Charles H. DePuy

1927–2013

BIOGRAPHICAL *Memoirs*

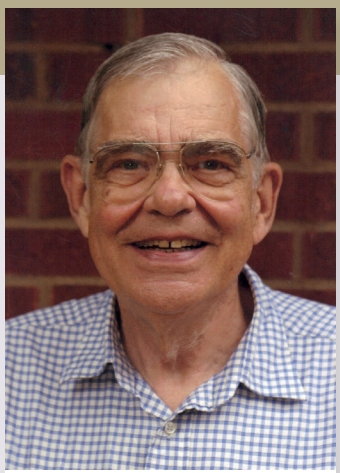
A Biographical Memoir by Veronica M. Bierbaum and Robert Damrauer

NATIONAL ACADEMY OF SCIENCES

CHARLES H **DEPUY**

September 10, 1927–March 14, 2013

Elected to the NAS, 1999



By Veronica M. Bierbaum and Robert Damrauer

Charles H. ("Chuck") DePuy, a distinguished organic chemist, had a profound impact on the field of physical organic chemistry. After making seminal contributions during his early career to "classical" solution chemistry through his insightful mechanistic and synthetic studies, Chuck went on to become an international leader in the emerging field of gas-phase organic-ion chemistry. His creativity, breadth and depth of research, and keen chemical intuition helped establish this field both as an intellectually exciting endeavor and as the foundation for a myriad of important applications. Chuck also had remarkable skills as a communicator, which made him an acclaimed teacher, lecturer, and author. His dedication to students and commitment to the future of chemistry were clearly reflected in the mentoring and guidance he provided over decades to his research group's members. Finally, Chuck's rich personal and family life reflected his deep involvement in and appreciation for the world beyond chemistry.

Early life, education, and professional appointments

Chuck was born in Detroit, MI, to Helen Louise Plehn DePuy and Carroll E. DePuy. His paternal ancestors were French Huguenots who had fled Paris in the mid-1600s because of religious persecution. They initially traveled to the Netherlands and then to the United States, eventually settling in upstate New York; their descendants later moved to Michigan.

Chuck's father, an architectural engineer, was fortunate to be employed as the Great Depression began; he had secured a position with the U.S. government, supervising the construction of government buildings—primarily post offices. Because these projects required about a year, his family moved every spring as soon as the school year ended. As a result, Chuck lived and attended school in several cities, including Newark, NJ; Mt. Joy, PA; Mechanicsville, PA; and Charlottesville, VA. Then, in 1937, his father accepted a

"I was also interested in trying out for basketball, but was told by the coach that it was well known that tall people were too awkward to play!"

two-year position in the Virgin Islands to supervise the construction of a post office on St. Thomas and the remodeling of the Governor's House on St. Croix. In Chuck's autobiographical notes, titled "A Sketch of My Life," he fondly wrote of these idyllic years, marked by beautiful surroundings, high quality of life, and deep childhood friendships—experiences that greatly expanded his horizons. In 1939, his family moved to Louisiana, where his father supervised construction of several buildings at the Carville leprosy colony, located on an otherwise deserted stretch of the Mississippi River about halfway between Baton Rouge and New Orleans. Chuck celebrated his 14th birthday in Louisiana; he later reminisced that at this age you could simply get in a car and legally drive—no training or license required!

Six months after Japan attacked Pearl Harbor, Chuck's father was transferred to the San Francisco Bay area in order to fortify government buildings there that were expected to become additional Japanese targets. Chuck enrolled in Oakland Technical High School, which had a small but distinguished college-prep program. Indeed, Oakland Tech served him well. Chuck's love of chemistry was sparked there by an outstanding teacher, he became editor of the school paper, and in general he greatly enjoyed the high-school experience. He was blocked from one particular activity, however, by someone with a curious perspective. Chuck (who was 6'5") wrote, "I was also interested in trying out for basketball, but was told by the coach that it was well known that tall people were too awkward to play!" During this period he often rode his bicycle to the nearby University of California, Berkeley campus, wandered with great curiosity through the buildings, and peeked into the old but charming organic chemistry labs—he was determined to become a student there.

Chuck's nontraditional educational background, with frequent school transfers and inevitable mismatch of course content, had at least one negative effect: he missed several fundamental math topics (for example, he never learned long division). Chuck mused later that a stronger math preparation might have directed him into physical chemistry. Instead, the world of organic chemistry became the beneficiary of this quirk of fate! But Chuck's unique educational preparation was overwhelmingly positive; he enjoyed a wide range of invaluable cultural experiences, he interacted with many fine teachers, and he had amassed sufficient academic credit to graduate from high school at the age of 15.

Thus Chuck entered UC Berkeley as a chemistry major when he was 16 years old. He boarded at the Alpha Chi Sigma house, a professional chemistry fraternity, because his parents were now living in Vancouver, WA. As a result he soon became a fraternity member, and eventually served as its president. Regarding his studies, Chuck found the atmosphere of the Berkeley chemistry department to be extremely exciting, and he enjoyed his classes and professors, who included William Giauque and Melvin Calvin. This experience was interrupted in 1945, however, when at the age of 18 Chuck was drafted. He trained as a medic at Fort Sam Houston Army Base and served at a medical unit in St. Louis, but after 13 months he returned to his studies at Berkeley and graduated in 1948.

Chuck had been a strong undergraduate but was not the top of his class. He wrote, "My best friend was a straight-A student and he was ruthlessly sent off to graduate school at Johns Hopkins University—in exchange for one of their best graduates. I guess my trading value wasn't that good." However, this status allowed Chuck to define his own future. He wished to live in New York City, so he enrolled at Columbia University—a decision that had positive lifelong consequences. There he met Eleanor Burch, a nurse at the nearby Bellevue Hospital, whom he married in December 1949. At the time of his death, Chuck and Ellie had been married 63 years, with four children and six grandchildren. (Other aspects of Chuck's life outside chemistry will be discussed later in this memoir.)

Chuck decided to join the research group of William von Eggers Doering, whom Chuck later described as "a young charismatic chemist in the forefront of the new emerging field of physical organic chemistry." Although Chuck was enticed by several of the organic chemistry programs at Columbia, he noted, "I attended one of Bill's group meetings and was sold." Those evening sessions were legendary for their length, intensity, and creativity. Chuck remembered that "problems submitted by students were welcome, and we all tried to come up with problems that even Bill could not solve." Chuck also enjoyed the collegiality of other Doering group members, including Ken Wiberg, Jerry Berson, Andy Streitwieser, and Al Wolf.

In 1952, Bill Doering accepted a position at Yale University and invited Chuck to accompany him there, help set up the new lab, and complete his studies at Yale. Thus Chuck received his M.S. degree from Columbia that year and, after additional research, his Ph.D. from Yale in 1953. He noted two memorable features of the lab protocol at Yale: the seemingly dangerous practice of using lit Bunsen burners in organic hoods to

create upward drafts; and the requirement that students personally cover the costs of chemicals and glassware. Chuck remarked, "It was important for new grad students to choose their research problem carefully to be sure they could afford it." Although he was at Yale for only nine months, he developed a close and lifelong friendship with fellow grad student Howard Zimmerman.

Chuck then returned to California—to UCLA—for a productive year as a postdoctoral research associate with Prof. Donald Cram; the most enjoyable part of the experience for Chuck was the weekly UCLA-CalTech seminar. In 1954 he accepted a position in Ames, IA, as assistant professor of chemistry at what was then called the Iowa State College of Agriculture and Mechanics (in 1959 it became the Iowa State University of Science and Technology). His independent research career there progressed quickly; he had access to the "best of the incoming students," and the Ames Laboratory provided an environment of capable colleagues and strong funding. In 1960, he was promoted to associate professor with tenure and in 1963 he attained the rank of professor.

Despite his success at Iowa State, Chuck was attracted to the University of Colorado by virtue of its "worldwide reputation in physical organic chemistry." In 1963, largely through the vision and encouragement of Prof. Stan Cristol, he accepted an offer from CU. In addition to carrying out an ambitious research program there, he played a pivotal role in the growth of the Department of Chemistry. Serving as chairman early in his CU career, he focused on strengthening physical chemistry through multiple critical hires and by establishing ties with CU's JILA (originally the Joint Institute for Laboratory Astrophysics, but it grew to embrace many more areas of science) and the U.S. National Oceanic and Atmospheric Administration. Colleagues suggest that the excellence of the department today is a testament to Chuck's efforts.

After having continued and expanded his research program in classical physical organic chemistry in solution, Chuck found himself greatly intrigued by lunchtime discussions with Dr. Eldon Ferguson, a NOAA colleague and adjoint professor of chemistry. Ferguson and co-workers had recently developed the flowing afterglow technique that was proving invaluable in gas-phase studies of ion reactions important to the Earth's atmosphere. Chuck recognized the enormous potential of the technique for exploring intrinsic organic ion chemistry—in the absence of solvent and counter-ions. Thus with the help of his NOAA colleagues and a small National Science Foundation (NSF) grant, he began his gas phase adventures. His partners in this endeavor were Prof. Robert

Shapiro, a faculty colleague in mass spectrometry; John Stewart, an outstanding and fearless graduate student; and Veronica Bierbaum, a newly hired postdoc trained in physical chemistry.

Chuck remembered these years as "riding a roller coaster." Construction of the instrument was challenging, funds were extremely short, and initial grant proposals and submitted manuscripts were being declined. But the chemistry was incredibly exciting! Persistence and hard work eventually led to strong support by NSF, the National Institutes of Health, the Petroleum Research Fund**,** and the Army Research Office over the years. During that time, Chuck enjoyed mentoring many of the graduate students and postdocs involved in this research, and he developed close and productive collaborations with colleagues—in particular Prof. Robert Damrauer of CU-Denver.

In 1992, Chuck officially retired from teaching and administrative responsibilities, and his friends and colleagues held a symposium in September of that year to celebrate his 65th birthday and look back on his distinguished career. But he remained active in research until his final grant expired in 1998, and he continued to interact with Veronica Bierbaum and her research group and to attend and present seminars until the fall of 2012. A few years earlier, Chuck had been diagnosed with chronic lymphocytic leukemia, and he passed away peacefully on March 14, 2013.

Attendees at the 65th Birthday Symposium for Charles DePuy, September 12, 1992.

Research in chemistry—from solution to the gas phase

Chuck's work in solution chemistry commenced during his doctoral studies. As a result he produced two papers with Bill Doering, one in which a two-step improved synthesis of azulene was reported; and a second in which diazocyclopentadiene was synthesized and structurally characterized by infrared and ultraviolet spectroscopy. Chuck reminisced in his autobiographical notes that his successful synthesis of diazocyclopentadiene was made possible when Doering personally taught him how to safely purify the compound by low-temperature crystallization—a technique that Doering had developed during his own doctoral studies with Patrick Linstead.

Chuck's postdoctoral work with Donald Cram, which immersed him in the physical organic studies of the stereochemistry of E2 processes, may have provided the link to his eventual move to the University of Colorado so strongly influenced by Stan Cristol. Indeed, the paper with Cram and Fred Greene (professor emeritus at MIT) that studied eclipsing effects in $PhCH(CH_3)$-CHPhX systems would certainly have been noticed by Cristol, whose studies on syn-eliminations are classic.

Arriving at Iowa State in 1954, Chuck launched work focused largely in two research areas: improved understanding of the electronic and directional effects of elimination reactions; and synthesis and study of the properties of highly reactive ring systems such as cyclopentenone; cyclopentene-3,5-dione; cyclopropanes; and cyclopropanols.

The elimination studies often involved the preparation of series of aromatic compounds substituted in aryl rings so as to allow Hammett sigma-rho analysis, thus providing information about transition-state structures and the competition between elimination and substitution. Pyrolysis studies of eliminations also appeared during this period, culminating in a 1960 *Chemical Reviews* article on "Pyrolytic Cis Eliminations." It is easy to recognize that Chuck's interest in elimination chemistry began during his postdoc with Cram, but the scope of Chuck's later studies went far beyond, initiating the type of physical organic chemical studies in which he excelled. These studies were substantive parts of his contributions while at ISU, and they continued at the University of Colorado as well.

Throughout his career, Chuck was fascinated by small reactive molecules, their chemical transformations, and the mechanistic frameworks that characterize their behavior. His early syntheses, defined by their simplicity, were improvements on less efficient synthetic pathways. All of these syntheses led to deeper explorations of such molecules and many of their readily synthesized derivatives.

For example, the synthesis of cyclopentene-3,5-dione was accomplished in reasonable yields by simple "textbook" organic reactions. Even in the initial communication, important characteristics of this molecule were reported, namely its high C-H acidity and its non-enolic form. Syntheses of cyclopropyl species opened doors wide to (1) probing the stereochemistry of ring-opening in cyclopropanes under electrophilic reaction conditions and to (2) a host of cyclopropanol studies.

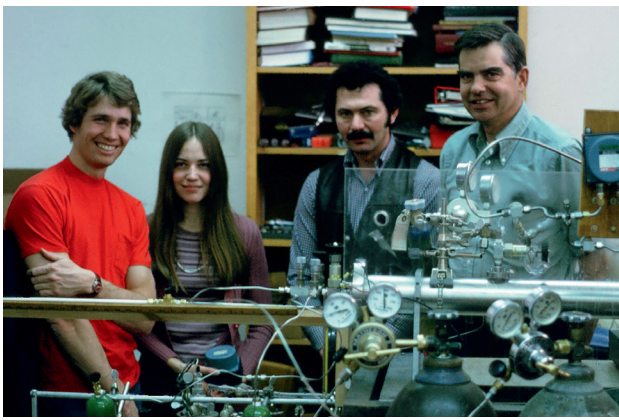
Consistent with the important developments occurring in organic chemistry at this time, Chuck addressed questions of the structure of norbornyl cations formed in solvolysis reactions. He definitively showed stereospecificity in certain norbornyl isomers and indicated that classical cation intermediates were not consistent with the results obtained. On the cusp of Chuck's ISU-to-CU transition, studies of cyclopropanol solvolysis often addressed questions of the nature of cationic intermediate species, again in light of the important mechanistic questions of those days.

The currency of Woodward-Hoffmann orbital-symmetry considerations led Chuck to conclude that in cyclopropanol ring-opening solvolyses "the direction of rotation is dependent upon the stereochemistry of the leaving group" (Cristol, Sequeira, and DePuy 1965). He did comment to friends that such ideas had been raised with Roald Hoffmann at a meeting in October 1964, but they had not been attributed to Chuck in Woodward-Hoffmann papers until some time later. Only in the light of history has this oversight been addressed in a recent review (Seeman, J. I., 2015. Woodward-Hoffmann's *Stereochemistry of Electrocyclic Reactions*: From Day 1 to the *JACS* Receipt Date [May 5, 1964 to November 30, 1964]. *Journal of Organic Chemistry* 80:11632-11671).

Other of Chuck's cyclopropanol studies—using two of his most potent tools, both of them based on labeling techniques—probed the nature of free radical intermediates, their lifetimes, and their eventual fates. For example, in a comparison study of a cyclopropanol ring opening under acidic and basic conditions, he made a clear distinction between acid- and base-catalyzed reaction mechanisms and demonstrated their stereochemistry. The simple expedient of carrying out these stereospecific ring-openings in D_2O allowed this interpretation in the study. A related and often-used tool, the determination of kinetic isotope effects (k_H/k_D in this case), indicated that the O-H bond of cyclopropanols was more readily cleaved than the O-D bond by photo-excited aryl ketones. Chuck summarized studies of cyclopropanols in two reviews, one in *Accounts of Chemical Research* (1968) and the other in *Chemical Reviews* (1974).

The CU years during which Chuck transitioned to gas-phase research produced extensive additional studies of cyclopropanes, cyclopropanols, and unsaturated cyclopentane derivatives, and he did a brief sojourn at that time into iron-tricarbonyl chemistry as well—all had the goal of generating and elucidating unusual organic species of physical-organic interest.

Beginning in the early 1970s, Chuck ventured into the challenging new field of gas-phase organic-ion chemistry. Using the flowing afterglow technique, over a period of three decades he carried out ingenious and wide-ranging studies of the reactivity, mechanisms, structures, and thermochemistry of gas-phase organic ions. Most of this work focused on negative ions—which undergo fewer rearrangements than positive ions and are critical reactants in classical organic processes; these anions were difficult to generate and explore by other available techniques.



Flowing afterglow instrument and researchers, 1974. (Left to right) John Stewart, Veronica Bierbaum, Robert Shapiro, and Chuck DePuy

Several common themes running through much of Chuck's work are highlighted below:

Hydrogen-deuterium exchange. Chuck discovered that many organic anions interact with deuterated reagents, in particular water and alcohol, by exchange of hydrogen and deuterium atoms. These reactions served as sensitive probes of the basicities of the anions, their structures, and the mechanisms of the interactions. Isomeric species could often be clearly distinguished by the extent of hydrogen-deuterium exchange in the anion.

S_N2 and E2 reactions. One of the most comprehensive areas of investigation involved bimolecular nucleophilic substitution (S_N2), bimolecular elimination (E2), and the competition between these two mechanisms. Chuck utilized kinetic isotope effects, microsolvation, and computational studies to characterize the reactivity and mechanisms of a wide variety of organic substrates. Moreover, reactions of microsolvated ions provided insight into the transition between the gas and condensed phases.

Isotope labeling. Reactions of anions using oxygen-18, chlorine-37, and sulfur-34 often revealed previously hidden mechanisms—for example, atom exchange in competition with associative detachment for the reaction $^{18}O^- + C^{16}O$. Moreover, quantitative kinetics allowed characterization of the intrinsic barriers for different mechanisms: rapid reaction ($^{37}Cl^- + H^{35}Cl$) reflects a low intrinsic barrier for proton transfer, whereas immeasurably slow substitution ($^{37}Cl^- + CH_3{}^{35}Cl$) indicates a high intrinsic S_N2 barrier.

Thermochemistry. Chuck determined the gas-phase acidities of organic compounds by using several methods, including: (1) measurement of forward and reverse proton-transfer-rate constants with well characterized acids and (2) competitive dissociation of proton-bound anion-heterodimers (the Cooks kinetic method). Combination of these gas-phase acidities with electron affinities, as determined by Carl Lineberger and other researchers, led to bond-dissociation energies via the negative-ion thermochemical cycle. Alternatively, electron-binding energies were often determined directly in the flowing afterglow by electron transfer from an anion to a molecule with well-known electron affinity.

Silicon chemistry. In collaboration with Bob Damrauer, Chuck explored the intriguing negative-ion chemistry of silicon compounds. In particular, fluoride displacement of substituted trimethyl silanes was found to generate specific isomeric anions that cannot be generated by other methods (e.g., $(CH_3)_3SiC(O)CH_3$ gives rise to CH_3CO^-). Moreover, competitive displacement of a variety of alkyl groups from $(CH_3)_3SiR$ allowed quantitative assessment of the gas-phase acidities of the alkanes—values that were challenging to determine by other experimental techniques.

Exotic species. Chuck examined the gas-phase chemistry of many exotic ions, including carbene radical anions, benzyne, vinyl, and acetic acid enolate anions, as well as novel boron anions and cations. He explored chemistry relevant to the interstellar medium and the reactions of electronically excited neutral reagents. Argon metastables were found to ionize a wide variety of molecules without fragmentation, and $O_2(^1\Delta)$ was found to induce reaction even with extremely stable anions.

Long-lived complexes. Exothermic ion reactions had often been viewed as occurring rapidly and irreversibly at long range. But Chuck's numerous studies over the years clearly indicated the existence of long-lived ion-molecule complexes in which well-defined sequential reactions take place. These complexes exist not only for reactions in which simple reversible proton-transfer occurs but also for complex rearrangements involving sequential elimination processes or other chemical mechanisms. Chuck iden-

tified his highlighting of the existence and importance of these complexes in gas-phase negative-ion reactions as his major contribution to the field.

Comparison of gas-phase and condensed-phase chemistry. There are striking contrasts between gas-phase and solution chemistry. For example, the acidity order of alcohols is reversed in the two phases, and reactions invariably occur more rapidly in the absence of solvation. However, Chuck was fascinated by the overwhelming similarities of the two phases. In an *Accounts of Chemical Research* paper (DePuy and Bierbaum 1981), he argued that traditional solution chemistry serves as an excellent guide to the exploration of gas-phase phenomena. "The whole realm of traditional organic chemistry is manifested in the gas phase," he said. "However, more fundamentally, the underlying principles and conceptual framework of organic chemistry—formulated from more than a century of research—are dramatically reinforced by gas-phase studies. Reactions sensitively respond to structural modifications and energy variation in the reactants in ways that are familiar to us from solution studies." To Chuck, the gas and condensed phases were just different facets of the fundamental chemistry that he loved.

Awards

Chuck received many prestigious awards throughout his career, including an Alfred Sloan Fellowship (1960), an NIH Senior Postdoctoral Fellowship (1969), the Gold Medallion Award of the American Chemical Society's (ACS's) Colorado section (1975), two Guggenheim Fellowships (1977, 1986), the University of Colorado Research Lectureship (1979), election as fellow of the American Association for the Advancement of Science (AAAS,1982), an Alexander von Humboldt Fellowship (1988), election to the National Academy of Sciences (1999), the ACS James Flack Norris Award (2001), and election to the American Academy of Arts and Sciences (2003). Chuck's extensive contributions to gas-phase ion chemistry were honored by his colleagues in a special issue of the *International Journal of Mass Spectrometry* in 1992. He was active in professional organizations, including the American Society for Mass Spectrometry, the ACS, and the AAAS.

James Flack Norris Award celebration, American Chemical Society Meeting, April 9, 2002. (Left to right) Robert Damrauer, Hilkka Kenttämaa, Veronica Bierbaum, Lenore Damrauer, Steven Kass, Eleanor DePuy, and Charles DePuy

Teacher, mentor, colleague, and scholar

Chuck was an outstanding educator, as evidenced by his formal teaching, his seminars, and his writing. He enjoyed teaching organic chemistry both at the undergraduate and graduate levels, and was known for his lucid and insightful style. His seminars and conference presentations always told an engaging "story"—he abhorred talks that merely presented countless tables of data. Chuck instead opted to communicate a few important concepts simply and elegantly. Similarly, his writing was renowned for its clarity and pedagogy. Chuck's textbook, *Introduction to Organic Chemistry*, was published in three editions over a span of 15 years and translated into several languages (DePuy, Rinehart, and Applequist 1982). His *Exercises in Organic Spectroscopy* was appreciated by a generation of students as a valuable workbook (Shapiro and DePuy 1977) and his more than 200 research papers have been widely cited.

Chuck was also an exceptional mentor for his graduate students. His genuine passion for research created an atmosphere of excitement in the lab, and his group meetings were exhilarating and exhausting. He had a unique chemical intuition—he truly understood the "dance" of the molecules—and with seeming effortlessness he would absorb and interpret new data with uncanny insight. Nevertheless, he was often the contrarian, or "devil's advocate," who would insist on exploring all possible explanations for the data. He took part in every aspect of the lab work, including synthesis of compounds, maintenance and cleaning, and theoretical computations. But he especially loved operating the instruments and obtaining data himself.

An indelible memory for Veronica involves Chuck asking her "help" for an experiment, then positioning her at the flowing afterglow—fire extinguisher in hand—near the pyrophoric gas he was using! He also instilled in Veronica the essential synergy of research and teaching; after a vacuum accident or other "disaster" by a new graduate student, he would counsel her that education, not merely publication, was the ultimate goal. Bob recalls the once-a-week experimental days when he and Chuck worked alone on the flowing afterglow (after students turned it on so they would do no damage). It was remarkable that Chuck understood the full implications of many experiments almost as they ran, sometimes before the results exited the recorders.

Chuck always welcomed colleagues into his lab, and he enjoyed many long-term and fruitful collaborations. He was generous and freely shared ideas, credit, equipment, and laboratory space. Even after his retirement, Chuck would edit his "former" group's manuscripts, formulate ingenious mechanisms, offer valuable advice, and even personally provide funding for a graduate student's travel to a conference.

Throughout his career and increasingly as he approached retirement, Chuck was committed to scholarly pursuits at the intersection of history and science. For example, he created a seminar—on the development of organic chemistry—in which he intertwined the evolution of chemical understanding with perceptive glimpses into the intriguing personalities involved. He similarly developed a seminar on the scientific and historical controversies surrounding the Vinland map, now housed at the Yale University library. This map, originating in the 15th century, had important implications regarding the Norse exploration of North America. Chuck told the tale as a suspenseful detective story that meshed with his long-time fascination with art, dyes and inks, and the increasingly powerful scientific approaches to detecting fraud. His deep interest in the history of science led to his creation of scientific "family trees" for himself and several colleagues. Moreover, Chuck amassed an impressive collection of rare and old chemistry books; his donation of some 150 of these valuable books now constitutes the DePuy Collection at the University of Colorado Library.

A rich personal life

Chuck met Eleanor Burch, a nurse at Bellevue Hospital, during his first year of graduate school at Columbia University. They were married on December 21, 1949, and had four children over the next eight years: David, Nancy, Stephen, and Katherine. With the DePuys' move to Boulder in 1963, they became deeply involved both in the university and community. Their beautiful home, on a spacious double lot with lush gardens and giant shade trees, became the site for many celebrations of holidays, birthdays, and weddings. Over the next few decades, they welcomed six grandchildren into their family. They also purchased a lovely cottage in nearby Chautauqua Park that became a guesthouse, a quiet haven for writing, and a charming venue for parties.

Chuck's family:(left to right) Stephen, David, Chuck, Eleanor, Katherine, and Nancy, February 6, 1993.

Chuck and Eleanor greatly enjoyed travel, and the family participated in several international adventures during his sabbatical years. Later, when David operated a diving and travel business, the family shared many scuba diving trips to

beautiful destinations, including Fiji and the Caribbean. Chuck and Eleanor also enjoyed bicycling through France and visiting Peru (especially Machu Picchu), among other travels. Their family members were avid skiers, and Veronica Bierbaum fondly remembers when her family and the DePuys shared a winter vacation in Aspen. Chuck continued to ski after his retirement; whenever a Colorado ski resort offered free lift tickets to senior citizens, he (with Stan Cristol or Eldon Ferguson) would take advantage of the opportunity for a great day in the mountains.

Chuck and Eleanor also loved music—opera in particular—and they attended many performances in the Boulder/Denver area. Favorites included the Takacs Quartet and the excellent recitals of the CU music faculty. Bob Damrauer recalls the time he and Chuck met in Chicago for a weekend Lyric Opera production of *Tristan and Isolde*. It was an emotionally gripping performance that Chuck indicated was the best he had ever witnessed. Expecting that maybe he had seen it a couple of times, Bob was stunned to learn that the Chicago production was perhaps the 12th or 15th performance of *Tristan* that Chuck had attended.

Chuck appreciated fine food and wine, and his research group enjoyed many memorable dinners (often grilled salmon, crusty baguettes, and an excellent wine) at his home or cottage. He was also a voracious reader, and colleagues fondly remember the familiar image of Chuck with the New York Times tucked under one arm and a novel under the other. (Perhaps it can be revealed that Chuck for years tried to plow his way through Marcel Proust's *À la Recherche du Temps Perdu* (In Search of Lost Time). It is not clear whether he succeeded!) Chuck's broad interest in literature and a diverse array of topics reflected his deep intellect and unbounded curiosity.

Chuck DePuy was an extraordinary scientist, superb teacher, and exceptional person who enriched many lives. He is deeply missed, but his spirit endures through his family and through the legacy of his chemistry, his students, and his colleagues.

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