1998 ACS National Award Winners

Following is the fourth set of vignettes of recipients of 1998 awards administered by the American Chemical Society. An article on the 1998 Priestley Medalist is scheduled to appear in the March 30 issue of C&EN. Most winners will receive their awards during the 215th ACS national meeting in Dallas. However, the Cope Medalist and the Cope Scholars will receive their awards at the 216th ACS national meeting in Boston during the Arthur C. Cope Symposium. The Roger Adams Award will be presented next year at the National Organic Chemistry Symposium in Madison, Wis.

C&EN will publish vignettes of the remaining awardees in successive issues.

Peter Debye Award in Physical Chemistry

Sponsored by DuPont

GRAHAM R. FLEMING, professor of chemistry at the University of California, Berkeley, is a dominant force in the application of ultrafast spectroscopy to elucidate the basic physics and chemistry of molecular dynamical processes. According to a colleague, Fleming's "originality and creativity—both in devising new techniques and formulating crucial experimental tests of theories—have allowed him to lead the way in addressing the most fundamental questions about chemical reactions in the gas phase, in liquids, and in biomolecules."

Fleming's research has centered on liquid- and solution-phase dynamics. He has developed important new experimental probes of fast-timescale processes and has greatly advanced the theoretical understanding of the chemistry of liquids.

Among his most significant research accomplishments of the past five years is the development—with former postdoctoral fellows Tony Ruggiero and Norbert Scherer—of phase-locked femtosecond pulses. Such exquisite control over optical pulses was widely believed to be impossible. His demonstration of real-time molecular interference effects via phase-locked interferometry on iodine has led to proposals and demonstrations for new nonlinear spectroscopies with greater information content than conventional echo or pump-probe methods.

In addition, Fleming has shown that the broad and featureless electronic spectra universal in solution need not be an impediment to the study of reaction dynamics in real time. The use of wave packet spectroscopy can overcome this difficulty and reveal the dynamics behind the mask of spectral broadening. The semiclassical interpretation of wave packet spectroscopy that he has developed has led to a clarification of when a classical description can or cannot be used.

The wave packet technique, combined with optical heterodyne polarization spectroscopy, enabled Fleming and coworkers to make the first direct observation of motion along the reaction coordinate for a solution-phase reaction.

Fleming was born in England and received a B.Sc. degree from the University of Bristol. After receiving a Ph.D. degree in physical chemistry from the University of London, he took a postdoctoral position first at California Institute of Technology and then at the University of Melbourne, Australia. He was a member of the faculty at the University of Chicago for 18 years until joining the faculty at UC Berkeley in 1996.

Fleming has been honored with numerous awards for his research, among them the Marlow Medal of the Royal Society of Chemistry in 1981, the Coblentz Award of the Coblentz Society in 1985, the Tilden Medal of the Royal Society in 1991, and the ACS Nobel Laureate Signature Award for Graduate Education in Chemistry in 1995. He is a fellow of the American Academy of Arts & Sciences and of the Royal Society of London.

Ipatieff Prize

ANDREW J. GELLMAN, professor of chemical engineering at Carnegie Mellon University, Pittsburgh, is being honored for fundamental studies of a range of chemical phenomena on metal surfaces. His group developed several new experiments in surface science that cast light on some of the basic aspects of catalysis.

Gellman has done research in essentially four areas: the role of surface defects in surface reactions; the nature of the transition state in model reactions; the role of chirality in surface reactions; and the study of the atomistics of tribology on well-defined surfaces.

One of Gellman's major focuses has been the attempt to understand the transition states of molecules reacting on surfaces. These species exist for an instant, but they are critical in determining chemical reaction rates on surfaces.

A recent accomplishment is Gellman's discovery that crystalline surfaces can be created in right- and left-handed versions. These surfaces offer the opportunity to study chiral surface chemistry—the chemistry needed to produce enantiomerically pure pharmaceuticals.

According to one of his nominators, Gellman "has probably done the best scientific work in [tribology] in the world using atomically clean single-crystal surfaces and well-controlled conditions." Gellman's ultra-high-vacuum tribometers, which measure friction forces, have clearly shown that monolayer-level characteristics are controlling the frictional process.

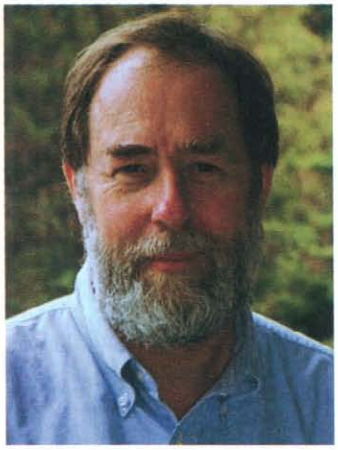
Gellman received a B.S. degree in chemistry in 1981 from California Institute of Technology and a Ph.D. degree in surface chemistry/catalysis from the University of California, Berkeley, in 1985. He was a postdoctoral fellow in physical chemistry at Cambridge University in 1985 and 1986 and an assistant professor of chemistry at the University of Illinois from 1986 to 1992. He joined the faculty of Carnegie Mellon in 1992.

Gellman has received more than 21 fellowships and grants. In 1991-93, he was made an Alfred P. Sloan Research Fellow, and in 1986, he was given the New Faculty in Chemistry Award by the Camille & Henry Dreyfus Foundation. From 1989 to 1994, he was a Packard Foundation Fellow. Gellman has published more than 80 research articles.

ACS Award in Chromatography

Sponsored by Supelco Inc.

GEORGES GUIOCHON, professor of chemistry at the University of Tennessee, Knoxville, and distinguished scientist at Oak Ridge National Laboratory, has been a leading force in chromatography for more than 30 years. "His contributions to all forms of chromatography have been


Fleming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Roy

prolific and of fundamental importance," notes one colleague.

Guiochon showed that gas-solid chromatography can be used to obtain accurate thermodynamic data for the interaction between adsorbed molecules and experimental conditions that are unobtainable by other techniques. His work on the interaction between solutes and alkyl chains bonded to silica gel surfaces in liquid chromatography is cited as a landmark achievement, while his research on the precision of chromatographic data and equipment helped establish chromatography as a standard analytical tool in such diverse environments as quality assurance/quality control and clinical labs.

But perhaps his greatest contribution to chromatographic sciences is his thermodynamic analysis of the chromatographic process, which is detailed in "Fundamentals of Preparative and Nonlinear Chromatography," published in 1994. The book is an essential guide to all who wish to perform chromatographic separations—whether in a preparative mode or in a process control environment. Its "significance cannot be overstated," says a colleague.

Guiochon's work has not been all theory; it has a very practical side as well. It made possible the development of industrial-scale preparative gas chromatography and, more recently, industrial-scale application of liquid chromatography to solve complex separation and purification problems confronting the pharmaceutical and biotechnology industries. His work over the years has resulted in the publication of more than 600 papers.

Guiochon received an engineering degree from the Polytechnical School of Paris in 1953 and a Ph.D. degree in chemistry from the University of Paris in 1958. Guiochon started his professional career at the Polytechnical School Laboratory of Physical Analytical Chemistry and moved to the Université Pierre et Marie Curie, Paris, in 1968. In 1984, he accepted a professorship at Georgetown University, Washington, D.C., and joined the Tennessee faculty in 1987.

ACS Award for Research at an Undergraduate Institution

Sponsored by Research Corp.

RABINDRA N. ROY, Walter H. Hoffman Distinguished Research Professor of Chemistry and department of chemistry chairman at Drury College, Springfield, Mo., is not only an internationally respected scientist but also the prototypical educator—one who has achieved unusual success in motivating students to pursue careers in chemistry.

Since 1966, when he joined the faculty at Drury, Roy's research program has benefited an exceptionally large number of students. His work—focused mainly on ionic activities, the physical chemistry of electrolyte solutions, and thermodynamic measurements—has been funded by Research Corp., the American Chemical Society's Petroleum Research Fund, the National Institutes of Health, and the National Science Foundation. It has resulted in publication of more than 120 papers in peer-reviewed journals, most coauthored with undergraduate students.

Indeed, Roy's program for student involvement in research is truly amazing, says one writer who supported his nomination. Students, including local high school students, start with routine laboratory tasks but soon are prepared to help perform research of publishable quality. As students gain experience, they are set to managing the day-to-day work of less experienced students. Finally, a highly experienced student can be selected to be "the super group leader" with supervisory responsibility for the research group.

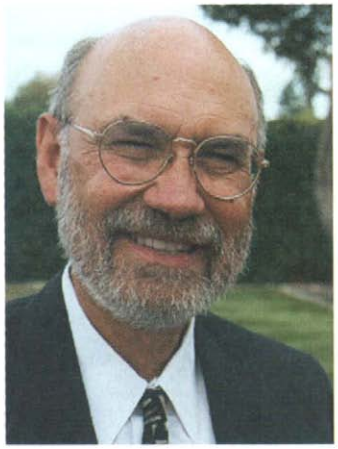
In addition to their experimental work, Roy's students learn to derive thermodynamic constants from experimental data and to prepare posters setting forth the procedures and results of the research. The students attend national and international meetings, including those of ACS, where they exhibit their posters and, in some instances, present talks on their work.

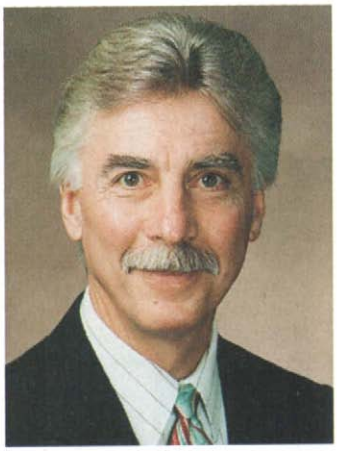
The program, which has been dubbed the "Drury model," has had remarkable results. Roy has supervised the research of more than 150 high school students in addition to some 370 undergraduates, approximately 100 of whom have earned coauthorship. More than 70 of Roy's students have received advanced degrees in the chemical sciences.

Roy received a B.Sc. degree, with chemistry honors, in 1959 and an M.Sc. degree in physical chemistry in 1961, both from Jadavpur University, Calcutta. Having been awarded a fellowship for advanced study in the U.S., Roy received a Ph.D. degree in chemistry from Louisiana State University in 1966.

During his 32 years at Drury, Roy has taught everything from introductory to advanced courses in chemistry, organized several international symposia, and conducted research at several U.S. institutions, including a 1996 stint with Johann Deisenhofer at Southwestern Medical Center, University of Texas, Dallas. He was selected as a Camille & Henry Dreyfus Scholar (1994-96) and in 1992 was named Most Distinguished Scientist by the Missouri Academy of Science.


Sheline


Silver


Wender

ACS Award for Nuclear Chemistry

Sponsored by the Gordon & Breach Publishing Group

In chemistry, the nucleus of an atom is often neglected while theorists and experimentalists focus on the more obvious chemical effects of electrons. But nuclei, which have their own specific spectroscopy, can have significant effects on the chemical properties of atoms—in radioactive decay, for example.

Florida State University chemistry and physics professor **RAYMOND K. SHELINE** has spent 40 years studying the subtle behavior of nuclei, focusing on the effects of nuclear deformations. Sheline and his colleagues have studied the unique spectroscopic properties of nuclei with octupole deformation—an accomplishment that more rigorously tests nuclear models than the simpler properties of quadrupole-deformed nuclei.

Sheline and his colleagues have also discovered that octupole deformation is a vital component in the interpretation of the rare mode of ^{14}C decay of ^{223}Ra to ^{209}Pb. His group has also found evidence for a hexadecapole deformation of certain nuclei.

In 1978, Sheline and colleagues published a theoretical study on the systematics of shell-structure effects and described a newly discovered property that is now known as superdeformation. Such contributions, says one scientist, "are truly significant to the field of nuclear structure in both theory and experiment."

Sheline received a B.S. degree in chemistry and math from Bethany College in Bethany, W.Va., in 1943. He worked on the Manhattan Project at Columbia University and at Los Alamos National Laboratory until 1946. He then received a Ph.D. degree in chemistry from the University of California, Berkeley, in 1949. After two years at the Institute for Nuclear Studies and the chemistry department at the University of Chicago, Sheline accepted a position at Florida State University, where he has worked since 1951. From 1955 to 1958, he was a Fulbright and Guggenheim Fellow at the Niels Bohr Institute, Copenhagen, Denmark, and in 1984, Sheline spent a year as a Fulbright professor at the University of Kinshasa in Zaire.

Sheline chaired the State Nuclear Program at Florida State University from 1959 to 1970; he cochaired a Gordon Research Conference on nuclear chemistry in 1967; and he also chaired the advisory committee for the Nuclear Chemistry Division of Lawrence Livermore National Laboratory in Livermore, Calif., from 1978 to 1981.

Sheline and coworkers have published more than 400 papers. He is a member of the Royal Danish Academy of Sciences & Letters, the American Physical Society, and ACS.

ACS Award for Creative Invention

Sponsored by Corporation Associates

SPENCER F. SILVER is being honored for development of pressure-sensitive adhesives, including the products that are the power behind 3M's Post-it Notes. Silver has concentrated on "topographical adhesives," which are composed of tacky, polymeric, microspherical particles. Their characteristics are determined by the three-dimensional structure of the adhesive coating as well as the viscoelastic properties of the polymer itself. Silver also spent several years working on biological adhesion.

The particulate adhesives Silver developed in 1969 were not immediately recognized by his company as useful, let alone the key to a blockbuster product first marketed a dozen years later. "The option for products that are easily removable as a result of low peel adhesion was not readily accepted as a desirable goal," he remembers. In fact, he had to put in "several years of determined effort to find a product development 'customer' within 3M" before he could get an initial product launched.

Silver persisted in his internal marketing efforts, coming up with a bulletin board sheet coated with the adhesive. Memos could be attached to this and later removed. This led Art Fry, a 3M engineer, to apply the adhesive to paper to make removable mailing labels. Ultimately, he realized it could also be used on removable notes.

The adhesives are made via a copolymerization of alkyl acrylates and ionic comonomers in water, and their existence contradicted conventional wisdom of the time, Silver says. Contemporary thinking suggested that the surfactant concentration, which was "well above the critical micelle concentration," would have generated a small-particle latex emulsion. (Small particles wouldn't have given the same type of adhesive product.) And even if a suspension of larger particles could be formed, it was thought that it would be unstable and that the tacky particles would eventually clump into a single mass.

Instead, the suspension turned out to be "unexpectedly stable" for reasons that are still unclear, Silver says. Unlike conventional adhesives, which form a planar coating when they are applied to a substrate, Silver's adhesives formed a bumpy, "topographically distinct" coating made up of discrete particles that permit good adhesion as well as easy and clean removal.

In later work, Silver developed several products including spray adhesives made of hollow microspheres, and water-dispersible adhesive tape, which doesn't foul paper-recycling operations.

Silver, who holds 23 patents, spent his entire career at 3M, retiring from his post as a corporate scientist in the firm's Adhesive Technologies Center in 1996. He was elected to the company's most prestigious scientific group, the Carlton Society, in 1983.

Silver received a B.S. degree in chemistry from Arizona State University, Tempe, in 1962. He joined 3M after receiving a

Ph.D. degree in organic chemistry from the University of Colorado, Boulder, in 1966.

3M's unique corporate culture has long been recognized as a key to continuing innovation. "Management must be tolerant of mistakes and patient about development time," Silver notes. "This is particularly true of scale-up, since if a product is truly new, no one will know how to make it easily and cheaply the first time." The Post-it Note adhesive and the notes themselves, in fact, had to overcome a number of production scale-up problems. "Most important," says Silver, "most of the time, more than one innovation is needed to introduce a truly new product."

ACS Award for Creative Work in Synthetic Organic Chemistry

Sponsored by Aldrich Chemical Co.

PAUL A. WENDER, professor of chemistry at Stanford University, has pioneered in devising both photolytic and transition-metal-catalyzed stereoselective cycloadditions and coupling these with other chemical steps to design strategic, economical syntheses of densely fused and functionalized polycyclic natural products. The sheer list of his total syntheses of complex structures is breathtaking, but one colleague's favorite is "his marvelous story of the 'pinene path to Taxol,' which I believe will become a landmark, not only with respect to Taxol synthesis, but also to the science of synthesis." For his own part, Wender sees the Taxol and other successes not as his own but the accomplishment of his research group.

The Wender group's Taxol synthesis begins with (1*R*)-verbenone, which comes from oxidation of β-pinene, a cheap component of turpentine. (One hallmark of Wender's syntheses is a rapid, efficient buildup of complexity from simple, inexpensive materials. Indeed, all his group's published syntheses use a dollar sign to mark the commercially available starting materials.) At 37 steps, the Taxol synthesis is the shortest route to the anticancer drug to date. It also offers many branch points for preparation of analogs.

The synthesis abounds in use of fine differences of reactivity or proximities of groups. Wanting an unsaturated aldehyde at one moment, the group tacks on a branched-chain alkenyl group and ozonizes that. They know that the ozone will hit only the electron-rich side chain.

The Stanford workers invoke a photochemical step to rearrange the carbon framework. But they deftly use methanol to avoid photolytic racemization. They go about masking hydroxyl groups not only to protect them, but also to stiffen a ring for further stereoselective operations. They tie up two hydroxyls as an acetonide only after putting a silyl group on one other. To make the acetonide, they choose 2-methoxypropene, not acetone.

And to build a cyclic carbonate ester, the group opts for triphosgene, not phosgene. But at a later step, they call on molecular mechanics calculations to tell them that they must cleave the cyclic carbonate if an aldol condensation next is to go as desired.

Wender received a B.S. degree in chemistry from Wilkes College, Wilkes-Barre, Pa., in 1969. He received a Ph.D. degree in chemistry in 1973 from Yale University. After a postdoctoral year at Columbia University, he joined the faculty at Harvard University in 1974. He has been at Stanford since 1981.◀

Nominations sought for environmental chemistry scholarship

The ACS Division of Environmental Chemistry seeks applications for the first Kenneth G. Hancock Memorial Scholarship in Green Chemistry. The scholarship will provide recognition for undergraduate and graduate student contributions to furthering the goals of green chemistry—also known as environmentally benign chemical synthesis and processing.

Creation of the scholarship awards was announced last year by then-ACS President Paul S. Anderson. Although the amount of the scholarships to be awarded has not been announced, the deadline for receipt of applications is April 15.

Hancock, who died in 1993 while attending an environmental chemistry conference in Eastern Europe, was one of the architects of the green chemistry approach to chemical synthesis and processing. He was director of the Division of Chemistry at the National Science Foundation and an active advocate of the role of chemists and chemistry not only in solving environmental problems that already exist, but also in avoiding future environmental problems in an economical fashion.

The scholarship is open to all undergraduate and graduate students. One scholarship is expected to be awarded annually, and it will be presented in conjunction with the Presidential Green Chemistry Challenge Awards at the national Green Chemistry & Engineering Conference, June 30-July 2. ACS is a cosponsor of the conference, and the society convenes the selection panel for the Presidential Green Chemistry Challenge Awards.

For more information or an application package, contact Paul Anastas or Tracy Williamson, Environmental Protection Agency; phone (202) 260-2659, e-mail: anastas.paul@epamail.epa.gov or williamson.tracy@epamail.epa.gov.◀

Organic Division seeks nominees for technical achievement awards

Nominations of non-Ph.D.-degree chemists are sought for the ACS Division of Organic Chemistry's Technical Achievement Awards. The awards consist of a plaque, the opportunity to give an invited presentation at the ACS national meeting in Boston, and being the honored guest at an awards banquet. They are meant to recognize the achievements of bachelor's- and master's-level chemists and to increase the involvement of such chemists in the division's activities. Deadline for receipt of nominations is March 20.

The awards are presented at the annual Symposium on Technical Achievements in Organic Chemistry held at the fall ACS national meeting. Award recipients present their discoveries in basic or developmental research during 30-minute presentations.

Awardees are selected in a two-phase process: First, a letter of nomination is sent to the division on behalf of the nominee. Second, a subcommittee composed of several members of the Organic Chemistry Division executive committee selects speakers based on the following criteria: evidence illustrating creativity and independence, publication and patent record, and any other information that documents special achievements and/or contributions.

Nominators are encouraged to select candidates who are both excellent scientists and good communicators. Nomination letters, including a copy of a candidate's curriculum vitae, should be sent to Anthony W. Czarnik, Irori Quantum Microchemistry, 11149 North Torrey Pines Rd., La Jolla, Calif. 92037-1031.◀