to an interest in immunology that would continue for more than a decade. Bell developed the first set of mathematical and computer simulation models of the then-new idea of clonal selection for which Frank Macfarlane Burnet received the Nobel Prize. Bell's work involved generating detailed models of the interaction of ligands with cell surface receptors and introducing a quantitative description of receptor cross-linking, an important process not only in immunology but in all of cell biology. This and subsequent work would create the modern field of theoretical immunology.

Early in his career, Bell recognized that the rapid developments in molecular biology would change the face of biology and medicine, creating unprecedented demands for information storage, handling, and analysis. With Bell's support and encouragement of genetic sequence analysis, Walter Goad at Los Alamos developed the first DNA sequence database. This database evolved into GenBank, the national genetic sequence database now run by the National Library of Medicine.

In the early 1970s, Bell hired Charles DeLisi to work in immunology at LANL. They published a series of papers together. DeLisi later moved to the National Institutes of Health and then to the US Department of Energy to head the Office of Health and Environmental Research; Bell had encouraged DeLisi to apply for that position. It was in that capacity, and inspired by Bell, that DeLisi formally launched the Human Genome Project, for which Bell was an early advocate. Bell served as acting director of the Los Alamos Genome Center when the center was first launched.

In 1974, Bell founded the theoretical biology and biophysics group at LANL, and led it until he retired in 1990. He first focused the group on theoretical immunology. In 1979, he formulated an influential set of physical-chemical models that described the repulsive and attractive forces between cells and how rapidly applied forces would break the chemical bonds holding cells together.

Through his work, leadership, scientific vision, and inspiration of others, Bell profoundly influenced the direction of modern biology. The atmosphere he created both as a colleague and as an administrator was important in bolstering good science in the theoretical division.

Bell was an avid mountaineer and outdoorsman. In the 1950s, he went on four expeditions to the Peruvian Andes, where he and his team made the first ascents of Yerupajá and Salcantay, two of Peru's most difficult peaks. He joined an ill-fated expedition in 1953 that attempted to scale the then-unclimbed K2, the second highest mountain in the world. During this attempt, Bell slipped and fell, pulling his partner—with whom he was linked by a rope—along with him. Their rope entangled with that of another pair of climbers below them. All four climbers fell down the mountain, entangling the rope of the remaining climbers, one of whom miraculously tied off his rope and held the others in what has perhaps become the most famous belay in mountaineering. Despite his experience on K2, Bell remained an enthusiastic mountaineer.

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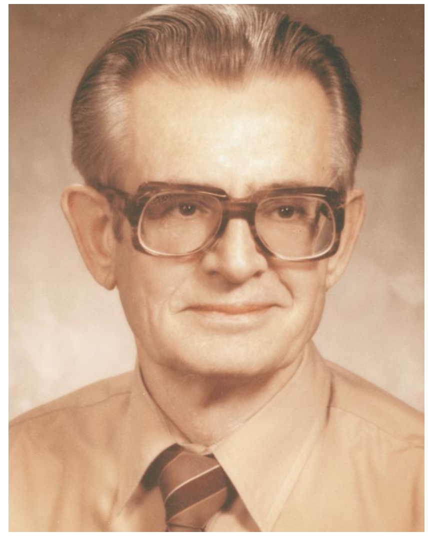
Gunter Schwuttke



Gunter Schwuttke

Gunter Schwuttke, professor emeritus in Arizona State University's College of Engineering and Applied Sciences and founding director of Arizona State's Semiconductor Materials Research Laboratory, died on 4 November 1998 in Scottsdale, Arizona, of complications following surgery.

Gunter was born in Breslau, Germany, on 7 August 1922. He began his studies at the Technical University of Breslau, continuing his education in 1947 at the University of Munich. There, he earned his MS in physics in 1949 and his PhD in physics in 1952. Simultaneously, he held a research associate position at the Max Planck Institute of Physics.

Gunter's first research endeavor in industry was with Siemens in Munich. In 1956, he became a consultant for the US Department of Defense (DOD). A year later, he joined the Sylvania Research Laboratories (later GTE Laboratories) in Bayside, New York, where he studied defects in semiconductor crystals with an emphasis on silicon. At that time, defect densities were generally determined by counting etch pits on specially etched wafer surfaces. He extended this technique to a useful application in a crystal orienter for fast and precise alignment and cutting of crystals into wafers.

In the early 1960s, x-ray topography made it possible to examine defects in the volume of the wafer. Gunter's invention of the scanning oscillator technique and his development of precise topographic cameras set the stage for his later work. The stereo x-ray topographs he produced, for example, allowed scientists to view and study the distribution and shape of dislocations tubes throughout the thickness of the wafers.

When Gunter joined IBM in Poughkeepsie, New York, in 1963 as a senior physicist, his colleagues already regarded him among the small cadre of the foremost x-ray topography experts as well as a preeminent solid-state physicist. He managed various development groups concerned with semiconductor materials science and processing. This research resulted in the identification of defects generated during semiconductor processing and their elimination to improve the performance of bipolar integrated circuits (ICs) and solar cells. His contributions in this area significantly influenced progress in minimizing defects in large metal-oxide semiconductor memories and complementary metal-oxide semiconductor microprocessors that are used today in computers and other electronic systems. He made other achievements in computer-controlled growth of high-quality silicon crystals and in basic studies of defects generated by radiation damage and by ion implantation.

One of us (Huff) warmly remembers and welcomed the occasional visits of Gunter and his colleagues in the late 1960s, during which we discussed methodologies for the identification, characterization, and control of dislocations introduced during bipolar IC processing. Gunter's work relating his x-ray diagnostic studies with rapid turnaround etchant diagnostic analyses was of critical importance in the early days of the IC industry. Although these concepts were known in principle, their elucidation by Gunter facilitated their rapid use for a generation of personnel working in production facilities. These concepts enabled workers to develop rapid "use tests" based on furnace thermal procedures and subsequent wafer etching to deduce the efficacy of the processes involved in controlling and, eventually, minimizing dislocation generation and macroscopic plastic deformation, which were major yield detractors for bipolar ICs.

With the burgeoning of the IC industry during the late 1960s, many publications in the scientific literature could be traced to real issues involved in the production of bipolar ICs. Indeed, the discussions at scientific conferences during these early days in the development of the IC industry were truly heady times.

During the 1970s at IBM, Gunter was involved with the improvements of growth techniques to produce better semiconductor materials and processes. Among these improvements were computer-controlled growth of large-diameter Czochralski silicon, growth of monocrystalline silicon ribbon, and growth of silicon carbide crystals. Even before the 1973 energy crisis, he had submitted proposals for solar energy conversion. Gunter also worked on innovative ways to produce low-cost, single-crystal silicon for photovoltaic energy generation. He was a member of the Department of Energy/Jet Propulsion Laboratory advisory group on high-performance, low-cost solar cells; in the early 1980s, this group studied the state-of-the-art poly-silicon properties and devices. These low-cost poly-silicon solar cells are currently produced widely and used as energy converters.

In 1982, Gunter retired from IBM and dedicated his efforts to building an academic laboratory, Arizona State's Semiconductor Materials Research Laboratory. He established a crystal growth laboratory with support from several government agencies. The expert crystal growth system developed by Gunter and his group achieved the growth of the largest gallium arsenide crystals grown at a university at that time. The system was an autonomous artificial intelligence system that not only automated the single-crystal growth process, but also used real-time feedback from the collected crystal growth parameter data. Gunter retired in 1988 from Arizona State and became a professor emeritus of the college of engineering and applied sciences.

During his career, Gunter was also active in advising the NSF and the Advanced Research Project Agency. As a DOD consultant, he successfully oversaw research programs that addressed the leading issues of the day in IC manufacturing and related defect studies. He received more than 56 US patents. Gunter also supported scientific exchange programs with postdoctoral fellows from European and South African universities.

The most advanced and precise scanning oscillator topographic cameras were manufactured from 1982 to 1992 by Gunter's instrument corporation, the GHS Corp in Scottsdale, Arizona. By a serendipitous event, the Schwuttke family donated three of these cameras to the SUNY Stony Brook materials science department; the department chair, Michael Dudley, had, as a graduate student, met Gunter at a conference in Paris. He had admired Gunter's research, but had just become aware that Gunter had manufactured those wonderfully machined and highly crafted precision instruments with the unique capability of oscillation. The cameras will expand research capabilities and will be invaluable tools for students and faculty. The department has designated the section of the laboratory with the x-ray cameras as the Gunter H. Schwuttke Topography Facility.

Gunter not only loved science but also had a balanced view of the relationship among science, technology, and manufacturing as it influences the economy and society as a whole. Following his interests, when he could no longer focus his eyes well enough, his daughter Ursula, a distinguished scientist in her own right, sat beside him in the hospital and read to him the latest news in physics and about cosmology. His friends, colleagues, and students will miss him, because they valued his enthusiasm and high work standards. His extensive knowledge and strong character set the standard for his many colleagues to emulate.

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Yvette Cauchois

Yvette Cauchois

Yvette Cauchois, a chemical physicist who profoundly influenced the development of x-ray spectroscopy and x-ray optics, died on 19 November 1999, following a bout with bronchitis during a visit to northern Romania. Cauchois had been a professor of chemical physics at the Sorbonne in Paris and, from 1953 to 1978, had served as the director of the Laboratoire de Chimie Physique (Laboratory of Physical Chemistry) at the Sorbonne (now the University of Paris VI).

Born in Paris on 19 December 1908, Cauchois had been attracted to science since childhood. In 1928, after she received her bachelor's degree in physics from the Sorbonne, she entered the Laboratory of Physical Chemistry, whose director was Jean Perrin. In 1933, she defended her doctoral thesis in which she reported on the use of curved crystals in transmission for high-resolution x-ray analysis. That same year, Cauchois was appointed as the research assistant at CNRS (National Center for Scientific Research), becoming the research associate in 1937. She became an associate professor at the Sorbonne in 1945 and a full professor in 1951. In 1953, she was appointed as the chair of chemical physics. She was nominated as professor emeritus after she retired in 1978.

Cauchois established the fundamental principles of a new x-ray spectrometer that was named after her and was introduced in the early 1930s. The Cauchois spectrometer had the triple advantage of being highly luminous, having a high resolution, and being easy to manipulate. Using the spectrometer, she was the first (in 1934) to observe weak emissions in gases, and later to resolve numerous multiplets. Specialized laboratories in Europe, the US, Japan, and Australia were highly interested in this new technique. Universally used for the analysis of x rays and