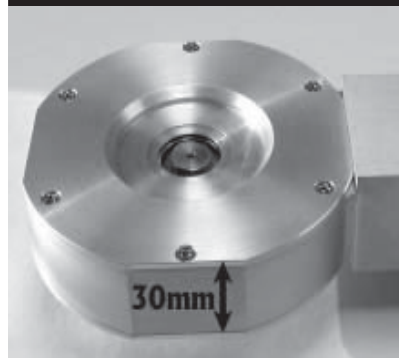


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Karl Leslie Brown

Stanford University: a BS in 1947, an MS in 1949, and a PhD in 1953. Joining the team of Bill Hansen, Edward Ginzton, and Marvin Chodorow, Karl began his work at Stanford on high-power klystrons and linear accelerators. His master's thesis addressed the beam dynamics of the first high-power klystron and his doctoral thesis dealt with the commissioning of the 30-MeV Mark II linear accelerator at Stanford.

After his PhD, Karl contributed to the solution of diverse problems through the commissioning, with the team led by Robert Kyhl, of the 1-GeV linear accelerator, the Mark III, at what is now the High Energy Physics Laboratory, part of the Hansen Laboratories at Stanford. Because that work was so successful, he was invited to join the planning group that prepared the proposal for the two-mile accelerator laboratory, which has now become SLAC.

In the late 1950s, in parallel with his work in high-energy particle physics, he joined a team led by Ginzton of Stanford's physics department and Henry Kaplan of the Stanford Medical School to build the first linear accelerator in the US to be used for cancer therapy. A few years later, he became president and chief scientist of Spectromagnetics, a small accelerator magnet design and manufacturing company in Palo Alto, California, that was later sold to Varian Associates. Subsequently, Karl served two years as senior scientist and director of research in Varian's radiation division. That division developed a family of linear accelerators for the radiation treatment of cancer. It is a remarkable coincidence that, in 2001, Karl himself was successfully

treated for prostate cancer by one of these machines.

Karl's best known contribution was his work on charged-particle beam dynamics in magnet transport systems. He developed a code that was called TRANSPORT and is widely used internationally to design beam transport systems, spectrometers, and accelerator-focusing systems that range in energy from less than 1 MeV up to 1 TeV. Karl contributed directly to accelerator design at many organizations—as a consultant, visiting scientist, and staff member.

In 1958–59, as a consultant to the newly founded Linear Accelerator Laboratory at Orsay, France, he shared his in-depth knowledge of linear accelerators. He also served as a consultant for CERN, where linear accelerators were used in the design of the secondary beam lines for the large Super Proton Synchrotron and the Large Electron–Proton Collider lattice. In the 1960s, while scientists were already using colliding beams in circular machines, Karl proposed that two linear accelerators shoot beams at one another. His informal suggestion has formed the basis for the next stage in high-energy accelerator programs: the electron–positron linear collider.

Karl designed achromatic beam-transfer systems for the Stanford Linear Collider in the late 1980s, which enabled the collider to focus beams to extremely small dimensions. From 1992 to 1994, he worked on the layout and design of the beam-transfer lines and injection systems for the various booster accelerators at the Superconducting Super Collider.

Karl was a very inventive individual whose ideas were applied in many fields. He was recognized worldwide as an expert in magnetic transport systems, and his contributions in numerous areas will long be remembered by his friends and colleagues at Stanford and elsewhere.

Wolfgang Panofsky
SLAC
Menlo Park, California

Philip Gerald Drazin

Philip Drazin, a leading international expert in fluid mechanics, died of cancer at his home in Bristol, England, on 10 January 2002.

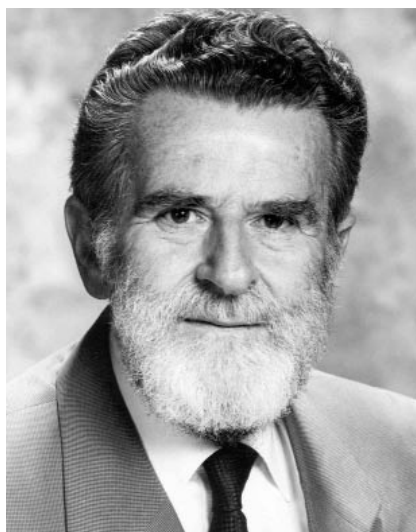
Philip, born on 25 May 1934, was sent from wartime London to board at St. Christopher's School, Letchworth. In 1955, he gained first-class honors in the Mathematical Tripos at the University of Cambridge. He stayed on at Cambridge to pursue his PhD,

which he received in 1958, with George Batchelor and G. I. Taylor as his PhD supervisors. There, Philip began what was to become seminal work on hydrodynamic stability and on shear flows. He then spent two years at MIT as a research associate with Jule Charney in meteorology before moving to the University of Bristol in 1960, where he eventually advanced to become a professor of applied mathematics in 1981.

Philip's research, for example his applications in meteorology with results on the stability of stratified shear flow and mountain waves, the instability of gravity waves, and the vertical propagation of internal waves, has influenced many areas of applied mathematics. In 1961, the *Journal of Geophysical Research* published a paper he coauthored with Charney on the seasonal dependence of the vertical structure of the stratosphere. That paper, which became a citation classic, helped to initiate an explosion in theoretical and observational work in the stratosphere that occurred in subsequent decades. Philip's studies of waves and stable stratified flow around mountains have been widely used in the development of numerical models for weather forecasting and for predicting the dispersion of environmental pollution. The Drazin layer description of stratified flow near the top of a mountain will remain his memorial like a cairn of stones. His later work extended to nonlinear analysis, studies of chaotic advection, and the analytic approximation of functions. Philip was extremely active in research right up until his death, and collaborated with colleagues in many universities worldwide.

Philip was a communicator of mathematics. His influential book *Hydrodynamic Stability* (Cambridge U. Press, 1981) with W. H. Reid has no competitor. In the last years of his life, Philip wrote a book that serves as an introduction to this work, and just before he died, was proud that it had been completed and sent to the publishers. His other textbooks, *Solitons* (Cambridge U. Press, 1983), *Solitons: An Introduction* (Cambridge U. Press, 1989) with R. S. Johnson, and *Nonlinear Systems* (Cambridge U. Press, 1992), were based on courses given at Bristol and have also been successful. Philip served on the editorial board of four periodicals and assisted the UK's Institute of Mathematics and Its Applications with its publication of *Mathematics Today*.

A dedicated university teacher, he taught a full load of lectures in an in-



Philip Gerald Drazin

spiring and masterful manner, was a founder and director of the Bristol MSc Course in Fluid Mechanics, and helped set up the University of Bath MSc in Modern Applications of Mathematics. Philip supervised numerous graduate students and took great care to look after and guide the careers of new staff and faculty members. To his students, he carefully emphasized the links between applied mathematics and physical reality. In the 19 years he led the applied mathematics and numerical analysis group at Bristol, Philip laid the foundations for, and contributed greatly to, the group's present high international profile.

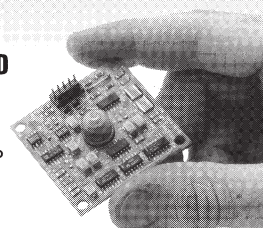
After his retirement from Bristol in 1999, he continued active research work at both Bristol and Bath and gave lecture courses at Bath and Oxford University. It is fitting that, in the year of his retirement, he received the Symons Memorial Medal, the premier award of the Royal Meteorological Society.

It is characteristic of Philip's care with the English language and his love of quotations and of the history of mathematics that he served for many years as the mathematical consultant to the *Oxford English Dictionary*. Philip was the driving force behind a Royal Meteorological Society committee that published the collected papers of Lewis Fry Richardson. He showed his empathy with Richardson's extraordinarily original ideas about meteorology, mathematics, and the modeling of conflict. He was a superb editor and wrote in the introduction a most insightful piece on Richardson's work on fractals.

We remember Philip as a genuine scholar with a brilliant mind and unassuming personality. Although

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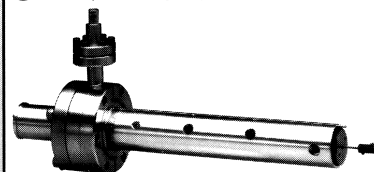
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rarely interested in university politics, he was skillful enough to participate fully in university activities without wasting time on bureaucracy that would impede his research activity. Although he cooperated in every way with the performance measures to which universities are subject, he rose above and saw beyond them: Concerned to find the origins and truth in every topic that he studied, he constantly reminded all of us that it was the quality of papers that mattered, not the quantity or any other artificial measure. Philip will live long in our hearts, both as a colleague and a friend who enhanced both mathematics and our lives.

Chris Budd

*University of Bath
Bath, UK*

Howell Peregrine

*University of Bristol
Bristol, UK*

Felix Marc Hermann Villars

Felix Marc Hermann Villars, a theoretical physicist and pioneer in biological physics, died of cancer on 27 April 2002 at his home in Belmont, Massachusetts.

Born on 6 January 1921 in Biel, Switzerland, Felix received the *Diplom* in physics and mathematics from ETH Zürich in 1945. During World War II, he served in the Swiss army as a staff meteorologist; he then returned to ETH Zürich and completed his doctorate in physics in 1946. His thesis research, with Gregor Wentzel, involved using meson field theory to study the properties of the deuteron. That work initiated a fruitful research career in theoretical nuclear physics and quantum field theory.

From 1946 to 1949, Felix was a research assistant at ETH Zürich. He was the first to recognize that the exchange of mesons that generate the nuclear force also contributes to the electromagnetic properties of nuclei. With this insight, he calculated the magnetic moments of three-body nuclei and laid the foundation for the systematic study of meson-exchange current effects in nuclei.

In the infancy of quantum electrodynamics, he and Wolfgang Pauli developed a simple and elegant method for regulating the mathematical singularities in quantum field theory and extracting finite physical results. The method, what became known as Pauli-Villars regularization, was influential and is widely used by stu-



Felix Marc Hermann Villars

dents of field theory.

Felix was a visiting member of the Institute for Advanced Study in Princeton, New Jersey, for a year before he came to MIT in 1950. He rose through the ranks to become full professor in 1959, and later (1980–83) would serve as chairman of the faculty. In addition to his MIT appointment, he was also a lecturer at Harvard Medical School. At MIT, he initially focused on nuclear physics, studying collective motion and developing the theory describing collective rotations of deformed nuclei. With Felix's theoretical developments as a foundation, both meson exchange currents and rotational states in deformed nuclei became fields of active research at MIT and other nuclear electron-scattering facilities. Felix also returned to his wartime interest in atmospheric physics: He studied the scattering of radio waves by atmospheric turbulence and examined the effect of Earth's magnetic field on ionization in the atmosphere.

A rare individual with the breadth, courage, and versatility to tackle a completely new field, Felix turned to the study of biological and medical physics in the late 1960s. He envisioned bringing the tools of theoretical physics to bear on problems in medicine and biology, and he played a major role as a founding member of the MIT-Harvard Health Sciences Technology program. The objective of that program was to demonstrate to medical students that medical and biological problems could be analyzed fruitfully through the basic physical sciences and mathematics. Such analysis required understanding the meaning of scattered physiological data and casting them into a con-

nected logical and analytical framework. Felix immersed himself deeply in the experimental literature and, from that data, created an analytical theory of central feedback and control problems in respiratory physiology, enzymology, and hormone physiology. His new insights became the foundation of new medical school courses in respiratory pathophysiology and quantitative physiology.

An inspiring teacher and research adviser, Felix gave memorable, lucid lectures in virtually every physics subject at MIT. His Harvard Medical School courses were master classes for medical students who sought a deep quantitative insight into organ physiology. He had the gift of formulating original, insightful problems with great clarity.

Felix was the coauthor of a pioneering and influential trilogy of undergraduate textbooks on physics with illustrative examples from medicine and biology. The texts—on mechanics, statistical physics, and electricity and magnetism—demonstrate to new students that the principles of physics can illuminate a range of biological and medical phenomena. For several years in the MIT physics department, Felix taught undergraduate courses based on these textbooks. Well into his retirement, which began in 1991, he returned to MIT to coteach a popular graduate course in biological physics and to collaborate on a graduate-level text.

Felix was a quiet, thoughtful man of great dignity. We remember fondly his pipe-lighting ritual: On being asked a question on any subject, he would put aside whatever he was working on, carefully fill his pipe with an aromatic blend, and light it while he collected his thoughts. When the tobacco was properly lit, he would smile and then provide an answer that had the clarity of a meticulously prepared lecture. He found great satisfaction in his beautifully maintained gardens and had a twinkle in his eye when he told his colleagues that Swiss chocolate was "brain food."

Those who knew Felix were inspired by the energy and devotion with which he cared for his family and continued his teaching and writing despite his final decade of illness. He is greatly missed by colleagues and friends, but his insights and his legacy of clear understanding will live on in the generations of students he taught and inspired.

George Benedek

John W. Negele

*Massachusetts Institute of Technology
Cambridge ■*