MINNESOTA CHEMISTS NEWSLETTER

Department of Chemistry
UNIVERSITY OF MINNESOTA

Fall 1993

A Letter from the Chair
W. Ronald Gentry

On behalf of the faculty, staff, and students of the Department of Chemistry at the University of Minnesota, I once again extend greetings to all our alumni and friends!

In writing another of these annual messages, I feel a little bit like Garrison Keillor (a U of M alumnus known to all fans of Minnesota Public Radio), who always begins his Prairie Home Companion monologues with "Well, it's been a quiet week in Lake Wobegon." The difference, of course, is that my letters could all begin with "Well, it's been a busy and exciting year in the Department of Chemistry." It seems as if the pace of change is accelerating within the university, just as it is within other institutions (including governments) worldwide. Many of the changes in our department are deliberate and positive. We have once again seen strong increases in chemistry undergraduate enrollments this year, and we continue to compete ever more effectively for recognition of our teaching and research excellence, including federal funding for research. However, we must also cope with unexpected and very sad changes, such as the tragic early death of one of our most illustrious faculty members, Regents' Professor **Paul Gassman**, and the passing of Professor Emeritus **I. M. Kolthoff**, one of the true giants of 20th century chemistry (see "Transition State", p. 6).

Despite such uncontrollable setbacks, we are committed as a department and as a university to maintaining our position as one of the world's leading research institutions. As a university, we are embarking this year on an ambitious internal reorganization, designated University 2000 by President Hasselmo, which is intended to concentrate energy and resources on our core responsibilities—the production and dissemination of knowledge. As a department, we are determined to maintain the strength of our faculty, staff, and students through ambitious and creative recruiting and development efforts. Eight new faculty members have been hired during the past four years, and this year's faculty recruiting committee is currently reviewing 370 applications in hopes of adding perhaps three more new faculty next year. While the challenges of finding setup funding and laboratory space for so many new faculty are very real, we must seize opportunities when they arise to move the department into the 21st century with a bountiful supply of new talent and new ideas.

We are confident that chemistry, as the "central science," will remain the foundation of much of the world's future scientific and technological progress. We are also confident that the University of Minnesota will continue to provide world leadership in the chemistry community, by excelling in both research and the education of successive generations of chemists. The support of our alumni and other friends for these endeavors is much needed and sincerely appreciated.

Alumnus Pioneers the Chemistry-Biology Interface

Daniel H. Rich (B. Chem., '64) wrote recently to let us know (and maybe rub it in a little) that the University of Wisconsin at Madison is one of the first four sites chosen by NIH to start the Chemistry-Biology Interface Training Program, a new NIH initiative designed to increase federal support for training chemistry graduate students to work on biological research. Rich, who is professor of medicinal chemistry and organic chemistry at Madison, is principal investigator and program director for the Wisconsin CBI-training grant, which will provide 5 years support for about 12 graduate students. "We are very excited to be selected for this program. This grant will enable us to train chemists who are especially knowledgeable in research at the chemistry-biology interface."

The last two years have been good ones for Rich, who has been honored several times for his research in drug design, especially the design of inhibitors of aspartic proteases, such as renin and HIV protease. He received the Vincent du Vigneaud Award in 1991, the ACS Division of Medicinal Chemistry Award in 1992, The ACS Ralph Hirschmann Award in Peptide Chemistry in 1993, the American Association of Pharmaceutical Scientists Research Achievement Award in 1992, an Alexander von Humboldt Senior Scientist Award in 1993, and the George Herbert Hitchings Award for Innovative Methods in Drug Design and Discovery in 1992. The Hitchings Award, a research grant for $350,000 that is awarded on the basis of a national competition, is designed to encourage entry into novel research areas. "In my case, we are trying to characterize peptide transporter systems in hepatocytes as a way to develop orally active peptide derivatives. In general, approaches that convert peptide structures into well-absorbed molecules have profound implication for future drug development."

Rich also has been active in public service. He chaired the Bio-organic and Natural Products study section of NIH in the early 1980s, and chaired the ACS Division of Medicinal Chemistry in 1992.

Rich still maintains good contacts with the U of M. His older daughter, Julie, is a third year law student at Minnesota and his son-in-law, Sean, is completing a physics degree. A few years ago, his younger daughter, Kristy, spent two years at Minnesota, where she played on the women's soccer team before returning to Madison to graduate. "And of course, my mother still sends me news clippings of University goings-on. I was delighted to see the recent attempts to focus the Minneapolis campus on research and education of outstanding undergraduate and graduate students. This was what I experienced as an undergraduate researcher in **Wayland Noland**'s laboratory, which probably had more impact on my career than anything since. I hope that the University can continue to provide that experience for its best students."

Research Profiles

PETER W. CARR Zirconia is an emerging material for chromatographic supports due to its high mechanical and chemical stability. Monodisperse non-porous spherical zirconia particles are especially attractive for both rapid clinical analysis and process-scale chromatography of proteins and immunochemicals useful as therapeutics or diagnostics. Research efforts by professor Peter Carr and coworkers (graduate students Michael Glavanovich, Qianhua Zhao, Lifang Sun, and Christopher Dunlap in Chemistry, and professors Michael Flickinger of the Biological Process Institute and Alon McCormick of the Department of Chemical Engineering and Materials Science) explore methods for preparation of zirconia particles, study their chromatographic performance, and develop zirconia spherules with pore size distribution and surface chemistries optimized for protein chromatography. The challenge is to learn how to synthesize ZrO_2 with the best pore characteristics for the chromatography of proteins. Detailed characterization of the pore and surface properties of these particles, using a variety of methods, sets the stage for production of these materials with high degree of reproducibility.

Monodisperse porous zirconia spherules of controllable pore and particle size are made by urea-formaldehyde polymer induced colloid aggregation (PICA) at pH 1–3. In this PICA method, zirconia colloid is mixed with urea and formaldehyde under acid catalysis, where a polymer is formed and adsorbs onto the colloid. Urea-formaldehyde coated zirconia particles then aggregate to yield monodisperse particles. After burning off the polymer, porous monodisperse spherules are formed. Zirconia spherule size can be tuned in the range of 1–10 μm by adjusting the pH or the polarity of the solution. The surface area of the spherules is between 12–29 m^2/g, and the average pore diameter is about 500 Å. Columns packed with such spherules are chemically and mechanically stable (at pH's 1–14 and at pressure >5000 psi). Spherules and silica gel are characterized using conventional techniques (electron microscopy, SEM and TEM; nitrogen adsorption) and NMR. To avoid errors in predicting the chromatographic behavior of the particles due to the topology of the pore space (branching, dead ends, accessible surface area, blocked pores, tortuosity, etc.), NMR spin lattice relaxation methods are used to calculate the pore size distribution. In addition, pulsed field gradient NMR makes it possible to measure the influence of the pore structure on diffusion of the pore fluid and to determine the connectivity of the pores using network models. These measurements reveal the importance of avoiding pore constrictions and excessive tortuosity.

A number of phases are currently being developed:

(1) a polyethyleneimine (PEI) coated zirconia phase for protein and small molecule separations by anion exchange and hydrophobic interaction mechanisms;
(2) a reversed-phase polybutadiene coated zirconia and alumina;
(3) a "diol" phase useful for size exclusion chromatography (SEC) and affinity supports; and
(4) non-porous particles for fast protein liquid chromatography (FPLC).

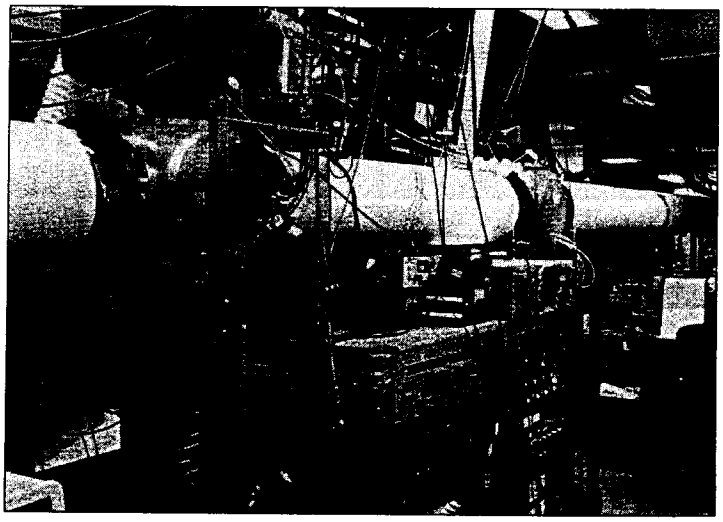
Polybutadiene coated zirconia is not useful for the separation of proteins due to irreversible adsorption. However, alumina particles coated with polybutadiene by the same coating procedure allowed successful separations of proteins. Professor Carr postulates that the irreversible adsorption may be due to restrictive pore structure introduced during synthesis of the zirconia spherules. By SEM, the alumina particles have a more open pore structure than zirconia.

Work is in progress on development of an SEC support to take advantage of the characteristics of zirconia particles: mechanical stability (high flow rates without bed collapse), stability at high temperature, and chemical stability (stable at high pH). SEC is commonly used as the final step in purification of therapeutic proteins and immunoglobulins (Ig's) from low molecular weight contaminants and lipopolysaccharide (LPS). The surface modification recently developed in the laboratory for production of a "diol" coating on the surface of colloidal zirconia is being used on spherules produced by water-in-oil emulsion [150 nm colloid after adsorption of dibasic sodium phosphate to activate the surface].

Thiophilic adsorption is a non-proteinaceous affinity technique, related to hydrophobic interaction chromatography, for purification of immunoglobulins. Work in progress to develop this phase on a zirconia particle will create a base-stable, sterilizable immunoglobulin adsorbent which would be of major benefit for clinical analysis, for Ig isolation from sera, and for purification of monoclonal antibodies.

Non-porous monodisperse zirconia particles would be extremely useful for very fast protein liquid chromatography for clinical analysis and as starting particles to build very large aggregates with large pores. Particles of 1-5 μm in diameter with very narrow size distribution have been synthesized. A pore-plugging method has been tried, with preliminary results indicating that the particle size and size distribution are only limited by the starting seeds. A route involving aggregation of zirconia colloids, followed by controlled pore annealing, is also being pursued.

RON GENTRY After at least 65 years of debate as to whether the diatomic molecule $^4He_2$ exists, this elusive species has finally been detected experimentally. Professor W. R. Gentry (working with physics professor Clayton Giese, graduate students Fei Luo and Geunsik Kim, and postdoctoral researcher George McBane) have used mass spectrometry to detect He_2 formed in very low concentrations in an extremely cold atomic helium beam. The most weakly bound of all diatomic molecules, helium dimer is formed in significant amounts only at beam temperatures less than about 0.001 Kelvin (1 mK) above absolute zero. Helium dimer is an important benchmark system



To observe the dimer, Professor Gentry and coworkers built an apparatus capable of producing very cold expansions. The apparatus, which features two 35-inch diameter diffusion pumps and a 60 foot long flight tube, spans two rooms in the basement of Kolthoff Hall.

for quantum structure calculations, and an accurate knowledge of the He_2 interatomic potential is also vital to an understanding of condensed-phase (superfluid) helium at low temperatures. Ironically, the extremely weakly-bound helium dimer may also provide an opportunity to study relativistic effects which usually are considered important only for systems at very high energies.

The force between two helium atoms is attractive at large values of internuclear separation R, and repulsive at short range. This produces a potential energy well with the deepest point at about R = 3.0 Å. However, the existence of a potential energy well does not ensure that the two atoms will form a stable molecule. Quantum mechanically, the atoms cannot sit at rest at the bottom of the well, but must be in motion so as to satisfy the Heisenberg Uncertainty Principle. In He_2, unlike other diatomic molecules, the resulting "zero-point" energy is almost equal to the well depth, making the net binding energy almost zero. Until now, it has not been confirmed whether the potential well for He_2 is sufficiently deep to support a zero-point bound state. This is a particularly difficult problem theoretically, since a binding energy corresponding to 1 mK is only 1 part in 2×10^9 of the total electronic energy of the molecule.

There have been many theoretical calculations on helium dimer going back to 1928, some of which predict a bound state and some of which do not. Likewise, since 1969, atomic scattering experiments designed to measure the well depth have yielded conflicting predictions as to whether a bound state should exist. Previous attempts to observe the helium dimer in cold supersonic expansions have failed, probably because the temperatures achieved were not low enough to produce dimers. Larger helium clusters were seen, but these are much more strongly bound than the dimer.

The nature of the helium diatomic molecule implied by such a small binding energy is somewhat bizarre. An extremely quantum mechanical system, He_2 exists in only one quantum state having only zero-point vibrational energy and zero rotational angular momentum. The quantum wavefunction which describes the distribution of internuclear distances R in the dimer extends to values of hundreds of Å, with an average value <R> of about 55 Å! This makes the physical size of helium dimer enormous compared to that of ordinary diatomic molecules—in fact, as large as many biological macromolecules. Furthermore, helium dimer is predicted to spend most of its time at internuclear separations which are beyond the limit which is possible according to the laws of classical mechanics.

The separation of the atoms in helium dimer is so large, in fact, that relativistic effects are predicted to have a significant influence on its binding energy. The long-range attraction between helium atoms is caused by the mutual influence which the electric fields of the two atoms exert on each other. Averaged over time, the electric field around each atom is zero. At any given instant of time, however, the two electrons in one of the helium atoms may not be exactly on opposite sides of the nucleus, and the atom will therefore possess a transient electric dipole. This dipole field induces a corresponding dipole in the other atom, which in turn produces a field which interacts with the first dipole. The force which arises from the mutually-induced dipole fields is called "dispersion," and is always attractive. If, however, the transient field around one atom is not experienced instantaneously by the other atom, but only after a delay due to the fact that it travels at the speed of light, then the net attractive force is smaller. This relativistic effect, called "retardation," tends to reduce the well depth of the interaction potential, and thus decrease the binding energy. Professor Gentry and his coworkers have predicted theoretically that retardation makes a 10% difference in the binding energy of helium dimer, raising the possibility of observing for the first time the influence of retardation on the properties of an isolated molecule. With such goals in mind, new experiments to obtain a quantitative measurement of the He_2 binding energy are being planned. [For more information on Gentry's research described above, see *J. Chem. Phys.* **98**, 3564–3567 and 9687–9690 (1993)].

Message from the Editors

George Barany and **Ken Leopold**

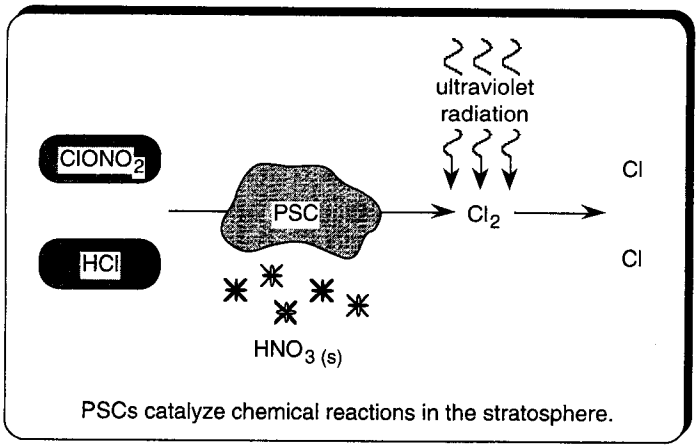
Greetings! It is once again the time of year when we re-establish contacts with friends and alumni in the form of the "Minnesota Chemist" newsletter. As usual, the past year has been a busy one, and there is never a shortage of news to report. Whether it's force of habit, a vague similarity to writing papers, or just the sudden drop in temperature, the coming of fall quarter triggers the "newsletter response" in which we do our best to download as much as we can of what we think will be of interest to our friends and former members of the department.

Last year, the featured theme in the newsletter was research, and we collected first-hand accounts of the research accomplishments of some of our outstanding senior graduate students. This year, we have chosen to emphasize the other important function of the department, namely teaching. With the continuing growth of national attention focused on quality science education, this is a particularly timely topic, and one that the department has been involved with for many years. Indeed, as we report in this issue, several of our faculty were honored this year for their innovative contributions to teaching, and others are continuing to strive for new and better ways to stimulate students' interest in chemistry.

We are grateful to many individuals for their help in assembling this year's newsletter. First and foremost, **Kathy Ross**, who has completed six years as "assistant editor" is, without a doubt, the person most responsible each year for getting this publication to press. Others, whose conscientious efforts in gathering and providing information have been greatly appreciated, are **Pete Carr**, **Ron Gentry**, **Tom Hoye**, **Kent Mann**, **Larry Miller**, **Stephanie Miller**, **Sue Page**, **Jeff Roberts**, **Melissa Sirek**, and **Bill Tolman**. Finally, we thank those of you with whom we have had contact throughout the year, or who have sent in "alumni reports," for continuing to keep us informed of your (very!) varied activities.

JEFF ROBERTS The greenhouse effect, water pollution, acid rain: our understanding of these, indeed virtually all, environmental problems is intimately connected to our understanding of the role chemistry plays in the natural world. Professor Jeff Roberts has made one such environmental problem, namely stratospheric ozone depletion, the inspiration of part of his research program. It turns out that ice particle surfaces, abundantly present in polar stratospheric clouds (also

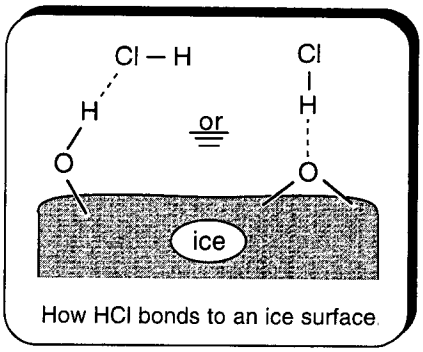
called PSCs), can actually catalyze certain chemical transformations, the products of which ultimately assist in opening the ozone hole. These reactions, one of which is shown schematically below, involve the conversion of otherwise benign chlorine-containing compounds into chlorine gas. Upon exposure to the intense ultraviolet bath which is present during the Antarctic spring and summer, chlorine dissociates and subsequently goes on to destroy ozone via an extraordinarily efficient catalytic cycle.



PSCs catalyze chemical reactions in the stratosphere.

Professor Roberts and his students would like to determine the mechanisms of these ice-catalyzed reactions. They have adopted an experimental approach which is novel and insightful: extremely thin (50 Å or less) ice films are deposited onto metal substrates, and reactions on the surfaces of the films are investigated under ultralow pressures ($\approx 10^{-13}$ atmospheres). The vapor pressure of water imposes an upper temperature limit of ≈175 K on their experiments, but this temperature is only slightly lower than those actually encountered within a polar stratospheric cloud (180-200 K). Because of the low temperature and pressure conditions, certain critical mechanistic issues are conveniently studied. In particular, each of the elementary steps which must be involved in any surface mediated transformation–adsorption of the reactants, conversion into adsorbed products, and release of products into the gas phase—can be separated and studied individually. Furthermore, since the ice films are so thin, the surface area to volume ratio is high, and it is therefore a relatively easy matter to discriminate between phenomena which occur at the surface and those which occur within the ice bulk.

Professor Roberts' group has now made the first *direct* adsorption and desorption rate measurements on ice. For HCl, a major player in heterogeneous atmospheric chemistry, the adsorption probability on ice is very close to unity. Upon encountering an ice surface, some HCl is incorporated into the ice bulk, and some is adsorbed onto the ice surface. Surprisingly, and in contrast to HCl in the bulk, HCl does not ionize at an ice surface, nor does it undergo proton exchange with water. The desorption energy of adsorbed HCl is approximately 30 $kJ \cdot mol^{-1}$, a value which is suggestive of the formation of a relatively strong hydrogen bond with the ice surface. Spectroscopic studies involving the use of Fourier transform infrared spectroscopy also point to the formation of a hydrogen bond: a sharp feature near 3750 cm^{-1} in the vibrational spectrum of pure ice disappears upon HCl adsorption. This mode has been previously assigned to the O-H stretch in non-hydrogen bonded water at the ice surface, and its disappearance



How HCl bonds to an ice surface.

can be attributed to the formation of a hydrogen bond with adsorbed HCl.

The existence of an ice-HCl hydrogen bonding interaction implies that surface polarity plays an important role in determining how molecules adsorb on ice. This turns out to be generally true. For instance, the adsorption of acetone on ice also involves formation of a hydrogen bond with surface water. In this case, the existence of such an interaction may be inferred from the inverse kinetic isotope effect for acetone desorption from D_2O ice. Even for the adsorption of nonpolar substances like CCl_4, the polarity of the surface appears to be of great importance. In fact, the enthalpy and entropy changes for CCl_4 adsorption imply that adsorption is accompanied by a structural reorganization of the underlying ice layer.

What's next for the Roberts research group? They would like to study reactions of coadsorbed molecules, like HCl and $ClONO_2$. They are also planning to study the chemistry of sulfuric acid surfaces. The latter issue is of great current interest because volcanic eruptions lead to the formation of enormous quantities of sulfuric acid droplets in the atmosphere. Stay tuned!

Larry Miller Improves his Teaching. Really...

As noted in our "Ovations" column, Professor Larry Miller has been honored as this year's winner of the Horace T. Morse-Minnesota Alumni Award for Outstanding Contributions to Undergraduate Education. The award is given to ten faculty members from the university system, and nominations are judged by both a college committee and a university committee. All aspects of undergraduate education are considered, but this year's emphasis was on teaching in large classes. Aside from being a significant honor, the recipients receive a $7,500 (taxable!) award for themselves, as well as $7,500 for use within the university.

Larry's innovative approach to teaching large classes (in this case, organic chemistry) starts with a recognition of the nature of the important problems. He notes, "...we have particular and important problems because of the size (the students feel anonymous) and our urban setting (the students commute and hold jobs off campus). In organic chemistry, the students are intimidated by the course material, the size of the class, and its competitiveness. The course is known as a 'flunk-out' course for pre-meds. Furthermore, many of our students have little intellectual connection with other students. By the time they get back and forth from Anoka there is not time to talk and learn, and these Minnesotans will sit next to each other in a class for a whole quarter and never learn the name of their neighbor!"

To tackle these problems, Professor Miller has combined several approaches. First, he spends a lot of time in class talking about learning strategies and trying to convince the students that he is there to help them through a very tough course. On the first day, he asks them to write about their goals, and especially to write about something personally important that might affect their learning in class. He reports that they respond in amazing ways and that it provides him with a renewed sense of motivation. Another innovative aspect (especially for large courses) is the assignment of study groups. Most students have no experience with such groups, and two assignments are given during the quarter with the requirement that they be done in these groups, outside of class. In terms of content, the emphasis is on problem solving skills, rather than facts, and "active learning" is applied by having students work problems in class, sometimes in groups of two or three. There is a continual emphasis on the idea that writing and speaking about organic chemistry is the only way to learn it well.

One particularly unusual assignment is a creative writing project about "molecular anthropomorphism." Molecules are described as people, chemical reactions as human interactions, and molecular structure as motivation. An illustrative example is the metaphor of a chemical bond as the bond of marriage. The idea is that thinking about the subject in this way requires that they see the big picture, not just the details needed for the next test. The responses to this assignment over the years have been remarkable. Students have written romances, detective stories, Shakespearean sonnets, rap music lyrics, and comic books, all of which accurately describe organic chemistry.

Professor Miller reports that the implementation of these methods has improved his student ratings substantially. As he puts it, "I have not required less, nor graded more easily. [The students] still complain that the tests are too difficult, but they learn better and they know it." When asked recently by the alumni magazine how the Morse award made a difference to him, he replied, "It increased my self esteem, so that I am now able to reply to your readers who have taken classes from me and are wondering, 'How did that jerk win?' I got a lot better recently. Really."

Becoming Better Teachers: Faculty Participate in the Bush Program for Teaching Excellence

"Sink or swim" aptly describes the usual way new faculty are trained to teach in the classroom. Having spent most of their graduate and postgraduate years becoming experts at research, new professors are generally poorly versed in teaching methods and philosophies beyond what they have learned by example during their own training. The Bush Program for Excellence and Diversity in Teaching, which began as a University-wide program in 1991, was developed largely in order to satisfy the need for pedagogical training of relatively inexperienced faculty members. Six faculty members from the Department of Chemistry have participated or are currently participating in the program, and have brought back new insights and methods into their classes: Professors **Christopher Cramer**, **Mark Distefano**, **Craig Forsyth**, **Karin Musier-Forsyth**, **Jeff Roberts**, and **William Tolman**.

Each year, approximately 60 untenured faculty from throughout the university are chosen for the program. They are divided into groups of 5, and each group is led by a resource teacher, usually someone with extensive teaching experience, who is recognized as an outstanding instructor. The groups meet regularly throughout the school year to discuss teaching strategies and issues, share information on instructional resources, and relate experiences and problems encountered in the classroom. Resource teachers are also available for observing participant's classes and interviewing students in order to evaluate teaching effectiveness in a meaningful fashion. Special seminars by leading educational experts each quarter round out the program. Specific emphasis on active and cooperative learning strategies in the program has had a direct impact on the participants from the Department of Chemistry, with the use of group work both in and outside of the classroom becoming a popular technique in both undergraduate and graduate chemistry classes. In addition to the many direct benefits of the program to the participants' teaching, the opportunity to meet and share experiences with faculty from other departments is particularly helpful for integration into the university community.

Transition State

PROMOTIONS

Doreen Leopold was promoted from assistant professor to associate professor with tenure. Doreen first received a bachelor's degree in philosophy at Cornell University in 1972, and a bachelor's in chemistry from MIT in 1978. She earned both a Master's and a Ph.D. from Harvard University, in 1980 and 1983, respectively. Her research advisor at Harvard was Veronica Vaida. Postdoctoral work at the Joint Institute for Laboratory Astrophysics with Carl Lineberger completed her preparation, and Doreen joined the faculty of chemistry in the fall of 1986.

Doreen's research involves the spectroscopic investigation of neutral radicals and negative ions in the gas phase. One area of particular interest involves exploring the effects of the metal valence s electrons on the bonding in coordinatively unsaturated transition metal complexes, and in tracing the evolution of the electronic structure from the bare metal atom to the fully ligated complex. These studies employ the experimental technique of flowing afterglow negative ion photoelectron spectroscopy, and the ambitious apparatus she and her coworkers constructed for their work is in some respects unique world-wide.

Scott Rychnovsky was promoted from assistant professor to associate professor with tenure. Scott joined the department in the fall of 1988, and his early promotion, the first in the department in many years, attests to the respect the chemistry faculty and his peers accord him. Rychnovsky did his undergraduate work at the University of California, Berkeley, and received his bachelor's degree there in 1981. His Ph.D. was earned at Columbia University in 1986, where his research advisor was Gilbert Stork. Prior to joining the faculty at Minnesota, he did postdoctoral work with David Evans at Harvard and Stuart Schreiber at Yale.

Scott's major research focus here has been the study of the synthesis and biological activity of the polyene macrolide antibiotics, an important class of antifungal agents. He and his group use a variety of techniques in these studies, including chemical synthesis and new methods development, ion channel measurements in membrane bilayers, affinity chromatography to estimate binding constants, and *ab initio* calculations to predict the conformations of radicals and 1,3-dioxanes.

NEW FACULTY

Li Sun joined the faculty of chemistry this fall, directly from a postdoctoral position with Richard Crooks at the University of New Mexico. Li's undergraduate degree was earned in his native country at Peking University in Beijing, China in 1983. His Ph.D. in Physical/Analytical Chemistry was from Northwestern University in 1990, under the direction of Richard Van Duyne.

Li's research area bridges analytical, physical, and materials chemistry, and is perhaps best characterized as the application of novel spectroscopic methods to the investigation of nanoscale molecular assemblies. By study of chemical and physical phenomena on ever smaller scales and in controlled spatial configurations, his work will have applications in the engineering of new materials, biology and optoelectronics. His major teaching affiliation will be in the analytical area.

Eric Munson was also hired in a search conducted during the 92-93 academic year, but he will complete a postdoctoral appointment with Alex Pines at the University of California, Berkeley, prior to joining the faculty of chemistry in the fall of 1994. Look for his introduction in this same column in next year's newsletter.

RETIREMENTS

C. Alden Mead was elevated to the rank of Professor Emeritus by his June, 1993 retirement. Alden was born in St. Louis, Missouri, and grew up in Webster Groves, a suburb of that city. As those who know him will confirm, the most notable effect of his youth has been his abiding interest in the fortunes of the St. Louis Cardinals and all things baseball. He received his bachelor's degree from Carleton College in Northfield, Minnesota in 1954, and a Ph.D. in chemistry from Washington University in St. Louis in 1957 under the tutelage of Sam Weissman. Subsequent to postdoctoral studies at Brookhaven National Laboratory in Upton, New York, he joined the faculty of chemistry in 1958, where he remained until retirement.

Alden's research has spanned a unique and broad swath through modern theoretical chemical physics. His first ten years here included fundamental studies on the quantum theory of the interaction of radiation with matter, especially line shapes, and he carried out studies that were years ahead of their time in measurement theory applied to the idea of a gravitational fundamental length. Later work included generalizations of the entropy concept in nonequilibrium statistical mechanics and a variety of contributions to molecular quantum mechanics. Included among the latter was his especially noteworthy work on the Born-Oppenheimer approximation, group theory applied to chirality (which earned him a well deserved reputation as one of the world's leading experts in this important field), isomer counting, and the geometric phase in quantum theory. Alden's teaching contributions ranged from freshman chemistry to the most advanced graduate courses, and his course lectures and seminars alike were crystal clear and stimulating.

Alden served as director of graduate studies first in chemistry and later in chemical physics. He has also served as assistant editor of the *Journal of Physical Chemistry*, and has been honored with fellowships in both the American Physical Society and the American Association for the Advancement of Science.

In the best tradition of Professors Emeriti, Alden maintains an office on campus and is seen frequently about the department. We wish him and his wife, Karin, many happy years ahead.

Dale Burling retired in June of 1993. Dale was born in Carver, Minnesota, and graduated from Minneapolis's South High in 1941. He served in the army from 1942 through 1945, and has many interesting stories to tell of his experiences in the South Pacific and Australia during World War II. In 1950, Dale graduated from Northwest Electronic Institute, and after working in the television repair business for a number of years, began working in the Department of Chemistry in April of 1960 as a chemical apparatus supervisor. His duties included not only the repair of electronic instruments, but also the operation of an electronic instruments "stockroom." In March of 1969, he was promoted to principal electronics technician, and in June of 1980, to electromechanical systems specialist. In addition to the repair of teaching and research instrumentation, Dale designed and constructed a variety of instruments, and served as an informational resource for those planning to purchase scientific apparatus.

Dale's career spanned more than three decades of development in the field of scientific electronic instrumentation, and in 1992 he was honored with the IT Civil Service Outstanding Service Award. From the relatively simple vacuum tube pH meter of the 60's, to the complex computerized FTIR spectrometer of today, Dale has worked on them all. Throughout this period he has been "Mr. Fixit" in the department, responding

to every repair call rapidly, patiently and courteously, and going to the heart of each malfunction with intelligence, common sense and lots of experience and know-how. During his career, Dale's continuity of service contributed to the efficient operation of the department. He knew the quirks and personalities of most of the instruments in the department, which was very helpful in quickly diagnosing instrument failure. He saved the department an incalculable amount of money by keeping many instruments running well beyond their expected lifetime. The instructional labs, too, owe him a debt of gratitude for keeping the equipment, and hence the courses, running.

Dale plans to revisit Australia and some of the South Pacific islands he became familiar with during the war. He would also like to travel to Sweden and England. Wherever he travels, we wish him a healthy, happy and prosperous retirement.

Mary Sende also retired in 1993, in April. Mary was born in Eckelson, North Dakota, graduated from St. Catherine's High School in Valley City, North Dakota, and attended the Valley City State Teacher's College to receive a teaching certificate in elementary education. She taught elementary grades in North Dakota for three years, and then met and married Charles (Phil) Sende in 1950. A son, Charles Lee, was born in 1951 and deceased in 1973; son Timothy Phillip was born in 1957 and now lives in Cambridge, Minnesota. Mary has, by the time this goes to press, three grandchildren–Crystal Lee, 13, Hannah, 3, and a new "bundle of joy" born this summer.

Mary joined the department as a senior clerk typist in March of 1967, advanced to the position of senior secretary and then to principal secretary, the position she held at the time of her retirement. During her 26-year tenure, she provided excellent secretarial assistance to many faculty. Juggling the needs of several faculty is a difficult task which Mary handled gracefully and proficiently. Over the years, hundreds of graduate students and postdoctoral fellows also appreciated Mary's helpfulness and encouragement. When Mary received an IT Civil Service Outstanding Service Award in 1991, many former students wrote letters of support expressing fond memories of the interest Mary took in their careers and the assistance she provided them during their stay in Minnesota.

Mary is devoted to her parents, who reside in St. Paul and are 85 and 90 years of age. Retirement will give her the time she relishes with them. In addition, she and Phil have plans for travel and summers at the lake. Her departmental friends wish her many happy and productive retirement years.

DEATHS

Paul G. Gassman was born on June 22, 1935, in Alden, New York, and died in Minneapolis, Minnesota on April 21, 1993 from complications following heart surgery. He received a B. S. degree from Canisius College in Buffalo, New York, in 1957, and a Ph.D. from Cornell University in Ithaca, New York, in 1960. In 1961, he accepted a faculty post at the Ohio State University in Columbus, Ohio, where he attained the rank of full professor in 1969. He came to the University of Minnesota in 1974, where he served as chair of the Chemistry Department from 1975 to 1979, and attained the rank of Regents' Professor in 1988.

Gassman was an internationally acclaimed research scientist whose research covered many areas of chemistry. He published over 300 papers, edited nine textbooks, received 33 patents, and presented over 500 invited lectures at scientific meetings, industrial laboratories, and universities and colleges throughout the world. He discovered the cycloaddition reaction of electron-deficient carbon-carbon multiple bonds across the sigma bonds of strained rings, and elucidated much of the mechanistic detail of the transition-metal complex-promoted isomerization of strained ring systems. Gassman was a highly regarded teacher both in the traditional classroom setting and through his laboratory research program. He served as mentor and thesis advisor to 72 Ph.D. and 13 M.S. students, and worked with dozens of postdoctoral associates and undergraduate research students over the years. At his passing, there were 20 research collaborators in his laboratory.

The list of honors and awards for this research and for teaching excellence is indeed lengthy. Among them are the James Flack Norris Award in Physical Organic Chemistry (1985) and the Arthur C. Cope Scholar Award (1986) of the American Chemical Society. He was named a Fulbright Scholar in 1988 and was elected to the National Academy of Sciences in 1989 and to the American Academy of Arts and Sciences in 1992. The State of Minnesota proclaimed January 5, 1990 as Paul Gassman Day in recognition of his many achievements. His imposing service record includes the presidency of the Council for Chemical Research in 1986-87, and culminated with his election to serve as American Chemical Society President for 1990.

He is survived by his wife, Gerda Ann, seven children, six grandchildren, a sister and a brother.

Izaak Maurits Kolthoff was born in Almelo, Holland on February 11, 1894, and died in St. Paul, Minnesota on March 4, 1993. He entered the University of Utrecht, Holland, in 1911. His first scientific paper, on acid base titrations, appeared in 1915, and this was followed by a host of papers and several books. By 1927, at age 33, he had a world-wide reputation and was invited to become Professor of Chemistry at the University of Minnesota, where he remained until his retirement in 1962. At that time, he had published about 800 papers and several books; after 1962, about 150 more papers were forthcoming.

Kolthoff's research, covering about a dozen areas of chemistry, has been recognized by many medals and memberships in learned societies in this country and abroad. He was a member of the National Academy of Sciences and a recipient of the Nichols Medal of the American Chemical Society. To the general public, he was best known for his work in synthetic rubber, carried out during and after World War II. Early in the war, the government established a comprehensive research program at the major industrial companies and several universities, including Minnesota. Kolthoff quickly assembled a large research group and made major contributions to the program.

Many of Kolthoff's graduate students went on to successful careers in industry and academic life, and the latter in turn trained many more. In 1982, it was estimated that about 1,100 Ph.D. holders could trace their scientific roots to him. When the American Chemical Society inaugurated an award for excellence in teaching in 1983, he was the first recipient.

Kolthoff was active in promoting international understanding, and, especially during the war years, in rescuing colleagues from oppressive regimes. He had broad cultural interests and traveled the world over.

He never married, and is survived by relatives in Holland and Israel.

Alumni Reports

Willard Beattie (Ph.D. '58, E. J. Meehan), retired.

I retired from the Los Alamos National Laboratory in May, 1989, after spending 23 years there.

Leise A. Berven (B. Chem. '84), Flinders University, Department of Medical Biochemistry, Bedford Park, South Australia.

I completed my M.S. in organic chemistry at the University of British Columbia in 1987. In 1988, I married Geoffrey Annison and moved to Sydney, Australia, where I obtained my Ph.D. from the University of Sydney in 1992. We are now living in Adelaide, South Australia, and my work at Flinders involves studying receptor-activated calcium channels and mechanisms which regulate intracellular calcium in hepatodytes and other cell types. We enjoy many outdoor activities in Australia, including sailing, snorkeling, bush-walking, and bicycle touring. Although I always look forward to trips back to Minnesota, I feel very fortunate that I have been able to pursue a career in research while living in some spectacular regions of the world.

Richard P. Berven (B. Chem. '67), deceased.

Richard P. Berven died from cancer on May 3, 1993, at age 54. After completing his degree, he was employed by 3M Company, St. Paul, Minnesota, where he worked for several years. He then went on to Donaldson Company, Bloomington, MN, where he was employed for 23 years as a senior chemical process engineer. He was respected and admired by colleagues, friends and family, and will be missed greatly by many. He is survived by his wife, Sharon, and daughters, **Leise** (B. Chem. '84), **Heidi** (B. Chem. '85), Rachel, and **Erica** (Biochem., '94) (reported by his daughter, Leise).

David Chatfield (Ph.D. '91, D. G. Truhlar), NIH, Bethesda, Maryland.

I am enjoying a postdoctoral associateship at NIH for a second year. As I write, Washington is putting on its glorious spring gala, foremost the cherries, dogwood and azaleas. This is our capitol's finest season. The goal of my research here relates to AIDS; it is to elucidate the mechanism by which the enzyme HIV-1 protease cleaves viral polyproteins. The method–a computer simulation–involves a marriage of quantum and classical mechanics to model the chemical system. Next year at this time I hope to have been offered my dream job in academia...we are allowed to dream, aren't we?

Reuben B. Ellestad (B. Chem., '22; M.S., '24; and Ph.D., '29, P. Brinton), deceased.

Dr. Ellestad, 93, died May 21, 1992, at his home in Gastonia, North Carolina, after a year of declining health. He was a pioneer in the field of lithium chemistry and one of the founders of the modern lithium industry. The mineral ellestadite was named for him after he determined its chemical composition during his early years at Minnesota. He retired as director of R & D for the Lithium Corporation of America, now FMC Lithium Division, in 1967, after 25 years of service, but continued to work as a consultant until about 1981. The Ellestad Research Laboratory of Lithium Corporation in Bessemer City, North Carolina, was named in his honor (from C&EN, July 26, 1993.)

Robert P. Hammer (Ph.D. '90, G. Barany), Department of Chemistry, Louisiana State University, Baton Rouge, LA.

I started at LSU as an assistant professor in August, 1992. My research interests include development of new peptide and nucleic acid analogs, and I have obtained support for my research from the ACS/PRF. Karen Hammer is working as a bookkeeper with a local food distributor.

Ada Helleloid (B.A. '75), Bach Christian Hospital, Hazara, Pakistan.

After graduating from CLA, I was accepted at the University of Minnesota's medical school. In my third year, I took advantage of RPAP (Rural Physicians Associate Program), which was excellent preparation for office medicine. I did a three-year family practice residency in Worcester, Massachusetts, followed by a one-year course in Bible at Oak Hills Bible College in Bemidji, Minnesota, while awaiting my visa to Pakistan. I arrived in Pakistan in April, 1983, and had 16 months of nearly full-time Urdu study. I work as a physician in a 50 bed hospital in the foothills of the Himalayas. I work primarily among women and children, both in-patient, with medical, surgical and obstetric patients, as well as the full gamut of out-patient medicine, including some tropical diseases. Relaxation includes hiking, both teaching and playing of the piano and flute, and baking. I have tutored some Pakistani girls in chemistry using English books but speaking and teaching in Urdu to help them understand. I have also learned to understand Hindho, and can speak and understand medical Pashtu. A great pastime here is sitting in homes, drinking tea and visiting in one of the local languages.

Harold E. Hicks (B. Ch.E. '41), retired.

I am enjoying retirement after 40 years with Hercules, Incorporated. Reading, gardening, travel and photography occupy my spare time. I am active in community, church, and other social activities. I married Virginia Calvin Hobson in 1990, a Vanderbilt Ph.D. Our primary activity is searching for and finding out-of-print books, much of which is done by mail. Hello, to my classmates!

William R. Knolle (Ph.D. '70, J. R. Bolton), AT & T Bell Labs, Allentown, Pennsylvania.

I have been with Bell Labs since receiving the Ph.D. I was involved with integrated circuit processing, thin film characterization, infrared spectroscopy, ion implantation, and molecular beam epitaxy. Recently, I switched to industrial hygiene and safety which is a new, challenging field for me.

Kenneth Kustin (Ph.D. '59, P. R. O'Connor), Department of Chemistry, Brandeis University, Waltham, Massachusetts.

I was recently appointed to serve a term on the board of editors of *Inorganic Chemistry*. Previously, I had served on the editorial advisory board of the *International Journal of Chemical Kinetics*, a journal whose editor is another University of Minnesota Department of Chemistry alumnus, **David M. Golden** (Ph.D. '61, B. L. Crawford, Jr.).

Gregory N. Maisel (B. Chem. '79), Twin City Testing Corporation, St. Paul, Minnesota.

W. James Maytum, M.D. (B.S. '47), Venice, California.

In addition to my undergraduate degree in chemistry, I also received a B.A. in journalism from the University of Minnesota in 1951. My M.D. was earned at the University of Pennsylvania, in 1956, and I then obtained a Mayo Foundation fellowship, completed with a specialty in internal medicine in 1960. From then until 1989, I was in private practice of medicine in Westwood and Santa Monica, California. In 1989, I resumed writing and I have a book in progress on the art of finding good food, good medicine and good doctors!

Michelle Mullikin (M.S. '92, S. R. Kass), H. B. Fuller Company, Vadnais Heights, Minnesota.

I am currently working at Fuller's corporate R & D facility, in their non-woven hygienic adhesives lab. We develop adhesives for personal care products, such as

disposable baby diapers, adult incontinent diapers, and feminine care products. On weekends, I teach chemistry classes to eight- to twelve-year olds at the Science Museum of Minnesota.

Lissa T. J. Nelson (M.S. '92, L. H. Pignolet), E. I. Du Pont de Nemours & Co., Wilmington, Delaware.

Constantine S. Papageorgiou (B. Chem. '85), Thessaloniki, Greece.

I finished my Ph.D. in chemistry at the joint doctoral program between the University of California at San Diego and San Diego State University in September, 1993. My thesis topic was laser spectroscopy in analytical chemistry. I am moving back home to my country to serve in the Greek Army and, afterwards, take over my father's hotel business. If you are in Europe, please look me up!

Robert W. Rinehart, Sr. (Ph.D. '59, B. L. Crawford, Jr.), Rinehart Labs, Inc., Arveda, Colorado.

I have been president and owner of Rinehart Labs, Inc., and Consulting Analytical Group, Inc., since 1969. Prior to that, I was a section head at The Upjohn Company, 1959–1962; research scientist at Lockheed Missiles and Space, 1962–1965; and vice president for Huffman Labs, Wheat Ridge, Colorado, 1965–69.

Donald N. Robinson (Ph.D. '59, W. E. Noland), Elf Atochem North America, King of Prussia, Pennsylvania.

I am a staff chemist, doing research and development in fluoropolymers. I have eight patents in the area of fluoroplastics and elastomers. I am grateful for the education I received at Minnesota, particularly to the research training from Wayland Noland.

Rob Rosen (Ph.D. '84, T. R. Hoye), TosoHaas, Montgomeryville, Pennsylvania.

In mid-1993, I joined TosoHaas as the technical service and operations manager. TosoHaas is a joint venture between Rohm & Haas, and Tosoh. We are in the bioseparations business, and are small but growing rapidly.

Our son, Elliot, was born last January, and is quite a handful. Our daughter, Miriam (age 3), hasn't yet been able to figure how to take him apart. Sue recently headed back to work at the New Jersey Department of Environmental Protection and Energy.

June Russell (M.S. '90, P. G. Gassman), Seattle, Washington.

Since receiving my masters in chemistry, I have as yet been unable to obtain a job in a science-related field. After two years, I have essentially given up hope, and have returned to my first love, music. I am currently on a west coast tour as one of the few, and might I add, the best, female Elvis impersonators. I joined the field at the optimum time, with the current upswing in attention to the King due to the issuance of the Elvis stamp on the anniversary of the day he was born. I am based in the northwest, but hope to incorporate more of the U.S. (especially the midwest) into my tour plans for next summer. My ultimate goal is to sing the National Anthem as Elvis during the World Series. Until then, I'll continue to play nightclubs, weddings, and bar mitzvahs.

Hassan Sahouni (Ph.D. '91, T. P. Lodge), 3M Company, St. Paul, Minnesota.

My degree was in polymer physical chemistry. I am currently employed as a senior physical chemist in the polymer physical characterization laboratory in the audio/video technology division.

Susan C. Saltzman (M.S. '62, S. W. Fenton), Saltzman Consulting Services, Inc., Philadelphia, Pennsylvania.

I took an early retirement last year from E. I. Du Pont de Nemours & Co., Inc., after 27 years with them–the last 16 as Hazardous Materials Consultant. I am now president of my own company, specializing in dangerous goods transportation of packaged material, establishing or supplementing corporate compliance systems.

Elmer O. Schlemper (Ph.D. '65, J. D. Britton), Department of Chemistry, University of Missouri, Columbia, Missouri.

I am presently professor of chemistry and chair of my department.

Gerald K. Schynoll (B. Chem. '85).

Between obtaining my IT degree and entering medical school at Columbia University in fall of 1988, I worked as an English teacher in Greece and traveled throughout Europe, the Middle East and Asia. I start a residency in internal medicine in July of 1993, and will pursue a career in international health and development and infectious diseases. Until then, I am traveling in Europe and Africa.

Grant Gill Smith (Ph.D. '49, R. T. Arnold), retired.

Following graduation from the University of Minnesota, I accepted a position at Washington State University (then WSC) where for twelve years I taught organic chemistry and did research. I advanced to the position of Associate Professor with tenure in five years. During the academic year 1956-58 for twelve months I was on sabbatical leave with Professor Derek Barton at Imperial College, University of London.

In September, 1961, I moved to Utah State University Chemistry Department and was advanced to the position of Professor with tenure within the first year. At USU I was awarded two sabbatical leaves. The first, 1969-70, I did research with Professor Carl Djerassi at Stanford in mass spectrometry. From September 1982 to February 1983, I was at the National Research Laboratories, Research School of Chemistry, The Australian National University in Canberra, Australia, with Professor Alan Sargeson, studying the effect of metals on the racemization of amino acids. I continued until mid-September, 1983, carrying out research with Dr. Jaap Boon at the Fundamentals of Matter (FOM) Institute for Atomic and Molecular Physics in Amsterdam. There, I studied the pyrolysis-mass spectroscopy of organic material and applied it to the characterization of living organisms, both plant and animal. During that sabbatical year, I lectured in Australia, Guam, Bangkok, India, and Amsterdam. My wife joined me on this lecture tour.

In 1988, I retired from teaching chemistry, but continued my research for two additional years. I have published approximately 100 refereed papers. In September 1990, I was hired as the director of the International Office for Water Education in the College of Engineering at USU and held this position for two years. Last September, 1992, I retired from all University activity, although some of our research papers are still being published. I was chosen to give the Utah State Faculty Honors Lecture in 1967; I received the Utah Award from the American Chemical Society (ACS) in 1978 and presented an award address. Earlier I served as chairman of the Washington-Idaho Border Section and the Salt Lake Section of the ACS. In 1978 I was president of the Utah Academy of Science, Arts and Letters. The International Organization of Pure and Applied Analytical Pyrolysis in June 1988 awarded me first prize for the paper I presented at their meeting held in Lund, Sweden.

My wife, Phyllis Cook Smith, and I have six children and thirty grandchildren. I stay physically active playing racquetball, swimming, fly fishing, and Alpine skiing on the "Greatest Snow on Earth." Now that I am over seventy, many resorts in Utah provide me with a free annual ski pass allowing me to ski two or three times a week.

I am very proud of my doctoral degree from the University of Minnesota and the training I received from its Chemistry Department. I look forward to returning for a visit someday soon.

We Thank You

Alumni and friends of chemistry have continued to indicate their faith in our programs by their financial support. Donors participate in exactly the kind of cooperation between academia, industry, and the public which will help to ensure the health and growth of all three sectors in the future. Thanks to these individuals and organizations, chemistry has maintained its high ranking among university departments in its level of outside support at a time of severe financial constraints. If you are interested in further information about the various funds, please contact Kathy Ross (612/624-6000). We gratefully acknowledge private donors to the department during the period July, 1992 through June, 1993.

The **Kolthoff Fund**, which since 1979 has supported a lectureship series of the same name, has brought to our campus many distinguished scientists, who spend Kolthoff Lecture week meeting with faculty and students, and also deliver a series of lectures open to the public. This year, we were pleased to feature G. Ertl (Fritz-Haber-Institut, Berlin; Fall, 1992), Karl Weighardt (Ruhr-Universität Bochum, Germany; Winter, 1993), and Robert H. Grubbs (California Institute of Technology; Spring, 1993). Donors were David C. Boyd, Edward F. Levy, Jerome Margulies, John C. McCool, Mary E. A. Mitchell, Yutaka Okinaka, Larry K. Pearson, Chiu Po-Yuen, Patricia A. Rethwill, Sidney M. Schwartzfield, Young-Tzung Shih, and Todd A. Swanson. The **Crawford Fund**, in honor of Regents' Professor Emeritus Bryce L. Crawford, Jr., received a donation from Robert G. and Jane B. Parr. You may be interested to know that during the 1993-94 year, we will be conducting a campaign for donations to this fund in order to institute a yearly lectureship in spectroscopy in honor of the fund's namesake.

The **Chemistry Special Projects Fund** is the general discretionary fund for the department and supports many special activities for which there are no other sources of funding. Our first priority for the use of this fund is fellowship and scholarship support of our students at both the undergraduate and graduate levels. Contributors were Irving M. Abrams, A. Karim Ahmed, C. J. Alexander, Gregory J. Anderson, Harold J. Andrews, Robert G. Andrus, John J. Baldwin, Gary W. Barfknecht, Jonathan L. Bass, Robert L. Batdorf, Wadim Batorewicz, Leonard F. Bjeldanes, Maynard A. Brandt, Nicolas Brodoway, William E. Brown, Albert V. Buettner, Richard O. Burmeister, Jr., Robert B. Carlin, Eugene J. Carlson, Sylvia A. and Joseph J. Casby, Charles J. Cerjan, Kuang-Chou Chang, Yeh M. Chow, Henry B. Clark, III, Matthew C. Comstock, Leonard J. Czuba, Darwin D. Davis, Michael J. Dipierro, Daniel H. Doughty, Richard E. Duvall, John A. Edgar, David C. Egberg, Gilbert L. Eian, James A. Elberling, Bentley W. Elliott, Lori S. H. Enrico, Ronald J. Eshleman, Milton H. Fischer, Steven R. Flom, Mary Lou Gantzer, Olie R. Garrison, Timothy P. Gibbs, James H. Gibson, Don D. Gilbert, Norman W. and Joan L. Gill, John M. Gliesner, Robert A. Goodman, Milton J. Gorham, David B. Gorman, Winston G. Granger, Thomas L. Guggenheim, William H. Gumprecht, Frederick J. Gustafson, Ho Gyeom and Myeong Hee Jang, Ben E. Hallaway, David A. Halsrud, Maxine B. Hancock, Michael J. Hansel, Curtis D. Hargadine, Kurt E. and Beth A. Heikkila, Mattie H. Helwig, Steven G. Hentges, Philip B. Herman, Gerald V. Hier, Robert E. Hileman, Otto J. Hill, Charles W. Hobbs, Ann G. and Milton L. Hoefle, Allan M. Huffman, Carolyn E. Hughes, Henry V. Isaacson, E. Harry Jancis, Michael Jarcho, Colin J. Jellish, Rosemary M. Jellish, Bryan M. Jewison, Charles D. Johnson, Roger D. Johnson, Roy A. Johnson, Thomas H. Johnson, Alan and Judith Johnston, Michael J. Joncich, Patrick J. Juenemann, Theresa M. and Dennis J. Kelly, III, Paul J. Killian, Duckee Kim, Michael A. Knoll, Paul F. Korkowski, Kenneth E. Kosel, Lester C. Krogh, Roger W. Kwong, Lawrence L. Landucci, Robert A. Larsen, William A. Larson, Paul M. Leach, Richard J. Legare, Steven C. Lien, Juei-Hua Lin, Robert M. Lindquist, Louis J. Ling, Chien-Pen Lo, Thomas W. Lorsbach, Rickard H. Malmberg, Brian J. Martin, Mark W. Martinson, Bruce M. Mattson, James H. Maysilles, Donald J. McClure, John A. Melin, Jerry K. Miller, Thomas C. Miller, Robert F. Modler, Lyn Camarano Moodie, Emmet B. Moore, Jr., William J. Mueller, Ann M. Mueting, Laurence A. Nafie, John G. Newman, Lawrence A. Nielsen, Carmen I. Nitsche, James A. O'Rourke, Gary V. Olhoft, Peter C. Olson, Paul K. Overbeck, Marion and Kenneth Owens, Rudolph Pariser, Helen M. Parker, Lynda L. Parrella, George W. Parshall, Steven E. Poss, William F. Prigge, Bo Qi, Floyd L. Ramp, Joel H. Rapaich, Anthony J. Razel, Janet S. Redman, Michael D. Rein, Edgar E. Renfrew, Norman C. Reynolds, Jr., Aloyce J. Rholl, Dale L. Rieger, Donald N. Robinson, William P. Schrader, Joseph D. Schroeder, John L. Schultz, Francis A. Schurb, Kirby J. Scott, Richard S. Smith, Richard V. Soderberg, Jane B. Spence, Roger C. Splinter, Peter A. Steck, Vernon A. Stenger, Robert E. and Debra R. Stevens, Catherine C. Stone, Melvin P. Stulberg, Richard J. Sundberg, Jerome D. Swalen, April J. Swanson, John J. Talley, Kenneth J. Tauer, Martin J. Tenenbaum, Roy W. H. Tess, Donald R. Theissen, Leigh S. Thomas, Steven J. Tinker, Joseph R. Tome, Daniel L. Torgersen, Charles A. Triplett, David W. Tweeten, Sarah A. Veldman, Richard E. Volkmann, Elizabeth R. and James J. Wade, Terence C. Wagenknecht, Donald E. Wald, Hsien Hau Wang, Victor K. Wang, Steven R. Wann, John B. Welch, III, Kenneth J. Welch, Edward O. Welke, Ann M. Wolf, Ellen L. Wu, Meigang Yet, Lucinda E. Yinger, Lee R. Zehner, Patrick G. Zimmerman, and Janet L. Zuffa.

Memorial funds, established as fitting remembrance of faculty members and students associated with this department, are designated primarily for our undergraduate chemistry student awards program. Funds and donors in 1992-93 were: The **Peteris Auzins Memorial Scholarship Fund**: William C. O'Mara. The **Robert C. Brasted Memorial Fund**: Arthur K. Nelson, Judson S. and Patricia B. Pond, and G. Paul Richter. The **Thomas P. Du Bruil Memorial Fund**: Ann C. Brey and Paul D. Brey. The **Margaret Etter Memorial Lectureship in Materials Chemistry Fund**: Barbara G. and George Barany, Mary W. Baum/Merck & Co., Peter A. and Sandra B. Beak, Udo H. Brinker/24th Reaction Mechanisms Conference, Doyle and Judith G. Britton, Barbara A. Bugg, Cynthia J. Burrows, Penelope A. Chaloner, James S. Chickos, Anthony W. Czarnik, Francois Diederich, Raymond M. Dodson, William L. Duax, David F. and Carroll P. Eaton, Judith L. Flippen-Anderson, Craig J. Forsyth and Karin Musier-Forsyth, Jerilyn J. Fosdick, Samuel H. Gellman, W. Ronald and Sharron R. Gentry, Wayne and Elizabeth Gladfelter, William B. Gleason, C. H. Gorbitz, M. Hamolsky and D. Hilvert/Scripps Research, Richard L. Harlow, David J. Hart, Dudley R. Herschbach, Mark D. Hollingsworth, M. S. Hunt/Eli Lilly, Lester T. Jones/3M, M. and S. Hockaday Jones, Jr., Olga Kennard/Cambridge Crystallographic Data Centre, Jeremy R. Knowles, Maurice M. Kreevoy, Jan Kroon/Sticht International Hydrogen Bond Conference, Jean-Marie Lehn, Kenneth R. and Doreen G. Leopold, Timothy P. and Susanna Lodge, A. Mac Lachlan/Du Pont, J. Michael McBride, Cal Y. Meyers, Patrice A. Morrow, Richard A. Newmark, Wayland E. Noland, Stanley J. Opella, Gregory A. Petsko, Philip S. Portoghese, Debra J. and Lawrence Que, Jr., Susan M. Reutzel, Jacob F. and Jane Schaefer, Richard L. Schowen, G. and G. L. Scoles, Elizabeth and Howard Simmons, Jr., Samuel Smith, Arno F. Spatola, S. Staley and M. Waugh, Charles E. Strouse/Crystal

Logic Inc., Galen and Kaaren Stucky, Muttaiya and Indra Sundaralingam, Fumio Toda, Kenneth N. Trueblood, Regitze E. Vold, Charles G. Wade, Robert C. West, and Rita Williams/Honeywell. The **Gassman Lectureship Fund**: Karen L. Andalman/Managed Care Concepts Inc., Victor G. and Nancy C. Badding, Alfred Bader, Barbara G. and George Barany, Peter A. and Sandra B. Beak, Mrs. James Ford Bell, Jr., Robert G. and Wendy S. Bergman, Newman M. Bortnick, Doyle and Judith Britton, Robert G. and Marcia S. Bryant, Michael P. and Esther L. Cava, Robert D. and Joan M. Church, Xavier and Elizabeth Creary, John K. Crum/American Chemical Society, A. J. D'Ambra/North American Vaccine Inc., Bernard Darre, Roy C. De Selms, Joseph A. and Lavada Jo M. Dixon, Norma J. Donovan, Timothy Donovan, H. Roger Drewes and K. P. Schodt, Debra A. Dykhuis, Warren and Adele Eidsness, Ernest L. Eliel, William F. Erman, Ellis Kirby Fields, Laurel A. Flebotte, Christopher S. Foote, Patricia Galloway, John F. and Gail S. Gislason, Jr., Arne E. Gomsi, David B. and Linda J. S. Gorman, Robert E. and Nancy L. Granrud, Gary R. Gray, J. Groth, June Ann and James A. Guldan, Timothy J. and Joyce B. Hall, Patrick E. Hanna, Marie A. Harrington, Laurie L. Hayes, Beth A. and Kurt E. Heikkila, S. Allen and Barbara G. Heininger, Kendall N. Houk, Steven E. Husebye, Elizabeth N. and William M. Jones, Joseph M. Kamrad, Jr., Antonius M. and Marty Kies, Milton A. and Esther C. Klayum, Marion G. and Gary Klein, Arthur F. and Susan C. Kluge, John J. and Diane O. Kobunski, Chang K. and Insook Han Lee, Sung J. Lee, Sheila S. Leete, J. Ivan Legg, Fred C. Levitt/Council for Chemical Research, Mrs. James C. Lewis, Tom and June H. Livinghouse, J. Robert Lovett, Arthur F. Luedtke/American Institute of Chemical Engineers, Christine M. Lundby, Helmut K. and Mary P. Maier, Christine L. and Kent R. Mann, C. Alden and Karin Mead, Edward J. and Katherine H. Meehan, Edward P. and June F. Ney, Angela M. and Gerald P. Nichols, Takeshi Nikai (on behalf of various donors), John A. and Lois A. Nikora, John Nystul, Steven and Sarah L. O'Brien, Neil J. and Choon Sam O'Reilly, Kentaro Okuma, Louis H. and Inger Pignolet, Timothy B. and M. Lucile Plunkett, Christine and Philip Portoghese, Gary Proehl and Jane Lanphear, Kathleen A. and Gregory M. Quitter, Nancy and Thomas Raich, James D. and Catherine L. Reed, Louise B. Reinhardt, Richard J. Riehle, Frederick R.Riehm/Minnesota Science Teachers Association Inc., David J. and Susan M. Rislove, Ken K. Robinson, A. Truman Schwartz, James A. and Gail B. Schwindeman, James A. Scozzie/Ricerca Inc., Stephanie and James Shields, Jr., Tami I. Spector, Peter J. and Christine S. Stang, Lenora E. and Joseph W. Steman, D. J. Stepka/Erico Products Inc., Henry C. and Jean Stevens, Malcolm and Marcia Stevens, Nancy T. Stolpestad, David and Sylvia Storvick, Catherine Swigon/FMC, Fred R. Taylor/PPG Industries, PatrickToy (on behalf of various donors), James A. Vellenga, B. and S. Elin Wagner, William N. and Hilda S. White, Frank J. Williams, III, Donald T. Witiak, and Wayne C. and Mary L. Wolsey.

The **Lloyd W. Goerke Fund**, which is dedicated to undergraduate scholarships, received a donation from Lloyd W. Goerke.

Industrial grants, frequently unrestricted, allow us to continue a number of essential programs, such as summer support for graduate students, matching funds for equipment proposals and summer pre-college minority laboratory experiences, and laboratory set-up contributions for new faculty. Unrestricted donations also allow for the provision of seed money for new initiatives. On occasion, industrial contributions are designated to support the research programs of specific faculty, or for special areas of interest, such as advanced materials research. Our thanks to the following companies and their educational foundations: 3M, Amoco, Dow Chemical, Du Pont, Eastman Chemical, Eastman Kodak, Eli Lilly, General Mills, Hercules, Rohm & Haas, Shell Oil, and Union Carbide. A special thanks is due to Hewlett Packard Co. for their gift-in-kind donation of computer equipment.

Matching programs, with ratios varying from one-to-one to three-to-one, are offered by companies to stimulate giving on the part of their employees and have the added advantage of promoting consistency of corporate giving with public opinion. We thank these companies for their matches: 3M, Abbott Labs, Alza, Amoco, Corning, Cray Research, Dow Chemical, Ecolabs, General Electric, IBM, IDS, Merck, Mobil, NSP, Pfizer, Shell Oil, Tennant, Texaco, and Upjohn.

Ovations

During the past year, faculty and staff received honors and awards from sources both internal and external. We are pleased to share their various accomplishments with you.

Professor **Pete Carr** received the 1993 Eastern Analytical Symposium Award in Separation Science.

Professor **Steven Kass** was selected as an Alfred P. Sloan Research Fellow. This two-year award, providing flexible research support, is extraordinarily competitive, involving nominations for the very best young scientists from around the country.

Professor **Ben Liu** was awarded the 1993 ACS Carbohydrate Chemistry Division Horace S. Isbell Award.

Professor **Tim Lodge** shared the 1993 George Taylor Award for Research with professor **Frank Bates** of Chemical Engineering and Materials Science.

Professor **Larry Miller** received the Horace T. Morse-Minnesota Alumni Award for Outstanding Contributions to Undergraduate Education.

Professor **Karin Musier-Forsyth** was selected as one of ten University of Minnesota McKnight-Land Grant Professors. The McKnight program offers research support for the two years of the professorship, along with teaching relief for one of the two years.

Professor **Lou Pignolet** was selected by the Minnesota Science Teachers Association as the MSTA-MAS 1992 Teacher of the Year in the college category for his exceptional involvement and excellence in teaching.

Professor **Scott Rychnovsky** received two industrial awards this year, the Cyanamid Faculty Award for 1992, and the Young Faculty Award from Pfizer Research Awards for Synthetic Organic Chemistry. Both of these awards provide unrestricted support for research and scholarly activities.

Professor **Hal Swofford** received the Best Chemistry Professor award from the IT Student Board.

Professor **Bill Tolman** was named a 1993 National Science Foundation Young Investigator in Chemistry, an award which carries unrestricted funding for research.

Professor **Donald Truhlar** received one of three new, prestigious Institute of Technology Professorships. These were established to recognize distinguished faculty members within the institute who are judged to be exceptional through unusual efforts in, and contributions to, teaching, through their reputation in the scholarly field, and through a genuine commitment to the Institute of Technology and its activities.

Among our staff, **Stephanie Miller** received the 1993 John Tate Award for Excellence in Undergraduate Advising. The Institute of Technology's Civil Service Outstanding Service Award program this year honored **Heather Bobbitt** (Principal Accounts Specialist) and **David B. Johnston** (Assistant Scientist).

Kent Mann

Pollution Prevented, Efforts Rewarded

The Department of Chemistry was honored (along with the University's Department of Environmental Health and Safety) by the State of Minnesota Governor's office for its efforts to reduce laboratory hazardous waste. Professor **Kent Mann**, Director of Undergraduate Laboratories, was recognized for his work by the Minnesota Governor's Award for Excellence in Pollution Prevention, presented by Governor Arne Carlson on June 17, 1993, at the Third Annual Office of Waste Management Pollution Prevention Conference in Brooklyn Park, Minnesota. The award recognizes "Minnesota businesses, public institutions, organizations, and individuals using creative approaches to reduce the use and release of hazardous and toxic materials at the source."

Mann rewrote all of the Chemistry Department's entry level laboratory experiments, so that they do not generate any hazardous waste. A few of the experiments do have steps which generate a hazardous waste, but students then deactivate the waste to render it nonhazardous. The deactivation steps were used to teach students about oxidation-reduction chemistry. This work, partially funded by a grant from the Office of Waste Management, reduced the amount of heavy metal and oxidizer waste coming out of the Chemistry Department by 6,000 kilograms per year, saving the University an estimated $35,000 annually.

Fourth Annual Chemistry Day

On November 6, 1993, the Department of Chemistry hosted its fourth annual "Chemistry Day." These Saturday events are designed as a forum for interaction between the Department of Chemistry, local colleges and industries, and local high school students and their teachers. This year's activities were organized by **Lou Pignolet**, **Stephanie Miller**, **Wayne Gladfelter**, **Kent Mann**, **Pete Carr**, and **Craig Forsyth**, and were funded entirely by the Department of Chemistry, although tickets were sold just to help defray the cost of providing lunch–a total of 450 tickets were sold!

The morning program featured the fifth annual Larry Conroy Memorial lecture, which was presented by Professor **Marye Anne Fox** of the University of Texas-Austin (also our fall quarter Kolthoff Lecturer). The title of her talk was "A Chemist's Approach to Improving the Environment." Following lunch, there was an open house, with an abundance of chemistry exhibits, demonstrations, and shows, throughout the first and second floors of Smith Hall. The chemistry outreach group conducted chemical demonstrations, and guided tours of the research facilities led by faculty left the lobby of Smith Hall every fifteen minutes. Fourteen schools participated in the event, while six local high schools (Blaine, Como Park, Duluth East, Princeton, St. Louis Park, and Woodbury) participated in the demonstrations: a total of 32 high school demonstrations, involving 66 people, were performed. Representatives from the Center for Interfacial Engineering, ECOLAB, Inc., Envirostaff, Gustavus Adolphus, Hamline, Macalester, the Metropolitan Waste Commission, and the College of St. Thomas were also in attendance. The day was concluded with a drawing for door prizes consisting of tee-shirts (complete with the logo, "Science equals fun" as a math equation), and as far as anyone can tell, the day was an overwhelming success for all concerned!

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Chemistry Students Recognized

Graduate and undergraduate honors and awards are an integral part of our program at Minnesota. Such recognition provides our students with tangible indications of their achievements. We have many annual award programs administered by the department, and available to chemistry majors and advanced degree candidates. These are sponsored by our friends in industry or supported by memorial funds, and we thank the generous contributors who make them possible. We are pleased to pass along information on this year's student honors. Undergraduates are listed first, and graduate students second.

General Mills Scholarship, awarded by the Technology and Operations Division of General Mills for a chemistry major: **Daniel LeCloux**. G. B. Heisig Undergraduate Research Fellowship–$1,500 fellowship awarded to advanced undergraduate students who have demonstrated outstanding achievement in undergraduate research in addition to overall scholastic excellence: **Brant Kedrowski**, **Brent Nielsen**, and **Paul Fischer**. Lloyd W. Goerke Scholarship–$1,000 awards to chemistry majors who have shown outstanding academic achievement and who have financial need: **Mark Aubart**. Robert C. Brasted Memorial Fellowship–$800 fellowship, as well as a part time apprenticeship in the department's general chemistry program, awarded to outstanding chemistry majors who have expressed an interest in a teaching career in chemistry: **Alison Eckhoff**. M. Cannon Sneed Scholarship–$600 award for chemistry majors who demonstrate great promise for future achievement: **Panna Dhond**. Chemistry Alumni and Faculty Scholarship–$500 award for a freshman chemistry major who has demonstrated outstanding academic achievement, funds donated by alumni of the department and by faculty: **Derek Sabatke**. Thomas Du Bruil Undergraduate Research Award, a $100 prize for an undergraduate student who has demonstrated outstanding achievement in undergraduate research in chemistry at the sophomore or junior level: **Carmen Rehder** and **Jack Wiley**. Eli Lilly Undergraduate Award, a $300 award for a sophomore or junior chemistry major who has an interest in a career in industry and who has shown outstanding academic achievement, made in the form of a check to the University Bookstores for the purchase of books and supplies: **Michael DeBrule**. J. Lewis Maynard Memorial Prize in Advanced Inorganic Chemistry–$100 cash award for the purchase of books, given for outstanding scholastic achievement in advanced inorganic chemistry: **Brant Kedrowski**. Walter M. Lauer Prize–$100 cash award for the purchase of books, for advanced undergraduate chemistry majors with distinguished academic records who have demonstrated strong interest in organic chemistry: **Robert Adcock**. CRC Freshman Chemistry Achievement Award sponsored by the CRC Press, Inc.–the latest CRC Handbook of Chemistry and Physics, given to freshman chemistry majors for outstanding achievement in freshman chemistry: **David Cole Hanson**. Merck Index Award sponsored by Merck & Co., Inc.–latest edition of the Merck Index, given to sophomore chemistry majors for outstanding scholastic achievement in organic chemistry: **Paul Bedrosian**. Undergraduate Award in Analytical Chemistry, sponsored by the Division of Analytical Chemistry of the American Chemical Society–a year's subscription to the journal Analytical Chemistry, given for outstanding scholastic achievement in analytical chemistry: **Brian Mader**. The American Institute of Chemists Foundation Award honors an outstanding senior, selected by the department based on ability, character, scholastic achievement and potential advancement in the chemical professions: **Steve Gerst**.

Other undergraduate students succeeded in competition for external awards. **Edris Sahar** was selected for science aptitude and promise in research with award of the 1993 Sigma Xi Thomas F. Andrews Prize. **Brant Kedrowski** won the 1993 Sigma Xi George T. Walker Prize based upon the same criteria. These are both cash prizes of $150, sponsored by Sigma Xi, the scientific research society.

Among our graduate students, teaching assistants **Laura Iverson** and **Bridget Killion** were recognized by the Robert L. Ferm Memorial Award for outstanding TA of the year. This award is sponsored by Pillsbury, and its parent company, Grand Metropolitan PLC, and consists of a cash prize. In the words of a senior research chemist at Pillsbury who participated in the June, 1993 award ceremony, the two awardees were "recognized by students who write urgently of teaching skills too easily overlooked, too quickly forgotten: preparation, expectations, enthusiasm, lab safety, chemical knowledge and patience." **Bill Burns** received the first annual Analytical Teaching Assistant Award.

Graduate students holding academic year corporate fellowships were: **Mark Munson**–Amoco; **Weiping Hu**–Dow; **Elizabeth Ottinger**–Du Pont; and **Jerry Gargulak**–Hercules. **Marc Ferrer** continued his Fulbright Fellowship. **Jennifer Bilunas** held a First-Year NSF Fellowship, and **George Griesgraber**, an ongoing NSF Fellowship. A Graduate School Dissertation Fellowship was held by **Joseph Suriano**. A First-Year Graduate School Fellowship was held by **Mark Vitha**, and a First-Year Graduate School Minority Fellowship was held by **Majula Canagaratna**. Finally, First-Year Departmental Fellowships were held by **Paul Jackson**, **David Graf**, **Jason Halfen**, **Michael Hare**, and **Sara Zimmerman**.

Paul Deck was awarded a National Science Foundation Postdoctoral Fellowship, one of about twenty given nationally, for research in the laboratory of Tobin Marks at Northwestern University.

Elise Sudbeck received the Paulina Prize for the best student poster at the meeting of the American Crystallographic Association in June, 1993.

Congratulations to all of our fine students!

Recent Department of Chemistry Graduates

Congratulations to our recent degree recipients, who were granted their degrees during the period from July 1, 1992 to June 30, 1993. Columns reading from left to right are name of graduate, research advisor, thesis title and current place of employment.

PH.D. DEGREES

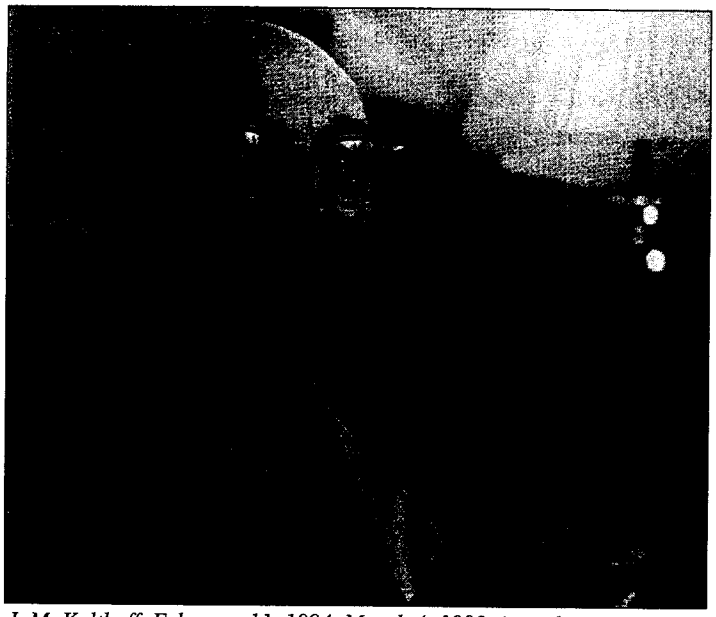
Ashfaq A. Bengali	D. Leopold	*"Laser photoelectron spectroscopy of gas phase organometallic and organosilicon anions"*	Postdoctoral, Dept. of Chemistry, Univ. of California, Berkeley, CA
David Walter Blackburn	Ellis	*"Highly reduced organometallics of the group IV elements"*	Assistant Professor, Allegheny College, Dept. of Chemistry, Meadville, PA
Chun-Lin Cheng	D. Leopold	*"Laser photoelectron spectroscopy of organometallic anions"*	Staff Scientist, Institute of Physics, Academia Sinica, Nan-Kang, Taipei, Taiwan
Phillip Kim Chou	Kass	*"Reactive species in the gas phase: a variable temperature flowing afterglow study on the formation, reactivity, and stability of carbanions and radical anions"*	Postdoctoral, Purdue Univ., Dept. of Chemistry, West Lafayette, IN
Thomas Michael Clausen	W. Miller	*"Rheology of rod/random coil polymer systems, and interpenetrating networks"*	3M Company, St. Paul, MN
Annelo John D'Ambra	Gray	*"Analysis by the reductive-cleavage method of complex carbohydrates containing 2-acetamido-2-deoxyhexopyranosyl residues"*	AmVax Inc., Beltsville, MD
Paul Anselm Deck	Gassman	*"Electron-deficient arenes as transition metal ligands"*	Postdoctoral, Northwestern Univ., Dept. of Chemistry, Evanston, IL
Jonathan Paul Dick	D. Leopold	*"Laser negative ion photoelectron spectroscopy of coordinatively unsaturated rhenium carbonyls"*	Assistant Professor, Fresno Pacific College, Fresno, CA
Michael Allen Dvorak	K. Leopold	*"Far infrared spectroscopy of van der Waals complexes and the microwave elucidation of a quasi-covalent system"*	Postdoctoral, Dept. of Chemical Engineering, Univ. of Minnesota, Minneapolis, MN
David Irvin Eikens	Carr	*"Applicability of theoretical and semi-empirical models for predicting infinite dilution activity coefficients"*	Cargill, Analytical Services, Minnetonka, MN
Michel Marie Fidler	Kariv-Miller	*"Investigation of antimony as an electrode for organic reductions: characterization and properties"*	GNB Battery Technology, Mendota Heights, MN
Daniel A. Freedman	Mann	*"1. Investigations of thermal and photochemical arene displacement reactions from ruthenium and osium arene complexes. 2. Photochemical carbon-hydrogen bond activation via the photolysis of iridium (III) azide and oxalate complexes"*	Assistant Professor, Div. of Natural Sciences and Mathematics, Bard College, Annandale-on-Hudson, NY
Abhik Ghosh	Gassman	*"X-ray photoelectron spectroscopic and* ab initio *computational study of substituent effects in tetrapyrroles"*	Postdoctoral, Dept. of Chemistry, Univ. of Minnesota, Minneapolis, MN
Eric Gary Gunderson	Kariv-Miller	*"Organic electrochemistry at tin cathodes, synthesis and kinetics"*	Waste Research & Reclamation, Eau Claire, WI
Paul R. Hanson	Hoye	*"Studies on the stereochemistry of the annonaceous acetogenins: the total synthesis of* hexepi-*uvaricin and ent-*bullatacin"	Postdoctoral, Dept. of Chemistry, Stanford Univ., Stanford, CA
Michael Gerard Hill	Mann	*"The development and application of spectroelectrochemical methods to the study of binuclear complexes of rhodium and iridium"*	Postdoctoral, Div. of Chemistry and Chemical Engineering, California Institute of Technology, Pasadena, CA
Alan Edward Johnson	Barbara	*"Ultrafast spectroscopy of reaction coordinate motion in solution"*	Postdoctoral, Dept. of Chemistry, Univ. of Rochester, Rochester, NY
Steven Douglas Jons	Gentry	*"Crossed molecular beam studies of state-to-state rotational, vibrational and electronic energy transfer in collisions of glyoxal, iodine, and nitric oxide"*	Dow Chemical Co., Midland, MI
Michael James Konkel	Noland	*"Diels-Alder reactions of 3-(2-nitrovinyl)indoles"*	Postdoctoral, Dept. of Medicinal Chemistry, Univ. of Minnesotsa, Minneapolis, MN
Ming-Tain Lai	Liu	*"Mechanistic study of the inactivation of medium chain acyl-coA dehydrogenase by (methylenecyclopropane) acetyl-coA: molecular basis of Jamaican vomiting sickness"*	Postdoctoral, Dept. of Chemistry, MIT, Cambridge, MA
Jianjun Li	Carr	*"Solvatochromic and thermodynamic studies of retention in gas chromatography and gas-liquid equilibria"*	Procter & Gamble Co., Miami Valley Labs, Cincinnati, OH
Charles A. Liberko	L. Miller	*"The electronic structure and optical properties of organic mixed valence anion radicals"*	Postdoctoral, Chemistry Dept., Univ. of Colorado, Boulder, CO
Yi-Ping Liu	Truhlar	*"Modeling the dynamics of chemical reactions involving multidimensional tunneling"*	Postdoctoral, Brookhaven National Laboratory, Upton, NY
Stanley F. Lo	Liu	*"Cloning and characterization of the CDP-6-deoxy(-$\Delta^{3,4}$-)glucoseen reductase gene"*	Postdoctoral, Dept. of Pathology & Internal Medicine, Washington Univ., St. Louis, MO
John Carkhuff Macdonald	Etter	*"Hydrogen-bonded aggregates: imidazole as a hydrogen-bond director with applications toward the design of solid-state materials"*	Postdoctoral, Dept. of Chemistry, Harvard Univ., Cambridge, MA
Daniel Edward Mickus	Rychnovsky	*"The total synthesis of the unnatural enantiomer of cholesterol and its interaction with amphotericin B"*	Senior Research Chemist, 3M Company, St. Paul, MN
Seng Poon Ong	Liu	*"The synthesis of substrate analogs and their interactions with ribonucleotide reductase from* corynebacterium nephridii"	Postdoctoral, Dept. of Molecular Biology, Univ. of Stockholm, Sweden

Mei Qi	Gray	*"Separation and evaluation of immunostimulatory property of peptidoglycolipid formed as a result of processing of bacterial cell walls by macrophages"*	Postdoctoral, Dept. of Pharmacology, Univ. of Minnesota, Minneapolis, MN
John Joseph Rabasco	Kass	*"Regio- and stereoselectivity in gas phase 1,2- and 1,4-elimination reactions: the synthesis of stereospecifically deuterium labeled methoxycyclohexenes and 1-(trimethylsilyl) fluorethylene: a flowing afterglow study"*	Research Scientist, Air Products & Chemicals, Allentown, PA
Scott W. Reeve	K. Leopold	*"Far infrared and microwave spectroscopic examination of weakly bound molecular complexes: potential energy surfaces and internal dynamics"*	Postdoctoral, Naval Weapons Research Center, China Lake, CA
Epaminondas Rosa	Dahler	*"Kinetic theory of a suspension of spherical colloidal particles and elasticity and static scattering function of ideal polymer chains"*	Postdoctoral, Departamento de Fisica, Universidade Federal do Parana, Centro Politecnio, Curitiba, Brazil
Christine R. Rozanas	Gray	*"Part 1: Selective reductive cleavage of esterified carbohydrates. Part 2: Synthesis and characterization of authentic standards for the analysis of ribofuranose-containing carbohydrates by the reductive-cleavage method"*	Vector Laboratories, Burlingame, CA
Yoshihide Senzaki	Gladfelter	*"Chemical vapor deposition (CVD) of thin films for electronic materials"*	Postdoctoral, Dept. of Chemistry, Univ. of New Mexico, Albuquerque, NM
Judith Silk Sherman	Gray	*"Reductive cleavage analysis of polysaccharides bearing ester substituents"*	Chemistry Instructor, Mathematics and Science Div., Minneapolis Community College, Minneapolis, MN
Donald James Skalitzky	Rychnovsky	*"The development of 1,3-diol synthons and the elucidation of the stereochemistry of the macrolactins"*	Postdoctoral, Dept. of Chemistry, Stanford Univ., Stanford, CA
Maoee Tsen	Evans	*"Study of the plasma oxidation of thin metal films by X-ray photoelectron spectroscopy and quartz crystal microbalance"*	Postdoctoral, Dept. of Chemistry, Univ. of Minnesota, Minneapolis, MN
Michael Unekis	Truhlar	*"Quasiclassical and quantum mechanical studies of intermolecular energy transfer"*	Researcher, Ballistic Research Labs, Aberdeen Proving Grounds, MD
Shankar Venkatraman	Noland	*"Cycloaddition reactions of isatogens and their analogs"*	Postdoctoral, Dept. of Medicinal Chemistry, Univ. of Minnesota, Minneapolis, MN
Leeyih Wang	W. Miller	*"Polymer latex particles - preparation, characterization, and coating patterns"*	Center for Condensed Matter Sciences, Nat'l Taiwan Univ., Taipei, Taiwan
James Thomas Wolter	Evans	*"Reactions of oxygen and cyclic hydrocarbons in radio frequency glow discharge"*	3M Company, St. Paul, MN
Beingkung Yao	W. Miller	*"The adsorption and desorption of water-soluble polymers onto polystyrene latex particles"*	Polaroid Corp., Boston, MA

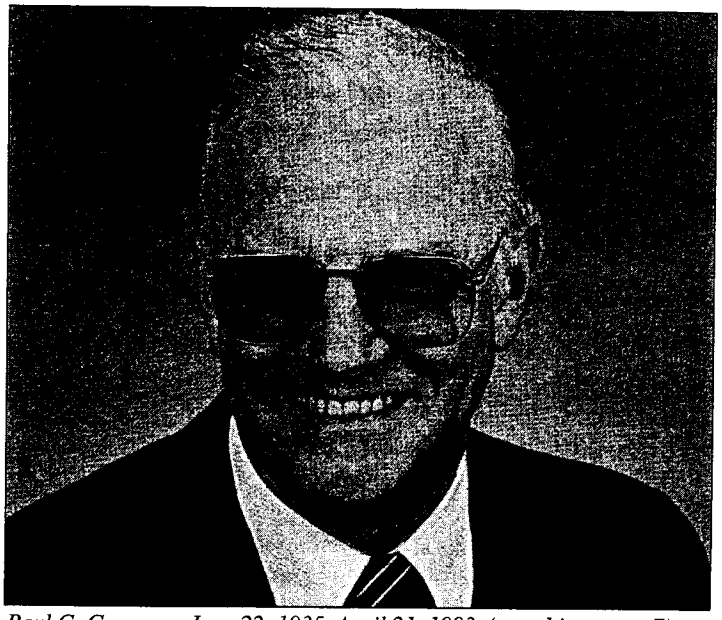
MASTER'S DEGREES

Mark William Arriola	Raftery	*"Synthesis of acetylcholine analogs"*	Pfizer, Groton, CT
Kathy Lynn Carlson	Raftery	*"Microbore high-performance liquid chromatographic analysis of cyclosporin from blood, bile, and tissue"*	General Mills, Golden Valley, MN
David William Gohl	Evans	*"Reactive adsorption studies of poly(methacrylic acid) on pristine nickel oxide surfaces using infrared reflection-absorption spectroscopy"*	EcoLabs, Minneapolis, MN
Richard Dale Hoffman	Gladfelter	*"Catalytic processes involving a novel biruthenium catalyst: carbonylation, dehyrogenation, hydrogenation reactions"*	Eli Lilly, Indianapolis, IN
Jasmina Hranisavljevic	Pignolet	*"Chemistry of mixed-metal-gold clusters with isonitrile ligands"*	Graduate Student, Dept. of Chemical Engineering, Rensselaer Polytechnic Inst., Troy, NY
Michelle Renee Mullikin	Kass	*(non-research plan)*	H.B. Fuller, Vadnais Heights, MN
Lissa Taka-Jennings Nelson	Pignolet	*"The synthesis and characterization of large metal clusters containing gold and/or palladium"*	Research Chemist, Du Pont, Willmington, DE

BACHELOR'S DEGREES with a major in chemistry were granted during this same period to:
Michael B. Armstrong (*Summa Cum Laude*), Mark A. Aubart (*Summa Cum Laude*), Kristine E. Burkhalter, Hojoon Cha, Yulan Chen (*with Distinction*), Paul J. Fischer (*Summa Cum Laude*), Brian T. Frink, Steven G. Gerst (*Summa Cum Laude*), Richard K. Harris, Sean D. Harvatine, Hideki Kawai (*with High Distinction*), Wade V. Konze, David L. Kropacek, Daniel D. Le Cloux (*Cum Laude*), Christina C. Lindberg, Bryan E. Lloyd, Brian Mader (*Cum Laude*), John R. Mansergh, Alan M. Miller (*with High Distinction*), Michael J. Nesler (*with High Distinction*), Canh-Nhan Nguyen-Minh, Brent A. Nielsen (*with High Distinction*), Maria L. Roemhildt, Jeanette M. Stallons (*with High Distinction*), Robert A. Stavenger, David G. Swanson (*with High Distinction*), Donald A. Swenson, Phi Hung Tran, Jolene M. Van Der Hagen, Kathryn A. Vidlock, Alan K. Wodarski, and Kurt S. Zabel.



I. M. Kolthoff, February 11, 1894–March 4, 1993 (see obituary, p.7)



Paul G. Gassman, June 22, 1935–April 21, 1993 (see obituary, p. 7)

PAUL G. GASSMAN MEMORIAL FUND

With characteristic thoroughness and foresight, "Doc" himself indicated his wishes in advance: a series of lectureships in organic chemistry will be established in his name. A research fund held by Professor Gassman has been converted to this purpose, and contributions to the endowment may be made by check payable to the University of Minnesota Foundation, marked for the Gassman Memorial, and sent to the Foundation at 1300 South Second Street, Suite 200, Minneapolis, MN 55454-1029.

MINNESOTA CHEMISTS NEWSLETTER
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