menological discipline to one based on fundamental structural and quantum mechanical principles.

Some of Pauling's greatest contributions came through his understanding of the structure of proteins. He was influential in developing the current view of protein structure, involving smaller units, coils and sheets, that fold together with weak bonds to make a three-dimensional structure. Working with Robert Corey, he was able to deduce the structure of the alpha helix and beta sheet in the late 1940s, thus laying the groundwork for modern developments in protein structure. His understanding of the importance of intermolecular interactions allowed him to describe the manner in which enzymes work, that is, by stabilizing the transition state of the substrate. In this research he emphasized the importance of molecular complementarity, in which the interactions between two molecules are stabilized by van der Waals and hydrogen bonding interactions as well as ionic forces. His stress on the detailed fitting together of molecules and the physical description of these interactions helped to explain a variety of biological phenomena. He again emphasized the importance of complementarity in considering the interaction of components that make up genes. The methodology that he developed in deducing the structures of polymeric peptides was used extensively by James Watson and Francis Crick in uncovering the double-helical structure of DNA.

In the mid-1940s Pauling learned of the disease sickle-cell anemia, in which hemoglobin molecules assemble together to make birefringent rods. He reasoned that for this process to occur there would have to be a change in the surface structure of the molecule. Together with his associates, he discovered that a mutation in hemoglobin led to this disease. This was the first description of a molecular disease, and the discovery electrified the research community in its simplicity.

Many of Pauling's discoveries were initially viewed as quite radical but then rapidly became incorporated into science to the point where they were regarded as obvious. An example was his work with Emil Zuckerkandl in 1962; they correlated the differences in the amino acid sequence of hemoglobin among different animals with the evolutionary periods at which those animals had diverged from one another. Pauling and Zuckerkandl suggested that mutations accumulate in a fairly regular manner with time and therefore can be used as a measure of evolutionary time. With this insight Pauling was able to unify paleontology, geology and molecular genetics. It was the beginning of molecular evolution, which is now an important field of biological science.

Pauling's intuition played a key role in his conviction that radiation was harmful to the genome, even in small amounts. Because of his conviction, in the late 1950s he started to crusade actively for a cessation of nuclear testing, even at a time when many regarded this as an outrageous and even subversive suggestion. He was subpoenaed to testify before the Senate internal security subcommittee for his support of a campaign against nuclear testing. In 1962, however, Pauling won the Nobel Peace Prize for his efforts to bring about a test-ban treaty. (He already had won the prize for chemistry in 1954.)

By the 1970s Pauling's attention had turned to antioxidants—vitamin E and especially vitamin C. His analysis and intuition led him to the conclusion that we would be healthier if we took supplements of these vitamins. The debate on the role of antioxidants in general, and vitamin C in particular, continues today.

Pauling's influence was widely felt not only in research but in teaching as well. His chemistry textbooks were widely read and imitated. In 1935, together with E. Bright Wilson, he wrote *Introduction to Quantum Mechanics* (McGraw-Hill), which served for many years as *the* vehicle for introducing students of both chemistry and physics to quantum mechanics and its applications.

Pauling's lecture style was brilliant. His ability to capture the attention of his audience left them with the feeling that they shared his understanding of the subject. His knowledge was wide-ranging, covering all fields of chemistry and structure. Pauling was widely regarded as the foremost chemist of the 20th century.

ALEXANDER RICH
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Peter van de Kamp

Peter van de Kamp died in Amsterdam on 18 May 1995, at the age of 93, after a long career in long-focus astrometry.

Van de Kamp started his astronomical studies at the University of Utrecht in the Netherlands in 1918, earned a PhD in astronomy at the University of California at Berkeley in 1925 and a doctorate at the University of Groningen in astronomy in 1926. From 1925 to 1937 he was associated with the McCormick Observatory of the University of Virginia, in Charlottesville, first as instructor (1925–28) and then as assistant professor. There he contributed to the knowledge of galactic structure. From 1937 to 1972 van de Kamp was a professor of astronomy at Swarthmore and director of the college's Sproul Observatory. Capitalizing on previous astrometric photographs from the Sproul 60-cm refractor obtained primarily for distance determination, van de Kamp extended the observatory's program to include an extensive and intensive study of the stars in our stellar neighborhood. This pioneering study had as its prime goals to search for low-mass stars, thus extending the lower end of the mass–luminosity relation, and to find out if other stars had planets. Visual detection being virtually impossible, any such discovery would be indicated by the gravitational pull of the planet on its star, giving rise to a wobble in the visible star's path across the plane of the sky.

Some 30 years ago van de Kamp announced that there was evidence that Barnard's star had a planetary companion with a mass similar to that of Jupiter, but with further studies, small discrepancies in the performance of the optics of the Sproul telescope indicated the "wobble" to be spurious. Even with the increased precision yielded by technical advances for the various methods of observation, no planetary companions to any stars in our stellar neighborhood have been found to date. The Sproul research under van de Kamp did, however, lead to the discovery of low-mass companions to stars, thus increasing our knowledge of low-mass stars and the prevalence of stellar duplicity in the galaxy. Also, through the study of known double stars, van de Kamp increased the knowledge of stellar masses.

During his tenure as director of the Sproul Observatory and chairman of the Swarthmore astronomy department from 1937 through 1972, van de Kamp increased the academic staff to four members. A large proportion of astronomers working in long-focus astrometry got their start under van de Kamp at Swarthmore.

Van de Kamp remained a research astronomer at Sproul from 1972 to 1976. In 1974–75 he was a lecturer at the Astronomical Institute of the University of Amsterdam.

During the middle part of this century van de Kamp was influential in molding the climate and progress of astronomy though various service positions; for example, he was the first program director for astronomy at the National Science Foundation, vice president of the American Association for the Advancement of Science (Section D, astronomy), a member of the US National Committee of the International Astronomical Union and director-at-large of the Association of Universities for Research in Astronomy. Between 1952 and 1981 he authored a number of books and monographs on the techniques and research applications of long-focus astrometry. In 1980 an asteroid was given his name.

Van de Kamp was well known as a popular and witty lecturer. An accomplished musician, he directed an amateur orchestra in Charlottesville and later became conductor of the Swarthmore College Orchestra. He played violin and piano and was a published composer of works for the piano. Van de Kamp always expressed the belief that astronomy was a marvelous synthesis of art and science, and he patterned his successful life in that fashion.

SARAH LEE LIPPINCOTT
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William B. Hanson

William B. Hanson died on 11 September 1994, at age 70, as a result of massive spinal-cord injuries suffered in a frustratingly improbable bicycle accident. At the time of his death he was pursuing his research at the University of Texas at Dallas and serving as professor and director of the university's Center for Space Sciences.

Hanson received a BS in chemical engineering from the University of Minnesota in 1944 and, following World War II military service, a PhD in physics from George Washington University in 1954. Although he started in low-temperature physics, in 1956 he made a dramatic change in fields of research. In a masterpiece of good timing, a year before the launch of Sputnik, he joined the Lockheed Missiles and Space Company in Palo Alto, California, where he started research in aeronomy and ionospheric physics. He went to Texas as a professor in 1962.

Bill wanted to understand the ionosphere so well that it became something he could feel at a gut level; it was a joy to hear him explain something. His insights seemed deceptively simple because they were so basic. His love of research caused him to develop a taste for good science and a distaste for bad science. "That can't be right, because . . . " was followed by an economical array of evidence logically arranged to demolish the offending presentation.

Hanson's research covered both experiment and theory. Here are two examples: At the dawn of the space age, he derived basic properties of the ionospheric structure. His solution of the problem of how the nighttime ionosphere is maintained was so fundamental that it is still used to infer the concentration of atomic hydrogen from measurements of other constituents. And he designed and built the instrument that made the (so far) only *in situ* measurements of the ionosphere of another planet when the Viking spacecraft landed on Mars.

Bill Hanson exhibited outstanding traits that went beyond those we usually see in a dedicated, productive scientist. His prowess in athletics and outdoor sports are legendary. He was a genuinely "nice guy," and he supported causes that he felt would benefit humanity. Those of us who interacted with him feel a void at his passing.

A. J. DESSLER
University of Arizona
Tucson, Arizona

Robert V. Coleman

Robert Vincent Coleman, the William Barton Rogers Professor of Physics at the University of Virginia, died on 26 December 1994, after a nearly yearlong struggle with a still-undiagnosed infection of his vascular system.

Bob was born on 11 October 1930 in Iowa City, Iowa. He and his twin brother, Joseph, both graduated from the University of Virginia with bachelor's degrees in physics in 1953. Bob continued in graduate school there, earning his PhD in physics in 1956. His dissertation research, done under the direction of Nicolas Cabrera, was on the growth of nearly perfect single crystals.

Following appointments at the General Motors Research Laboratory and at the University of Illinois, Bob returned in 1961 to the University of Virginia, where he spent the rest of his life as a devoted teacher and researcher. He served as chairman of the physics department from 1977 to 1983. His guidance and leadership were critical in the successful completion of two major additions to the Jesse Beams Laboratory of Physics in 1989 and 1992, an appropriate accomplishment for the winner of the 1976 Jesse W. Beams Award.

Bob was an ingenious experimenter with a remarkable diversity of interests who contributed profoundly to many areas of solid-state and biological physics. His laboratory was constantly at the forefront in crystal growing techniques. He was a world leader in the study of the electrical conductivity and crystal structure of magnetized materials. He pioneered the application of inelastic electron tunneling to the study of biological molecules adsorbed on solid surfaces. His atomic-scale images of the surfaces of chalcogenide crystals are classics in the literature.

Beginning in 1973 Bob and an entire generation of graduate students were regular users of the Francis Bitter National Magnet Laboratory's high-field facility at MIT. Bob's careful planning and preparation were legendary there.

Bob also had a fruitful collaboration for more than 20 years with Paul Hansma and his group at the University of California, Santa Barbara. Three highlights of this work were discovering the liquid-phase doping for inelastic electron tunneling spectroscopy, obtaining the first atomic-resolution images of surfaces in liquids, and obtaining the first images of charge-density waves with the scanning tunneling microscope. He also had a long and productive collaboration with Leo Falicov at the University of California, Berkeley, particularly on the theory of magnetoconductivity in charge-density-wave systems.

Bob was a dedicated teacher who was highly respected by undergraduates and graduate students. At the university his accomplishments led to his appointment as Commonwealth Professor of Physics in 1975 and as the William Barton Rogers Professor of Physics in 1979.

Robert Coleman was a very private, independent person who had incredibly good judgment about things of importance, and he was a devoted and loyal friend to those who knew him best.

VITTORIO CELLI
BASCOM S. DEAVER JR
University of Virginia
Charlottesville, Virginia
PAUL K. HANSMA
University of California
Santa Barbara, California
LAWRENCE G. RUBIN
Massachusetts Institute of Technology
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