

Yale University, and **James A. Yorke**, Distinguished University Professor of Mathematics and Physics at the University of Maryland, College Park, for their “creation of universal concepts in complex systems—fractals and chaos.” The prize in the category of visualizing techniques in medicine will go to **Seiji Ogawa** for his “discovery of the principle for functional magnetic resonance imaging.” Ogawa retired in 2001 as a distinguished member of the technical staff at Lucent Technologies’ Bell Labs in Murray Hill, New Jersey, but currently is director of Ogawa Laboratories for Brain Function Research at the Hamano Life Science Research Foundation in Tokyo. A cash prize of ¥50 million (about \$415 000) will be awarded in each category.

Wendy Freedman became the director of the Carnegie Observatories in Pasadena, California, this month, succeeding **Augustus Oemler Jr.**, who will continue at the observatories as a research staff member. Freedman joined the observatories in 1984 as a postdoctoral fellow and has been a scientific faculty member there since 1987.

In January, **Giovanni Bignami** became director of the Centre d’Etude Spatiale des Rayonnements (CESR) in Toulouse, France, replacing **Dominique LeQueau**. Bignami, who is also a professor of astronomy at the University of Pavia in Italy, previously was the science director of the Italian Space Agency (ASI).

John McTague has returned to the University of California, Santa Barbara, where he is a professor of materials. From May 2001 until early January of this year, he was the university’s vice president of laboratory management, overseeing Lawrence Berkeley, Lawrence Livermore, and Los Alamos National Laboratories, which are operated by UC for the US Department of Energy and its National Nuclear Security Administration. His successor is UC senior vice president **Bruce B. Darling**, who has taken the laboratory management post on an interim basis until a permanent replacement is found.

The European Physical Society’s division of nuclear physics awarded the 2002 Lise Meitner Prize for Nuclear Science to **James Philip Elliott** and **Francesco Iachello** for their “innovative applications of group theoretical methods to the understanding of atomic nuclei.” Elliott is an emeritus

professor of theoretical physics at the University of Sussex in the UK and Iachello is the J. W. Gibbs Professor of Physics and Chemistry at Yale University. The prize is given biannually.

At a ceremony during the 24th International Colloquium for Group Theoretical Methods in Physics held in Paris last July, **Harry J. Lipkin**

received the 2002 Wigner Medal given by the Group Theory and Fundamental Physics Foundation. Lipkin, professor in the particle physics department of the Weizmann Institute of Science in Rehovot, Israel, was recognized for his “contributions to the algebraic method in nuclear and particle physics and its extension to describe the spectra of nuclei.”

Obituaries

George Porter

With the death of George Porter on 31 August 2002 in Canterbury, England, the scientific community and the world at large have lost one of the key scientists of the post-1945 period. Porter was not only a Nobel Prize-winning physical chemist, but was deeply involved in promoting science.

Both the research and science communication aspects of his career were fulfilled by his directorship of the Royal Institution in succession to Lawrence Bragg. Porter had been a part-time professor of chemistry at the Royal Institution and, in 1960, had edited Michael Faraday’s *Advice to a Lecturer* (Royal Institution). Faraday was Porter’s hero; in many ways, Porter sought to emulate him insofar as the conditions of late 20th-century science and society would allow. As reflected in Porter’s book *Chemistry for the Modern World* (G. G. Harrap, 1962), Porter, like Faraday, was not only an enormously distinguished scientific figure, but was deeply involved in communicating science to a broad audience.

Porter was born in Stainforth, Yorkshire, on 6 December 1920 and attended Thorne Grammar School, where his interest in science began. His father bought him an old bus so that he could undertake experiments away from the house! After leaving school in 1938, Porter studied chemistry as an Ackroyd scholar at the University of Leeds and developed his particular interest in physical chemistry. He also took a course in radio physics. He put his knowledge of radio physics to good use when, after graduating, he joined the war effort in 1941 as a radar officer in the Royal Navy.

Following demobilization in 1945, he became a research student with photochemist Ronald Norrish at the University of Cambridge. During that time, Porter developed the ideas and experimental strategies that allowed him and, later, his research groups to make their fundamental discoveries in

photochemistry. Norrish was interested in understanding chemical reactions caused by intense beams of light produced by an arc lamp. At that time, Norrish and others studied such reactions by analyzing the stable products.

In 1947, Porter realized that the way to tackle the problem of identifying short-lived intermediates in photochemical reactions was to use highly intense short pulses of light for excitation, rather than a weaker continuous beam as Norrish had done. The intermediates thus created could be detected either by a second continuous weak beam of light or by a second pulse of light delayed in time with respect to the exciting flash. This so-called flash photolysis was the first “pump-and-probe” technique. It has proved immensely fruitful in understanding short-lived transient molecules and molecular fragments, and it was for the invention of flash photolysis that Norrish and Porter shared the 1967 Nobel Prize in Chemistry with Manfred Eigen of the Max Planck Institute for Physical Chemistry in Göttingen, Germany. By 1950, Porter could study molecules that existed for less than a millisecond. By 1960, micro-



George Porter

seconds were routine, but the invention of the laser by Theodore Maiman in 1960 made it possible to use even shorter flashes of light, and Porter was one of the earliest people to exploit the scientific potential of the laser. By the time he joined the Royal Institution in the 1960s, he could study reactions of a nanosecond's duration and, by 1975, of a picosecond (light travels about 3 mm in that time). By the time he had moved to Imperial College, London, in 1985, the femtosecond timescale had become accessible and was widely used to study photosynthesis among other subjects.

During nearly 10 years at Cambridge, Porter became a demonstrator in physical chemistry in 1949 and the assistant director of physical chemistry research three years later. In 1954, he worked in Manchester for a year as assistant director of the British Rayon Research Association, where he sought to understand the essentially photochemical problems surrounding the fading of fabric dyes. The following year, he was appointed professor of physical chemistry at the University of Sheffield and, in 1963, became Firth Professor and the head of the department.

His appointment to the Royal Institution in 1963 to become a part-time chemistry professor was followed by his move there in 1966 as director, which entailed both continuity and change. Porter pursued and enhanced the programs and policies initiated and implemented patiently by Bragg following the deep trauma created in the early 1950s by the row between the secretary of the Royal Institution, Alexander Rankine, and the directory of the laboratory, Edward Andrade, over who ran the Royal Institution—an affair that had nearly destroyed the Royal Institution. Porter, though, wished to bring his research group from Sheffield; that move spelled the end of x-ray crystallography research that, since 1923, had been the main research topic in the Royal Institution's Davy-Faraday Research Laboratory. During Porter's directorship from 1966 to 1985, he streamlined the institution's administration, enhanced the schools' lectures program, began the immensely successful mathematics masterclass program, and raised considerable funds for the refurbishment of the building. This refurbishment included building, in the basement, a museum devoted entirely to the life and work of Faraday. In 1973,

the museum was opened by Queen Elizabeth during the first visit by a reigning monarch to the Royal Institution. Porter showed the queen around and offered a demonstration of the Royal Institution's research, as shown in the photo on page 94.

In science communication, Porter was responsible for establishing the annual TV broadcast of the Royal Institution's Christmas Lectures (of which he gave two highly successful series himself). He was the driving force behind the British Broadcasting Corporation's "Young Scientists of the Year," in which school science projects were judged by panels that would usually comprise some combination of Porter, Richard Gregory, Heinz Wolf, and Eric Laithwaite.

In 1985, Porter was elected president of the Royal Society. He used the unique opportunity as president of this society, director of the Royal Institution, and president of the British Association for the Advancement of Science to establish, for the three organizations, a joint Committee on the Public Understanding of Science (COPUS). He chaired that committee himself for the first four years. During that time, the science budget was drastically cut, and he used his position as president



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of the Royal Society to sharply criticize government science policy, although he welcomed the inclusion of science in the National Curriculum.

As a consequence of his election to the Royal Society presidency, Porter decided that he should retire from the directorship of the Royal Institution. Most of his research group moved to the Centre for Photomolecular Sciences, newly created for him at Imperial College, where he also chaired the newly created Imperial College Press. Following the end of his term of office at the Royal Society, Porter continued with his research at Imperial College. He also continued to promote science, particularly through his position in the House of Lords, after he had been created a Life Peer in 1990.

Porter was awarded innumerable medals, prizes, and honorary degrees, including the Order of Merit in 1989. Notwithstanding his fame, he was a polite, courteous, stylish man, who cared deeply about his young colleagues and was passionate about science—his own and in general. He is missed.

Frank A. J. L. James

*Royal Institution
London, England*

David Phillips

*Imperial College, London
London, England*

Edsger Wybe Dijkstra

Edsger Wybe Dijkstra, a pioneer in the fields of computer science and computational physics, died of cancer on 6 August 2002 in Nuenen, the Netherlands.

Edsger was born on 11 May 1930 in the Dutch port of Rotterdam. His father was a chemist and his mother was a mathematician; her wise advice on mathematical method was much valued in his later career. He attended the University of Leiden; in 1951, he passed his candidate's examination in mathematics and physics and, in 1956, his predoctoral examination in theoretical physics.

As a reward for examination success in 1951, his father sent him to a summer school on computing, organized by Maurice Wilkes in the Cambridge University Mathematical Laboratory. In March 1952, he took a part-time job at the Mathematical Centre (precursor of the Centre for Mathematics and Computer Science) in Amsterdam, where he was responsible for drafting an exceptionally precise and accurate reference manual for their new X1 computer. This work was the basis of his PhD dissertation "Communication With an Automatic Computer," submitted under

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Edsger Wybe Dijkstra

the supervision of Aad van Wijngaarden to the University of Amsterdam in 1959.

At first, Edsger resisted the pressure to become a programmer, because he missed in programming the element of professional and scientific rigor that had attracted him to physics. It was van Wijngaarden who inspired in him the lifelong goal of laying the scientific and mathematical foundations that would make programming a respectable discipline in the years to come. Edsger was sufficiently confident of his role as one of the founders of this emergent branch of knowledge that he began to keep his papers and correspondence in good order for future historians of science. His confidence was fully justified by his subsequent achievement, and his papers are now in store at the Charles Babbage Institute at the University of Minnesota. See also the Web site of the University of Texas at Austin (see <http://www.cs.utexas.edu/users/EWD/symposiumProgram.pdf>).

In 1957, he discovered the algorithm for the shortest path in a graph, which now bears his name. Edsger was a leading member of the international working group that designed ALGOL 60, and he wrote the first complete working compiler for the language. He invented the display technique of addressing global variables of a program; to this day, his technique makes recursive procedures work in the presence of higher-order procedure parameters.

In 1962, Edsger was appointed a full professor of mathematics at the Eindhoven University of Technology. There, he developed a time-shared operating system for the university's computing service. Its elegant and in-

fluent hierarchical structure was reported to the first Symposium on Operating Systems Principles in 1967. From the beginning of the design, Edsger paid attention to the problems of concurrent execution and invented the semaphore as a means of synchronizing concurrent programs while avoiding race conditions. He took seriously the obligation to prove absence of deadlock in software and was depressed at what he viewed as the failure of IBM Corp to anticipate and avoid the problem in the architecture of the System 360 and in the early releases of its software.

His depression was deepened by his belief that his mathematical colleagues at Eindhoven had failed to recognize the academic status of computer science. He recovered his self-confidence by writing his famous "Notes on Structured Programming," in which he distilled the essence of his unusually wide systems programming experience into a methodology that is now widely taught and practiced by millions of programmers. That distillation was published as a chapter in *Structured Programming* (Academic Press, 1972), written by Edsger, Ole-Johan Dahl, and this author.

In 1973, Edsger took an appointment as a research fellow by the Burroughs Corp, a computer manufacturer whose distinctive software strategy was based on ALGOL 60. That company farsightedly gave him the freedom to pursue his research wherever it led him. He invented and patented a number of systolic algorithms ("elephants from mosquitos"), intended for implementation in hardware. He also designed some of the first self-stabilizing algorithms, those that are guaranteed to return to working order no matter how their current state is perturbed. He developed a proof-of-correctness of a concurrent "on the fly" garbage collector, which collects free storage simultaneously with the program that uses it. These topics still inspire lively research, which drives innovation in product development. He also gave many weeklong programming methodology courses for Burroughs programmers.

At a meeting in 1973 of the International Federation for Information Processing working group on programming methodology, Edsger discovered the logical foundations for a mathematical theory of programming that supported all his more practical precepts. Eight months later, he submitted to the *Communications of the Association for Computing Machinery* a paper entitled "Guarded Commands,