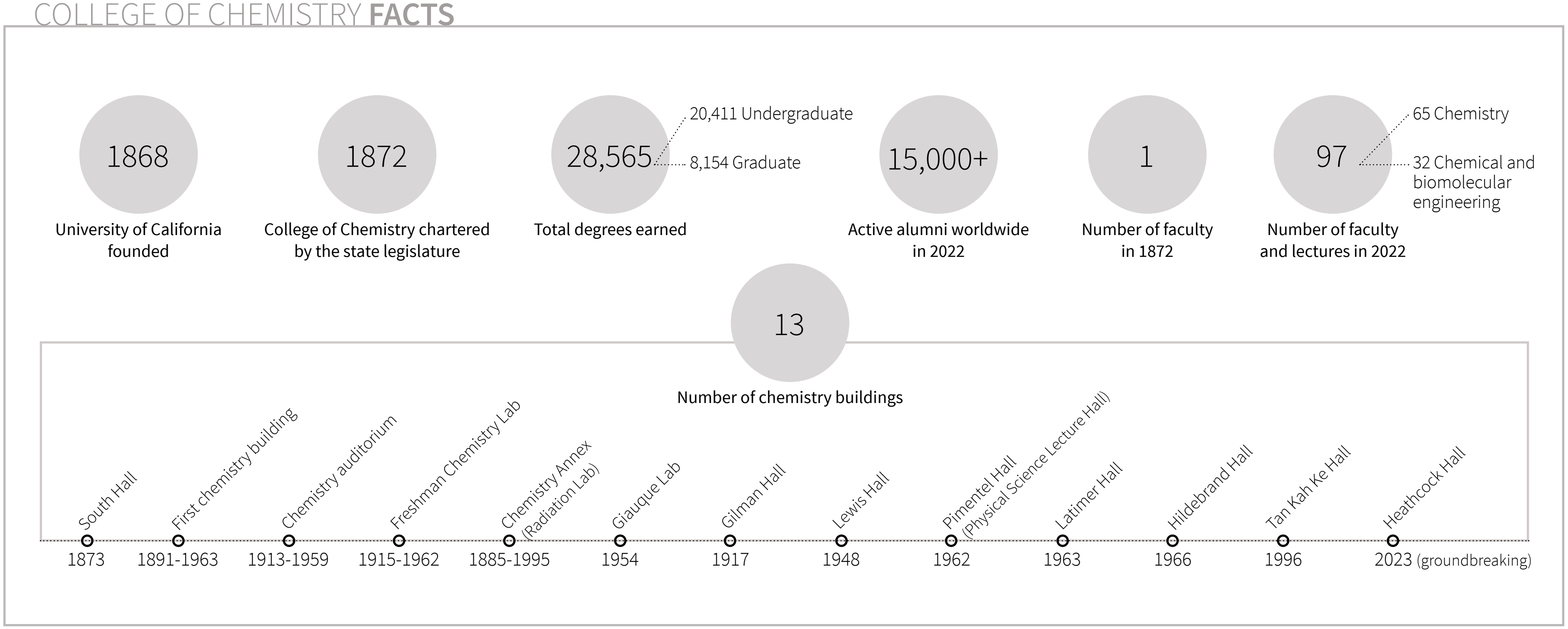
In a further evolution, the chemical engineering department was renamed the Department of Chemical and Biomolecular Engineering in 2010 to recognize the department's substantial research and teaching activities in the areas of biochemical and biomedical engineering, biotechnology, and synthetic biology. Interdisciplinary researcher David Schaffer is at the forefront of research in stem cell biotechnology and virus-based gene delivery vehicles.

In one of her lines of research, Markita Landry has developed a nanotechnology that enables high-throughput delivery of biomolecules to plants resulting in transient protein expression without incorporation of foreign DNA.

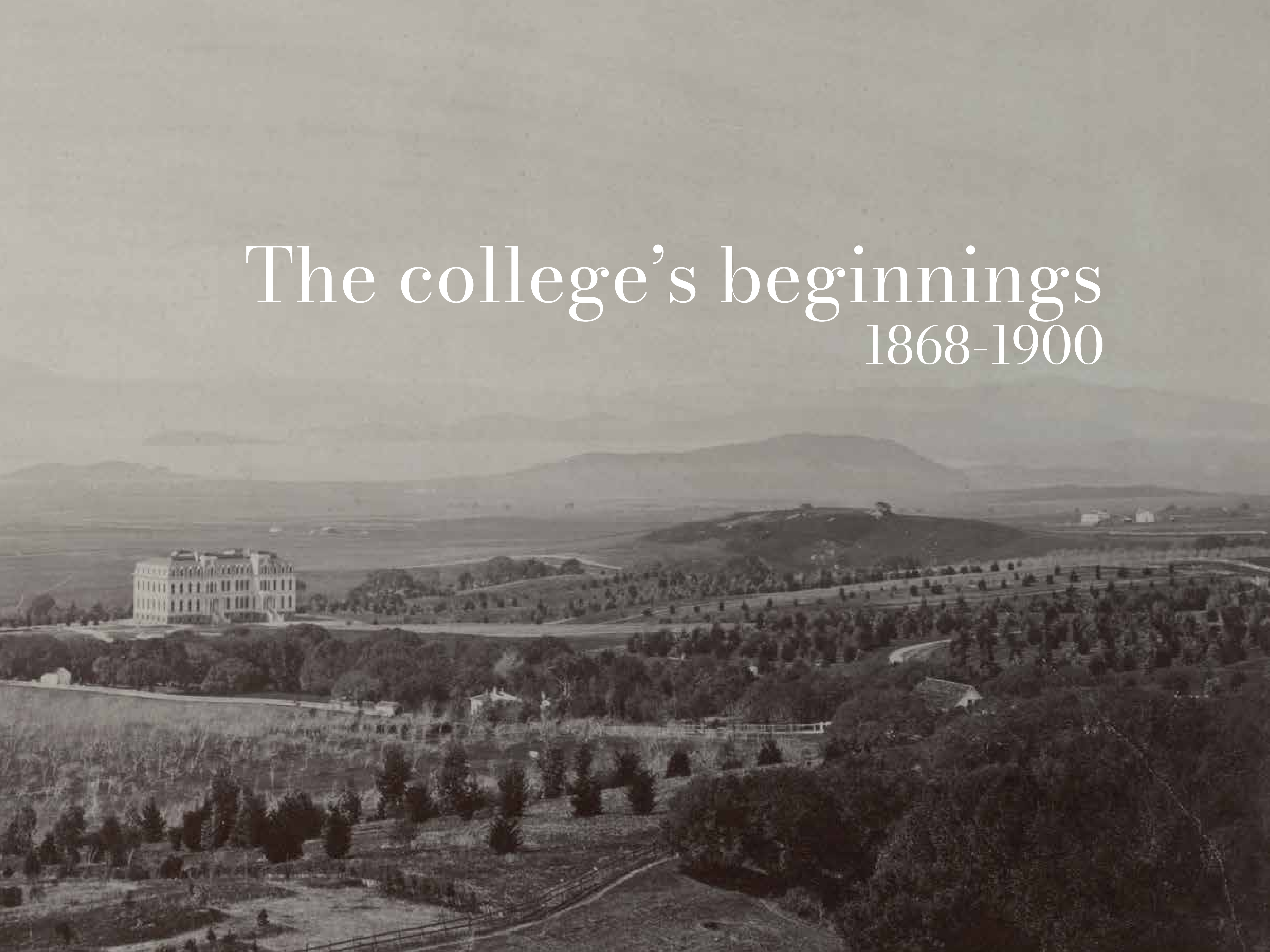
The College recently added a series of new initiatives and programs increasing interdisciplinary collaboration and enhancing the 21st century undergraduate experience: the groundbreaking Berkeley Center for Green Chemistry, the Synthetic Biology Institute (co-founded with the College of Engineering), the eChem project in online introductory chemistry, modernization of the college's undergraduate instructional labs, the recently launched Peer Tutoring Center in Bixby Hall (2019), and an upgrade to the College's library in Hildebrand Hall.

The College is currently fundraising for Heathcock Hall, a new teaching and research building, scheduled to break ground in 2023.

COLLEGE OF CHEMISTRY **FACTS**



The college's beginnings
1868-1900



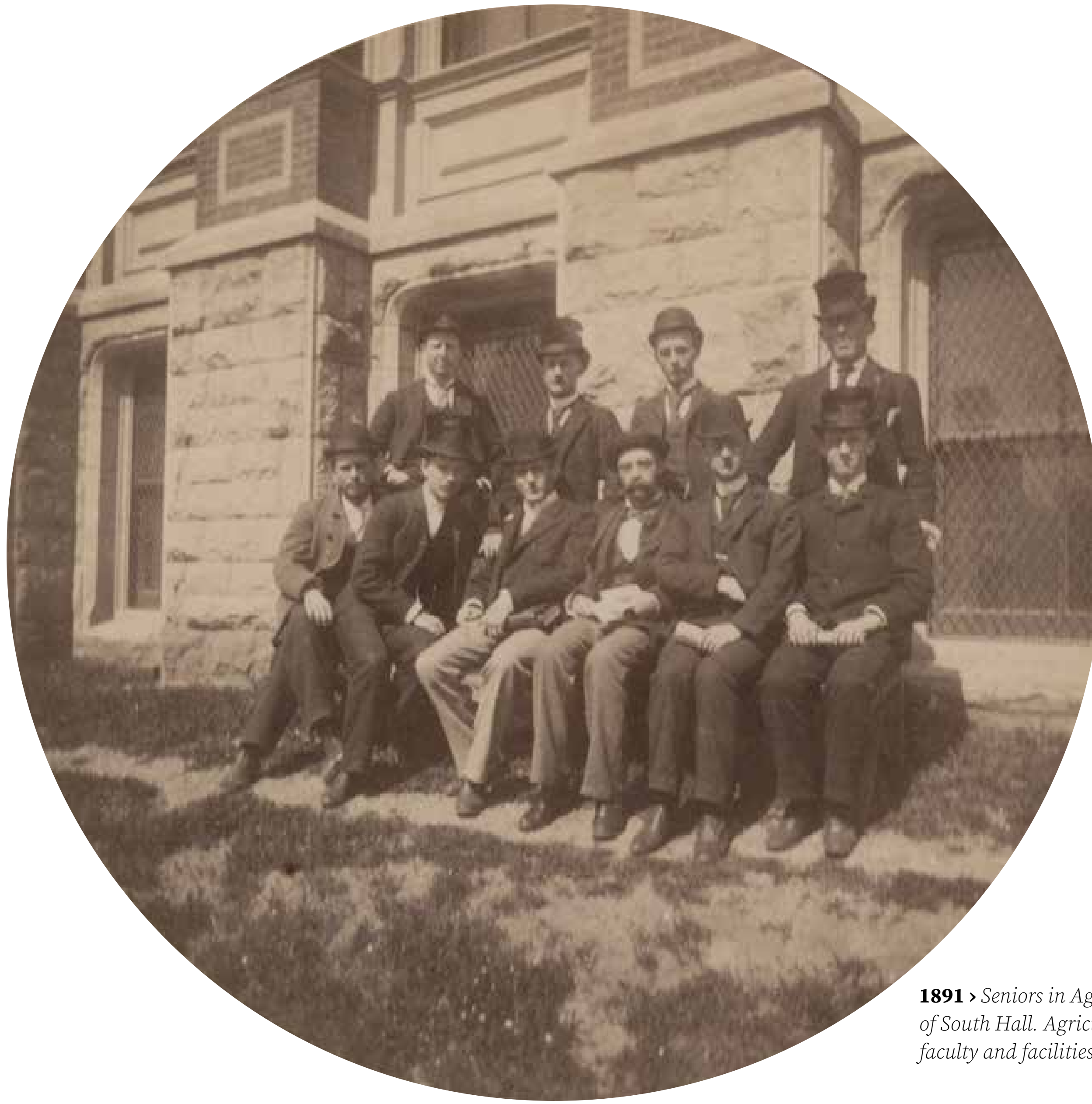
South Hall

Chemistry was first housed in South Hall, the oldest building on campus, designed by the Architect David Farquharson. Farquharson was a well-established architect in the Bay Area at the time and designed many of the original campus buildings. The building was completed in 1873 at a total cost of $197,000. Its four stories contain 29,500 square feet. South Hall is the only original building remaining from that period. When it was first opened, the building housed the chemistry and physics departments along with the first campus library. The College's first chemistry lab was located in South Hall. The interior furnishings were made from California laurel, the desks black walnut and the hoods were plate glass. The building incorporated stained-glass windows into its design. The glassware used in the lab was purchased and brought over from Europe by Robert Fisher who was the first chemistry faculty member on campus.

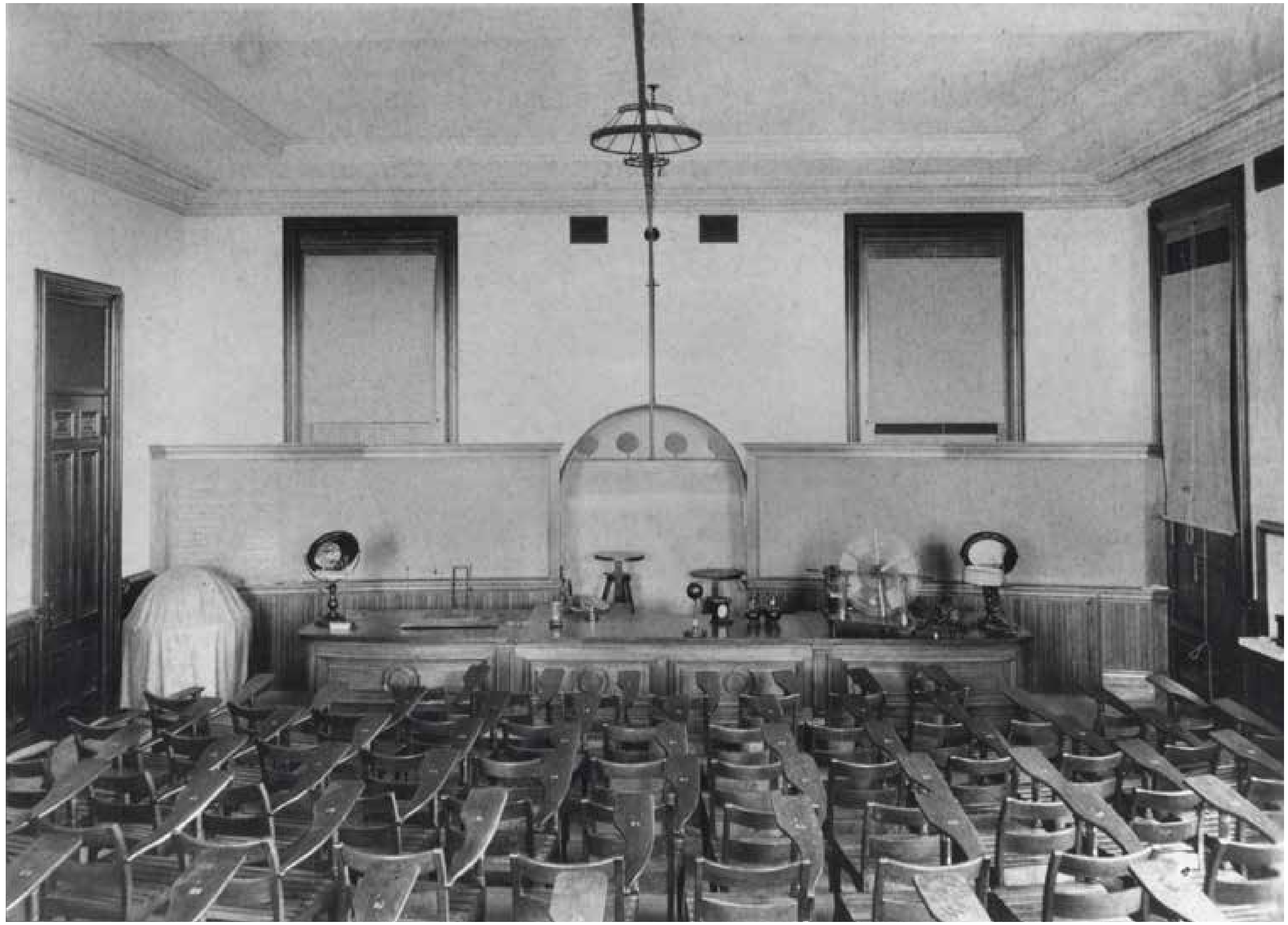
According to Edmond O'Neill (professor and later College dean), in a 1918 *Industrial Engineering Chemistry* Journal, "When completed, the laboratory was physically superior to any in America and was probably unexcelled by any in the world. With the smallness of the classes and the lack of distracting avocations and activities, now unhappily so prevalent, we could devote ourselves to study and reflection…the small college in the midst of uninhabited fields of Berkeley had a charm that can never come again."

1874 › *Willard Rising, chemistry professor and first official dean of the college, stands in the first chemistry lab on campus in South Hall. Chemistry shared the lab with the Agriculture and Mining Departments.*

1890 › *On Oct. 3, 1870, just two years after the University of California was founded, the UC Board of Regents unanimously approved a resolution proposed by Regent Samuel F. Butterworth to open the University's doors to women, and "on equal terms" with men.*

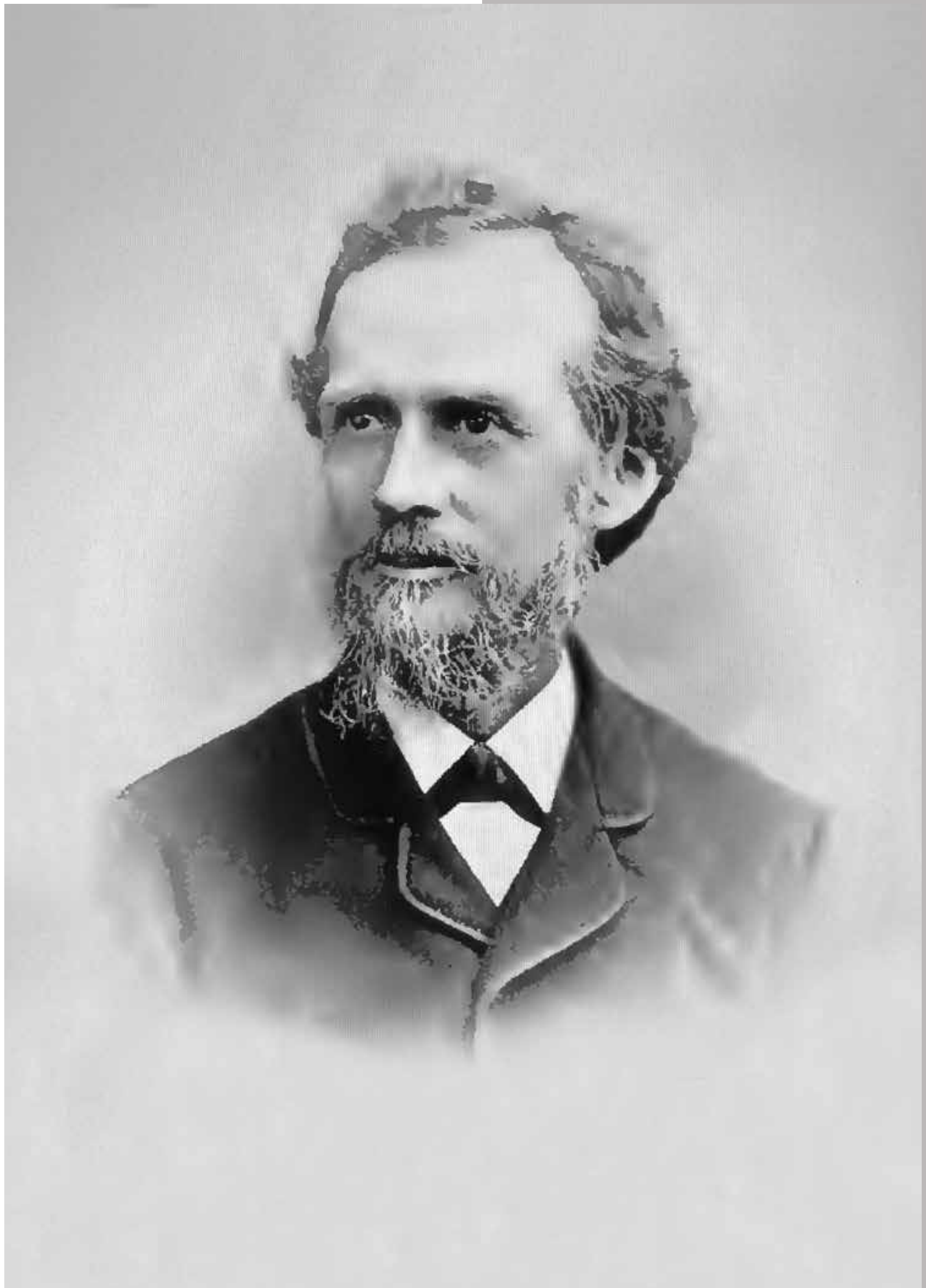


1891 › *Seniors in Agricultural studies in front of South Hall. Agriculture and chemistry shared faculty and facilities at this time.*



1892 › *South Hall physics' lecture auditorium.*

1898 › *Coeducation was in full swing after 1870 at UC Berkeley. Students at a lecture in South Hall. The faculty member is unidentified.*



Robert A. Fisher

When the University of California was founded in 1868, one of the first ten faculty hired was the chemist Robert A. Fisher (1832-1893) as the professor of chemistry, mining and metallurgy. His position was in the College of Agriculture because an official College of Chemistry was not established until 1872.

One of the many challenges Fisher faced was the complete lack of chemical lab equipment available for purchase on the west coast. Fisher was sent to Europe by the administration with the sizeable sum of $9,500 ($275,000 today) to buy the University's first equipment and textbooks which included glassware and reference books for chemistry. He taught the University's first chemistry class in the temporary downtown Oakland campus at night with chemical demonstrations. He left the University abruptly in 1870 when the Board of Regents cancelled his faculty position for unexplained reasons.

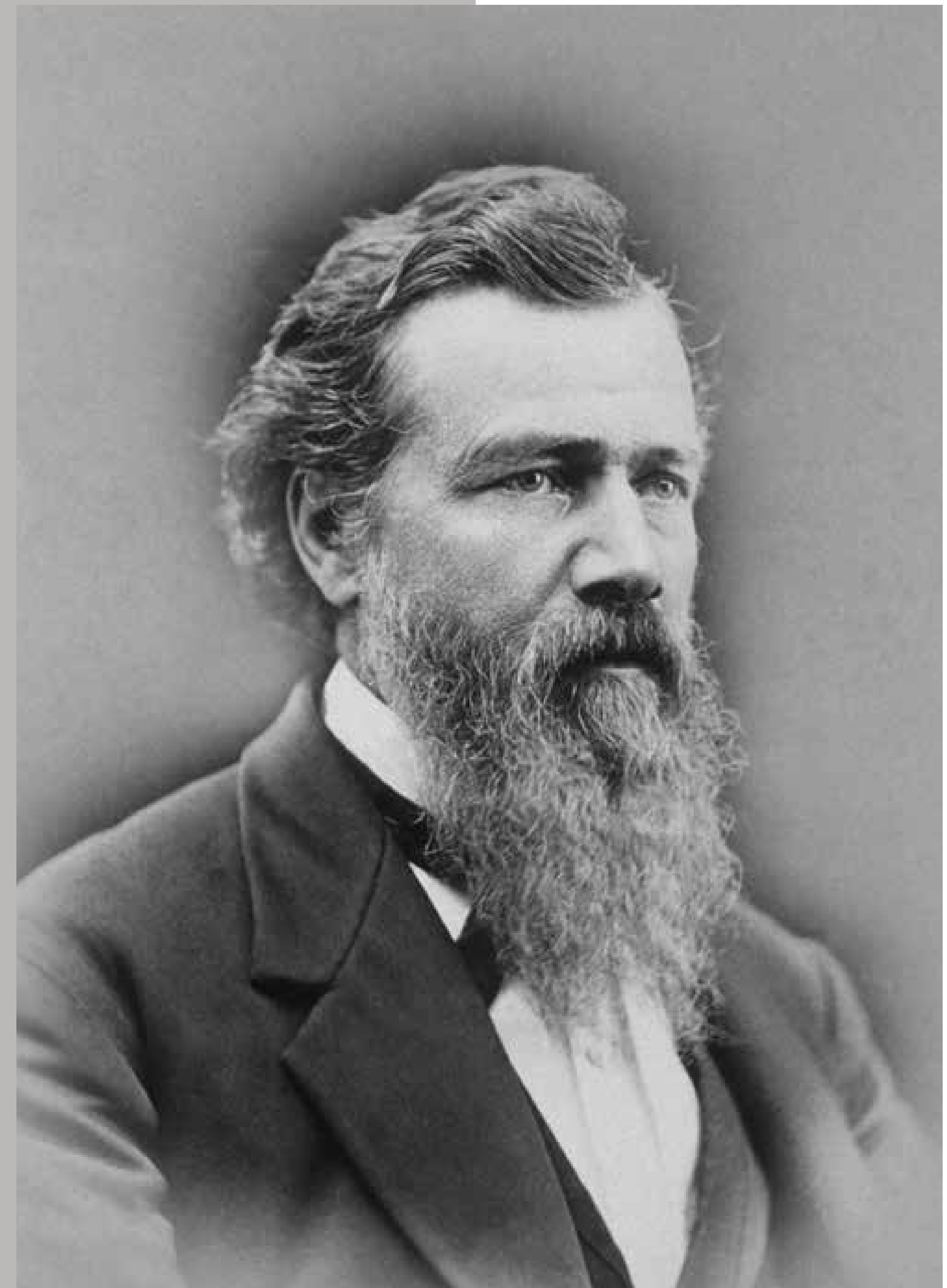
Ezra S. Carr

Ezra Carr (1818-1894) followed Fisher as the first professor of agriculture and the second chemistry professor arriving in 1869. The new university was a land grant college. In addition to liberal arts subjects, federal law required that land grant colleges offer practical instruction in agriculture and mechanics.

Although Carr lectured his students on the history of agriculture, he interpreted the landmark college law to mean that he should establish a largely vocational program that taught young men to become good farmers. This conflicted with the vision of Daniel Coit Gilman, the first university president. He felt the university should discover and disseminate new principles, technologies, and methods that would improve the productivity and efficiency of California's agriculture.

Carr was popular with the state's labor and farming groups who backed his attempt to abolish the Board of Regents and replace it with the elected State Superintendent of Public Instruction in support of his plans. Predictably, Carr lost his job over the struggle. He would however go on to become the elected State's Superintendent of Public Instruction in 1875, becoming an ex-officio member of the Board of Regents. This was too much for Gilman who left to become the president of John Hopkins University.

Personal tragedy struck the Carrs during this time causing Carr's health to decline. He retired from active life in 1880 moving into the newly formed Indiana Colony, the forerunner of Pasadena, Ca.



Willard B. Rising

Willard B. Rising (1839-1910) arrived in September 1872 on his 33rd birthday, to organize the College of Chemistry which had just been approved in the California Political Code in March of that year.

He received his undergraduate degree at Hamilton College in 1864 and was an Instructor in Chemistry at the University of Michigan starting in 1866. He was briefly Professor of the Natural Sciences at the College of California (the institution that grew to become UC Berkeley).

He went on to Germany taking his Ph.D. (1870) with Bunsen at Heidelberg. He served as Dean of the College of Chemistry for six of his 36 year career retiring in 1908. Rising also served as Analyst for the California State Board of Health to test and certify water supplies statewide.

John M. Stillman

John M. Stillman (1852-1923) was the College's first Ph.D. graduate in 1885. He did his undergraduate work at Berkeley, graduating in 1874, and went to Germany for his graduate training. He returned to lecture at Berkeley from 1876 to 1882 and then went on to work as the Chief Chemist and Superintendent for the Boston and American Sugar Refining Company. He did not write a formal dissertation to receive his Ph.D. His degree was awarded for his "exemplary record as a student and for his publication while a university faculty member of nine papers on the composition of certain resins and the ethereal oil of the California bay tree."

Stillman was the first chemistry faculty hired at the inception of Stanford University in 1891. In addition to his teaching and scholarship there, Stillman took an active part in department and university administration, including time as Stanford's Vice President and Acting President. He was executive head of the department from 1904 to 1919.

Edmond O’Neil

Edmond O’Neill (1858-1933) received his B.S. at Berkeley specializing in chemistry and agriculture. Upon his graduation in 1879, he was appointed instructor in analytical chemistry. Except for the period from 1884-1887, when he was a graduate student in Europe, O’Neill spent the rest of his professional life at Berkeley. He taught everything from analytical to physiological chemistry (biochemistry). Physiological chemistry was his main interest and he studied fatty acids of the seeds of the California bay laurel and the terpenes of Monterey cypress.

Similar to Rising, he was involved in solving water quality problems around the state. He was dean of the College from 1901 until 1912. Gilbert N. Lewis arrived at Berkeley and became dean in 1912. O’Neill took the position back temporarily during WWI as Lewis was involved in the war effort in France and Washington. O’Neill was a good judge of character and was largely responsible, along with Rising, for hiring Frederick Cottrell and Gilbert N. Lewis.

Frederick G. Cottrell

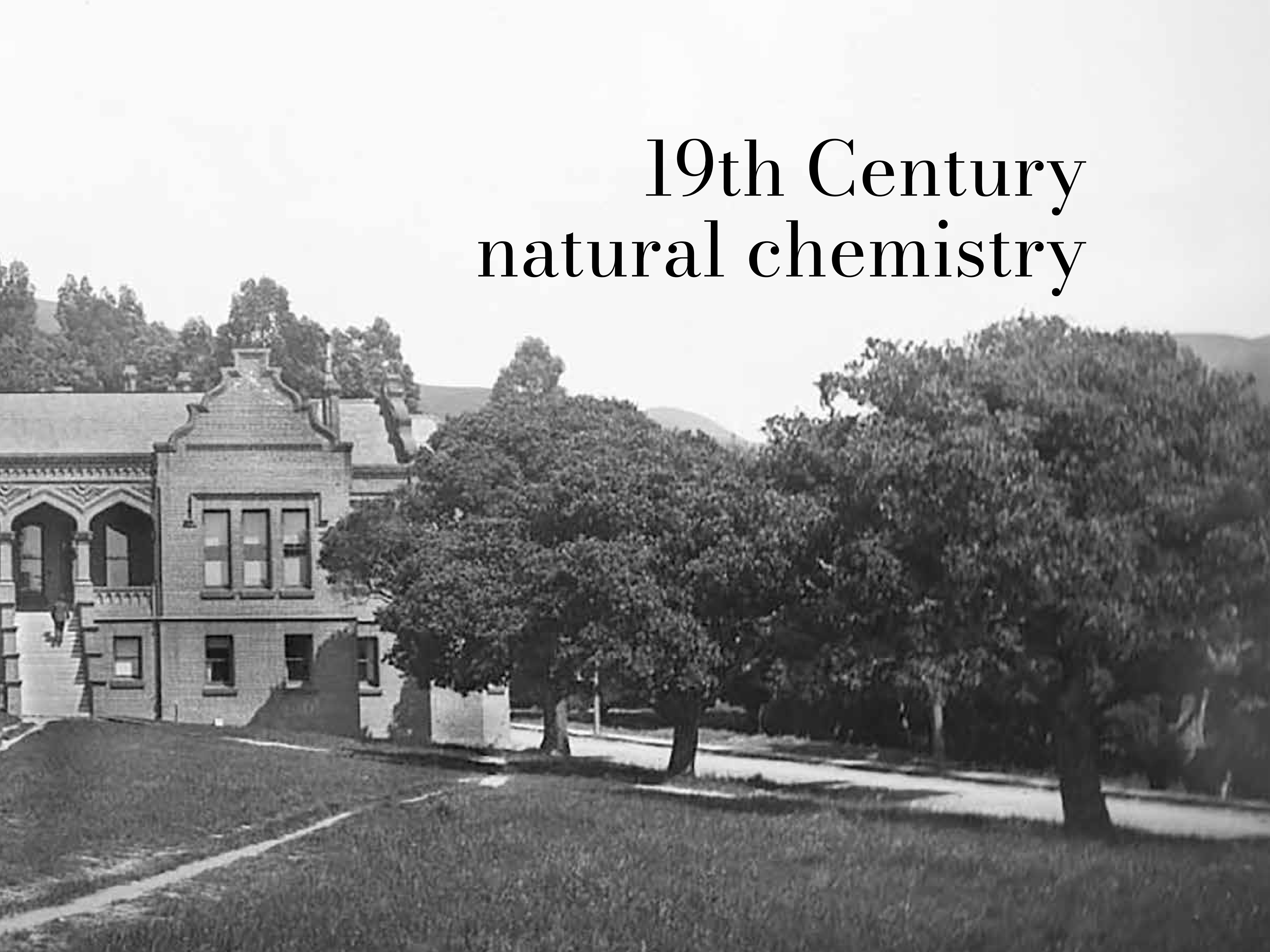
Frederick G. Cottrell (1877-1948) finished his undergraduate chemistry degree at Berkeley in three years. He went on to study in the lab of Wilhelm Ostwald (1909 Nobel Prize in Chemistry) in Leipzig in 1901 completeing his Ph.D. in one and a half years.

He returned to Berkeley as a lecturer. In 1904, he installed the first liquid air plant on the West Coast. The plant was the start of the low temperature laboratory that later was developed and used by thermodynamicists George E. Gibson, Wendell M. Latimer, and Nobel Laureate William F. Giauque.

In 1905, the Du Pont sulfuric acid plant at San Pablo Bay asked Cottrell for help with the problem of precipitating the acid mists which form when sulfur trioxide vapor is bubbled through water or dilute sulfuric acid. Cottrell determined that an electrical method, similar to one unsuccessfully tried by Sir Oliver Lodge in 1884, could be used for precipitating the mists. Thus the electrostatic precipitator was developed.

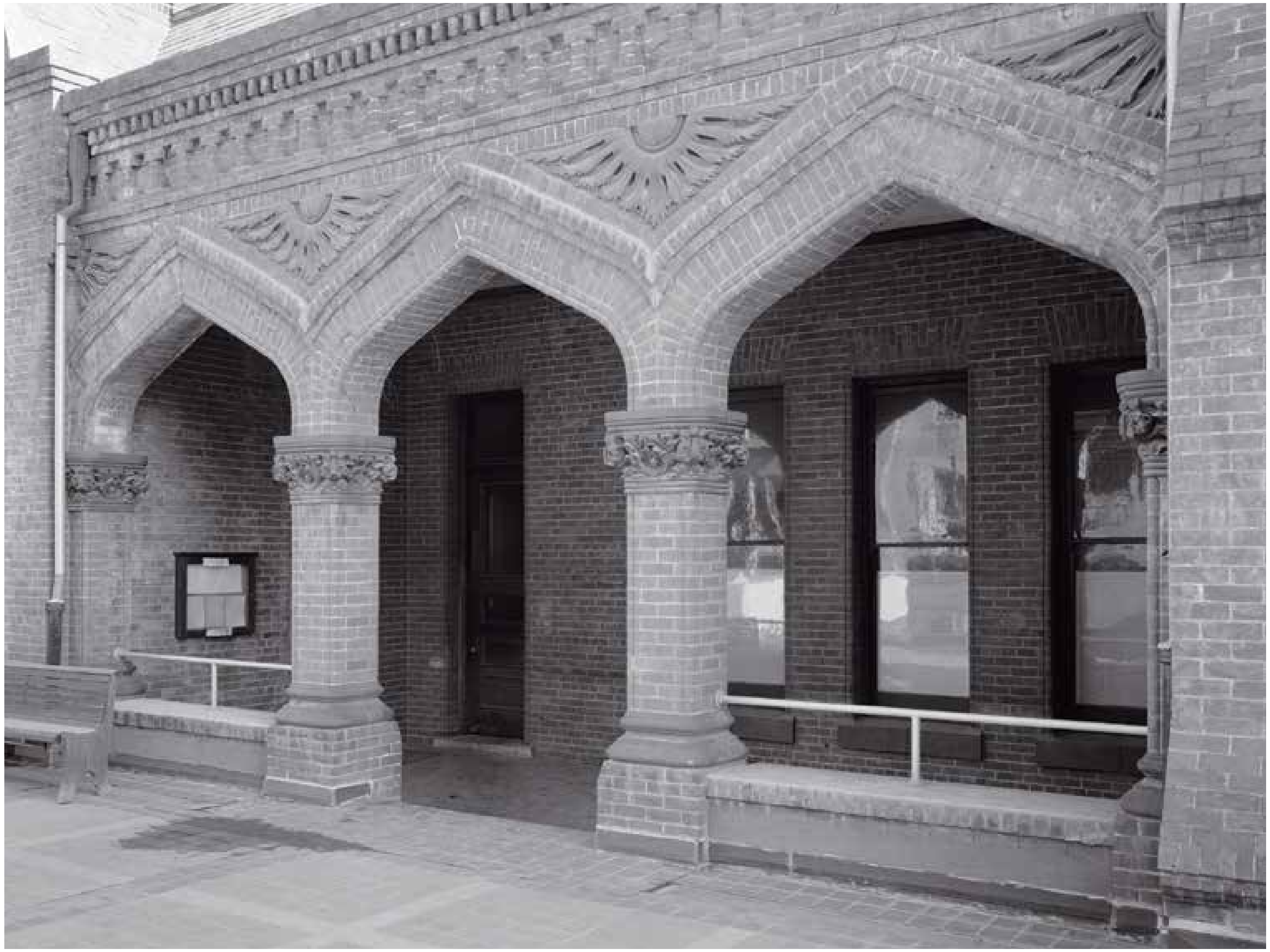
The precipitator had far reaching applications pertaining to managing toxic chemical pollution. Cottrell donated the patents and established the first scientific philanthropy organization in the U.S. to support scientific research.

19th Century natural chemistry



1897 › *In 1891, a dedicated brick building (center) was constructed for the College on what is now the site of Hildebrand Hall and nestled between the first mining building (left) and Bacon Hall (right). It was designed by architect Clinton Day and constructed from 43,180 bricks. Additions were added in 1900, 1902, and 1912. Day designed some of San Francisco's finest buildings of the period, including the City of Paris building, Union Trust building, and Gump's department store.*

1962-1963 › *Interior views of the "Old Chemistry Building" before it was razed to be replaced by Hildebrand Hall.*
PHOTOGRAPHS COURTESY OF THE ESTATE OF MORLEY BAER.

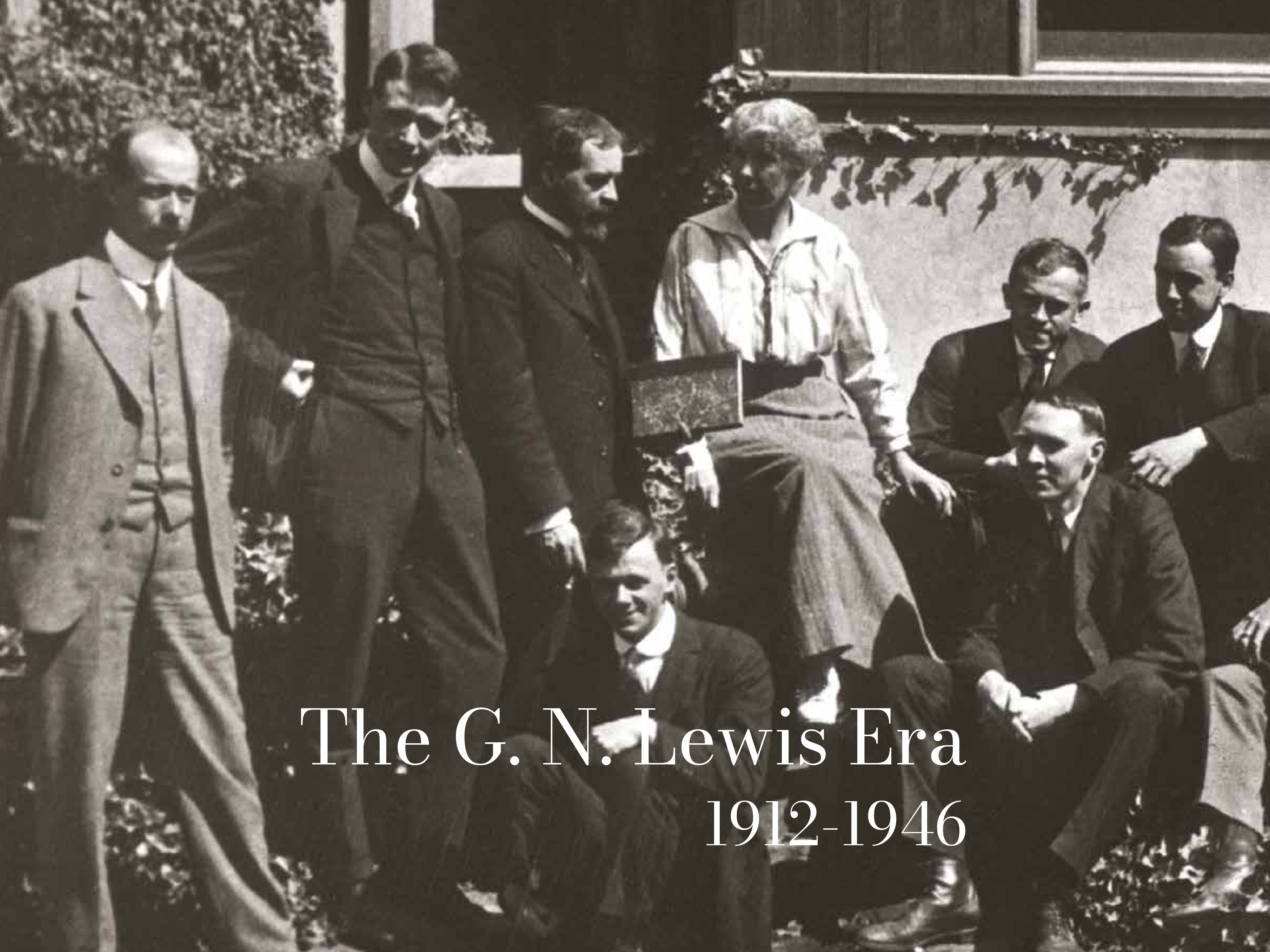


1963 › *Details of the 'Old Chemistry Building" facade. These photographs were taken right before the building was razed to make way for Hildebrand Hall.*

PHOTOGRAPHS TAKEN BY AND COURTESY OF THE ESTATE OF MORLEY BAER.

1894 › *Willard Rising in his office in the first dedicated chemistry building on campus.*

1899 › *Willard Rising teaching in the chemistry building. Young men and women dressed differently for class at the time. The women wore straw hats to tuck up their long hair and full-length skirts. The men wore suits and ties to class. Note the chemistry glassware of the period: all handblown and imported from Europe.*



The G. N. Lewis Era
1912-1946

1917 › *College personnel on the south side of Chemistry Annex building.*
(l to r) Front row seated: Axel R. Olson, Thomas B. Brighton, Orville E. Cushman, and Guy W. Clark. Back row: Willaim C. Bray, William L. Argo, Gilbert N. Lewis, Constance Gray, Parry Borgstrom, George S. Parks, Merle Randall, Charles S. Bisson, Asa L. Caulkins, Svend Holmatrup (shopman), and William J. Cummings (glassblower).

Gilbert N. Lewis

Gilbert Newton Lewis (known as G.N. Lewis) was one of the most influential and admired scientists of the twentieth century and was a pioneer in both chemistry and physics.

Born in Weymouth Landing, Massachusetts in 1875, Lewis was able to read by the age of 3. He entered college at age 15, and then transferred to Harvard University, where he earned a B.S. (1896) and a Ph.D. (1899). His research concentrated on thermodynamics and valence theory (on the behavior of electrons when atoms combine). From this early work on valence, Lewis developed the concept of the covalent bond and invented the "Lewis symbols," which are still used to describe ways in which atoms bond today.

Lewis taught at Harvard and then Massachusetts Institute of Technology (MIT) before coming to UC Berkeley in 1912 to take up positions as professor and dean at the College. His arrival signaled a renaissance in research and education turning the College into one of the nation's best in advanced chemistry education.

When Lewis arrived, the Chemistry faculty consisted of four members: Edward Booth, Edmund O'Neill, Walter Blasdale, and Henry Biddle. Lewis brought with him from MIT William Bray, Merle Randall, and Richard Tolman together with several graduate students. Scottish chemist George Gibson arrived from a teaching position at the University of Edinburgh and Joel Hildebrand, from a teaching position at the University of Pennsylvania. Both joined the faculty in 1913. They were the last non-Berkeley Ph.D. appointments until Melvin Calvin's appointment in 1937.

Lewis mentored and influenced numerous Nobel laureates at Berkeley including Harold Urey (1934), William F. Giauque (1949), Glenn T. Seaborg (1951), Willard Libby (1960), and Melvin Calvin (1961), turning Berkeley into one of the world's most prestigious centers for chemistry.

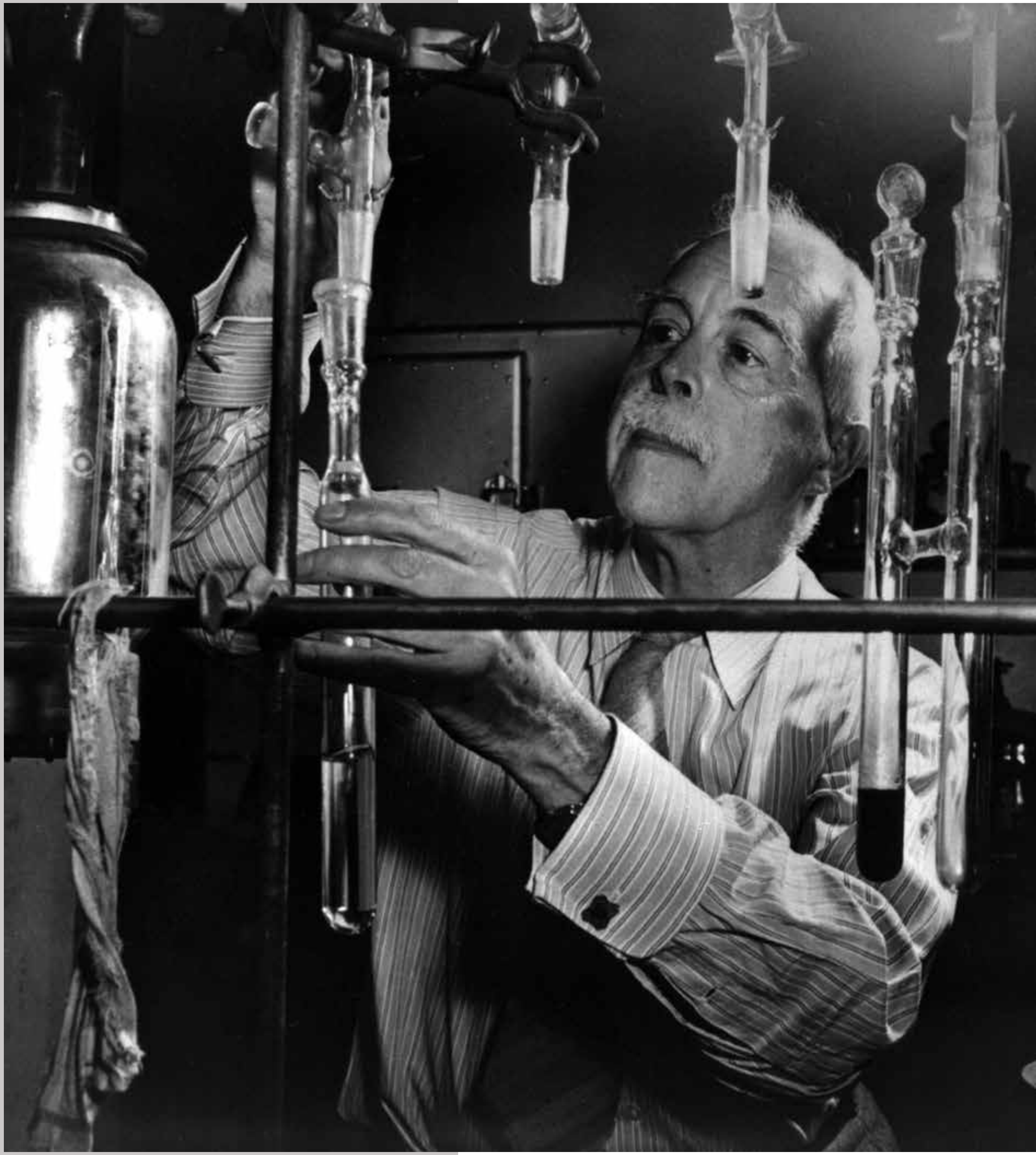
In his own work, Lewis combined strict discipline in collecting and organizing data with innovative interpretation of the results. He was instrumental in developing the theory of covalent bonding which is at the heart of chemistry. In 1916, he published his seminal paper suggesting that a chemical bond is a pair of electrons shared by two atoms. Also, his observations, published in separate papers (1916) with German chemist Walther Kossel, is known as the rule of eight, or octet rule, and is used to determine the valence, or combining capacity, of several chemical elements.

In the early 1930s, he became the first scientist to produce "heavy water" with double-weight hydrogen atoms, which was essential to early experiments in atomic energy. He worked with Ernest Lawrence on the invention of the cyclotron and in early atom-smashing experiments. Lewis focused on photochemistry from the late 1930s until his death in 1946. He coined the term "photon."

Lewis won numerous honors for his work, including the Society of Arts and Sciences Medal as "the outstanding chemist in America" (1930). He was nominated for the Nobel Prize in Chemistry a total of 41 times, and to this today, many scientists believe he well deserved winning it.

1910 › *(l) Portrait of Lewis taken at Harvard University.*

1944 › *(r) Publicity photo of Lewis taken in his lab at UC Berkeley.*



George E. Gibson

George E. Gibson (1884-1959). Gibson was born in Edinburgh, Scotland, and came to Berkeley by way of the University of Breslay where he received his Ph.D. He joined the faculty at Berkeley in 1913. His research started in the field of organic chemistry, but he soon transferred his major interest to physical chemistry and quantum theory. His work on thallium vapor, published in 1911, was the first conclusive proof that spectral lines are produced by thermal emission.

Gibson was enlisted to teach the honors courses in thermodynamics and advanced physical chemistry. He published an English translation of "A Text book of Thermo-chemistry and Thermodynamics" by Otto Sackur in 1917.

Gibson's early research at Berkeley followed two main patterns, spectroscopy and low temperature calorimetry. In 1917 he published, in collaboration with Lewis, a survey of the entropies of the elements from existing but rather inadequate low temperature calorimetric data. He enlisted three of his graduate students, Wendel M. Latimer, George S. Parks, and William F. Giauque, in low temperature research designed to test the validity of this method of evaluating absolute entropies of elements and compounds. These three students served as nuclei (Parks at Stanford and Latimer and Giauque at Berkeley) for a rapid spread of low temperature research through their own students. This development put the United States in a leading position in experimental work related to the third law of thermodynamics at the time.

Besides his prolific research, he was adept in languages, including Sanskrit, and played the violin. He was very proud that two of his students, Giauque and Seaborg received Nobel Prizes.

1917 › *(l to r) Dale Stewart, Walter Porter, G. Ernest Gibson, and Merle Randall*

Joel H. Hildebrand

From Kenneth Pitzer's biography of Joel Hildebrand:

First, there is the remarkable diversity of fields in which Joel H. Hildebrand (1881-1983) made major contributions. To research scientists and engineers, his contributions to our knowledge of liquids and nonelectrolyte solutions are most important. But a substantially larger group recognize him as their outstanding teacher of freshman chemistry from 1913 through 1952, and often as the most inspiring teacher of their college experience. He taught approximately 40,000 students during that period. He also served as dean of the College of Letters and Science from 1939-43, chairman of the Department of Chemistry from 1941-43, and dean of the College of Chemistry from 1949-51.

Others knew him as mountaineer, lover of the outdoors, and president of the Sierra Club. He was captain of the Olympic ski team in 1936. There was his effective leadership in a variety of educational and scientific organizations far beyond chemistry, involving service as a member of the Council of the National Academy of Sciences (1949-52) and member of the Citizens Advisory Committee on Education to the California Legislature.

1924 › *Portrait of Joel HIldebrand*

Wendell M. Latimer

Wendell M. Latimer (1893-1955) was born in Garnett, Kansas. He entered the University of Kansas planning to become a lawyer, but finding that he enjoyed mathematics, he sought a subject to which he might apply it. His first contact with chemistry came during his third year at the University. The subject captured his interest and he decided to become a chemist.

He received the B.A. degree from the University of Kansas in 1915 and served as Instructor there from 1915-1917. The reputation of G. N. Lewis and his study of some of Lewis' papers led him to Berkeley for graduate study, and he received the Ph.D. degree in 1919. His thesis research was concerned with low-temperature calorimetry under the direction of G. E. Gibson.

He was retained as a member of the staff and attained full professorship in 1931. He was Assistant Dean of the College of Letters and Science, 1923-1924; Dean of the College of Chemistry, 1941-1949; and Chairman of the Department of Chemistry, 1945-1949.

Latimer had a stimulating effect on his colleagues and students. He was mainly responsible for initiating a seminar on nuclear chemistry that interested such men as Libby, Seaborg, Wahl, and Kennedy and helped lay the foundation for the discovery of plutonium.

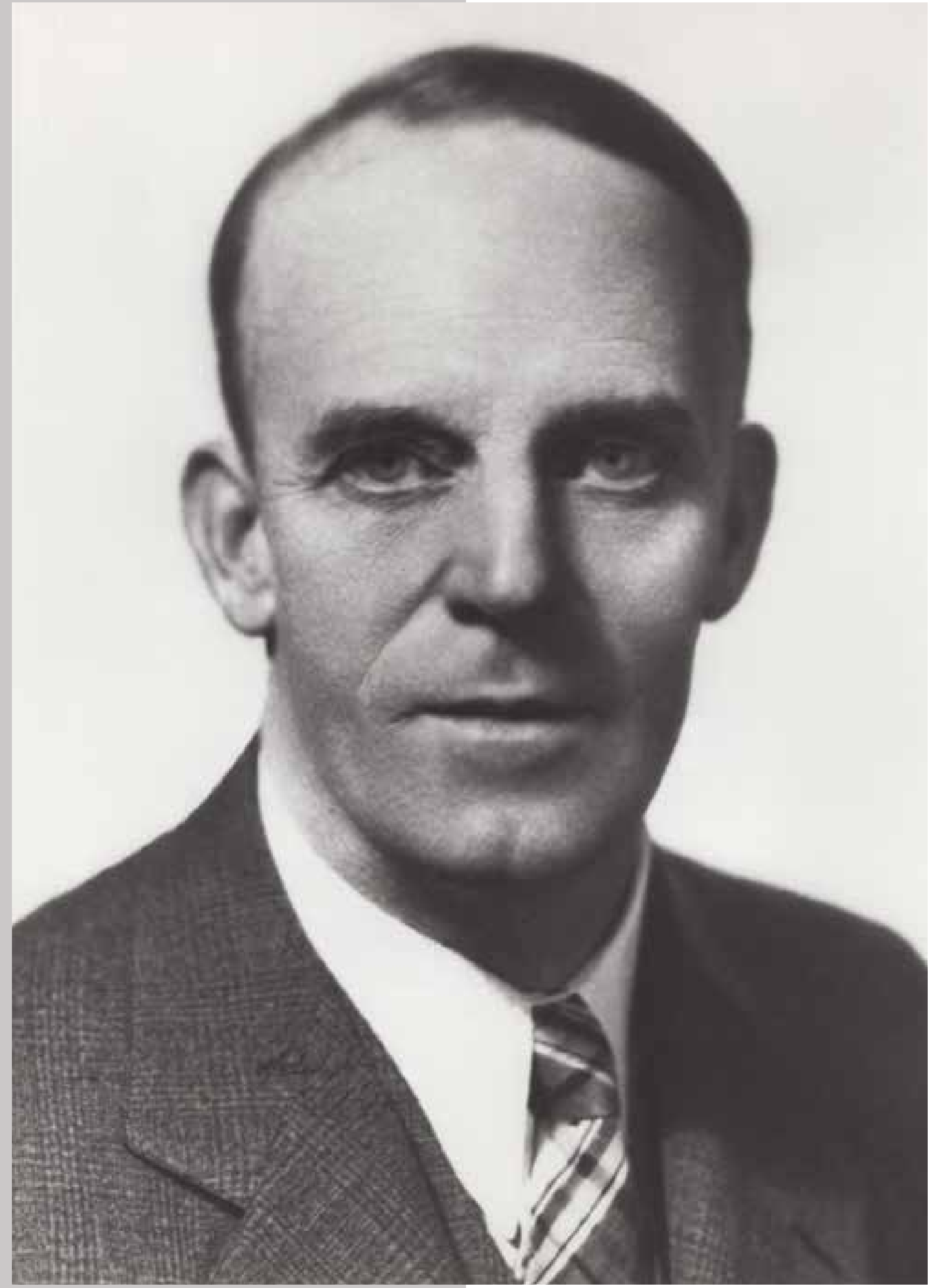
1915 › *Portrait of Wendell Latimer*

Gerald E.K. Branch

Gerald E.K. Branch (1886-1954) was born in the British West Indies. In 1904 he entered the University of Edinburgh to study medicine. He passed his First Professional with distinction, also winning the medal in elementary chemistry under Crum Brown. Ultimately, however, he gave up medicine for chemistry. After a brief return home, he entered the Chemistry Department under F. G. Donnan at Liverpool University in 1909 where he sustained a brilliant Honours B.Sc. degree examination in 1911. After a year's continuing research, he received his M.S. in 1912, and became engaged to Esther Hudson, the outstanding woman student at Liverpool, whom he married in 1915. In 1912 Branch left for Berkeley.

Branch may be considered as having established, at the University of California, the first modern school of theoretical organic chemistry. His extensive study of the relationship of the structure of organic acids with acid strength gave rise to many of the basic notions of induction and mesomerism (resonance) stemming from Gilbert N. Lewis's theory of chemical bonds. Branch's views contributed much to the development of this theory.

1936 › *Portrait of Gerald Branch*



Kenneth S. Pitzer

Kenneth S. Pitzer (1914-1997) was the only child of Pomona attorney and citrus magnate Russell K. Pitzer. He learned to drive a tractor by age 12 and participated in setting out smudge pots in the groves on the occasional cold nights. He attended the nearby California Institute of Technology, where undergraduate research with A. A. Noyes stimulated his interest in chemistry.

He did his Ph.D. research with Wendell Latimer graduating in 1937. Upon graduation, he was appointed to the faculty of UC Berkeley's Chemistry Department and was eventually elevated to professor. From 1951 to 1960, he served as dean of the College.

During World War II, he was technical director of the Maryland Research Laboratory, and from 1949 to 1951 directed research at the Atomic Energy Commission, now the Nuclear Regulatory Commission. He remained an advisor to the commission for several years after returning to academia.

As a scientist, Pitzer was nationally known for his work in physical and theoretical chemistry, particularly in predicting the thermodynamic properties of molecules.

Pitzer left Berkeley to become president of Rice University in Houston from 1961 until 1968 and of Stanford from 1968 until 1971. He then returned to UC Berkeley to teach.

Among his awards were the Priestly Medal of the American Chemical Society and, in 1974, the National Medal of Science.

1948 › *Publicity still of Kenneth Pitzer in his lab at Berkeley before he joined the atomic energy commission.*

Willard F. Libby

After receiving his Ph.D. at Berkeley in 1933, Willard F. Libby (1908-1980) joined the College faculty. He was on the faculty until 1945 with a break during WWII to work on the Manhattan Project. While associated with the Manhattan Project, Libby helped develop a method for separating uranium isotopes by gaseous diffusion, an essential step in the creation of the atomic bomb.

In 1946 he became a professor of chemistry in the Institute for Nuclear Studies at the University of Chicago. He showed in new research that cosmic rays in the upper atmosphere produce traces of tritium, the heaviest isotope of hydrogen, which can be used as a tracer for atmospheric water. By measuring tritium concentrations, he developed a method for dating well water and wine, as well as for measuring circulation patterns of water and the mixing of ocean waters.

Libby was a Physical Chemist, and specialist in radio-chemistry, particularly hot atom chemistry, tracer techniques, and isotope tracer work. He became well-known at University of Chicago for his work on natural carbon-14 (radiocarbon) and its use in dating archaeological artifacts, and natural tritium, and its use in hydrology and geophysics.

He was the second college alumnus after Harold Urey, in 1934, to be awarded the Nobel Prize in 1960 “for his method to use carbon-14 for age determination in archaeology, geology, geophysics, and other branches of science.”

1930s › *Portrait of Willard F. Libby at UC Berkeley.*

William F. Giauque

After undergraduate school, William F. Giauque (1895-1982) worked at the Hooker Electro-Chemical Company as an engineer in Niagara Falls, New York. After two years, he entered the College of Chemistry, where he received his B.S. degree in Chemical Engineering in 1920 and his Ph.D. in chemistry with a minor in physics in 1922.

Although he started out thinking of an engineering career, he soon acquired a liking for fundamental research. The emphasis on scientific investigation by the group of faculty and students associated with Professor Gilbert N. Lewis was his major influence. He was appointed Instructor of Chemistry in 1922 and became a full Professor in 1934.

His interest in the third law of thermodynamics as a field of research was inspired by the experimental work for his Ph.D. advisor George Gibson. This work, which was concerned with the relative entropies of glycerine crystals and glass, had its origin in discussions with Professors Lewis and Gibson.

The principal objective of his research was the demonstration, through a considerable number and variety of tests particularly concerning the behavior of substances at extremely low temperatures, that the third law of thermodynamics is a basic natural law. Never leaving his engineering roots, he designed and oversaw the build, of many of the apparatus he used in his lab.

1935 › *Portrait of William Giauque*

Glenn T. Seaborg

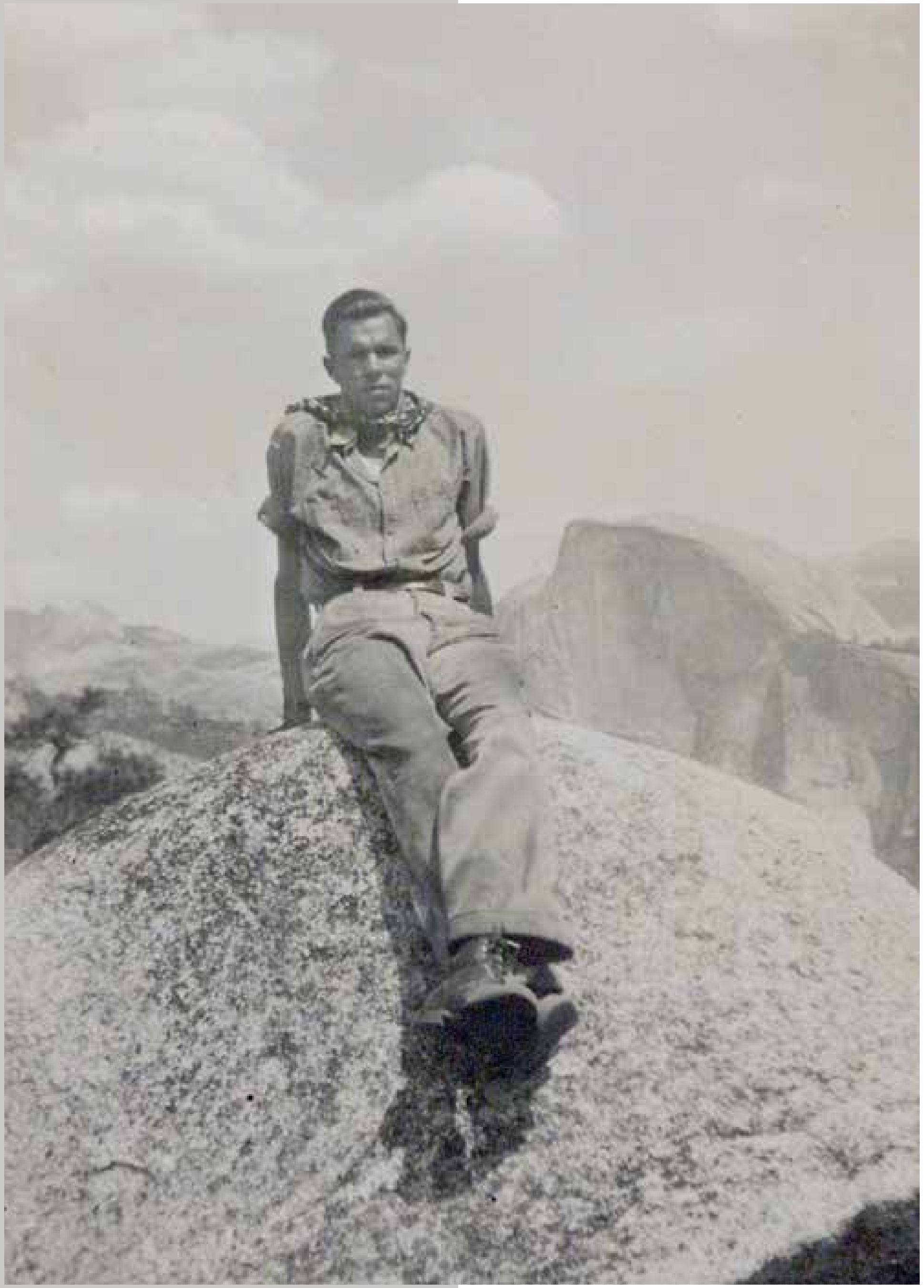
Glenn T. Seaborg (1912-1999) was an American chemist whose involvement in the synthesis, discovery, and investigation of ten transuranium elements earned him a share of the 1951 Nobel Prize in Chemistry. His work in this area also led to his development of the actinide concept and the arrangement of the actinide series in the periodic table of the elements.

Seaborg received his Ph.D. from UC Berkeley in 1937. He began his career as an instructor in 1939 becoming a professor in 1945. He was given a leave of absence from the College from 1942-1946, during which period he headed the plutonium work of the Manhattan Project at the University of Chicago Metallurgical Laboratory. Between 1958 and 1961 he served as the university's second chancellor. He was advisor to ten US Presidents, from Harry S. Truman to Bill Clinton, on nuclear policy and was Chairman of the United States Atomic Energy Commission from 1961 to 1971, where he pushed for commercial nuclear energy and the peaceful applications of nuclear science.

He was a signatory to the Franck Report and contributed to the Limited Test Ban Treaty, the Nuclear Non-Proliferation Treaty, and the Comprehensive Test Ban Treaty.

Seaborg was the principal, or co-discoverer, of ten elements: plutonium, americium, curium, berkelium, californium, einsteinium, fermium, mendelevium, nobelium, and element 106, which, while he was still living, was named seaborgium in his honor. In addition, he and his colleagues were responsible for the identification of more than 100 isotopes of elements throughout the Periodic Table.

1936 › *Glenn Seaborg on a trip in Yosemite National Park.*



Melvin E. Calvin

Melvin E. Calvin (1911-1997) was born in St. Paul, Minnesota of Russian immigrant parents. He received his B.S. degree in Chemistry in 1931 at the Michigan College of Mining and Technology, and Ph.D. degree in Chemistry from the University of Minnesota in 1935. He spent the academic years 1935-1937 at the University of Manchester, England. He began his academic career at the UC Berkeley in 1937, as an instructor, and became a full professor in 1947. He served as Director of the big-organic chemistry group in the Lawrence Radiation Laboratory beginning in 1946. This group became the Laboratory of Chemical Biodynamics in 1960.

Encouraged by Glenn Seaborg, Calvin started experimenting with carbon-14 isotopes which had been discovered in 1940 by Martin Kamen (1913–2002) and Samuel Ruben (1913–1943), who created it artificially using the cyclotron.

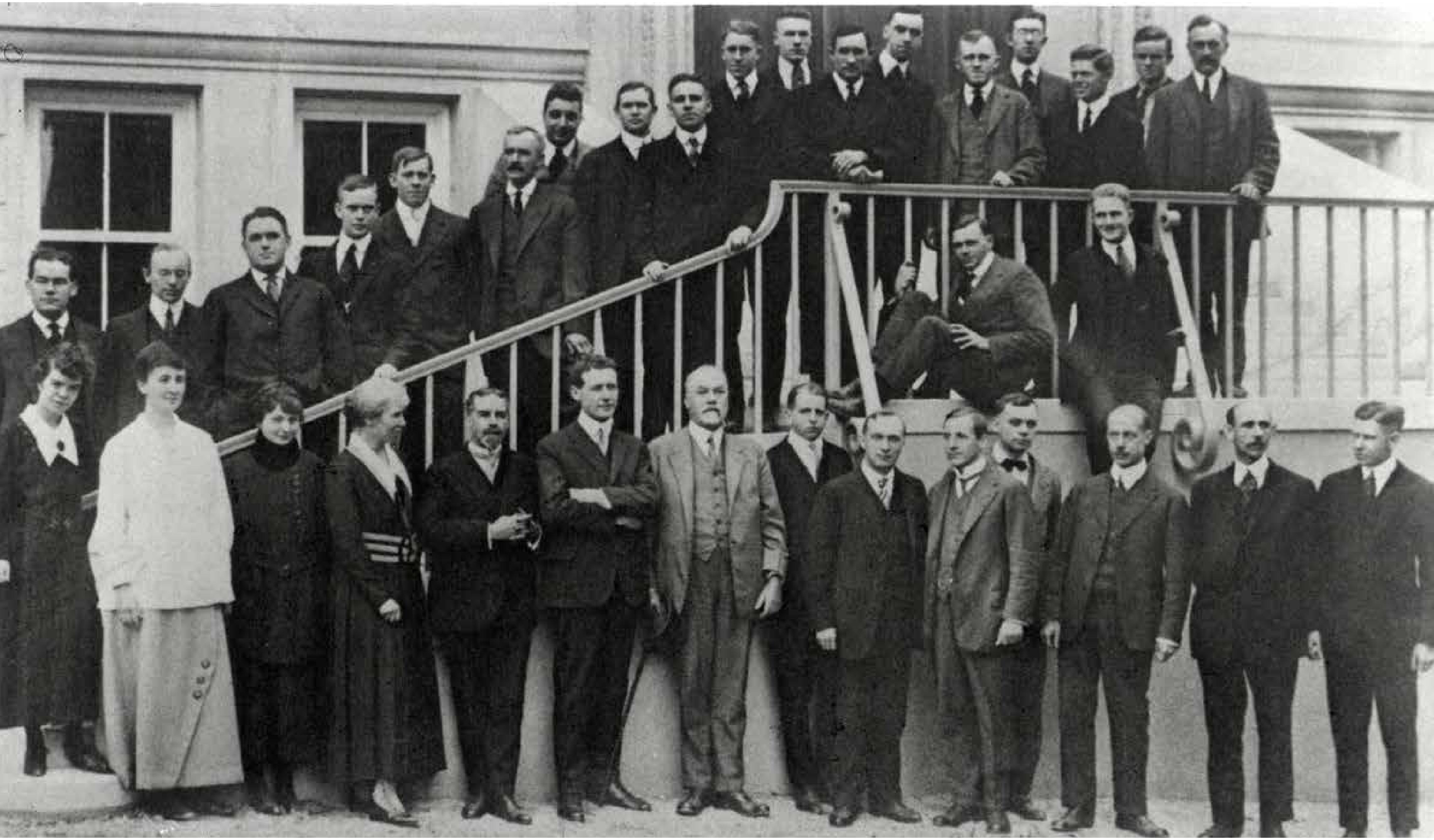
Calvin, along with Andrew Benson and James Bassham, mapped the complete route that carbon travels through a plant during photosynthesis, starting from its absorption as atmospheric carbon dioxide to its conversion into carbohydrates and other organic compounds. In doing so, they showed that sunlight acts on the chlorophyll in a plant to fuel the manufacturing of organic compounds, rather than on carbon dioxide as was previously believed.

Calvin was the sole recipient of the 1961 Nobel Prize for Chemistry for what is sometimes dubbed the Calvin-Benson-Bassham Cycle.

1940s › *Melvin Calvin in the lab.*

1938 › *Chem 1A teaching assistants meet with Professors Hildebrand and Libby in the storeroom of the Freshman Chemistry lab to discuss the quiz they are to give in their respective classrooms. (Seated l to r) J.K. Royal, L.V. Coulter, W.F. Libby, T.T. Magel, and unknown. (Standing l to r) A.P Carrol who was in charge of the freshman lab; J.H. Hildebrand, J.C. Goodrich, DC. DeValut, J.W Kennedy, and R.W. Long.*

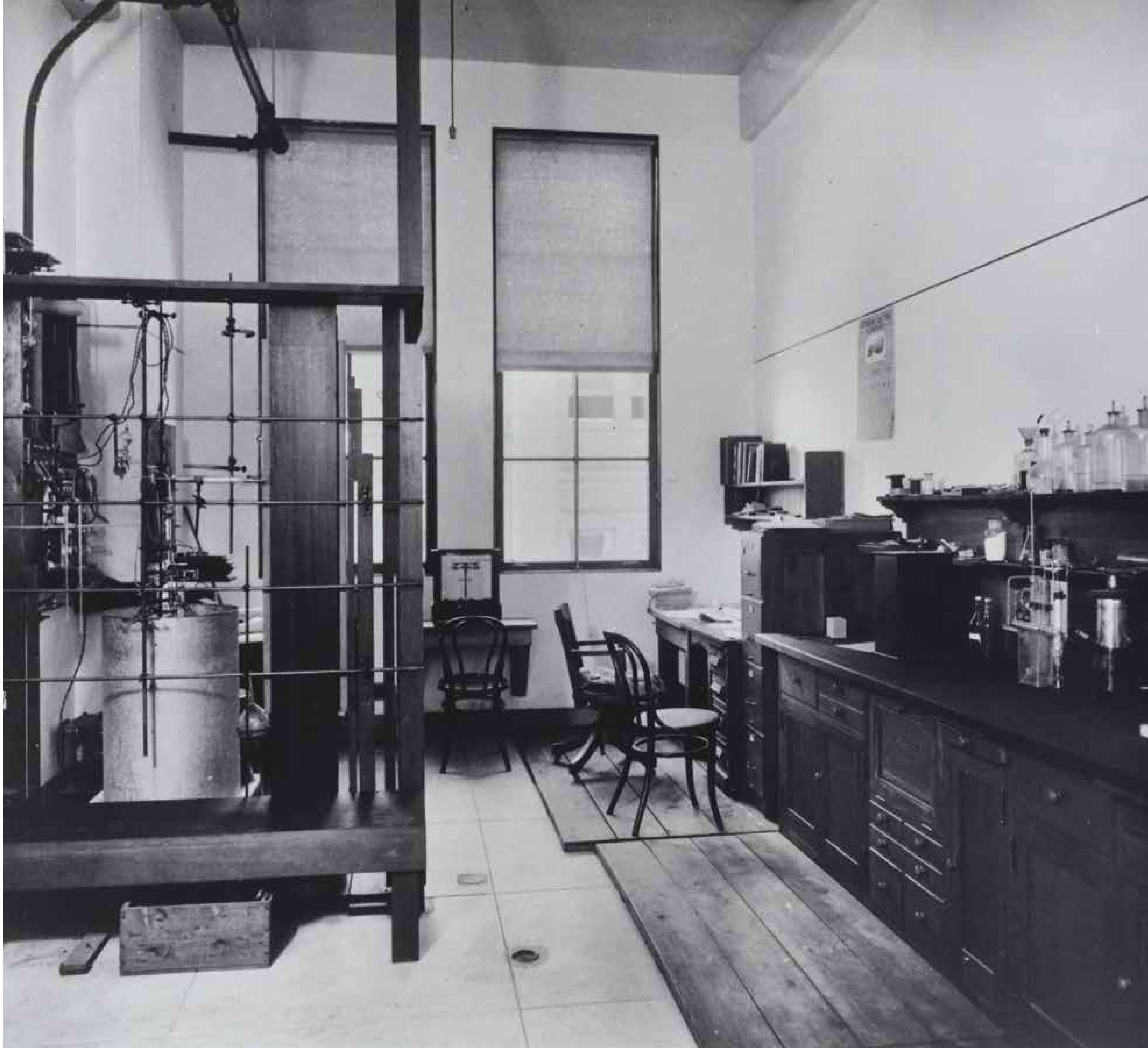
"G.N. Lewis set up a system whereby the whole department pitched in to teach the freshmen. We were a long way from the centers of population, we had no reputation, we had to start freshmen properly in order to produce the kind of graduate students we wanted."
— JH. HILDEBRAND

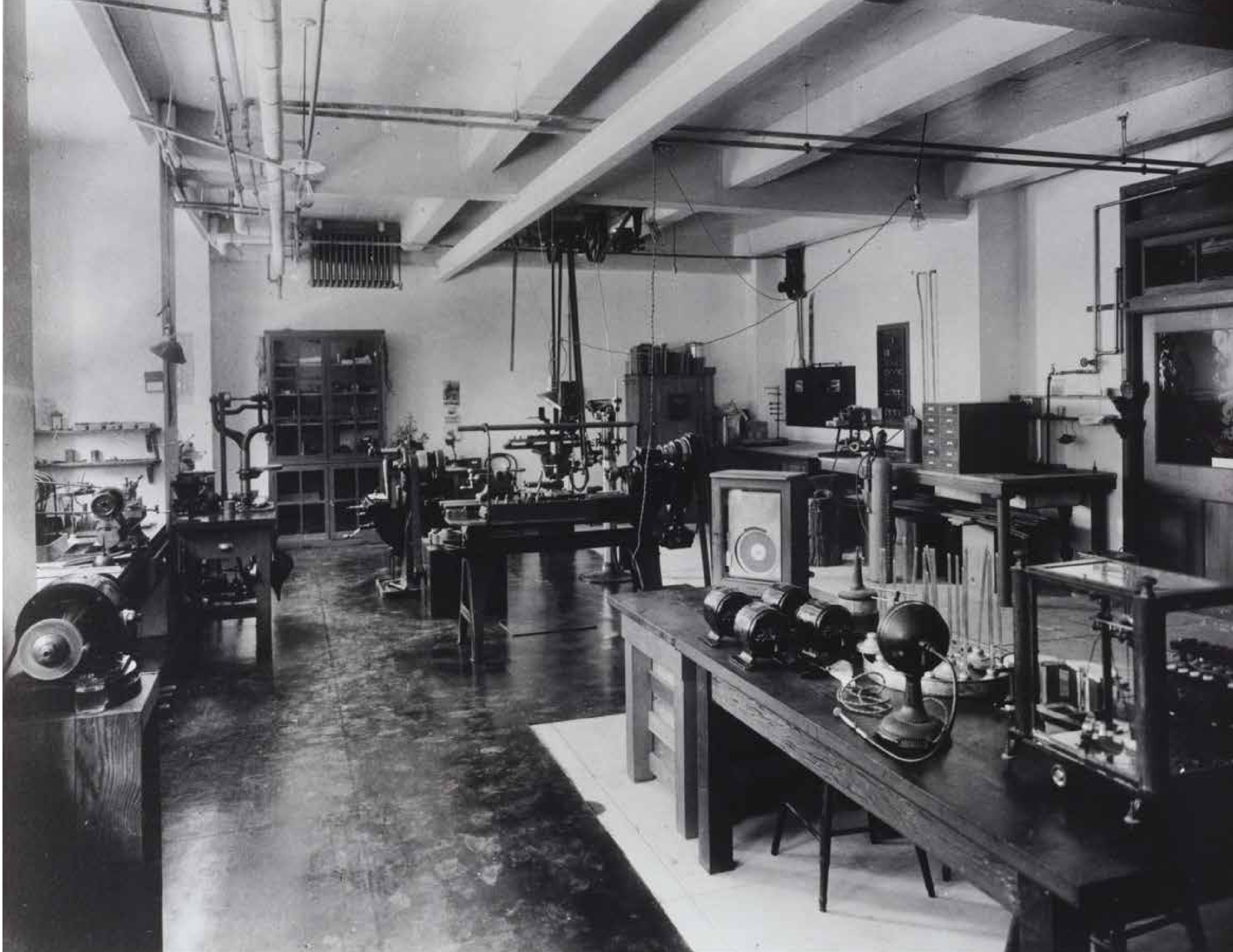


1917 › *The College staff in front of newly finished Gilman Hall: front row (l to r): M.J. Fisher (bookkeeper), Esther Branch, Esther Kittredge, Constance Gray, Gilbert N. Lewis, William L. Argo, Edmond O'Neill, T. Dale Stewart, C. Walter Porter, G. Ernest Gibson, Merle Randall, William C. Bray, Walter C. Blasdale, and Ermon D. Eastman. Ascending stairs (l to r): Charles S. Bisson, Wendell M. Latimer, William J. Cummings (glassblower), Carl Iddings, Reginald B. Rule, J.T. Rattray (woodworker), Charles C. Scalione, Hal D. Draper, William G. Horsch, William H. Hampton, Willard G. Babcock, John M. McGee, George S. Parks, Parry Borgstrom, Albert G. Loomis, George A. Linhat, William D. Ramage, and Harry N. Cooper. Seated (l to r) Axel R. Olson and Angier H. Foster.*

1914 › *G.N. Lewis agreed to come to Berkeley from Harvard on condition the University build him a new lab. University architect John Galen Howard's orignal concept for Gilman Hall shows it with two wings. The larger wing, on the right with the copola and chimneys, was not constructed. Gilman Hall was designated a National Historical Chemical Landmark in 1997.*

1917 › *Gilman Hall, lab interiors of newly-completed building.*
JOHN GALEN HOWARD ARCHITECT.





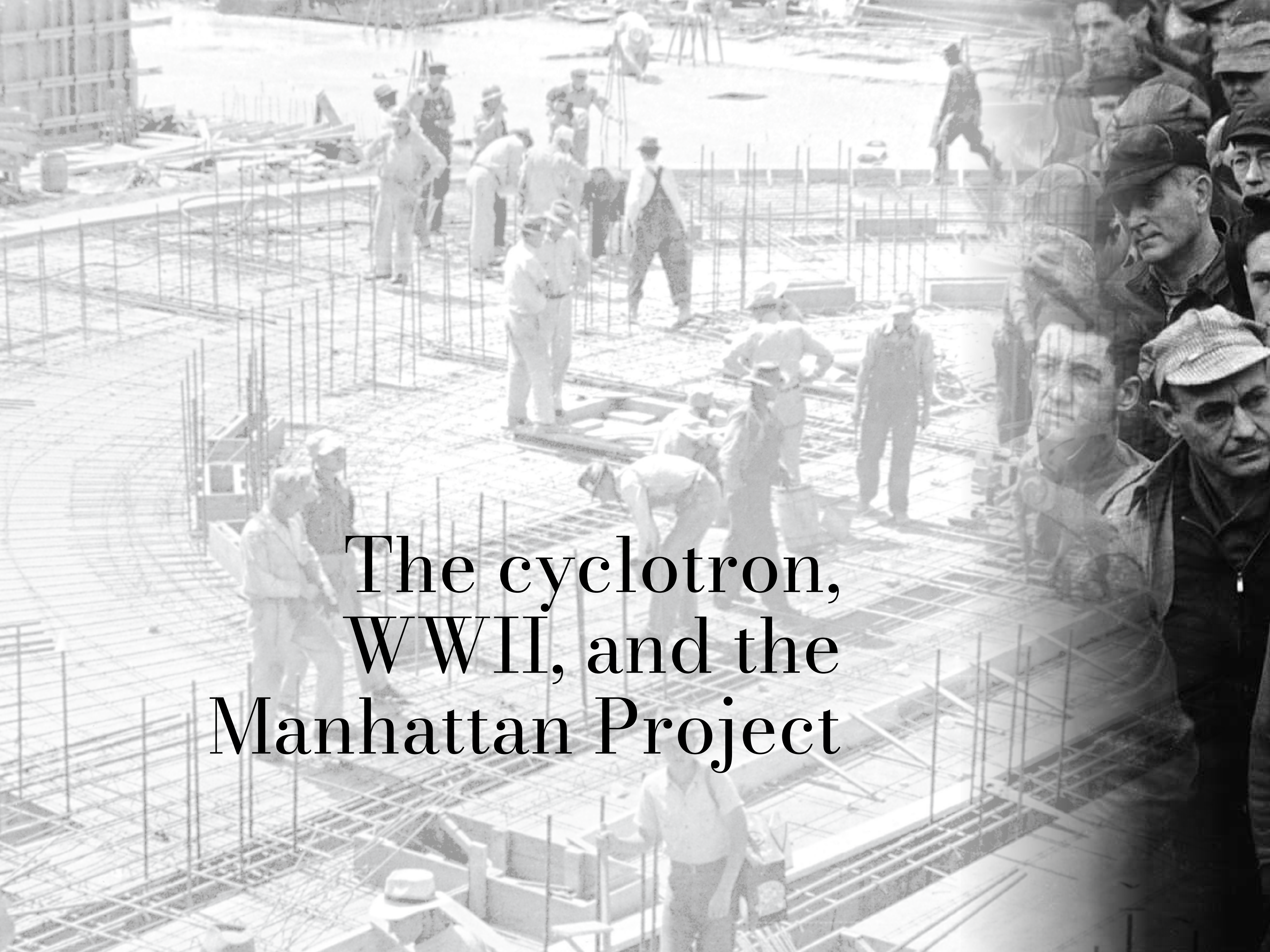
1913 › *The College quickly ran out of space with just the Chemistry Building. An auditorium was designed by John Galen Howard and built in 1913 to help accommodate the growing demands for teaching more students. It was specially equipped for instruction in chemistry with a seating capacity of 500; It was in continual use until 1959 when it was razed to make way for Latimer Hall.*

n.d. › *The Freshman chemistry lab was built in 1915 and razed in 1962 to clear the site for the Physical Sciences Lecture Hall (now known as George C. Pimentel Hall).*
THE BUILDING WAS DESIGNED BY JOHN GALEN HOWARD.

1920 › *College buildings including Gilman Hall on the far left, the old chemistry building covered in ivy in the middle, and the chemistry annex on the right.*

1946 › *Gilman Hall after WWII.*

The cyclotron, WWII, and the Manhattan Project



Faces of some of the 30,000 strong workforce at Oak Ridge, Tennessee attending a "Stay on the Job" rally. These men and women were responsible for building the Y-12 and K-25 processing plants that created the uranium used to build the Hiroshima atomic bomb. The projects were so top secret that the workers were not told what the facilities they were building would be used for.

1931 › *The radiation laboratory, or "rad lab", sitting next to the "old chemistry building".*

Early nuclear discoveries at the Rad Lab

Lynn Yaris, Berkeley Lab

High-energy beams, nuclear science, heavy ion acceleration, radioisotopes – whatever the research focus, the “Rad Lab” at Berkeley would define physics and nuclear chemistry in the coming decades – both at home and around the world.

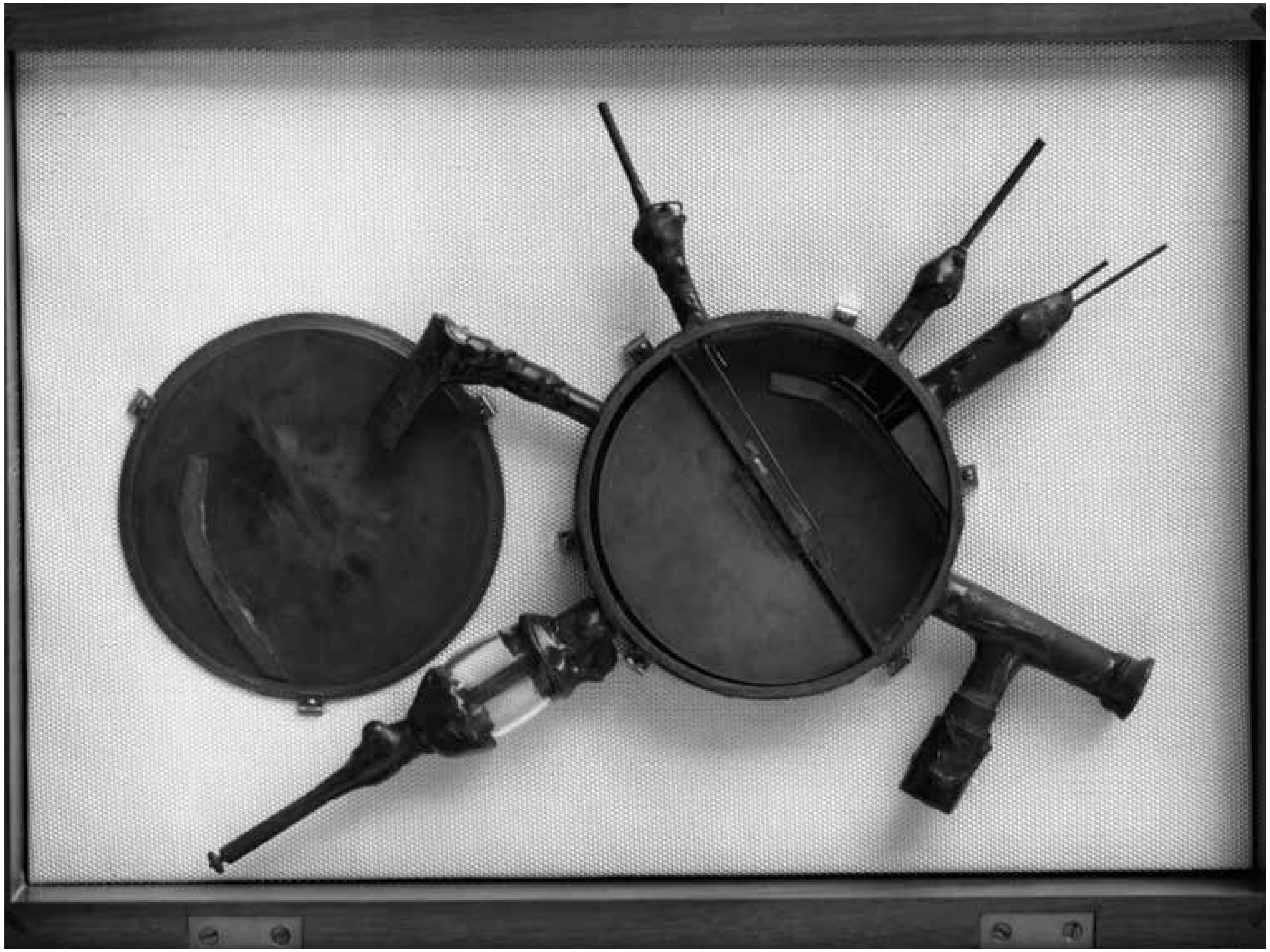
The 16,000 square foot, two story structure was designed by John Galen Howard originally to be used as the Mechanic Arts Laboratory (1885-1907). Located next to the Old Chemistry Building, it was converted to the Civil Engineering Testing Laboratory in 1907. The building was turned over to the Physicis Department in 1931 to house the first cyclotron developed by Ernest Lawrence and renamed the Radiation Laboratory (‘Rad Lab’ for short). Lawrence’s radiation experiments had begun two years earlier in a lab in the basement of the Physics Hall (formerly LeConte Hall).

The young physicist Ernest Lawrence had been working out of Room 329 in Physics Hall, which was just large enough to accommodate his first 11-inch cyclotron, but not the 27-inch cyclotron, with its 80-ton magnet. After being refused space by the engineering faculty in the Mining Building, Lawrence turned to UC President Sproul who agreed to let Lawrence take over the Civil Engineering Testing Laboratory.

It took a year to get the 27-inch cyclotron up and running, but by September 1932 the machine was accelerating protons to 3.6 million electron volts. The centerpiece of the new Rad Lab would not enjoy its celebrity for long. Lawrence, always eager to advance to the next level, and somehow able to obtain funding despite the scarcity of money, laid plans to expand its accelerating chamber and make other modifications that resulted in a new 37-inch cyclotron, which, by 1937, could accelerate deuterons to 8 MeV and alpha particles to 16 MeV. This machine was used to create radio-isotopes and the first artificial element, technetium.

The Rad Lab staff grew during this period from five to 60 members. Team members included Edwin McMillan, Luis Alvarez, Glenn Seaborg, and Emilio Segrè, all of whom would go on to be Nobel laureates, plus other notables, such as Martin Kamen, J.J. Livingood, Philip Abelson, Felix Bloch and the peerless instrument maker Donald Cooksey. In 1935, Lawrence invited his brother John, a physician, to join the Lab and explore the use of cyclotron-produced radioisotopes in biology and medical research.

Lawrence went on to build a 220 ton, 60 inch cyclotron up the hill above the campus in 1939. The Rad Lab was demolished in 1959 to make way for Latimer Hall.



1931 › *Ernest Lawrence built his first cyclotron that used electrical and magnetic fields to accelerate protons to high velocities in a spiral-shaped path before they collided with their target in 1931. He was awarded the Nobel Prize in 1939 for his discovery. The cyclotron would be instrumental in the chemical discoveries at Berkeley of multiple elements and isotopes.*

PHOTOGRAPHED BY ANSEL ADAMS FOR THE FIAT LUX COLLECTION IN 1966.

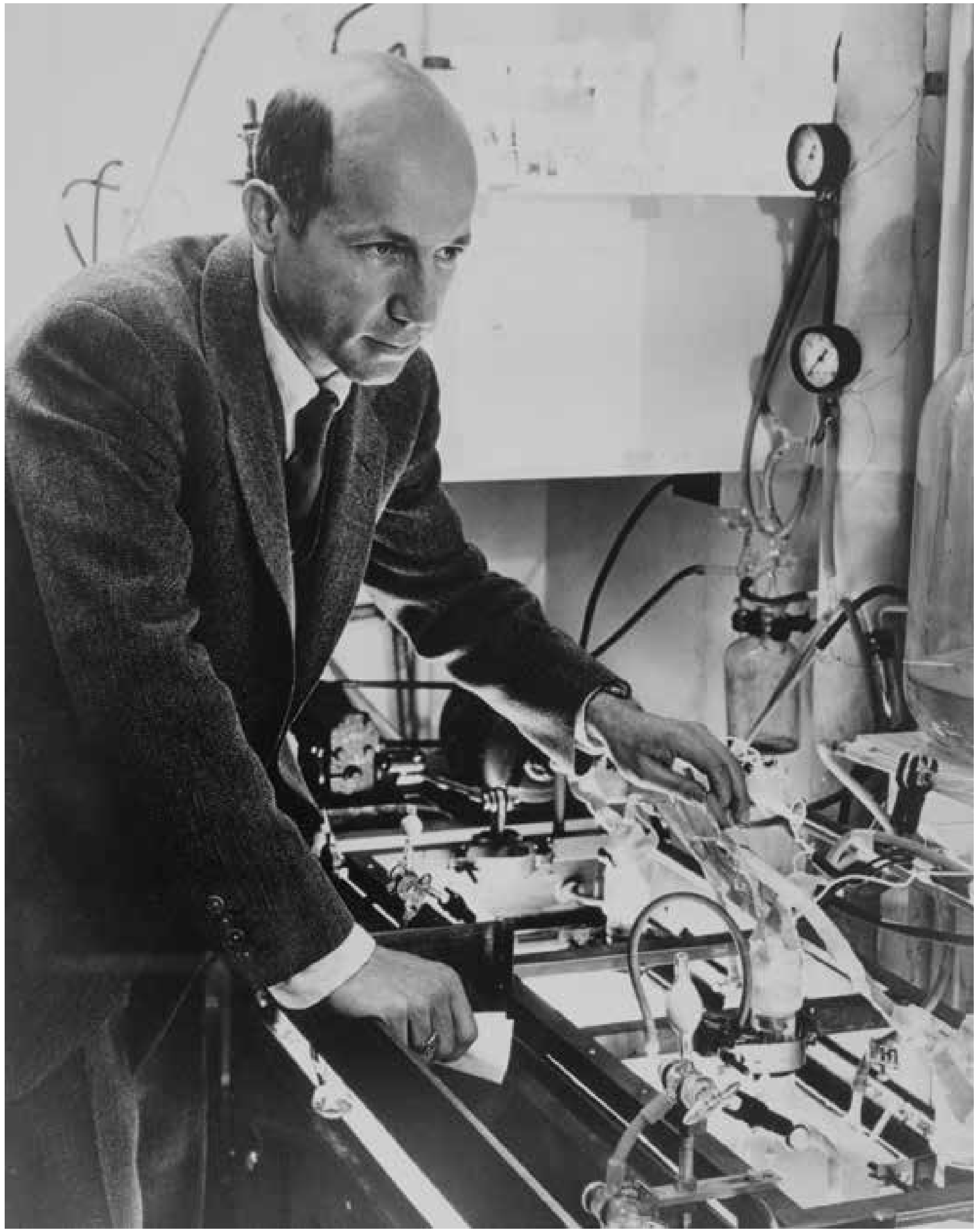
1939 › *View of the 60" cyclotron used to generate the plutonium discovered in 1941. Members of the design team shown include (l) William Brobeck and Dale Corson. In 1937, at the age of 29, Brobeck became assistant director and chief engineer of the Lab. He oversaw the design and construction of the 60-inch and 184-inch cyclotrons, and finally the Bevatron.*

1938 › *William Brobeck with aluminum cans that were being recycled to be used as radiation shielding.*

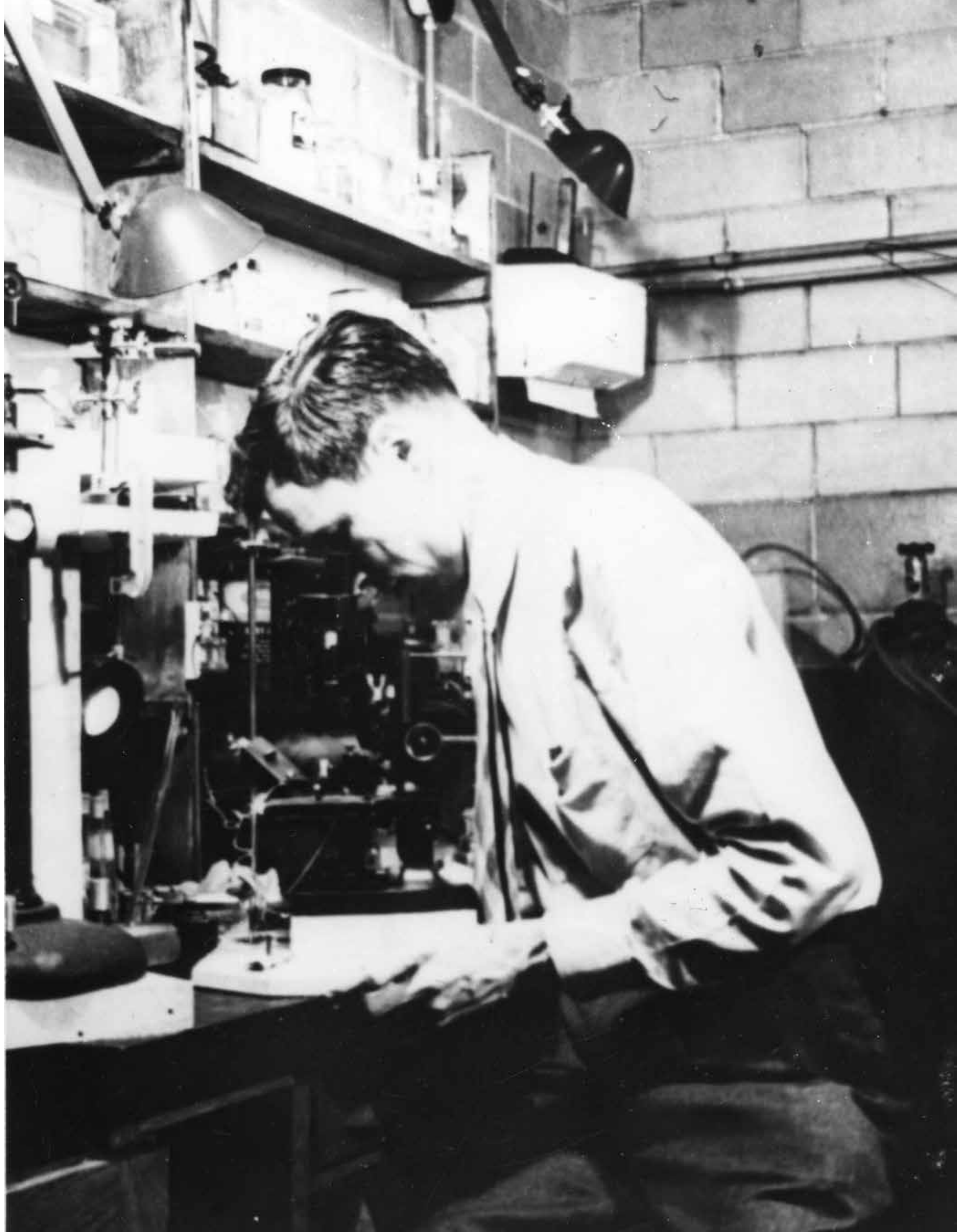
Samuel Ruben's (Ph.D. '38, Chem) greatest achievements resulted from the use of radioactive isotopes of the light elements as tracers to follow the course of biological reactions. Working in the radiation lab, he was co-discoverer of the isotope carbon 14, but many of his experiments were performed with the short-lived carbon-11. In these experiments he displayed great ingenuity in devising methods which enabled an entire experimental procedure to be completed in the course of a few hours. His research in photosynthesis received world-wide recognition.

For several months preceding his death Ruben had devoted his full energy to a war research program, obtaining by his extraordinary talents important results within a very brief period of time. On the day of the tragic accident that ended his young life, he had received a message requesting a certain experiment. The work was hazardous. In the manner so characteristic of his nature, he himself assumed the responsibility and shielded his assistants from the danger leading to his death.

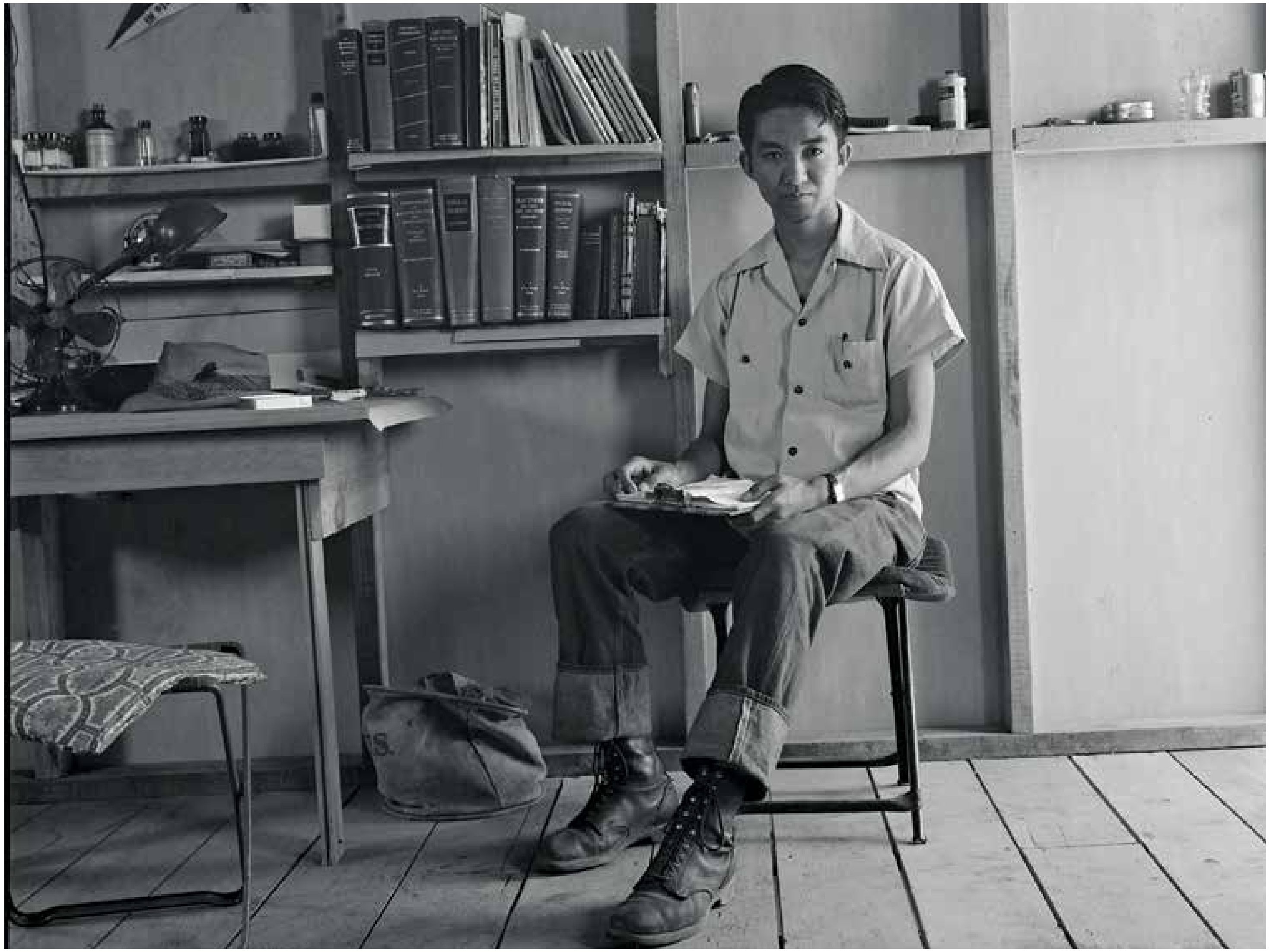
1941 › *Samuel Ruben at work in his lab.*



1935-1937 › *Melvin Calvin in the Rad Lab shown with the apparatus he used to study the role of carbon in photosynthesis. He was labeled "Mr. Photosynthesis" by Time magazine in 1961. During World War II he designed an oxygen-generating apparatus for use in submarines and on destroyers. As a member of the Manhattan Project, he developed a method to purify and isolate plutonium from the fission products of irradiated uranium.*



1942 › *Glenn Seaborg looks through a microscope at the first sample of pure plutonium at the Met Lab, University of Chicago, August, 1942.*



1942 › *Harvey K. Itano, UC Berkeley senior in chemistry and winner of the 1942 Berkeley Medal, photographed at the Sacramento Assembly Center by Dorothea Lange. Itano did not receive his award on campus as he was taken with his family three weeks before graduation to the Tule Lake Relocation Center. The government, via Executive Order 9066, incarcerated over 120,000 people of Japanese descent on the West Coast because of the bombing of Pearl Harbor. Itano went on to graduate school at Cal Tech receiving his Ph.D. in chemistry with Nobel Laureate Linus Pauling. He made major discoveries about the nature of sickle cell disease at CalTech and UC San Diego.*

1944 › *Y-12 Calutron Operators monitored components of the machines used to separate isotopes of uranium for the manufacture of the Hiroshima atomic bomb. Calutron operators were predominately female high school graduates who worked in shifts 24 hours a day. The women were consider more adept for the job of managing the machinery than the chemists working on site. The young women were not told what they were working on and only learned 50 years later the real nature of their work.*

Y-12 plant

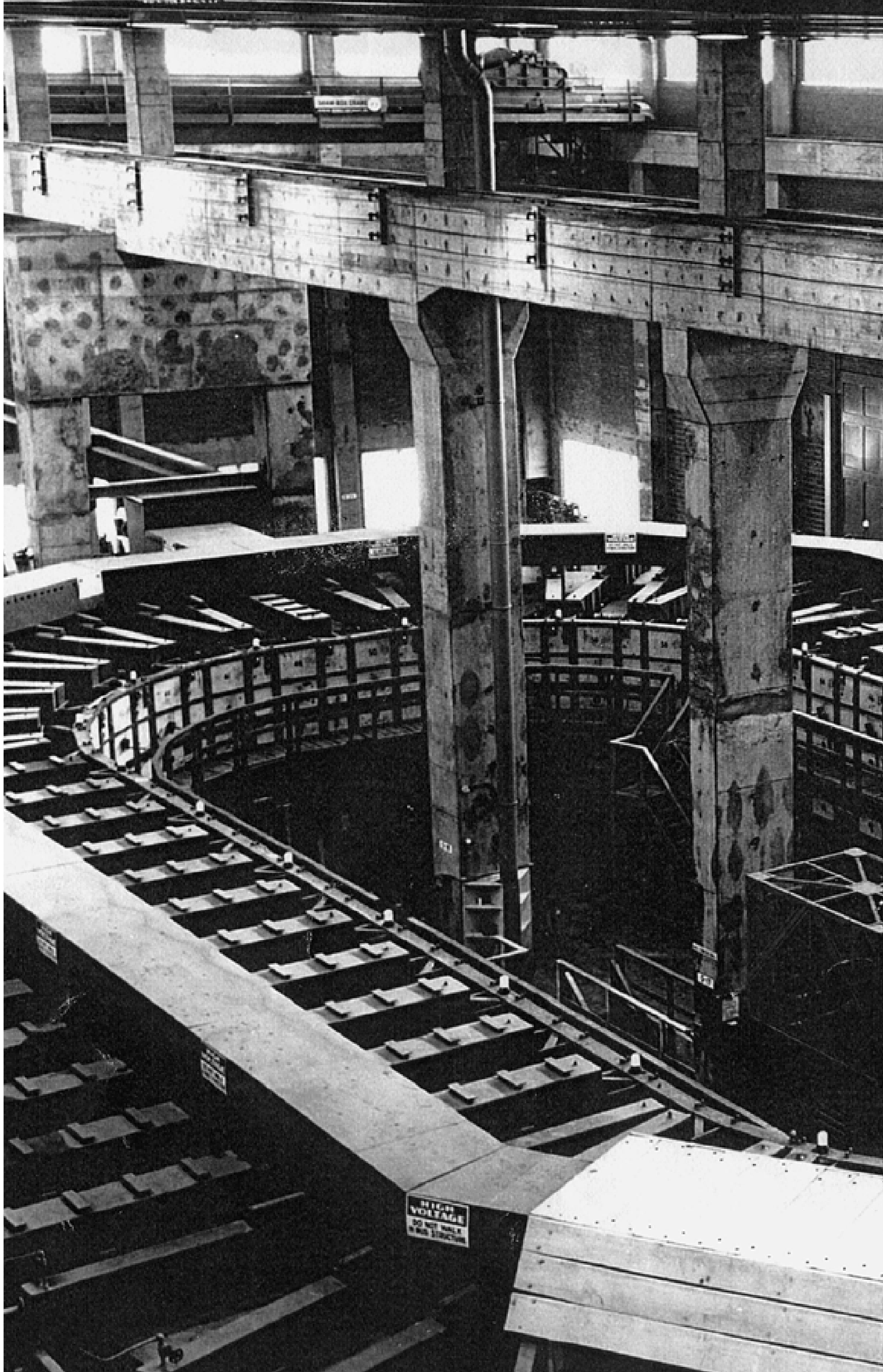
The massive Y-12 plant at Oak Ridge was designed to enrich uranium using calutrons (short for California University Cyclotron), which adapted the electromagnetic separation method developed by Ernest Lawrence at UC Berkeley. Despite being plagued by troubles, the Y-12 plant eventually produced the enriched uranium for the first atomic bomb. The calutrons required an exorbitant amount of energy and over 22,000 employees to build and keep them running.

The project required a chemist to run the chemical operations. The Berkeley chemistry department was already engaged on the Plutonium Project so at the request of Ernest Lawrence, Herbert Young (Ph.D. ’32, Chem) who was at UC Davis at the time, was assigned as the University’s coordinator for the work. He worked as the director of research for the Davis Group, Manhattan District of the U. S. Engineering Corps.

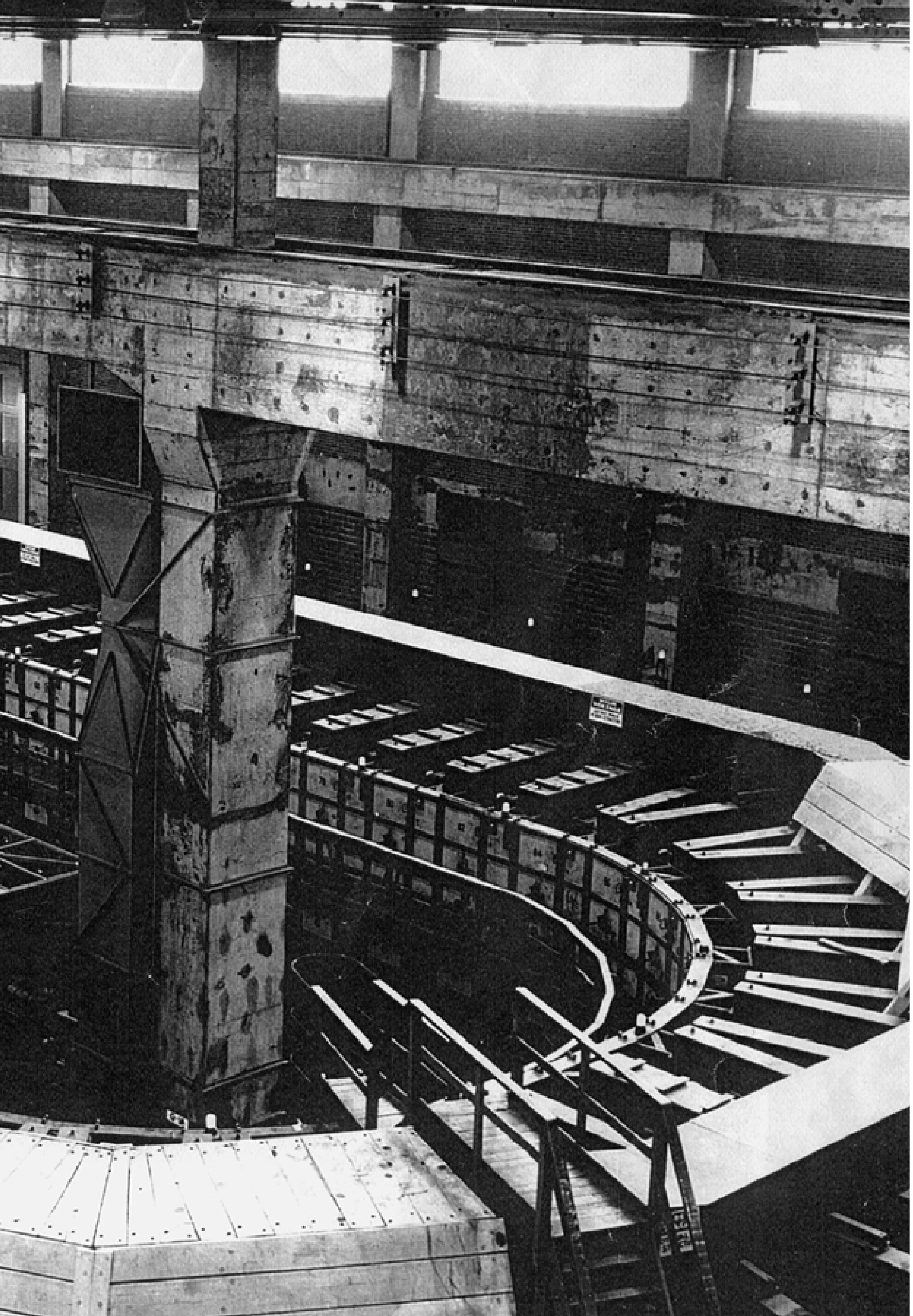
Young faced serious problems at Oak Ridge. Besides the handling of rare and dangerous compounds, there were building-construction difficulties, labor agitations, slumps in morale, and military regulation obstacles. Oak Ridge was a remote location, with a hot summer climate, no air-conditioned buildings, and inadequate hospital care. When uranium was finally converted, on schedule, into a volatile salt, no small credit belonged to Young.

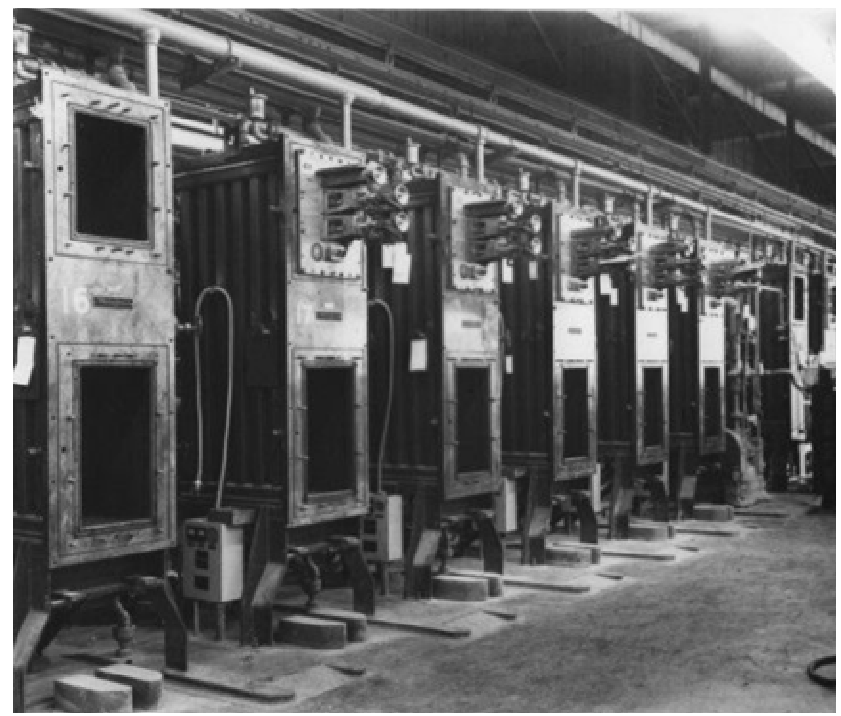
Built near the northeastern end of the Oak Ridge reservation, the Y-12 facility used the electromagnetic method to separate uranium-235 from the uranium-238 in natural uranium. During the Manhattan Project, Y-12 housed nine Alpha and eight Beta racetracks, which were arrangements of huge electromagnets containing a number of calutrons in the magnets’ gaps. The calutrons sent a stream of charged particles through the magnetic field, deflecting the atoms of the lighter isotope more than those of the heavier isotope. This resulted in two streams that could be collected in different sections of the receivers.

The racetracks required extraordinary amounts of copper for magnet windings. As copper was badly needed for the war effort, the Manhattan Engineer District borrowed as a substitute almost 15,000 tons of silver bullion from the United States treasury to fabricate into strips and wind on to coils.



1944 › *Y-12 alpha racetrack. Used in the separation of uranium 235 from uranium 238.*





1944 › *Y-12 Beta rectifiers and dry dock used in the processing of uranium 235 from uranium 238.*

Hanford B Reactor

Stanley G. Thompson (Ph.D. ’48, Chem) was an American chemist responsible for discovery of the bismuth phosphate separation process used in the production of plutonium at the Hanford site during the Manhattan Project. After the war, Thompson also helped discover a number of transuranium elements at Berkeley.

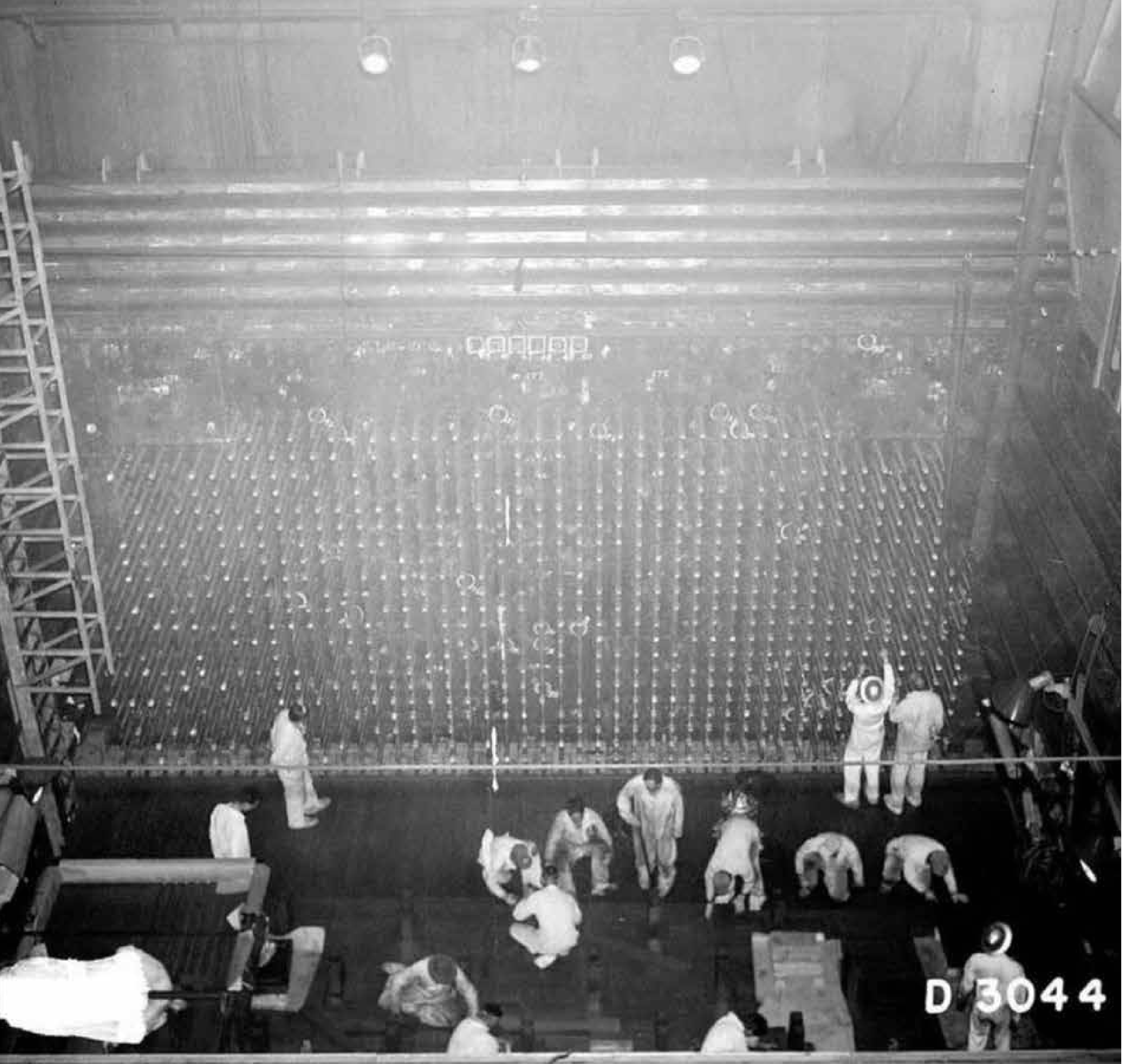
Thompson received his B.A. from the University of California, Los Angeles, in 1934. He began working for Standard Oil in California after graduation, where he continued his friendship with Glenn Seaborg, whom he had met in his freshman year of high school. When Seaborg moved to the Chicago Met Lab in 1942, he asked Thompson to join him. While in Chicago, Thompson devised a chemical process to help separate plutonium from the other radioactive products created in the reactors. The bismuth phosphate separation process was employed at Hanford at an industrial scale, and Thompson moved to Washington to help oversee its implementation.

Thompson returned to Chicago in 1945, where he shifted his focus to the discovery of transuranium elements. He moved to Berkeley in 1946 and completed his Ph.D. in 1948. He led the team that synthesized and identified berkelium and californium, elements 97 and 98. Thompson also led the teams that discovered the next three transuranic elements—einsteinium, fermium, and mendelevium.

Over the course of his career, Thompson did research in many other areas as well, including nuclear fission and heavy-ion reactions. He received two Guggenheim fellowships, and the American Chemical Society Award for Nuclear Applications in Chemistry in 1965.

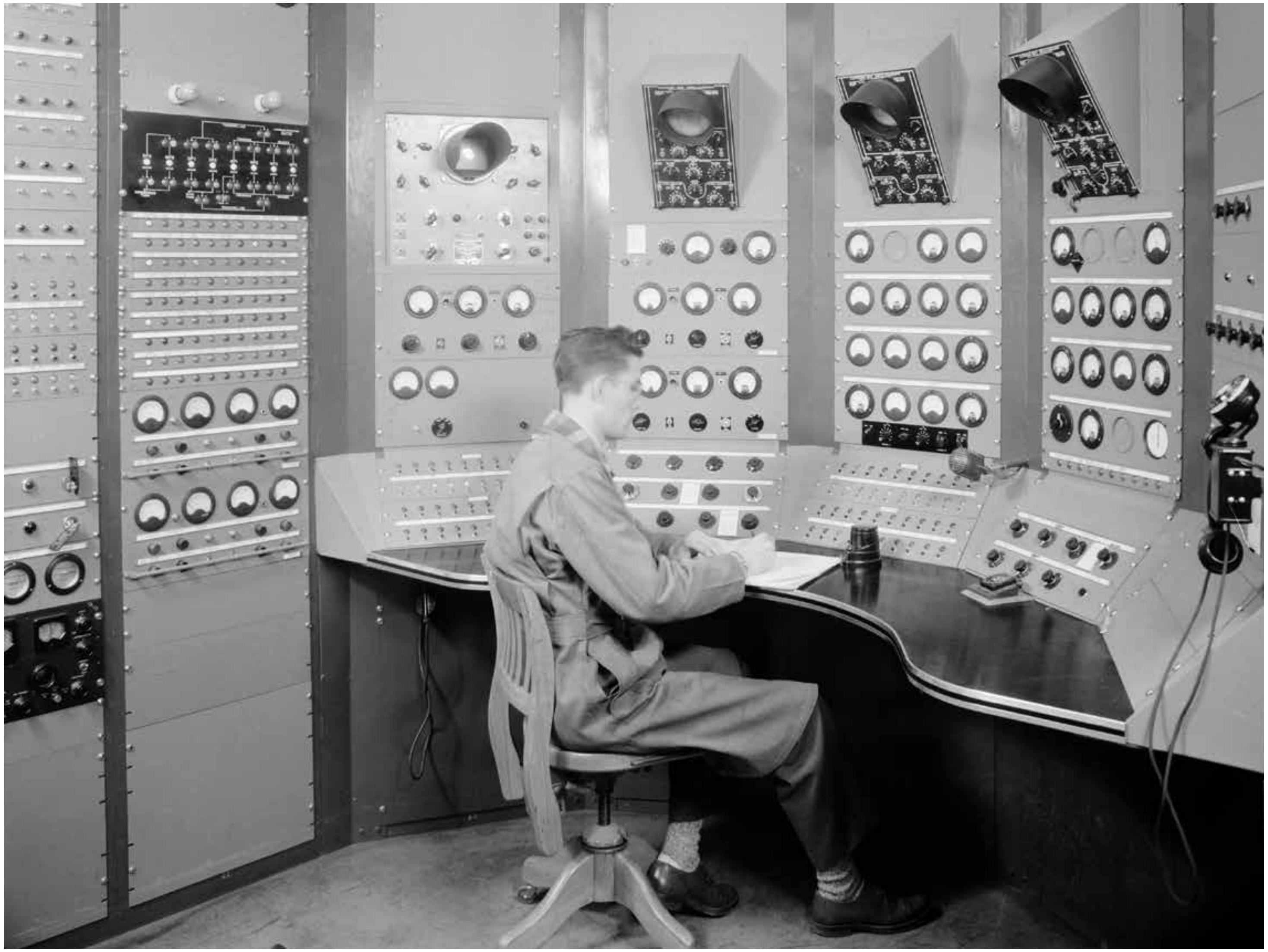
Thompson died in 1976. After his death, Seaborg said, “His radiochemical research during World War II rivals in importance the isolation of radium by Pierre and Marie Curie, and his leadership in the discovery of five transuranium elements must rank as among the leading chemical accomplishments of his time.”

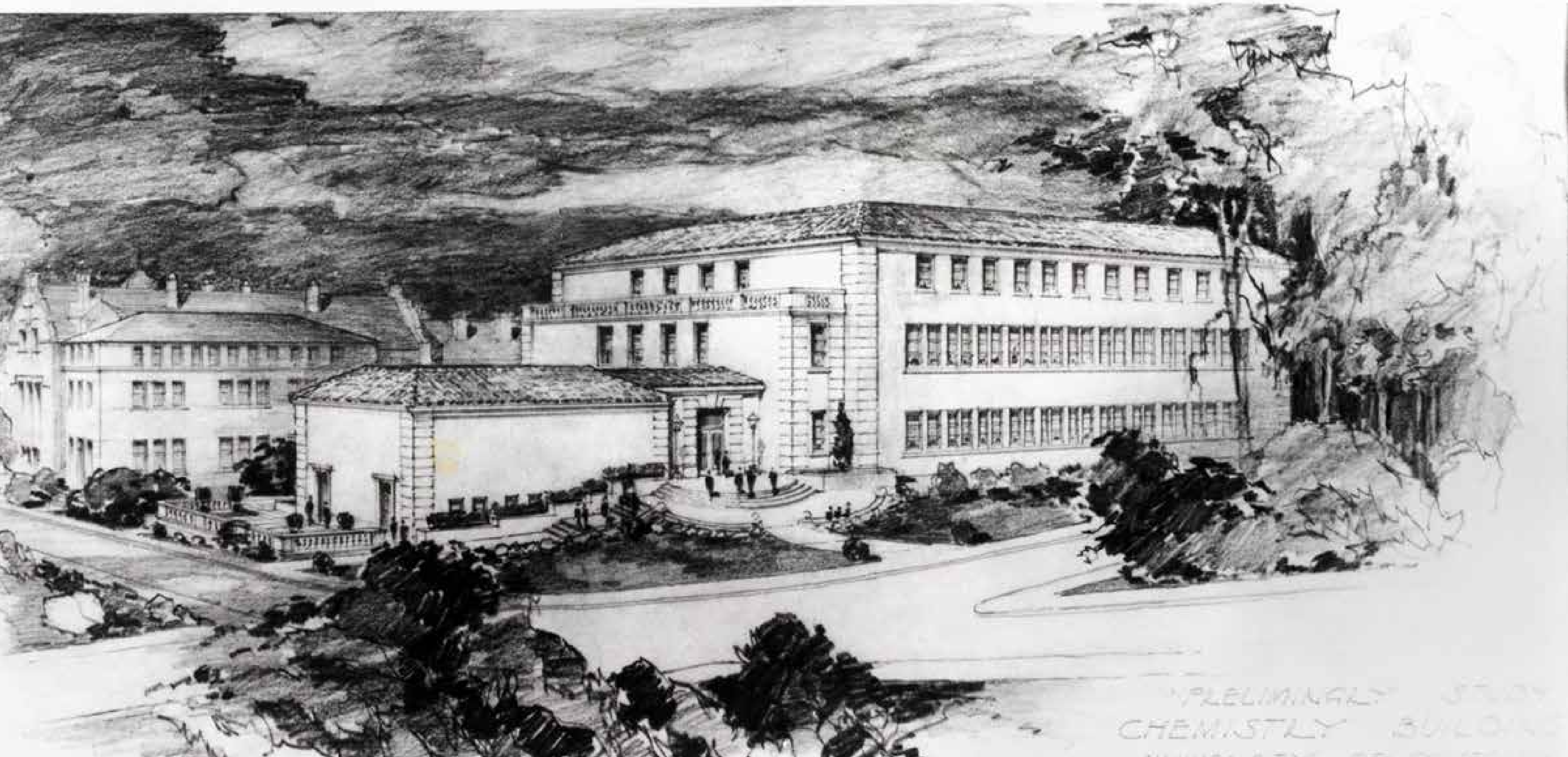
1948 › *Nuclear sorcerers Stanley Thompson (left) and Glenn Seaborg try their best to look like old-time alchemists in this picture shortly before their discovery of element 98, californium.*



1944 › *Completed in September 1944, the B Reactor was the world's first large-scale plutonium production reactor. Consisting of a 28- by 36-foot, 1,200-ton graphite cylinder lying on its side, the reactor was penetrated through its entire length horizontally by 2,004 aluminum tubes. Two hundred tons of uranium slugs the size of rolls of quarters and sealed in aluminum cans went into the tubes. Cooling water from the Columbia River, which first had to be treated, was pumped through the aluminum tubes around the uranium slugs at the rate of 75,000 gallons per minute. Water consumption approached that of a city of a third-of-a-million people. The reactor had its own auxiliary facilities that included a river pump house, large storage and settling basins, a filtration plant, huge motor-driven pumps for delivering water to the face of the pile, and facilities for emergency cooling in case of a power failure. The B Reactor along with two other reactors produced the plutonium for the Trinity test device at Los Alamos, the bomb that was dropped on Nagasaki, and Cold War weapons.*

1946 › *(l to r) Physicist Robert Oppenheimer, chemist Glenn Seaborg and, physicist Ernest Lawrence at the control panel of the 184-Inch Cyclotron. Returned to peace time use after 1945, the cyclotron would launch an era of nuclear research into discovery of new elements and medicine. On the right is a view of the expanded control panel used for the Bevatron which was the cyclotron's replacement (1954).*





Lewis Hall was built in 1948 and was designed by architect Geoffrey Bangs. He was a Berkeley alumnus earning his M.A. degree in 1915. He served in WWI and afterwards taught architecture for several years in France. He then returned to Berkeley where he became a partner of University architct John Galen Howard. As an architect, he designed and built many public buildings in northern California including the Contra Costa Hall of Records in Martinez and the courthouses in Shasta and Butte Counties.

1952 › *When built, Lewis Hall was assigned to be used for analytic, inorganic, and microchemistry. It was built after WWII to help accommodate the increased number of students entering the university. The building was named in honor of Gilbert N. Lewis.*

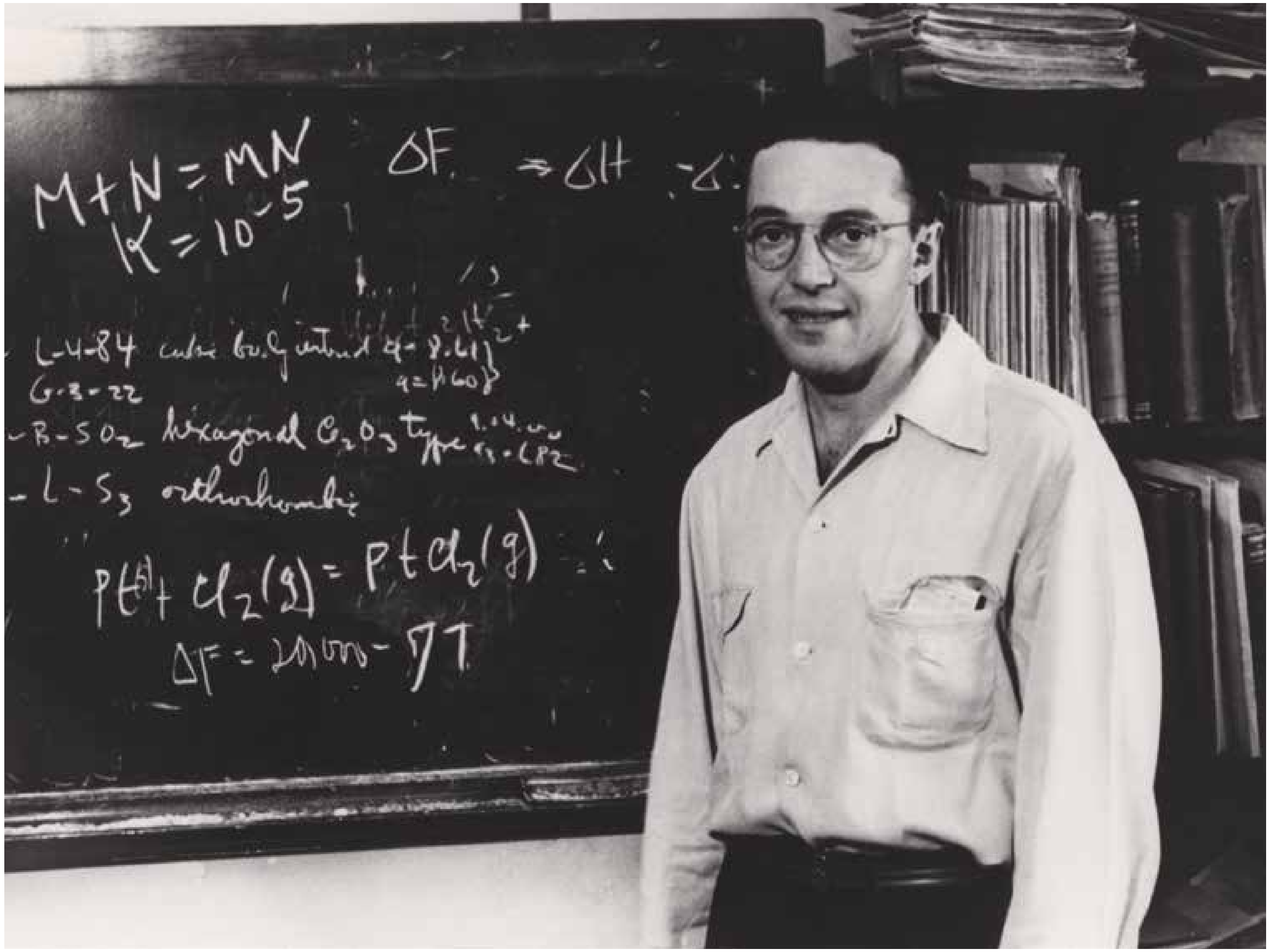
From 1943 to 1946, Robert Connick was a research associate on the Manhattan Project. Soon after the discovery of plutonium, when only miniscule amounts of that new element were available, he researched the fundamental chemical properties of plutonium and separation techniques for recovering it. In early 1943, he and John Gofman oversaw a team that irradiated a ton of uranyl nitrate by placing the material around Ernest Lawrence's cyclotron for six to seven weeks, and then by using various chemical extraction processes, secured a mere milligram of plutonium. This doubled the world's supply at a time when plutonium was critically needed for research on its chemical properties.

After the war, Connick turned his attention to devising new methods for determining the chemical properties of zirconium, ruthenium, and other heavy elements. He also used novel techniques to investigate very fast chemical reactions, and was an early user of nuclear magnetic resonance (NMR) to study inorganic complex ions.

Through the decades, his areas of research included NMR, reaction kinetics, ligand exchange reactions, hydrolytic oligomerization, ruthenium chemistry, sulfur chemistry and computer modeling of exchange reactions.

He became chair of the Department of Chemistry (1958-60) and then followed Pitzer as dean of the College (1960-65).

1945 › *Robert Connick (Ph.D. '42, Chem) Connick became a chemistry professor at UC Berkeley after receiving his Ph.D. with William Bray.*



1948 › *Leo Brewer (Ph.D. '43, Chem) is widely regarded as the founder of modern high-temperature chemistry. He contributed in fields ranging from organic chemistry and astrochemistry to ceramics and metallurgy. He joined the Manhattan Project after graduation and headed the group charged with predicting the possible high-temperature properties of the newly discovered plutonium element. The combination of theory with experimentation that he exhibited during his World War II work marked his research throughout his career.*

Isadore Pearlman (1915-1991) received his B.S. and Ph.D. at Berkeley. It was during his time in college that Perlman first met fellow Manhattan Project scientist Glenn Seaborg. Perlman joined Seaborg's research group at Berkeley, which had recently discovered the element plutonium. At the time, Seaborg recorded in his journal, "He is an outstanding scientist with a thorough understanding of chemistry and will be a great help in overall direction of the work of the group."

During World War II, Perlman helped develop plutonium extraction methods at Berkeley before going to work at the Chicago Met Lab. He would also work on reactor development at Oak Ridge and at Hanford.

In 1945, Perlman returned to Berkeley where he started as a chemistry professor and worked at the Berkeley Lab. Together with Seaborg, Perlman published the first table of isotopes in 1948. For his work, Perlman would receive the Ernest O. Lawrence award from the Atomic Energy Commission in 1960.

Perlman went on in 1973 to work at the Institute of Archeology at Hebrew University in Jerusalem, where he researched the use of neutrons in archeological dating. He returned to the Berkeley Lab in 1985 to work with Frank Asaro on researching the massive extinction events on earth.

1959 › *Isadore Perlman (B.S. '36, Chem; Ph.D. '40, Physiol)*

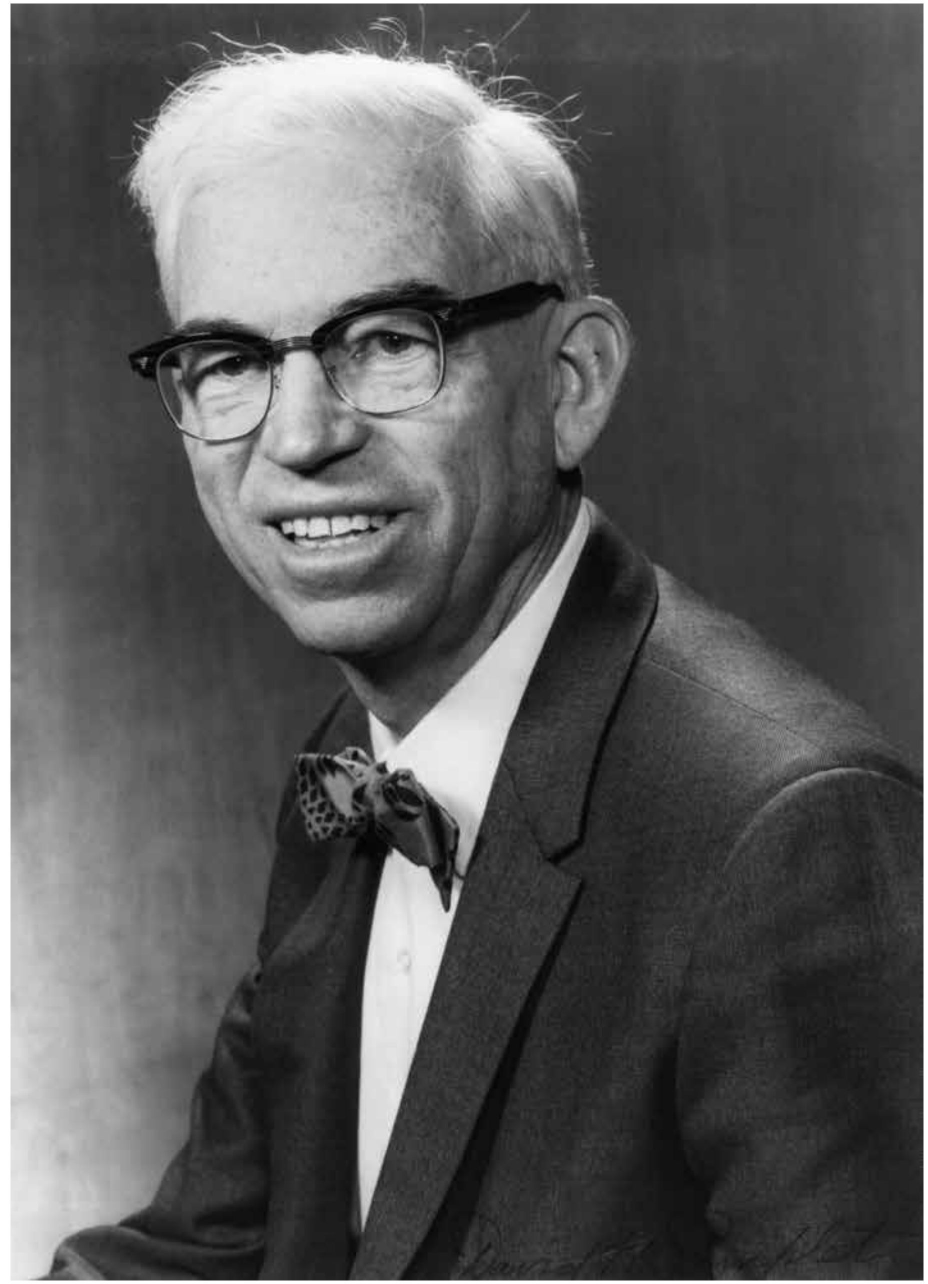
David H. Templeton (1920-2010) received his B.S. from Louisiana Polytechnic Institute in 1941. He went on to graduate work in chemistry at the University of Texas at Austin acquiring his M.A in May 1943. He had begun his Ph.D. studies, but in early 1944 he was recruited to work on the Manhattan Project.

The Manhattan Project was a pivotal experience. David was always quick to point out that his own role in the project was very junior, but it gave him a front row seat to cutting-edge science, and to history. He also made personal contacts that would prove very beneficial to him, including William Zachariasen, an expert on X-ray diffraction, and Glenn Seaborg, who encouraged him to come to UC Berkeley.

Templeton went on to Berkeley in 1946 completing his Ph.D. in 1947. Shortly after the war, the accelerators for charged particles, cyclotrons, synchrotrons, and other exclusive machines were the source of most of the newly discovered radionuclides, and Berkeley was one of the most prominent centers in this field. His first research studies examined radiochemistry. His publications with Isadore Perlmann and Glenn Seaborg were dedicated to the fission of various heavy metals by high-energy particles and to artificial radioactive isotopes.

Ultimately his research group went into the burgeoning area of crystallography reporting numerous discoveries with coreasearchers Lilo Templeton (B,S, ’46, Chem; Ph.D. ’50, Chem), Helena Ruben (B.S. ’35, phy), Allan Zalkin (Ph.D. ’51, Chem), Carol Dauben (M.S. ’47, phy), and others. Along with his research, he was dean of the College of Chemistry during the tumultuous period of 1970 to 1975. He was president of the American Crystallographic Association in 1984.

n.d. › *David Templeton (Ph.D. ’47, Chem) portrait for the American Crystallographic Association*

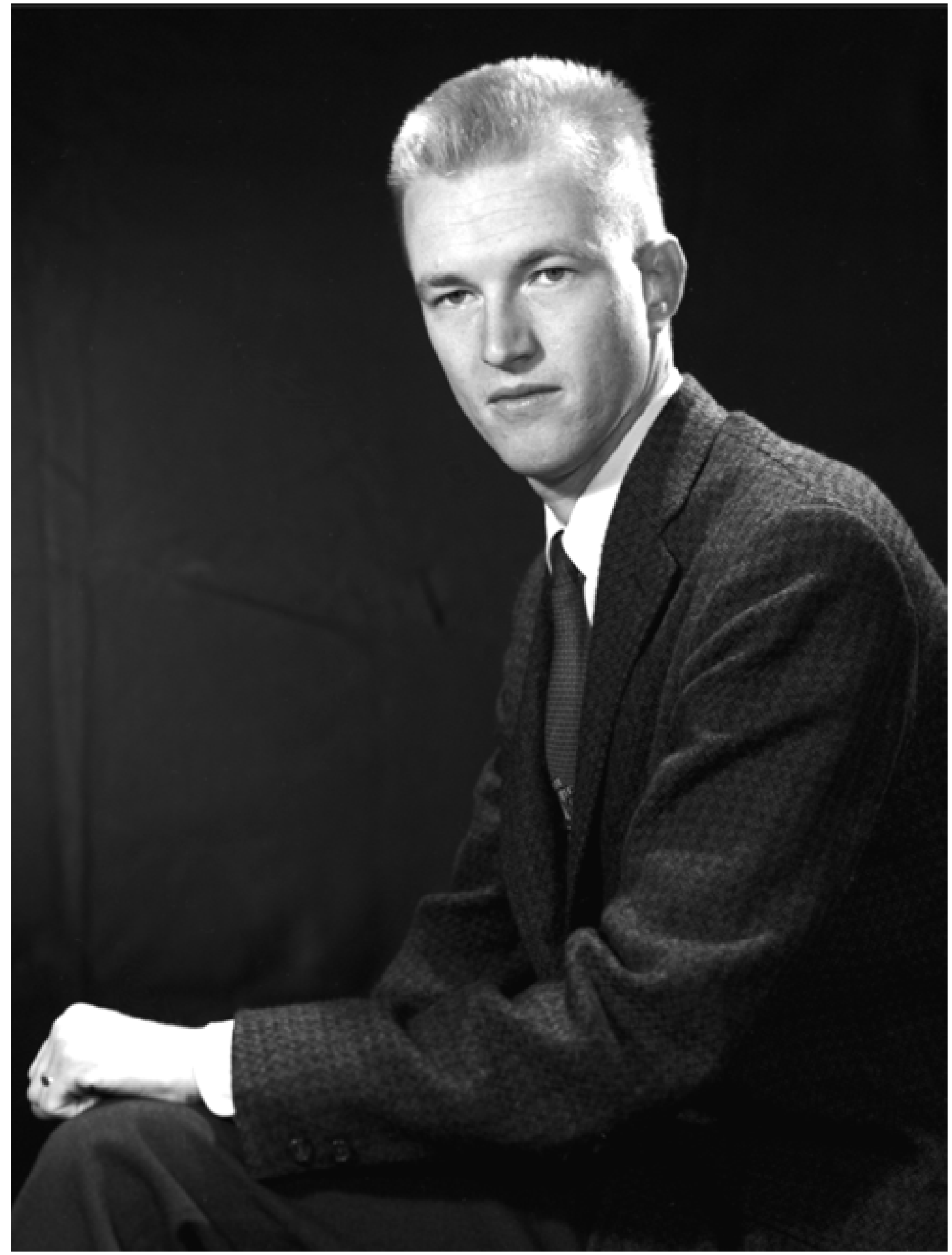


John O. Rasmussen, a highly respected nuclear and theoretical chemistry researcher, received his bachelor's degree from Caltech in 1948 and his Ph.D. in nuclear chemistry from UC Berkeley in 1952 with Glenn Seaborg. In 1953, he was a visiting professor at the Nobel Institute in Stockholm and in 1962 at the Niels Bohr Institute in Copenhagen. From 1969 to 1972 he was professor and associate director of Yale University's Heavy Ion Accelerator Laboratory. He returned to Berkeley to an expansive career as a Lawrence Radiation Laboratory scientist, senior staff member in Berkeley's Nuclear Chemistry Division, and as professor of chemistry at the College. Rasmussen was very involved in teaching at the College and a very valued member of the community.

Among his many awards, in 1967 he received the Ernest Orlando Lawrence Prize for his outstanding contributions to the better understanding of nuclear structure through imaginative experimental and theoretical investigations. In 1976 he received the Glenn T. Seaborg Award in Nuclear Chemistry from the American Chemical Society.

Rasmussen's research into nuclear chemistry covered both the theoretical and experimental. His research covered peripheral heavy ion reactions and pion production in relativistic heavy ion collision. He was interested in the theory of nuclear structure, especially of deformed nuclei, and in classical S-matrix methods and Monte Carlo applied to heavy ion nuclear reactions.

1959 › *John Rasmussen (Ph.D. '52, Chem)*



David A. Shirley (1934-2021) was a director of Berkeley Lab and professor of chemistry at the College. Shirley was a pioneer of electron spectroscopy, a teacher, a mentor, and an extraordinary scientific leader with broad vision, who spearheaded the creation of the Advanced Light Source at Berkeley Lab and helped motivate the construction of third-generation synchrotron radiation facilities in the U.S. and around the world.

Shirley received his Ph.D. in 1959 under the supervision of William Giauque. Shirley became a lecturer in chemistry at UC Berkeley in 1959 and rapidly rose through the academic ranks to become chairman of the chemistry department in 1968. His early research was on low-temperature physics, nuclear orientation, and hyperfine interactions, particularly the Mössbauer effect. Later, he helped pioneer X-ray photoelectron spectroscopy. He served as Berkeley Lab's fourth director from 1980 to 1989, the first chemist to lead the Lab. He expanded the Lab's efforts in cancer research and oversaw its selection in 1987 to participate in the Human Genome Project.

He established the Center for X-Ray Optics (CXRO), the world's first research facility specializing in the use and application of soft X-rays and extreme ultraviolet light. That led to a proposal to construct the Advanced Light Source (ALS), the first "third generation" electron synchrotron optimized to produce soft X-ray light, based primarily on permanent magnet undulators.

He retired from the College in 1992.

1974 › *David Shirley (Ph.D. '59, Chem)*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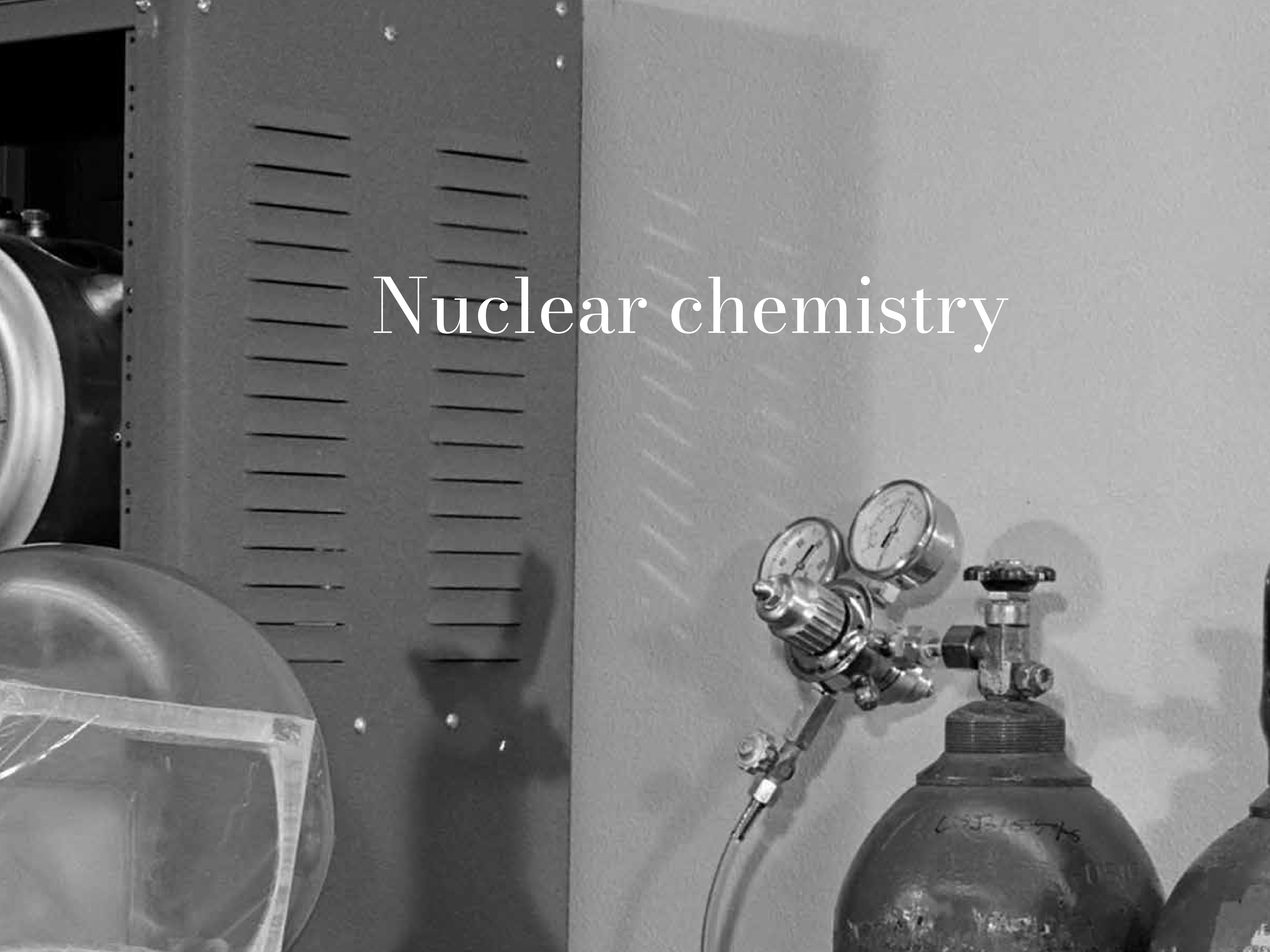
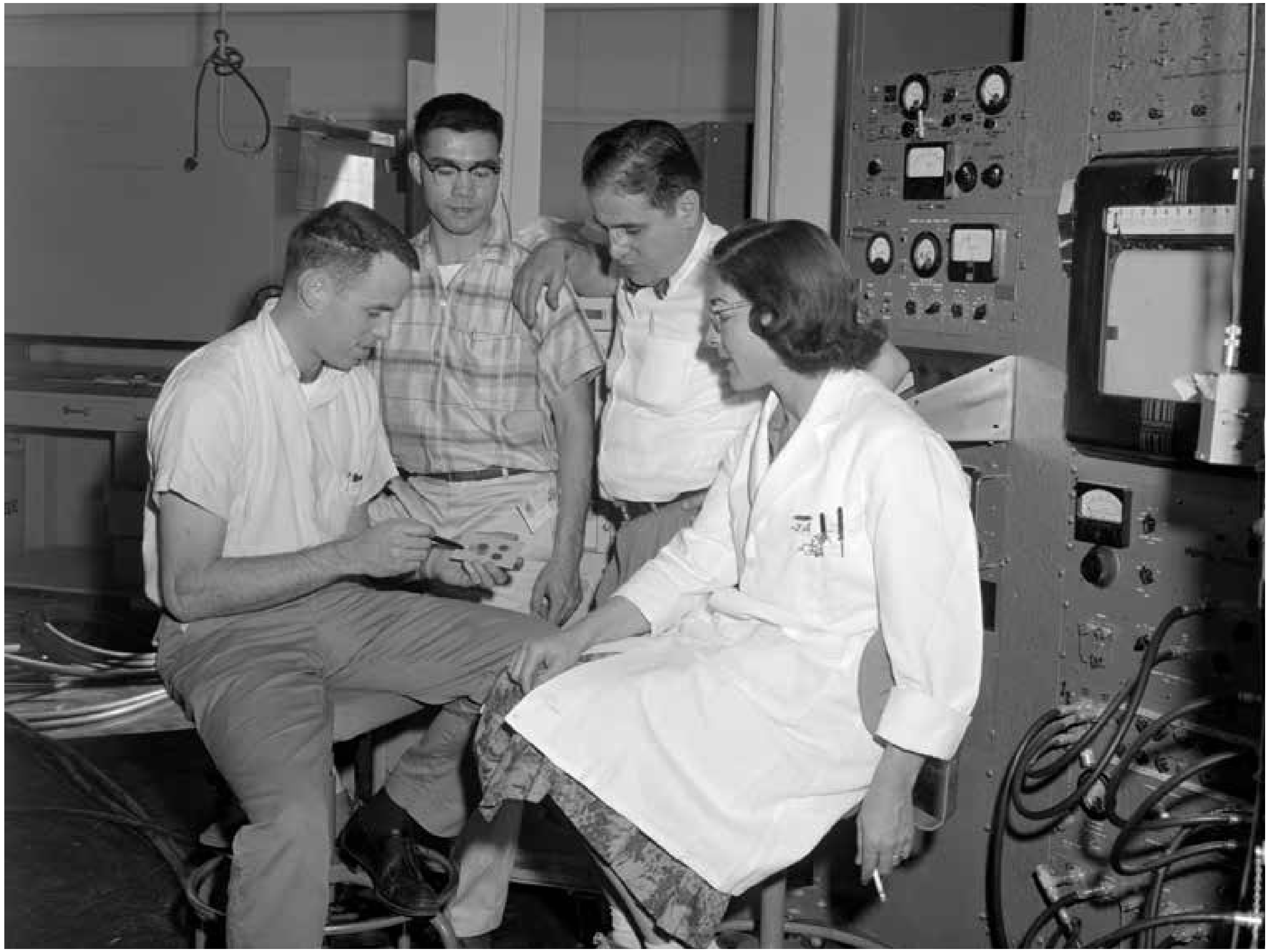
SPEEDOMAX

Nuclear chemistry



1949 › *Carol H. Dauben in her lab in 318 Lewis Hall demonstrates the use of a Unicam X-ray refraction camera. Dauben (M.S. '47, Physics) was the wife of chemist William Dauben. They met after he arrived on the faculty, and she was a student. Dauben and David Templeton co-authored a number of research papers in crystallography research.*



1961 › *Student members of physicist Cornelius Tobias' group in the Donner Lab check the beam intensity for a "brain mapping" experiment. (l to r) John Lyman, Howard Chung, Nicholas Yanni, and Jean Luce. Tobias co-founded the nuclear medicine division at Berkeley Lab with John Lawrence. Born in Hungary, he was instrumental in bringing his brother Charles to the United States. Charles Tobias was the founding father of electrochemical engineering and a professor and chair of the chemical engineering department in the College of Chemistry.*

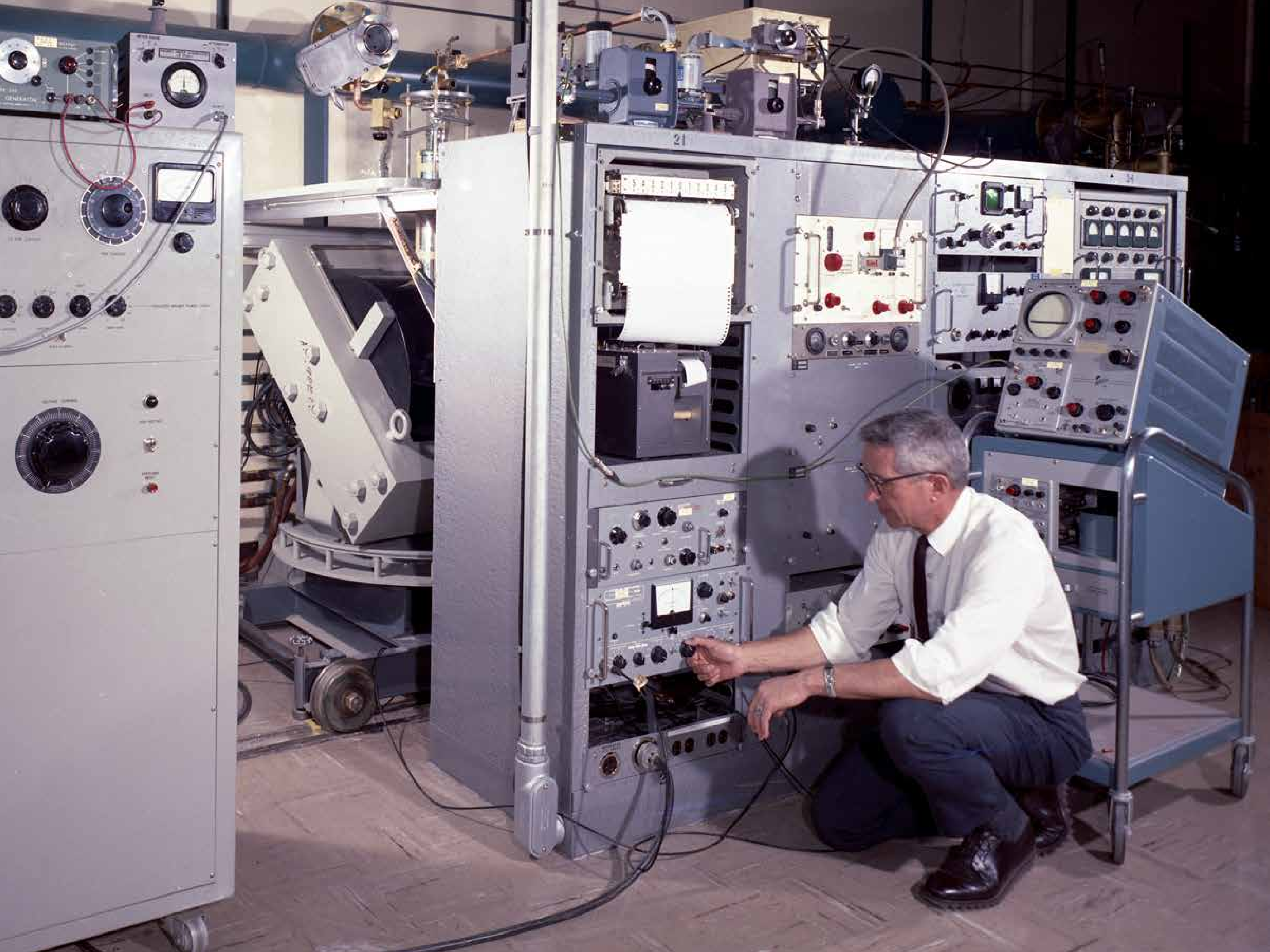
1957 › *Martha Kirk with carbon-14 pattern respiration analyzer at the radiation lab prepares to work with a test subject. Kirk researched and co-authored numerous papers with William Dauben, Melvin Calvin, and other chemistry faculty on the decomposition effects of Carbon-14.*

Burris B. Cunningham (1912-1971) well-known as the “dean of actinide chemists”, spent almost his entire scientific career as student and faculty member at UC Berkeley, except for a World War II interlude in the Met Lab at the University of Chicago where his work in ultra-microscopic chemistry helped determine the chemical properties of plutonium.

Cunningham returned to Berkeley in 1946 to work as an assistant professor of chemistry. At Berkeley, he and his coworkers became the first to isolate in weighable quantities a variety of heavy synthetic elements: americium, berkelium, californium, einsteinium. They also isolated neptunium and curium.

Cunningham’s work in the field of ultra microchemistry led him to become the world’s leading chemical investigator of actinide elements and one of the top inorganic chemists at the time.

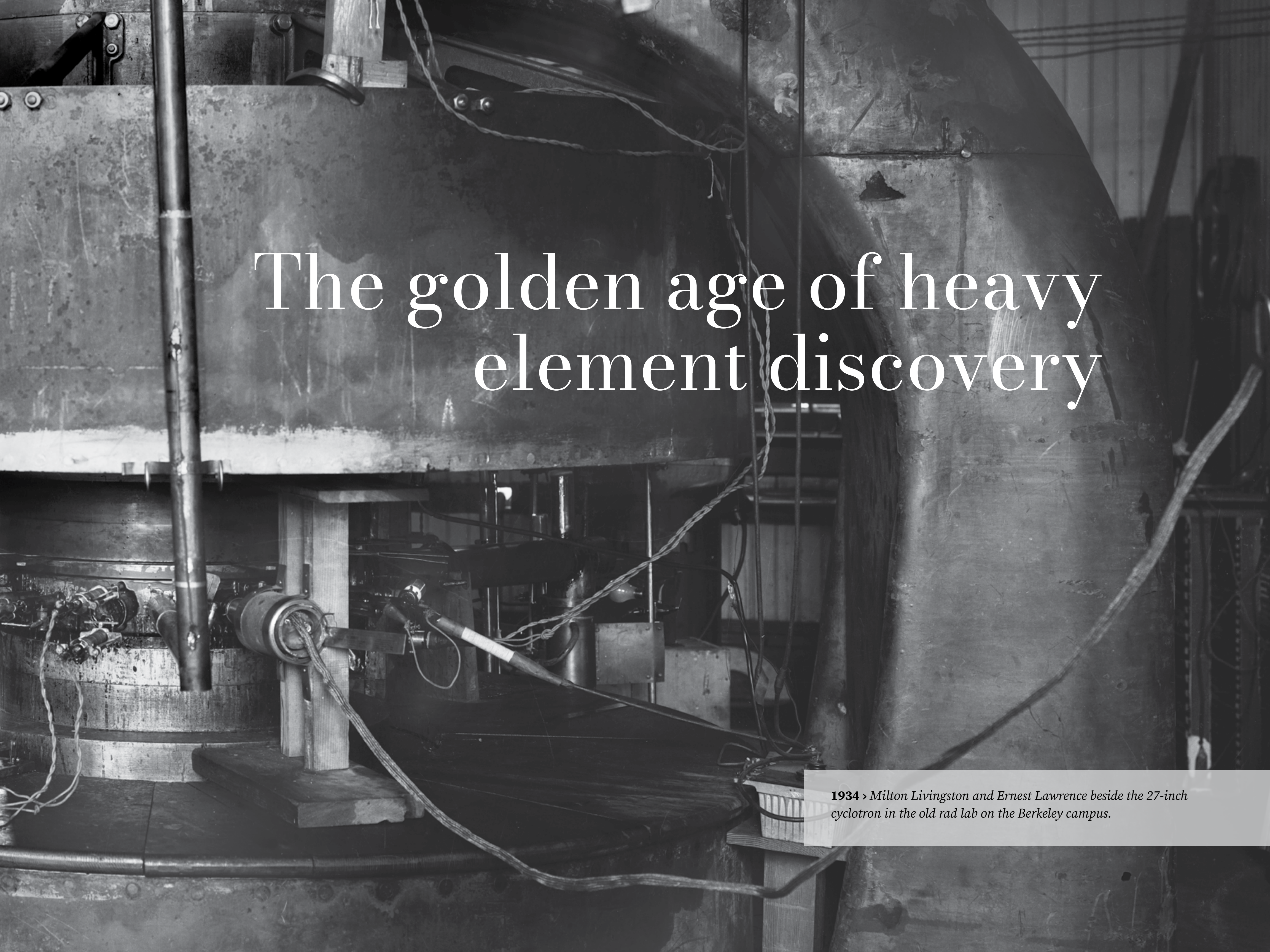
1964 › *Burris Cunningham (B.S. ’35, Chem; Ph.D. ’40, Chem) adjusts a para magnetic resonance apparatus located in Building 70A at the Berkeley Lab.*



1966 › *Much like the female "human computers" at NASA, the Berkeley Lab utilized trained women scientists to work in support roles on important nuclear projects. Here we see Virginia Shirley, wife of faculty member David Shirley, working on a new edition of the Table of the Isotopes. She received her bachelor's degree in chemistry from Carnegie-Mellon University in 1955 and her master's degree in nuclear chemistry from UC Berkeley in 1957. She met David while attending graduate school at Cal. The original caption states: 'Virginia Shirley (Nuclear Chemistry) has been looking up references to new or revised data on the isotopes several days a week since 1958. Magnet, Vol. 10, No. 8, August 1966, p. 6 Chemical Sciences'*

1968 › *Nuclear archaeology team (seated l to r) Betty Holtzman of the UC Berkeley Anthropology Department and Chemistry Professor Isadore Perlman (Ph.D. '40, Physiology). Alumni Helen V. Michel (B.S. '55, Chem) and Frank Asaro (Ph.D. '53, Chem) (second row l to r) of Lawrence Radiation Laboratory Nuclear Chemistry. The team pioneered high-precision methods of neutron activation analysis used to determine the origin of ancient pottery and other artifacts. Asaro also with Michel, and geologist Luis and physicist Walter Alvarez, developed the theory that an asteroid impact killed the dinosaurs.*

The golden age of heavy element discovery



1934 › *Milton Livingston and Ernest Lawrence beside the 27-inch cyclotron in the old rad lab on the Berkeley campus.*

Discovering synthetic elements

Albert Ghiorso, Darleane Hoffman, and Mary Singleton; from the National Historic Chemical Landmark introduction: “Discovery of Transuranium Elements at Berkeley Lab”.

The quest to understand what comprises the world around us dates back to ancient times. As early as the fourth century BCE, the Greek philosopher Aristotle proposed that the physical universe consisted of varying combinations of four “elements”—earth, water, air, and fire. Over the next few hundred years, practitioners isolated and used elements that meet our modern definition—they were fundamental substances consisting of one type of atom that singly or in combination constitute all matter. Some of these elements, like gold, silver, and tin, were found in nature in relatively pure form; others, such as lead, mercury, and sulfur, had to be isolated from their ores. The 18th-century development of experimental science allowed rapid discovery of more new elements. But uranium, identified in 1789, remained the heaviest known chemical element for more than 150 years.

NEW ELEMENTS AT BERKELEY

In the mid-1930s, a new breed of nuclear scientists, made up of chemists and physicists, became intrigued with the possibility of synthesizing new elements not found in nature. Their dream was finally realized in 1937 when Italian mineralogist Carlo Perrier and physicist Emilio Segrè discovered technetium. Since then, several other elements were created, or discovered for the first time at Lawrence Berkeley National Laboratory (Berkeley Lab) in Berkeley, California. This body of work has contributed to a better understanding of the structure of the atom’s nucleus and the nature of matter.

Forming new elements involves changing the nuclei of known atoms by fusing them with other nuclei or with neutrons. Since nuclei contain positively charged protons as well as charge-free neutrons, fusing one nucleus with another requires overcoming the tremendous repulsion between the two positively charged nuclei. The forces required are millions of times greater than those involved in, for example, the explosion of TNT.

Devices called particle accelerators have been used to provide energetic beams of various charged particles to produce the desired nuclear reactions with suitable targets. Accelerators can be linear, in which the beam of particles is accelerated in a straight line, or circular, as in the cyclotron invented by the American physicist Ernest O. Lawrence (1901–1958). Both accelerator types have been used in the discovery of elements at Berkeley Lab.

Synthesis of new elements at the lab began with the creation of neptunium (atomic number 93), the first element beyond uranium in the periodic table, by Edwin McMillan (1901–1991) and Philip Abelson (1913–2004) in 1940. Their work involved irradiating a uranium target with neutrons and was conducted at the Radiation Laboratory at the University of California, Berkeley (predecessor to Berkeley Lab).

GLENN SEABORG AND THE HEAVY ELEMENTS

Later, protons or deuterons (nuclei of hydrogen or deuterium atoms), alpha particles (nuclei of helium atoms), and heavier particles were used as projectiles. One outcome of this effort was plutonium (94), which was created in 1940 by bombarding uranium with deuterons—work conducted by a team led by Glenn Seaborg (1912–1999). Seaborg was a promising nuclear chemist whose creativity in studying radioactive isotopes caught the attention of leaders of the Manhattan Project, an effort for nuclear weapons development during World War II. Seaborg moved temporarily to work with the Metallurgical Laboratory at the University of Chicago for this work in the early 1940s. While at Chicago, he continued his work

SYNTHETIC ELEMENTS **DISCOVERED BY BERKELEY TEAMS**

43	Tc	Technetium	Discovered: 1936*
85	At	Astatine	Discovered: 1940
93	Np	Neptunium	Discovered: 1940
94	Pu	Plutonium	Discovered: 1940
95	Am	Americium	Discovered: 1944**
96	Cm	Curium	Discovered: 1944**
97	Bk	Berkelium	Discovered: 1949
98	Cf	Californium	Discovered: 1950
99	Es	Einsteinium	Discovered: 1952
100	Fm	Fermium	Discovered: 1952
101	Md	Mandelevium	Discovered: 1955
102	No	Nobelium	Discovered: 1958
103	Lr	Lawrencium	Discovered: 1961
104	Rf	Rutherfordium	Discovered: 1969
105	Ha	Hahnium	Discovered: 1970
106	Sg	Seaborgium	Discovered: 1974

to discover new elements with collaborators from Berkeley Lab, resulting in the discovery of americium (95) and curium (96) in 1944. Seaborg's "actinide hypothesis," one of his major contributions to chemistry, proposed the organization of the actinide series (atomic numbers 89-103) under the lanthanides (atomic numbers 57-71) and resulted in the configuration that the periodic table shows today.

When Seaborg and his research group returned to Berkeley Lab after the war, they soon developed new methods to form and detect radioactive elements and used them in the discoveries of berkelium (97) in late 1949 and californium (98) in early 1950. Isolation and identification of these elements required chemical separations, a particularly difficult problem because their chemistry was completely unknown.

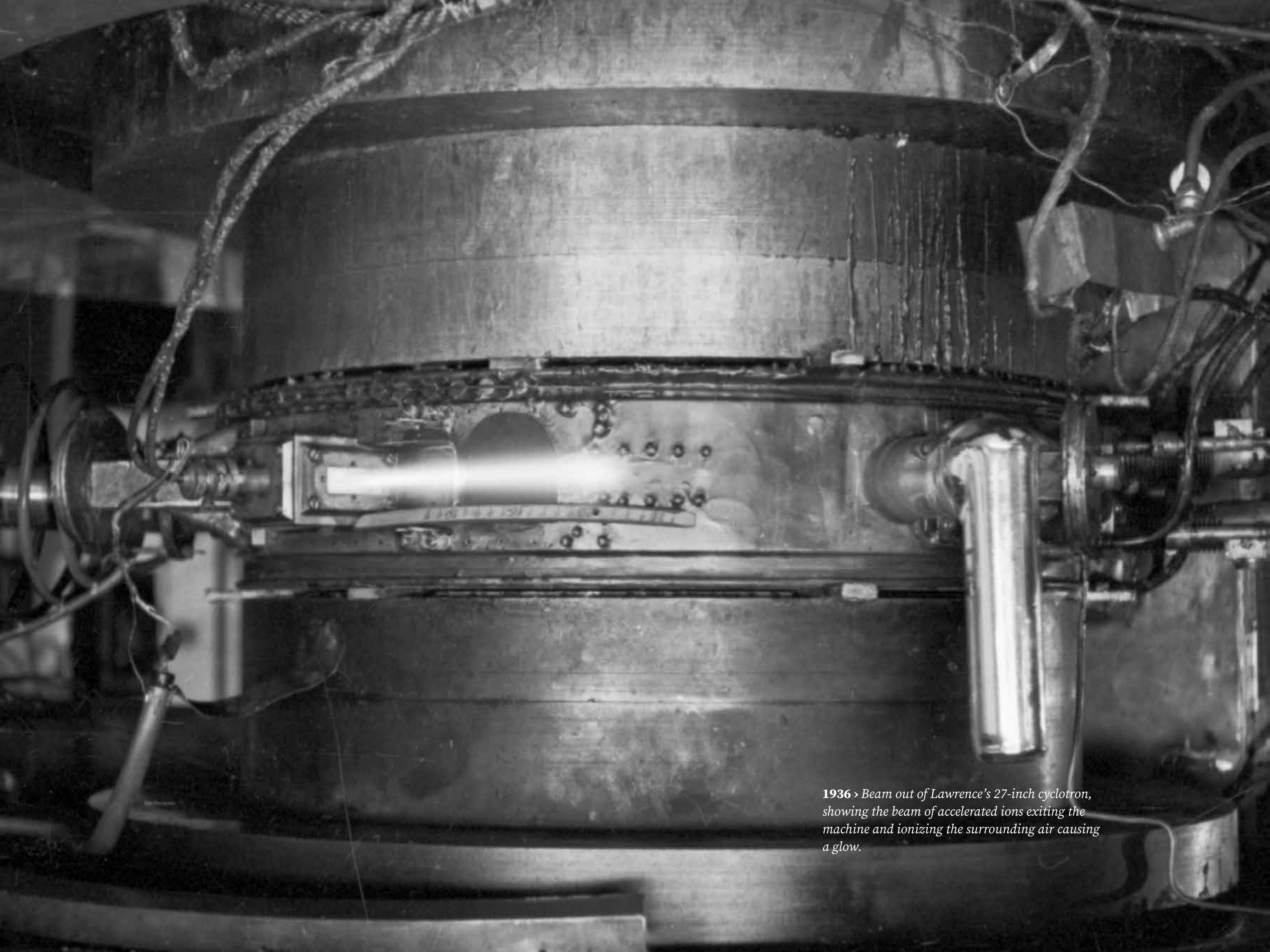
New discoveries and inventions would propel the scientists at the College and Berkeley Lab to go on to the co-discovery and creation of more transuranium elements over time.

*Element 43/Technetium discovered at Berkeley and confirmed at the University of Palermo in Sicily.

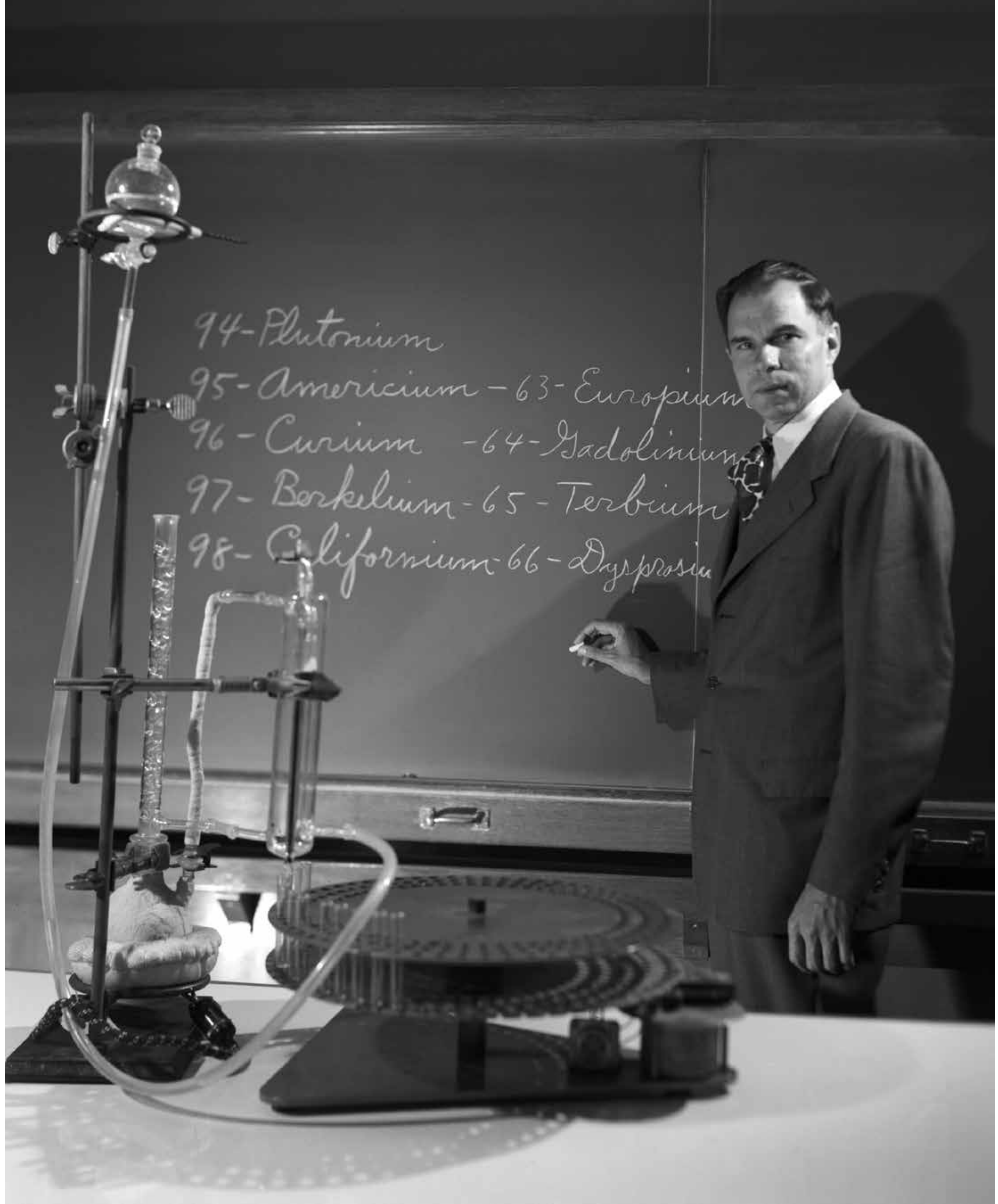
In 1937, a piece of molybdenum plate arrived at the University of Palermo in Sicily. It had been shipped from the University of California, Berkeley, where it had been part of Exrnest Lawrence's 'atom smasher' — one of the first particle accelerators, known as the 37-inch cyclotron. The plate contained the most important missing piece of the chemical world.

Element 43 — Technetium — provisionally named 'eka-manganese' before its discovery — was a hole in the periodic table set out by Dmitri Mendeleev in 1869. Although there had been earlier attempts to order the chemical elements, Mendeleev arranged his table according to the atomic mass and properties of elements, and left gaps where he felt particular ones were missing. Most of the spaces were gradually filled, validating Mendeleev's ideas. By the 1930s, the most notable of the still-absent building blocks was eka-manganese. Researchers had long sought this elusive element, but each of the claims had been proved wrong. Now, in Palermo, it was Italian physicist Emilio Segrè's turn to try. Segrè, who had been a visitor at the Berkeley cyclotron facility in California, was given the molybdenum plates that had been irradiated for several months with a deuterium beam. Various chemical analyses by the Italian team revealed the new element Technetium.

** Elements 95/Americium and 96/Curium were discovered in Chicago during WWII by a team of Berkeley researchers.



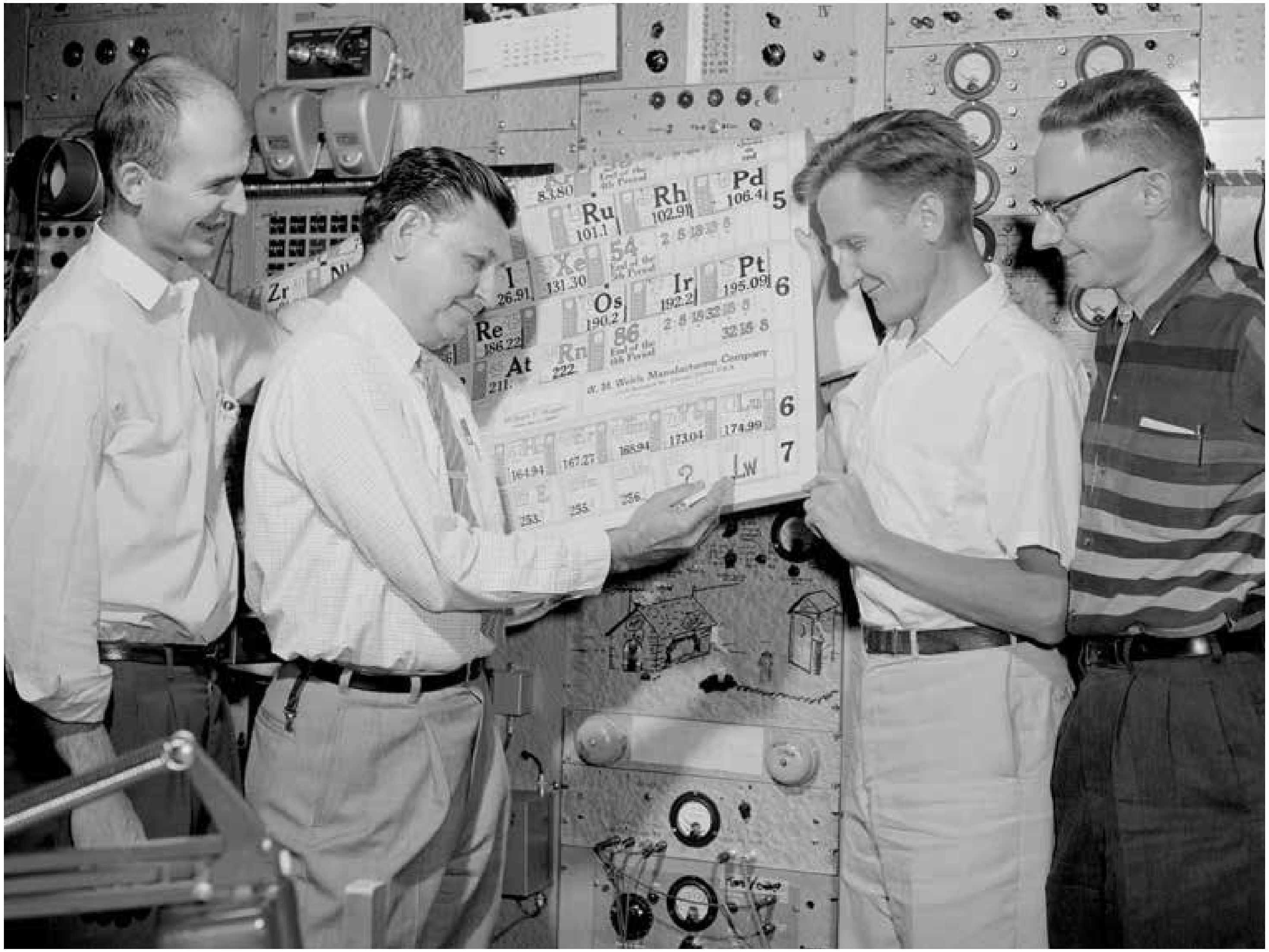
1936 › *Beam out of Lawrence's 27-inch cyclotron, showing the beam of accelerated ions exiting the machine and ionizing the surrounding air causing a glow.*



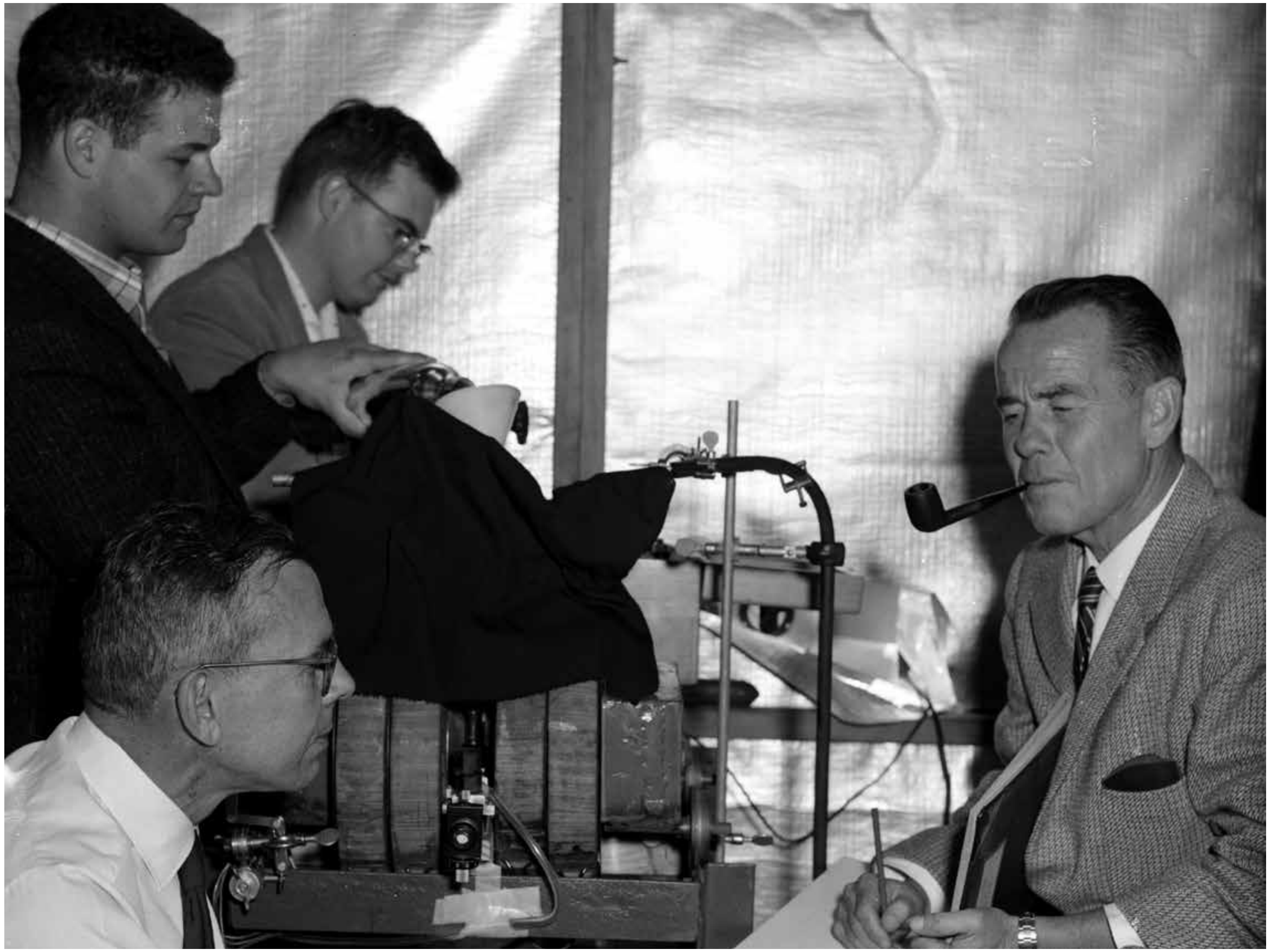
1950 › *Publicity shot of Glenn Seaborg lecturing on the discovery of elements 97 (berkelium) and 98 (californium).*

Co-discoverors of carbon-14.
1941 › *(l) Samuel Ruben and* **1949 ›** *(r)Martin Kamen.*

1954 › *(l to r) Physicist Albert Ghiorso and chemist Glenn Seaborg discuss issues with work on elements einsteinium (99) and fermium (100).*



1961 › *Updating the periodic table. Albert Ghiorso inscribes "Lw" in space 103; co-discoverers (l to r) Robert Latimer (son of Wendell Latimer), Torbjorn Sikkeland, and Almon Larsh look on.*



1958 › *Members of the californium (98) isolation team. Inside a fabricated tepee on the roof of the College of Chemistry building, the chemists perform their experiment. (Standing) alumni Ray Gatti (B.S. '55, Chem) and Llad Phillips (B.S. '56, Chem) (seated) Professor of Chemistry Burris Cunningham and Berkeley Lab nuclear chemist and alumnus Stanley Thompson (Ph.D. '48, Chem).*

1966 › *Al Ghiorso holds the first sample of Plutonimn-239. After being used for various characterization measurements, the plutonium was stored in a cigar box originally belonging to Seaborg's cigar-smoking former laboratory supervisor, chemistry professor G. N. Lewis. A note taped to the inside of the lid is dated "7-13-41" and includes some data on Sample B and a Sample F, prepared by Seaborg's graduate student Arthur C. Wahl from another irradiation.*

1966 › *Cigar box found in a shielded vault in Lawrence Radiation Laboratory's Building 5 turned out to conceal a treasure of the first ever isolated specimen of plutonium-239 (1941). Health Chemistry's Rosemary Barrett came upon the box during routine housecleaning operations in the vault. The plutonium sample and cigar box are now housed at the Smithsonian Institution. (Tracing Plutonium's Roots; https://cen.acs.org/articles/87/i14/Tracing-Plutoniums-Roots.html) (March 28, 1966)*

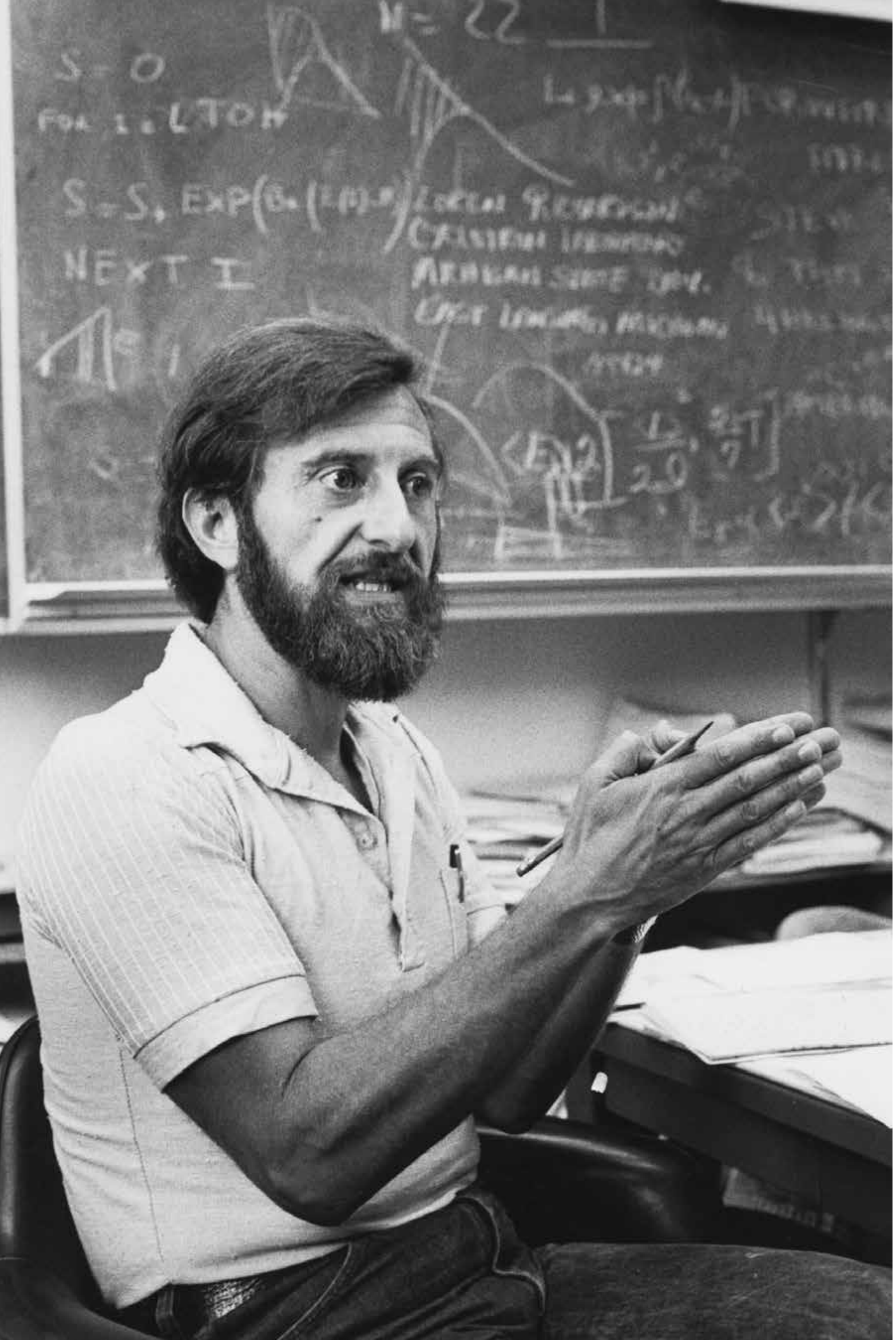
1969 › *Al Ghiorso and Glenn Seaborg at the 104 wheel. The Berkeley group gradually developed a new apparatus called the "vertical wheel". It was used at the HILAC in 1969 to perform the first positive identification of rutherfordium (104) by measuring the decay of its isotopes 257 and 259.*

1969 › *The rutherfordium (104) discovery team. (l to r) Matti Nurmia, James (Jim) Harris, Kari Eskola, Glenn Seaborg, Pirkko Eskola and Albert Ghiorso.*

1963 › *Professor of Chemistry Samuel Markowitz is the inventor of a trace analysis technique that demonstrates a Helium-3 activation. In the photo, thin aluminum foil containing one ten-trillionth of an ounce of oxygen molecules is removed from a target holder.*

1983 › *Nuclear chemist Lucianno Moretto in the classroom.*

1969 › *Nuclear chemist Joseph Cerny uses equipment to do particle identifier work at the Berkeley Lab.* PHOTOGRAPHED FOR AN ARTICLE IN THE MAGNET JOURNAL.



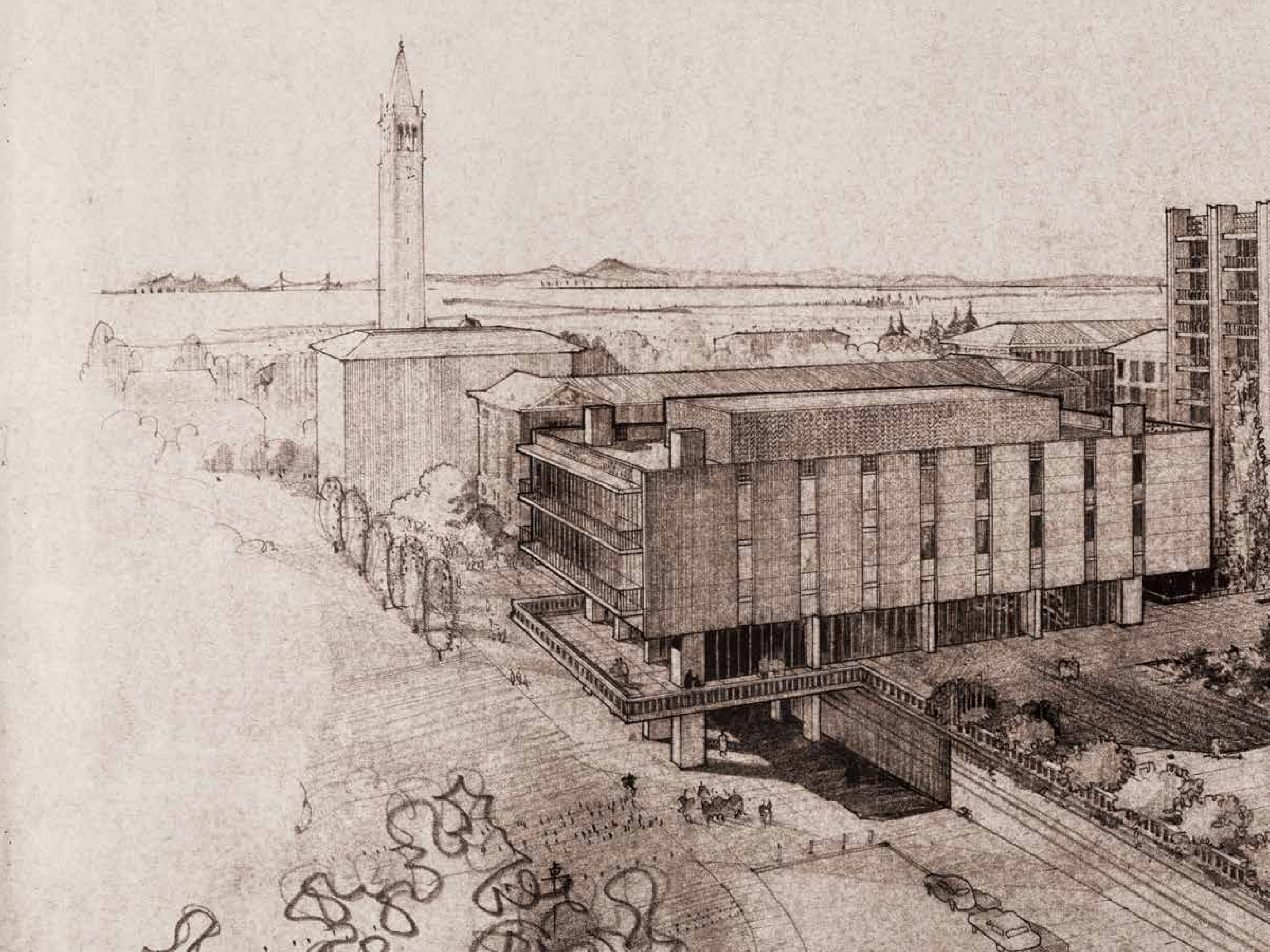
1970 › *(l to r) Bob Latimer (B.S. '56, Chem) son of Wendell Latimer, Jean Rees (Health Chemistry Personnel), and James (Jim) Harris (team lead) prepare a radioactive target to be bombarded by the Super Heavy Ion Linear Accelerator (Super-HILAC), at Berkeley Lab. Harris was on the discovery teams for elements rutherfordium (104) and dubnium (105).*

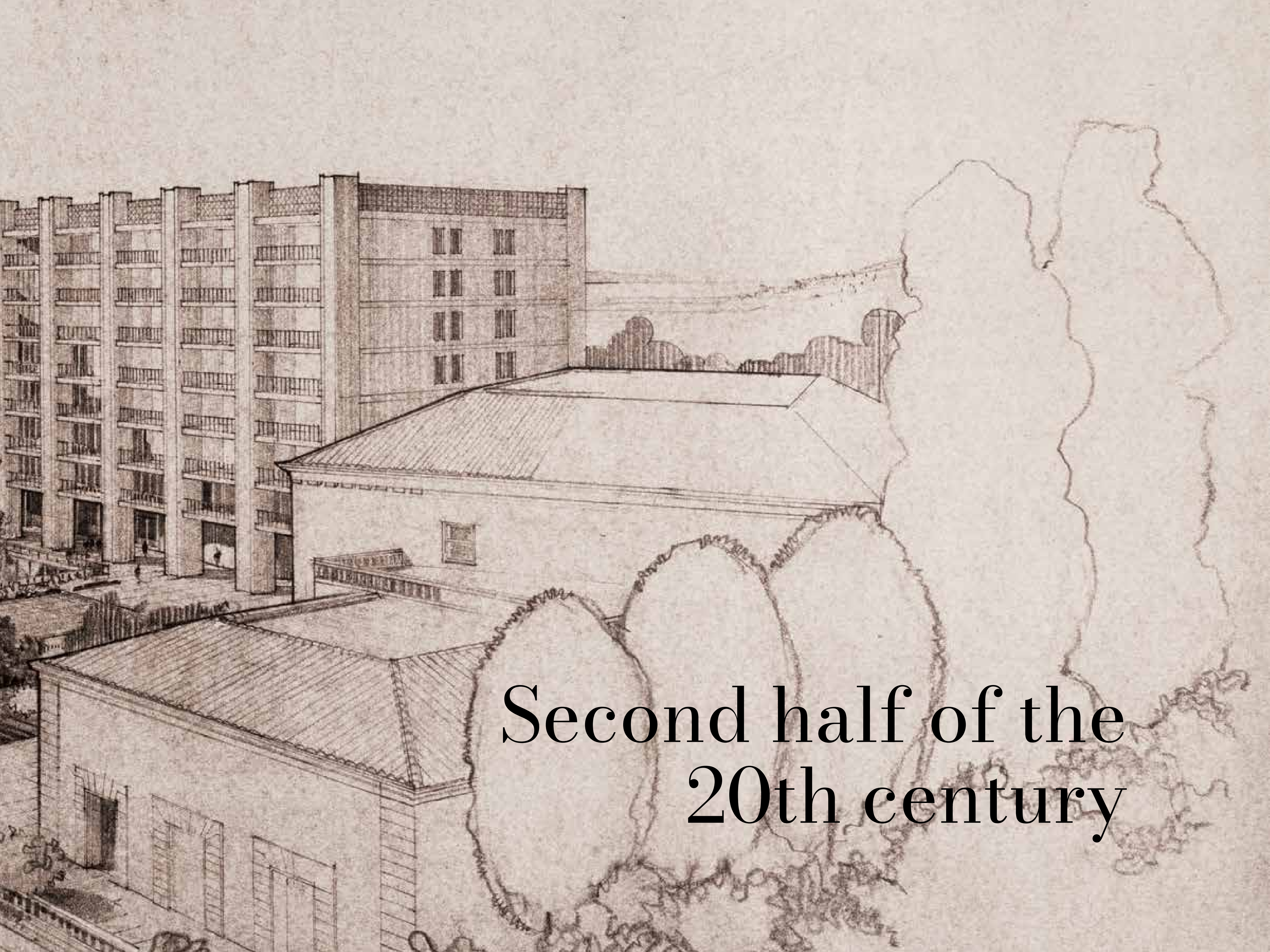
PHOTOGRAPH WAS TAKEN FOR EBONY MAGAZINE ARTICLE.

1974 › *Element 106, which was created at Berkeley Lab in 1974 and confirmed in 1993, was named "seaborgium" in honor of Nobel Laureate Glenn T. Seaborg. Discovery team at the Heavy Ion Linear Accelerator includes (l to r) Matti Nurmia, Jose R. Alonso, Albert Ghiorso, E. Kenneth Hulet, Carol T. Alonso, Ronald W. Lougheed, Glenn T. Seaborg, and J. Michael Nitschke.*

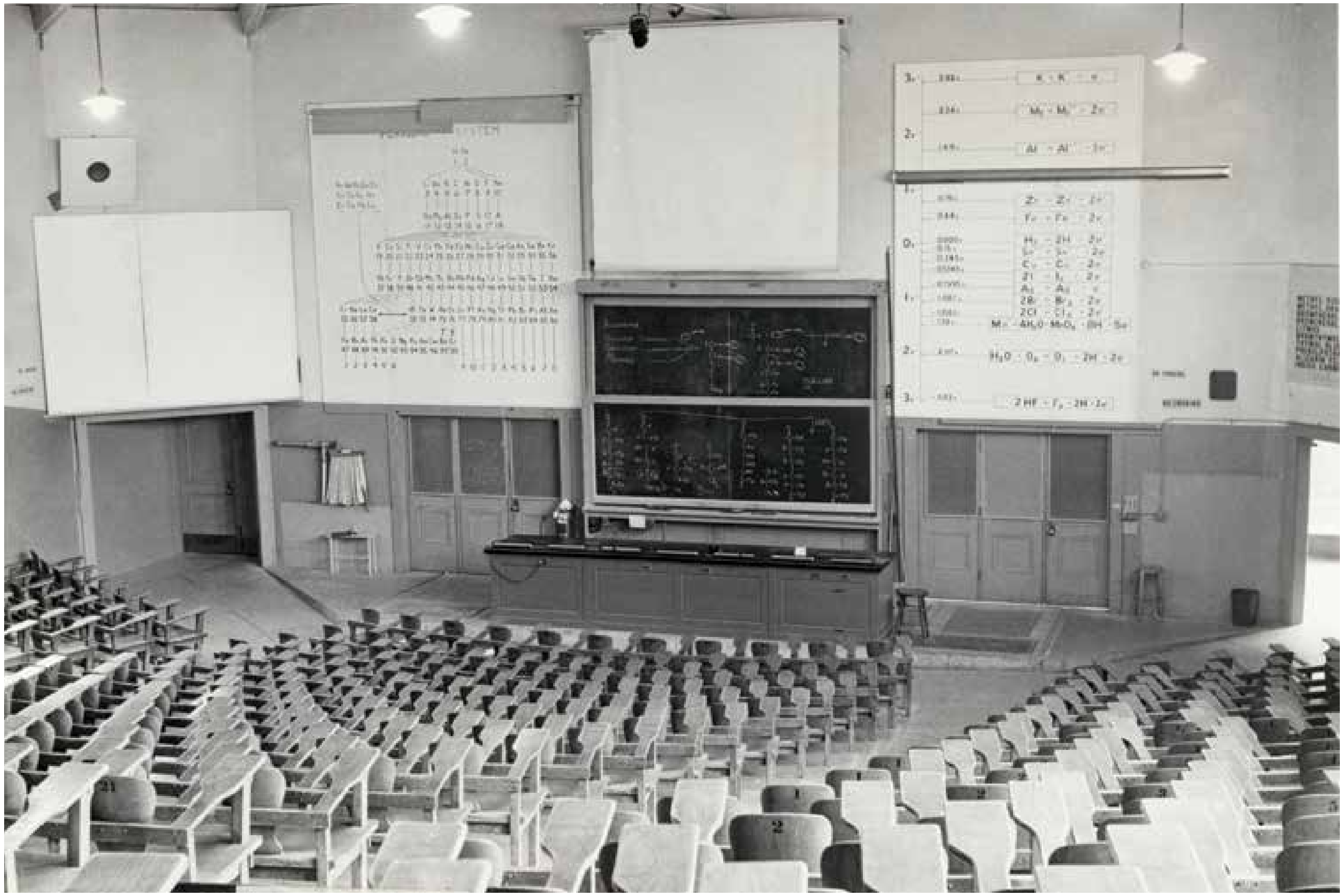
2017 › *Multiple generations of Berkeley Lab Scientists Jacklyn Gates (Ph.D. '08, Chem) and Kenneth Gregorich (Ph.D. '85, Chem) oversee the FIONA (For the Identification Of Nuclide A) project located at Berkeley Lab's 88-inch cyclotron. Gates played a leading role in the conception, construction, and testing of FIONA with Gregorich advising on the project.*

2020 › *Researchers in the lab of Professor Rebecca Abergel (Ph.D. '06, Chem) obtained a small sample of einsteinium (99), a highly radioactive and difficult-to-obtain element, and made the first ever measurement of its bond distance. (l to r) Leticia Arnedo-Sanchez (Posdoc), Katherine Shield (Ph.D. '21, Nucl. Eng.) Korey Carter (Postdoc), and Jennifer Wacker (Postdoc) at Berkeley Lab.*

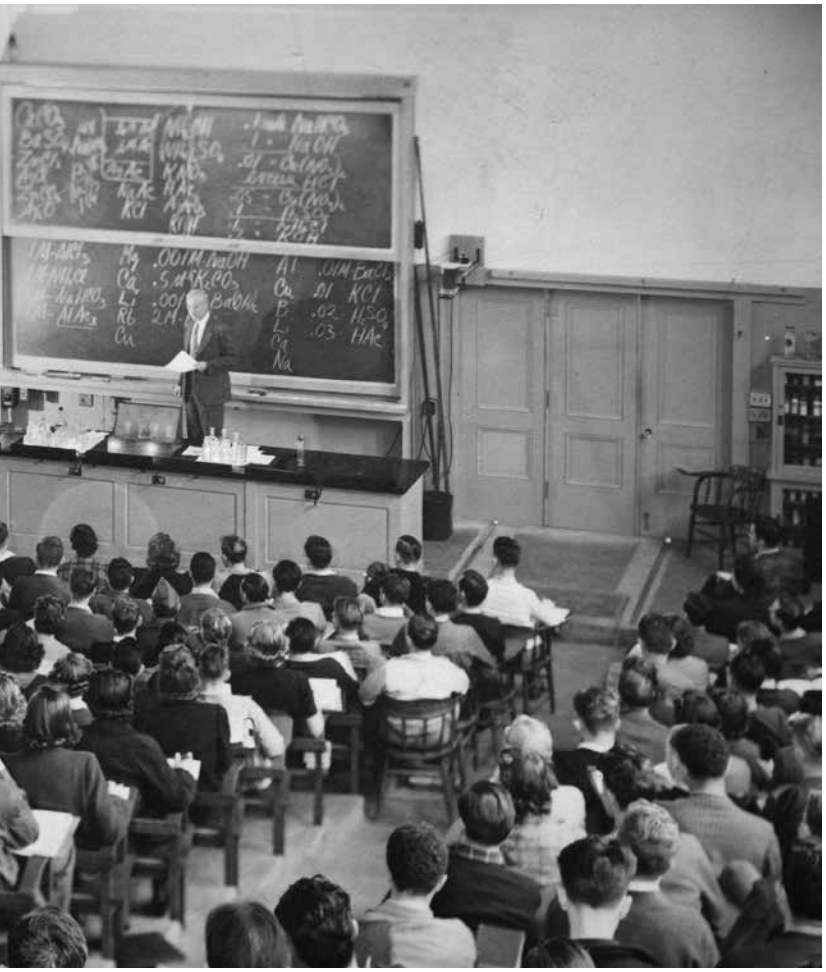


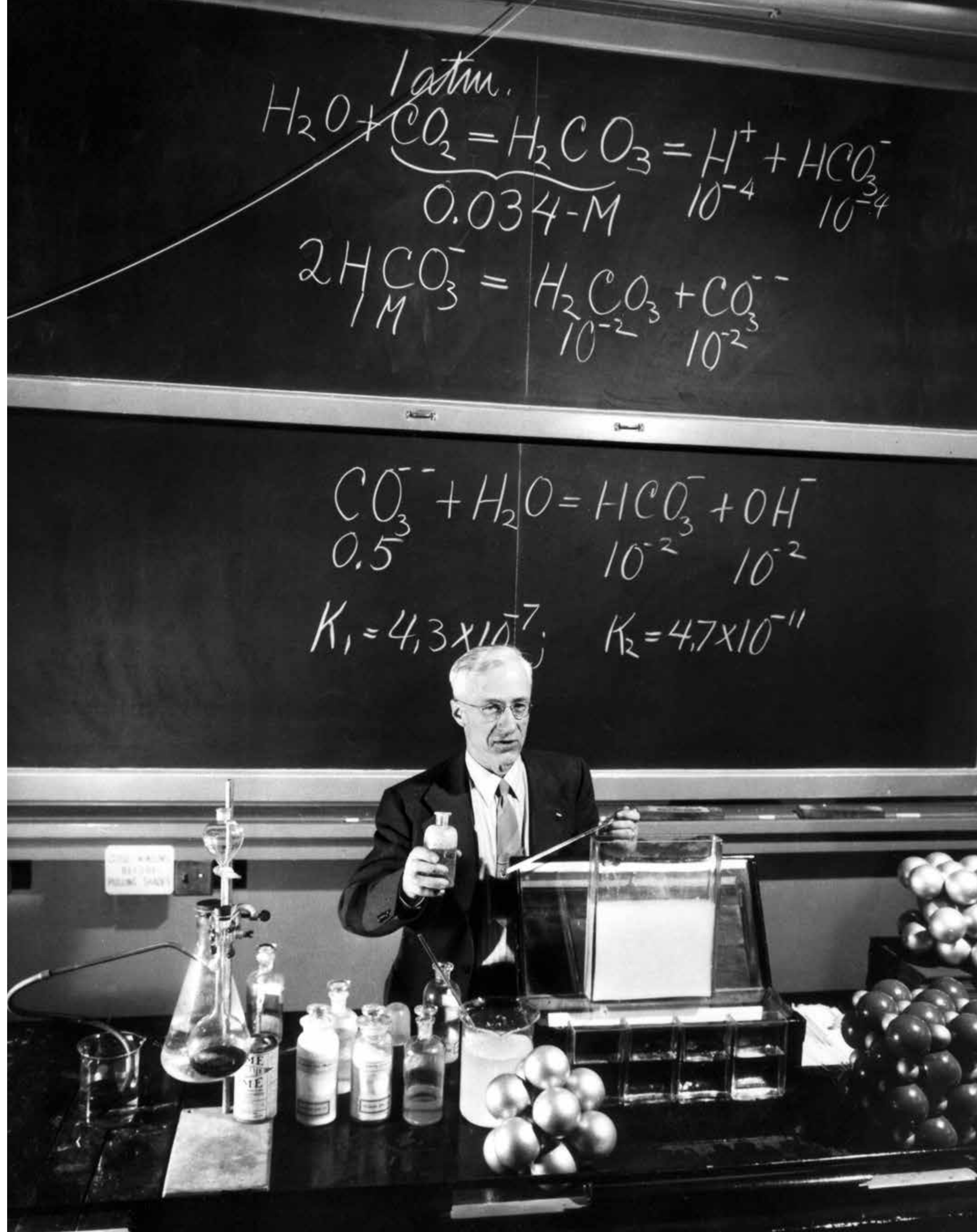


Second half of the 20th century



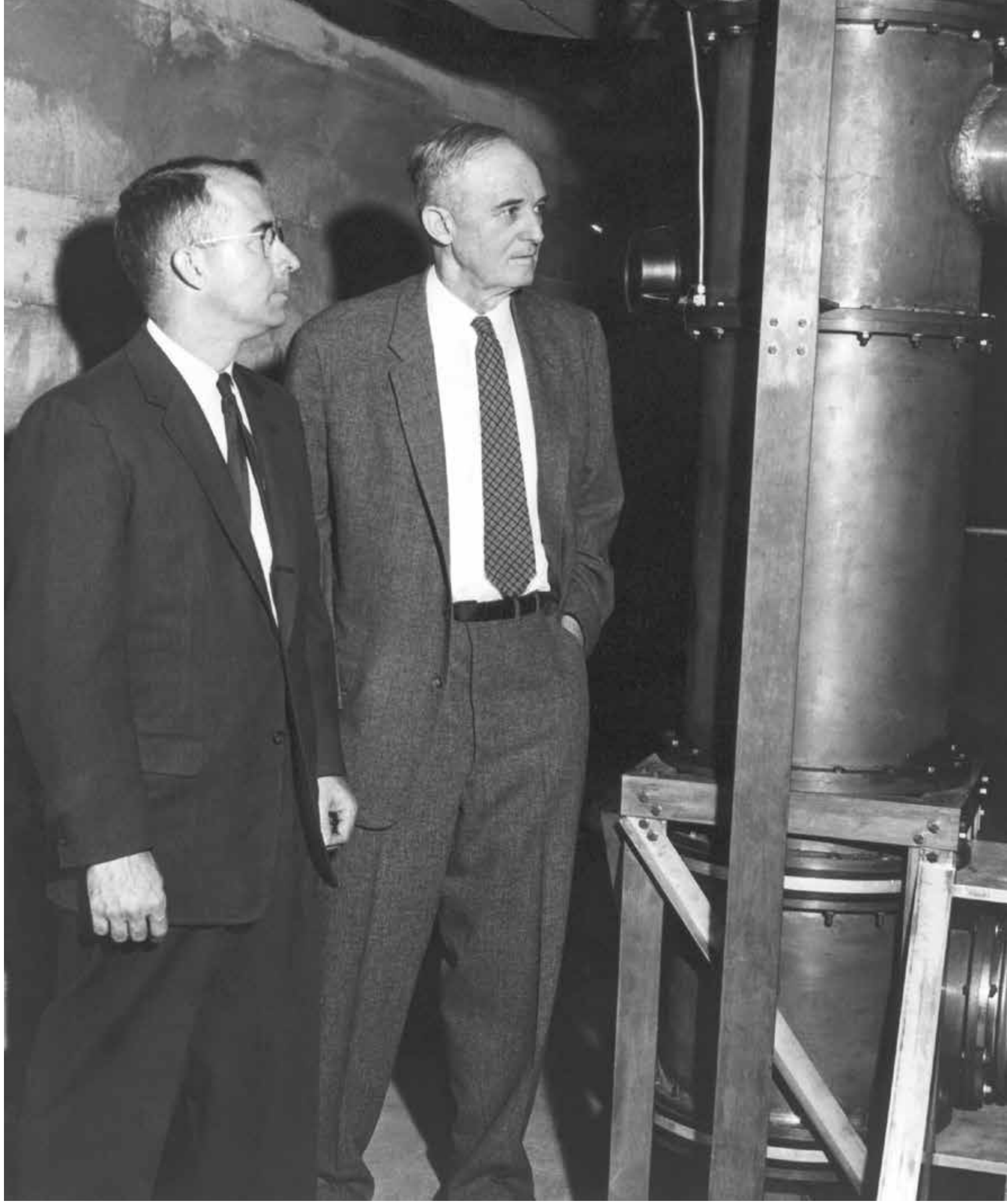
"A good lecturer must be something of a ham actor. He should perform experiments on the lecture table, not just demonstrations. I tried more and more as the years went by to stimulate students to interpret for themselves what they see on the lecture desk. The dramatist doesn't tell, in the prologue, how the last act is going to turn out." —JOEL HILDEBRAND





1946 › *Joel Hildebrand taught approximately 40,000 students, most of them in the chemistry auditorium, during his time teaching Chem 1A at the College.*

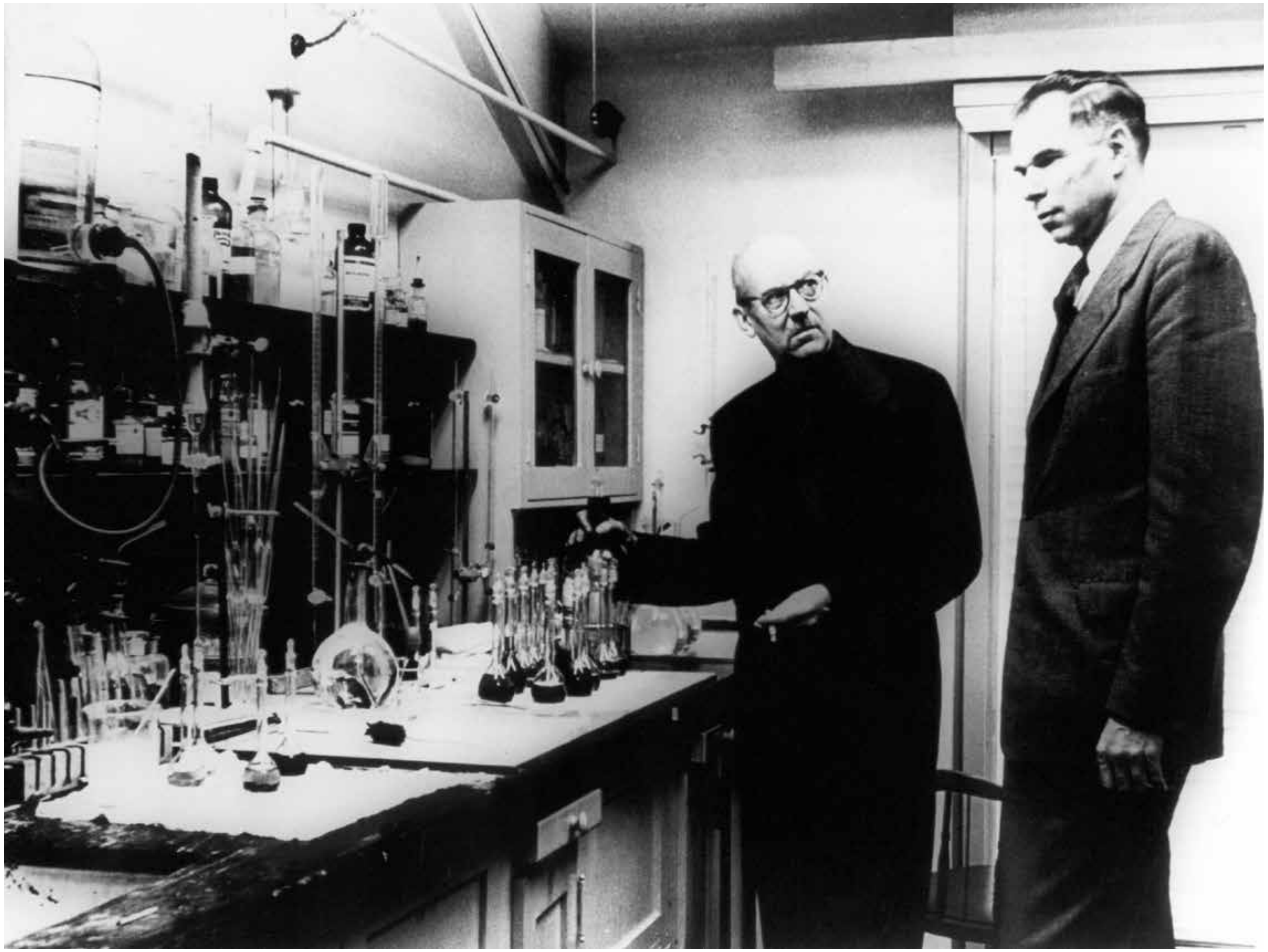
1951 › *Glenn Seaborg and Edward McMillan photographed on the day of the announcement of their Nobel Prize for "their discoveries in the chemistry of the first transuranium elements."*



1960 › *David Lyon and William Giauque. Lyon, a longtime UC Berkeley Chemical Engineering professor received his Ph.D. with Giauque in 1948. He was an authority on the strange things that substances do when they are chilled to very nearly absolute zero. He was best known for helping to develop, with Professor Giauque, an electromagnet in 1958 used to cool small bits of matter to a fraction of a degree above absolute zero. At that temperature, he found, steel shatters like glass and rubber bands become harder than nails.*

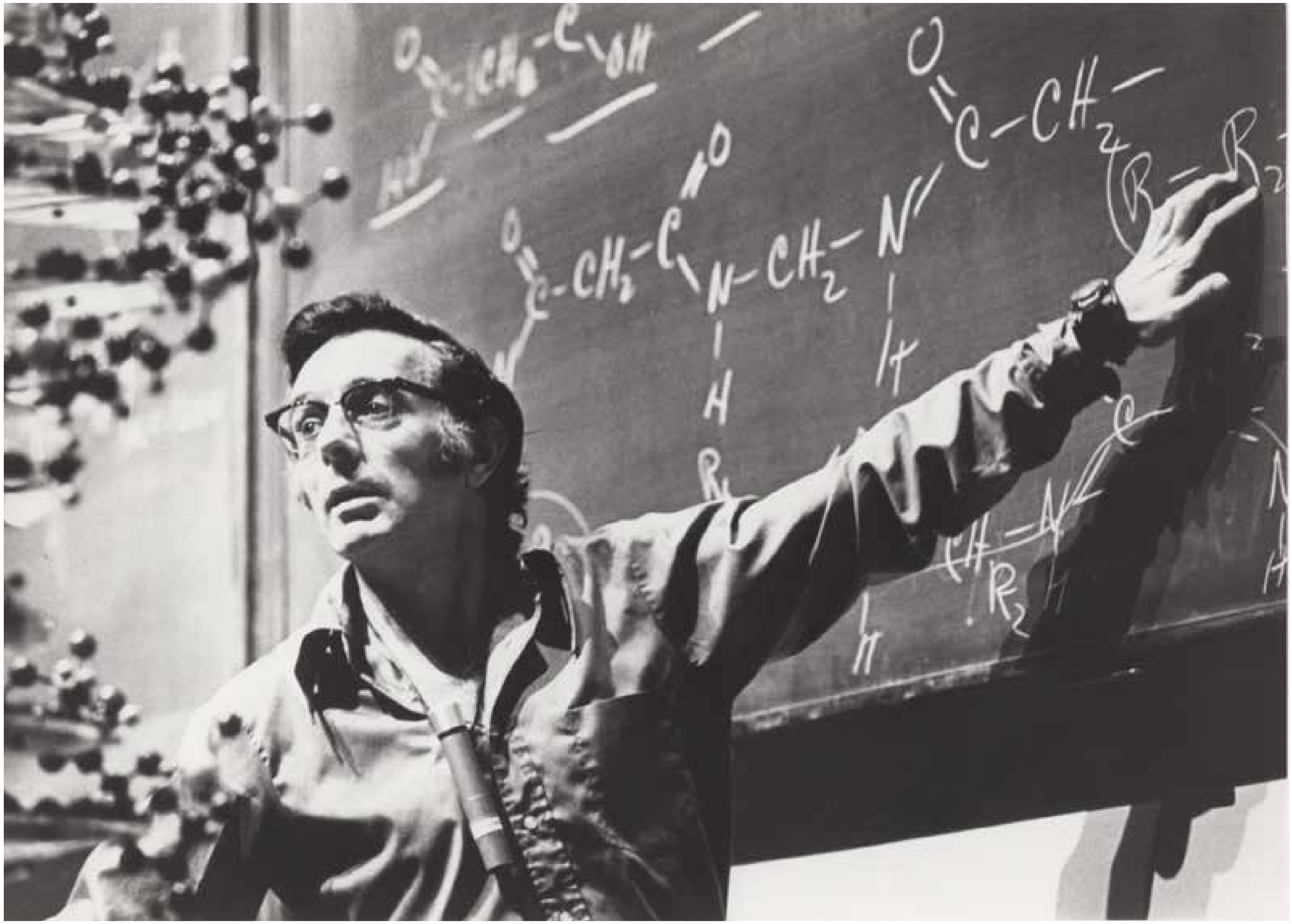
1976 › *Earl Muetterties was a major figure in American inorganic chemistry and he contributed to almost every area of this discipline. He arrived late in his career to Berkeley from MNR research at Dupont and a professorship at Cornell University. Upon arriving at Berkeley, Muetterties set up his research lab in organometallic catalysis and cluster chemistry in the Chemistry Department and at the Lawrence Berkeley Laboratory. He instituted a new advanced inorganic course, emphasizing modern structural and mechanistic principles, and taught the course himself for several years. He died at the age of 56 of cancer.*

2019 › *Historic periodic table in a window at the College library celebrates the discovery of element 106 Seaborgium.*



1950 › *Wendell Latimer and Glenn Seaborg in Seaborg's lab in 307 Gilman Hall. Latimer had just finished his position as dean of the College. Seaborg had returned to work at Berkeley in 1945 and was working on the discovery of transuranium elements at the Berkeley Lab.*

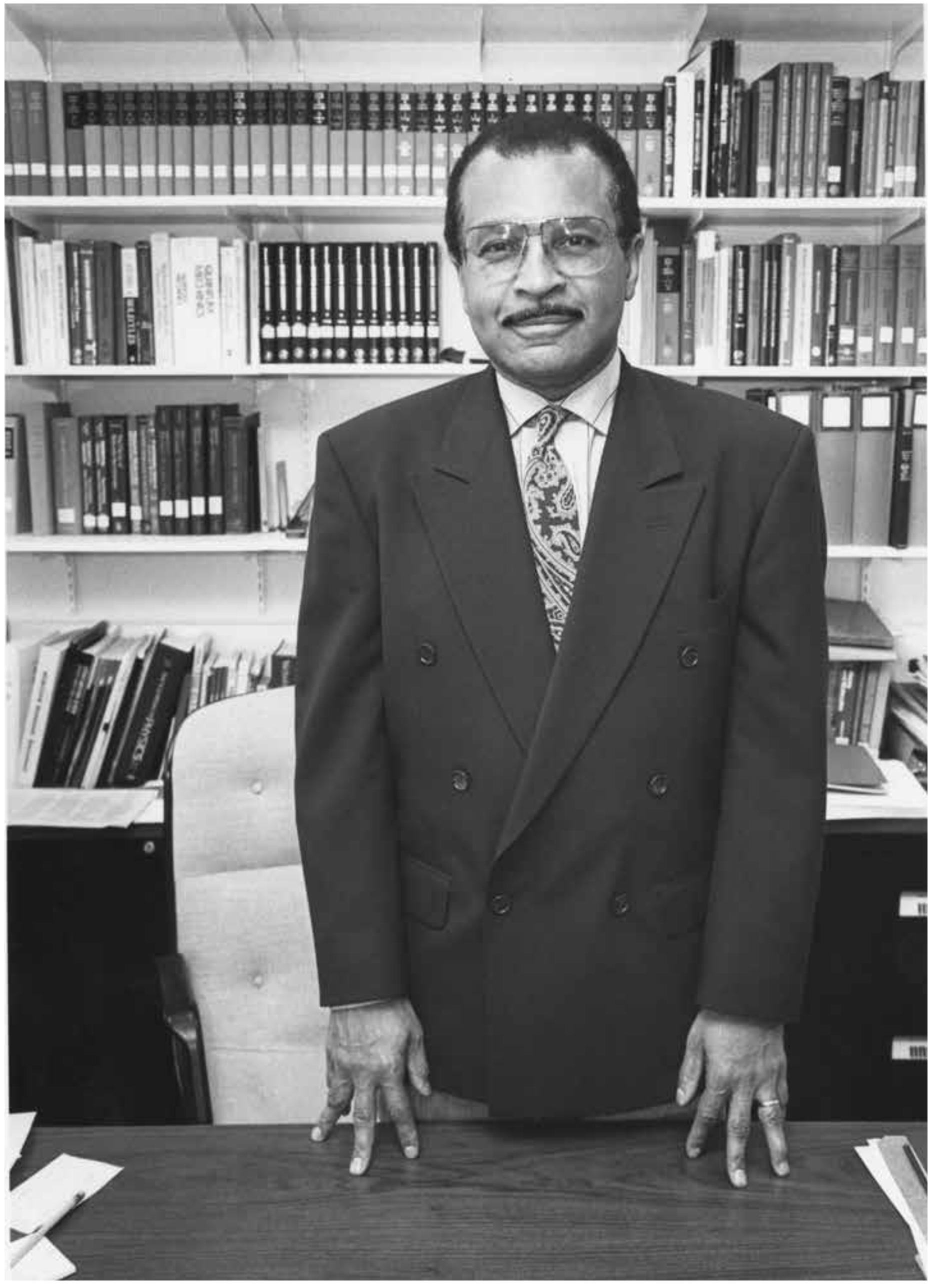
George C. Pimentel (1922-1989) was the inventor of the chemical laser. He also developed the technique of matrix isolation in low-temperature chemistry. In theoretical chemistry, he proposed the three-center four-electron bond which is now accepted as the best simple model of hypervalent molecules. In the late 1960s, Pimentel led the University of California team that designed the infrared spectrometer for the Mars Mariner 6 and 7 missions that analyzed the surface and atmosphere of Mars.



1974 › *George Pimentel was a dynamic educator and lecturer.*

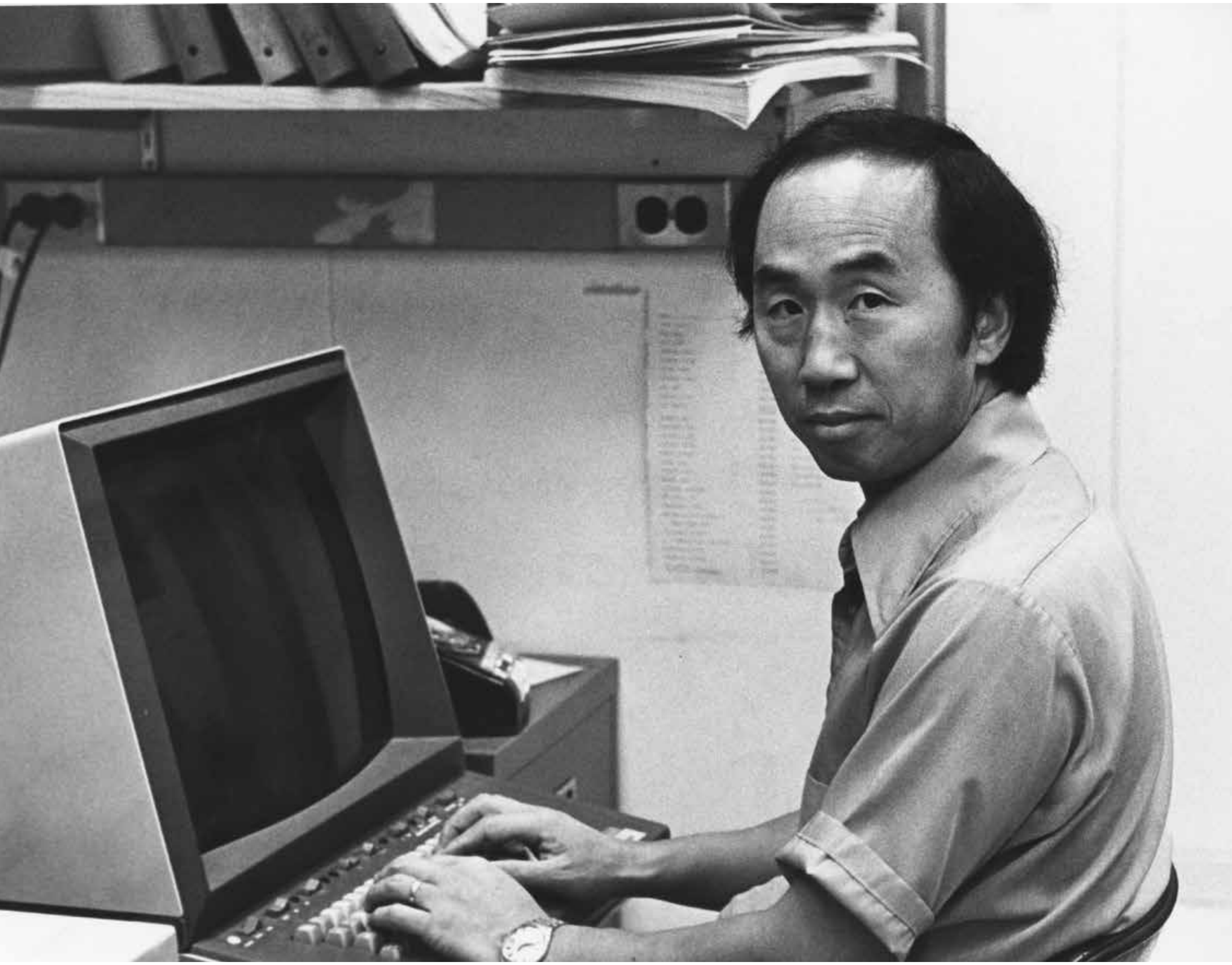
1965 › *The Vietnam Day Committee was formed in May, 1965, during a two-day-long protest of the Vietnam War on the Berkeley campus, with the ultimate goal of organizing a large-scale march against the war in November. Chemist John Hearst (left) and theorist Robert Harris (right) were participants in the campus marches.*


END
THE
WAR



1991 › *William Lester joined the College in 1981 as a theoretical chemist. After a post-doctoral appointment at U. Wisconsin at Madison, he went on to the IBM Corporation, where he worked at its research laboratory in San Jose. Later, as the director of the National Resource for Computation in Chemistry, he organized and led the first unified effort in computational chemistry in the United States. After coming to Berkeley, his research focused on theoretical studies of the electronic structure of molecules. His efforts extended the powerful quantum Monte Carlo method into a wider range of chemical problems. Lester held dual appointments at Berkeley Lab and was on the editorial boards of a number of prestigious scientific publications. A lectureship at the College was named in his honor in 2020.*

1953 › *Kenneth Pitzer was the founder of modern theoretical chemistry at Berkeley. He not only used quantum and statistical mechanics to explain the thermodynamic and conformational properties of molecules, he pioneered quantum scattering theory for describing chemical reactions at the most fundamental level. He also made contributions to relativistic effects in chemical bonding and the theory of fluids and electrolyte solutions.*



1980s › *Sung-Hou Kim arrived at Berkeley in 1978 from MIT. Kim and his research colleagues applied a new way of thinking to the Tree of Life, a concept that has been around since Darwin's time. Drawing from their collective expertise, they applied an Information Theory-based non-alignment method to compare whole-proteome sequences,the protein sequences coded by all genes of each organism. His research group has studied over 4,000 organisms and the results have shown evidence of a 'deep burst' of the founders of all six major groups of life occurring near the root of the Tree of Life.*

n.d. › *Carolyn Bertozzi (Ph.D. '93, Chem) photographed in the courtyard of the College. Bertozzi was a professor of chemical biology from 1996 to 2015 when she relocated to Stanford University. A trailblazing researcher, she discovered and developed bioorthogonal chemistry which led to her 2022 Nobel Prize.*

1974 › *C. Bradley Moore was among the first chemists to use lasers in the 1960s and opened major new areas of molecular energy transfer, chemical reaction kinetics, and photochemistry. In recent years his lab provided quantitative benchmarks for theories of chemical bond breaking.*

1971 › *Clayton Heathcock and Andrew Streitwieser fly fishing at the Streitwieser summer home. They had returned from the Snake River and Sue Streitwieser had made ice cream cones.*

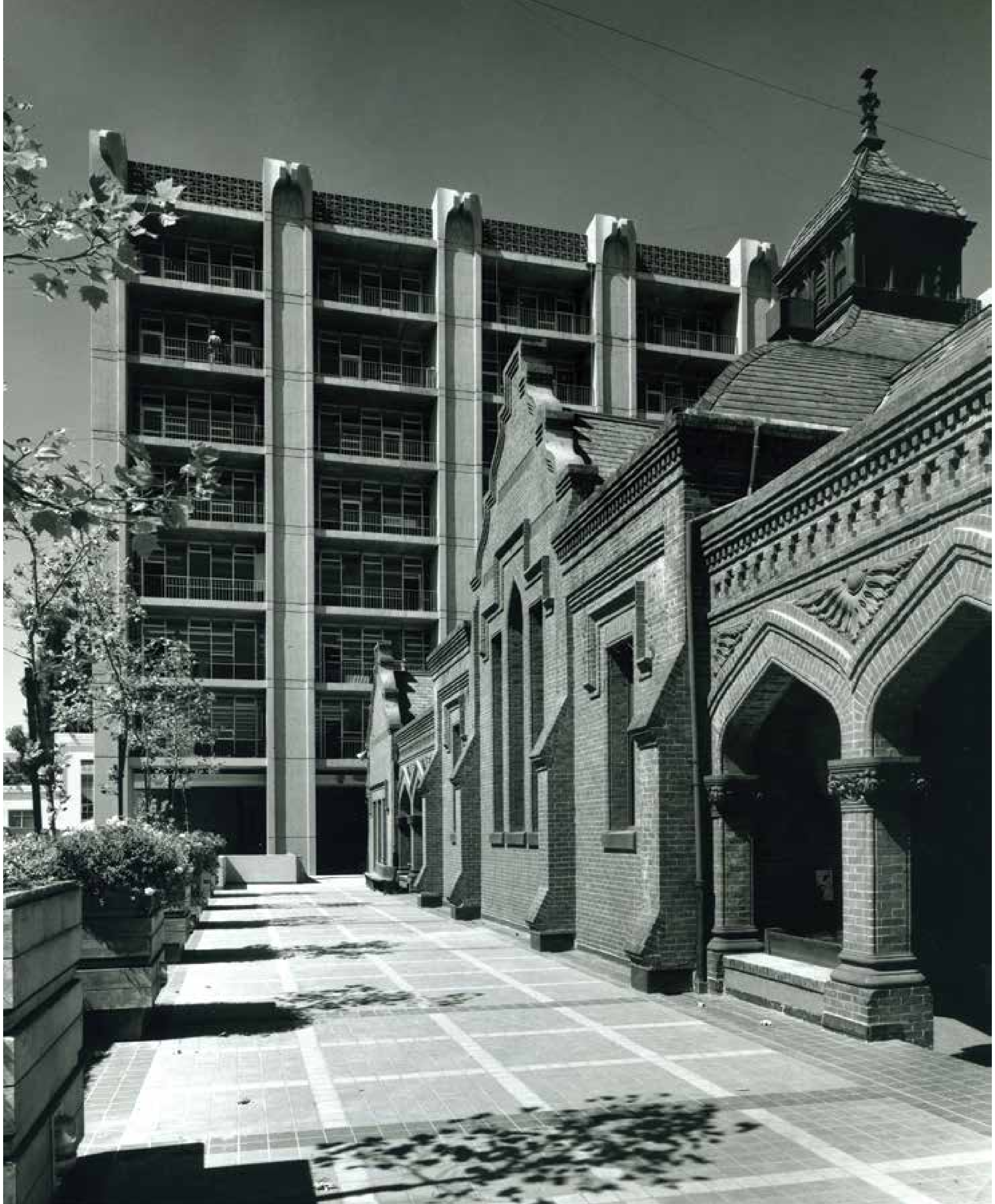
1980s › *Andrew Streitwieser (1927-2022) was a pioneer of molecular orbital theory and wrote the well-known organic chemistry textbook, Molecular Orbital Theory for Organic Chemists, which had a lasting impact on the field of physical organic chemistry. He was also well-known for proposing the currently accepted interpretation of the origin of secondary deuterium kinetic isotope effects. He developed the technique of using protium/deuterium exchange to measure the acidity of exceedingly weak carbon acids and was a co-developer of the MSAD acidity scale. He was a member of the National Academy of Sciences, the American Academy of Arts and Sciences, and was a fellow of the American Association for the Advancement of Science.*

Latimer, Pimentel and Hildebrand Halls

Latimer, Pimentel, and Hildebrand Halls, were designed by architects Bob Anshen & Steve Allen, and built between 1963 and 1966 for the College of Chemistry. They joined the existing chemistry buildings Gilman Hall, Lewis Hall, and Giauque Hall completing the chemistry courtyard design. The Old Chemistry Building was torn down to accommodate Hildebrand Hall. The cupola that was on the building remains today on the chemistry plaza.

Latimer Hall, an 11-story building, was built between and to the north of Gilman and Lewis Halls in 1963. It is named after Wendell Mitchell Latimer, dean of the College of Chemistry in the 1940s. Pimentel Hall, a round, 2-story lecture hall, was built north of Latimer Hall in 1964 and named after George C. Pimentel, inventor of the chemical laser. Hildebrand Hall was built in between Gilman and Lewis Halls to the south of the complex in 1966. It is named after Joel Henry Hildebrand, a long-time chemistry professor and dean, and houses the California Institute for Quantitative Biosciences and the Chemistry and Chemical Engineering Library.

1966 › *Joel Hildebrand in front of the newly constructed Hildebrand Hall.*



1963 › *Generations: Photo of the "Old Chemistry" building (built 1890), with newly completed Latimer Hall (built 1962) before the building was demolished to make way for Hildebrand Hall.*

1963 › *Demolition of the 'Old Chemistry Building' was completed in 1963 with the exception of the cupola which was saved and later mounted in the Chemistry Plaza. It still stands there today.*

Kenneth Pitzer on the development of Pimentel Hall

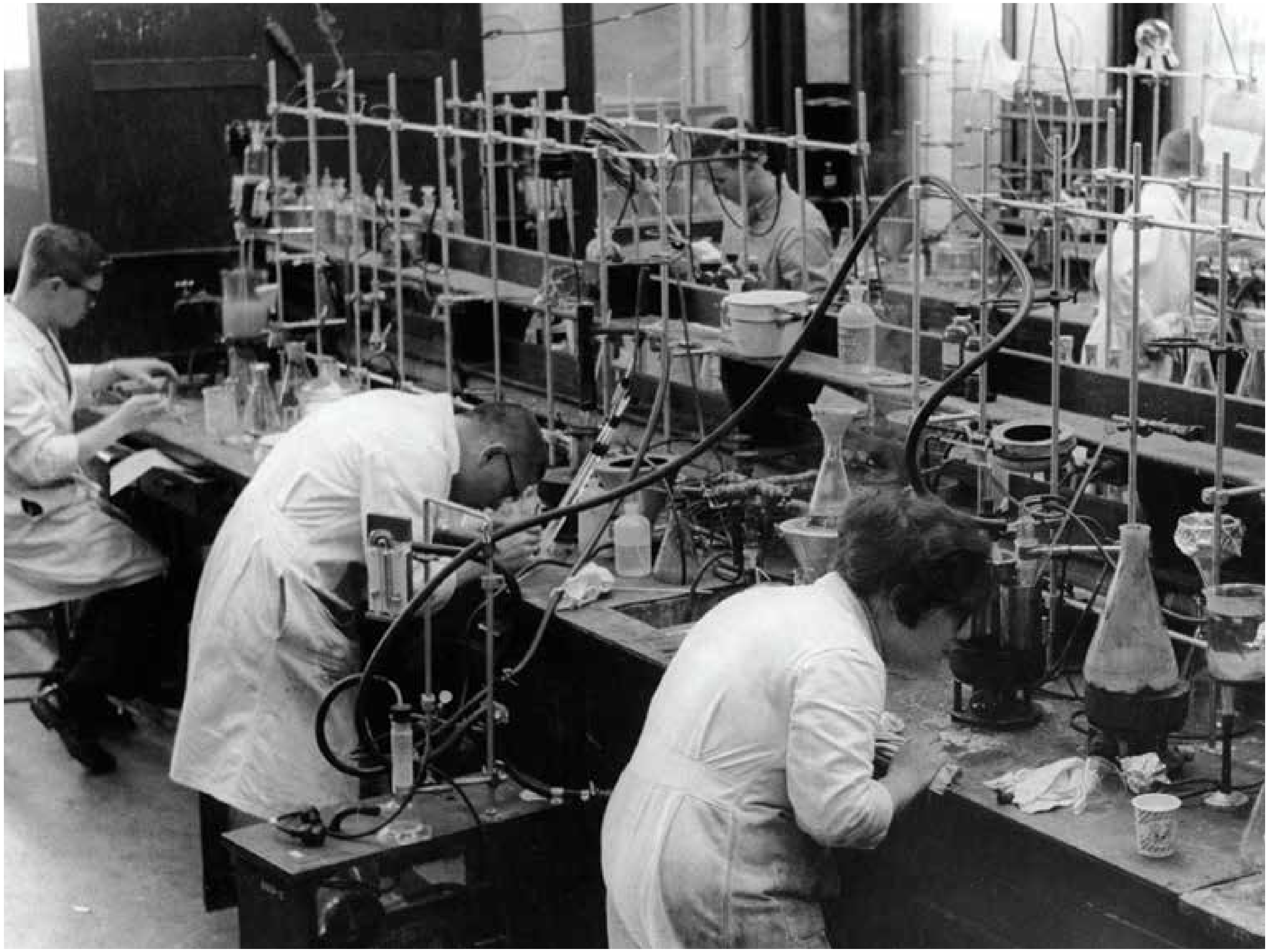
"There was another addition that had to be made, and that's the large auditorium we use for the freshmen lectures. It was decided that should be joint with physics, and was called the Physical Sciences Lecture Hall until it was renamed George Pimentel Hall. That was part of the first stage, and I don't remember whether it was funded separately, or whether it was funded as part of the Latimer Hall project. I presume the same architect handled it, although I'm not explicit in my memory there.

I had occasion to recall some of this because [laughs] the question came up recently of naming the lobby of the lecture hall for Harvey White, who was in physics and was on the committee that designed the lecture hall, and had some role in the very clever rotating demonstration unit or stage, which had three positions so you can set up demonstration experiments back in the preparation room, then rotate the stage out for your lecture, then rotate it away again for the lecture immediately afterwards. Without that it was not feasible to have lectures without gaps in between lectures for the preparations for demonstrations, and so on.

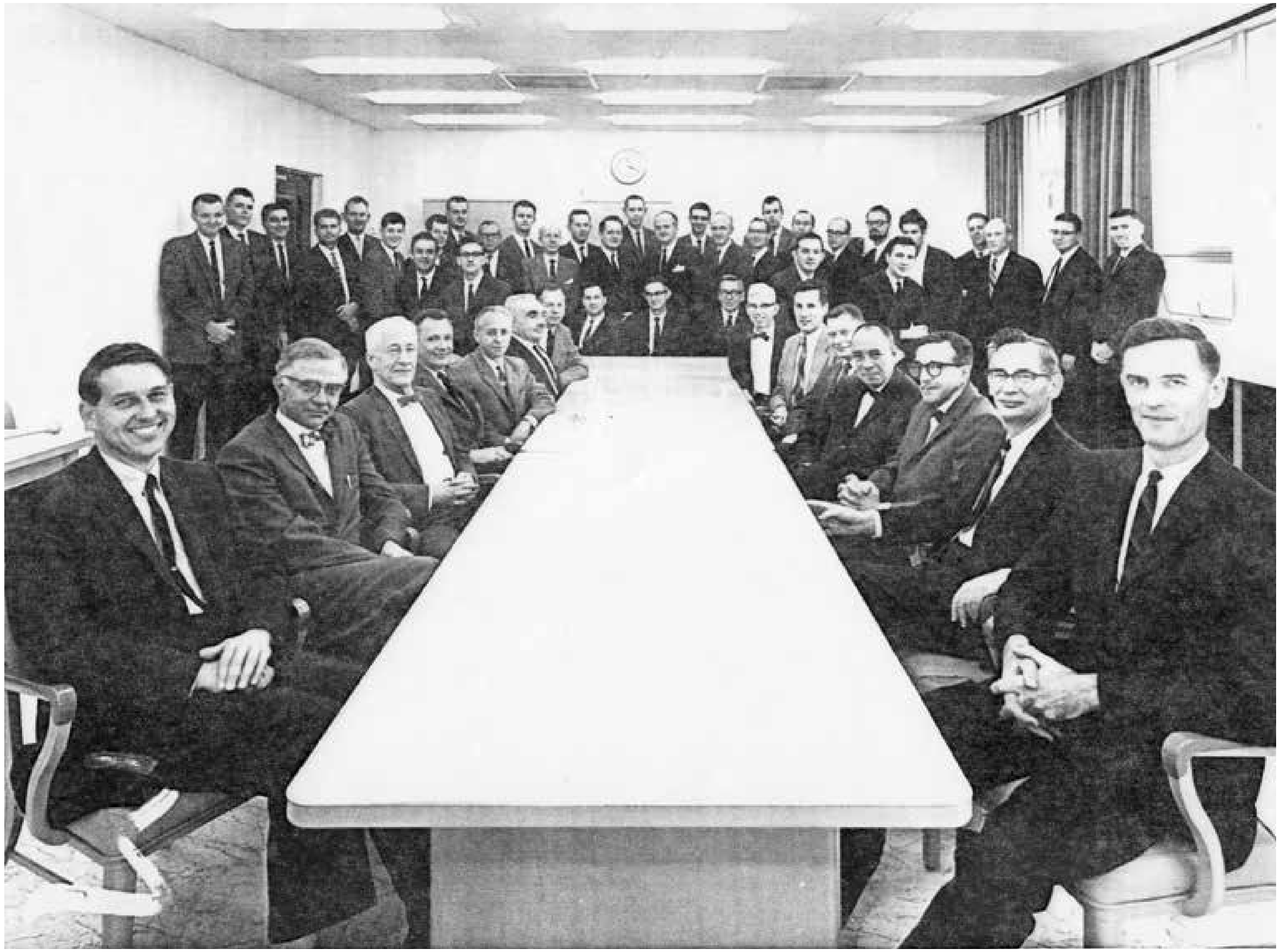
So it was a real contribution. How much other people contributed to it, I don't know, but I was asked to evaluate the appropriateness of this recognition of Harvey White. So I had to look it up to some degree, and found out that actually, Richard Powell (Professor of Chemistry, Chairman of the Chemistry Department, and temporary dean of the College), who was the chairman of the committee that was involved with the design of the auditorium; and he was the one that was then giving freshmen chemistry lectures. I'm sure he must have had something to do with it too; but he died many years ago now, and Harvey White isn't living either. Nobody seems to remember any further detail. As long as it's kept modest, and as long as there's some recognition of Powell, as well as Harvey White, why, I think it's all right to have some recognition of Harvey White. I passed that word along, and I think it's all going to work out."

1965 › *Harvey White lectures in Pimentel Hall using the overhead TVs for demonstrations.*

1953 › *G. Ernest Gibson with students in the Freshman Chemistry Lab.*



1961 › *Students in lab in the old chemistry building.*



1965 › *College faculty: Seated at the table (l to r) Rollie Myers, R.E. Powell, J.H. Hildebrand, D.N. Hanson, I. Perlman, Otto Redlich, T. Vermeulen, A. Streitwieser, J. Cason, W.D. Gwinn, D.H.Templeton, W.L. Jolly, H.M. Prausnitz, E.F. Orlemann, L. Brewer, H. Rappaport, R.E. Connick. Standing (l to r) K. Street, C.J. King, L.V. Interranate, F.R. Jensen, C.W. Koch, S.L. Goren, G.C. Pimentel, E.E. Petersen, J. Cerny, Stanley Williamson, B.B. Cunningham, David Shirley, Melvin Calvin, Charles Sederholm, C.H. Heathcock, E.A. Grens, C.W. Tobias, C.B. Moore, H.S. Johnston, K. Sauer, N.L. Strauss, N.E. Phillips, A.L Burlingame, Gabor Somorjai, K.V. Scherer, Robert Harris, D. Wallace, B. Kirtman, Leroy Bromley, J.E. Hearst, R.J. Ayen.*

1981 › *Joel Hildebrand's 100th birthday bash - the first College event held on the newly built chemistry plaza. Judson King (fourth from left) was the new dean at the time and served as emcee. (l to r) Dan Koshland, Rod Park (then Vice Chancellor), Joel Hildebrand, Judson King, and (on the far right) Ken Pitzer. George Pimentel is at the lectern.*

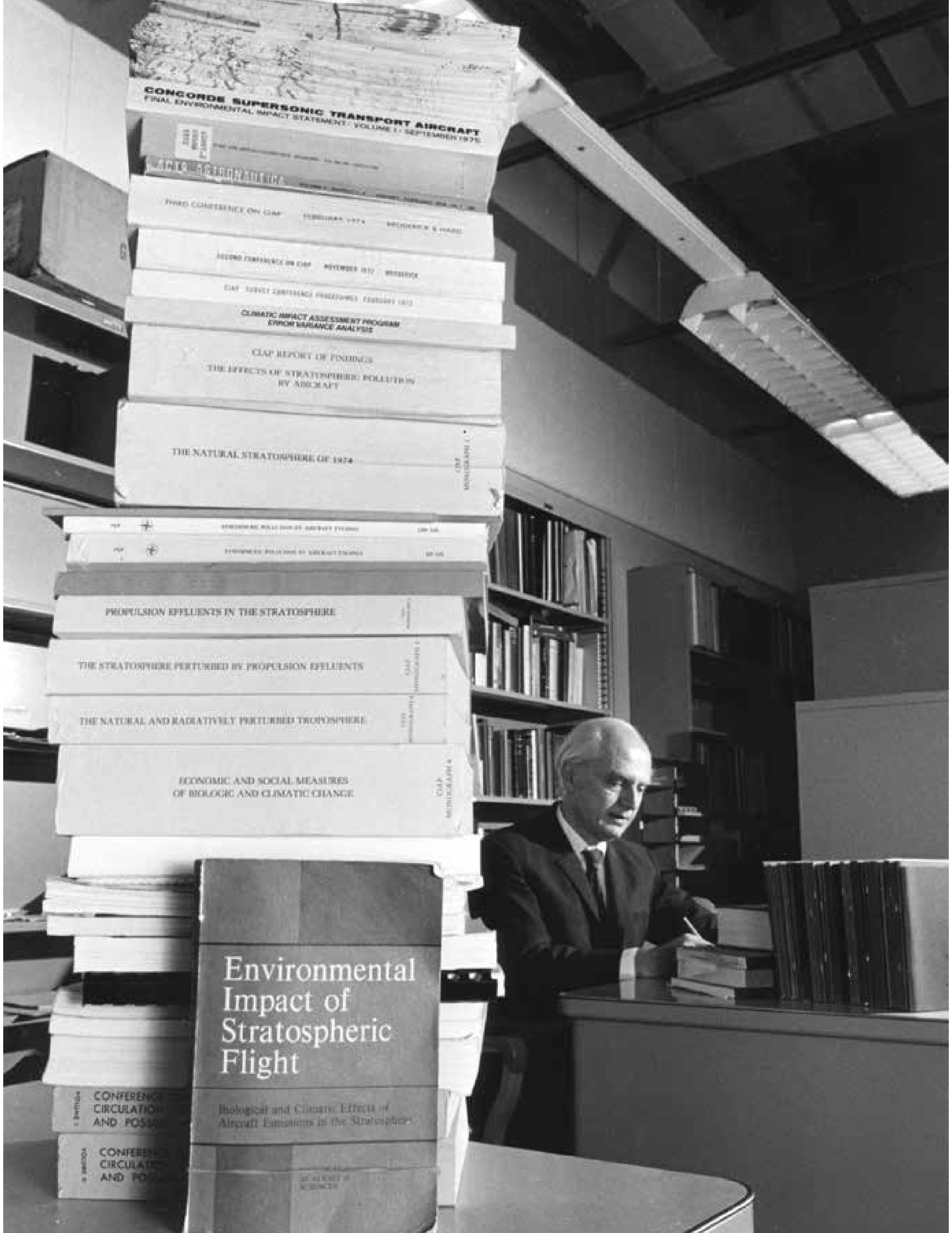
1969 › *George Pimentel and Kenneth Herr review the infrared spectrometer built at UC Berkeley by the machine shop and used in the Mariner Mars 6 and 7 missions.*

1960s › *William Jolly in the lab. Jolly's research at UC Berkeley, Lawrence Livermore and Lawrence Berkeley National Labs included thermodynamics, volatile hydrides, sulfur-nitrogen compounds, liquid ammonia solutions and atomic core binding energies. He wrote a wonderful College history entitled* From Retorts to Lasers *covering the period from 1868 to 1986. The book is available electronically at https://escholarship.org/uc/ucb_chemistry_history.*

In 1945, William Dauben came to the University of California, Berkeley, as an Instructor. He and James Cason, who arrived at the same time, were the first appointments in a planned post-war expansion of organic chemistry by Wendell Latimer. They initiated new courses and planned the further expansion that included the appointment of Henry Rapoport the following year and Donald Noyce three years later. Dauben was promoted to Assistant Professor in 1947, Associate Professor in 1952 and Professor in 1957. During his long career at Berkeley, he helped to train many undergraduate, graduate and postdoctoral students; 101 students received their Ph.D. degrees under his direction and 105 post-doctorates worked with him. He was active in research until he died and during his life published almost 400 papers.

1970s › *William Dauben in the classroom.*

1963 › *Photograph of newly constructed three-story Bio-dynamics Lab created for faculty member Melvin Calvin after he received his Nobel Prize. Designed by College of Environmental Design faculty member Michael A. Goodman who designed a number of campus buildings including Wheeler Hall. The three-story, doughnut-shaped structure was designed by Calvin and had an open interior with radial lab benches, all intended to foster an atmosphere of cooperative teamwork. Upon Calvin's retirement, the building was renamed the Melvin Calvin Laboratory.*



Harold Johnston was in a unique position to evaluate the Haagen-Smit proposal that Los Angeles smog was created by photochemistry of organic compounds. Early on, Johnston recognized the genius of this idea. In 1952, he proposed that free radical reactions were at the heart of this chemical mechanism, a concept we now take for granted.

1975 › *Harold Johnston, seen here with some of his writings on the pioneering studies of atmospheric kinetics which were basic scientific contributions that led to extraordinary insights that transformed how we think about the Earth's atmosphere.*

1989 › *David Templeton was a faculty member at the College starting in the late 1940s after stints in the Manhattan Project and completing his Ph.D. at Berkeley with Glenn Seaborg. Lieselotte (Lilo) Templeton (née Kamm) received her Ph.D. in chemistry in 1950 with Leo Brewer. For part of the 1960s, and then nearly continuously from the early 1970s onwards, the two conducted many crystallographic experiments and wrote many scientific papers together. This culminated in their being selected to jointly receive the Patterson Award for crystallography in 1987. Their pioneering work made possible the development of multi-wavelength anomalous diffraction phasing, now a standard method for protein structure analysis.*

John Hearst (1935-2022) was born in Vienna, Austria. He completed his B.E. in chemical engineering at Yale University in 1957 followed by a Ph.D. in chemistry at CalTech in 1961. From 1961-62, John was an NSF Postdoctoral Fellow at Dartmouth College. He joined the faculty at UC Berkeley as an assistant professor in the fall of 1962 and retired in December 1995.

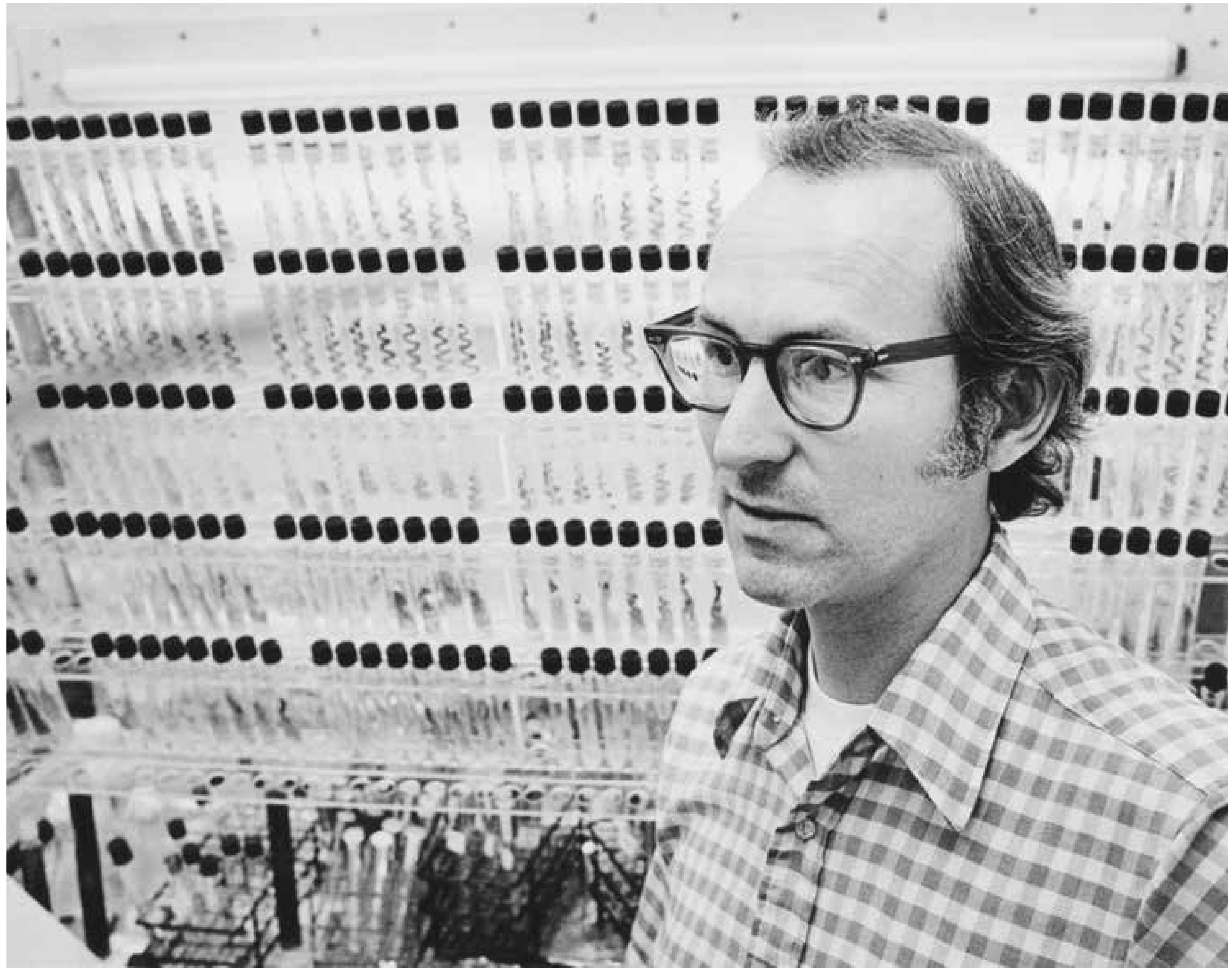
John was a prominent figure in the field of psoralen interactions with nucleic acids, an area of research that he largely developed. One of his Ph.D. students, Thomas Cech, received the Nobel Prize in 1989 for his discovery that RNA can be catalytic. In the 1970's, John collaborated with his colleague, Henry Rapoport, on developing a photochemical method of inactivation of pathogens that became the basis for the work of a series of companies cofounded with Henry Rapoport and Stephen Isaacs.

1987 › *John Hearst*

Kenneth Sauer (1931-2022) was born in Cleveland, Ohio. He completed his A.B. degree in chemistry at Oberlin College in 1953. He then moved to Harvard University for graduate studies in gas-phase photochemistry with George Kistiakowsky. Ken obtained his Ph.D. in physical chemistry in 1958 and taught at the American University of Beirut in Lebanon until 1960. In 1960, Ken came to Berkeley to study photosynthesis as a postdoctoral fellow with Melvin Calvin.

Ken joined the Berkeley faculty in the Department of Chemistry in 1963 and was promoted to full Professor in 1972. In his early research, Ken's work concentrated on the two light reactions of photosynthesis, Photosystem I (PS I) and Photosystem II (PS II), and he later spent most of his career exploring the mysteries of the Z-scheme. He developed sophisticated analytical devices to provide a more detailed picture of the nature of the components and their arrangement in the photosynthetic light reactions. He retired in 2001.

1987 › *Kenneth Sauer*

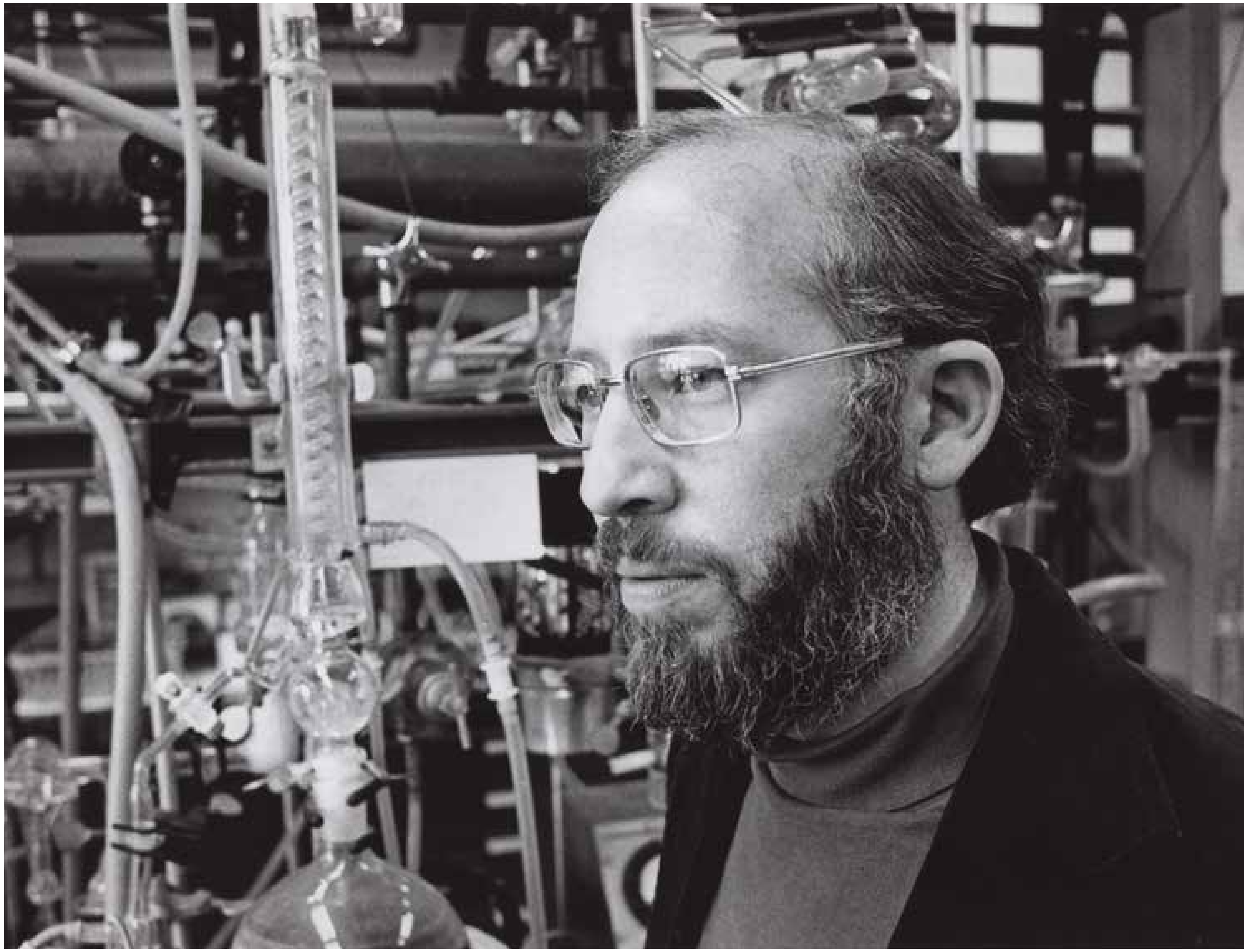


Gabor A. Somorjai (Ph.D. '60, Chem) had a nearly five decade-long research career at UC Berkeley, beginning with his study of metalized catalysts using small angle X-ray scattering in 1960. He co-authored more than 1,200 scientific papers and three textbooks on surface chemistry and heterogeneous catalysis. He mentored over 400 graduate students and postdoctoral fellows, many of whom went on to prominent positions in Department of Energy national laboratories and major universities as world class surface science and energy conversion researchers. He is the recipient of numerous awards including the Wolf Prize and the Priestley Medal. Most recently in early 2023, President Biden awarded him, along with Professor Darleane Hoffman, the Enrico Fermi award which is one of the oldest and most prestigious science and technology honors bestowed by the U.S. government.

1971 › *Gabor Somorjai*

Robert G. Bergman joined the College from a faculty position at Cal Tech in 1977. Trained as an organic chemist, he spent the first part of his independent career studying reaction mechanisms. In 1972 he discovered a transformation of ene-diynes that was later identified as a crucial DNA-cleaving reaction in several antibiotics that bind to nucleic acids. In the mid-l970's Bergman's research broadened to include organometallic chemistry, He is probably best known for his discovery of the first soluble organometallic complexes that undergo intermolecular insertion of transition metals into the carbon-hydrogen bonds of alkanes and the application of this class of reactions to problems in organic synthesis. He has received many notable awards including the Wolf Prize (2017), the U. S. National Academy of Sciences Award in Chemical Sciences (2007), and the E.O. Lawrence Award in Chemistry (1993).

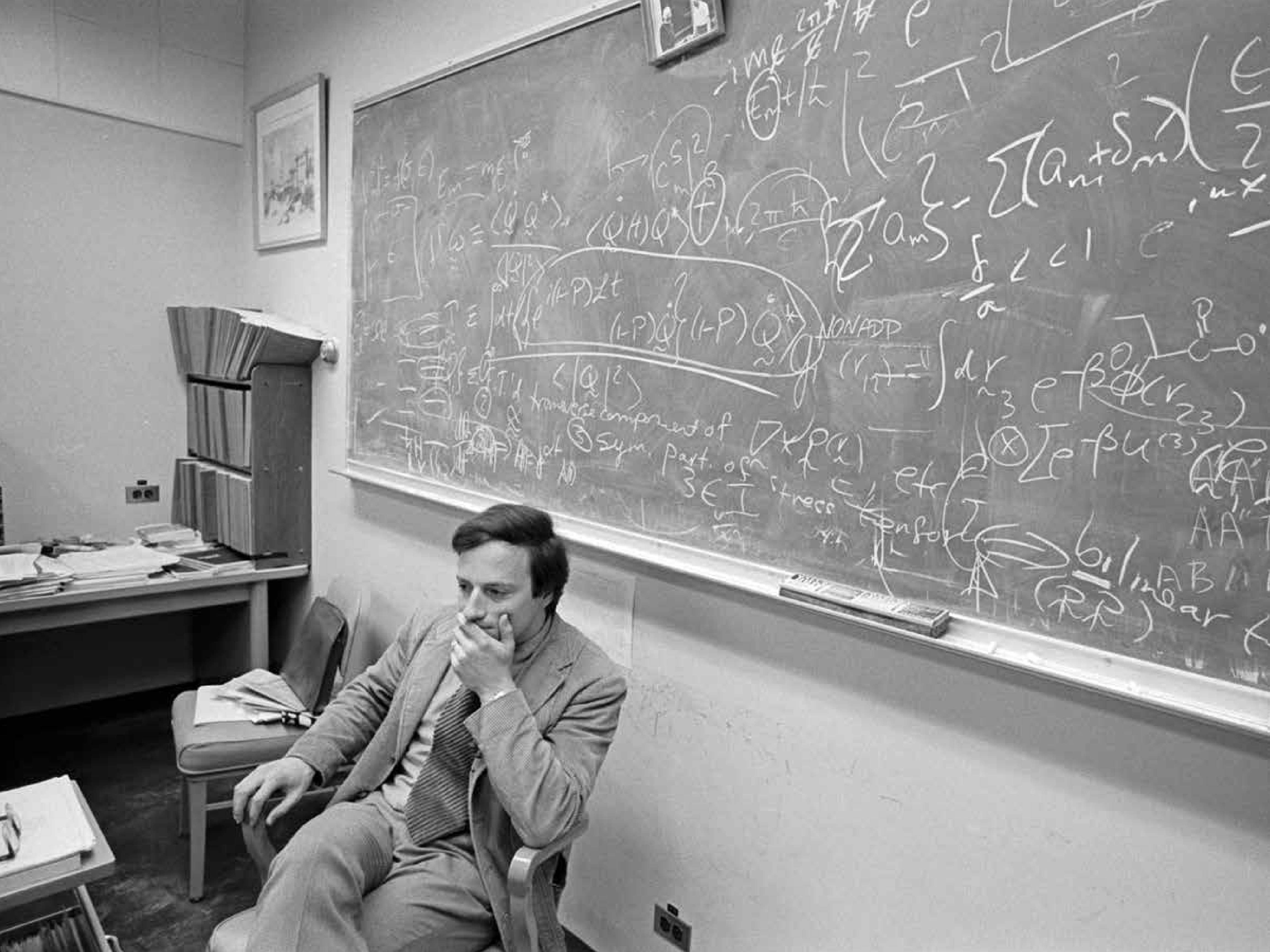
1982 › *Robert Bergman*



Heino Nitsche, (1949 – 2014) was a nuclear chemist, chemistry professor and senior scientist at Berkeley Lab. Nitsche first worked at the Berkeley Lab from 1980 to 1993 after completing his Ph.D. at the Freie Universität Berlin. His early research focused on the environmental chemistry of actinides but later grew to include the search for new heavy elements. In 1993 he returned to Germany to assume the directorship of the radiochemistry division of the Dresden-Rossendorf Research Center. He also become a professor of radiochemistry at the Technische Universität, Dresden. Nitsche returned to Berkeley in 1998 to serve as a professor in the University's chemistry department, as a senior research scientist at Berkeley Lab, and founding director of Berkeley lab's new Glenn T. Seaborg Center, a role he held until 2002.

2005 › *Heino Nitsche with Julia Chamberlain in the lab.*

1974 › *Theoretical chemistry in the 1970s. William Gelbart sits in front of an equation in his office.*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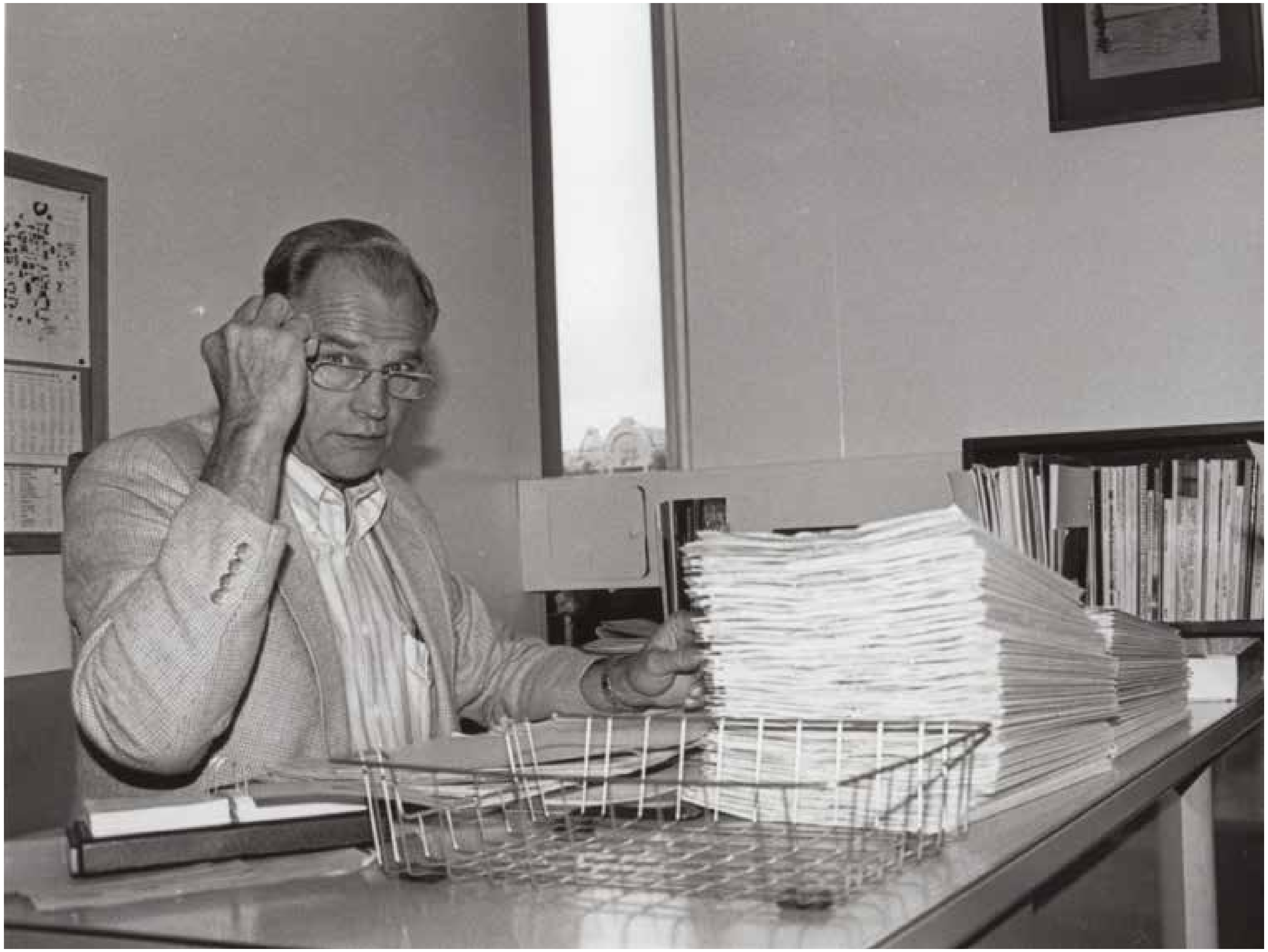


After graduate degrees at Caltech, and a postdoc at the Technical University in Delft, Netherlands, Scott Lynn spent 12 years as a Senior Research Engineer at Dow Chemical Company. In 1967, he joined the chemical engineering faculty at Berkeley. Lynn's career at Berkeley was marked by teaching industrial and design processes in the field of chemistry. His research interests involved process synthesis and design, especially in the fields of industrial electrochemistry, inorganic chemicals, removal of H2S from gases at high and low temperatures and pressures, pollution abatement, and methods of treatment of industrial waste water.

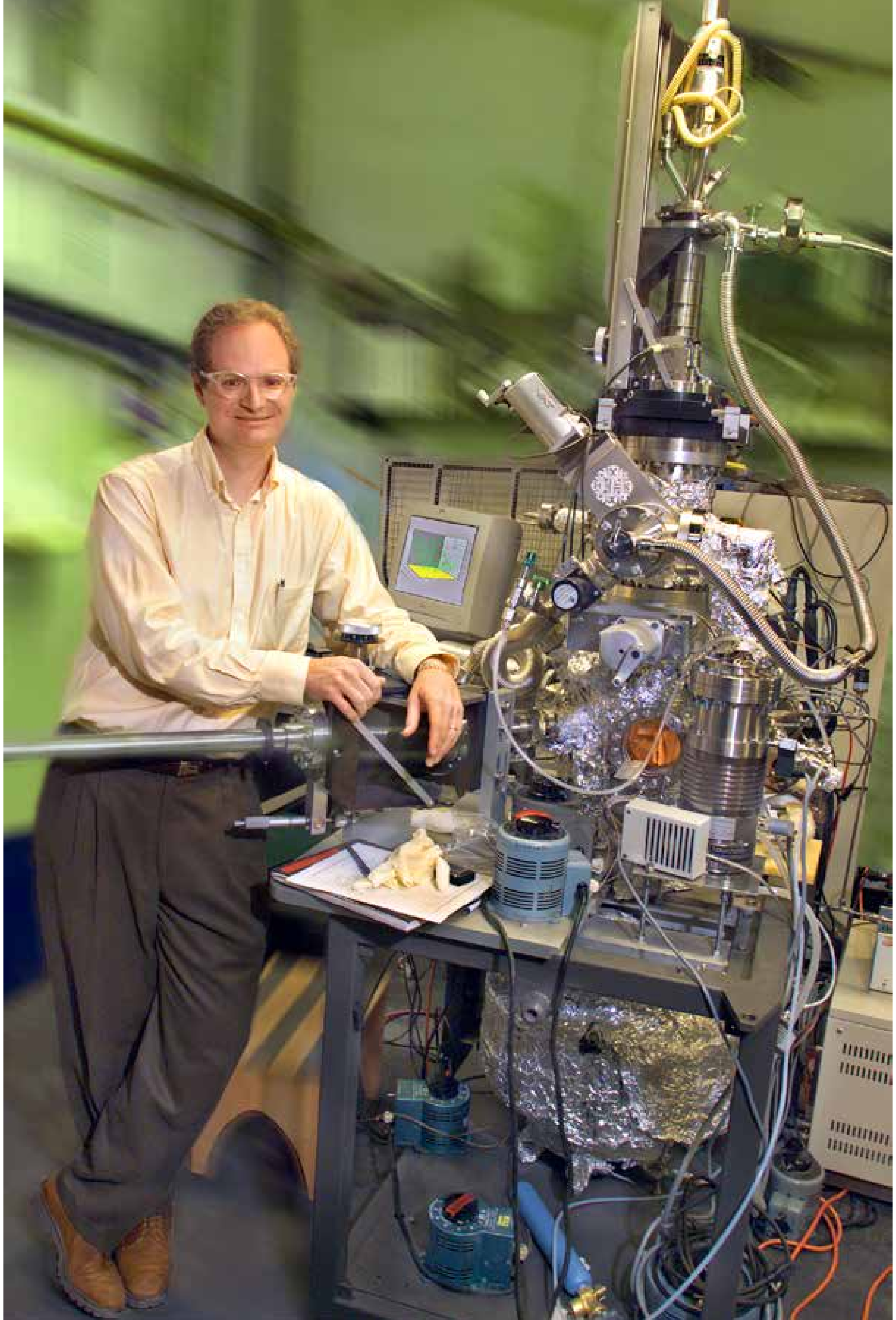
n.d. › *Scott Lynn (1928-2022)*

2002 › *Early members of the Pitzer Center for Theoretical Chemistry. (l to r) William Miller, Birgitta Whaley, WIlliam Lester, Martin Head-Gordon, and David Chandler.*


Alex Pines

Alex Pines is a pioneer in the development and applications of nuclear magnetic resonance (NMR) spectroscopy. In his early work, he demonstrated time-reversal of dipole-dipole couplings in many-body spin systems, and introduced high sensitivity, high resolution NMR of dilute spins such as carbon-13 in solids (proton-enhanced nuclear induction spectroscopy), thereby helping to launch the era of modern solid-state NMR in chemistry. He also contributed to the areas of multiple-quantum spectroscopy, adiabatic sech/tanh inversion pulses, zero-field NMR, double rotation and dynamic-angle spinning, iterative maps for pulse sequences and quantum control, and the quantum geometric phase. His combination of optical pumping and cross-polarization made it possible to observe enhanced NMR of surfaces and the selective «lighting up» of solution NMR and magnetic resonance imaging (MRI) by means of laser-polarized xenon.

2007 › *Alex Pines in his office in Hildbrand Hall.*

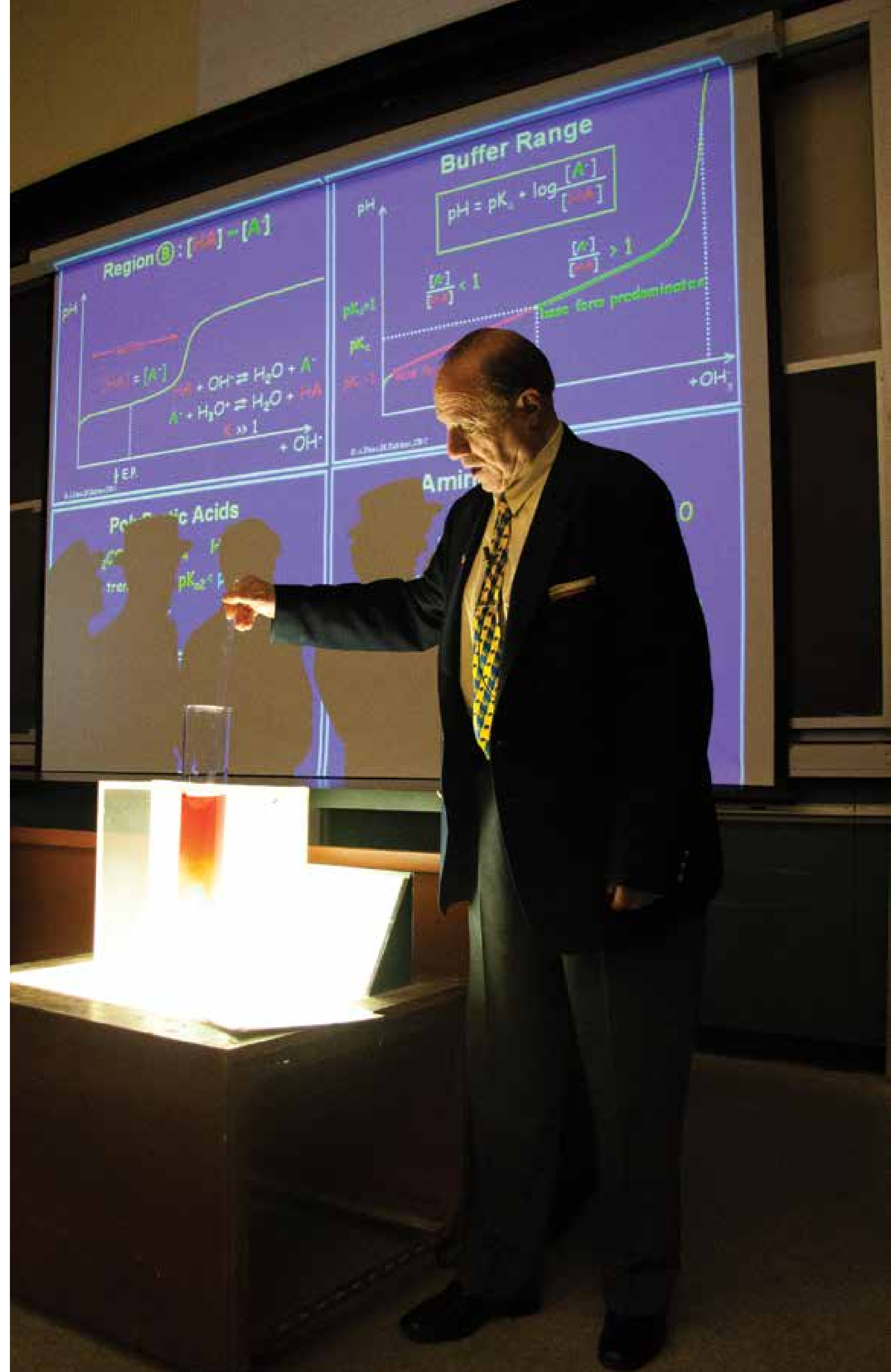


Armand Paul Alivisatos (Ph.D. ’86, Chem) is an internationally recognized authority on nano chemistry in the synthesis of semiconductor quantum dots and multi-shaped artificial nano-structures. He is considered a world expert on the chemistry of nanoscale crystals.

Currently he is the 14th President of the University of Chicago and the John D. MacArthur Distinguished Service Professor. He previously served as the Executive Vice Chancellor and Provost (EVCP) of the University of California, Berkeley. From 2009-2016 he served as Director of the Lawrence Berkeley National Laboratory. A member of Berkeley’s faculty from 1988-2021, he held professorships in the departments of chemistry and materials science, and served in several administrative roles, including Vice Chancellor for Research.

2010 › *Paul Alivisatos in his lab in Hildebrand Hall.*

2018 › *Our faculty showing their colors. Group photo of chemistry and chemical and biomolecular engineering faculty in the foyer of Zellerbach Hall ahead of commencement.*



2006 › *Joel Hildebrand was the inventor of Chem 1A's fabled Big Game Titration in the 1930s. Nuclear chemist Sam Markowitz taught Chem 1A from the early 1960s through the mid 2000s. He performs a titration before the annual homecoming game changing the chemicals from Stanford's red to Cal's blue and gold to make sure of Cal's win over Stanford.*

2006 › *The Cal band annually parades to great fanfare into Pimentel Hall the day before the "Big Game" against Stanford and plays during the Chem 1A Big Game Ttitration ceremony.*

2019 › *John Arnold teaches Chem 1A in Pimentel Hall.*

2019 › *A full size mural is placed in the lobby of Pimentel Hall to celebrate the Mars Mariner mission and life of George Pimentel.*

The rise of the Nobel Laureates


JENNIFER A. DOUDNA

The Nobel Laureate tradition at the College of Chemistry

The College of Chemistry is honored that in our first 150 years, eight faculty and 10 alumni have been awarded the Nobel Prize in Chemistry. As of this year, three of our laureates are women with alumna Frances Arnold (Ph.D ’85, ChemE), professor Jennifer Doudna, and alumna and former professor Carolyn Bertozzi (Ph.D. ’93, Chem). No other university in the world can claim this honor.

The first Berkeley chemist associated with the Prize was alumnus Harold Urey (Ph.D. ’23, Chem). Under the direction of Gilbert N. Lewis, he received a doctorate for his dissertation on electron distribution in the energy levels of the hydrogen atom and thermodynamic calculations on gaseous molecules. He was awarded the Nobel Prize in 1934 “for his discovery of heavy hydrogen”.

Next was Willard Libby who received his Ph.D. in 1933. He was the second college alumni after Harold Urey to be awarded the Nobel Prize in 1960 “for his method to use carbon-14 for age determination in archaeology, geology, geophysics, and other branches of science.”

The first Berkeley faculty member to win the Nobel Prize in Chemistry was William Giauque in 1949 for his contributions in the study of properties of substances at extremely low temperatures. He invented a magnetic cooling device that allowed him to attain temperatures near absolute zero, which is about 460 degrees below zero Fahrenheit and 275 degrees below zero centigrade.

Professor Glenn Seaborg shared the 1951 Nobel Prize for Chemistry with Berkeley physicist Edwin McMillan for their discoveries of transuranium elements. Seaborgium was named in honor of Seaborg, making him the only person for whom a chemical element was named during his lifetime.

Professor Melvin Calvin was awarded the 1961 Nobel Prize for Chemistry for his discovery of the chemical pathways of photosynthesis. Calvin’s original research at Berkeley was based on the discoveries of Martin Kamen and Sam Ruben in long-lived radioactive carbon-14 in 1940. By 1946, Calvin had begun his Nobel prize-winning work on photosynthesis.

In 1986, professor emeritus Yuan T. Lee was awarded the Nobel Prize in Chemistry along with former professor Dudley Herschbach and John Polanyi for their work “for their contributions concerning the dynamics of chemical elementary processes”. Lee is a world leader in the development of molecular beam techniques and their application to the study of chemical dynamics. His work has heavily influenced many areas of physical chemistry.

While at Berkeley, former professor Dudley Herschbach (1959-1963) developed his first crossbeam instrument large enough for reactive scattering experiments. After Lee received his Ph.D. in 1965, he went on to a postdoc with Herschbach at Harvard where they commenced their crossbeam molecular research. Lee would join the faculty at the University of Chicago before returning to Berkeley in 1974.

Jennifer Doudna’s Nobel Prize in Chemistry was awarded in 2020 with Emmanuel Charpentier for their revolutionary discovery of the gene editing tool CRISPR/CAS 9. She was awarded the prize during the middle of the COVID epidemic. That year there was no award ceremony in

Stockholm. Her award was flown to the United States by diplomatic courier and given to her by the Honorary Consul General of Sweden Barbro Osher at Doudna's home.

David MacMillan's award also came in the time of COVID. For a second year there was no awards ceremony in Stockholm. He shared the 2021 Nobel Prize in Chemistry with Benjamin List "for the development of asymmetric organocatalysis". MacMillan thought it was a prank when List called him and said they had won the Nobel Prize. "[When I did get up,] I opened up the New York Times website and there's my face!" MacMillan said. "That has got to be one of the most unbelievably surreal moments of my entire existence. I went back upstairs and woke my wife to tell her, 'I just won the Nobel Prize!' It was just completely bizarre but fantastic at the same time."

And to cap our 150th anniversary, we were ecstatic when Carolyn Bertozzi was awarded the prize this year for her discovery research in bioorthogonal chemistry. She is the eighth woman in the Nobel's 121 year history to win the award and shares it with "click" chemists Morten Meldal and Barry Sharpless. "[Eight women] is not a huge number, but I'm very optimistic because there's so much talent, and I'm lucky enough to be the one of the women who's picked to share the prize this year," Bertozzi said. "Then I have a platform now that I can use to hopefully, you know, keep that trend moving in the right direction."

2020 › *Jennifer Doudna presents her Nobel Prize in Chemistry medal after the brief ceremony in her home. Due to COVID the event in Stockholm was cancelled that year.*

William F. Giauque

Awarded the Nobel Prize in Chemistry 1949 “for his contributions in the field of chemical thermodynamics, particularly concerning the behavior of substances at extremely low temperatures.”

William Giauque was the first Berkeley faculty member to win the Nobel Prize in Chemistry for his contributions to the study of properties of substances at extremely low temperatures. He invented a magnetic cooling device that allowed him to attain temperatures near absolute zero, which is 460 degrees below zero Fahrenheit and 273 degrees below zero centigrade.

Giauque’s research enabled him to predict what would happen with elements at higher temperatures and opened a new frontier for scientists investigating the properties of matter.

Practical applications of his research brought improved gasoline, stronger steel, longer-wearing rubber, better glass, and more efficient processes for industry.

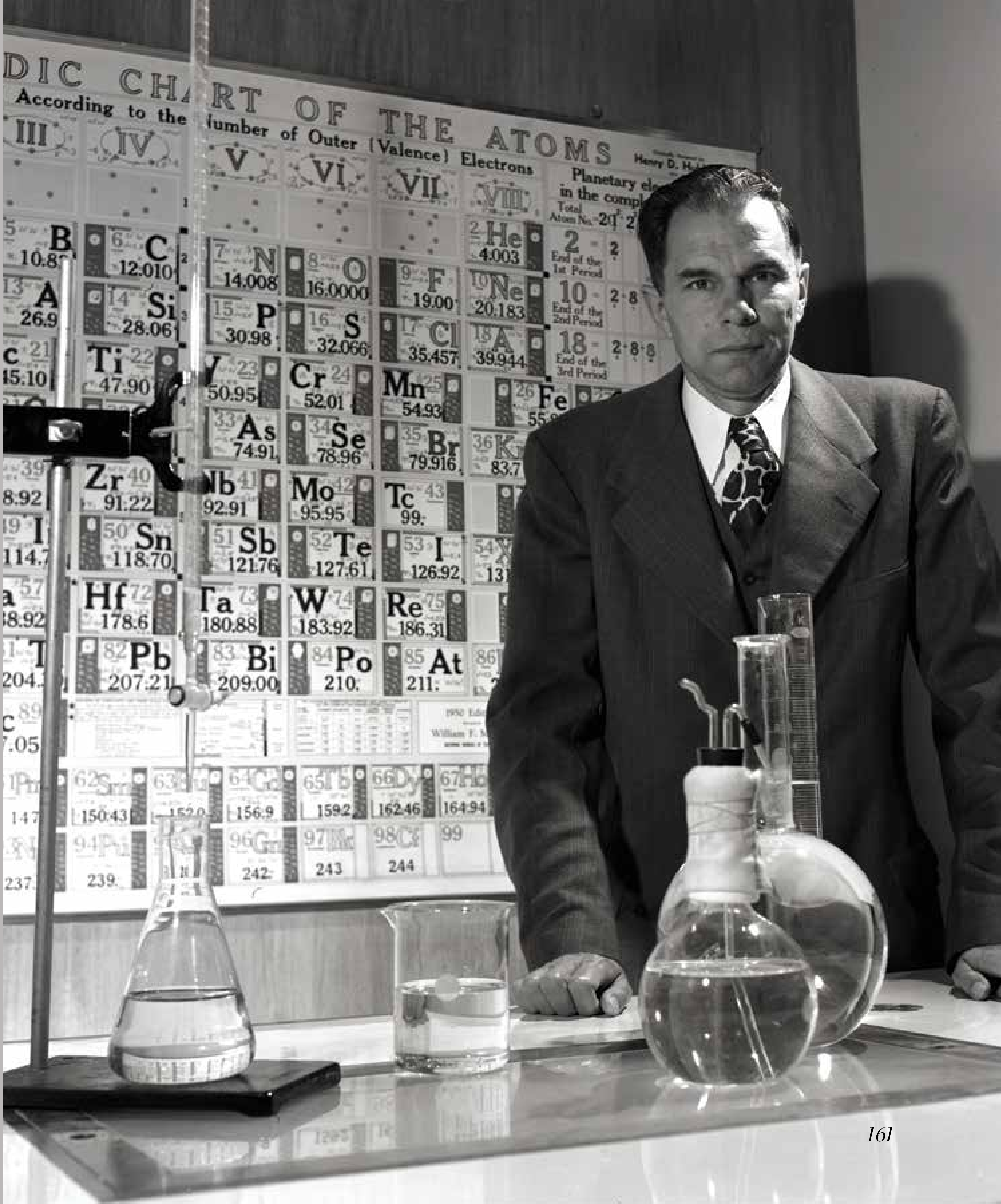
1966 › *Giauque photographed by Ansel Adams in his lab.*

Glenn T. Seaborg

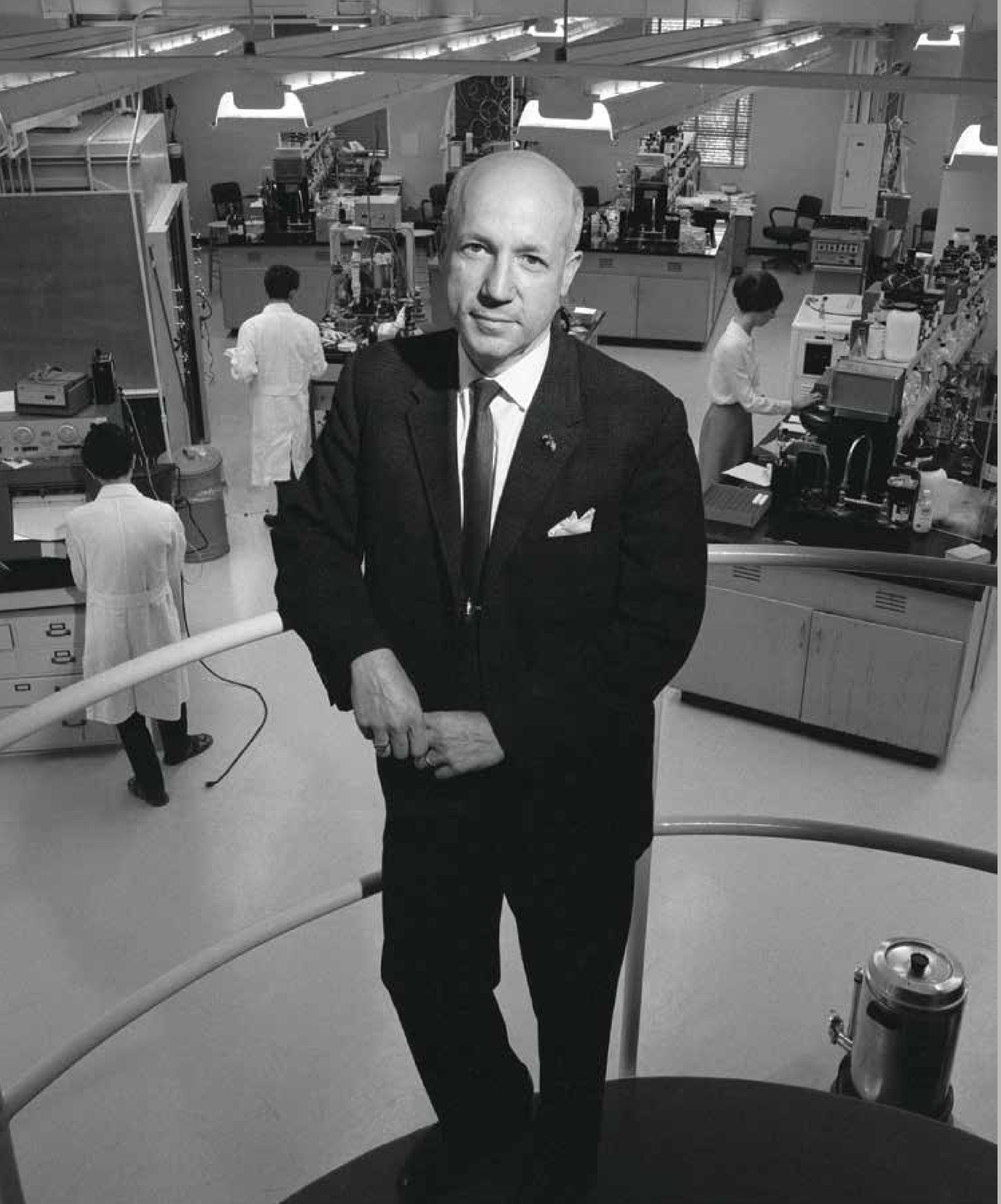
Awarded the Nobel Prize in Chemistry in 1951 with Edwin Mattison McMillan “for their discoveries in the chemistry of the transuranium elements.”

Glenn Seaborg was a world-renowned nuclear chemist, educator, scientific advisor to 10 U.S. presidents, and humanitarian. He is best known for his leadership of the team that in 1941 accomplished the first chemical separation and positive identification of plutonium and his “revolutionary” actinide concept (1944) in which he placed the first 14 elements heavier than actinium in the periodic table of elements as a 5f transition series under the lanthanide 4f transition series.

Seaborg was also well known as an educator and for his tireless efforts to improve U.S. science education at all levels. He served as chancellor of UC Berkeley from 1958 until 1961 when he was called by President-elect John F. Kennedy to chair the U.S. Atomic Energy Commission, a position he held until 1971.



1950 › *Publicity still of Seaborg with an ion exchange column for actinide elements.*



Melvin E. Calvin

Awarded the Nobel Prize in Chemistry in 1961 "for his research on the carbon dioxide assimilation in plants."

In the 1950s at Berkeley, Melvin Calvin, James Bassham, and Andrew Benson used the carbon-14 isotope as a tracer to map the route that carbon travels through a plant during photosynthesis. What became known as the Calvin-Benson cycle shows the stages of chemical reactions that take place in chloroplasts during photosynthesis.

Explanation and clarification of the mechanisms of photosynthesis led to Calvin being the sole recipient of the 1961 Nobel Prize for Chemistry. In 1963, Calvin was given the additional title at UC Berkeley of Professor of Molecular Biology. He was the founder and Director of the Laboratory of Chemical Biodynamics and the Associate Director of Berkeley Radiation Laboratory.

1966 › *Calvin photographed by Ansel Adams in his lab.*

2022 › *(l to r) Jennifer Doudna, Carolyn Bertozzi, and Frances Arnold celebrate their Nobel Prize awards in Chemistry in Stockholm, December 9, 2022.*

Dudley R. Herschbach

Awarded the Nobel Prize in Chemistry in 1986 with Yuan T. Lee and John Polanyi “for their contributions concerning the dynamics of chemical elementary processes.”

Dudley Herschbach received his Ph.D. in chemical physics from Harvard University in 1958. He taught at UC Berkeley from 1959 until 1963. He went on to join the faculty at Harvard University.

At Harvard, Herschbach decided to try a new program for exploring chemical reactions. At the time, observing chemical reactions was very static. He focused on a variation of the accelerated beams that were rapidly becoming a basic experimental tool of elementary particle physics. He invented what is now known as the crossed molecular beam technique: a pair of beams in a vacuum chamber bringing different kinds of molecules together in a collision that allows the resulting chemical reaction to be traced with great precision.

1986 › *Herschbach photographed by Rolf Hamilton at the Nobel ceremony.*

Yuan T. Lee

Awarded the Nobel Prize in Chemistry in 1986 with Dudley Herschbach and John Polanyi “for their contributions concerning the dynamics of chemical elementary processes.”

Yuan T. Lee developed the “universal crossed molecular beams” experiment, which opened up new areas of research in chemical reaction dynamics. In these experiments, two beams of reactant species intersect in a vacuum chamber. Scattered products are analyzed with mass spectrometry.

His experiments on the reactions of oxygen atoms with hydrocarbons provided the first definitive identification of the primary products from these reactions, many of which play a key role in combustion.

His photodissociation experiments on molecules ranging from ozone to complex hydrocarbons yielded new insights into the unimolecular decay of these species, with significant applications ranging from atmospheric science to the modeling of combustion chemistry.

1986 › *Lee photographed by Rolf Hamilton at the Nobel ceremony.*

Jennifer A. Doudna

Awarded the Nobel Prize in Chemistry in 2020 with Emmanuelle Charpentier "for the development of a method for genome editing."

Jennifer Doudna and colleague Emmanuelle Charpentier (director of the Max Planck Institute for Infection Biology) determined the development of CRISPR-Cas9, a genome editing breakthrough that has revolutionized biomedicine.

CRISPR-Cas9 allows scientists to rewrite DNA — the code of life — in any organism, including human cells, with unprecedented efficiency and precision. The including the treatment of thousands of intractable diseases.

While women have conducted research at UC Berkeley that, after they left the campus, won them a Nobel Prize, Doudna is the first woman on the UC Berkeley faculty to win the coveted award.

2021 › *Doudna photographed for the National Academies New Heroes series by Christopher Michel.*

David W.C. MacMillan

Awarded the Nobel Prize in Chemistry in 2021 with Benjamin List "for the development of asymmetric organocatalysis."

"Building molecules is a difficult art. Benjamin List and David MacMillan are awarded the Nobel Prize in Chemistry 2021 for their independent development of a precise new tool for molecular construction: organocatalysis. This has had a great impact on pharmaceutical research, and has made chemistry greener," the Royal Swedish Academy of Sciences noted in announcing the award.

While at Berkeley from 1998-2000, MacMillan's research centered on the development of novel reactions and enantioselective synthesis. In 2000 he reported his first major breakthrough, the first enantioselective organocatalytic Diels-Alder reaction, in which a small organic molecule, rather than a metal, was used to drive the production of a specific enantiomer. At the time, in need of a word to describe the process, he coined the term organocatalysis.

2022 › *MacMillan photographed at the College of Chemistry by Brittany Hosea-Small.*

Carolyn R. Bertozzi

Awarded the Nobel Prize in Chemistry in 2022 with Morten Meldal and K. Barry Sharpless “for the development of click chemistry and bioorthogonal chemistry.”

Bertozzi was recognized for founding the field of bioorthogonal chemistry, a set of chemical reactions that allow researchers to study molecules and their interactions in living things without interfering with natural biological processes.

While on the faculty at UC Berkeley, Bertozzi’s lab first developed the methods in the late 1990s and early 2000s. Since then, her lab and others have used those methods to answer fundamental questions about the role of sugars in biology, to solve practical problems, such as developing better tests for infectious diseases, and to create a new biological pharmaceutical that can better target tumors, which is now being tested in clinical trials.

2022 › *Bertozzi photographed for the National Academies New Heroes series by Christopher Michel.*

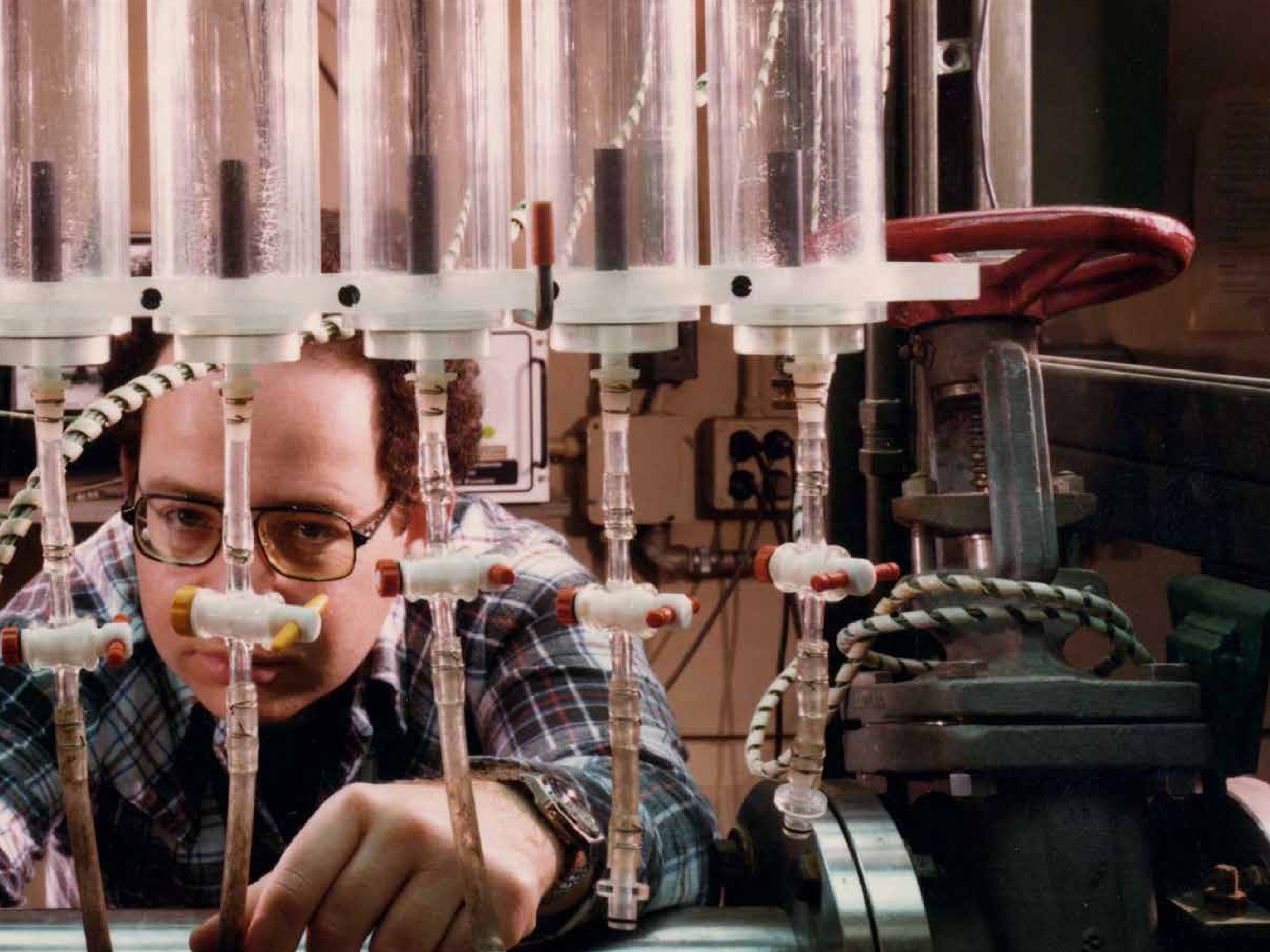
December 10, 2022 › *Carolyn R. Bertozzi receiving her Nobel Prize from H.M. King Carl XVI Gustaf of Sweden at Konserthuset Stockholm.*
PHOTOGRAPHED BY NANAKA ADACHI.

2019 › *Professors Alex Bell, Frances Arnold (Caltech), and Robert Bergman celebrate Arnold's 2018 Nobel Prize for pioneering the use of directed evolution to engineer enzymes during a private reception. Arnold received her Ph.D. in Chemical Engineering from the College with advisor Harvey Blanch in 1985.*

ALUMNI **NOBEL LAUREATES**

1934	**Harold C. Urey** (Ph.D. ’23)
1960	**Willard F. Libby** (B.S. ’31, Ph.D. ’33)
1973	**Geoffrey Wilkinson** (Postdoc ’50)
1983	**Henry Taube** (B.S. ’35, Ph.D. ’40)
1989	**Thomas Cech** (Ph.D. ’ 75)
1995	**Mario Molina** (Ph.D. ’72)
1996	**Robert F. Curl, Jr.** (Ph.D. ’57)
1999	**Ahmed Zewail** (Postdoc ’74)
2002	**Kurt Wüthrich** (Postdoc ’67)
2018	**Frances Arnold** (Ph.D. ’85)

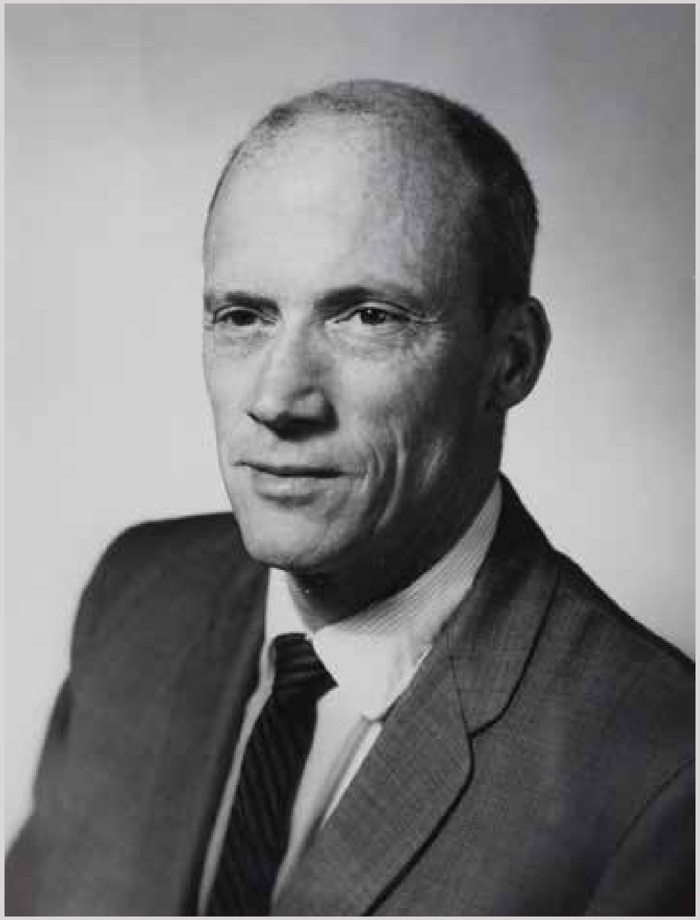
Chemical Engineering joins the College



Chemical Engineering Founding members

LeRoy Bromley had started at the College as a research assistant with chemistry professors Leo Brewer and Wendell Latimer for the Manhattan Project in 1943. He and Charles Wilke were the first official instructors hired in 1946 to establish formal instruction in chemical engineering. Theodore Vermeulen, who was the first Ph.D. in chemistry from UCLA, arrived in spring 1947. He came from the Shell Development Company. Charles Tobias and Donald Hanson were next, arriving in the fall of 1947.

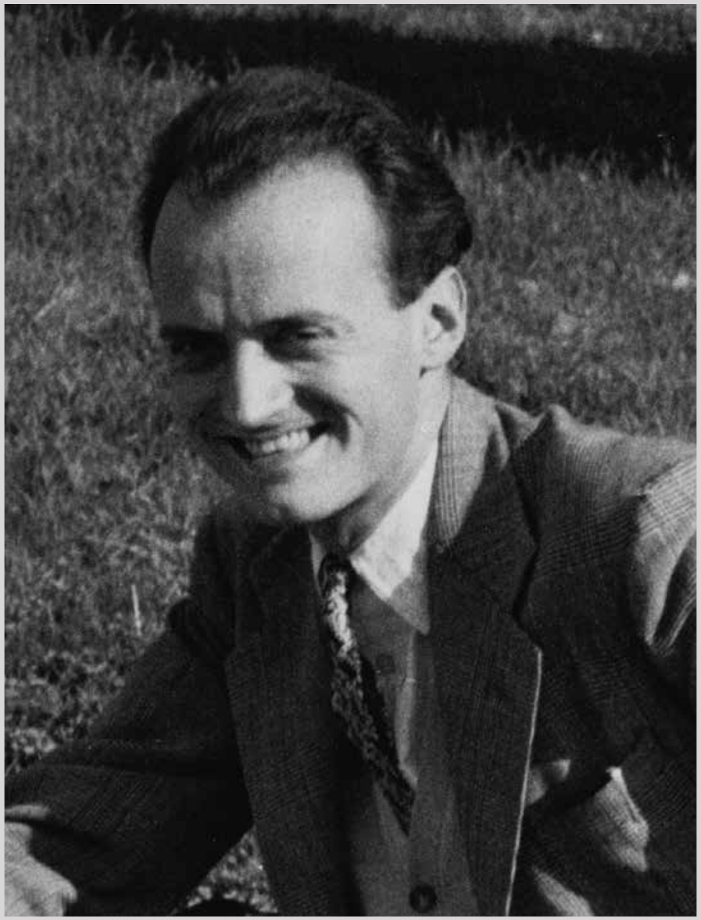
The Chemical Engineering program was approved to grant Ph.D. and B.S. degrees in 1947 and 1948. In 1949, the Department of Chemistry was renamed the Department of Chemistry and Chemical Engineering.



1946 › *LeRoy Bromley*

1946 › *Charles Wilke*

1947 › *Theodore Vermeulen*



1947 › *Charles Tobias*

1947 › *Donald Hanson*

1982 › *Chemical Engineering Faculty on the front steps of Gilman Hall.*
Left to right, front row: Michael Williams, Ralda Sullivan, Dennis Hess, David Soane, Charles Wilke. Harvey Blanch (behind and to the left of Hess). David Lyon (behind Hess and Soane). Simon Goren (behind Wilke). David Quady (behind Goren and Soane). Second row: Eugene Petersen, Alexis Bell, Morton Denn, Jeffrey Reimer. Third row: John Newman, John Prausnitz, Frank Valle-Riestra, Rolf Muller. Bud Blue (behind Denn). Fourth row: Scott Lynn, Judson King, Donald Hanson. Fifth row: Arthur Morgan, Edward Grens. Rear: Alan Foss, William Benjamin, Theodore Vermeulen. Not present: Elton Cairns, Clayton Radke

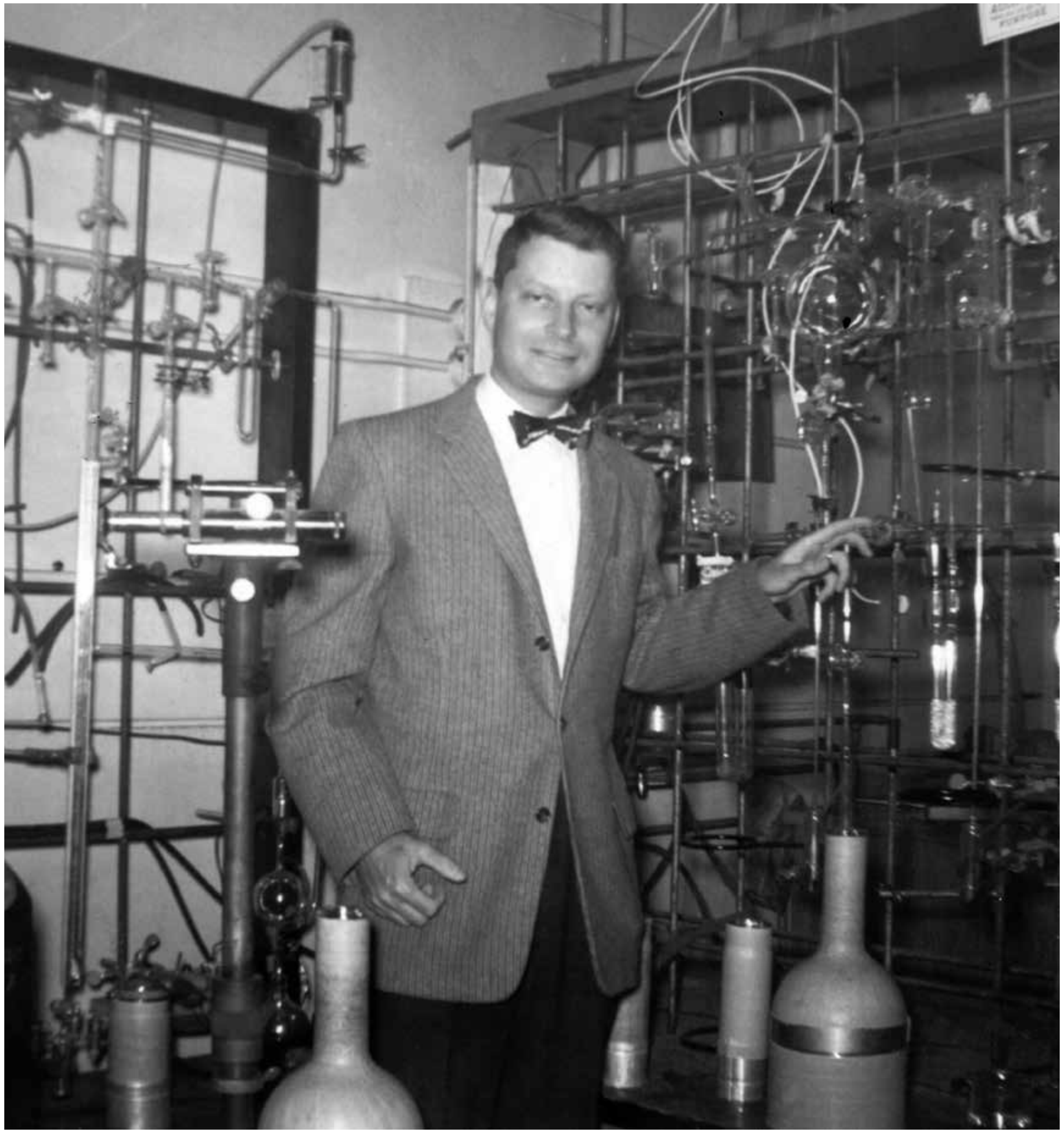
1949 › *The first AIChE Club at Berkeley. Marie H. Lavering (née Johnson) in the front row, was the first female Chemical Engineering graduate of the College. She received her B. S. degree in 1950 and went on to teach chemistry and physics at Vallejo High School.*

1949-1955 › *Charles Tobias gets ready to shoot a cap gun. (l to r) Mary Ellen Powell, Dick Powell, Jean Pitzer, Charles Tobias, Bill Gwinn, Don McClure's wife plugging her ears, Ken Pitzer, and Don McClure.*

1955 › *William Corcoran (Caltech faculty) together with Don Hanson and Ted Vermeulen at State College Airport, Pennsylvania, in connection with the American Society for Engineering Education Annual Conference.*

1960s › *Edward Grens joined the faculty in 1963, following a Ph.D. that year with Charles Tobias and a prior three-year career with Union Oil Company. He was interested in the use of digital computers for process simulation and other purposes within chemical engineering and launched the department's first graduate course in that area. His research concerned those areas, electrochemical energy storage and conversion, and processes for coal liquefaction. He left in 1987.*

1965 › *UC Chemical Engineers Against the War. (l to r) Peter Cukor (Ph.D. '71, ChemE with Prausnitz) whose career began with Teknekron before he went on to start his own companies. Bryan Rogers (Ph.D. '71, ChemE with Prausnitz), who went on to a multidimensional career in art and design, education and practice that culminated in his being Dean of the School of Art and Design at the University of Michigan.*



John Prausnitz, Professor of the Graduate School, has for more than sixty-five years been a major intellectual figure in Berkeley chemical engineering, and indeed in chemical engineering worldwide. He is the originator, and still the principal academic shepherd of, the field of molecular thermodynamics wherein fundamental properties of molecules and functional groups within molecules are used to predict macroscopic phase equilibria, which underlie the selection and design of large-scale separation processes such as distillation, extraction, and adsorption. He has expanded that work over the years to ever more complex systems, including polymers, colloids, and biological substances. His contributions reflect the benefits of the association of chemical engineering at the College, an unusual organizational feature that drew him to Berkeley originally in 1955.

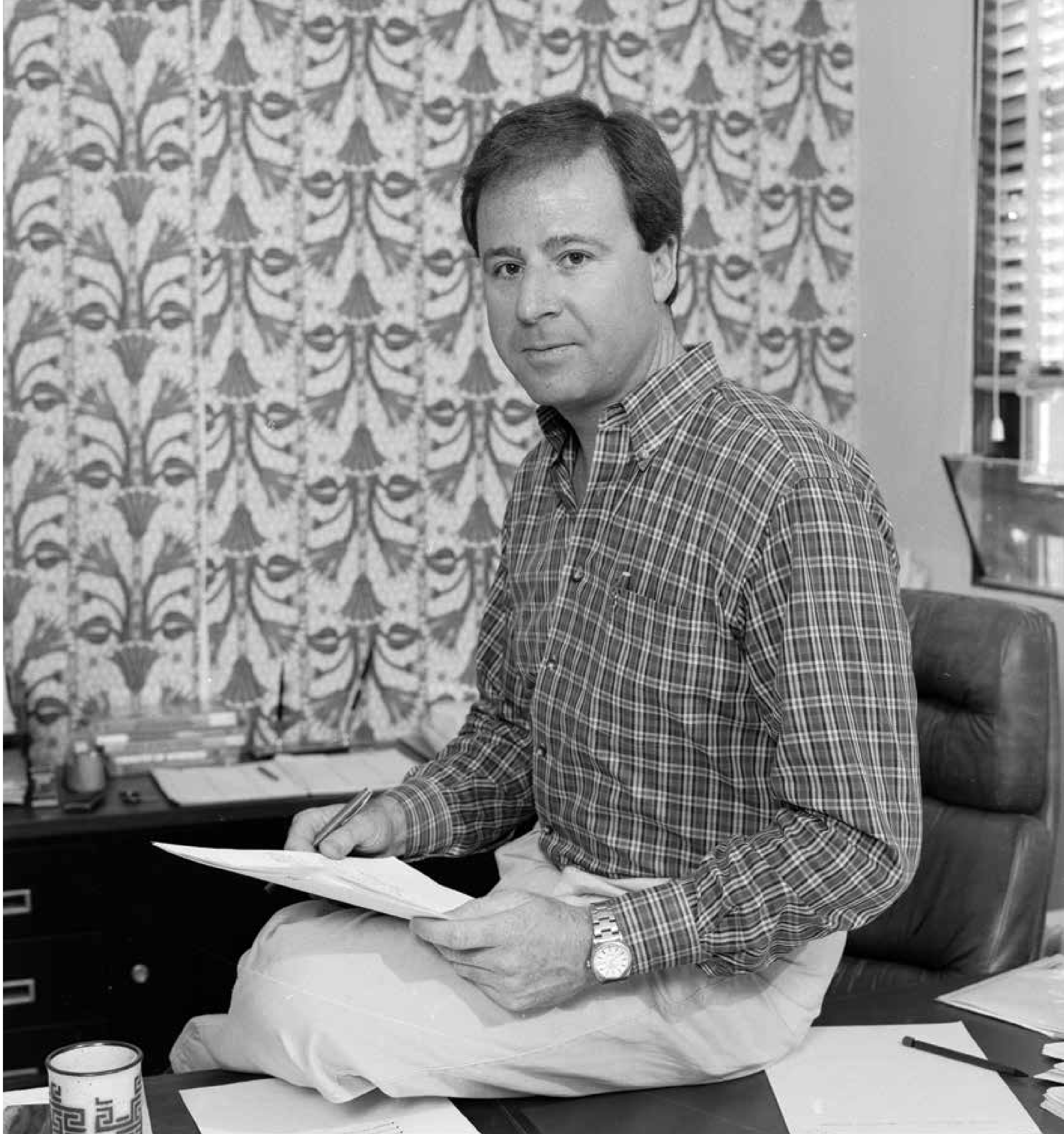
He has been acknowledged with numerous awards including the National Medal of Science in 2003. As of 2011, it was reported that Prausnitz had written 760 articles in 134 journals with 421 co-authors.

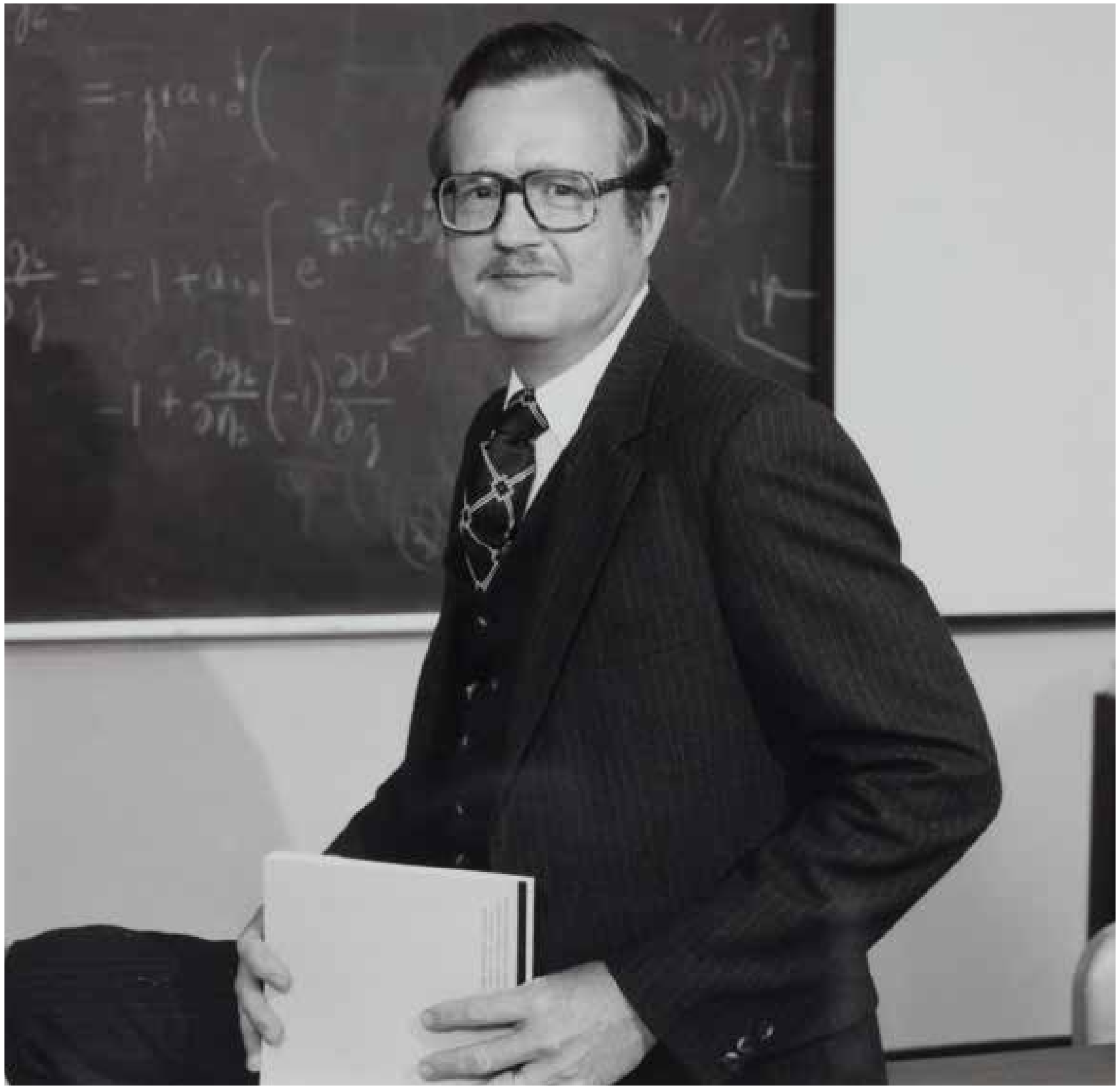
Besides his major scientific and educational accomplishments, Prausnitz is a man of broad classical interests. Throughout his career, he has exposed his students to non-scientific subjects including opera and art. More recently he started the ongoing Leonardo Project to encourage students to write about the interface of the arts, humanities, and technology.

1959 › *Publicity photo of John Prausnitz in the lab*

Throughout Harvey Blanch's research career, he has addressed both the fundamental and applied aspects involved in the biological production of therapeutic proteins to commodity chemicals. His recent research includes biothermodynamics, bioseparations, biofuels, protein interactions, DNA electrophoresis, and mammalian cell metabolism. Blanch was born and raised in Australia. He received his Ph.D. (1971) in chemical engineering at the University of New South Whales. He was a professor of Chemical Engineering at the University of Delaware before joining the College of Chemistry in 1982 where he served on the faculty until 2014. He was also a Senior Faculty Scientist at Berkeley Lab and CSTO of the Joint BioEnergy Institute from 2007-2014. Blanch currently is a Professor of the Graduate School at UC Riverside.

1986 › *Harvey W. Blanch*



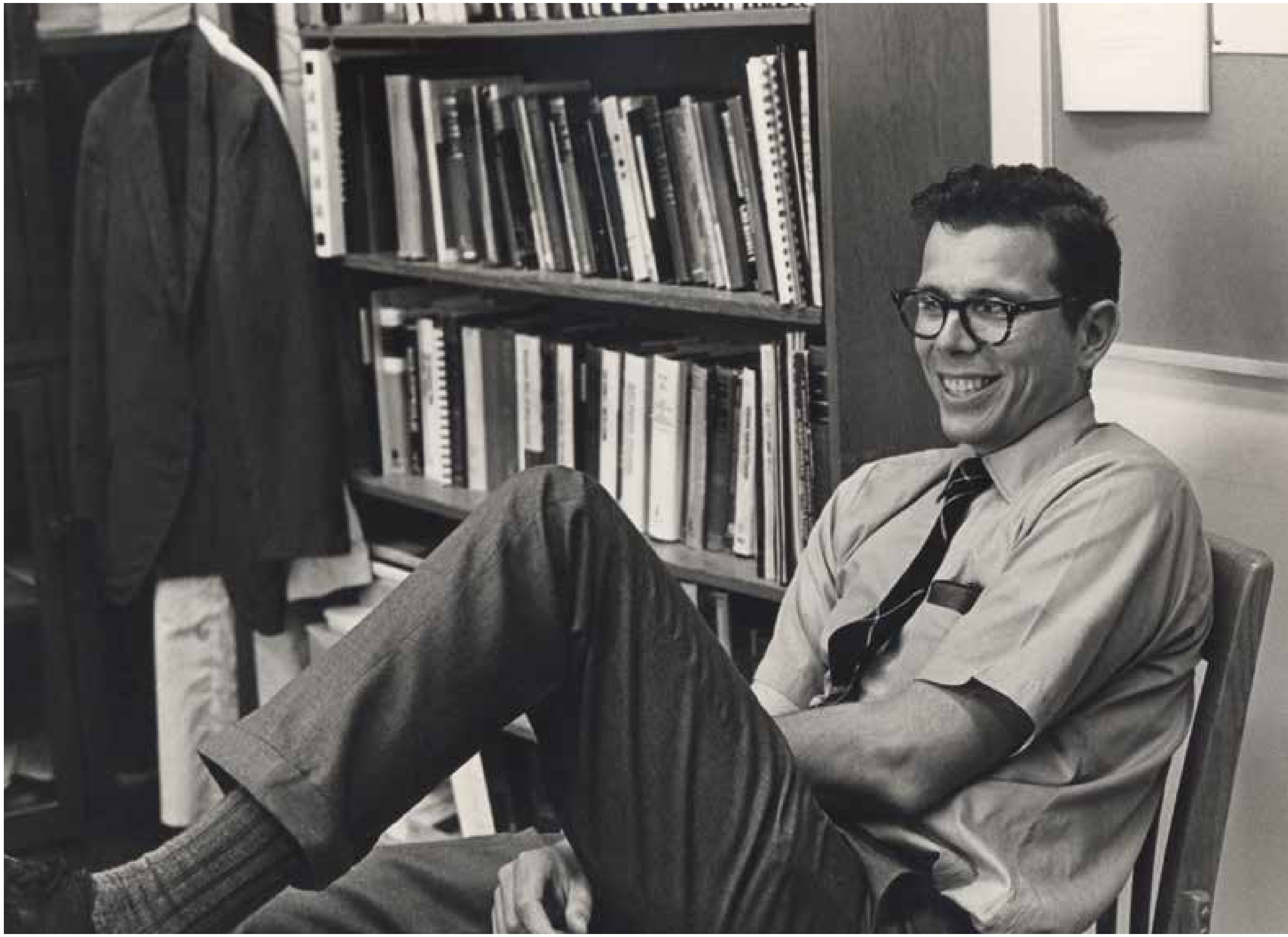


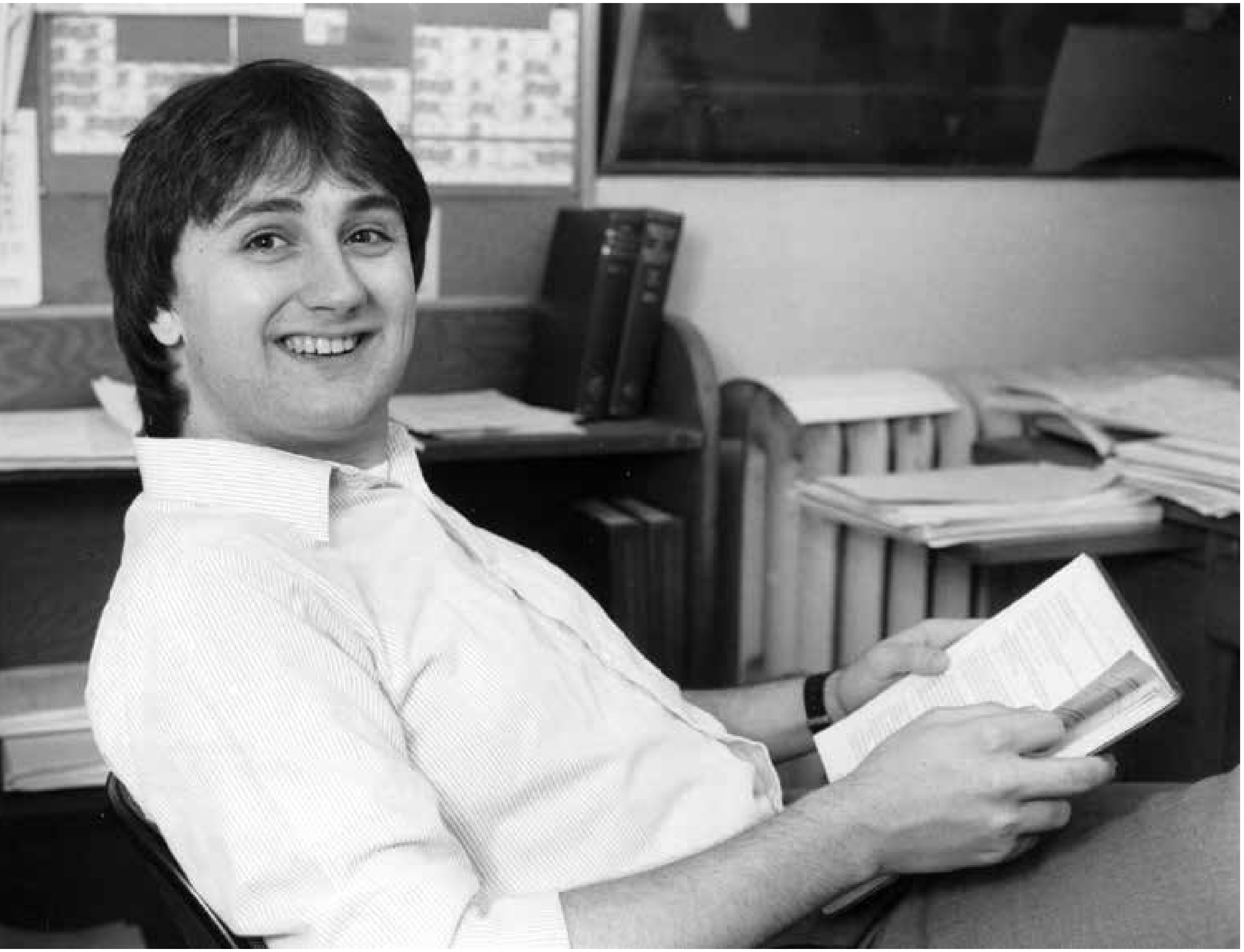
John Newman (Ph.D. ’63, ChemE), Professor Emeritus of Chemical and Biomolecular Engineering. Member of the faculty since 1963. His research interests include investigation of efficient and economical methods for electrochemical energy conversion and storage, development of mathematical models to predict the behavior of electrochemical systems and to identify important process parameters, and experimental verification of the completeness and accuracy of the models. Author of over 300 technical publications and the book Electrochemical Systems (3rd edition). He is a Fellow of The Electrochemical Society and member of the National Academy of Engineering. He is the recipient of many awards and honors including the Henry B. Linford Award for Distinguished Teaching, the Olin Palladium Medal, and the Vittorio de Nora Award.

1986 › *John Newman*

C. Judson King is Professor Emeritus of Chemical and Biomolecular Engineering, having researched and published extensively in the field for forty years of a sixty-year career at Berkeley. He chaired the Chemical Engineering Department from 1972-81 and was dean of the College from 1981-87. From 2004-14 he was Director of the Center for Studies in Higher Education on the Berkeley campus. He went on to become Provost and Senior Vice President of Academic Affairs for the University of California from 1995-04. King has published several books including the textbook on Separation Processes (1971, 1980) as well as *The University of California: Creating, Nurturing, and Maintaining Academic Quality in a Public University Setting (2008), and A History of Berkeley Chemical Engineering (2018).*

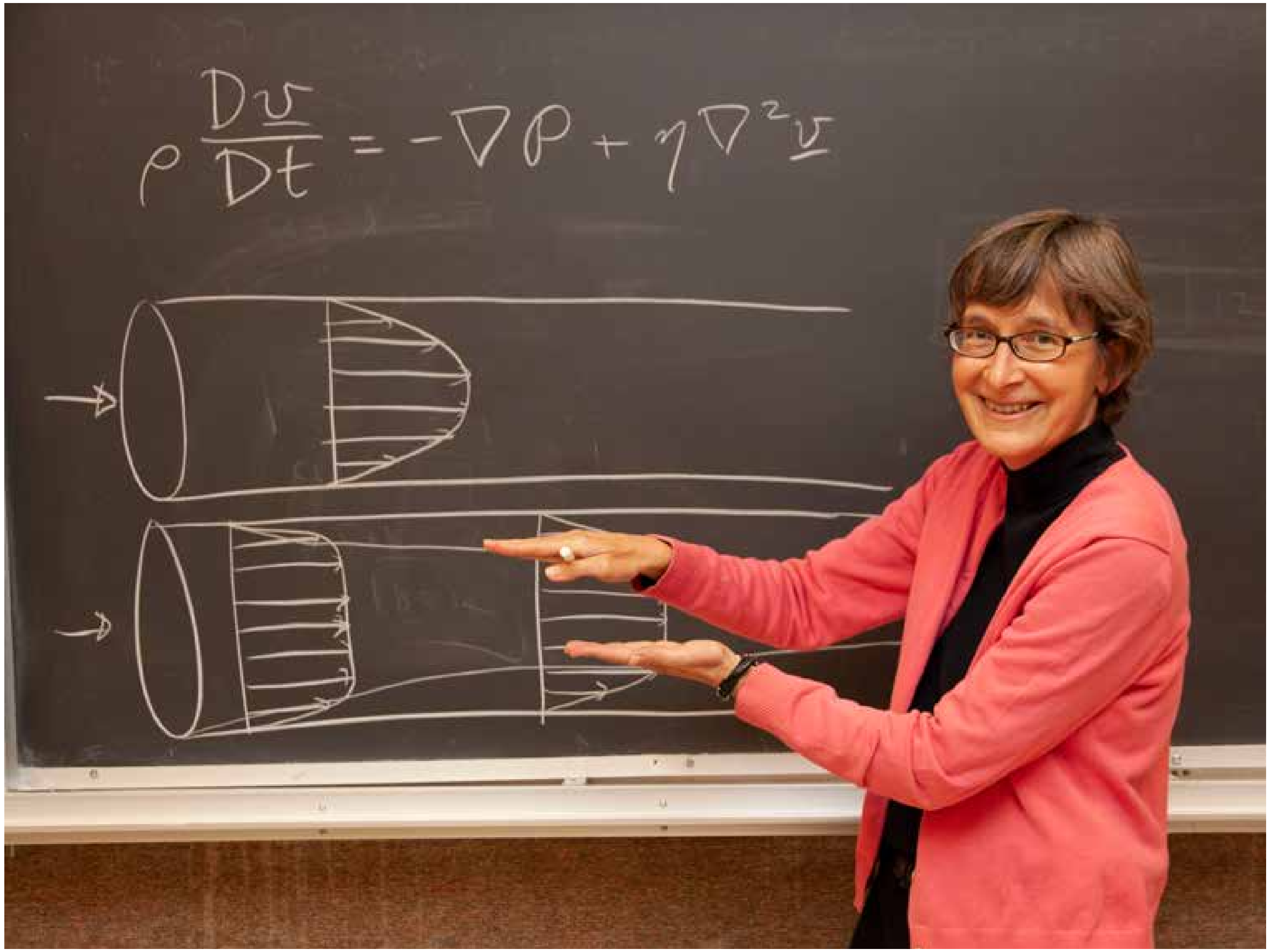
1986 › *C. Judson King*





Jeffrey A. Reimer received his bachelor's degree from UC Santa Barbara, and his doctorate from the California Institute of Technology in chemistry. After a postdoc at IBM Research in New York he joined the Berkeley faculty where he became the C. Judson King Endowed Professor and the Warren and Katharine Schlinger Distinguished Professor and Chair of the Chemical and Biomolecular Engineering Department. His research has generated new knowledge for environmental protection, sustainability, and provides fundamental insights into condensed matter via materials chemistry, physics, and engineering. He is a Fellow of the American Association for the Advancement of Science, of the American Physical Society, and of the International Society for Magnetic Resonance. He has published ~260 research publications and several textbooks.

1982 › *Jeffrey A. Reimer*



2012 › *Susan Muller teaching in the classroom. Susan is currently professor of the graduate school and professor emeritus of chemical and biomolecular engineering. She joined the College in 1991 coming from a technical position at AT&T Bell Labs. She studied the behavior of macromolecules—either naturally occurring biopolymers such as DNA or synthetic polymers such as polystyrene—in complex flows that arise when they are analyzed or processed. Her research focused on designing microfluidic devices for analysis of DNA and proteins, developing tools to study the dynamics of macromolecules in complex flows, and understanding the effects of macromolecules on the hydrodynamic stability of both microscale and large scale flows.*

Women scientists join the College

AGNES FAY MORGAN

Agnes Fay Morgan (1884-1968) majored in physical and organic chemistry at the University of Chicago receiving her Ph.D. in 1914. The "new Dr. Morgan" examined her fields of study and observed that there were many highly competent young men also looking for similar jobs. She decided to seek other related fields where there was less prejudice against women chemists.

Her interest in improving health and diet, plus an invitation to teach dietetics at UC Berkeley, combined to provide her with a faculty position in 1915. She accepted a job earning 2/3s of her male counterparts and never looked back.

Morgan pioneered the development of home economics as a scientific discipline and spearheaded research in nutrition. She began teaching and research when she arrived becoming a full professor in 1923; professor of home economics and biochemistry (1938–54); and department chair (1923–54). She received the prestigious Garvin-Olan Medal from the American Chemical Society for her work on vitamins in 1949 and the Borden Award from the American Institute of Nutrition in 1954.

She focused her research on the interrelationships between vitamin and hormone activities. Three primary areas of discovery included: that of vitamin D and the parathyroid secretion; of vitamin A and carotene to thyroid secretion; and of adrenal gland secretion to riboflavin and pantothenic acid. Her interest in public health led Morgan to her proof, via rats and dogs, that heat destroyed part of the nutritional value of proteins.

Throughout her career at Berkeley, she had a strong relationship with the College of Chemistry heading up the chemistry honorary society Iota Sigma Pi, of which she was a permanent national secretary.

1930 › *(r) Agnes Fay Morgan in her lab; (l) Students working in Morgan's lab.*

JUDITH KLINMAN

Judith P. Klinman is Professor of the Graduate School in Chemistry and Molecular and Cell Biology and a member of the California Institute for Quantitative Biosciences. She has contributed to the understanding of the fundamental properties that underlie enzyme catalysis.

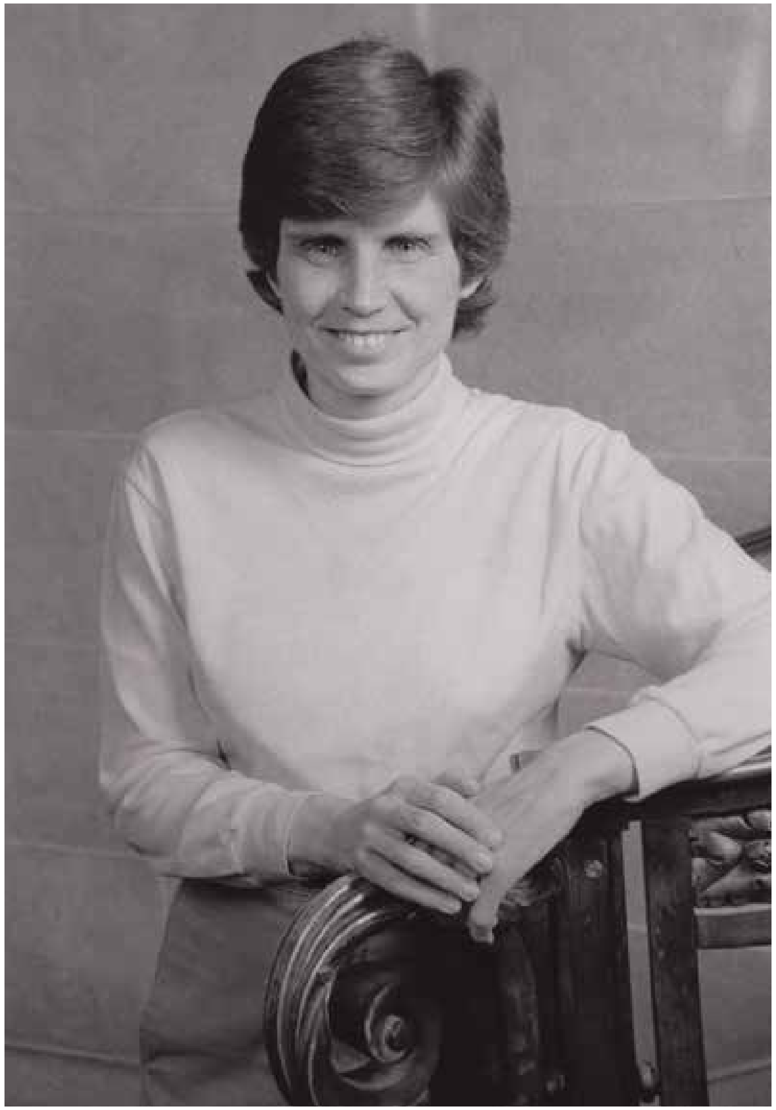
She joined the College in 1978 and was the first woman faculty member in the physical sciences at UC Berkeley. Early in her career at Berkeley, she developed the application of kinetic isotope effects to the study of enzyme catalysis, showing how these probes can be used to uncover chemical steps, to determine kinetic order, and to obtain substrate dissociation constants. In 1990, she demonstrated the presence of the neurotoxin 6-hydroxydopa quinone (TPQ) at the active site of a copper-containing amine oxidase from bovine plasma, overcoming years of incorrect speculation regarding the nature of the active site structure and opening up the currently active field of protein-derived cofactors. Subsequent work from her group showed that the extracellular protein lysyl oxidase, responsible for collagen and elastin cross-linking, contains a lysine crosslinked variant of TPQ.

Since the 1990s, Klinman's kinetic studies of enzyme reactions have demonstrated anomalies that implicate quantum mechanical hydrogen tunneling in enzyme-catalyzed hydrogen activation reactions. In recent years she has developed a unique set of experimental probes for determining the mechanism of oxygen activation.

During her tenure at Berkeley, she has been a Chancellor's Professor, Guggenheim Fellow, and Miller Fellow. In 2012, she was awarded the National Medal of Science, our countries top honor in the sciences, for her discoveries of fundamental chemical and physical principles underlying enzyme catalysis and her leadership in the community of scientists.

1982 › *Judith Klinman*

2014 › *Judith Klinman being presented the National Medal of Science by President Barack Obama during a ceremony at the White House on November 20, 2014. She was awarded the nation's highest honor in science for her discoveries of fundamental chemical and physical principles underlying enzyme catalysis and her leadership in the community of scientists.*



1987 › *Angelica Stacy*

ANGELICA STACY

Professor of Chemistry emeritus Angelica Stacy received her Ph.D. in chemistry from Cornell University (1981) with advisor Michell Sienko. She was a postdoctoral fellow at Northwestern University before joining the faculty at the College of Chemistry in 1983. Her chemical research interests included solid-state inorganic chemistry, with an emphasis on the synthesis and characterization of new materials and chemistry at the interface between materials. Her lab did research into superconductivity, valence fluctuations, magnetic ordering, Schottky junctions, and metal-support interactions. Generally, her research program was experimental including the synthesizing of new inorganic materials by reactions in solutions, electrochemical methods, and high-temperature techniques.

She was also very involved in service to the University. Stacy was outspoken about her commitment to issues surrounding diversity and equity in the sciences. She served as co-investigator and principal investigator of the University of the California Faculty Family-Friendly Edge, which is a Sloan Foundation research project based at UC Berkeley.

In 2001, she stepped into the role of associate vice provost for faculty equity in a new department created at that time. She was committed to promoting "data-driven initiatives to increase equity and inclusion in faculty recruitment, advancement, and retention".

Stacy was the recipient of the Garvin-Olan medal in 1995 among her many awards for her scientific research and educational service.

1983 › *Newly arrived at Berkeley, Professor Stacy demonstrates the effect of shattering a flower that has been dipped in liquid nitrogen to the delight of her class.*


NO.5

1971 › *The "plutonium 244 in nature" discovery team. (l to r) Francine Lawrence, Jack Mewherter, Darleane Hoffman, Frank Rourke at Los Alamos Scientific Lab. In 1971, scientists still believed that transuranium elements did not occur in nature. Hoffman and her team discovered small amounts of plutonium-244 in a rock formation. Hoffman also isolated and characterized fermium-257, work that represented a monumental advance in the understanding of the fission process. She studied the chemical and nuclear properties of rutherfordium, bohrium, and hassium, and confirmed the existence of seaborgium. She permanently joined the College in 1984 as a tenured professor.*

DARLEANE C. HOFFMAN

Darleane Hoffman gained international recognition for capturing and analyzing elusive transuranic elements (elements heavier than uranium) that typically exist for only short periods, making important discoveries about the nature of fission—the atomic process at the heart of nuclear power.

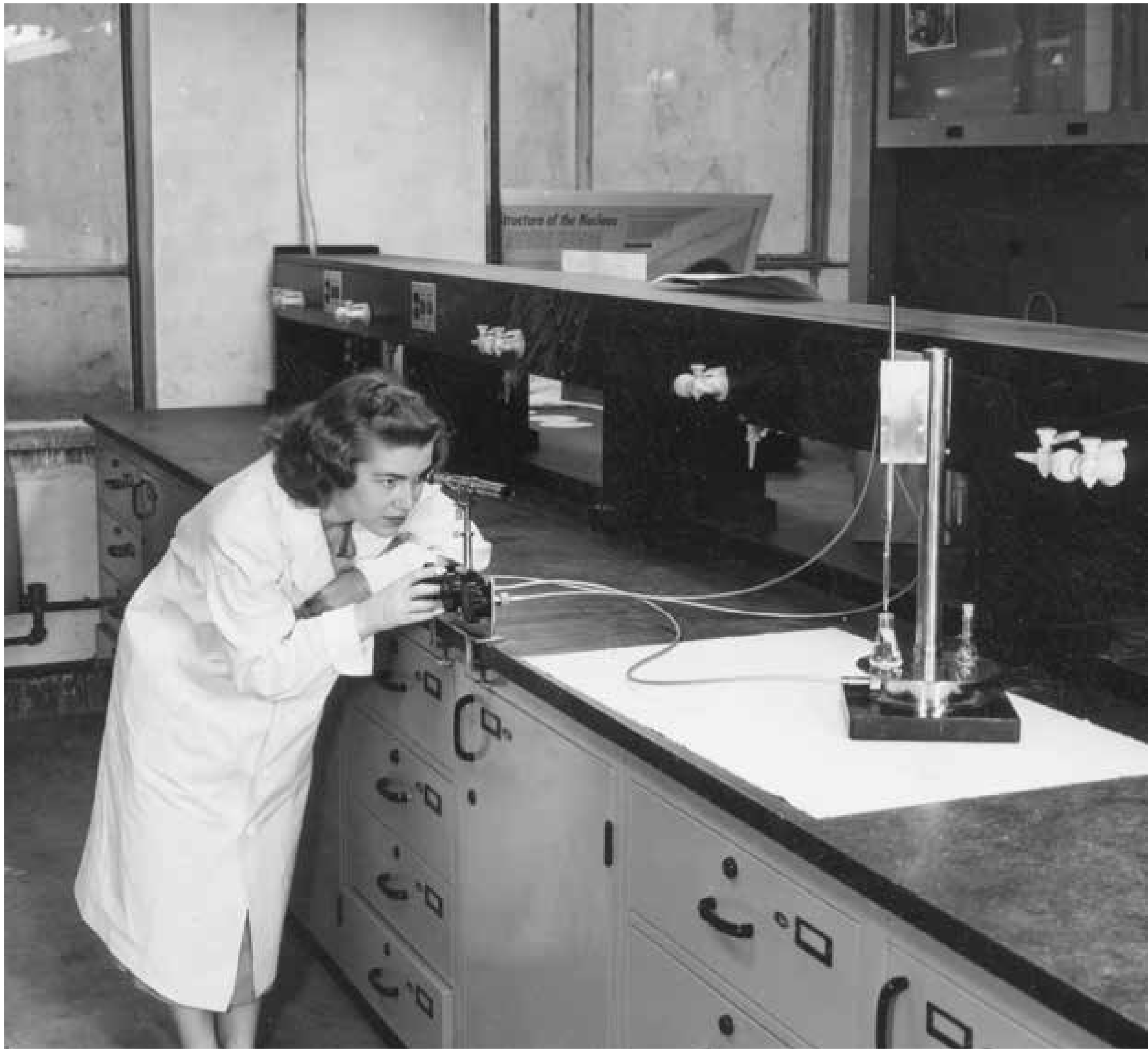
When Hoffman entered Iowa State College (now Iowa State University), she was not on the path to a career in chemistry. Her major was applied art until a professor inspired her to pursue chemistry. She received her Ph.D. from Iowa in 1951. In 1953, she took a position at Los Alamos National Laboratory where she worked on nuclear chemistry and would establish herself as the world authority on spontaneous fission, the sudden decay of heavy nuclei into two "daughter" nuclei.

For years, scientists believed that transuranium elements did not occur in nature until 1971 when Hoffman published her discovery of small amounts of a plutonium isotope (plutonium-244) in a rock formation several billion years old. Hoffman also did chemistry studies on other transuranium elements including hahnium and lawrencium.

Hoffman also made a significant discovery about nuclear fission. Scientists had known since the late 1930s that the nuclei of certain elements split when bombarded with neutrons, but in the early 1970s Hoffman discovered that the atoms of one element, fermium, could split spontaneously.

Hoffman came to UC Berkeley in 1984 to become a professor at the College and a researcher at Berkeley Lab. She was among the researchers who confirmed the existence of Seaborgium (element 106).

Hoffman received many awards for her research including the National Medal of Science, the ACS Priestley Medal and Nuclear Chemistry Award, and the Garvan-Olin Medal.



1950 › *Darleane Hoffman in lab coat at the Ames Lab before she began her career at Los Alamos National Lab.*

K. BIRGITTA WHALEY

K. Birgitta Whaley was the first woman theorist to join the College in 1986. Born in England, she received her B.A. at Oxford University in 1978. She went on to Harvard (M.Sc, 1982), the University of Chicago (Ph.D. 1984), and Tel Aviv University (postdoc 1986) for advance education.

She is Professor of Chemical Physics and the director of the Berkeley Quantum Information and Computation Center. Whaley's research is at the forefront of chemistry, physics, and biology. Her work is broadly focused on quantum information and quantum computation; control and simulation of complex quantum systems; and quantum effects in biological systems.

Her group's current research is focused on quantum control; quantum information and quantum measurement; analysis and simulation of open quantum systems; macroscopic quantum states; and quantum metrology.

She has won numerous awards for her work and in 2019 was appointed to the White House science advisory council focused on the future of quantum research in the United States.

1986 › *Birgitta Whaley when she first joined the faculty.*

1993 › *Architectural rendering for the exterior design of Tan Kah Kee Hall (Tan Hall). Tan Hall is in the middle with Latimer Hall on the left and Gilman Hall behind. On the right is Campbell Hall.*

TAN HALL WAS DESIGNED BY THE ARCHITECTURAL FIRM OF STONE, MARRACCINI, AND PATTERSON, ARCHITECTS.

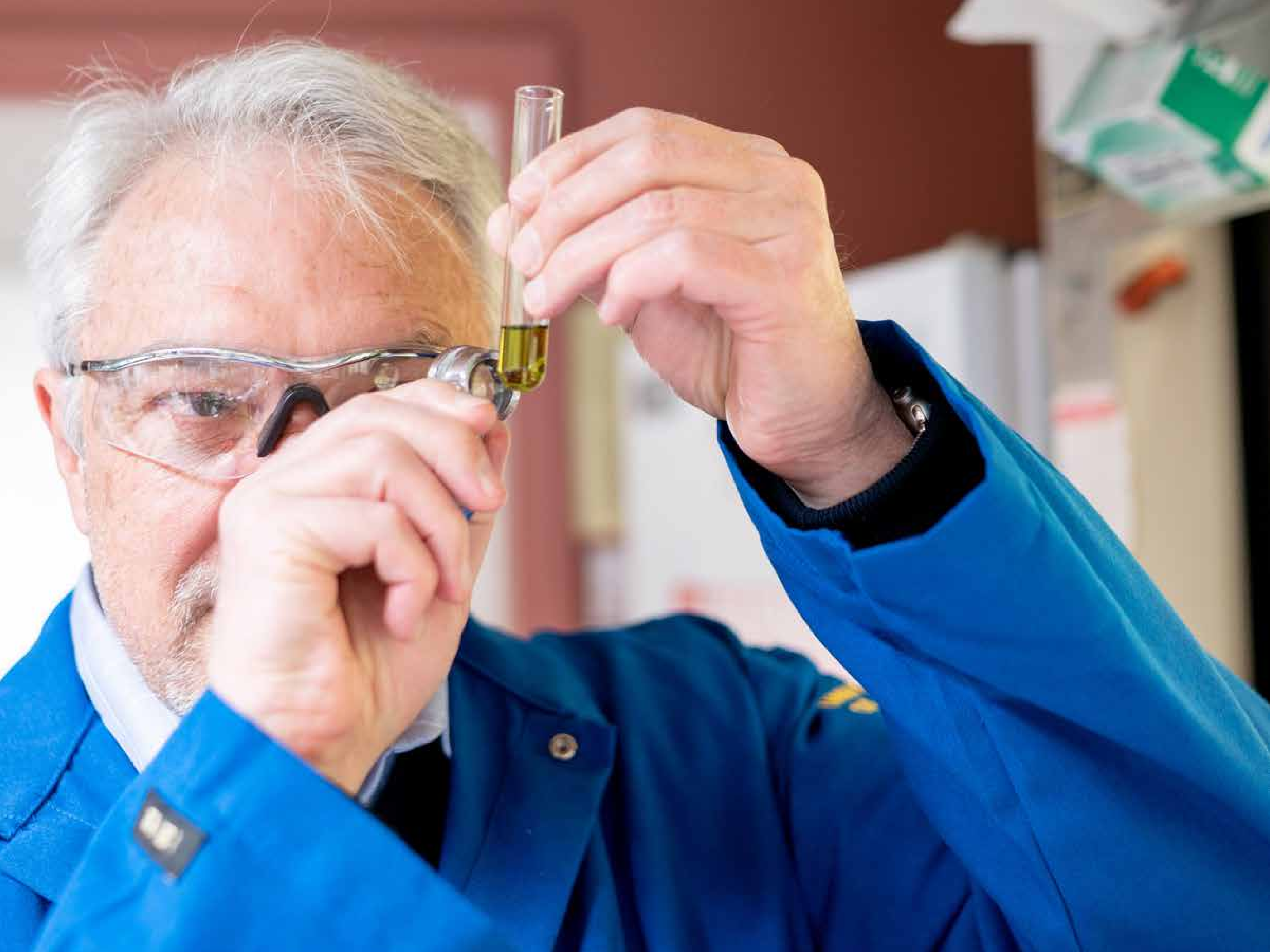
Tan Hall

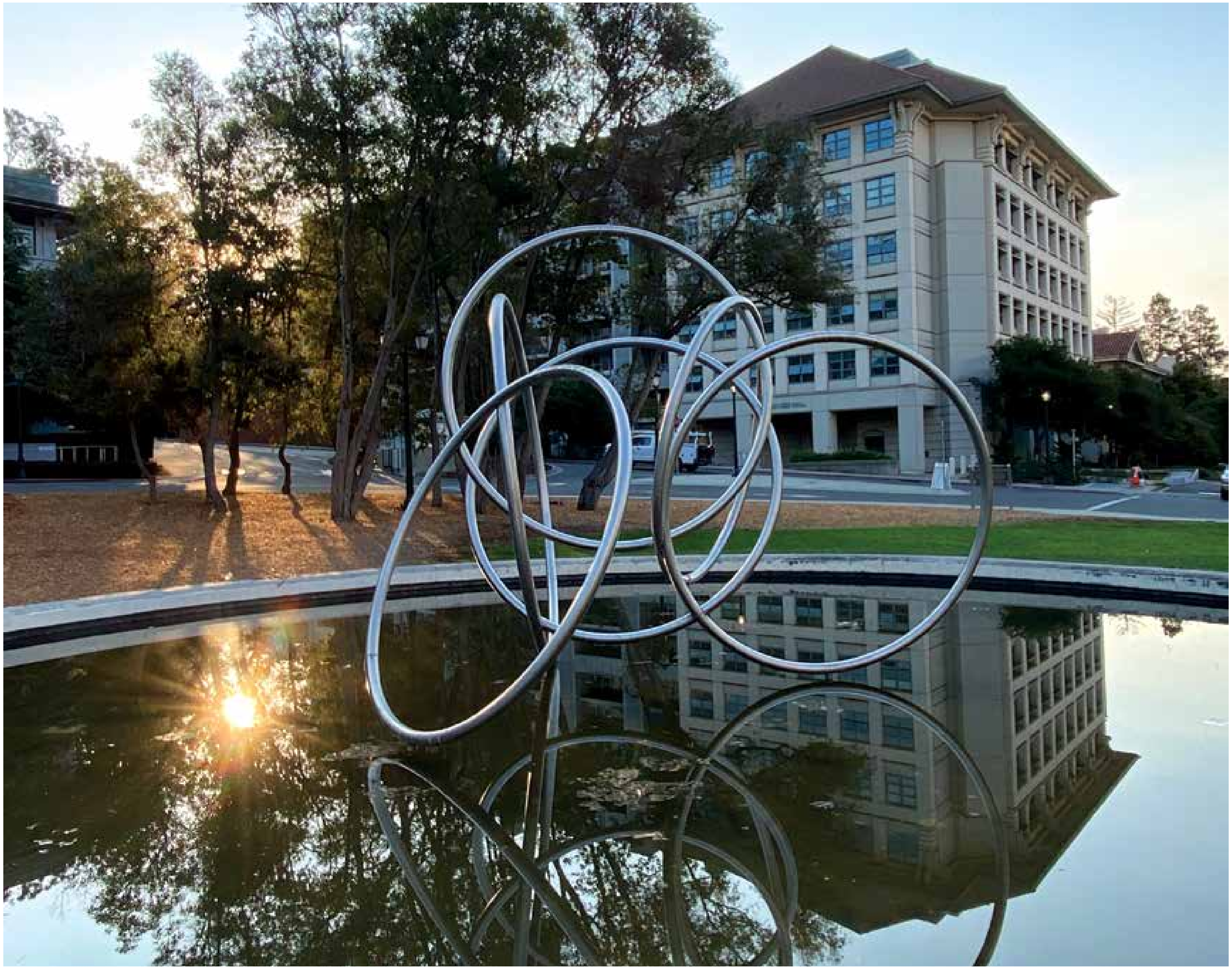
Thanks to the generosity of more than 2,000 individuals, corporations, and foundations, Tan Kah Kee Hall (Tan Hall) was the first building at the College of Chemistry constructed with a majority of private funds. Completed in 1997, the project marked an exceptional partnership not only between the state and the private sector, but also between the College of Chemistry and a global community of supporters who were deeply invested in Berkeley's mission as one of the leading scientific institutions in the world. When Tan Hall opened in 1997, it addressed the immediate need for new lab space to house the College of Chemistry's growing chemical engineering program.

1995 › *Construction begins on Tan Hall.*

1997 › *(l to r) Professor and Nobelist Yuan T. Lee, Alexis Bell (dean of the College at the time), and Chang-Lin Tien, University chancellor, cut the ribbon on Tan Kah Kee Hall.*

Contemporary faculty





2021 › *Early morning light is captured in the mining circle pool with Tan Hall in the background.*

Chemistry and Chemical Biology

The Departments of Chemistry and Chemical Biology provide the opportunity to research major scientific and technological challenges, such as climate change, increasing the world's food supply, synthesizing new materials, removing plastics from the environment, and discovering and delivering important new drugs to combat major diseases. The College prides itself on a balanced approach to science, with research areas ranging from experimental to theoretical. Faculty in both departments are engaged in teaching and research in a wide range of applications and subdisciplines.

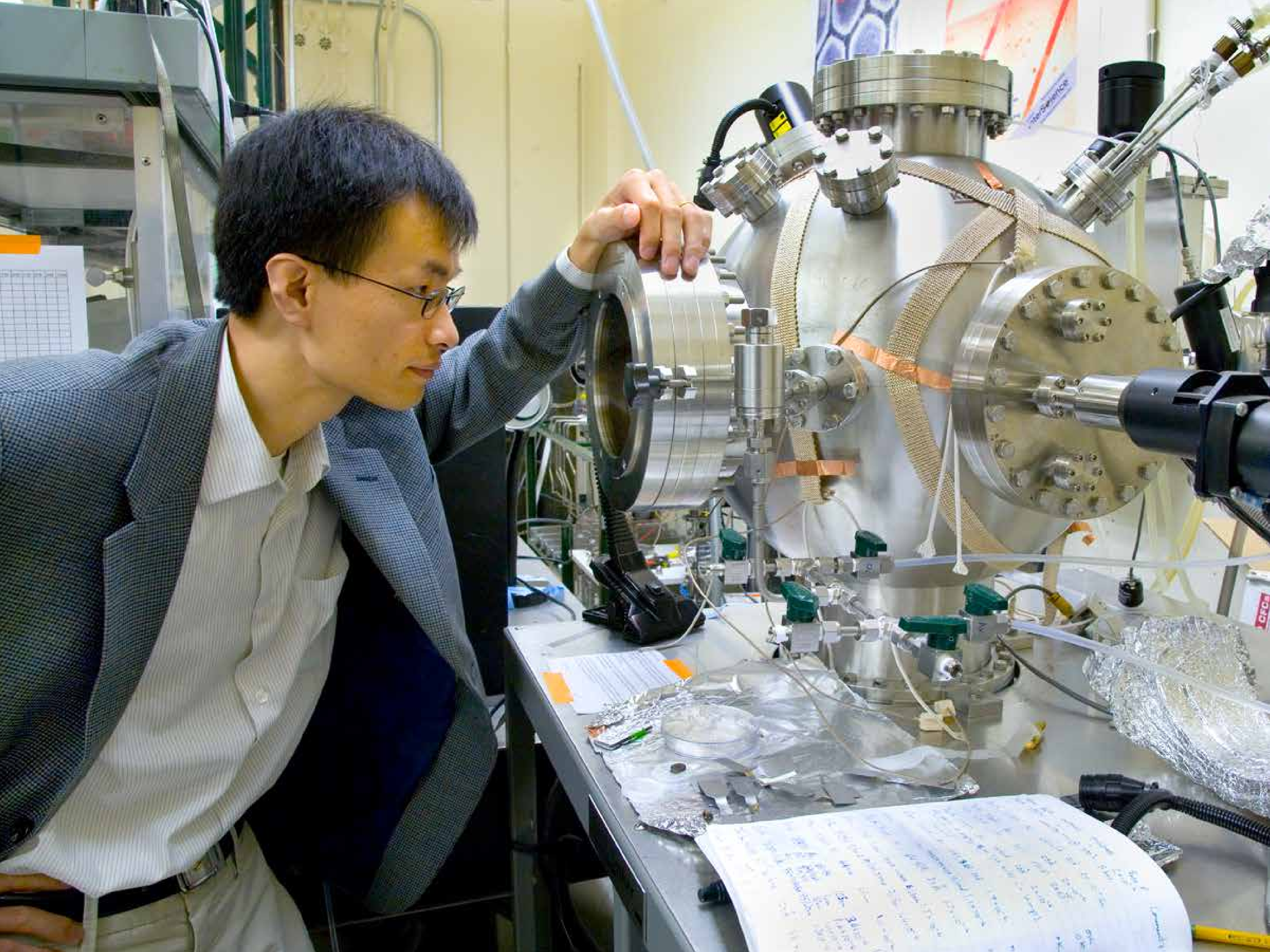
Faculty in the chemistry department are currently interested in research that includes analytical, inorganic, organic, and physical chemistry, as well as such diverse areas as nanoscience, nuclear, biophysical, materials and atmospheric chemistry; and structural and chemical biology.

Examples of current research in Chemical Biology includes developing new ways to analyze, diagnose, and treat cancer and infectious diseases; inventing new technologies for studying brain circuitry; identifying new biological strategies for renewable synthesis of fuels, medicines, and materials; advancing technologies for genome editing, protein engineering, chemoproteomics, and molecular imaging.

College researchers collaborate with scientists across campus, the nation, and the world. Researchers have access to numerous facilities on campus including the micro-fabrication laboratory and the brain imaging center. Many of our faculty hold a joint appointment with the Lawrence Berkeley National Laboratory which houses numerous state-of-the-art labs such as the charged particle accelerators.

In recent years, emphasis has been placed on undergraduates working in partnership with graduate students in research labs to gain experience for moving on to graduate programs. The College also prides itself on having a robust in-house tutoring program for assisting students in their studies.

To learn about the amazing research of our chemistry and chemical biology faculty, please visit https://chemistry.berkeley.edu/faculty/chem at our website. Links to each faculty member, both current and emeritus, are available here with information on how to review their research sites.



Chemistry and Chemical Biology

• Analytical and Bioanalytical
• Atmospheric • Chemical Biology
• Green Chemistry • Inorganic & Organometallic
• Materials, Polymers & Nanoscience
• Nuclear • Theoretical • Organic • Physical

2007 › *Peidong Yang in the laser lab in Hiledbrandt Hall.*

| MATERIALS CHEMISTRY, SOLID STATE CHEMISTRY, INORGANIC CHEMISTRY, PHYSICAL CHEMISTRY |

1983 › *Joseph Cerny*

| NUCLEAR CHEMISTRY |

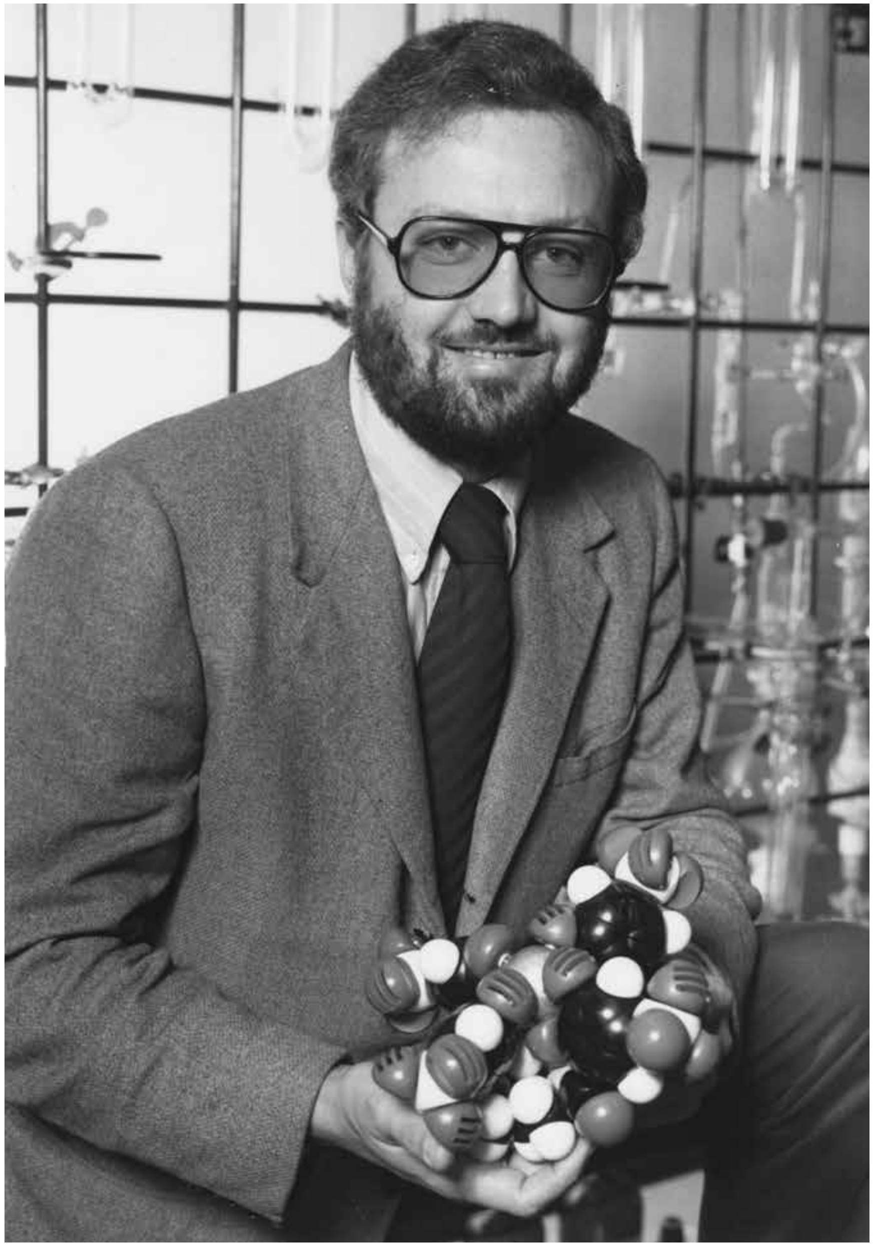
1988 › *Judith Klinman*

| BIOCHEMISTRY, BIOPHYSICAL, BIOORGANIC AND BIOINORGANIC CHEMISTRY |

CHEMISTRY **DEPARTMENT CHAIRS**

2018	Matthew Francis
2014-2018	David Wemmer
2010-2014	Daniel Neumark
2005-2010	Michael Marletta
2003-2005	Charles Harris
2000-2003	Judith Klinman
1996-2000	Paul Bartlett
1996-1998	Jon Ellman
1993-1996	Ken Raymond
1989-1993	Bill Miller
1986-1989	Clayton Heathcock
1982-1986	C. Bradley Moore
1979-1982	Ignacio Tinoco, Jr
1975-1979	Joseph Cerny
1971-1975	David Shirley
1968-1971	Bruce Mahan
1966-1968	George Pimentel
1960-1966	Richard E. Powell
1959-1960	Robert Connick
2/1959-9/1959	Rollie Myers
1958-1959	Robert Connick
1957-1958	Isadore Perlman
1955-1956	James Cason
1951-1955	Kenneth Pitzer
1949-1951	Joel Hildebrand
1945-1949	Wendell Latimer
1943-1945	William Bray
1941-1943	Joel Hildebrand

• Department chairs prior to 1941 were both Chair of the Department and Dean of the College. See list on page 3.

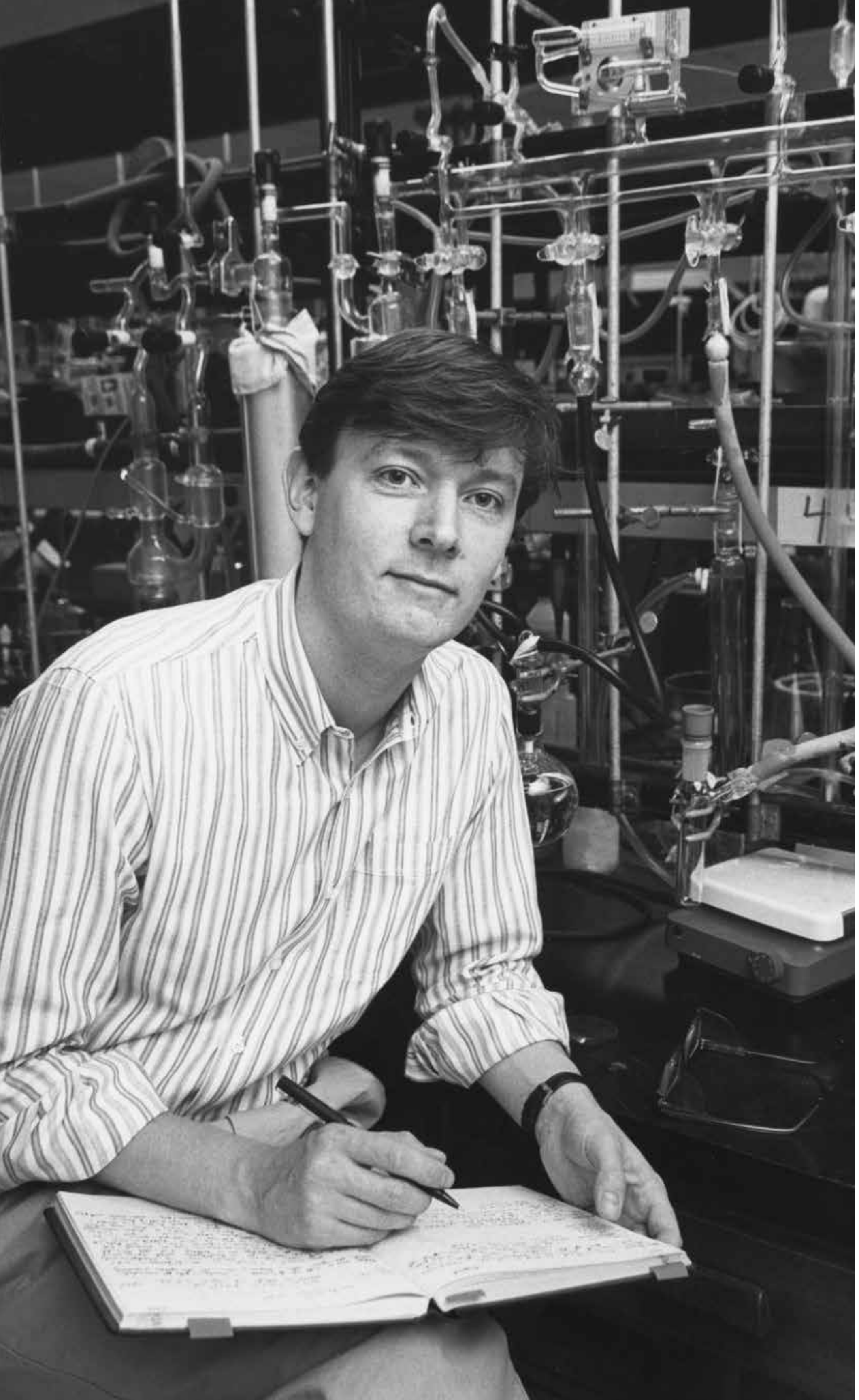


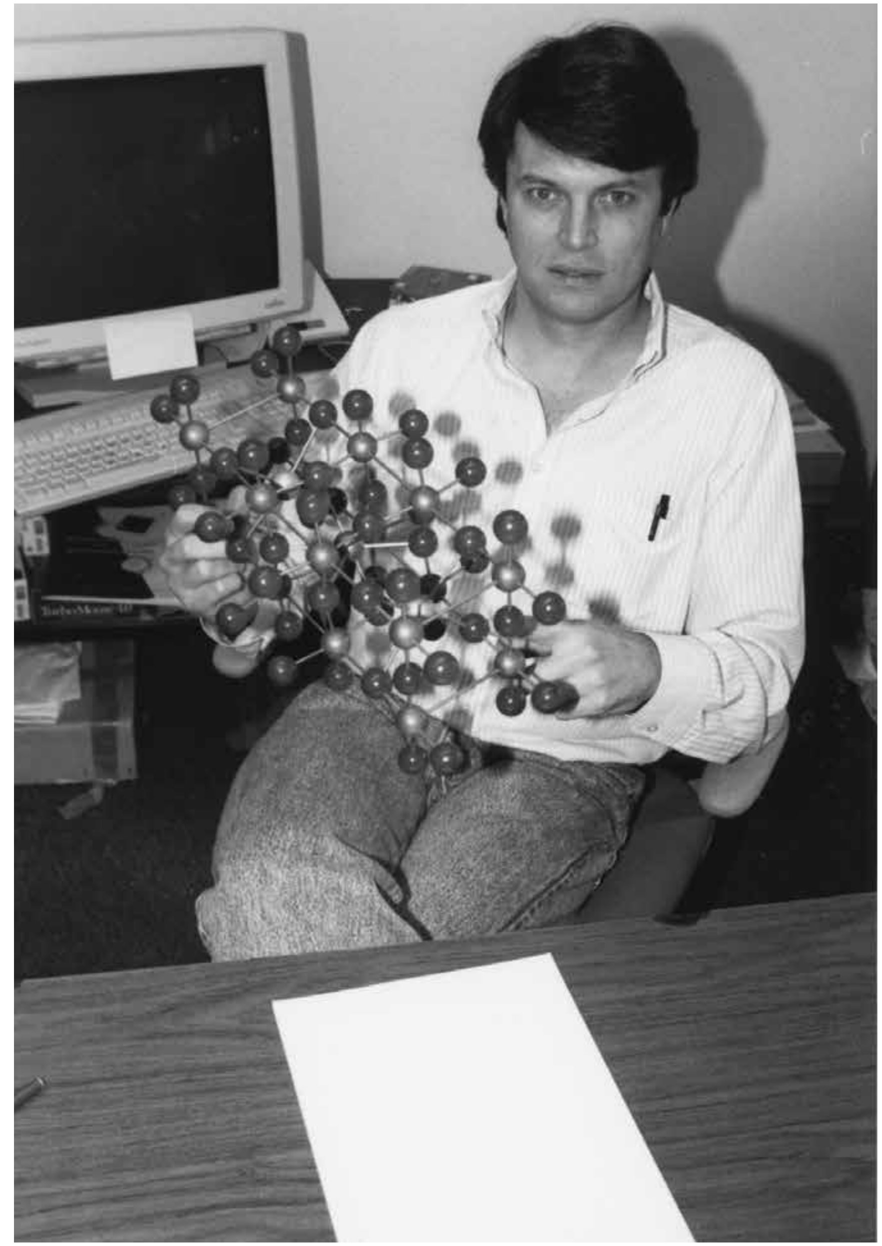
1988 › *Kenneth Raymond*

| COORDINATION AND BIOINORGANIC CHEMISTRY, BIOPHYSICAL CHEMISTRY, SUPRAMOLECULAR CHEMISTRY |

1986 › *Angelica Stacy*

| SOLID STATE, PHYSICAL AND INORGANIC CHEMISTRY |





1995 › *T. Don Tilley*

| ORGANOMETALLIC, POLYMER AND MATERIALS CHEMISTRY |

1986 › *John Arnold*

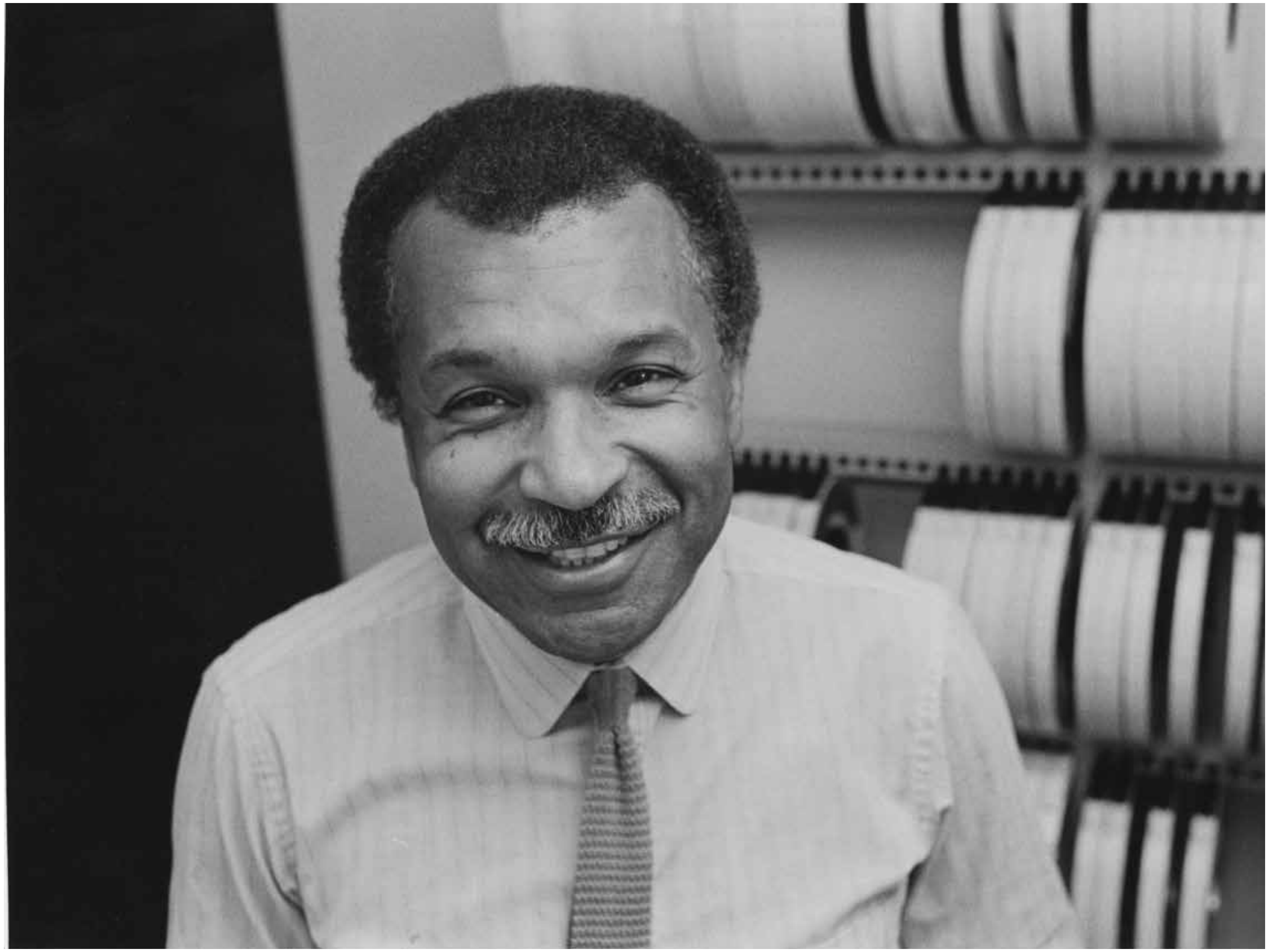
| INORGANIC & ORGANOMETALLIC CHEMISTRY |

2014 › *K. Birgitta Whaley*

| QUANTUM PHYSICS, MOLECULAR QUANTUM MECHANICS, AND QUANTUM INFORMATION |

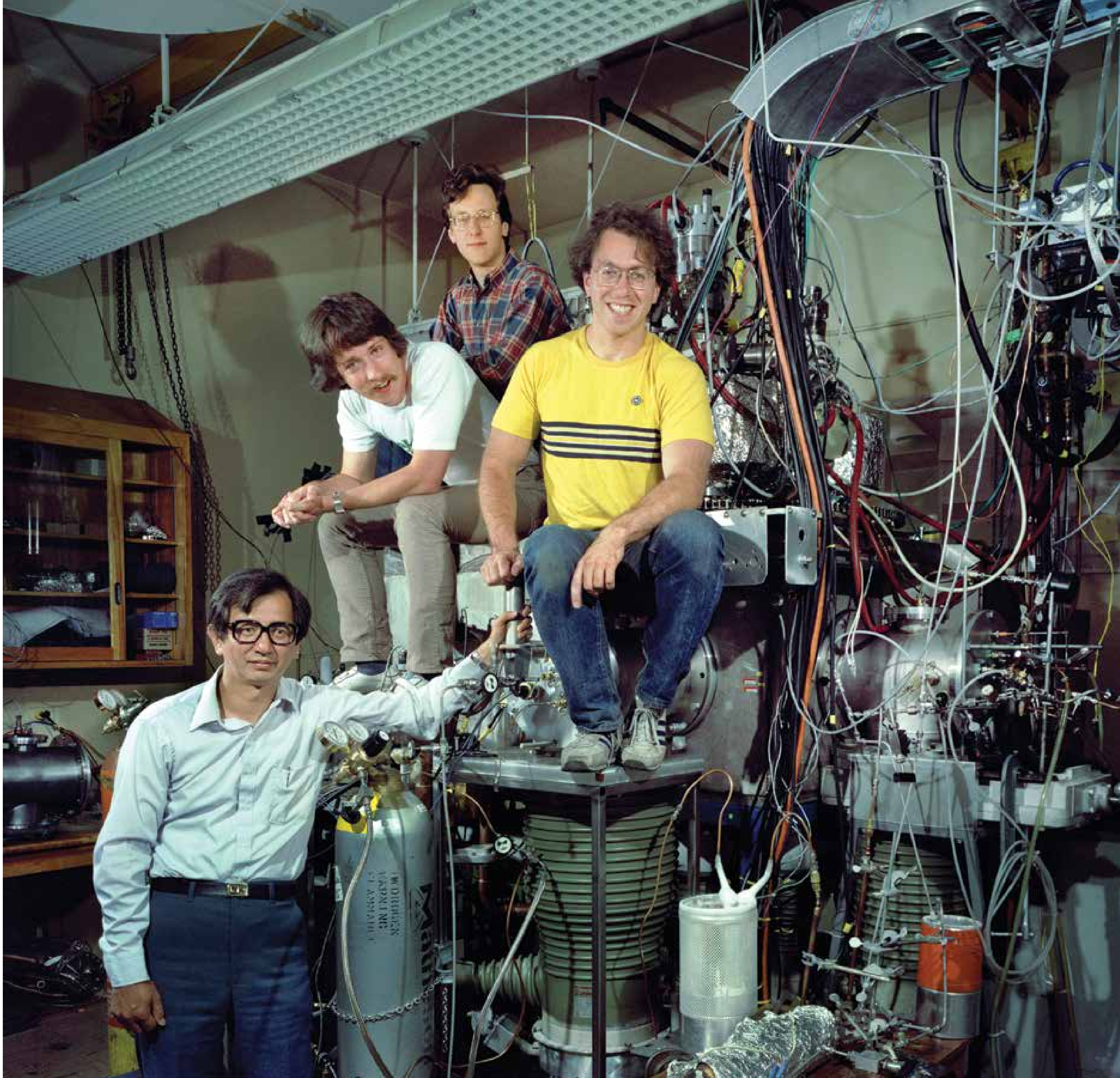
n.d. › *William H. Miller*

| THEORETICAL CHEMISTRY, CHEMICAL DYNAMICS |



1983 › *William A. Lester, Jr.*

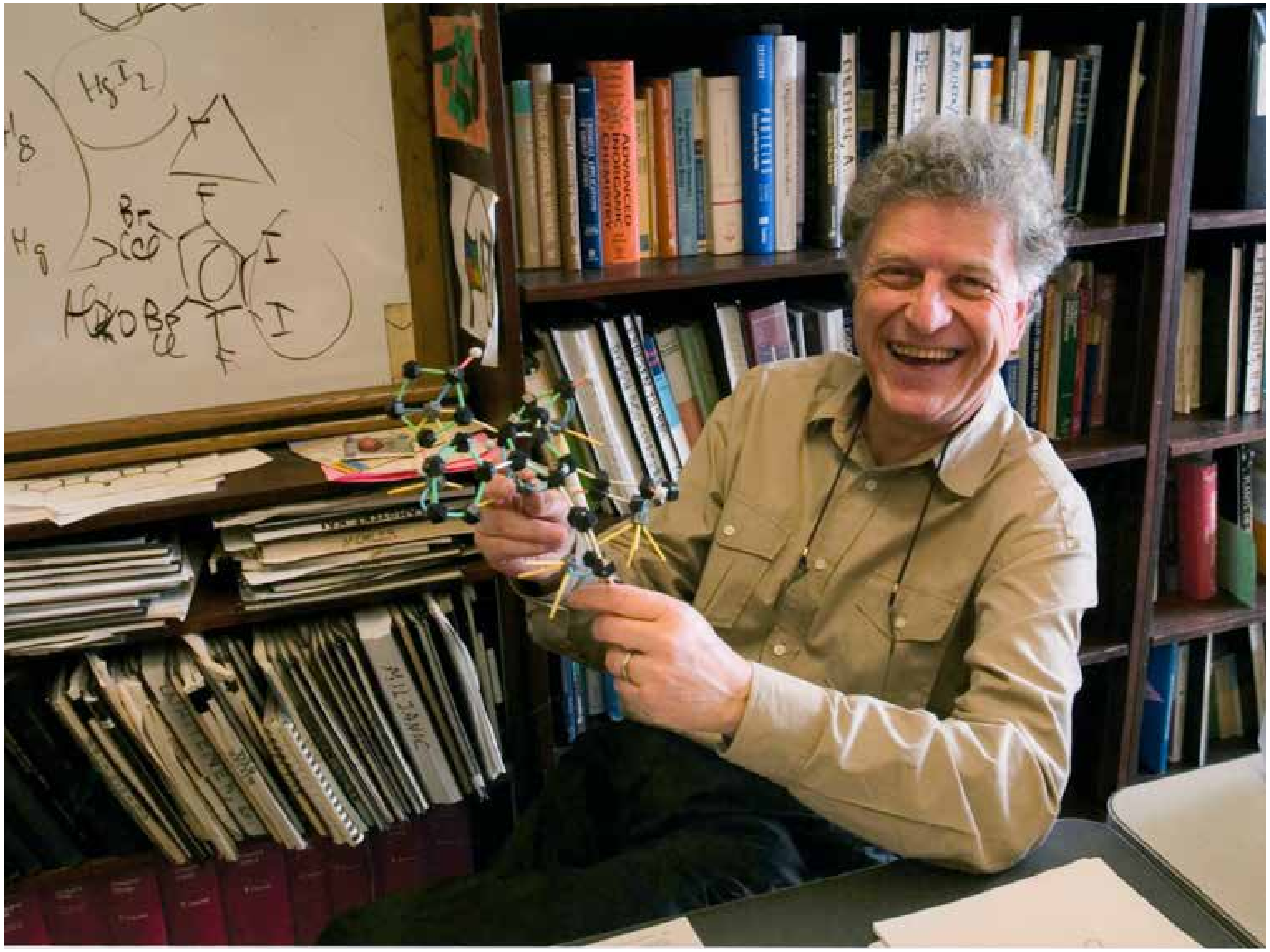
| THEORETICAL AND PHYSICAL CHEMISTRY |



1980 › *Chemistry professor and Nobel Laureate Y. T. Lee, with then graduate students Daniel Neumark (Professor of Chemistry) in yellow shirt, Alec Wodtke (left), the director of the Max Planck Institute for Biophysical Chemistry, and Gary Robinson (rear), the founder and chief business officer for Celek Pharmaceuticals seated on the crossed molecular beams instrument which was used for studies of the F + H2 reactions. The instrument was most likely built at the Berkeley Lab machine shop.*

1983 › *Darleane Hoffman receives the American Chemical Society Award for Nuclear Chemistry from Glenn Seaborg the year before she joined the College's faculty and Berkeley Lab.*

| NUCLEAR CHEMISTRY, ACTINIDE, TRANSACTINIDES AND SUPERHEAVY ELEMENTS |

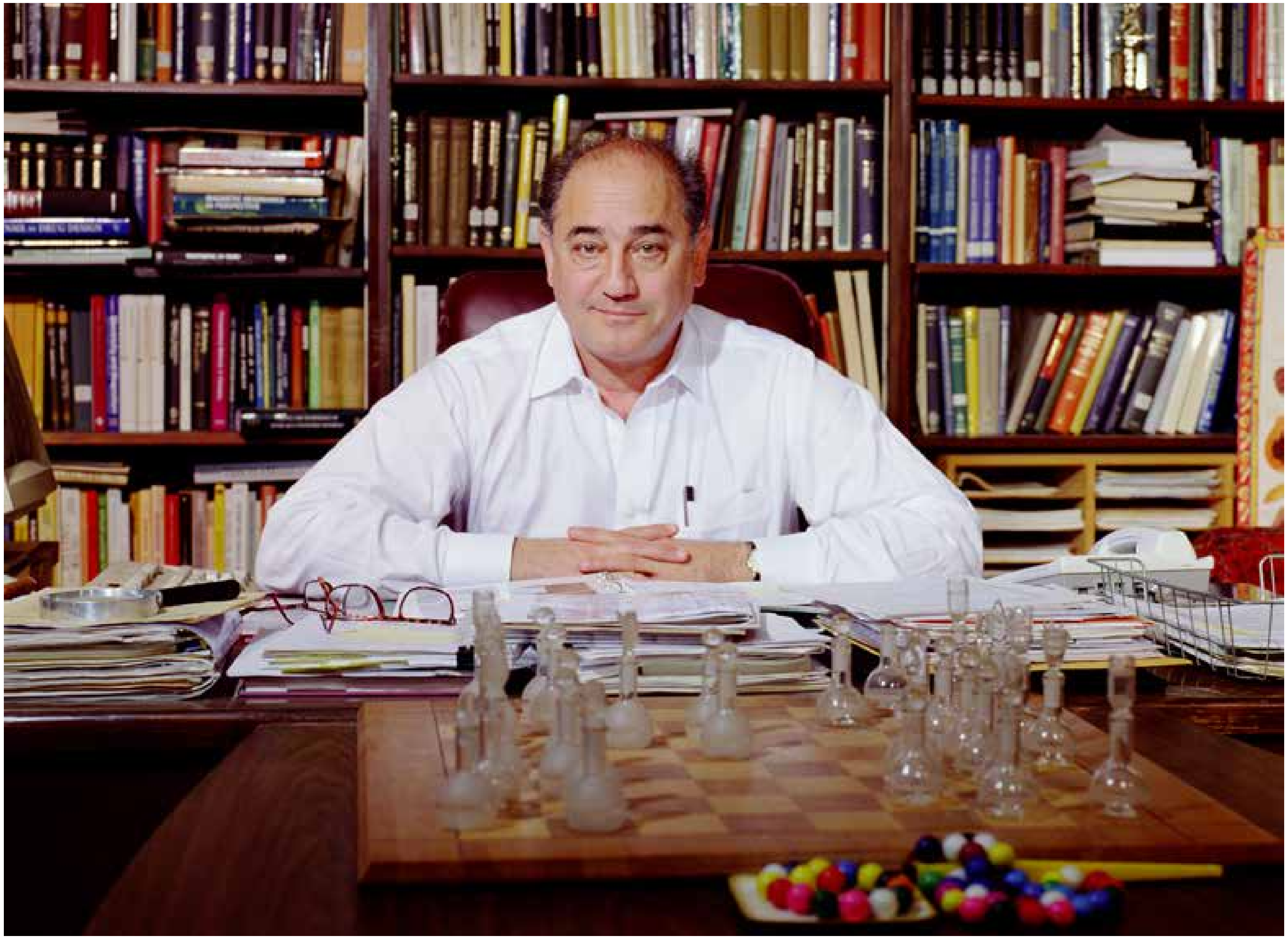


n.d. › *Peter C. Vollhardt*

| ORGANIC AND ORGANOMETALLIC CHEMISTRY |

2018 › *Robert Bergman at the podium gives a speech after accepting the Wolf Prize in Chemistry in 2017 for his discovery of the activation of carbon-hydrogen bonds of hydrocarbons by soluble transition-metal complexes.*

| INORGANIC, ORGANOMETALLIC, AND ORGANIC CHEMISTRY |

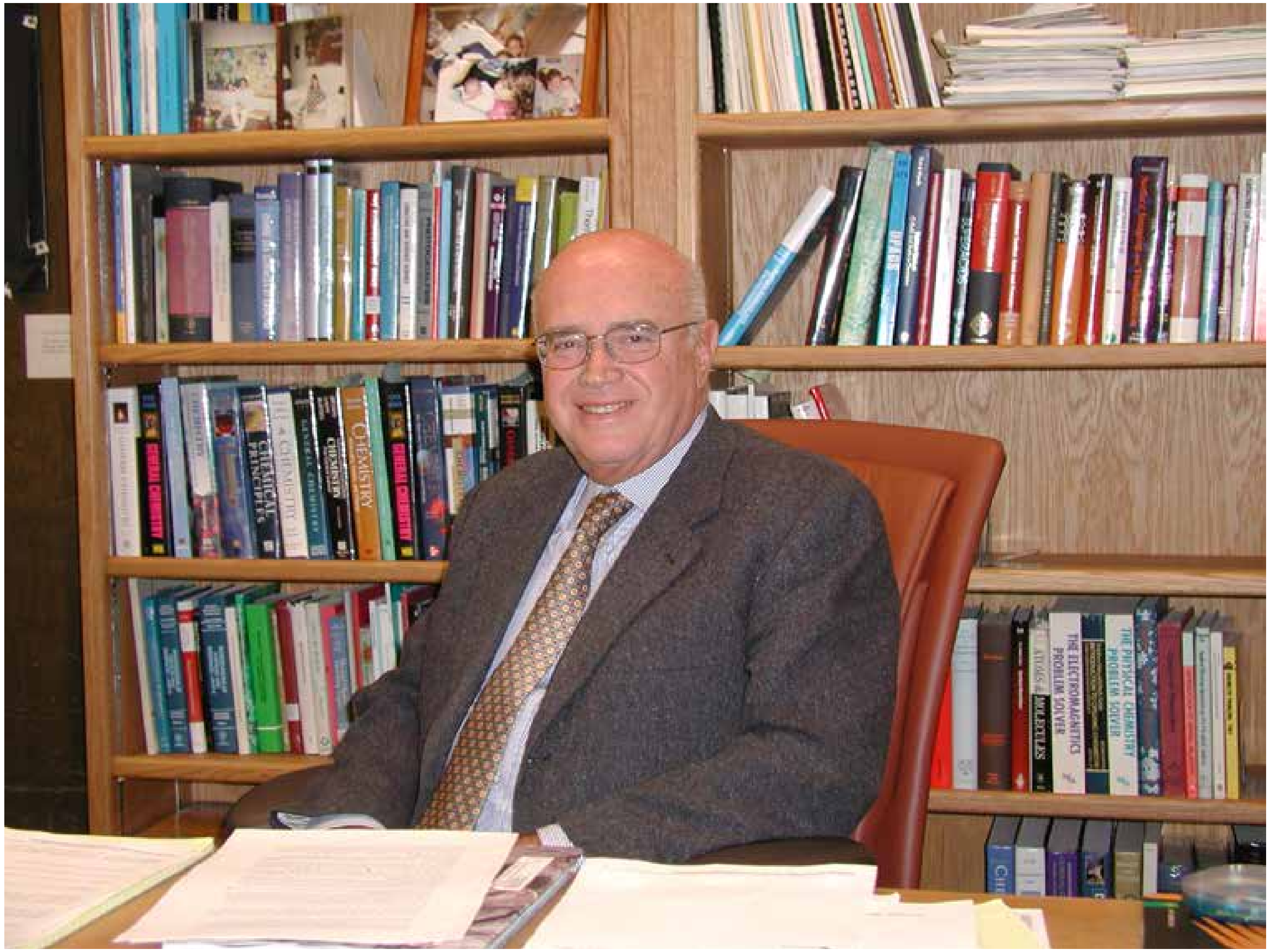


n.d. › *Alexander Pines*

| NMR AND MRI, MATERIALS SCIENCE, BIOPHYSICAL CHEMISTRY |

2018 › *Michael Marletta*

| INTERFACE OF CHEMISTRY AND BIOLOGY, STUDY OF PROTEIN FUNCTION AND ENZYME REACTION MECHANISMS, MOLECULAR ANSWERS TO COMPLEX FUNCTION IN BIOLOGY |

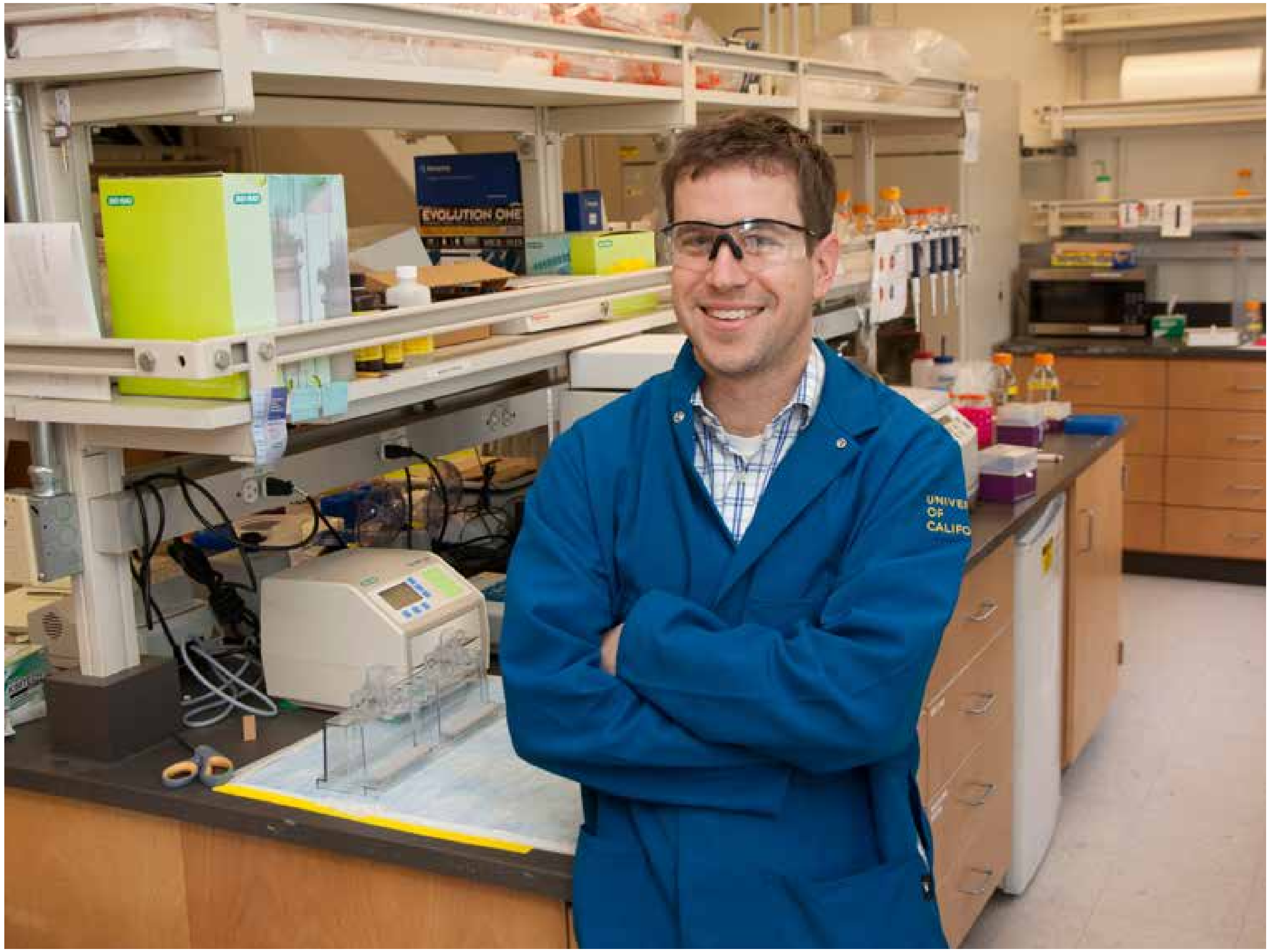


2002 › *Gabor Somorjai*

| PHYSICAL CHEMISTRY, SOLID STATE CHEMISTRY, SURFACE SCIENCE AND CATALYSIS |

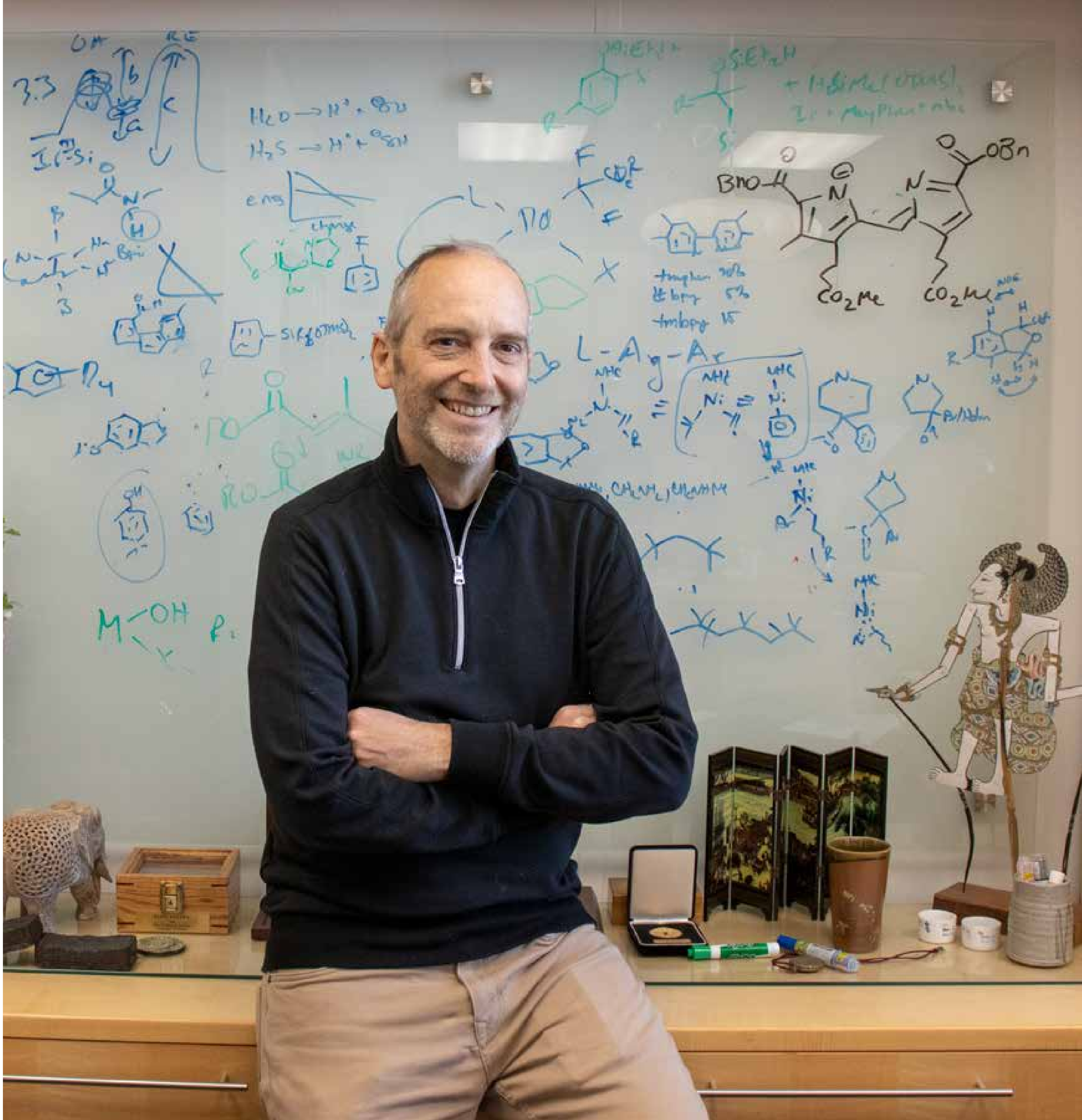
1995 › *Paul Bartlett*

| BIO-ORGANIC AND SYNTHETIC CHEMISTRY |



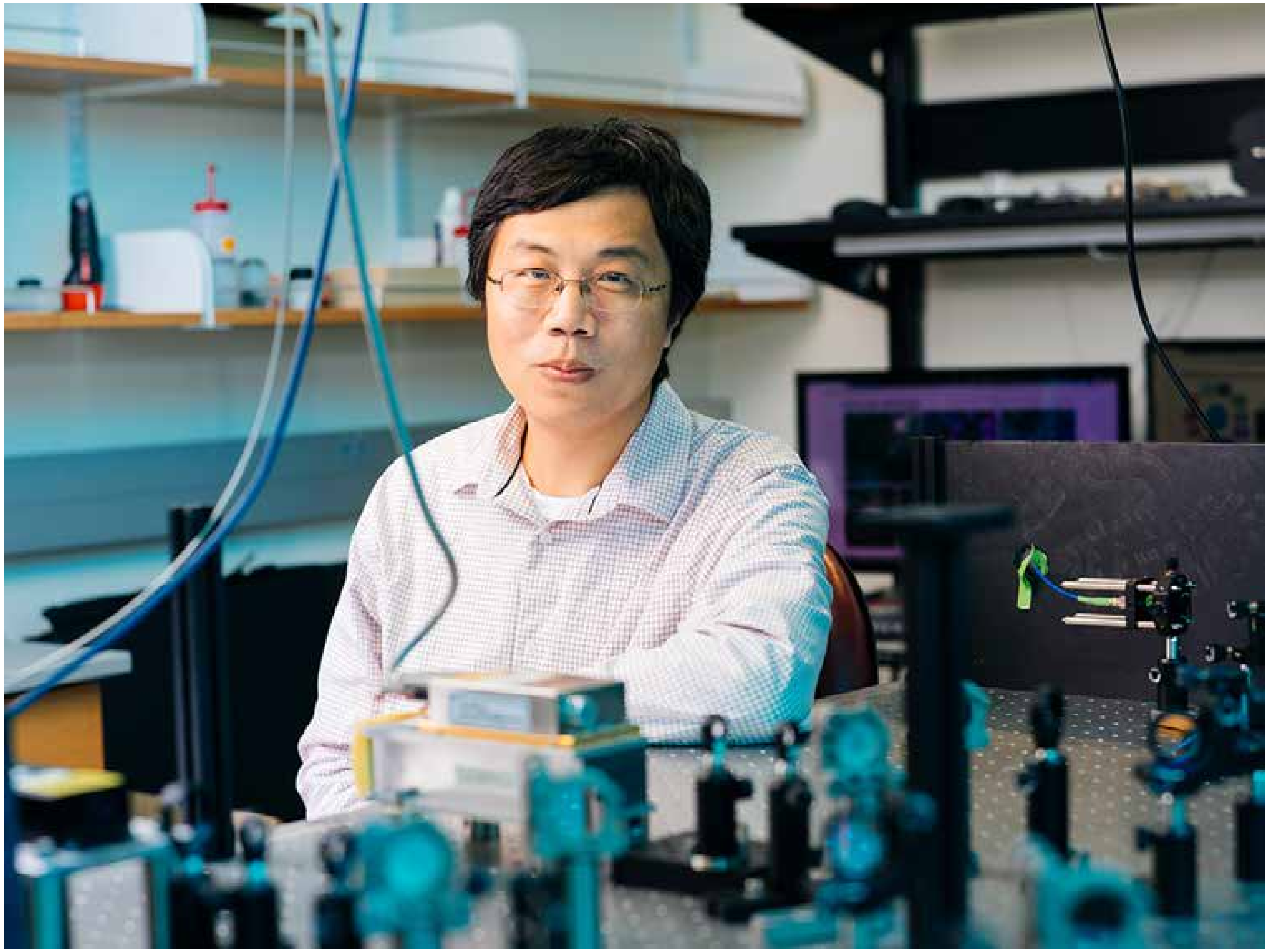
2017 › *Evan Miller*

| CHEMICAL BIOLOGY, THEORETICAL, ORGANIC, AND PHYSICAL CHEMISTRY |



2019 › *John Hartwig*

| ORGANIC CHEMISTRY,
ORGANOMETALLIC CHEMISTRY,
AND CHEMICAL BIOLOGY |



2023 › *Ke Xu*

| BIOPHYSICAL CHEMISTRY, SUPER-RESOLUTION MICROSCOPY, SINGLE-MOLECULE SPECTROSCOPY, NANOSCALE CELL BIOLOGY, GRAPHENE MICROSCOPY |

2020 › *Matthew B. Francis*

| ORGANIC, BIOORGANIC, AND MATERIALS CHEMISTRY |

2023 › *Jennifer Bergner*

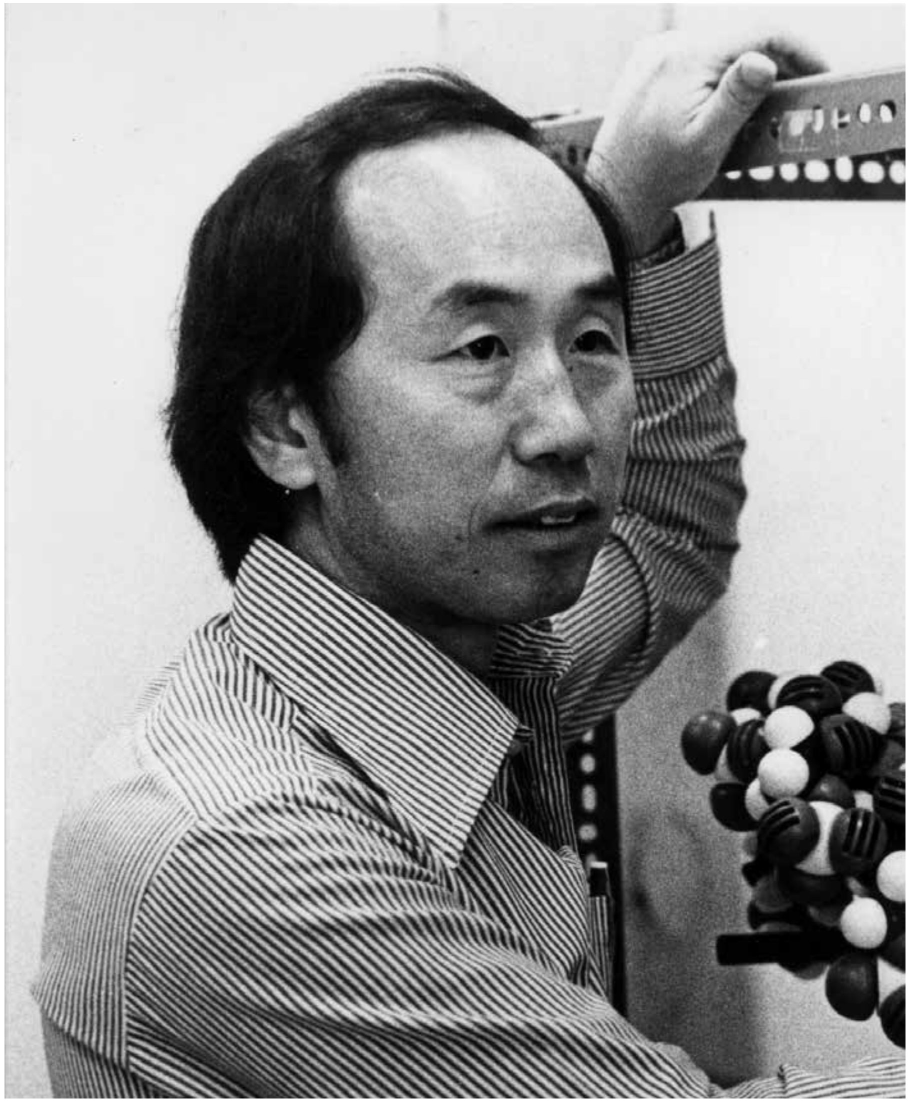
| PROTOSTARS AND PROTOPLANETARY DISK CHEMISTRY |

2016 › *Susan Marqusee*

| BIOCHEMISTRY AND MOLECULAR BIOLOGY |

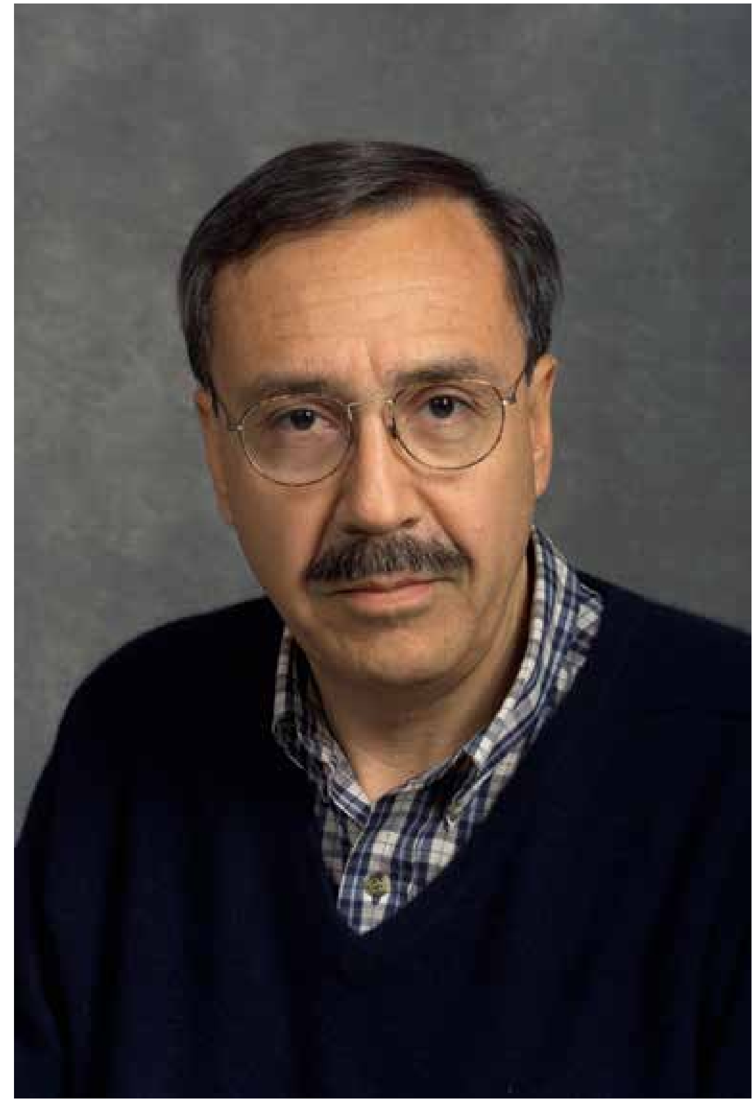
2016 › *Jeffrey Long*

| INORGANIC AND MATERIALS CHEMISTRY |



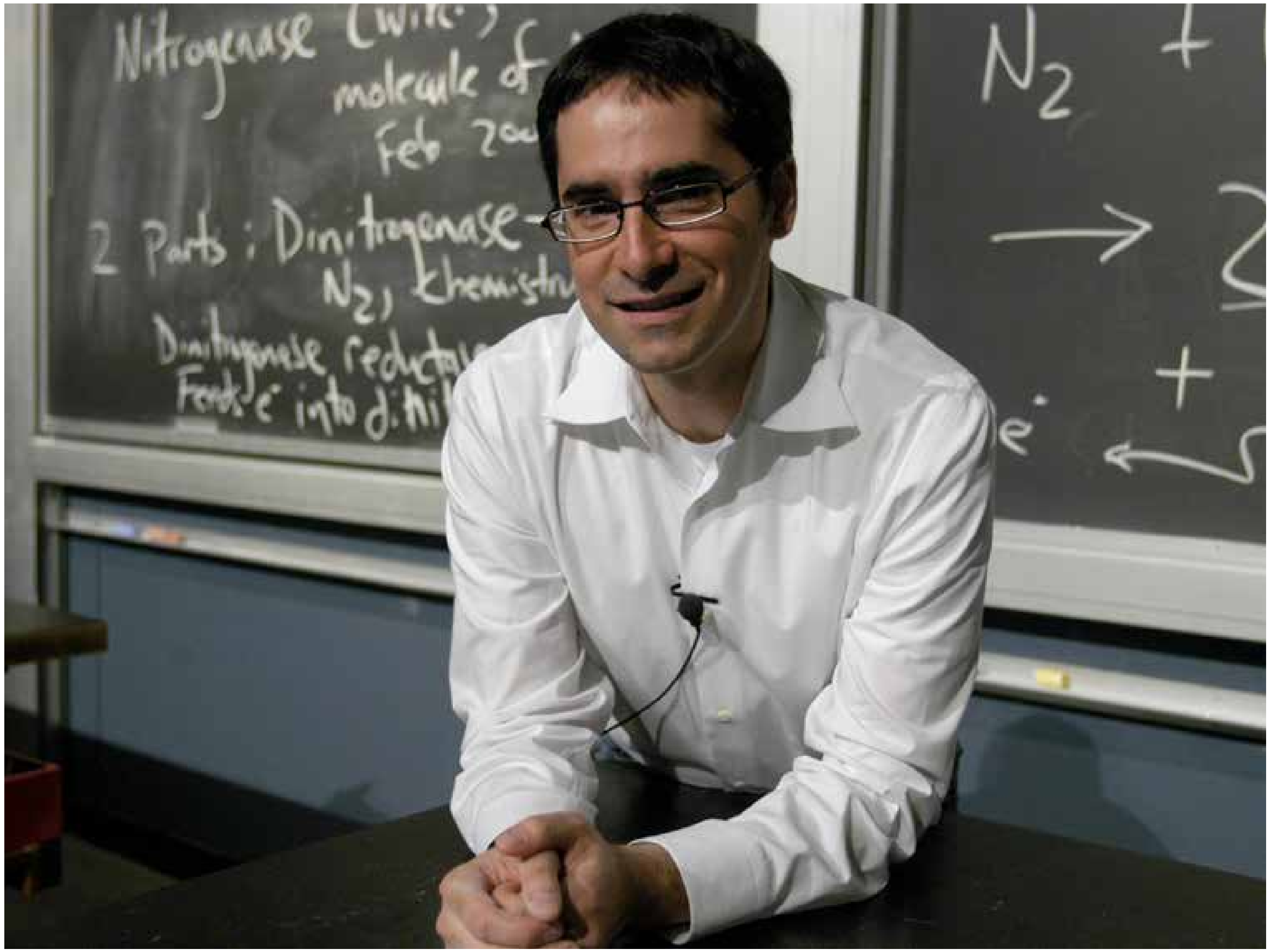
1982 › *Sung-Hou Kim*

| STRUCTURAL BIOLOGY, STRUCTURAL GENOMICS, AND COMPUTATIONAL GENOMICS |



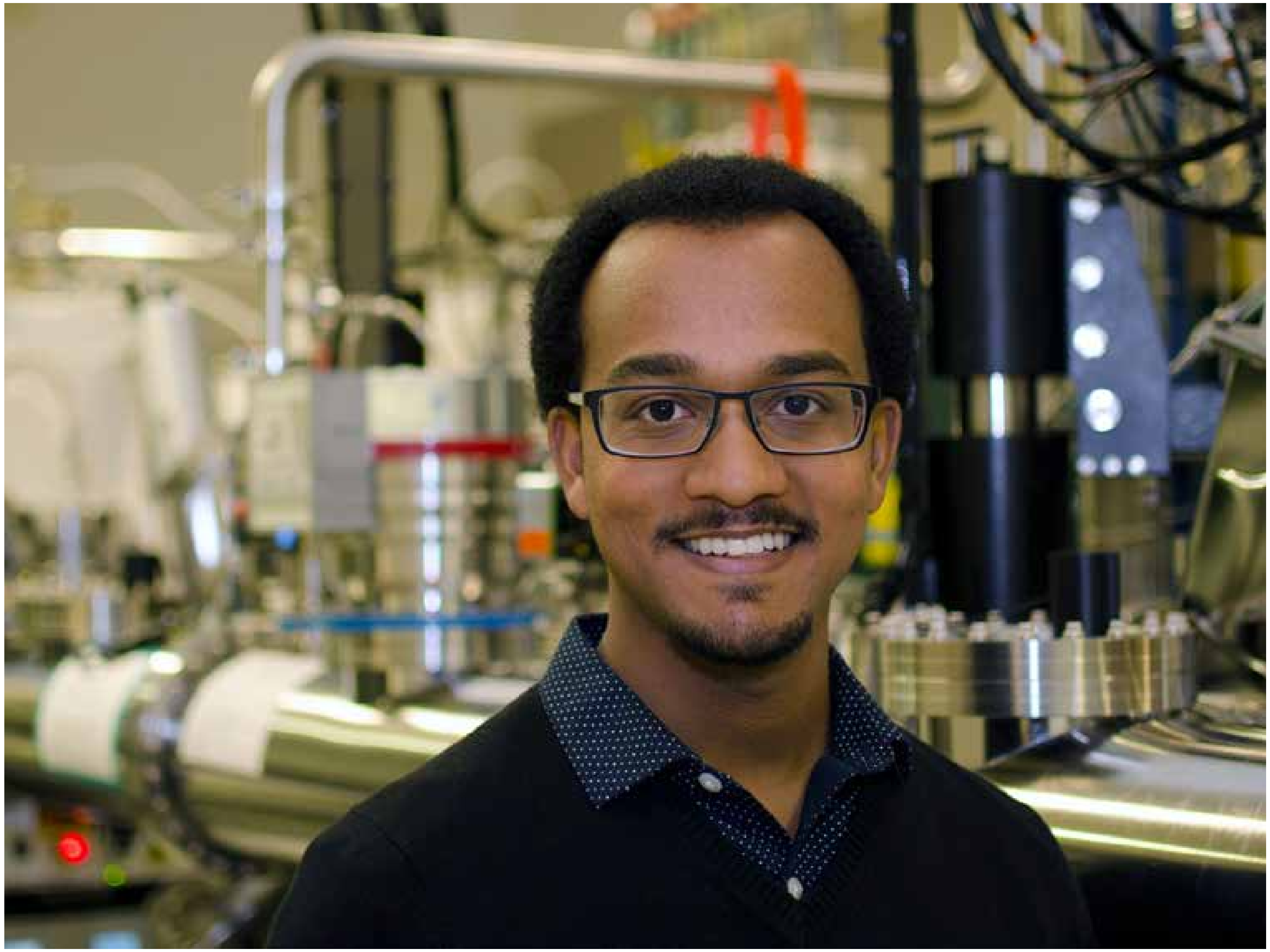
2002 › *Carlos Bustamante*

| BIOPHYSICAL CHEMISTRY |



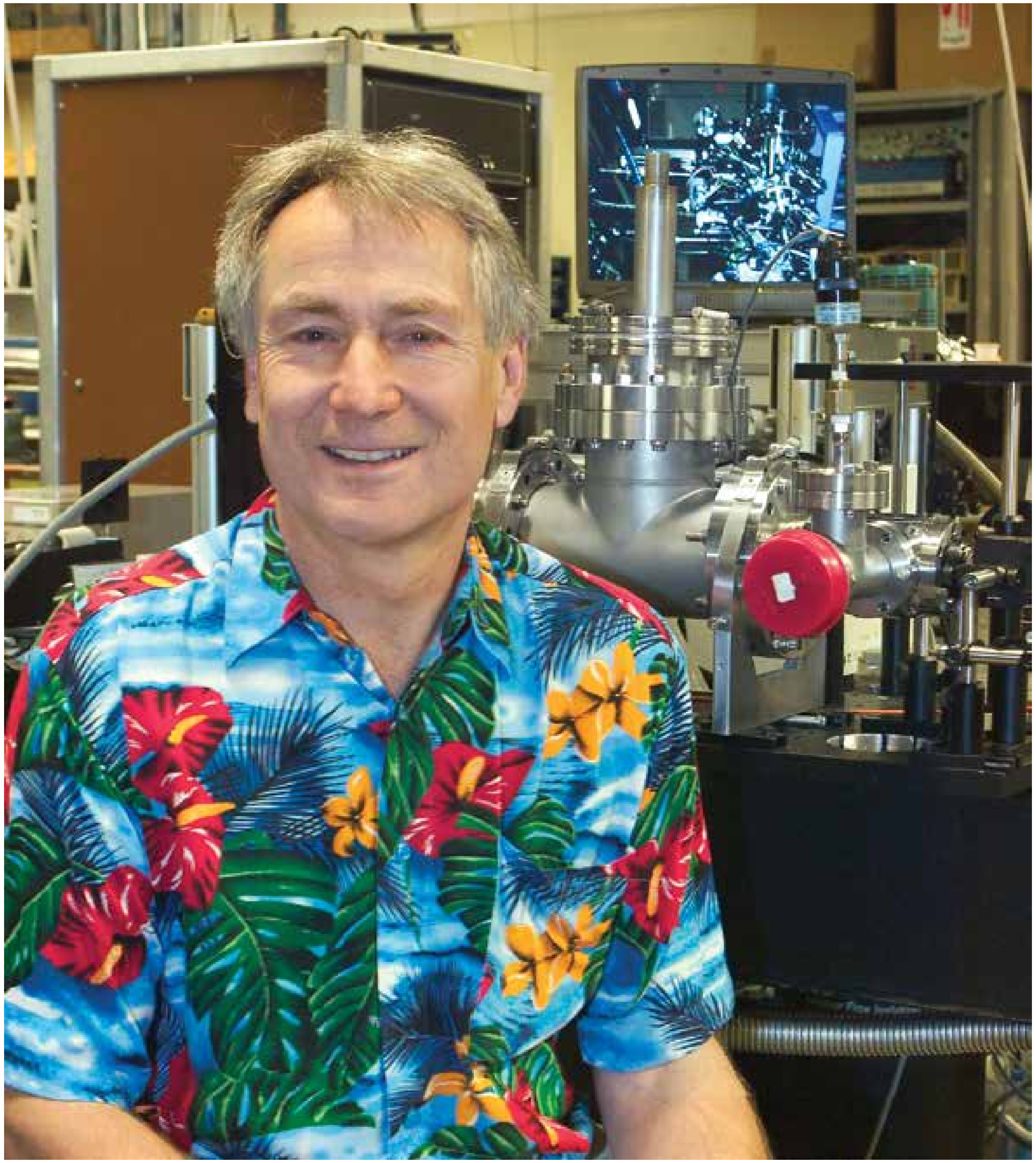
2006 › *Jamie Cate*

| STRUCTURAL BIOLOGY, BIOPHYSICAL CHEMISTRY, AND SYSTEMS BIOLOGY |



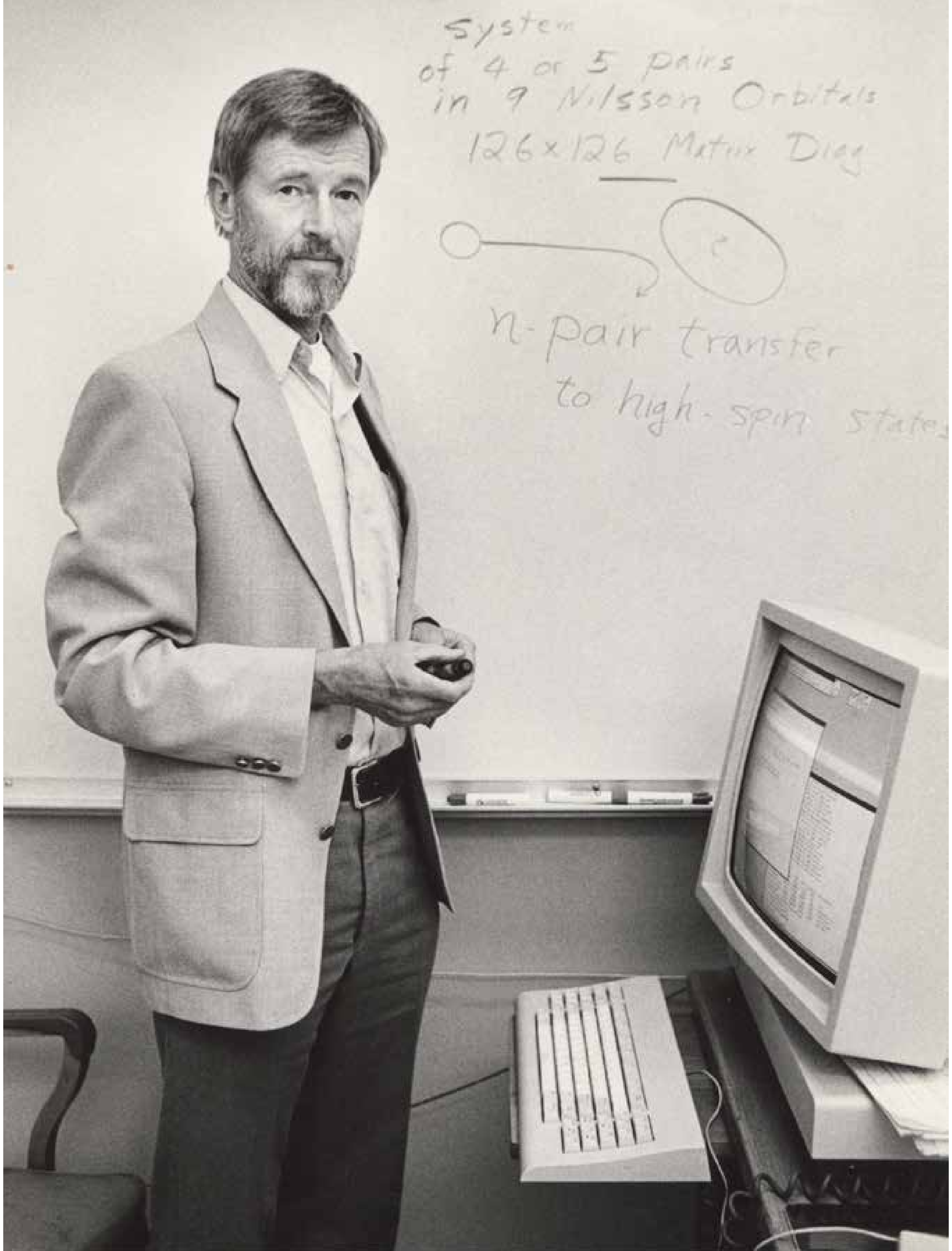
2017 › *Kwabena Bediako*

| INORGANIC MATERIALS CHEMISTRY, ELECTROCHEMISTRY, LOW-DIMENSIONAL MATERIALS, QUANTUM TRANSPORT, AND OPTOELECTRONICS |



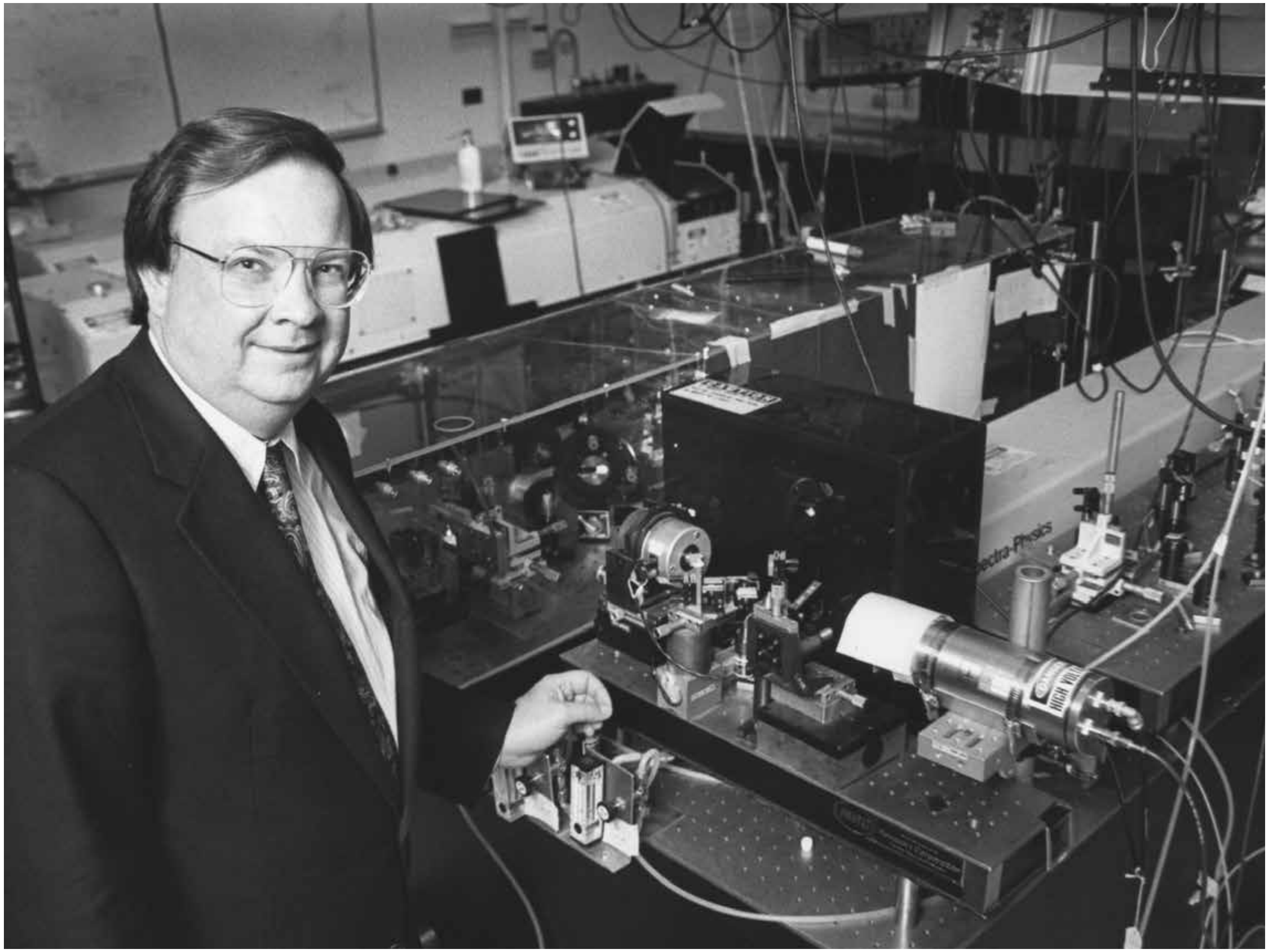
2005 › *Richard J. Saykally*

| PHYSICAL CHEMISTRY, SURFACE SCIENCE, ANALYTICAL CHEMISTRY, MATERIALS AND SOLID STATE CHEMISTRY |



1988 › *John Rasmussen*

| NUCLEAR AND THEORETICAL CHEMISTRY |



1995 › *Charles Shank*

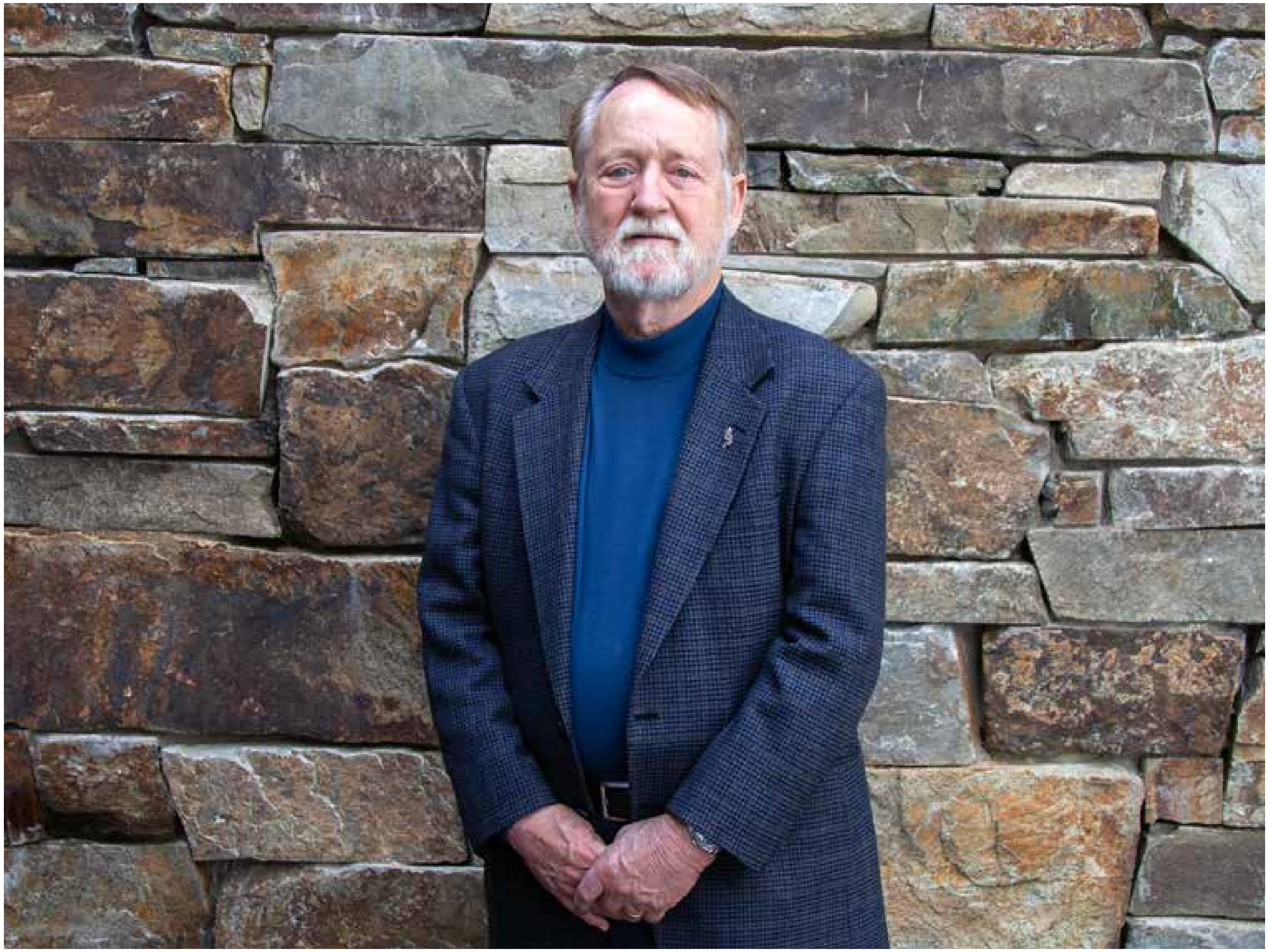
| CONDENSED MATTER PHYSICS AND MATERIALS SCIENCE |

2006 › *Jean Fréchet*

| ORGANIC, POLYMER, MATERIALS, AND MEDICINAL CHEMISTRY |

n.d. › *John Kuriyan*

| STRUCTURAL BIOLOGY OF CELLULAR SIGNAL TRANSDUCTION AND DNA REPLICATION |



2008 › *Clayton Heathcock*

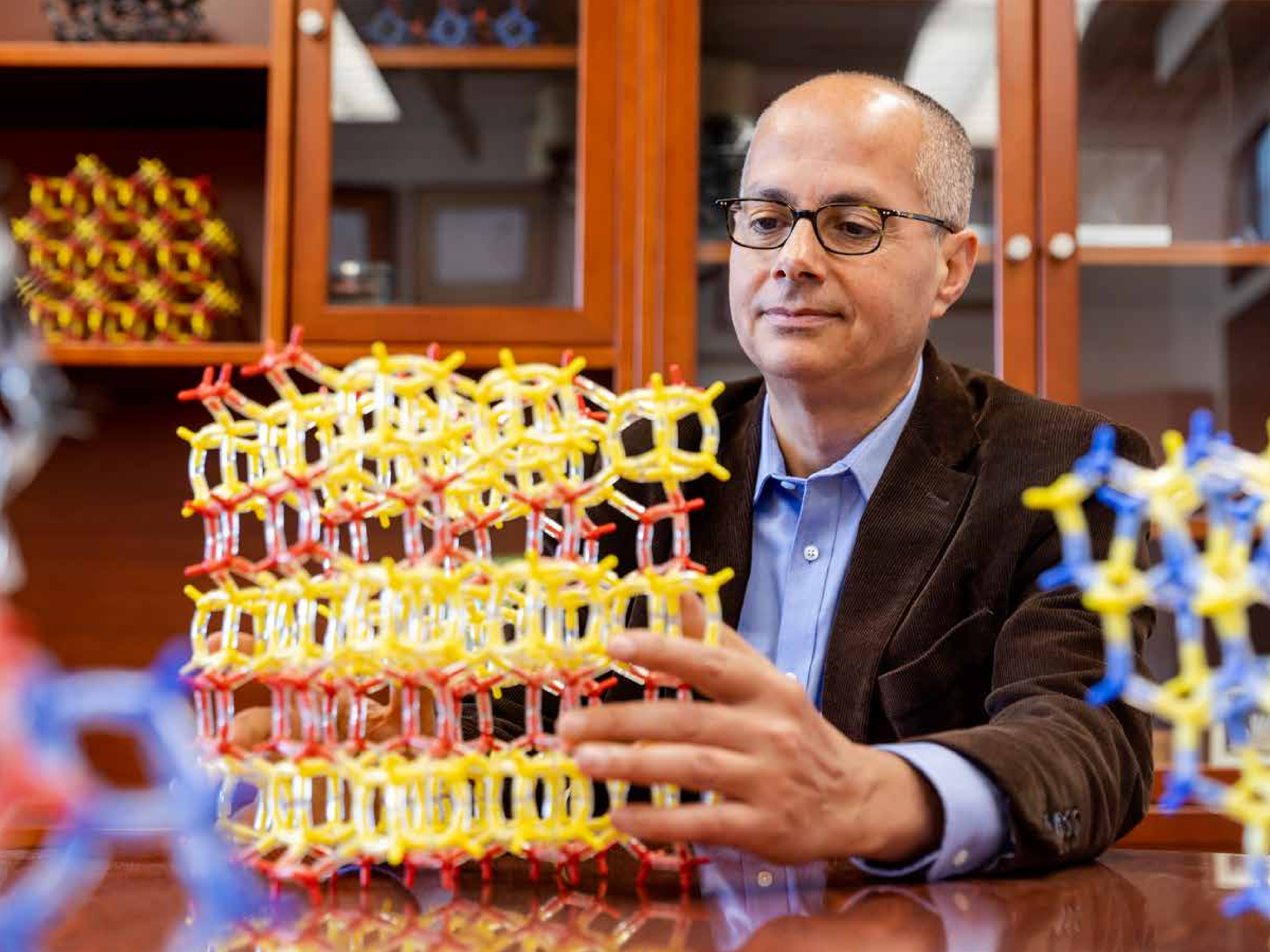
| SYNTHETIC ORGANIC CHEMISTRY |

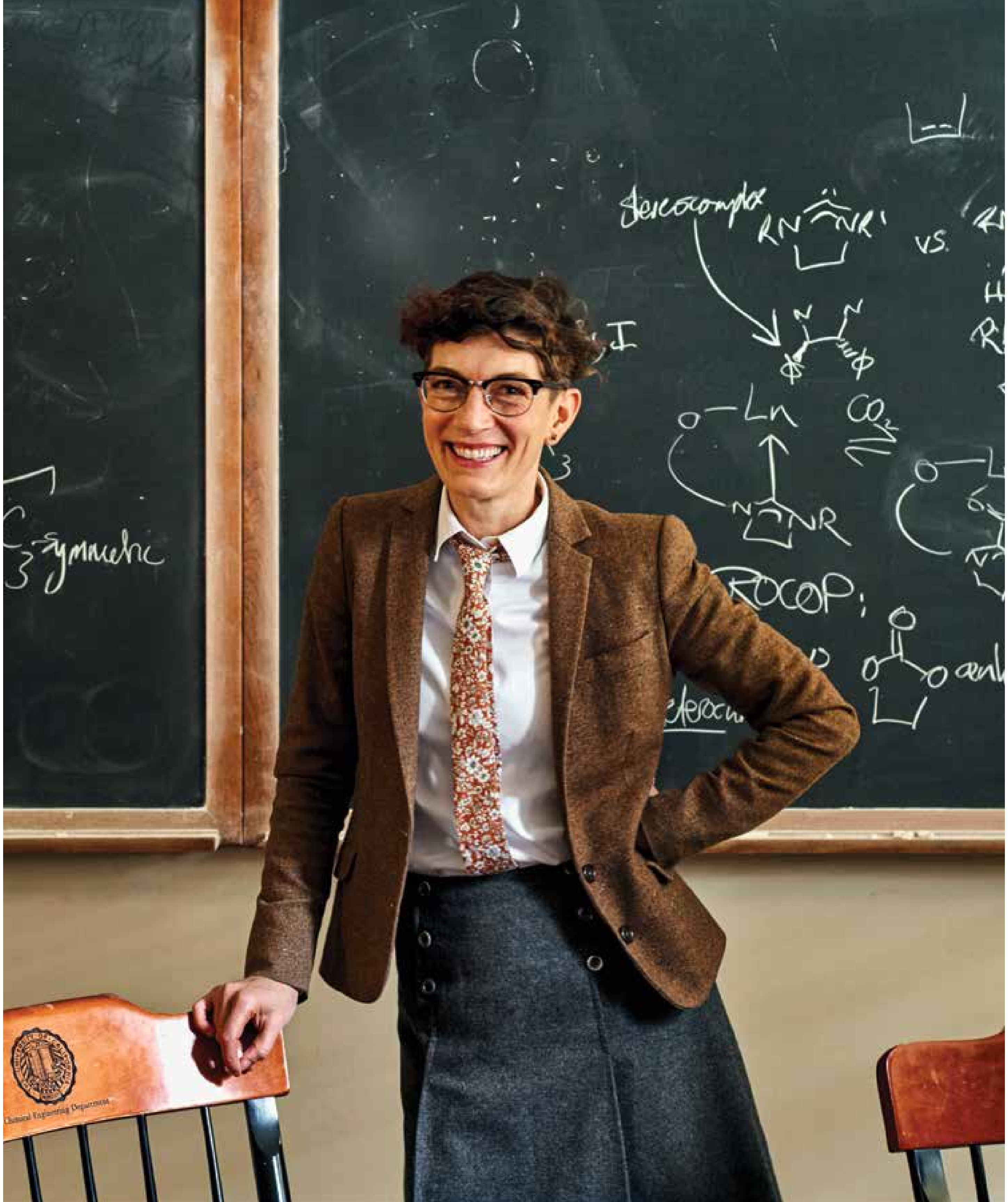
2015 › *F. Dean Toste*

| ORGANIC AND ORGANOMETALLIC CHEMISTRY |

2022 › *Omar Yaghi*

| RETICULAR CHEMISTRY, CLEAN ENERGY, MULTI-FUNCTIONAL MATERIALS, INORGANIC CHEMISTRY, ORGANIC CHEMISTRY, NANOSCIENCE, SUPERCAPACITORS, BIOINSPIRED MATERIALS, CATALYSIS, HIGH-THROUGHPUT SYNTHESIS, AND MATERIAINFORMATICS |



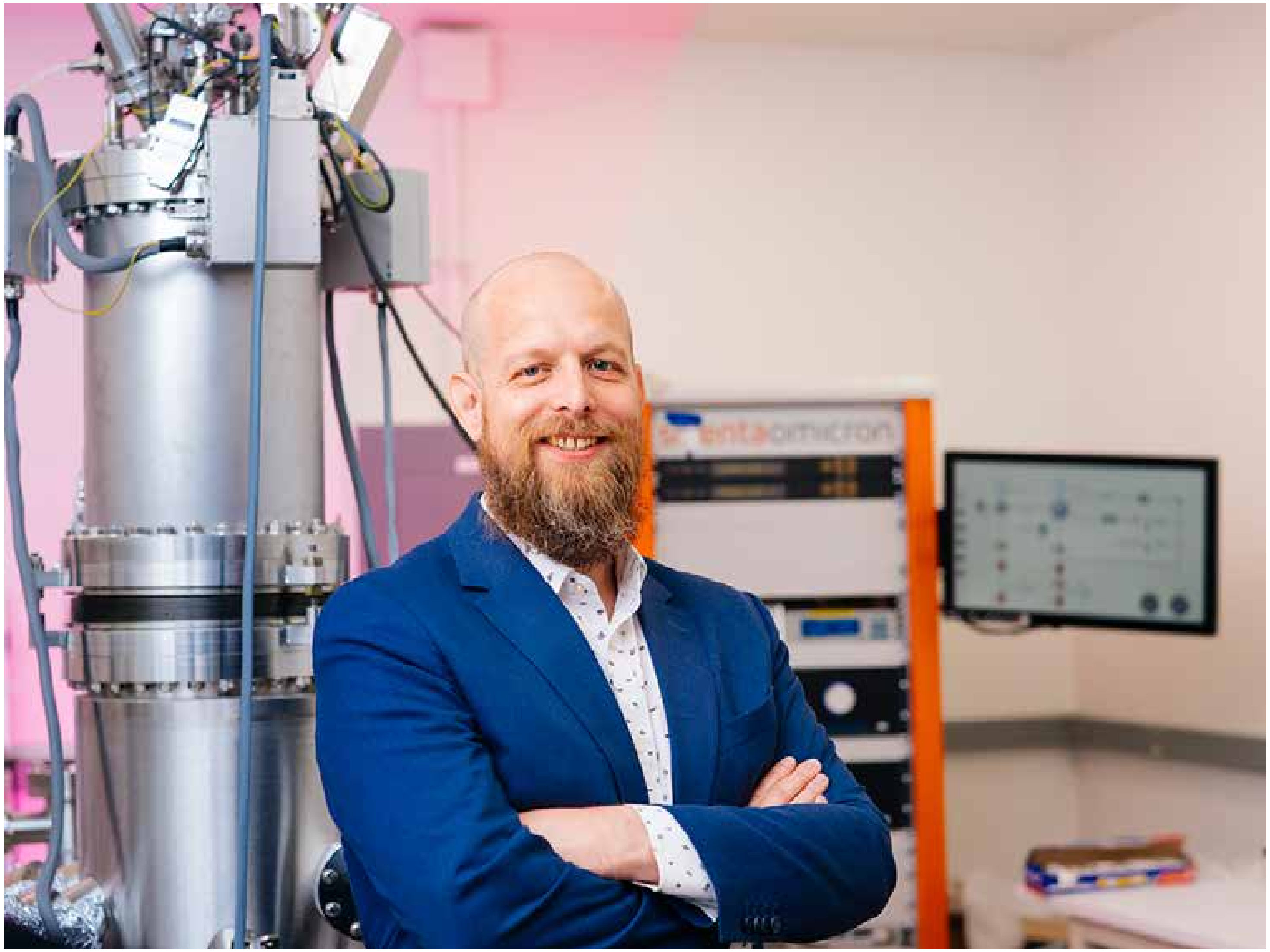


2021 › *Polly Arnold*

| SYNTHETIC, INORGANIC, ORGANOMETALLIC CHEMISTRY, AND CATALYSIS OF THE RARE EARTHS AND ACTINIDES |

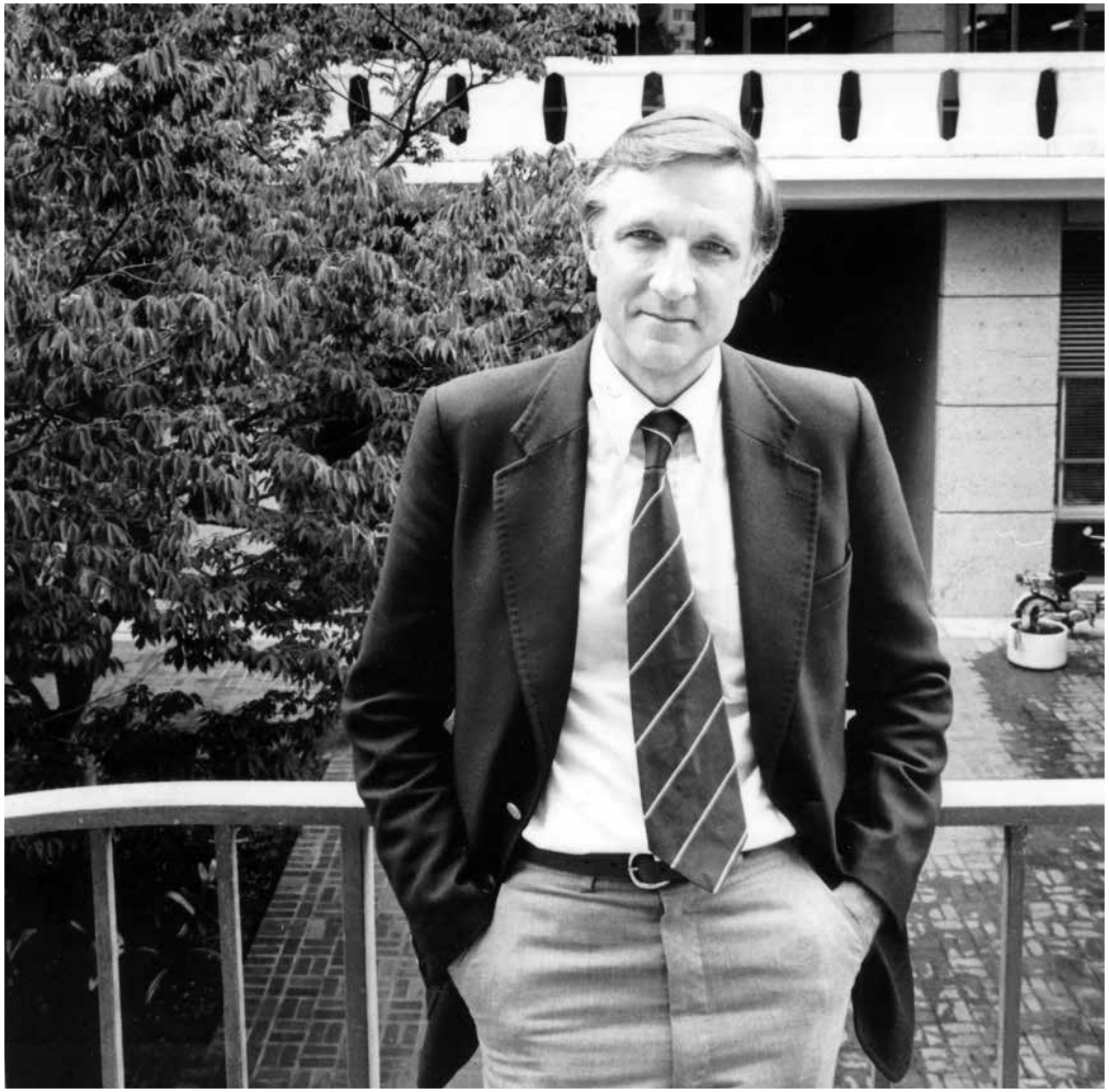
2022 › *Hendrik Utzat*

| NANOSCIENCE, NANO-OPTICS, SINGLE MOLECULE SPECTROSCOPY, QUANTUM OPTICS, FUNCTIONAL INORGANIC NANOSTRUCTURES, OPTOELECTRONIC MATERIALS, PHOTONICS, AND MATERIALS CHEMISTRY |



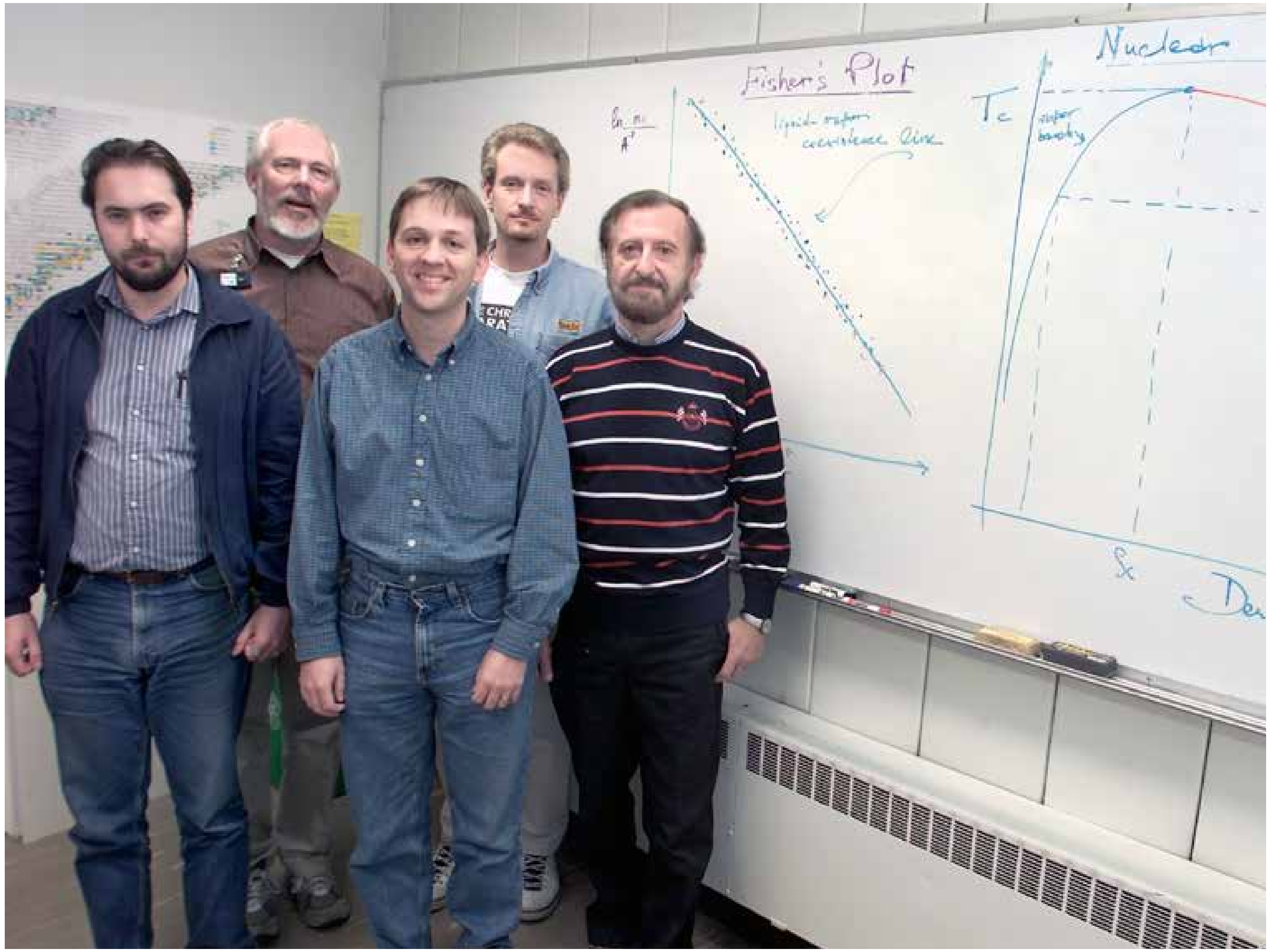
2022 › *Felix R. Fischer*

| ORGANIC AND INORGANIC MATERIALS CHEMISTRY, SUPRAMOLECULAR CHEMISTRY, POLYMER CHEMISTRY, AND MOLECULAR ELECTRONICS |



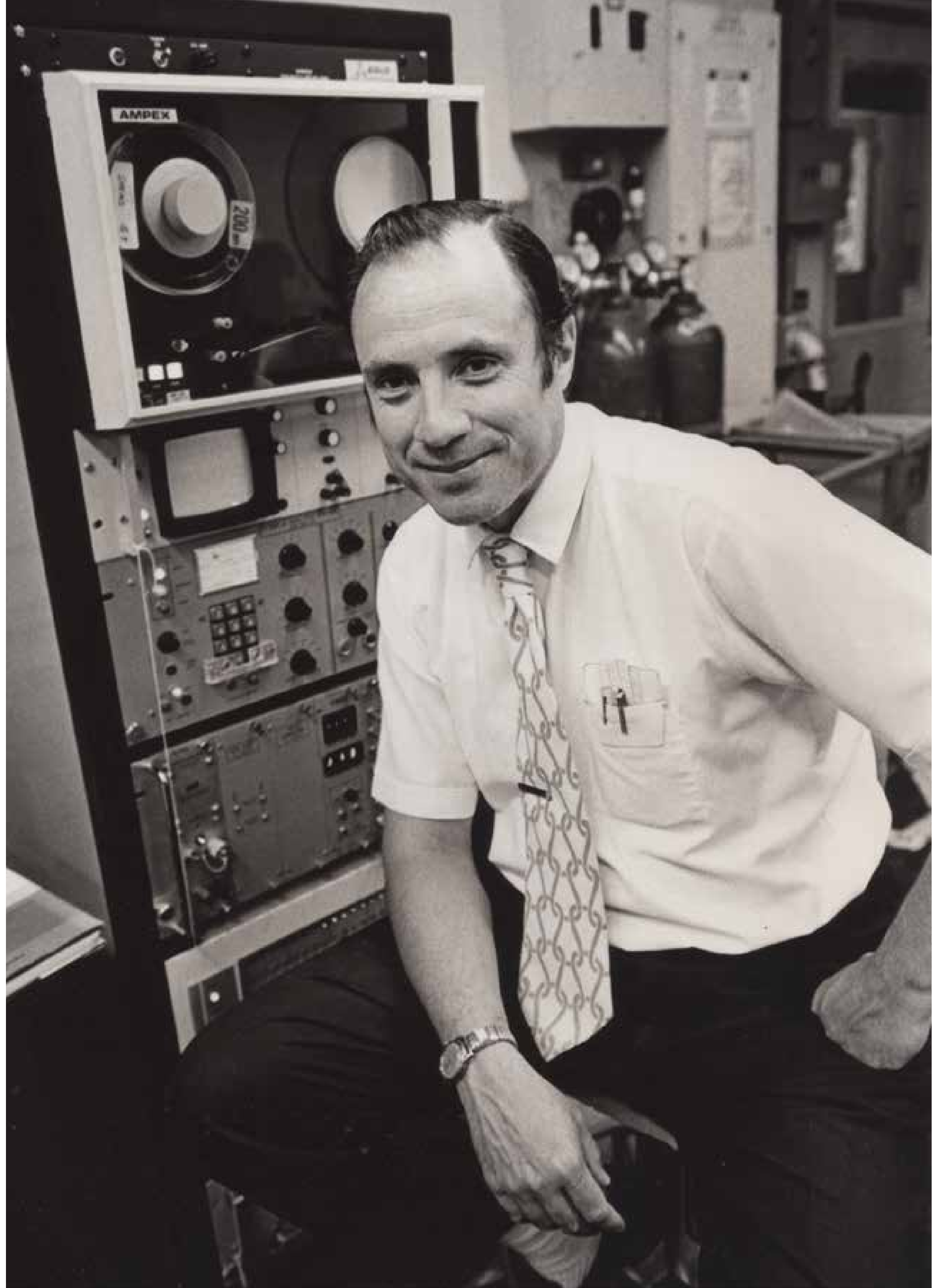
1985 › *C. Bradley Moore*

| PHYSICAL CHEMISTRY |



2002 › *Luciano Moretto (on the right) and atomic nuclei research team at Berkeley Lab. (l to r) Dimitri Breus, Gordon Wozniak, Larry Phair, and Jim Elliott.*

| NUCLEAR SCIENCE — STATISTICAL AND DYNAMICAL PROPERTIES OF NUCLEI AND NUCLEAR REACTIONS |

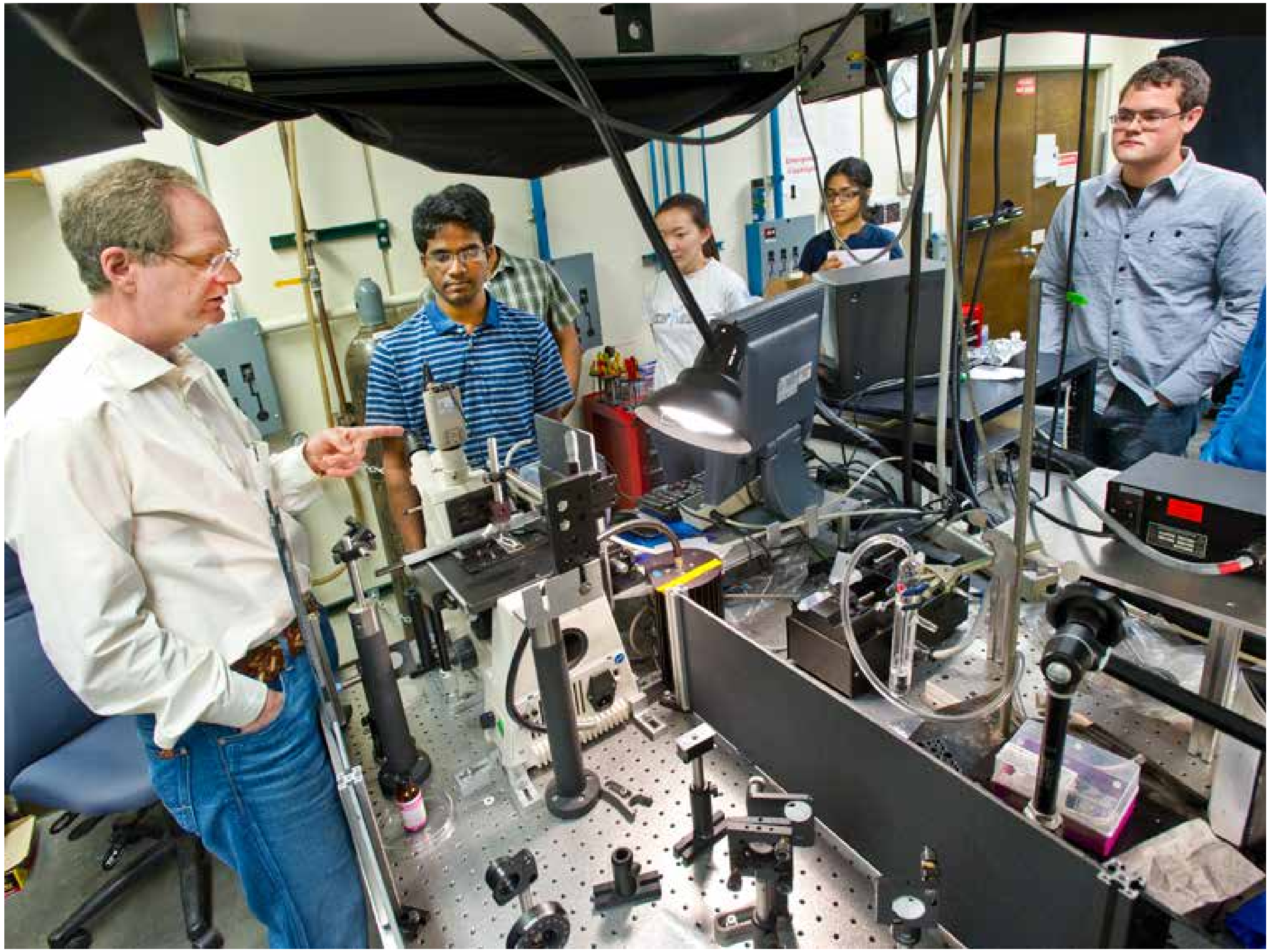


1983 › *Samuel S. Markowitz*

| NUCLEAR CHEMISTRY AND ATMOSPHERIC CHEMISTRY |

2020 › *Ashok Ajoy*

| PHYSICAL CHEMISTRY, NMR MICROSCOPY, ENHANCED NMR VIA SPIN HYPERPOLARIZATION, QUANTUM SENSING AND COMPUTING, AND NANOSCALE SPIN DYNAMICS |



2007 › *Paul Alivisatos (on the left) with students at UC Berkeley's Hildebrand Hall in a meeting at the laser lab.*

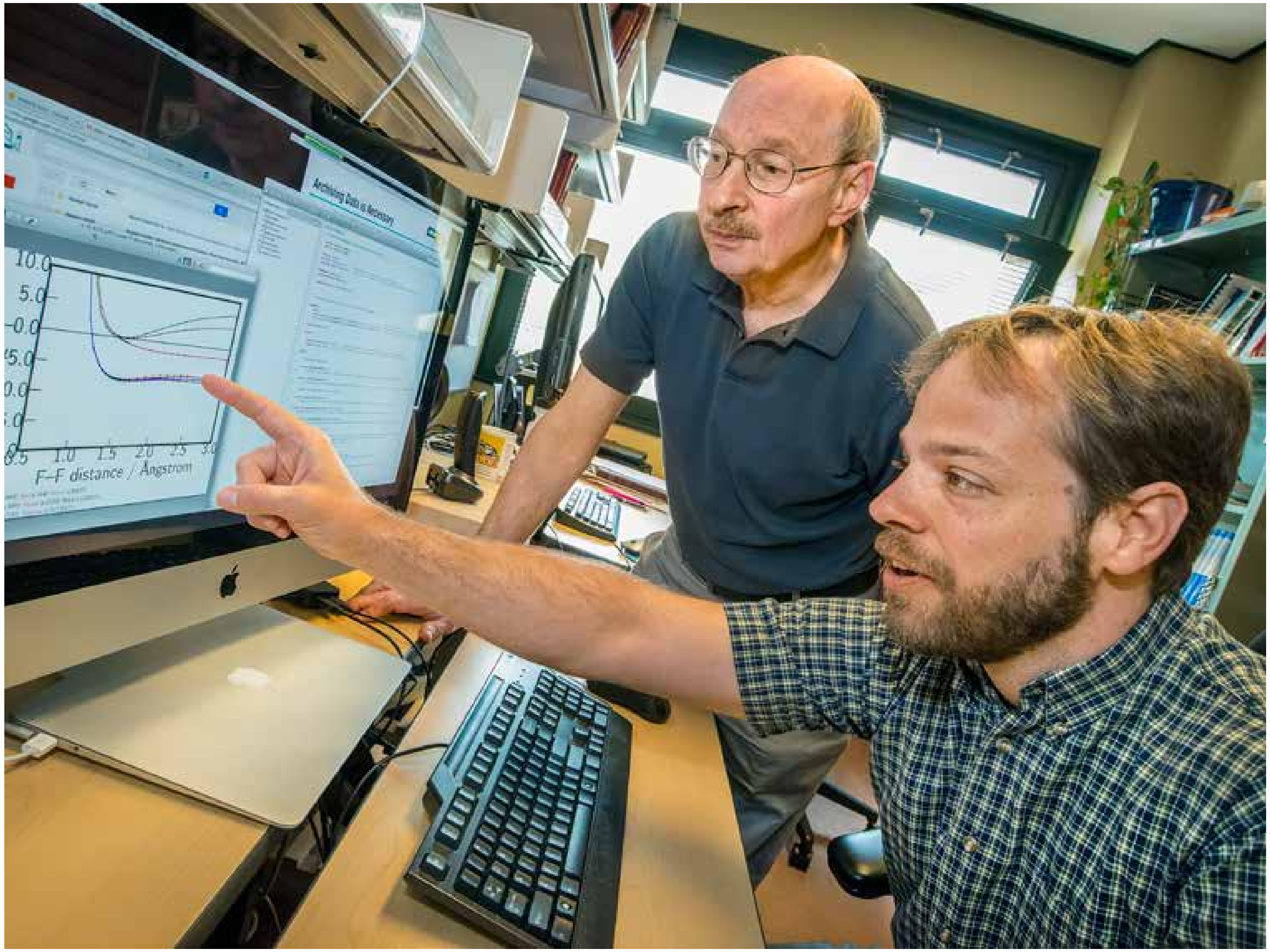
| PHYSICAL CHEMISTRY, MATERIALS CHEMISTRY, NANO CHEMISTRY, SEMICONDUCTOR QUANTUM DOTS, AND COLLOIDAL NANOCRYSTAL CHEMISTRY |

2022 › *Kristie Boering*

| PHYSICAL AND ANALYTICAL CHEMISTRY, ATMOSPHERIC CHEMISTRY AND TRANSPORT |

2022 › *Michelle C. Chang*

| BIOCHEMISTRY, CHEMICAL BIOLOGY, AND SYNTHETIC BIOLOGY |

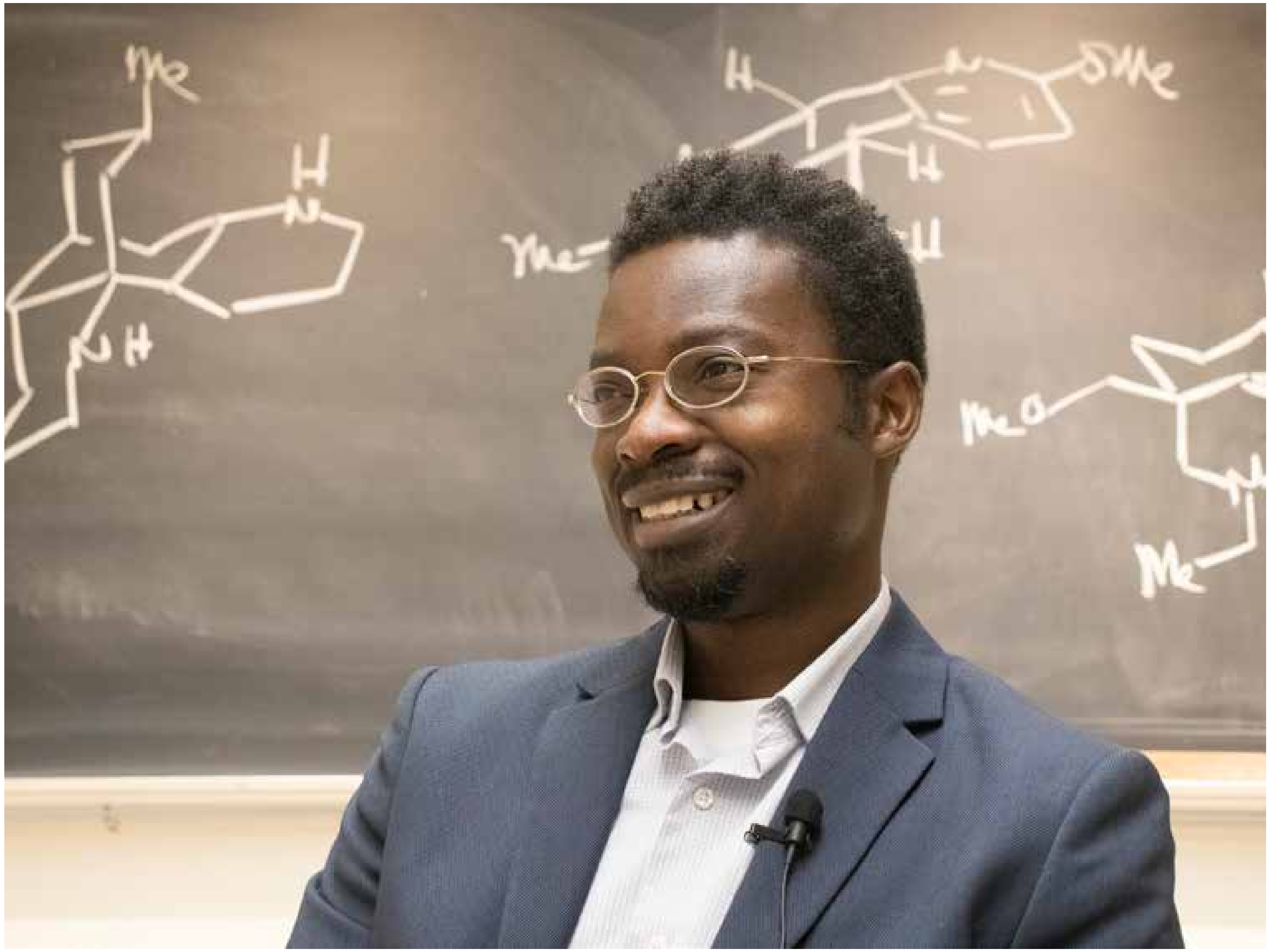


2014 › *Stephen R. Leone*

| PHYSICAL CHEMISTRY, CHEMICAL DYNAMICS AND NANOSTRUCTURED MATERIALS |

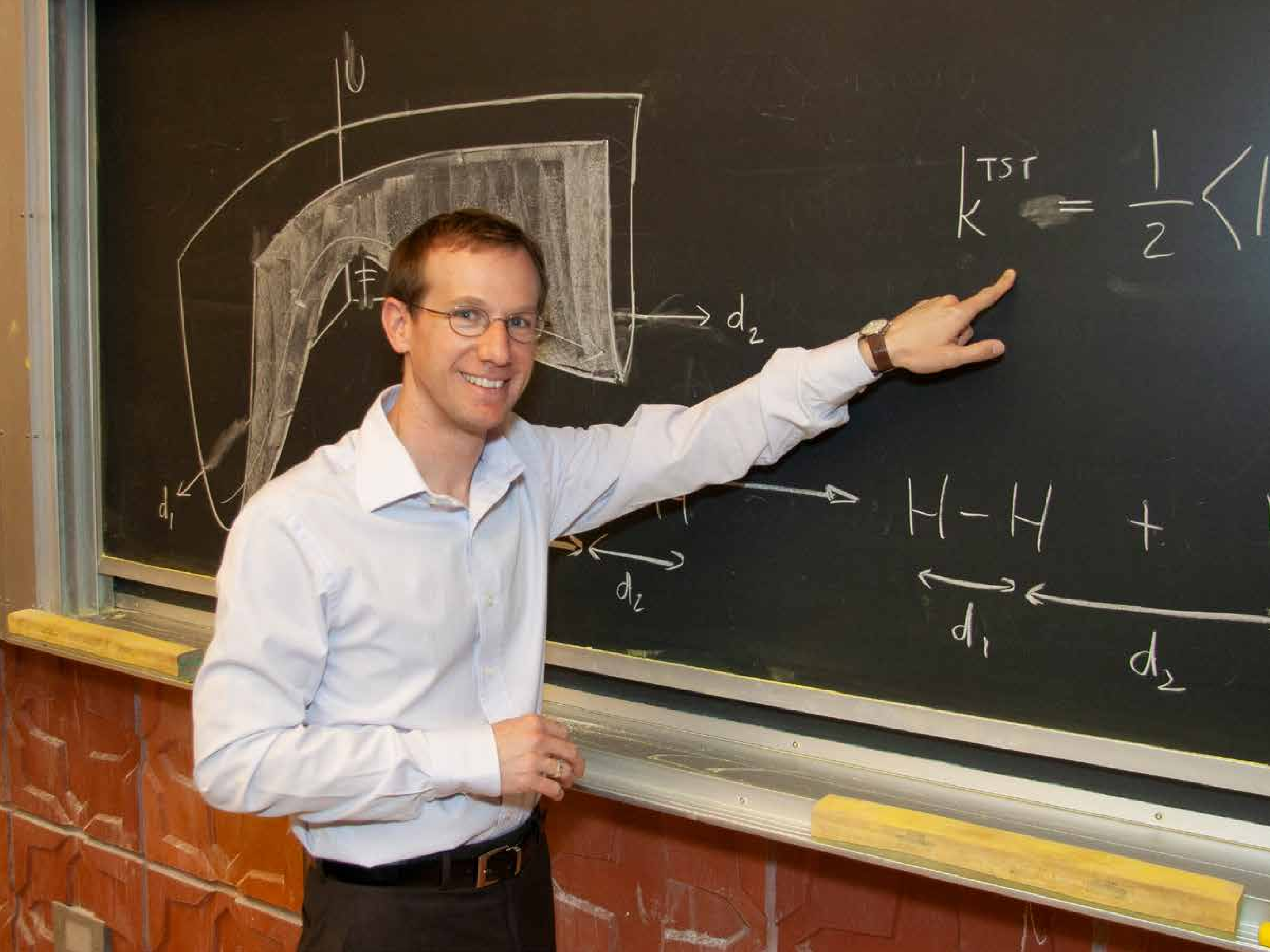
2023 › *Kevan Shokat*

| SYNTHETIC ORGANIC CHEMISTRY, PROTEIN ENGINEERING, STRUCTURAL BIOLOGY, BIOCHEMISTRY, AND CELL-BASED ASSAYS |



2020 › *Richmond Sarpong*

| ORGANIC AND ORGANOMETALLIC CHEMISTRY |



U
d_2
d_1
$k^{TST} = \frac{1}{2}$
H–H +
d_2
d_1
d_2

2009 › *David Chandler (1944-2017) and Phillip Geissler (1974-2022)*

| STATISTICAL MECHANICS | | THEORETICAL CHEMISTRY |

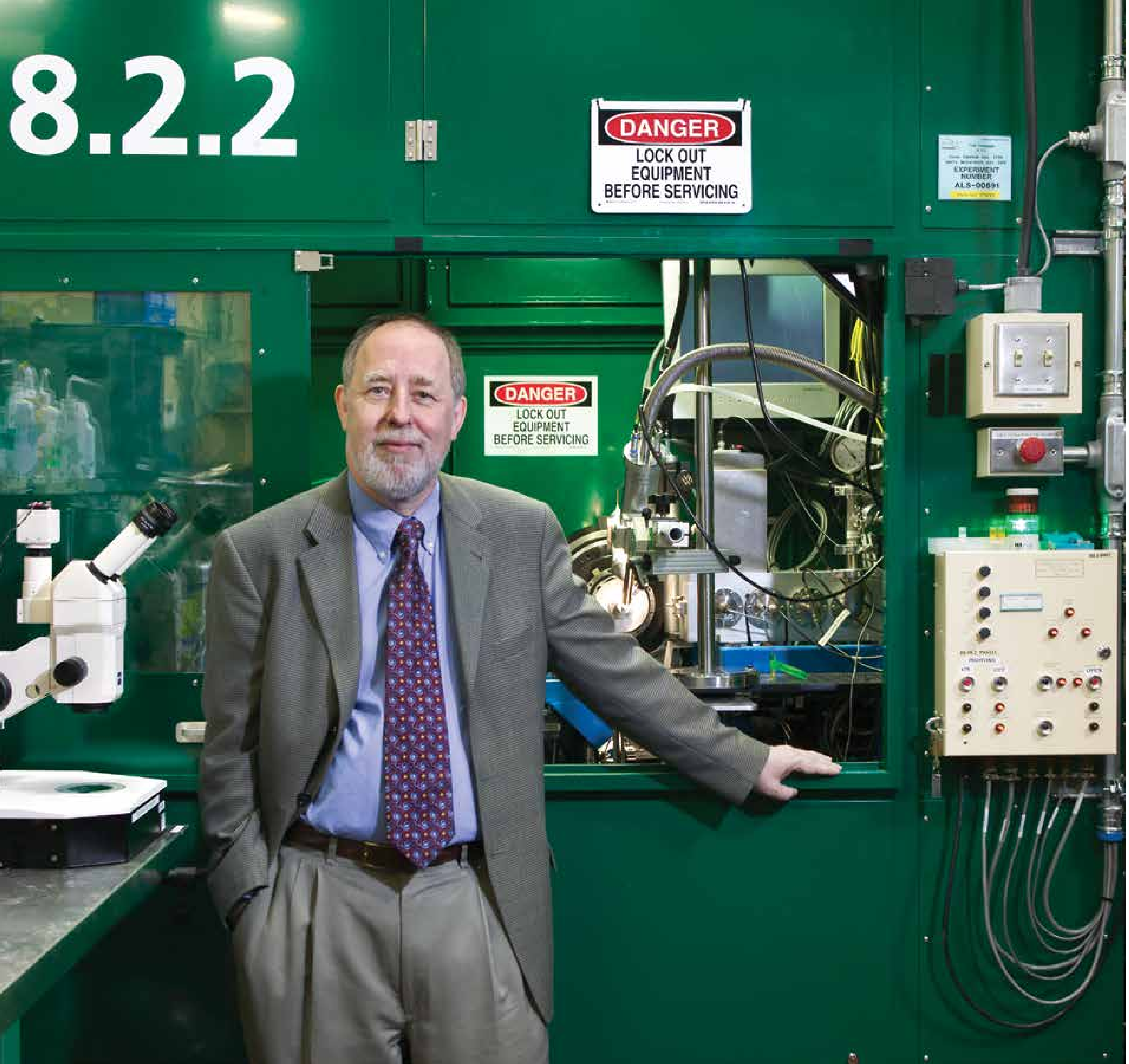
2012 › *Phillip Geissler (Ph.D. '00, Chem)*

1995 › *Ronald C. Cohen*

| ATMOSPHERIC CHEMISTRY, IMPACT OF AIR QUALITY AND CLIMATE ON THE ATMOSPHERE AND BIOSPHERE |

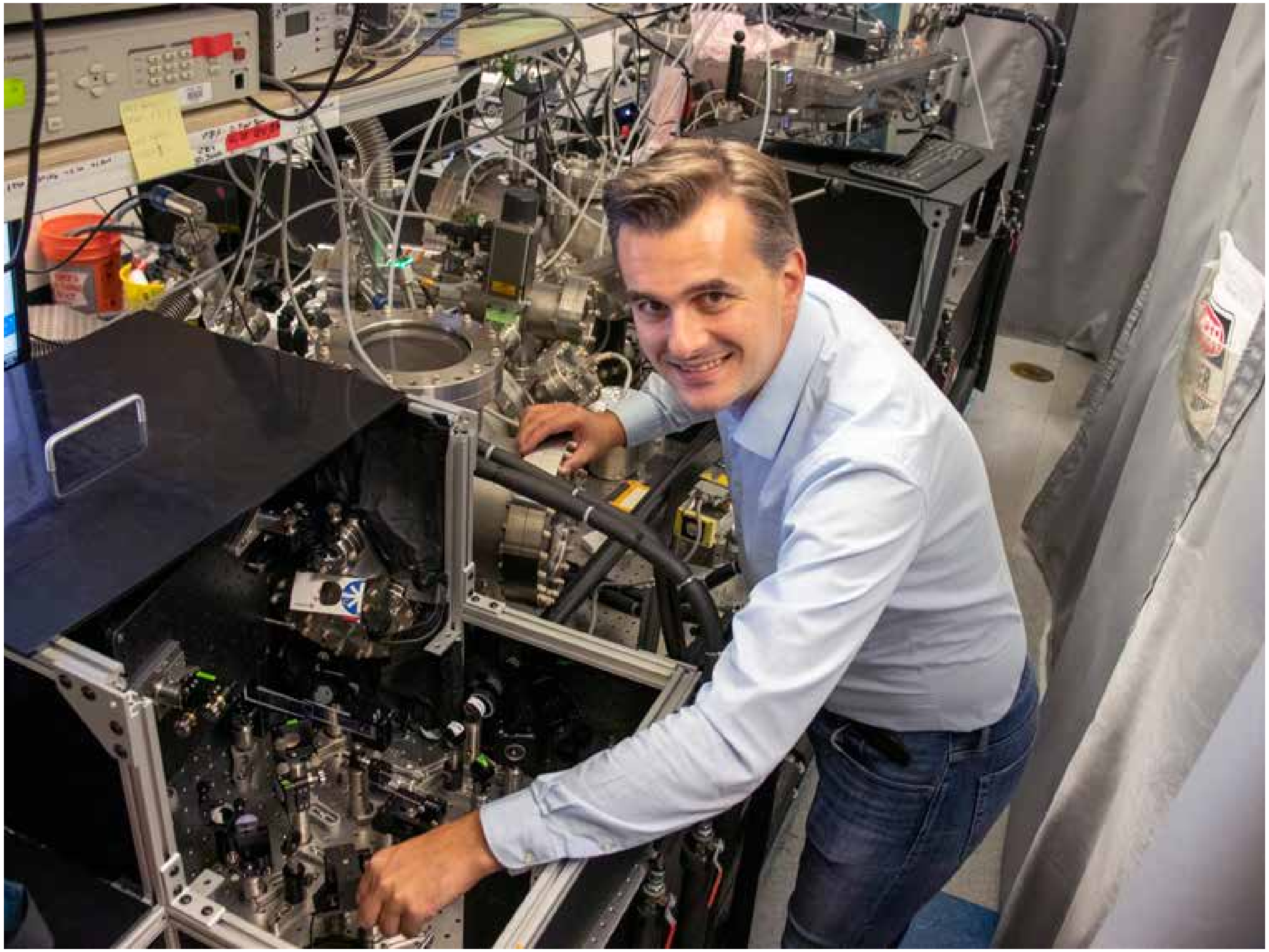
2023 › *Teresa Head-Gordon*

| COMPUTATION AND THEORY IN THE AREAS OF CHEMISTRY, MATERIALS, AND BIOPHYSICS |



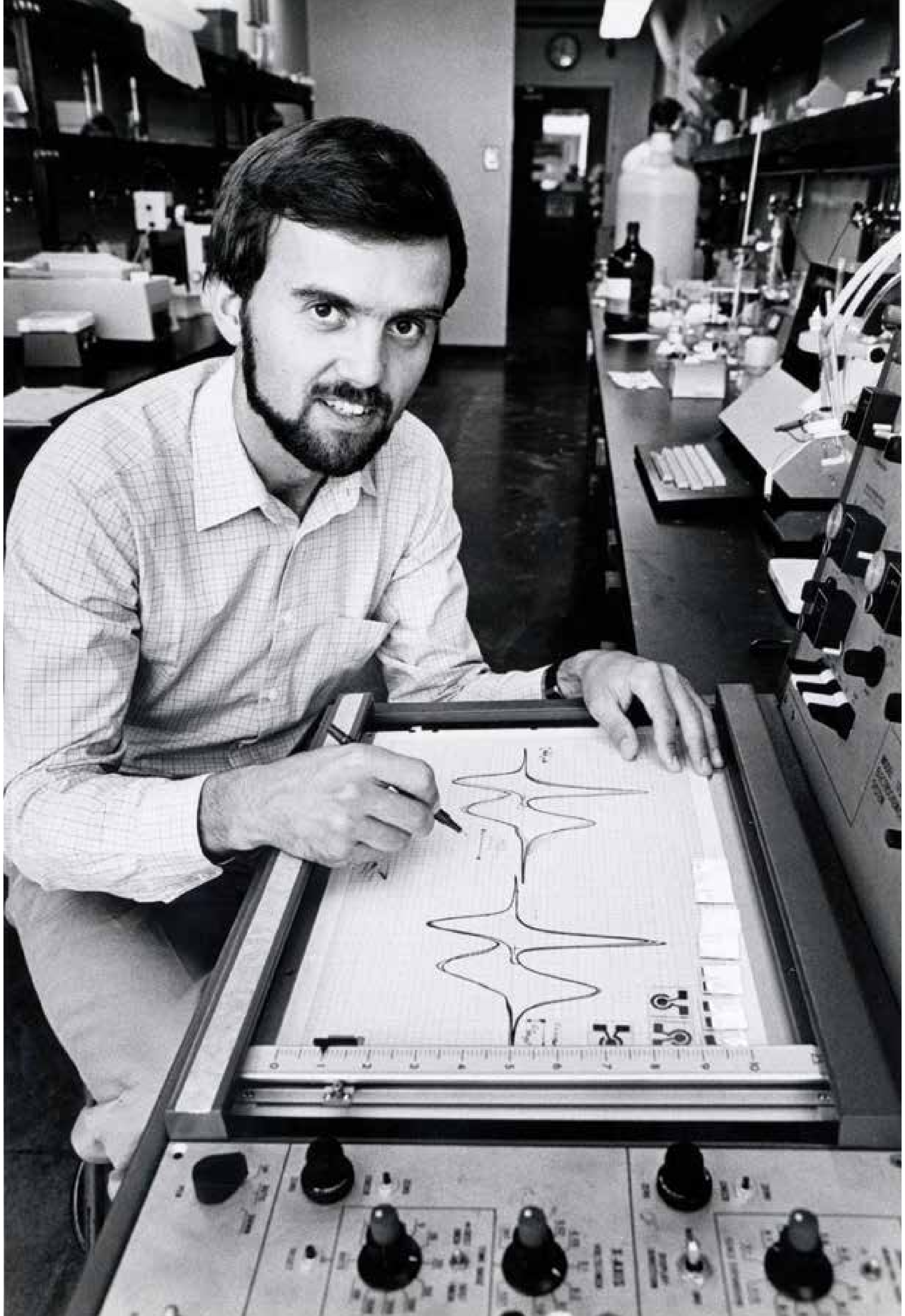
2004 › *Graham Fleming*

| CHEMICAL BIOLOGY,
PHYSICAL CHEMISTRY |



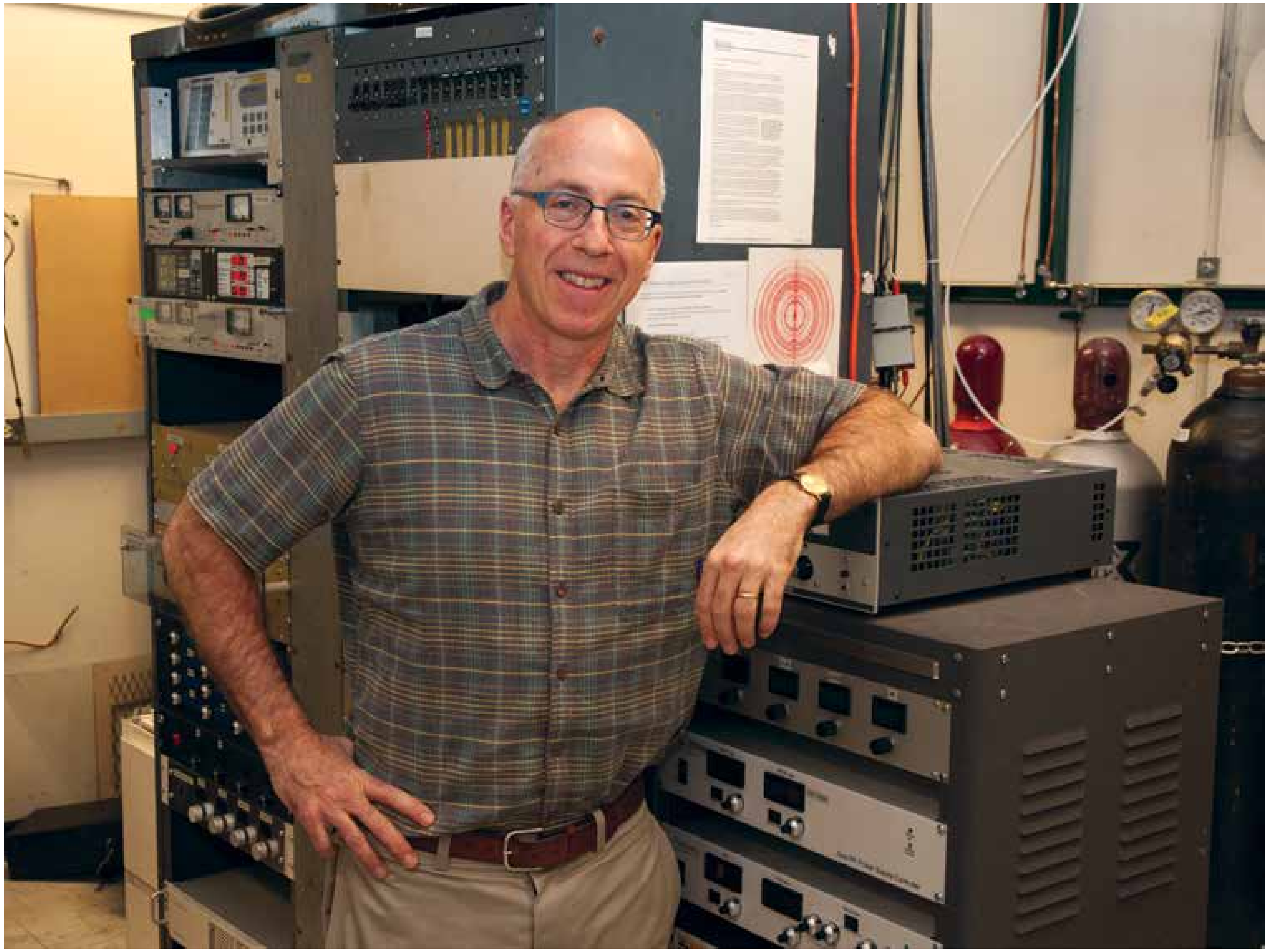
2019 › *Michael W. Züerch*

| MATERIALS, POLYMERS & NANOSCIENCE, AND PHYSICAL CHEMISTRY |



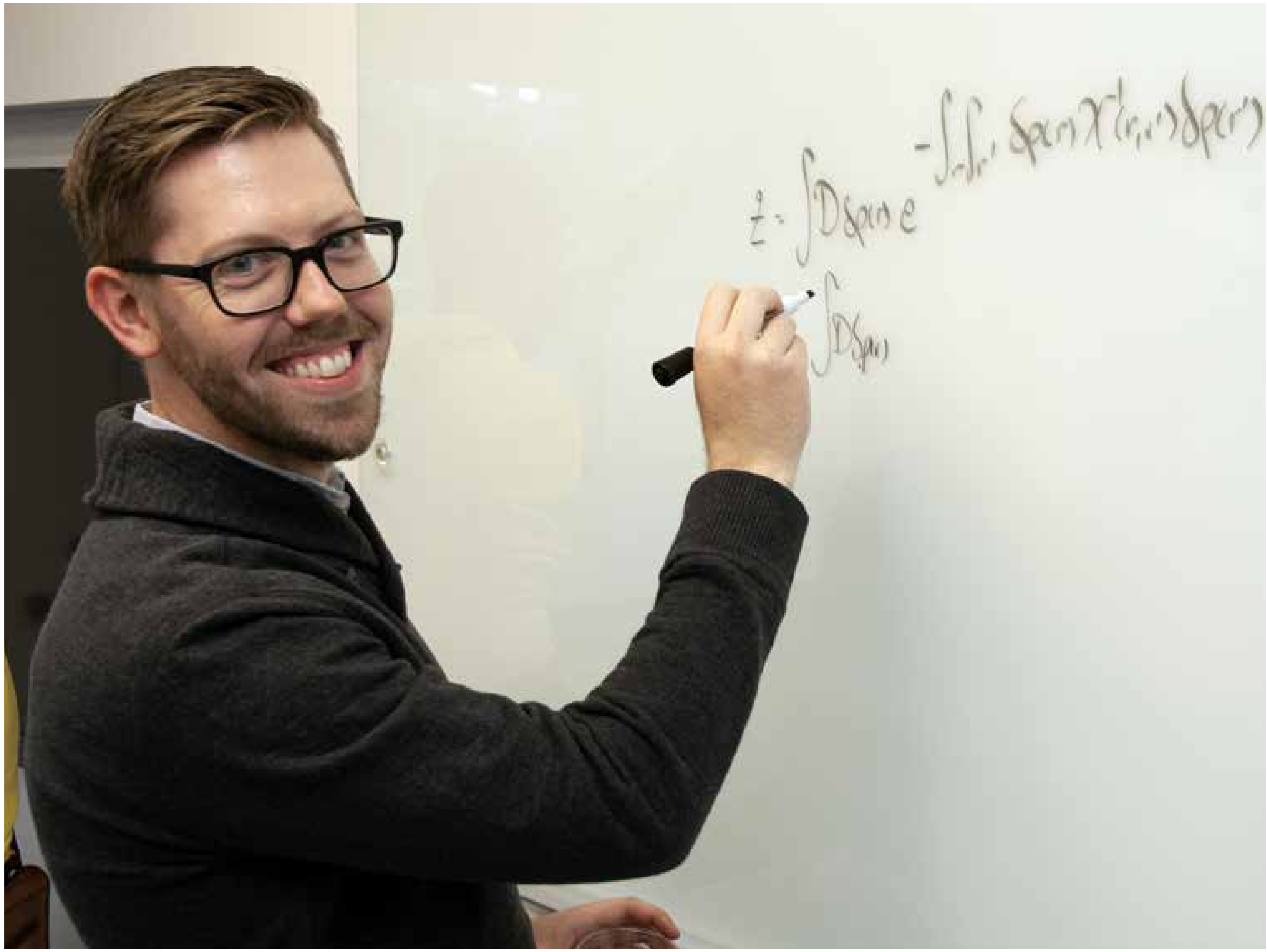
1986 › *Marcin Majda*

| BIOANALYTICAL, BIOPHYSICAL, AND INTERFACIAL CHEMISTRY |



2013 › *Daniel Neumark*

| PHYSICAL CHEMISTRY, MOLECULAR STRUCTURE AND DYNAMICS |

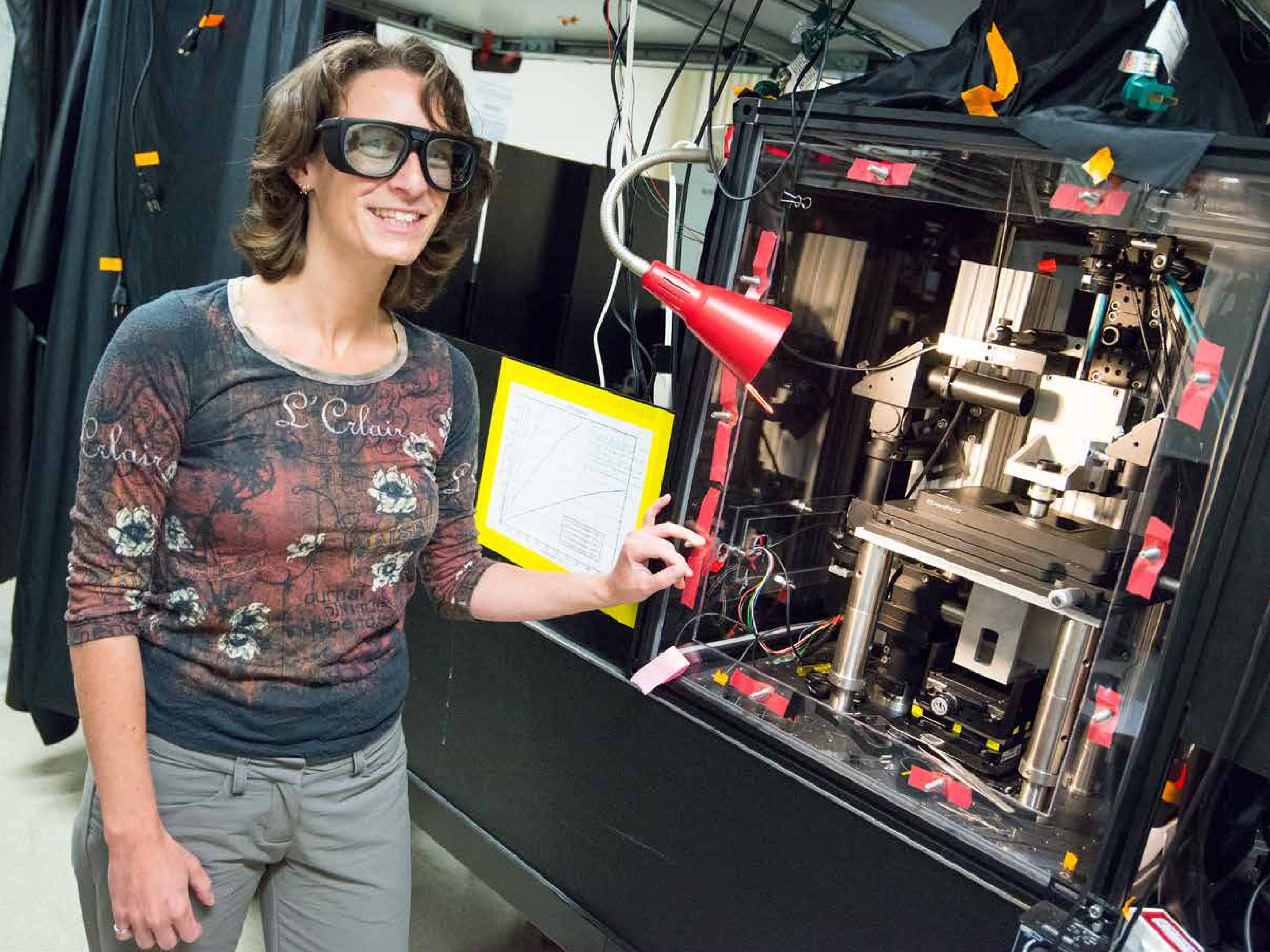


2016 › *David Limmer*

| THEORETICAL CHEMISTRY |

2017 › *Eran Rabani*

| MATERIALS, POLYMERS & NANOSCIENCE, THEORETICAL, PHYSICAL CHEMISTRY |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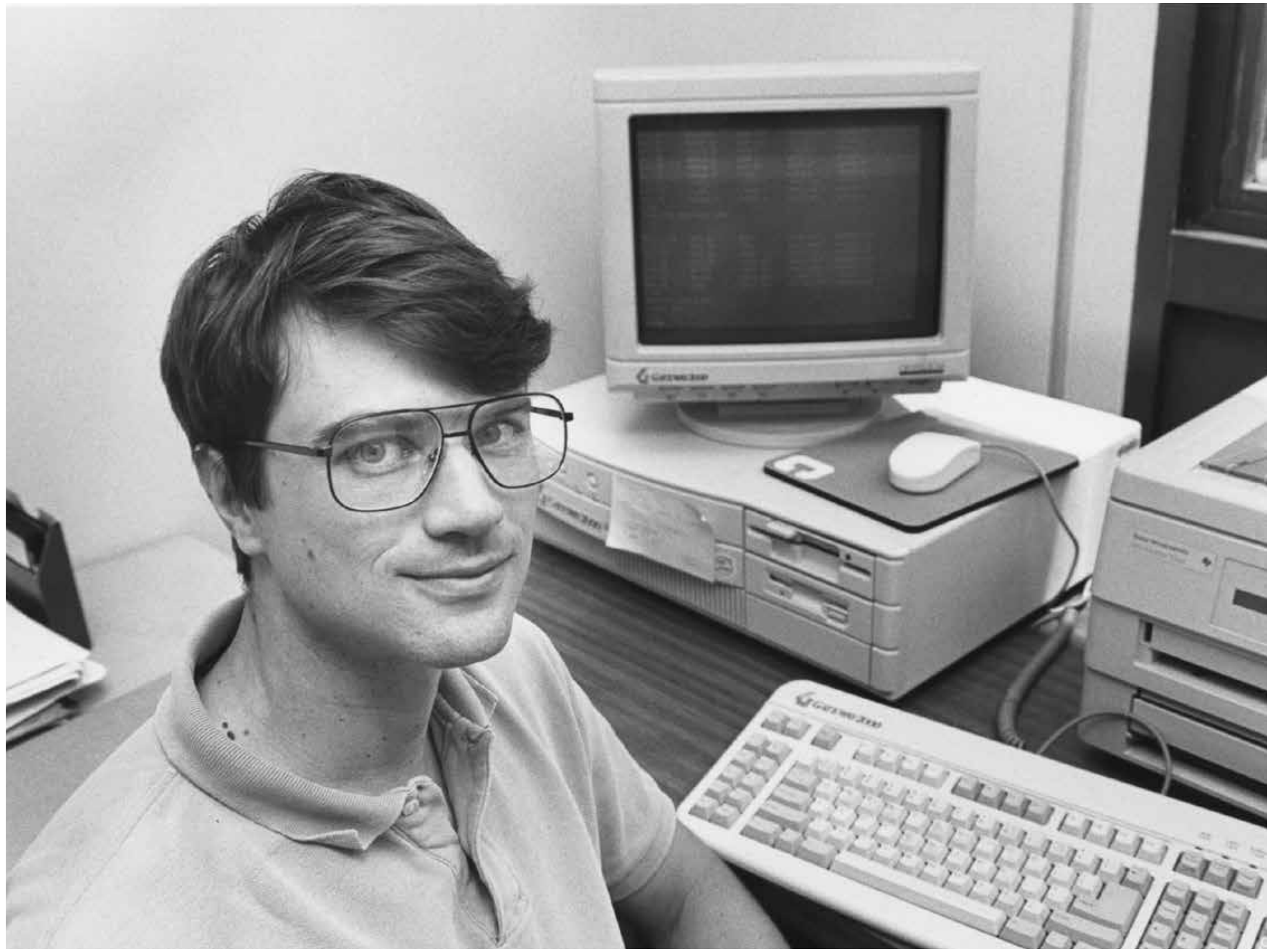


n.d. › *Martin Head-Gordon*

| THEORETICAL CHEMISTRY, ELECTRONIC STRUCTURE THEORY |

2015 › *Naomi Ginsberg*

| CHEMICAL BIOLOGY, MATERIALS,
POLYMERS & NANOSCIENCE,
PHYSICAL CHEMISTRY |

2013 › *Thomas Maimone*

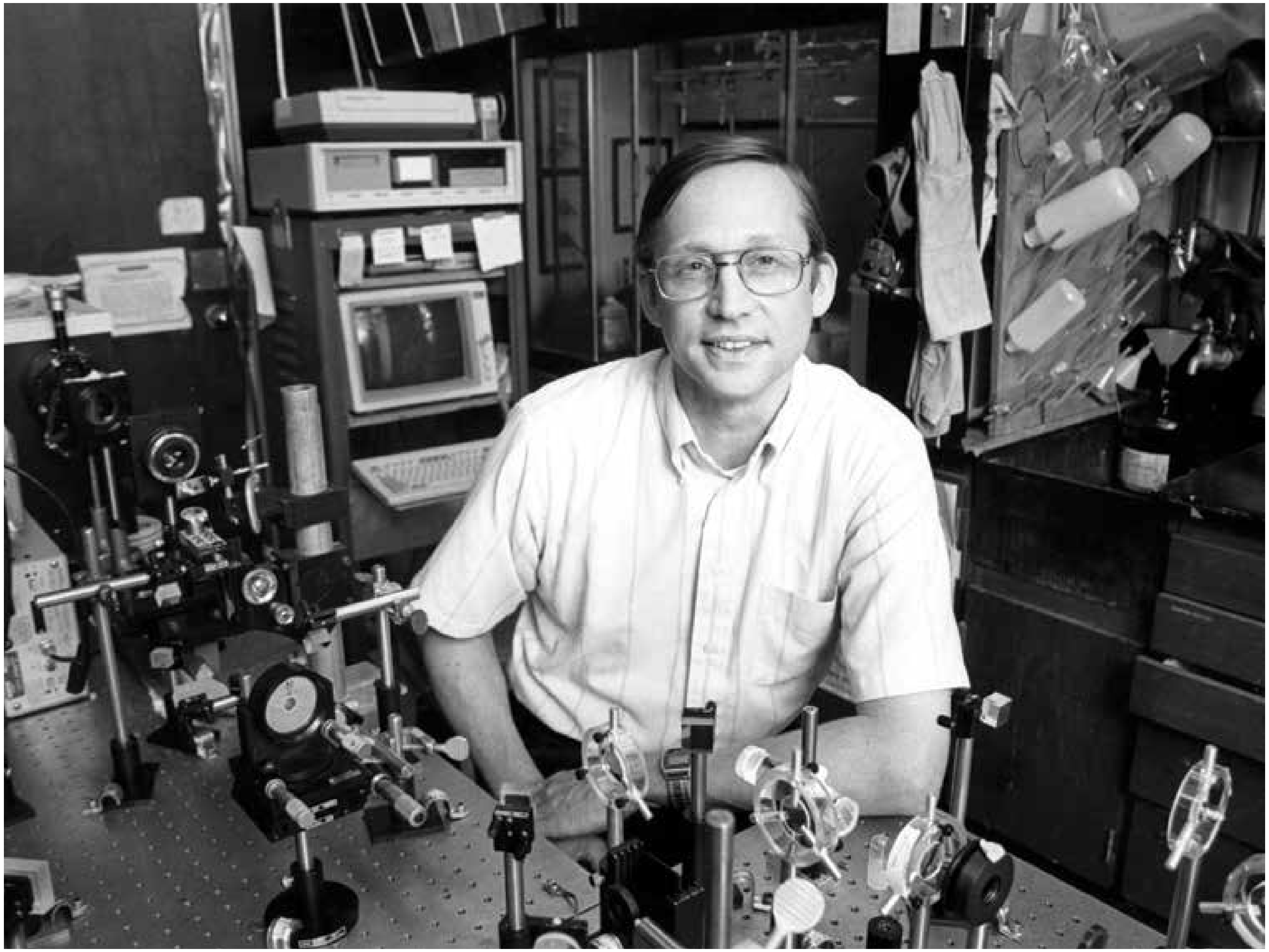
| INORGANIC & ORGANOMETALLIC, ORGANIC CHEMISTRY |

2008 › *Jay Groves*

| CHEMICAL BIOLOGY, MATERIALS, POLYMERS & NANOSCIENCE, PHYSICAL CHEMISTRY |

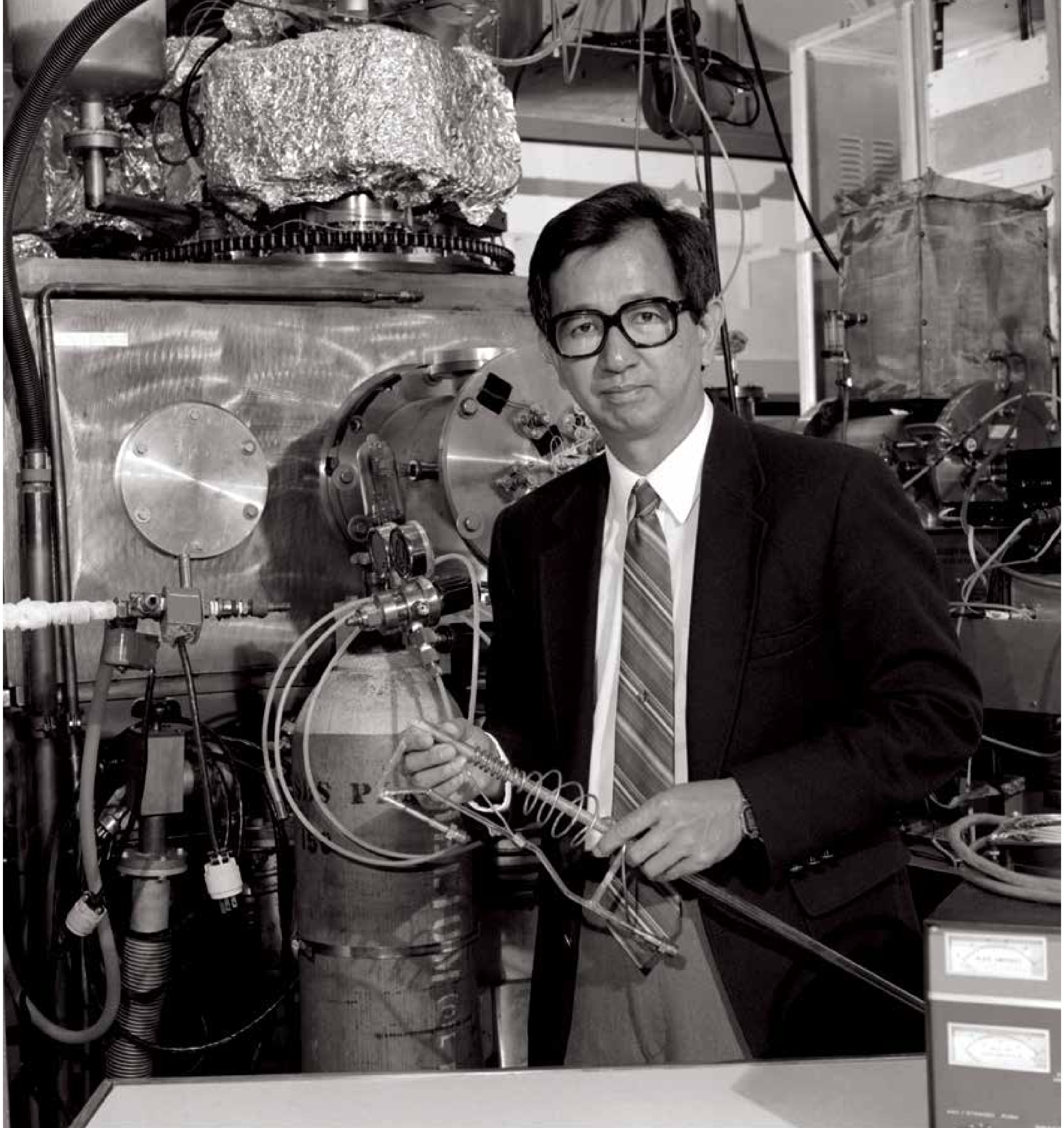
2016 › *Eric Neuscamman*

| THEORETICAL CHEMISTRY, ELECTRONIC STRUCTURE THEORY |



1986 › *Richard Mathies*

| ANALYTICAL & BIOANALYTICAL, CHEMICAL BIOLOGY, MATERIALS, POLYMERS & NANOSCIENCE, PHYSICAL CHEMISTRY |



1986 › *Yuan T. Lee*

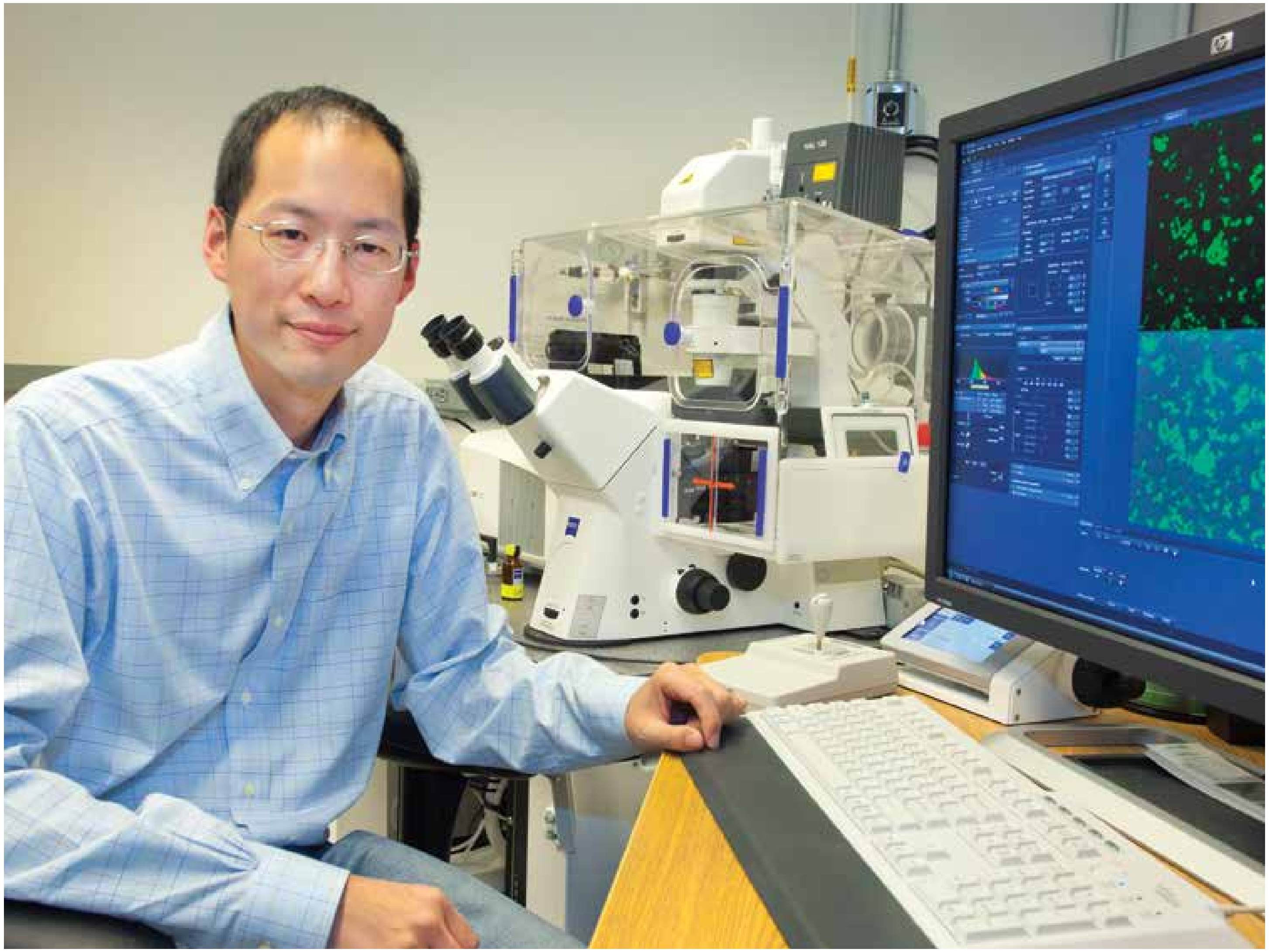
| REACTION DYNAMICS, PHOTOCHEMICAL PROCESSES, AND MOLECULAR SPECTROSCOPY |

2023 › *Robert Saxton*

| PROTEIN ENGINEERING AND DIRECTED EVOLUTION, STRUCTURAL BIOLOGY, AND RECEPTOR PHARMACOLOGY |

2023 › *Ziyang Zhang*

| SMALL MOLECULE AND SYNTHETIC CHEMISTRY, COVALENT CHEMISTRY, AND DRUG DISCOVERY |



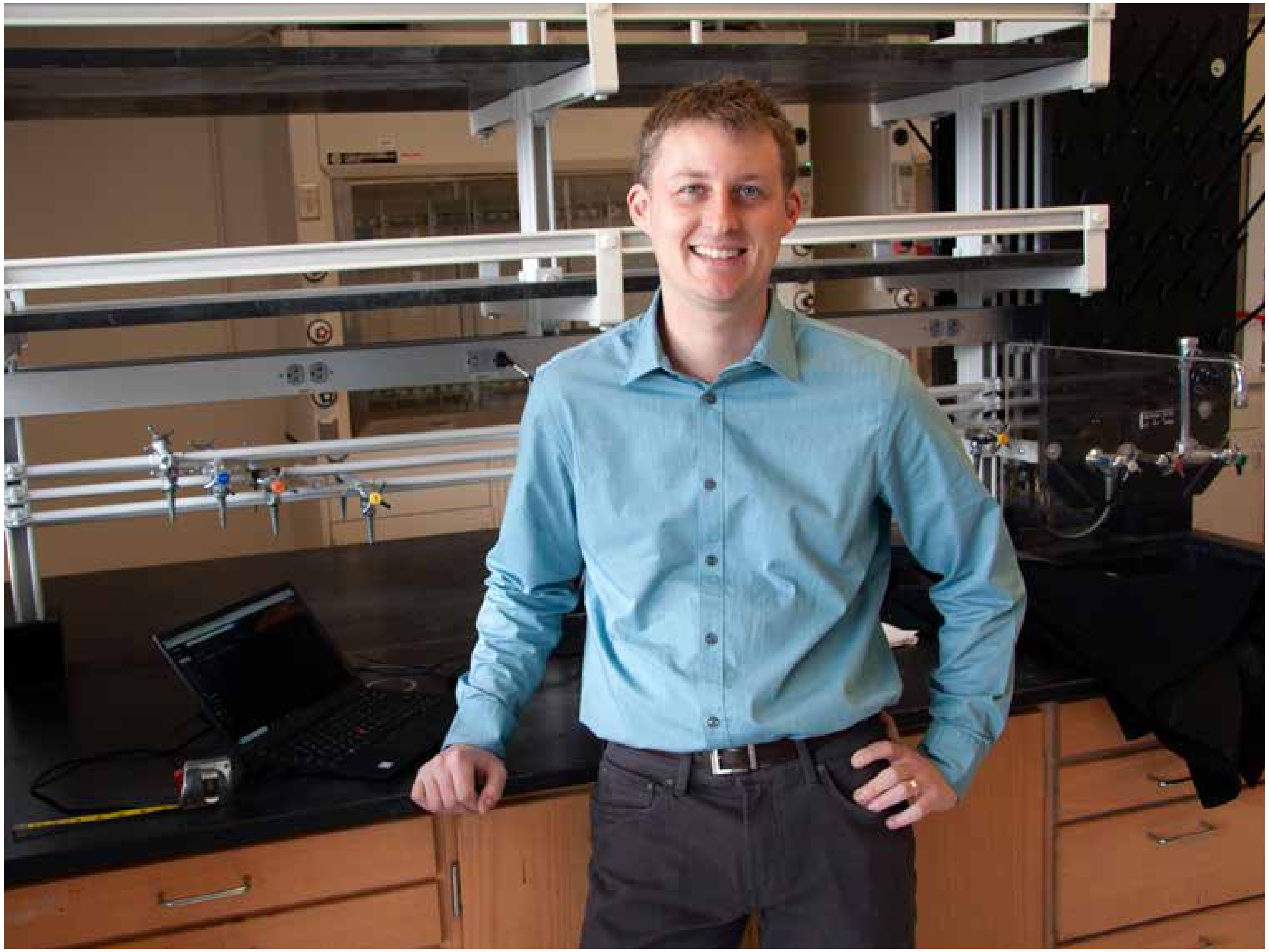
2011 › *Christopher Chang*

| CHEMICAL BIOLOGY, BIOINORGANIC CHEMISTRY, AND INORGANIC CHEMISTRY |

2020 › *Jennifer Doudna displays her Nobel diploma on the day she received her Nobel Prize in Berkeley, California (December 8, 2020). Nobel Prize winners did not go to Sweden that year because of the COVID epidemic. The medals were sent by diplomatic courier to the awardee's home countries.*

| CHEMICAL BIOLOGY, GENE EDITING TOOLS, CELL STRUCTURE & MECHANISMS, AND CELL EDITING |


KUNGL VETENSKAPSAKADEMIEN
HAR DEN 7 OKTOBER 2020
BESLUTAT ATT MED DET
NOBELPRIS
SOM DETTA ÅR TILLERKÄNNES
DEN SOM GJORT DEN VIKTIGASTE
KEMISKA UPPTÄCKTEN
ELLER FÖRBÄTTRINGEN
GEMENSAMT BELÖNA
Jennifer A Doudna
FÖR UTVECKLING AV EN METOD
FÖR GENOMEDITERING

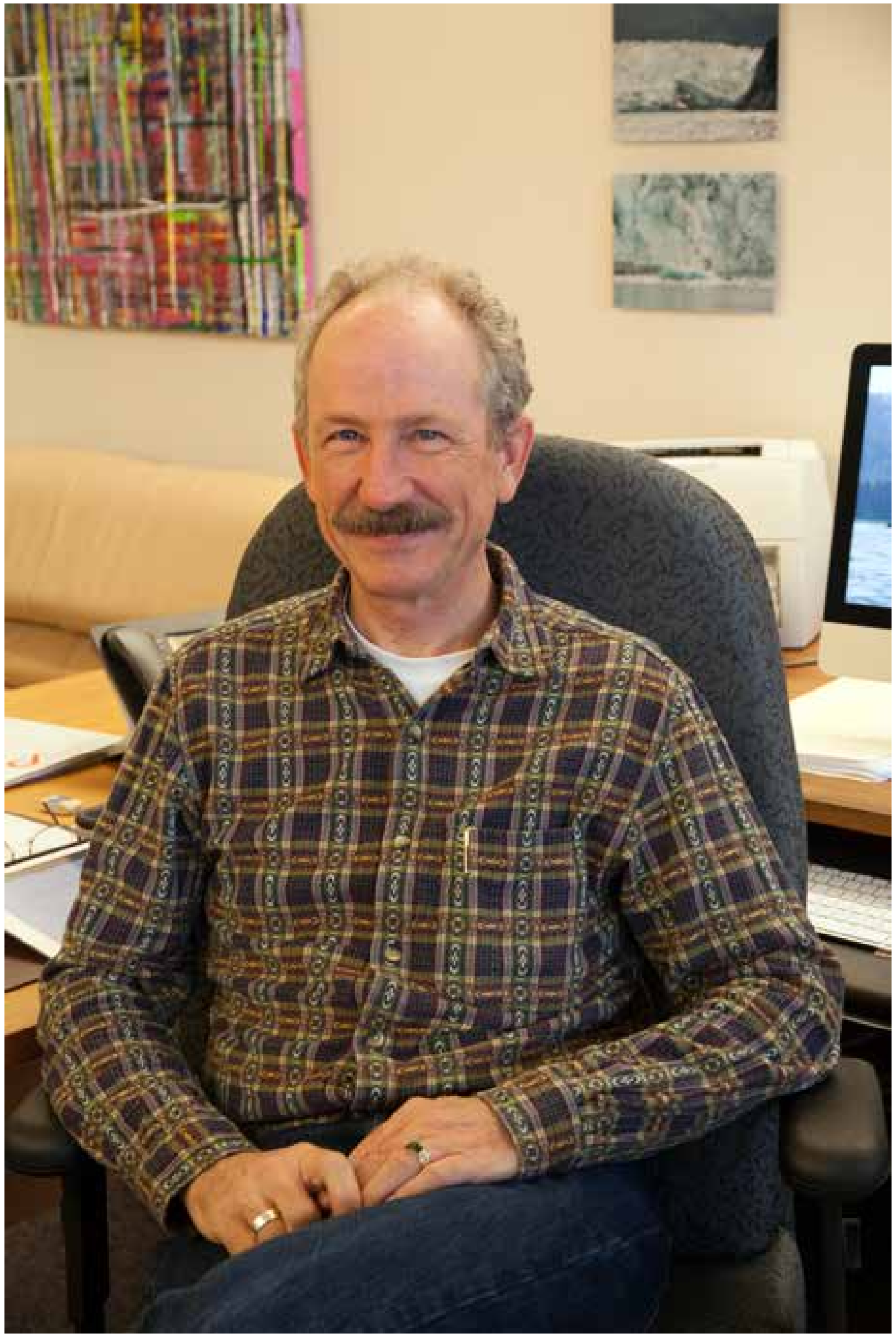


2018 › *Jonathan Rittle*

| CHEMICAL BIOLOGY, INORGANIC AND ORGANOMETALLIC CHEMISTRY |

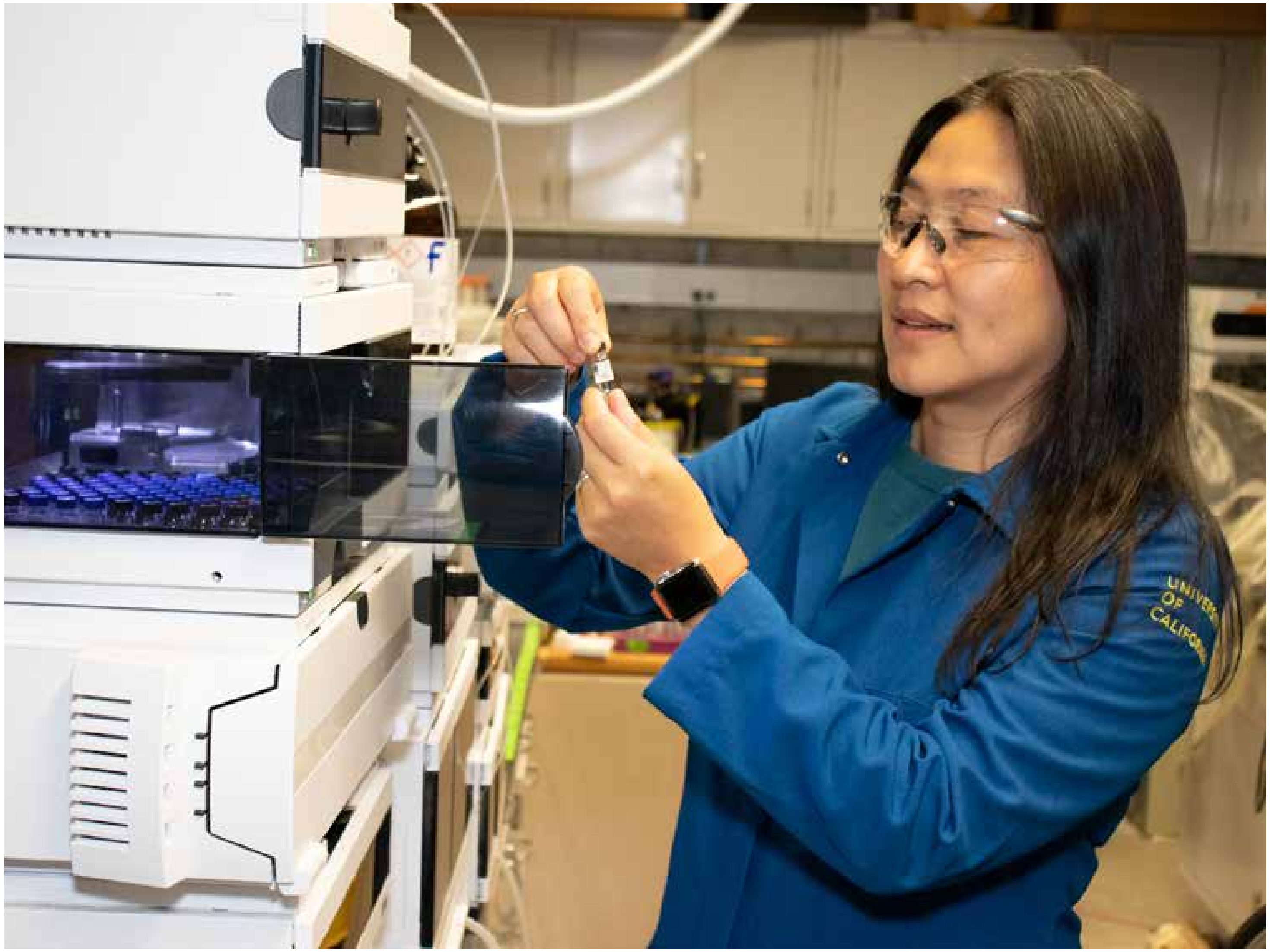
1995 › *Evan Williams*

| ANALYTICAL & BIOANALYTICAL CHEMISTRY, CHEMICAL BIOLOGY, ORGANIC CHEMISTRY, AND PHYSICAL CHEMISTRY |



2014 › *David Wemmer*

| BIOPHYSICAL CHEMISTRY, PROTEINS, NUCLEIC ACIDS, NMR SPECTROSCOPY |



2019 › *Ting Xu*

| MATERIALS, POLYMERS, AND NANOSCIENCE |

2022 › *Alanna Schepartz*

| CHEMICAL BIOLOGY, SYNTHETIC BIOLOGY, ORGANIC CHEMISTRY, AND BIOPHYSICS |

1982 › *Robert A. Harris (1936-2022)*

| THEORETICAL CHEMISTRY |

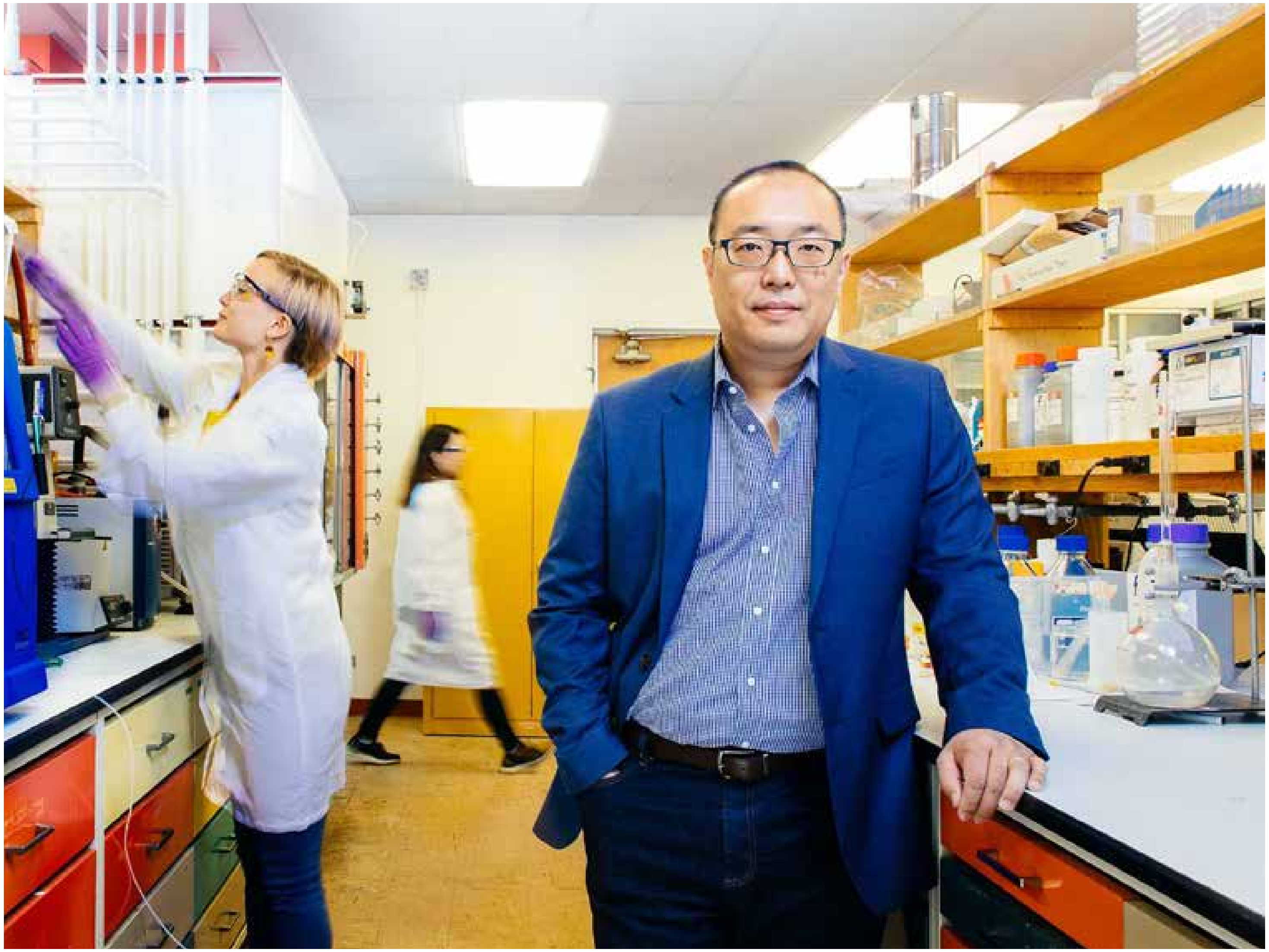
2021 › *Brooks Abel*

| POLYMER CHEMISTRY, ORGANIC CHEMISTRY, STEREOSELECTIVE CATALYSIS, AND POLYMER RECYCLING |

2018 › *Anne Baranger*

| CHEMICAL EDUCATION, CURRICULAR DEVELOPMENT, AND ASSESSMENT |

2020 › *(l to r) Laura Armstrong, Lauren Irie, Anne Baranger, and Michelle Douskey examine the results of an octanol-water partitioning experiment.*



2019 › *Daniel K. Nomura*

| ANALYTICAL AND BIOANALYTICAL CHEMISTRY, CHEMICAL BIOLOGY, AND ORGANIC CHEMISTRY |

HISTORICAL LIST OF TENURE TRACK
CHEMISTRY AND CHEMICAL BIOLOGY FACULTY

1868 Robert A. Fisher*
1869 Ezra S. Carr*
1871 Willard B. Rising
1875 Samuel B. Christ
1876 John M. Stillman
1879 Edward Booth
Edmond O'Neill
1890 John H. Gray, Jr.
1892 William J. Sharwood
1895 Walter C. Blasdale
1901 Henry C. Biddle
William C. Morgan
1902 Frederick G. Cottrell
1912 Gilbert N. Lewis
Merle Randall
Richard C. Tolman
William C. Bray
1913 Joel H. Hildebrand
G. Ernest Gibso
1915 Gerald E. K. Branch
1917 C. Walter Porter
Ermon D. Eastman
Wendall M. Latimer
T. Dale Stewart
1919 Axel R. Olson
1921 Thorfin R. Hogness
1922 William F. Giauque
1923 Gerhard K. Rollefson
1933 Willard F. Libby
1937 Melvin Calvin
Kenneth S. Pitzer
1938 Samuel Rubin
1941 Glenn T. Seaborg
Edwin F. Orlemann
1942 Robert E. Connick
William D. Gwinn
1945 James Cason
William G. Dauben
1946 Leo Brewer
Burris B. Cunningham
George Jura
Isadore Perlman
Richard E. Powell
Henry Rapoport
1947 David H. Templeton
1948 Donald S. Noyce
Chester T. O'Konski
1949 George C. Pimentel
Kenneth Street, Jr.
1951 Rollie J. Myers
1952 William L. Jolly
John 0. Rasmussen
Andrew Streitwieser, Jr.
1954 David Lyon
1955 Frederick R. Jensen
Norman E. Phillips
1956 Bruce H. Mahan
Ignacio Tinoco, Jr.
1957 Harold S. Johnston
1958 Samuel S. Markowitz
1959 Dudley R. Herschbach
1960 David A. Shirley
1961 Joseph Cerny
Herbert Strauss
1962 John Hearst
Robert A. Harris
1963 C. Bradley Moore
Kenneth H. Sauer
1964 Clayton H. Heathcock
Robert Merrill
Gabor A. Somorjai
1966 James Wang
1967 Charles Harris
1968 Kenneth N. Raymond
1969 William H. Miller
1969 Neil Bartlett
Henry Schafer
1970 Wayne Hubbell
1971 Luciano G. Moretto
1972 Alexander Pines
1973 Paul A. Bartlett
1974 Peter C. Vollhardt
Yuan T. Lee
1976 Richard Andersen
Richard A. Mathies
1977 Robert G. Bergman
1978 Judith P. Klinman
Sung-Hou Kim
Earl Muetterties
1979 Richard J. Saykally
1981 William A. Lester, Jr.
1982 Carlos J. Bustamante
Marcin Majda
1983 Angelica Stacy+
1984 Darleane C. Hoffman
Peter Schultz
1985 David E. Wemmer
K. Birgitta Whaley
1986 Daniel N. Neumark
David Chandler
1988 A. Paul Alivisatos
1989 Charles V. Shank
John Arnold
1991 Martin P. Head-Gordon
1993 Evan R. Williams
1992 Jon Ellman
1994 T. Don Tilley
1995 Ronald C. Cohen
1996 Carolyn Bertozzi
Jean M. J. Fréchet
1997 Graham R. Fleming
Jeffrey R. Long
1998 David MacMillan*
Kristie A. Boering
Heino Nitsche
1999 Kevan M. Shokat
Peidong Yang
2000 Matthew B. Francis
Jay T. Groves
2001 John Kuriyan
Jamie Cate
Michael Marletta
2002 Jamie H.D. Cate
Jennifer A. Doudna
Stephen R. Leone
Dean Toste
2003 Phillip Geissler
Christopher J. Chang

2004	Richmond Sarpong
2007	Michelle C. Chang Ting Xu
2010	Naomi Ginsberg
2011	Anne M. Baranger Felix R. Fischer John F. Hartwig
	Omar Yaghi
2012	Thomas Maimone Teresa Head-Gordon
2013	Ke Xu
2013	Evan Miller
2014	Eran Rabani
2015	Eric Neuscamman Daniel Nomura
2016	David Limmer
2018	Kwabena Bediako* John Rittle* Susan Marqusee
2019	Polly L. Arnold Alanna Schepartz Michael W. Züerch*
2020	Ashok Ajoy*
2021	Ziyang Zhang* Brooks Abel*
2022	Hendrik Utzat*
2023	Robert Saxton* Jennifer Bergner*

*Not yet tenured

2020 › *Gilman Hall*

Chemical and Biomolecular Engineering

The appointment of the first Professor of Chemical Engineering in July of 1946 marked the administrative decision that ultimately led to the present chemical engineering program at Berkeley. As the university began to more fully recognize the importance of chemical engineering—especially through its contributions to the war effort in the development of the atomic bomb and in the petroleum and chemical industry—the need for a full-fledged program became apparent. Initially, considerable controversy developed as to whether the program should be in the College of Engineering or the College of Chemistry. The stronger program in the College of Chemistry ultimately prevailed.

Philip Schutz, a professor of chemical engineering at Columbia University, was selected to head the fledgling chemical engineering program. To assist him, Dean Wendell Latimer appointed Charles Wilke (PhD, University of Wisconsin) and LeRoy Bromley (MS, Illinois Institute of Technology). Sadly, shortly after the first class enrolled in 1946, Philip Schutz passed away. Theodore Vermeulen (PhD, UCLA) joined the program in February 1947 and became its head. Don Hanson (PhD, University of Wisconsin) and Charles Tobias (a Hungarian émigré, PhD, Budapest) joined the faculty in the fall of 1947, and they were followed by F. Campbell Williams in 1948.

This initial group remained in place without further additions until 1952 when Ken Gordan from MIT joined the faculty. During this period, a PhD program was formally approved (1948) and the BS program was fully accredited (1949). Charles Wilke succeeded Theodore Vermeulen as Chairman in 1953, and between 1953 and 1955 he recruited three more remarkable intellects: Eugene Petersen from Penn State (1953), Andreas Acrivos from Minnesota (1954), and John Prausnitz from Princeton (1955).

These pioneers established standards of excellence that have consistently marked the department. New areas of research were established in the period between 1953 and 1985. The sub-field of electrochemical engineering (under the leadership of Charles Tobias) is a notable example. During those same years, John Prausnitz developed a systematic approach for obtaining activity coefficients and equations of state for substances central to the petrochemical industry.

In the 1970's Dennis Hess headed up the first program in microelectronics processing within a chemical engineering department. In that same decade, Charles Wilke and Harvey Blanch initiated a pioneering program in biochemical engineering. Under the leadership of Gene Petersen, Michel Boudart, and Alex Bell, an innovative program in catalysis and reaction engineering was established. When Mort Denn joined the faculty in 1981, he set up a world-class program in polymer processing.

In 2010, the name of the department was changed to the Department of Chemical & Biomolecular Engineering to reflect the widened scope of teaching and research activities in the department.

An extensive history was published in 2020 by C. Judson King detailing the story of the department. A History of Berkeley Chemical Engineering: Pairing Engineering and Sciences is available as a pdf from our eScholarship site.

To learn more about the amazing current research of our chemical and biomolecurlar faculty, please visit https://chemistry.berkeley.edu/faculty/cbe-directory at our website. Links to each faculty member, both current and emeritus, are available here with information on how to review their research sites.

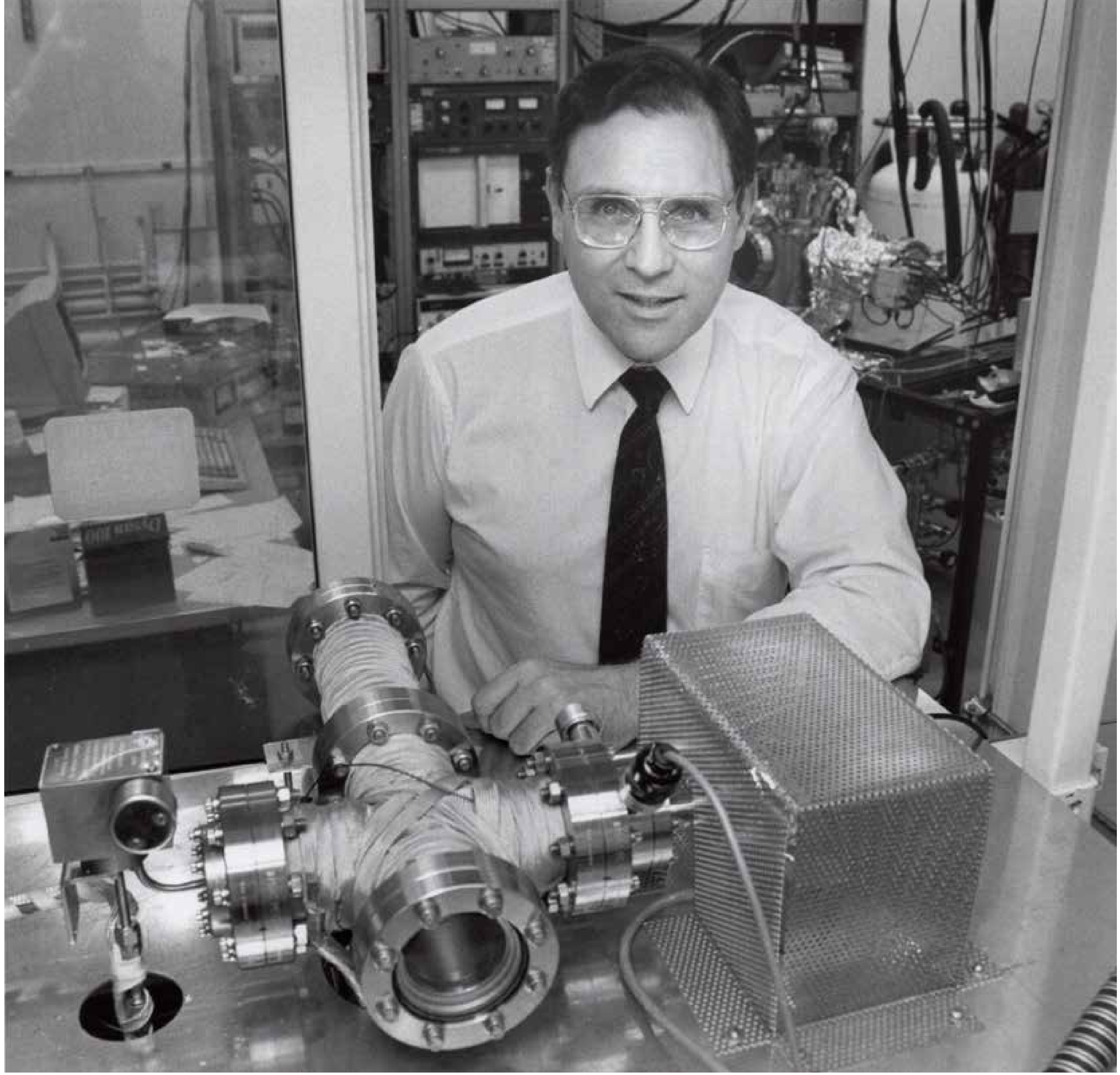
Chemical and Biomolecular Engineering

- Biomolecular Engineering
- Energy, Sustainability, Catalysis, and Electrochemical Engineering
- Theory, Computations Systems, and Machine Learning
- Materials and Interfaces

2022 › *Douglas S. Clark launches the 150th birthday party celebration by cutting cake at the College.*

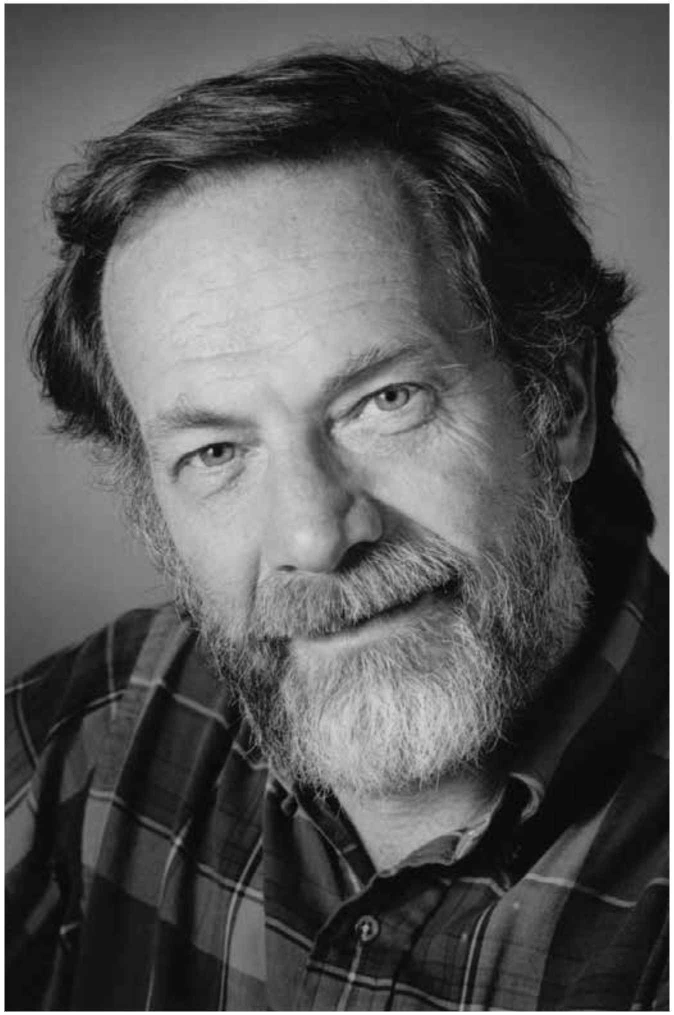
| BIOCHEMICAL ENGINEERING AND BIOCATALYSIS |


150
150
150



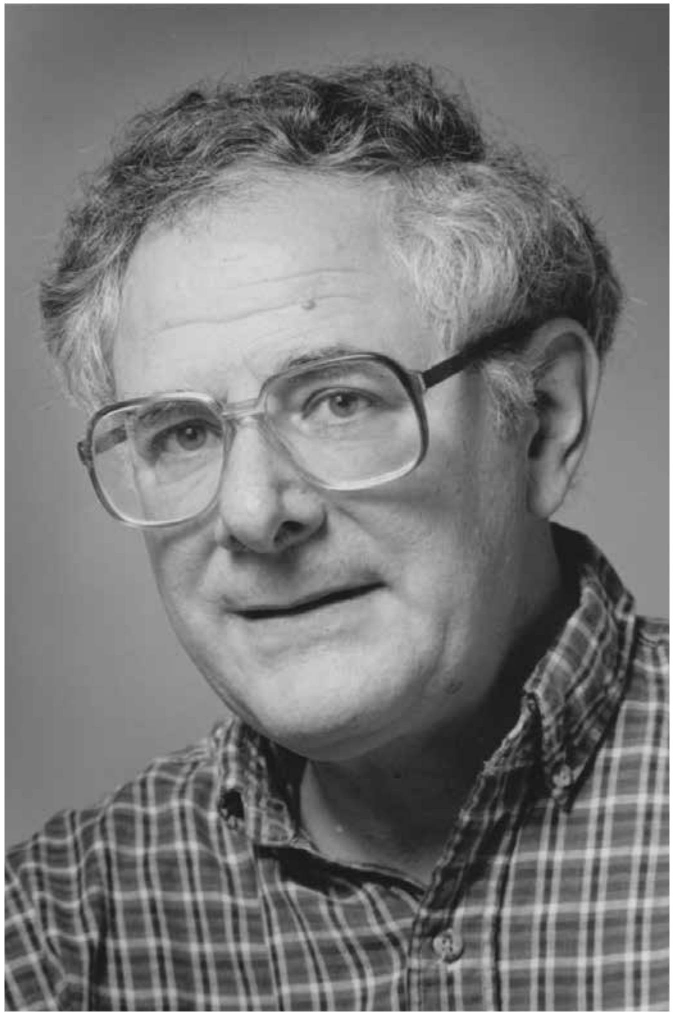
1984 › *Alexis T. Bell*

| HETEROGENEOUS CATALYSIS AND REACTION ENGINEERING |



1999 › *Moton Denn*

| POLYMER PROCESSING AND CHEMICAL PROCESS ANALYSIS |



1995 › *Simon L. Goren*

| FORMATION DYNAMICS AND SEPARATION OF PARTICULATE SYSTEMS |

CHEMICAL AND BIOMOLECULAR ENGINEERING **DEPARTMENT CHAIRS**

2022	**Bryan McCloskey**
2013-2022	**Jeffrey Reimer**
2011-2013	**Doug Clark**
2006-2011	**Jeffrey Reimer**
2005-2006	**Alexis Bell**
2001-2005	**Arup Chakraborty**
1997-2001	**Harvey Blanch**
1994-1997	**Simon Goren**
1991-1994	**Morton Denn**
1981-1991	**Alexis Bell**
1972-1981	**Judson King**
1966-1972	**Charles Tobias**
1963-1966	**Donald Hanson**
1960-1963	**Charles Wilke**
Jan-June 1960	**Leroy Bromley**
1957-1959	**Charles Wilke****
1953-1956	**Charles Wilke***
1947-1953	**Theodore Vermeulen***
1946	**Philip Schutz***

*Division Head

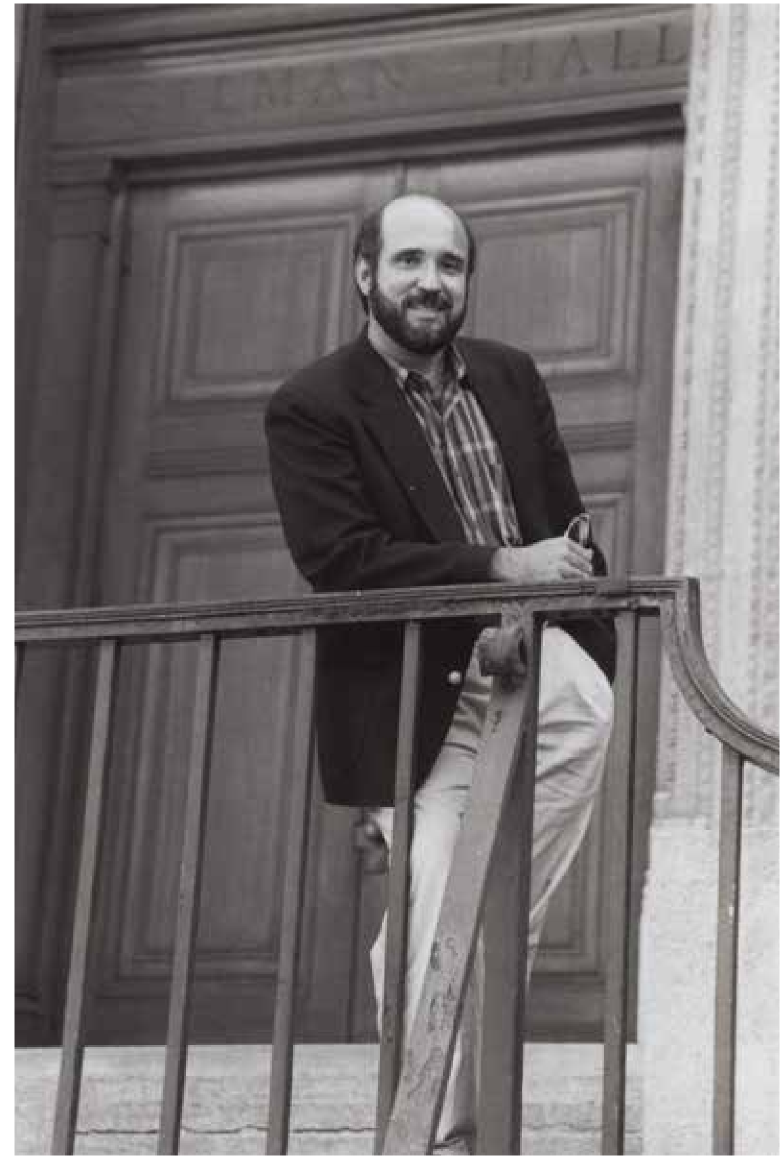
**Department Head

1986 › *C. Judson King*

| SEPARATION PROCESSES, FOOD DEHYDRATION, AND PROCESS SYNTHESIS |

n.d. › *Elton J. Cairns*

| ELECTROCHEMISTRY AND ELECTROCATALYSIS |



1993 › *Enrique Iglesia*

| HETEROGENEOUS CATALYSIS AND CHEMICAL REACTION ENGINEERING |

n.d. › *Portrait of John S. Newman*

| ANALYSIS AND SIMULATION OF ELECTROCHEMICAL SYSTEMS |

2002 › *Portrait of Susan Muller*

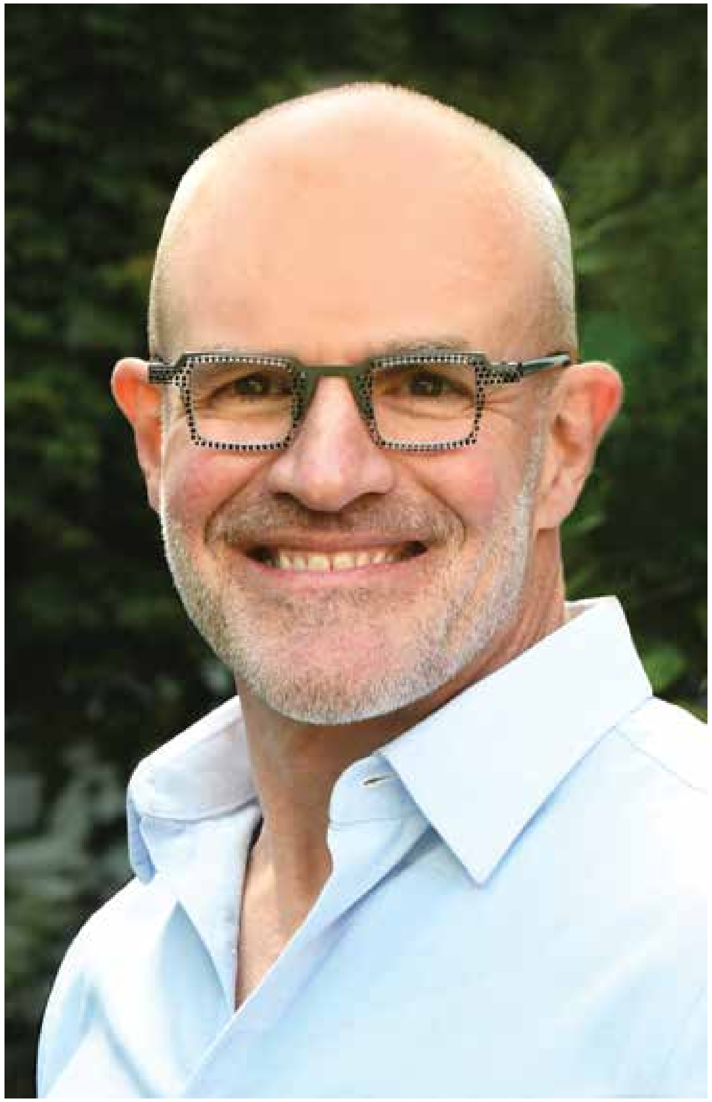
| RHEOLOGY AND FLUID MECHANICS OF COMPLEX FLUIDS |

2010 › *Harvey Blanch in grow lab.*

| BIOCHEMICAL ENGINEERING |

1997 › *Jeffrey A. Reimer*

| MATERIALS CHEMISTRY, APPLIED SPECTROSCOPY, ALTERNATIVE ENERGY, AND NUCLEAR SPINTRONICS |



2022/2012 › *Jay D. Keasling*

| METABOLIC ENGINEERING OF MICROORGANISMS |

2003 › *John M. Prausnitz receives the National Medal of Science from President George W. Bush for his development of engineering-oriented molecular thermodynamics.*

| MOLECULAR THERMODYNAMICS OF PHASE EQUILIBRIA |

2019 › *Wenjun Zhang receives her Presidential Early Career Award for Scientists and Engineers at a Ceremony on July 25, 2019, held in Washington, D.C.*

| NATURAL PRODUCT BIOSYNTHESIS AND ENGINEERING, GENOME MINING, AND MICROBIAL PRODUCTION OF FUEL-LIKE MOLECULES |

2022 › *Sanjay Kumar*

| BIOMATERIALS, MOLECULAR AND CELLULAR BIOENGINEERING, STEM CELLS, CANCER BIOLOGY, AND TRANSLATIONAL MEDICINE |

2018 › *Clayton J. Radke (r) receiving the 2018 Faculty Outstanding Mentorship of GSIs award from Professor Lewis Feldman, UC Berkeley Associate Dean for Academic Affairs.*

| SURFACE AND COLLOID SCIENCE TECHNOLOGY |

2017 › *Markita Landry*

| NANOMATERIALS, FLUORESCENCE MICROSCOPY, SENSORS, IMAGING, NEUROSCIENCE, AND PLANT ENGINEERING |

1989 › *David Graves*

| PLASMA APPLICATIONS IN NANOTECHNOLOGY |


HAL 100

2022 › *Jason Ryder (Ph.D. ’03, ChemE)*

| DIRECTOR BIOPROCESS ENGINEERING PROGRAM |

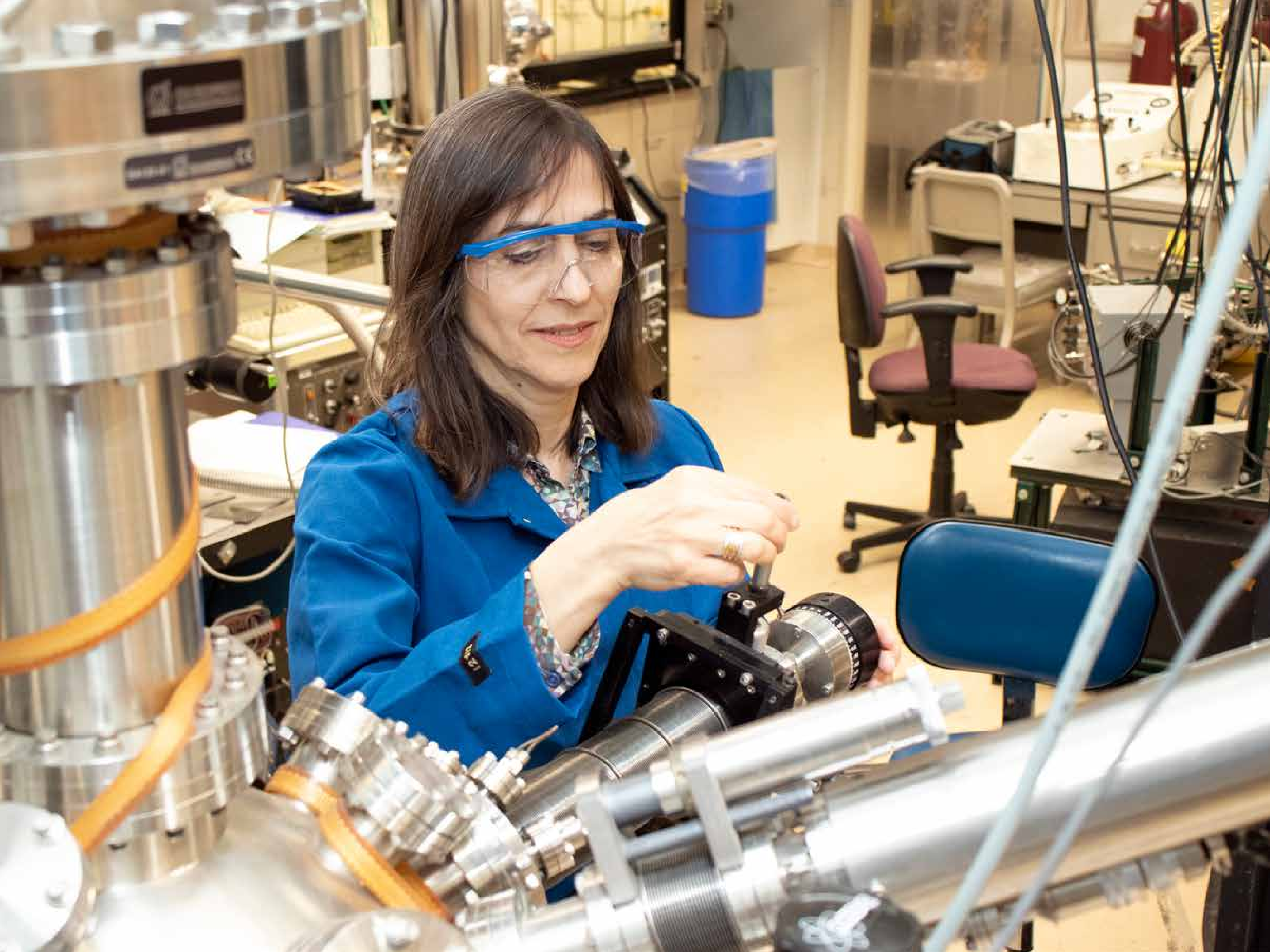
2015 › *David V. Schaffer*
| BIOMEDICAL ENGINEERING |

2022 › *Bryan D. McCloskey*

| ELECTROCHEMICAL ENERGY STORAGE, ELECTROCATALYSIS, AND MOLECULAR AND IONIC TRANSPORT THROUGH POLYMERS |

2015 › *Roya Maboudian*

| SURFACE, INTERFACIAL SCIENCE, AND MICRO-NANOSYSTEMS TECHNOLOGY |

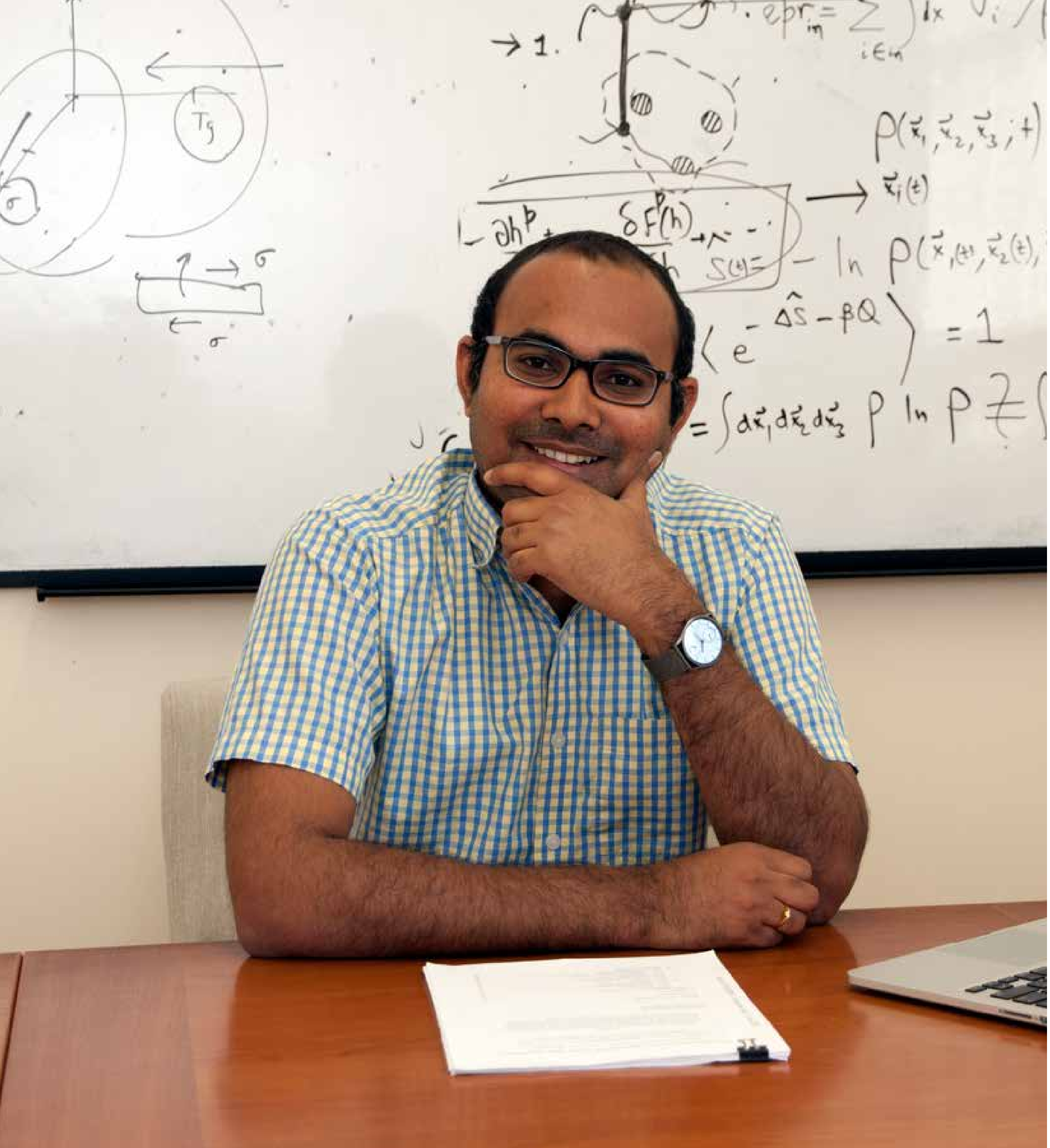


2006 › *Alexander Katz*

| MOLECULAR ENGINEERING OF SINGLE-SITE SOLID CATALYSTS AND FUNCTIONAL MATERIALS |

2023 › *Aditi Krishnapriyan*

| PHYSICS-INSPIRED MACHINE LEARNING METHODS, GEOMETRIC DEEP LEARNING, DIFFERENTIABLE PHYSICS, DYNAMICAL SYSTEMS, NUMERICAL METHODS, COMPUTATIONAL GEOMETRY, AND OPTIMIZATION |



2017 › *Kranthi K. Mandadapu*

| THEORETICAL, STATISTICAL MECHANICS, CONTINUUM MECHANICS (FLUID AND SOLID MECHANICS), AND APPLIED MATHEMATICS |

2005 › *Keith Alexander*

| DIRECTOR PRODUCT DEVELOPMENT PROGRAM |

2019 › *Nitash Balsara*

| ELECTROCHEMICAL ENERGY AND ION TRANSPORT |

2017 › *Ali Mesbah*

| LEARNING-BASED PREDICTIVE CONTROL, UNCERTAINTY QUANTIFICATION, PLASMA PROCESSING, AND MANUFACTURING SYSTEMS |

2019 › *Rui Wang*

| THEORETICAL POLYMER AND SOFT MATERIALS |

2019 › *Joelle Frechette*

| SOFT MATERIALS, INTERFACIAL SCIENCE, AND ADHESION |

2010 › *Berend Smit*

| APPLICATION AND DEVELOPMENT OF NOVEL MOLECULAR SIMULATION TECHNIQUES |

2019 › *Karthik Shekhar*

| CELLULAR AND SYSTEMS BIOLOGY, STATISTICAL INFERENCE, SINGLE-CELL GENOMICS |

HISTORICAL LIST OF TENURE TRACK
CHEMICAL ENGINEERING FACULTY

1946 Philip Schutz
LeRoy Bromley
Theodore Vermeulen
Charles Wilke

1947 Donald Hanson
Charles Tobias

1948 Campbell Williams

1952 Kenneth Gordon

1953 Eugene Petersen

1954 Andreas Acrivos

1955 John Prausnitz

1958 Don Olander

1961 Michel Boudart
Alan Foss
Richard Wallace

1962 Simon Goren

1963 Edward Grens
John Newman
Judson King
Richard Ayen

1964 Robert Merrill

1965 David Lyon
Michael Williams

1966 Robert Pigford

1967 Scott Lynn
Alexis Bell

1969 Mitchell Shen

1970 Thomas Sherwood
Lee Donaghey

1975 Clayton Radke

1977 Dennis Hess

1978 Elton Cairns

Harvey Blanch

1979 David Soane

Edward Reiff

1981 Morton Denn

1982 Jeffrey Reimer

1983 James Michaels

1986 Douglas Clark
David Graves
Doros Theodorou

1988 Arup Chakraborty

1991 Susan Muller

1992 Jay Keasling

1993 Enrique Iglesia
Roya Maboudian

1999 David Schaffer

2000 Alexander Katz
Nitash Balsara

2004 Rachel Segalman

2005 Jean M. J. Fréchet†

2006 Jhih-Wei Chu

2007 Berend Smit

2008 Keith Alexander

2009 Danielle Tullman-Ercek

2011 Teresa Head-Gordon†
Wenjung Zhang

2013 Bryan McCloskey

2014 Ali Mesbah

2015 Sanjay Kumar†
Jeffrey R. Long†

2016 Markita Landry

Kranthi Mandadapu

2019 Michelle C. Chang†
Rui Wang*

2020 Karthik Shekhar*

2021 Joelle Frechette

2023 Aditi Krishnapriyan*

†primary appointment in another department

*Not yet tenured

Dr. Donald Cooksey, a physicist who studied at Yale, was the associate director of the Radiation Laboratory (today the Berkeley Lab). He worked with Ernest Lawrence and helped him set up the laboratory. Dr. Cooksey worked directly on the development of the laboratory's 37-inch cyclotron. He served as associate director for 16 of his 23 years at the facility. Dr. Cooksey was an avid amateur photographer and many of the photos in this collection during the period of WWII through the nuclear discovery era were taken by him.

Catalog

The editors have made every effort to correctly identify the photographers and dates in this collection. The photographs have come from many amazing collections and individuals. We cannot thank enough the archival librarians at the Bancroft Library and our sister UC archival libraries at UC Davis, UC Santa Cruz, and UC Riverside for their remarkable, and in some cases, tenacious assistance especially during the COVID-19 pandemic. Also, we are very grateful for the amazing archival projects at the Berkeley Lab, the National Archives and Records Administration, the AIP Emilio Segrè Visual Archives, and the City of Oak Ridge Public Library Manhattan Collections which offered us a very special window into the periods of WWII and the early nuclear discovery era. Photographers from this era include photographs by Edward Westcott, Dorothea Lange, and Donald Cooksey.

Another photographer of note is Dennis Galloway. His collection housed at the Bancroft Library of 106,000 photographs taken during his tenure at UC Berkeley from 1962-1996 include many marvelous photographs of the College's buildings and faculty. Galloway especially loved the College's faculty and took stunning black and white photographs of them for catalogs and newsletters.

Other photographers whose work grace these pages include Marilee B. Bailey and Roy Kaltschmidt of Berkeley Lab; architectural and fine art photographer Morely Baer; UC Berkeley photographers Keegan Houser and Michael Barnes; and freelancers Peg Skorpinski, Marcus Hanschen, and Brittney Hosea-Smith.

We are exceptionally grateful for the beautiful 1964-66 photographs taken by the incomparable Ansel Adams for the University of California Fiat Lux project. They have been stunningly preserved at UC Riverside.

COVER

1960 Architectural rendering of Hildebrand and Latimer Halls

COLLECTION: College of Environmental Design Archive

LOCATION: UC Berkeley Environmental Design Archives

ILLUSTRATION: Attributed to architects Bob Anshen & Steve Allen

PAGE 2

1986 Douglas Clark when he first arrived at UC Berkeley photographed in Gilman Hall

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 4

1917 Chemistry annex with campanile in the background

COLLECTION: UC Berkeley Bancroft Library

LOCATION: University of California, Berkeley campus views; UARC PIC 03:138

PHOTOGRAPHER: G.E. Ferriter

PAGES 10-11

1874 View from the university ground [sic] at Berkeley: the Golden Gate (in the distance)

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Framed items from the collections of the Bancroft Library; UARC PIC 03:226a--FR

PHOTOGRAPHER: Watkins, Carleton E., 1829-1916

PAGE 12

1900 South Hall

COLLECTION: UC Berkeley Bancroft Library

LOCATION: University of California, Berkeley campus views; UARC PIC 03:138

PHOTOGRAPHER: Unknown

PAGE 13

1874 Willard Rising in the first chemistry lab on campus in South Hall

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Days Of Cal; UARC PIC 5:25b

PHOTOGRAPHER: Unknown

PAGE 14

1890s Women students with bicycle on path leading from west entrance toward campus

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Days of Cal; UARC PIC 4:81

PHOTOGRAPHER: Unknown

PAGE 15

1891 Members of the 1891 senior class in agriculture outside South Hall

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Days of Cal; UARC PIC 4:148a

PHOTOGRAPHER: Unknown

PAGE 16

1898 Lecture in South Hall

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Centennial Exhibit from the Nine Campuses of the University of California, 1868-1968; UARC PIC 1900.04

PHOTOGRAPHER: Unknown

PAGE 17

1892 South Hall physics' lecture auditorium

COLLECTION: College of Chemistry

LOCATION: Private collection

PHOTOGRAPHER: Unknown

PAGE 18

n.d. Robert A. Fisher

COLLECTION: Smith, Anna Warton, Genealogy of the Fisher family, 1682 to 1896; pg 119

LOCATION: https://archive.org/details/genealogyoffishe00smit/page/n205/mode/2up

PHOTOGRAPHER: Unknown

PAGE 19

1873 Ezra S. Carr

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Portraits of University of California individuals and groups; UARC PIC 13

PHOTOGRAPHER: Unknown

PAGE 20

1879 Willard B. Rising

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Portraits of University of California individuals and groups; UARC PIC 13

PHOTOGRAPHER: Bradley & Rulofson, San Francisco

PAGE 21

1874 John Maxson Stillman, Class of 1874

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Portraits of University of California individuals and groups; UARC PIC 13

PHOTOGRAPHER: Bradley & Rulofson, San Francisco

PAGE 22

1879 Edmond O'Neill, Class of 1879

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Portraits of University of California individuals and groups; UARC PIC 13

PHOTOGRAPHER: Bradley & Rulofson, San Francisco

PAGE 23

1922-1930 Frederick Gardner Cottrell photographed when he was Director of the USDA Fixed Nitrogen Research Laboratory.

COLLECTION: Smithsonian Institution Archives

LOCATION: SIA Acc. 90-105 [SIA2008-0279]

PHOTOGRAPHER: Watson Davis 1896-1967

PAGES 24-25

1897 C.U. Chemistry Bldg., 1897, University of California at Berkeley

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Oliver family photograph collections; BANC PIC 1960.010 ser. 2 :0596--NEG (5x7); brk00012003_31b.tif

PHOTOGRAPHER: William Letts Oliver

PAGES 26

1897 (l to r) Mining, Chemistry, and the Library

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Oliver family photograph collections; BANC PIC 1960.010 ser. 2 :0595--NEG (5x7): brk00012002_31b.tif

PHOTOGRAPHER: William Letts Oliver

PAGE 27

1961-1962 Chemistry Building, U.C. Berkeley: views of a lab and outdoor space

Published by permission of the Morley Baer estate

COLLECTION: UC Santa Cruz Archive

LOCATION: Morley Baer Photographs, MS.006, Box 44; 81861-7 1961-1962

PHOTOGRAPHER: © 2022 MORLEY BAER

PAGE 28

1961-1962 Chemistry Building, U.C. Berkeley: view of entrance

Published by permission of the Morley Baer estate

COLLECTION: UC Santa Cruz Archive

LOCATION: Morley Baer Photographs, MS.006, Box 44; 81861-7 1961-1962

PHOTOGRAPHER: © 2022 MORLEY BAER

PAGE 29

1961-1962 Chemistry Building, U.C. Berkeley: detail brick archway

Published by permission of the Morley Baer estate

COLLECTION: UC Santa Cruz Archive

LOCATION: Morley Baer Photographs MS.006, Box 44; 81861-7 1961-1962

PHOTOGRAPHER: © 2022 MORLEY BAER

PAGE 30

1899 Willard Rising teaching in the first dedicated chemistry building lecture hall

COLLECTION: UC Berkeley Bancroft Library

LOCATION: College of Chemistry

PHOTOGRAPHER: Private Collection

PAGE 31

1894 Willard Rising in his office in the first dedicated chemistry building

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGES 33-34

May 14, 1917 Lewis era faculty and staff on the south side of Chemistry Annex building

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 34

1910 Gilbert N. Lewis portrait likely taken at Harvard University

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: William Notman

PAGE 35

1944 Press photo of Gilbert N. Lewis in his lab

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 36

1917 (l to r) Walter Porter, George Ernest Gibson, Merle Randall, and William Bray

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 37

1924 Joel H. Hildebrand portrait

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 38

1915 Wendell M. Latimer portrait

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 39

1936 Gerald E.K. Branch portrait

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 40

1948 Press photo of Kenneth S. Pitzer in his lab before joining the atomic energy commission

COLLECTION: AP Wire photo

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 41

1930s Willard F. Libby

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 42

1935 William F. Giauque portrait

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 43

1936 Glenn Seaborg in Yosemite in 1936 with Half Dome in the background

COLLECTION: Glenn Seaborg family photo album

LOCATION: Lawrence Berkeley National Lab; XBD9903-00377-05.TIF

PHOTOGRAPHER: Seaborg family

PAGE 44

1940s Melvin E. Calvin in his lab in the Radiation Laboratory

COLLECTION: James Bassham private collection by permission

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: James Bassham (Calvin's graduate student and co-author of the Calvin-Benson-Bassham cycle)

PAGE 45

1938 Chem 1A teaching assistants meet with Professors Hildebrand and Libby in the storeroom of the Freshman Chemistry lab to discuss the quiz they are to give in their respective classrooms

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 46

1917 Gilbert Lewis with faculty and staff in the newly completed Gilman Hall

COLLECTION: UC Berkeley Bancroft Library

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 47

1914 Architectural rendering of Gilman Hall

COLLECTION: UC Berkeley College of Environmental Design Archive

LOCATION: UC Berkeley Environmental Design Archives

ILLUSTRATION: Attributed to John Galen Howard, campus architect

PAGES 48 AND 49

1917 Newly completed labs in Gilman Hall

COLLECTION: UC Berkeley Bancroft Library

LOCATION: John Galen Howard pictorial collection, 1885-1920; BANC PIC 1967.016-1967.018

PHOTOGRAPHER: Unknown

PAGES 50 AND 51

1913 "Temporary" buildings, (l) auditorium and (r) freshmen chemistry lab designed by John Galen Howard for G.N. Lewis to accommodate the growing student population in the College of Chemistry

COLLECTION: UC Berkeley Bancroft Library

LOCATION: John Galen Howard pictorial collection, 1885-1920; BANC PIC 1967.016-1967.018

PHOTOGRAPHER: Unknown

PAGE 52

1920 College buildings including Gilman Hall on the far left, the "old chemistry building" covered in ivy in the middle, and the chemistry annex on the right.

COLLECTION: UC Berkeley Bancroft Library

LOCATION: John Galen Howard pictorial collection, 1885-1920; BANC PIC 1967.016-1967.018

PHOTOGRAPHER: Unknown

PAGE 53

1946 Gilman Hall after WWII

COLLECTION: National Archives and Record Administration

LOCATION: "gilman hall, university of california, berkeley"

PHOTOGRAPHER: Likely Donald Cooksey

PAGES 54-55

1943-1944 (l) early construction of the Y-12 plant; (r) workers at a "stay on the job" rally at Oak Ridge, Tennessee

COLLECTION: US Department of Energy

LOCATION: https://photosofedwest-cott.tumblr.com/

PHOTOGRAPHER: Edward Wescott

PAGES 56

1931 The radiation laboratory next to the "old chemistry building"

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9606-02512.tif

PHOTOGRAPHER: Possibly Donald Cooksey

PAGE 58

1931 Photograph of the original model (1931) for Ernest Lawrence's cyclotron in its suitcase

COLLECTION: UC Riverside California Museum of Photography, FIAT LUX Collection

LOCATION: (FIAT LUX p. 116) 6.UCB.83.4

PHOTOGRAPHER: Ansel Adams

PAGE 59

1939 Photograph of the assembly of the 60" cyclotron; (l to r) William Brobeck and Dale Corson

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD200907-00446

PHOTOGRAPHER: Donald Cooksey

PAGE 60

1938 William Brobeck, the Lab's first professional engineer with cans used as radiation shielding at the Radiation Laboratory

COLLECTION: National Archives and Record Administration

LOCATION: Cooksey photograph collection+

PHOTOGRAPHER: Donald Cooksey

PAGE 61

1941 Samuel Ruben in his lab in the Radiation Laboratory

COLLECTION: Life Magazine

LOCATION: Issue October 20, 1941

PHOTOGRAPHER: Photo pool: Margaret Bourke-White, Alfred Eisenstaedt, Thomas McAvoy, and Peter Stackpole

PAGE 62

1935-1937 Melvin Calvin in his lab with photosynthesis research project

COLLECTION: College o Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 63

1942 Photo documenting Glenn Seaborg's identification of plutonium sample while in residence at the University of Chicago for the Manhattan Project

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9611-05595.TIF

PHOTOGRAPHER: Likely Elwin Covey (Seaborg's assistant at UChicago)

PAGE 64

1942 Harvey Itano, UC Berkeley senior and winner of the 1942 Berkeley Medal, photographed at the Sacramento Assembly Center by Dorothea Lange

COLLECTION: US National Archives, War Relocation Authority

LOCATION: Wikipedia.org/Harvey_Itano_media

PHOTOGRAPHER: Dorothea Lange

PAGE 65

1944 Y-12 Calutron Operators (mainly young women high school graduates) monitored components of the machines used to separate isotopes of uranium for the manufacture of the Hiroshima atomic bomb; location Oakridge, Tennessee

COLLECTION: US Department of Energy

LOCATION: https://photosofedwest-cott.tumblr.com/

PHOTOGRAPHER: Edward Wescott

PAGE 66

1944 Y-12 alpha racetrack used in the separation of uranium 235 from uranium 238; location Oakridge, Tennessee

COLLECTION: US Department of Energy

LOCATION: https://photosofedwest-cott.tumblr.com/

PHOTOGRAPHER: Edward Wescott

PAGE 67

1944 Y-12 Beta rectifiers and dry dock used in the processing of uranium 235 from uranium 238; location Oakridge, Tennessee

COLLECTION: US Department of Energy

LOCATION: City of Oak Ridge Public Library Digital Collections

PHOTOGRAPHER: Edward Wescott

PAGE 68

1948 "Nuclear sorcerers" Stanley Thompson (left) and Glenn Seaborg try their best to look like old-time alchemists in this picture shortly before their discovery of element 98 californium

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9704-01812.TIF

PHOTOGRAPHER: Donald Cooksey

PAGE 69

1944 B Reactor, Hanford, Washington, Manhattan Project

COLLECTION: US Department of Energy

LOCATION: https://www.energy.gov/management/b-reactor

PHOTOGRAPHER: Donald Cooksey

PAGE 70

1946 (l to r) Physicist Robert Oppenheimer, chemist Glenn Seaborg and, physicist Ernest Lawrence at the control panel of the 184-Inch Cyclotron

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9704-01422.TIF

PHOTOGRAPHER: Donald Cooksey

PAGE 71

1954 Worker at section of the Bevatron Main Control Room

COLLECTION: Lawrence Berkeley National Lab

LOCATION: Unknown

PHOTOGRAPHER: Donald Cooksey

PAGE 72

1946 Rendering for Lewis Hall, attributed to Geoffrey Bangs Architect

COLLECTION: UC Berkeley, College of Environmental Design Archive

LOCATION: E. Geoffrey Bangs Collection, ca. 1950-1969

PHOTOGRAPHER: Unknown

PAGE 73

1952 Photograph of newly built (1949) Lewis Hall

COLLECTION: UC Berkeley, College of Environmental Design Archive

LOCATION: E. Geoffrey Bangs Collection, ca. 1950-1969

PHOTOGRAPHER: Unknown

PAGE 74

1945 Portrait of Robert Connick

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 75

1948 Portrait of Leo Brewer

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 76

1959 Portrait of Isadore Pearlman

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 77

n.d. David Templeton (Ph.D. '47, Chem) portrait for the American Crystallographic Association

COLLECTION: AIP: Emilio Segrè Visual Archives

LOCATION: https://repository.aip.org/islandora/object/nbla:311403

PHOTOGRAPHER: credited to Lawrence Berkeley National Lab

PAGE 78

1959 Portrait of John Rasmussen

COLLECTION: National Archive and Records Administration

LOCATION: https://repository.aip.org/islandora/object/nbla:311403

PHOTOGRAPHER: Donald Cooksey

PAGE 79

1974 Portrait of David Shirley

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

Pages 80-81

See listing page 84

PAGE 82

1952 Portrait of Carol Dauben in her lab in 318 Lewis Hall

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD202004-00086 (photo mis-identified as "Carol Daubere")

PHOTOGRAPHER: Donald Cooksey

PAGE 83

1962 Student members of physicist Cornelius Tobias' group in the Donner Lab check the beam intensity for a "brain mapping" experiment

COLLECTION: National Archive and Records Administration

LOCATION: https://nara.getarchive.net/media/members-of-the-tobias-group-check-the-beam-intensity-for-a-brain-mapping-experiment-4fbc74

PHOTOGRAPHER: Donald Cooksey

PAGE 84

1952 Martha Kirk with carbon-14 pattern respiration analyzer at the radiation lab prepares to work with a test subject

COLLECTION: Lawrence Berkeley National Lab

LOCATION: JHL-2134

PHOTOGRAPHER: Attributed to Donald Cooksey

PAGE 85

1964 Burris Cunningham adjusts a Para Magnetic Resonance apparatus

COLLECTION: Lawrence Berkeley National Lab

LOCATION: JHL-2134 (ORIGINAL FILE LOCATION - Chem 3618-C, CN 193)

PHOTOGRAPHER: Unknown

PAGE 86

1966 Virginia Shirley working on a new edition of the Table of the Isotopes

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9609-04769.TIF

PHOTOGRAPHER: George Kagawa

PAGE 87

1968 Nuclear archaeology team: Betty Holtzman of the UC Berkeley Anthropology Department, and Helen Michel, Isadore Perlman, and Frank Asaro

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9609-04769.TIF

PHOTOGRAPHER: Doug McWilliams

PAGE 88-89

1934 (l to r) Milton Livingston and Ernest Lawrence stand beside the 27-inch cyclotron

COLLECTION: National Archives

LOCATION: NAID: 558593; Local ID: 434-RF-25(1)

PHOTOGRAPHER: Donald Cooksey

PAGE 92

1936 Twenty-seven-inch cyclotron beam out

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD200907-0046.TIF

PHOTOGRAPHER: Donald Cooksey

PAGE 93

1950 Publicity shot of Glenn Seaborg

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD201002-00136.TIF

PHOTOGRAPHER: Marilee B. Bailey

PAGE 94

1941/1949 Samuel Ruben and Martin Kamen; co-discoverers of carbon-14

LOCATION: Ruben - Life Magazine/ Kamen – private collection of the Martin Kamen family

PHOTOGRAPHERS: Unknown

PAGE 95

1954 (l to r) Albert Ghiorso and Glenn Seaborg in the lab

COLLECTION: Lawrence Berkeley National Lab

LOCATION: 084_XBD9808-02046.TIF

PHOTOGRAPHER: George Kagawa

PAGE 96

1961 Element 103 co-discoverers (l to r) Robert Latimer (son of Wendell Latimer), Albert Gioroso, Torbjorn Sikkeland, and Almon Larsh

COLLECTION: Lawrence Berkeley National Lab

LOCATION: 083_XBD9609-04536.TIF

PHOTOGRAPHER: Unknown

PAGE 97

1958 Members of the californium (98) isolation team inside a fabricated tepee on the roof of the College of Chemistry building

COLLECTION: National Archives and Records Administration

LOCATION: https://nara.getarchive.net/media/isolation-of-californium-in-visible-amounts-inside-a-fabricated-tepee-on-the-8d9541

PHOTOGRAPHER: Donald Cooksey

PAGE 98

1966 Al Ghiorso holds the first sample of Plutonimn-239

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD202004-00086

PHOTOGRAPHER: Likely George Kagawa

PAGE 99

1966 Cigar box found in a shielded vault in Lawrence Radiation Lab

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9705-02401.TIF

PHOTOGRAPHER: Doug McWilliams

PAGE 100

1969 Al Ghiorso and Glenn Seaborg at the 104 wheel

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD201504-00063.TIF

PHOTOGRAPHER: George Kagawa

PAGE 101

1966 The rutherfordium (104) discovery team (l to r) Matti Nurmia, James (Jim) Harris, Kari Eskola, Glenn Seaborg, Pirkko Eskola, and Albert Ghiorso

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9705-02401.TIF

PHOTOGRAPHER: Likely George Kagawa

PAGE 102

1963 Samuel Markowitz, inventor of trace analysis technique

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9609-04563.TIF

PHOTOGRAPHER: Unknown

PAGE 103

1982 Nuclear chemist Lucianno Moretto

COLLECTION: UC Berkeley Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 5615M

PHOTOGRAPHER: Dennis Galloway

1969 Nuclear chemist Joseph Cerny

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9702-00637.TIF (mis-identified as Joe "Cerney")

PHOTOGRAPHER: Unknown

PAGE 104

1970 (l to r) Bob Latimer, Jean Rees, and James (Jim) Harris (team lead) prepare a radioactive target to be bombarded by the Super Heavy Ion Linear Accelerator

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD202011-00004.TIF

PHOTOGRAPHER: Thor Swift

PAGE 105

1974 The co-discoverers of element 106 (Seaborgium) at the Heavy Ion Linear Accelerator (HILAC) building at Berkeley Lab

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9704-01419.TIF

PHOTOGRAPHER: Unknown

PAGE 106

2017 Multiple generations of Berkeley Lab Scientists Jacklyn Gates (Ph.D. '08, Chem) and Kenneth Gregorich (Ph.D. '85, Chem) oversee the FIONA (For the Identification Of Nuclide A) project located at Berkeley Lab's 88-inch cyclotron

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD201704-00065-003.tif

PHOTOGRAPHER: Marilyn (Chung) Sargent

PAGE 107

2020 (l to r) Rebecca Abergel (Ph.D. Chem, '06) lab member's Leticia Arnedo-Sanchez, Katherine Shield, Korey Carter, and Jennifer Wacker at Lawrence Berkeley National Laboratory obtained a small sample of einsteinium, a highly radioactive and difficult-to-obtain element

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD-202011-00149-010.tif

PHOTOGRAPHER: Marilyn (Chung) Sargent

PAGE 108-109

1960 Architectural rendering of Hildebrand and Latimer Halls

COLLECTION: UC Berkeley Environmental Design Archives

LOCATION: 2013-08

ILLUSTRATION: Attributed to architects Bob Anshen & Steve Allen

PAGE 110

1946 Photos of Joel Hildebrand in the Chemistry annex auditorium

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 111

1946 Joel Hildebrand teaching in the Chemistry annex auditorium

COLLECTION: College of Chemistry

LOCATION: Private collection of the College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 112

1951 Press photo of Glenn Seaborg and Edward McMillan for the Nobel Prize

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Donald Cooksey

1960 David Lyon and William Giauque

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 113

1976 Press photo of Earl Muetterties

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

2019 Photograph of a Periodic Table highlighting element 106 seaborgium in the window of the Chemistry and Chemical Engineering Library in Hildebrand Hall

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Leigh Moyer

PAGE 114

1950 Wendell Latimer and Glenn Seaborg in 307 Gilman Hall

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 115

1974 George Pimentel at a blackboard teaching

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A; item 3359M

PHOTOGRAPHER: Dennis Galloway

PAGE 116

1965 John Hearst at the Vietnam Day march

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A; item 1191M - item 1198M

PHOTOGRAPHER: Dennis Galloway

PAGE 117

1965 Robert Harris at the Vietnam Day march

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A; item 1191M - item 1198M

PHOTOGRAPHER: Dennis Galloway

PAGE 118

1991 William Lester in his office

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A; item 1191M - item 1198M

PHOTOGRAPHER: Dennis Galloway

PAGE 119

1953 Kenneth Pitzer in his office

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 120

1982 Sung-Hou Kim at a computer

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A; item 5634M

PHOTOGRAPHER: Dennis Galloway

PAGE 121

n.d. Carolyn Bertozzi in the College courtyard

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dan Krauss or Dennis Galloway

1974 C. Bradley Moore in the lab

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A; item 4106M

PHOTOGRAPHER: Dennis Galloway

PAGE 122

1971 Clayton Heathcock and Andrew Streitwieser fly fishing at the Streitwieser summer home

COLLECTION: Courtesy of Clayton Heathcock

LOCATION: Private collection of the Heathcock family

PHOTOGRAPHER: Sue Streitwieser

PAGE 123

1974 Andrew Streitwieser in his office

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 4078M

PHOTOGRAPHER: Dennis Galloway

PAGE 124

1960s Architectural rendering of Hildebrand and Latimer Halls

COLLECTION: College of Environmental Design Archive

LOCATION: UC Berkeley Environmental Design Archives

ILLUSTRATION: Attributed to architects Bob Anshen & Steve Allen

PAGE 125

1960s Joel Hildebrand stands in front of newly completed Hildbrand Hall

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Possibly Rondal Partridge

PAGE 126

1963 "Old Chemistry Building" in front of Latimer Hall before demolition

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 0034M

PHOTOGRAPHER: Dennis Galloway

PAGE 127

1963 Cupola of the "Old Chemistry Building" being salvaged during demolition

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 0413M- item 0415M

PHOTOGRAPHER: Dennis Galloway

PAGE 128

2018 Exterior view of Pimentel Hall

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Leigh Moyer

PAGE 129

1965 Harvey White, instrumental in the media design of Pimentel Hall lectures in the newly constructed building

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 0883M - item 0886M

PHOTOGRAPHER: Dennis Galloway

PAGE 130

1953 G. Ernest Gibson teaching in the Freshman Chemistry Lab

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 131

1961 Students in the lab of the "Old Chemistry Building"

COLLECTION: Retorts to Lasers: The story of chemistry at UC Berkeley; Jolly, William L.; 1987

LOCATION: College of Chemistry

PHOTOGRAPHER: Unknown

PAGE 132

1965 College faculty in the 1960s (see page 132 for complete list)

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 132

1981 Joel hildebrand's 100th birthday bash

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 134

1969 George Pimentel and Kenneth Herr review the infrared spectrometer design at Berkeley for the Mars Mariner 6 and 7 program

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 2453M

PHOTOGRAPHER: Dennis Galloway

PAGE 135

1960s William Jolly in the lab

COLLECTION: College of Chemistry

LOCATION: Private collection

PHOTOGRAPHER: unknown

PAGE 136

1970s William Dauben in the classroom

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: likely Dennis Galloway

PAGE 137

1963 Bio-dynamics lab constructed by UC Berkeley for Melvin Calvin after he won the Nobel Prize; Calvin wanted the round building design so the labs would all be open to inspire more interactive research

COLLECTION: College of Environmental Design archive

LOCATION: Michael Goodman Collection, 1920-1970

PHOTOGRAPHER: Attributed to Michael Goodman Collection

PAGE 138

1975 Harold Johnston seen here with some of his writings on the pioneering studies of atmospheric kinetics

COLLECTION: AIP Emilio Segrè Visual Archives, Gift of Dr. Johnston

LOCATION: https://repository.aip.org/islandora/object/nbla%3A298147

PHOTOGRAPHER: Unknown

PAGE 139

1987 David and Lieselotte Templeton

COLLECTION: Niels Bohr Library & Archives

LOCATION: https://repository.aip.org/islandora/object/nbla%3A310735

PHOTOGRAPHER: Physics Today collection

PAGE 140

1987 John Hearst in the lab

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 6140M - item 6141M

PHOTOGRAPHER: Dennis Galloway

PAGE 141

1987 Kenneth Sauer in the lab

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 6145M

PHOTOGRAPHER: Dennis Galloway

PAGE 142

1971 Gabor Somarjai

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A:

PHOTOGRAPHER: Dennis Galloway

PAGE 143

1982 Robert Bergman

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A:

PHOTOGRAPHER: Dennis Galloway

PAGE 144

2005 Heino Nitsche and Julia Chamberlain in the lab

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD200402-00104-02.TIF

PHOTOGRAPHER: Roy Kaltschmidt

PAGE 145

1974 William Gelbart sits in front of a theoretical equation in his office

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: 4076M:32

PHOTOGRAPHER: Dennis Galloway

PAGE 146

1974 Scott Lynn in his office

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Attributed to Dennis Galloway

PAGE 147

2002 Early members of the Pitzer Center for Theoretical Chemistry. (l to r) William Miller, Birgitta Whaley, WIlliam Lester, Martin Head-Gordon, and David Chandler

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 148-149

2007 Alex Pines in his office

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD200708-00368-02.TIF

PHOTOGRAPHER: Roy Kaltschmidt

PAGE 150

2010 Promotional portrait of Paul Alivisatos in his Hildebrand Hall lab

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD200209-00526-01.PSD

PHOTOGRAPHER: Roy Kaltschmidt

PAGE 151

2018 Chemistry and Chemical Engineering faculty ahead of commencement in the foyer of Zellerbach Hall

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Unknown

PAGE 152

2006 Sam Markowitz performs the Big Game Titration before the annual Cal-Stanford game; (r) Stanford's red and white turns to (l) Cal's blue and gold assuring that Cal will win

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Likely Peg Skorpinski

PAGE 153

2006 The Cal band annually parades to great fanfare into Pimentel Hall the day before the "Big Game" against Stanford and plays during the Chem 1A Big Game Ttitration ceremony

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Likely Peg Skorpinski

PAGE 154

2019 John Arnold teaches Chem 1A in Pimentel Hall

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Michael Barnes

PAGE 155

2018 Exhibit installed in the lobby of Pimentel Hall celebrating the Mars Mariner 6 & 7 missions and the life of George Pimentel; in 2017, the importance of George Pimentel and his lab researcher Kenneth Herr's research and design of the Mars Infrared Spectrometer was officially recognized with the designation of the American Chemical Society National Historic Chemical Landmark

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Marge d'Wylde

PAGE 156-157

2022 As part of the 150th anniversary celebration of the College; College faculty members (l to r) David MacMillan, Jennifer Doudna, and Yuan T. Lee were recognized at the College; newly installed plaques recognizing MacMillan and Doudna's achievements were unveiled

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Brittney Hosea-Small

PAGE 159

2020 Jennifer Doudna displays her Nobel medal after the ceremony honoring her at her home during the COVID pandemic

COLLECTION: Nobel Foundation

LOCATION: https://www.nobelprize.org/prizes/chemistry/2020/doudna/photo-gallery/

PHOTOGRAPHER: Brittany Hosea-Small

PAGE 160

1966 William Giauque is photographed with one of his beautiful testing apparatus

COLLECTION: UC Riverside: California Museum of Photography; Fiat Lux collection

LOCATION: (4.UCB.32)

PHOTOGRAPHER: Ansel Adams

PAGE 161

1950 Glenn Seaborg poses for a photograph with an ion exchange illusion column of actnide elements

COLLECTION: Lawrence Berkeley National lab

LOCATION: XBD202004-00086.TIF

PHOTOGRAPHER: Likely Donald Cooksey

PAGE 162

1966 Melvin Calvin photographed at the bio-dynamics lab

COLLECTION: UC Riverside: California Museum of Photography; Fiat Lux collection

LOCATION: (6.UCB.49.4)

PHOTOGRAPHER: Ansel Adams

PAGE 163

2022 (l to r) Jennifer Doudna, Carolyn Bertozzi, and Frances Arnold celebrate their Nobel Prize awards in Chemistry in Stockholm, December 9, 2022.

COLLECTION: Nobel Foundation

LOCATION: https://www.nobelprize.org/

PHOTOGRAPHER: © Nobel Prize Outreach; photo credit Clément Morin

PAGE 164

1986 Nobel Award ceremony in Sweden for Dudley Herschbach with Karl Gustaf, King of Sweden

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9608-3595

PHOTOGRAPHER: Rolf Hamilton/TT/Sipa USA

PAGE 165

1986 Nobel Award ceremony in Sweden for Yuan T. Lee with Karl Gustaf, King of Sweden

COLLECTION: SIPA USA

LOCATION: https://www.sipausa.com/

PHOTOGRAPHER: Rolf Hamilton/TT/Sipa USA

PAGE 166

2021 Jennifer Doudna photographed for the National Academies New Heroes Series

COLLECTION: National Academies of Sciences, Engineering, and Medicine

LOCATION: https://www.christopher-michel.com/New-Heroes/National-Academies-Portraits/

PHOTOGRAPHER: Christopher Michel

PAGE 167

2022 David MacMillan photographed at the College of Chemistry on the occasion of the College's 150th birthday

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Brittany Hosea-Small

PAGE 168

2022 Carolyn Bertozzi photographed for the National Academies New Heroes Series

COLLECTION: National Academies of Sciences, Engineering, and Medicine

LOCATION: https://www.christopher-michel.com/New-Heroes/Carolyn-Bertozzi/

PHOTOGRAPHER: Christopher Michel

PAGE 169

2022 Nobel Award ceremony in Sweden; Carolyn Bertozzi receives her award from Karl Gustaf, King of Sweden

COLLECTION: Courtesy © Nobel Prize Outreach

LOCATION: Nobel media; _NNK3858.jpg

PHOTOGRAPHER: Nanaka Adachi

PAGE 170

2019 Professors Alex Bell, Frances Arnold (Caltech), and Robert Bergman celebrate Arnold's 2018 Nobel Prize for pioneering the use of directed evolution to engineer enzymes during a private reception

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Keegan Houser

PAGE 171

2018 Group of alumni Nobel laureates in Chemistry on the wall of the College's Latimer Lobby

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Marge d'Wylde

PAGE 172-173

1980s Process engineering lab at the College with student running a test

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 174-175

1946-1947 Founding faculty of Chemical Engineering Department: LeRoy Bromley (1946), Charles Wilke (1946), Theodore Vermeulen (1947), Charles Tobias (1947), and Donald Hanson (1947)

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Various portrait photographers

PAGE 176

1982 Chemical Engineering faculty on the front steps of Gilman Hall

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 177

1949 First woman undergraduate ChemE student Marie H. Lavering in the front row of a AIChE club photo

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 178

1950s Charles Tobias gets ready to shoot a cap gun

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 179

1955 (l to r) William Corcoran (Caltech faculty) together with Don Hanson and Ted Vermeulen

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 180

1960s Edward Grens in the classroom

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 181

1965 UC Chemical Engineers Against the War: (l to r) alumni Peter Cukor (Ph.D. '71, ChemE with Prausnitz) and Bryan Rogers (Ph.D. '71, ChemE with Prausnitz)

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

PAGE 182

1959 PR photo of John Prausnitz in the lab

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 183

1986 Harvey Blanch in his office

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 184

1986 John Newman

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 185

1986 C. Judson King

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 186

1982 Jeffrey Reimer

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 187

2012 Susan Muller

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Michael Barnes

PAGE 188-189

Collage (l to r) Judith Klinman **(1982)**; Ting Xu **(n.d.)**; Kristie Boering **(2013)**

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway, unknown, Michael Barnes

PAGE 190-191

1930 Colorized photos of Agnes Fay Morgan and students in her lab

COLLECTION: UC Berkeley, Nutritional Science and Toxicology

LOCATION: Courtesy of UC Berkeley, Rausser College of Natural Resources

PHOTOGRAPHER: Unknown

PAGE 192

1982 Portrait of Judith Klinman

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

PAGE 193

November 20, 2014 Judith Klinman receives the National Medal of Science from President Barack Obama

COLLECTION: UPI/Alamy Stock Photo

LOCATION: Image ID:W0HK27

PHOTOGRAPHER: Kevin Dietsch

PAGE 194

1987 Angelica Stacy

COLLECTION: College of Chemistry

LOCATION: letters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

PAGE 195

1983 Angelica Stacy presents a liquid nitrogen demonstration in the classroom

COLLECTION: College of Chemistry

LOCATION: newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

PAGE 196

1971 The "plutonium 244 in nature" discovery team. (l to r) Francine Lawrence, Jack Mewherter, Darleane Hoffman, Frank Rourke

COLLECTION: Los Alamos National Lab (Los Alamos Scientific Laboratory)

LOCATION: B&W negative XBB7609-8640

PHOTOGRAPHER: Robert M Couto

PAGE 197

1950 A young Darleane Hoffman in lab coat in the Ames Lab

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9803-00530.TIF

PHOTOGRAPHER: Unknown

PAGE 198

1986 Portrait of K. Birgitta Whaley

COLLECTION: College of Chemistry

LOCATION: newsletters, journals, and magazines

PHOTOGRAPHER: Likely Dennis Galloway

PAGE 199

1993 Architectural rendering of Tan Kah Kee Hall

COLLECTION: College of Chemistry

LOCATION: Private collection

ILLUSATRATION: Attributed to the firm of Stone, Marraccini, and Patterson, Architects

PAGE 200

1995 or 1996 Tan Kah Kee Hall under construction

COLLECTION: Private collection of C.Judson King

LOCATION: College of Chemistry; newsletters, journals, and magazines

PHOTOGRAPHER: Harry Scheiber

PAGE 201

1997 Professor and Nobelist Yuan T. Lee, Alexis Bell (dean of the College at the time), and Chang-Lin Tien, University chancellor, cut the ribbon on Tan Kah Kee Hall

COLLECTION: College of Chemistry

LOCATION: newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 202-203

2022 T. Don Tilley conducts an experiment in his lab in Tan Kah Kee Hall

COLLECTION: College of Chemistry Tan Kah Kee Hall 25th Anniversary series

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Keegan Houser

PAGE 204

2021 Early morning light is captured in the mining circle pool with Tan Hall in the background

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Marge d'Wylde

PAGE 206

2007 Peidong Yang in the Laser lab; Hildebrand Hall

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD200707-00204-02.TIF

PHOTOGRAPHER: Roy Kaltschmidt

PAGE 208

2007 Portrait of Joseph Cerny

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD200707-00204-02.TIF

PHOTOGRAPHER: Roy Kaltschmidt

PAGE 209

1988 Judith Klinman with unidentified student

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

PAGE 210

1988 Kenneth Raymond with model

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

1986 Angelica Stacy in the lab

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

PAGE 211

1986 John Arnold

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

1995 T. Don Tilley

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

PAGE 212

2014 K. Birgitta Whaley photo from a Japanese poster promoting a laptop

COLLECTION: Courtesy of Birgitta Whaley

LOCATION: Private collection

PHOTOGRAPHER: Unknown

PAGE 213

n.d. William H. Miller in his office

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

PAGE 214

1983 William A. Lester, Jr.

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Dennis Galloway

PAGE 215

1980 Chemistry professor and Nobel Laureate Y. T. Lee, with then graduate students Daniel Neumark (Professor of Chemistry) in yellow shirt, Alec Wodtke (left), and Gary Robinson (rear).

COLLECTION: Lawrence Berkeley National Lab

LOCATION: Lawrence Berkeley National Lab arcive

PHOTOGRAPHER: Roy Kaltschmidt

PAGE 216

1983 Darleane Hoffman receives the American Chemical Society Award for Nuclear Chemistry from Glenn Seaborg

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9804-00770.TIF

PHOTOGRAPHER: Unknown

PAGE 217

n.d. Peter C. Vollhardt

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

PAGE 218

2018 Robert Bergman at the Wolf Prize ceremony

COLLECTION: College of Chemistry

LOCATION: Courtesy Wolf Prize Foundation

PHOTOGRAPHER: Unknown

PAGE 219

n.d. Alexander Pines in his office

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9702-00428.TIF

PHOTOGRAPHER: Roy Kaltschmidt

PAGE 220

2018 Michael Marletta in his lab

COLLECTION: Private collection

LOCATION: Courtesy of Michael Marletta

PHOTOGRAPHER: Unknown

PAGE 221

2002 Gabor Somorjai

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Possibly Peg Skorpinski

PAGE 222

1995 Paul Bartlett in his lab

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 6742M

PHOTOGRAPHER: Dennis Galloway

PAGE 223

2017 Evan Miller in his lab

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Michael Barnes

PAGE 224

2019 John Hartwig in his office

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Michael Barnes

PAGE 225

2023 Ke Xu with microscope

COLLECTION: UC Berkeley Research Division

LOCATION: Heising-Simons Faculty Fellows Program

PHOTOGRAPHER: Elena Zhukova

PAGE 226

2020 Portrait of Matthew Francis

COLLECTION: Private Collection

LOCATION: Courtesy of Matthew Francis

PHOTOGRAPHER: Unknown

PAGE 227

2023 Portrait of Jennifer Bergner

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalog

PHOTOGRAPHER: Brittany Hosea-Small

PAGE 228

2016 Portrait of Susan Marqusee

COLLECTION: Department of Molecular and Cell Biology

LOCATION: Courtesy of Susan Marqusee

PHOTOGRAPHER: Marcus Hanschen

PAGE 229

2016 Jeffrey Long in the Lab

COLLECTION: California Magazine, Cal Alumni Association

LOCATION: For the article “Matter of Degrees: How Hot It Gets Still Depends on Us”

PHOTOGRAPHER: Marcus Hanschen

PAGE 230

1982 Sung-Hou Kim

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 5634M

PHOTOGRAPHER: Dennis Galloway

2002 Carlos Bustamante

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Likely Peg Skorpinski

PAGE 231

2006 Jamie Cate

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Likely Peg Skorpinski

PAGE 232

2017 Kwabena Bediako

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 233

2005 Richard Sakally

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD200409-00496-01.TIF

PHOTOGRAPHER: Roy Kaltschmidt

PAGE 234

1997 John Rasmussen

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 6142M

PHOTOGRAPHER: Dennis Galloway

PAGE 235

1995 Portrait of Charles Shank

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 6771M

PHOTOGRAPHER: Dennis Galloway

PAGE 236

2006 Portrait of Jean Fréchet

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Unknown

n.d. Portrait of John Kuriyan

COLLECTION: Department of Molecular and Cell Biology

LOCATION: Courtesy of John Kuriyan

PHOTOGRAPHER: Unknown

PAGE 237

2008 Portrait of Clayton Heathcock

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Michael Barnes

PAGE 238

2015 Portrait of Dean Toste

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and magazines

PHOTOGRAPHER: Michael Barnes

PAGE 239

2022 Portrait of Omar Yaghi

COLLECTION: College of Chemistry

LOCATION: Photographed for the Bakar Institute of Digital Materials for the Planet

PHOTOGRAPHER: Brittney Hosea-Small

PAGE 240

2019 Polly Arnold in Gilman Hall

COLLECTION: Chemistry World

LOCATION: Photographed for “Polly Arnold’s diversity of interests”, Jan 2020

PHOTOGRAPHER: By permission © Carlos Chavarría

PAGE 241

2022 Portrait of Hendrik Utzat

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Brittney Hosea-Small

PAGE 242

2022 Felix Fischer in his lab

COLLECTION: UC Berkeley Research Division

LOCATION: Heising-Simons Faculty Fellows Program

PHOTOGRAPHER: Elena Zhukova

PAGE 243

1985 Portrait of C. Bradley Moore

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 5907M

PHOTOGRAPHER: Dennis Galloway

PAGE 244

2002 Luciano Moretto (on the right) with atomic nuclei research team members at Berkeley Lab. (l to r) Dimitri Breus, Gordon Wozniak, Larry Phair, and Jim Elliott

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD200112-02459-02.PSD

PHOTOGRAPHER: Roy Kaltschmidt

PAGE 245

1983 Samuel S. Markowitz

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A

PHOTOGRAPHER: Dennis Galloway

PAGE 246

2020 Ashok Ajoy in his lab

COLLECTION: Private Collection

LOCATION: Courtesy Ashok Ajoy

PHOTOGRAPHER: John Fyson

PAGE 247

2007 Paul Alivisatos with students in the laser lab in Hildebrand Hall

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD201204-00258-28TIF

PHOTOGRAPHER: Roy Kaltschmidt

PAGE 248

2022 Portrait of Kristie Boering

COLLECTION: Private Collection

LOCATION: Courtesy of Kristie Boering

PHOTOGRAPHER: Unknown

2022 Portrait of Michelle C. Chang

COLLECTION: Private Collection

LOCATION: Courtesy of Michelle Chang

PHOTOGRAPHER: Unknown

PAGE 249

2014 Stephen R. Leone

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD201408-00978.TIF

PHOTOGRAPHER: Roy Katschmidt

PAGE 250

2023 Kevan Shokat

COLLECTION: University of California San Francisco

LOCATION: Courtesy Department of cellular and molecular pharmacology

PHOTOGRAPHER: Noah Berger

PAGE 251

2020 Richmond Sarpong

COLLECTION: College of Chemistry

LOCATION: PR for undergraduate program

PHOTOGRAPHER: Unknown

PAGE 252

2012 Phillip Geissler

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 253

2009 Phillip Geissler and David Chandler

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 254

1995 Ronald Cohen

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Likely Dan Krauss

PAGE 255

2009 Teresa Head-Gordon

COLLECTION: Courtesy of the College of Engineering

LOCATION: College of Chemistry; newsletters, journals, and catalogs

PHOTOGRAPHER: Adam Lau

PAGE 256

2004 Graham Fleming photographed for an annual LBNL report

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD200403-00158-03.JPG

PHOTOGRAPHER: Roy Kaltschmidt

PAGE 257

2019 Michael W. Zürech

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 258

1982 Marcin Majda

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 5626M

PHOTOGRAPHER: Dennis Galloway

PAGE 259

2013 Daniel Neumark

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Unknown

PAGE 260

2016 David Limmer

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 261

2017 Eran Rabani

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 262

2015 Naomi Ginsberg

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD201501-00005.TIF

PHOTOGRAPHER: Kelly Owen

PAGE 263

n.d. Martin Head-Gordon

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Dennis Galloway

PAGE 264

2013 Thomas Maimone

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 265

2008 Jay Groves

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

2016 Eric Neuscamman

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 266

1985 Richard Mathies

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 5946M

PHOTOGRAPHER: Dennis Galloway

PAGE 267

1986 Yuan T. Lee

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9607-03332.TIF

PHOTOGRAPHER: George Kakawa

PAGE 268

2023 Robert Saxton

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Brittney Hosea-Small

PAGE 269

2023 Ziyang Zhang

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Brittney Hosea-Small

PAGE 270

2011 Christopher Chang

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 271

2020 Jennifer Doudna

COLLECTION: UC Berkeley, Public Affairs

LOCATION: News listings

PHOTOGRAPHER: Britney Hosea-Small

PAGE 272

2018 Jonathan Rittle

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 273

1995 Evan Williams

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 5946M

PHOTOGRAPHER: Dennis Galloway

PAGE 274

2014 David Wemmer

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 275

2019 Ting Xu

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 276

2022 Alanna Schepartz

COLLECTION: College of Chemistry

LOCATION: Video profiles

PHOTOGRAPHER: Stephen McNally

PAGE 277

1982 Robert Harris

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 5642M

PHOTOGRAPHER: Dennis Galloway

2021 Brooks Abel

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Marge d'Wylde

PAGE 278

2018 Anne Baranger

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

2020 (l to r) Laura Armstrong, Lauren Irie, Anne Baranger, and Michelle Douskey in the lab

COLLECTION: Private collection

LOCATION: Courtesy of Anne Baranger

PHOTOGRAPHER: Unknown

PAGE 279

2019 Daniel Nomura

COLLECTION: UC Berkeley, Rausser College of National Resources

LOCATION: Photographed for article "Reimagining "Druggability"

PHOTOGRAPHER: Elena Zhukova

PAGE 281

2021 College at dusk

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Keegan Houser

PAGE 282

2020 Detail of doors, Gilman Hall

COLLECTION: Private collection

LOCATION: Book cover: King, C. Judson, A History of Berkeley Chemical Engineering: Pairing Engineering and Science

PHOTOGRAPHER: Bryan McCloskey

PAGE 285

2022 Douglas Clark

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Brittany Hosea-Small

PAGE 286

1984 Alexis T. Bell

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Dennis Galloway

PAGE 287

1999 Morton Denn

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Likely Dan Krauss

1995 Simon Goren

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Likely Dan Krauss

PAGE 288

1987 C. Judson King photographed when he was College Dean

COLLECTION: UC Berkeley, Bancroft Library

LOCATION: UARC PIC 27A and 2700A: item 6077M

PHOTOGRAPHER: Dennis Galloway

PAGE 289

n.d. Elton J. Cairns

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Likely Dan Krauss

1993 Enrique Iglesia

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Likely Dan Krauss

PAGE 290

n.d. Portrait of John S. Newman

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Unknown

2002 Portrait of Susan Muller

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Unknown

PAGE 291

2010 Harvey Blanch in grow lab

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 292

1997 Jeffrey Reimer rides into Tan Kah Kee Hall during the inauguration of the building on a motorcycle as part of a demonstration about materials science

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD9907-01549.TIF

PHOTOGRAPHER: Unknown

PAGE 293

2022 Portrait of Jay Keasling

COLLECTION: Lawrence Berkeley National Lab

LOCATION: Courtesy of Jay Keasling

PHOTOGRAPHER: Likely Paul Mueller

2012 Jay Keasling in the lab

COLLECTION: Photographed for the 18th Heinz Awards

LOCATION: Courtesy of Jay Keasling

PHOTOGRAPHER: Ryan Schude

PAGE 294

2003 John M. Prausnitz receives the National Medal of Science from President George W. Bush

COLLECTION: National Science Foundation

LOCATION: Courtesy National Medals Foundation

PHOTOGRAPHER: NSF.gov media (no photographer cited)

PAGE 295

2019 Wenjun Zhang receives the Presidential Early Career Award for Scientists and Engineers

COLLECTION: Department of Energy

LOCATION: Department of Energy FLICKR photo stream

PHOTOGRAPHER: "Donica Payne/ U.S. Department of Energy; PECASE2019_151"

PAGE 296

2019 Portrait of Sanjay Kumar

COLLECTION: College of Engineering

LOCATION: College of Engineering

PHOTOGRAPHER: James Block

PAGE 297

2018 Clayton J. Radke (r) receives the 2018 Faculty Outstanding Mentorship of GSIs award from Professor Lewis Feldman, UC Berkeley Associate Dean for Academic Affairs

COLLECTION: UC Berkeley, GSI Teaching and Resource Center

LOCATION: College of Chemistry; newsletters, journals, and catalogs

PHOTOGRAPHER: Peg Skorpinski

PAGE 298

1989 David Graves

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Likely Dan Krauss

PAGE 299

2017 Markita Landry in her lab

COLLECTION: Innovative Genomics Institute

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Unknown

PAGE 300

2022 Jason Ryder in front of the Campanili

COLLECTION: Private collection

LOCATION: Courtesy of Jason Ryder

PHOTOGRAPHER: Sasha Haagensen

PAGE 301

2015 David Schaffer

COLLECTION: Private collection

LOCATION: Courtesy of David Schaffer

PHOTOGRAPHER: © Mark J. Hanson

PAGE 302

2022 Bryan McCloskey

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD-202203-015.TIF

PHOTOGRAPHER: Thor Swift

PAGE 303

2019 Roya Maboudian

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 304

2006 Alexander Katz

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Likely Peg Skorpinski

PAGE 305

2023 Aditi Krishnapriyan

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Brittney Hosea-Small

PAGE 306

2017 Kranthi Mandadapu

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 307

2005 Keith Alexander

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Likely Peg Skorpinski

2015 Nitash Balsara

COLLECTION: Pioneers of Clean Energy Project

LOCATION: Courtesy Rick Chapman

PHOTOGRAPHER: © Rick Chapman; Pioneers of Clean Energy Project

PAGE 308

2017 Ali Mesbah

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

PAGE 309

2019 Rui Wang

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Marge d'Wylde

PAGE 310

2019 Joelle Frechette

COLLECTION: John Hopkins University

LOCATION: Courtesy of Joelle Frechette

PHOTOGRAPHER: Unknown

PAGE 311

2010 Berend Smit

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Michael Barnes

2019 Karthik Shekhar

COLLECTION: College of Chemistry

LOCATION: Newsletters, journals, and catalogs

PHOTOGRAPHER: Unknown

PAGE 313

2020 Campanili behind Gilman Hall

COLLECTION: UC Berkeley, University Development and Alumni Relations

LOCATION: Via Keegan Houser

PHOTOGRAPHER: Keegan Houser

PAGE 314

1940s Dick Connell (center) and Donald Cooksey with camera

COLLECTION: Lawrence Berkeley National Lab

LOCATION: XBD200907-00514.TIF

PHOTOGRAPHER: Unknown

PAGE 331

1966 Portrait of Ansel Adams in the College's courtyard

COLLECTION: UC Riverside: Sweeney/Rubin Ansel Adams Fiat Lux Collection

LOCATION: 6.UCB.63.3

PHOTOGRAPHER: Likely Liliane de Cock, Adams' assistant during the FIAT LUX shoots

Acknowledgements

This historic collection of photographs in this book has been several years in the making. Originally inspired by research done for the College to commemorate the University's 150th anniversary, it quickly became apparent that there were many interesting photographs that should be dusted off to the see the light of day. Like a pebble skipping across a quiet pool, this collection only touches on a small part of the story of the College of Chemistry.

Photographs in the collection can be described as whimsical, heart breaking, fascinating, and mundane. Thanks to many fine photographers, the College's day-to-day and momentous periods have been documented largely through the story of the faculty. No less important has been the dedicated staff who have kept the College running and been the brilliant designers of the spectacular machines and glassware in the photographs seen alongside the scientists.

I want to acknowledge our marvelous dean, Douglas Clark who commissioned this book. For their historical perspective about the Chemical and Biomolecular Engineering department my thanks go to Chemical and Biomolecular Engineering emeritus professors C. Judson King, John Prausnitz, and Jeffrey Reimer. Chemistry emeritus professors Robert Bergman, David Wemmer, and Judith Klinman graciously opened their doors and answered numerous questions about the College's history. The former Assistant Dean of College Relations Jane Scheiber's passion for history helped centralize many early, rare College photographs. Waverly Lowell, Curator Emeritus, UC Berkeley Environmental Design Archives, provided insights into many of our buildings including South Hall, Gilman Hall, and the "old chemistry building" sharing access to rare materials. I am also indebted to current and past College of Chemistry staff Laruen Nakashima, Geralyn Unterberg, Annai Cuvelier, Elle Lam, Mindy Rex, Esayas Kelkile, and Michael Barnes for their technical contributions to this book. And to my dear friend and designer Alissar Rayes, whose dedication to this project was simply inspiring.

History doesn't "collect" itself. Building pictorial and data archives takes passion, perseverance, and a keen interest in the past. I am deeply grateful to the following individuals, and collection holders, for their aid in helping tell the story of the College via the many materials, knowledge, and downright detective work that was shared with me for this project. I would like to acknowledge the marvelous archival librarians at the following institutions whose aid, especially during the COVID shutdown, made it possible to keep working. Thank you especially goes to the UC Riverside California Museum of Photography, UC Berkeley Bancroft Library, UC Davis Archive and Special Collections, UC Santa Cruz Special Collections and Archives, MIT Lincoln Lab Archive, Harvard University Archive, and many more organizations and individuals. A complete list of record holders of the images is available in the book's catalog.

And to everyone I missed here, THANK YOU!

Marge d'Wylde
College of Chemistry

1966 › *Portrait of Ansel Adams in the College's courtyard. Picture was taken when Adams was shooting the Fiat Lux book project for the University of California.*

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1868