emerging area of geochemistry. Many classical geology colleagues around the country, who literally accused Caltech of "selling out" geology to the geochemists, initially did not look favorably on the new emphasis on geochemistry. However, they subsequently recognized it as a forward-looking and daring move. The second new thrust in the 1960s required a choice between ocean-floor geophysics and planetary science. The presence in Pasadena of the Jet Propulsion Laboratory was a strong argument in favor of planetary science, and Bob even received the blessing of the Caltech astronomers, who were deeply engrossed in far-out space and were quite willing to "give away" our solar system to the geologists.

Numerous national honors were bestowed on Bob during his career. But the two in which he took the most pride were the 1977 Penrose Medal of the Geological Society of America—its highest honor—and NSF's National Medal of Science, presented to him in 1989. When awarded the Penrose Medal, he commented that "few scientists in other professional fields seem to enjoy and savor their work as fully as do Earth scientists." If there was one activity Bob enjoyed above all, it was the planning and leading of geological field trips for students, alumni, and others. Those included yearly trips to Hawaii for graduating students.

It is an intriguing enigma that Bob, with his profoundly rigid self-discipline and basically conservative ways, would nevertheless leave a lasting legacy of truly forward-looking innovation in his scientific and academic ventures. He is remembered so fondly by a multitude of friends from all walks of life as an immensely warm and generous individual.

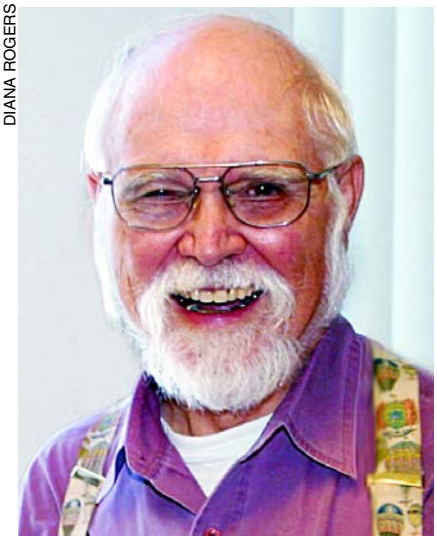
Clarence R. Allen
David J. Stevenson
California Institute of Technology
Pasadena

William Edward Spicer

William Edward Spicer, a pioneer in the field of photoelectron spectroscopy, teacher, mentor, and inventor, died of heart failure on 6 June 2004 while vacationing with his family in London, England.

Born in Baton Rouge, Louisiana, on 7 September 1929, Spicer overcame learning and speech difficulties to obtain a bachelor's degree in physics in 1949 from the College of

DIANA ROGERS



William Edward Spicer

William and Mary in Williamsburg, Virginia. He earned a second bachelor's degree in physics from MIT in 1951. He then attended the University of Missouri–Columbia, where he received his master's and doctoral degrees, both in physics, in 1953 and 1955, respectively. His doctoral thesis, prepared under the guidance of Eugene B. Hensley, was on luminescence from sodium chloride.

For the next seven years, Spicer worked at RCA Research Laboratories in Princeton, New Jersey, where he studied photocathodes. In doing so, he developed a keen understanding of the photoemission process. That work ultimately developed into his career. In the late 1950s, he used the studies of specific photocathode materials to develop a general model of photoemission, which led to the later use of photoemission as a scientific tool.

After coming to Stanford University in the early 1960s, Spicer pioneered the use of photoemission spectroscopy to study the band structure of solids. He introduced the so-called three-step model to interpret the results and connect the measured photoemission spectra to the electronic band structure. According to the model, the photoemission process occurs in three independent steps: photoexcitation, transport to the surface, and escape of the electron into vacuum. Spicer's pioneering work opened up a new field that over the years has become the main line of research for hundreds of scientists worldwide. During his more than 40 years at Stanford, he was instrumental in further developing the technique and its application to a broad range of problems in condensed matter physics.

Spicer's interest in photocathodes extended to industrial applications, including early development of the medical x-ray image intensifier tube and the night-vision tube. The US military today uses night-vision devices based on those developments. On learning of Spicer's death, John Pollard, a scientist at the US Army's Night Vision Laboratory, left a note that stated, "Our night-vision capability today stems from his efforts, and our soldiers owe a debt of gratitude to Professor Spicer for his vision, insight, and deep understanding. We have lost a true giant."

Spicer recognized, though, that the light sources he was using for his research were limited and that synchrotron radiation would provide a superior excitation source. As soon as he learned that SLAC was building such an accelerator, he wrote a letter to Wolfgang Panofsky, then director of SLAC, and explored the possibility of accommodating a port on the new accelerator for use in solid-state physics. As a result of that letter, a port was added to the SPEAR storage ring, and in the early 1970s, Spicer and Seb Doniach cofounded what is now the Stanford Synchrotron Radiation Laboratory. Spicer immediately started using synchrotron radiation along with his laboratory sources.

Spicer published more than 700 papers in refereed journals, and during his long career at Stanford, he supervised more than 80 doctoral students. He also worked hard to recruit women and minorities into his group. One of the honors he treasured most was the American Association for the Advancement of Science's Lifetime Mentor Award, which, in 2000, recognized his contributions to that effort. Spicer received other prestigious awards, including the American Physical Society's Oliver E. Buckley Prize in 1980, Scientist of the Year by *R&D Magazine* in 1981, and the Medard W. Welch Medal of the American Vacuum Society (now AVS Science & Technology Society) in 1984.

Spicer was an avid reader of books in a variety of fields. He had a deep love for history in general, and over the years, he amassed a remarkable stamp collection that focused mostly on military and postal history. He was also an accomplished tennis and bridge player.

Colleagues at Stanford and worldwide sorely miss Spicer for his pioneering work and high professional standards. His many students remember him as a caring and understanding mentor who was supportive not only during their scientific training, but also personally. For those of

us who had the privilege of working closely with Spicer for many years, it is easy to understand why so many of his students developed deep and lifelong bonds with him.

Ingolf Lindau
Piero Pianetta
Stanford University
Stanford, California

Carl Joseph Vyborny

Carl Joseph Vyborny was a distinguished medical physicist and radiologist whose vision and expertise contributed to improved image quality in screening mammography and to the use of computers in the interpretation of medical images. He died of lung cancer on 20 March 2004 in his Riverside, Illinois, home.

Born on 23 November 1950 in Oak Park, Illinois, Carl obtained an early education that included the ardent reading of encyclopedias, and his love of learning was evident during his high-school appearances on the television show *It's Academic*. He continued his education at the University of Illinois at Chicago, where he received a BS in physics and mathematics in 1972. He earned an MS in physics from the University of Illinois at Urbana-Champaign in 1973.

Later that year, Carl turned his focus to medical physics and, subsequently, to medicine at the University of Chicago, an institution that he would never leave completely. He wrote his dissertation "The Speed of Radiographic Screen Film Systems as a Function of X-Ray Energy and Its Effect on Radiographic Contrast" under the guidance of Charles E. Metz and received his PhD in medical physics in 1976. Carl enrolled immediately in medical school, earning an MD with honors in 1980. He served a clinical residency in diagnostic radiology at the University of Chicago and then became an assistant professor, rising to the rank of clinical professor in 2001.

Carl joined a private radiology practice in the western suburbs of Chicago in 1985 while researching and teaching part-time at the University of Chicago. He was an attending radiologist at LaGrange Memorial Hospital in LaGrange, Illinois, for 17 years, a radiation safety officer at LaGrange Memorial Hospital for 14 years and at Glen Oaks Hospital for 3 years, and a member of the Radiation Protection Advisory Council of the State of Illinois for 10 years.

One of Carl's most significant contributions was the refinement of mammographic imaging for improved detection of early breast cancer. In 1985, as a member of the American College of Radiology's mammography accreditation program, he helped write the guidelines for accrediting mammography centers. Such efforts led to a position in the newly formed Academy of Radiology Research, which fruitfully encouraged the US government to create, in 2000, the National Institute for Biomedical Imaging and Bioengineering. He also organized delegations of US experts to lecture on screening mammography to the Czech medical establishment.

Carl Joseph Vyborny

Carl was a crucial member of the University of Chicago team that developed the first computerized systems to enable radiologists to detect abnormalities in mammograms and chest radiographs. He helped both by guiding algorithm development and by establishing the first clinical trial of computer-aided mammographic diagnosis in metropolitan Chicago. Subsequently, he played a key role in making LaGrange Memorial Hospital one of the two Chicago-area sites in the digital mammography imaging screening trial of the American College of Radiology Imaging Network, the largest clinical trial in radiology ever organized.

As a clinical professor of radiology at Chicago, Carl was a coadviser to PhD students in the university's graduate programs in medical physics, and he lectured annually on the physics of image quality to the department's resident physicians. Characteristically, his lectures in the university's continuing-education courses usually covered physical image quality as well as clinical interpretation methods.

Though a full-time practicing radiologist, Carl published and contributed more to his field than many full-time academics. He was the author or coauthor of more than 75 peer-reviewed journal articles on medical physics and radiology; was a member of national committees of the National Institutes of Health, the Centers for Disease Control and Prevention, the American College of Radiology, and other institutions; served as an editorial consultant for the leading journals in his field; and played an active role in the teaching of graduate students, medical students, and residents.

Because of Carl's exceptionally strong understanding of both imaging physics and the image-interpretation process, the International Commission on Radiation Units and Measurements (ICRU) invited him to lead the formulation and writing of the document *Image Quality in Chest Radiography*, published in 2004. This comprehensive review covers the physical quality and human perception of chest x rays in order to provide medical physicists and radiologists with a strong foundation in the scientific aspects of chest radiography.

Carl was elected a diplomate of the American Board of Radiology (1984) and a fellow of the Society of Breast Imaging (1992), American College of Radiology (1994), and American Association of Physicists in Medicine (1999). In 2000–01, he was president of the Chicago Radiological Society, and received the society's Distinguished Service Award Gold Medal in early 2004.

Astronomy and genealogy were among Carl's passions. While attending academic meetings, he, his wife, Terrieann, and his daughter, Margaret, saw two solar eclipses. Carl also created one of the largest websites devoted to a Czech family (see http://vyborny.com).

In less than three years, Carl completed all of the University of Chicago's requirements for the PhD in medical physics—a record that still stands. He combined the talents of an outstanding scientist, a natural teacher, and a devoted clinician in ways that enabled him to see the big picture and to explain it to others. He was a visionary thinker, yet he helped connect academic research to its ultimate use in private practice.

Maryellen L. Giger
Charles E. Metz
University of Chicago
Chicago, Illinois

Mildred Widgoff

Following World War II, in years not famous for providing easy paths for