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Badger Chemist

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THE NEWSLETTER OF
THE UNIVERSITY OF WISCONSIN-MADISON

CHEMISTRY DEPARTMENT

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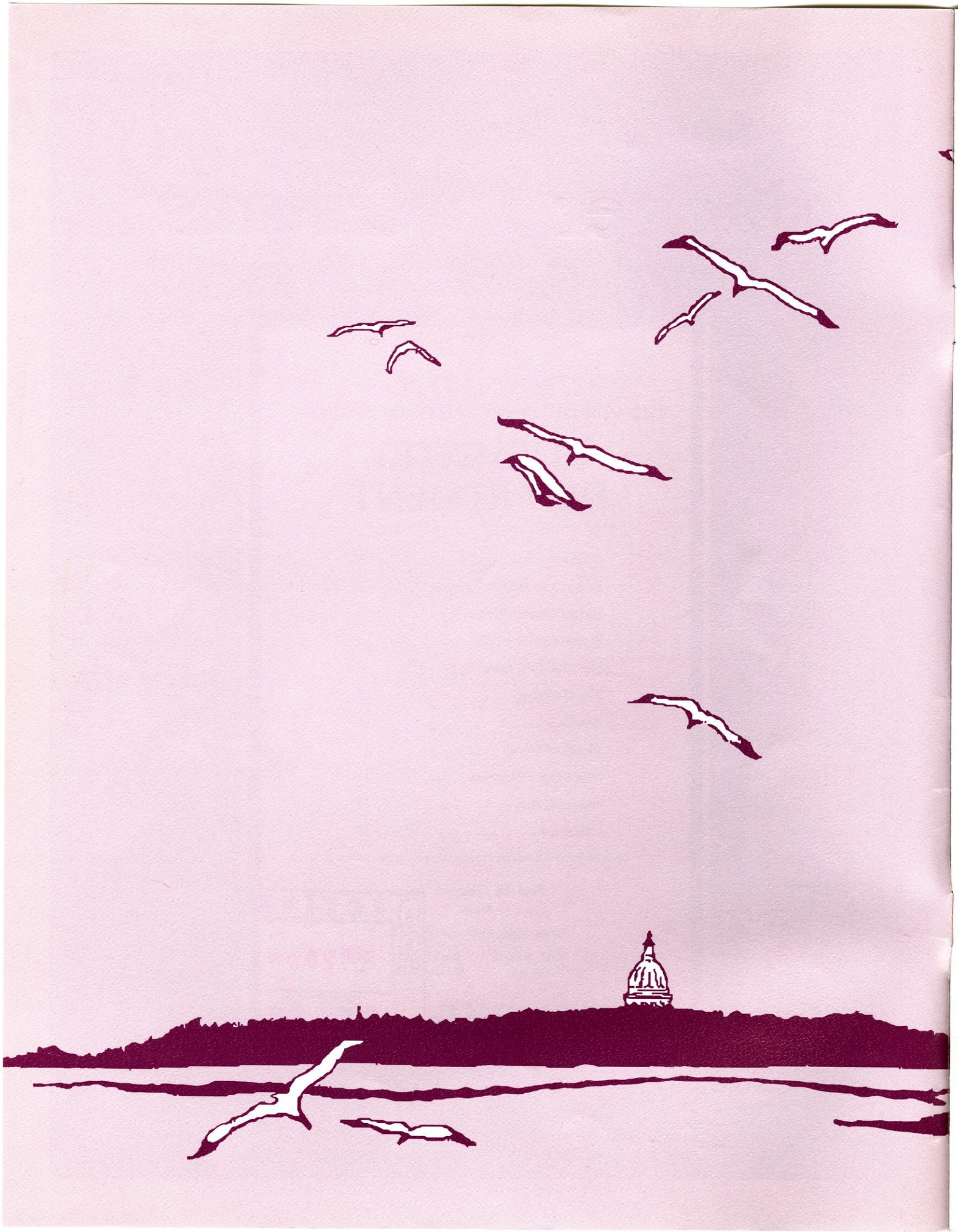
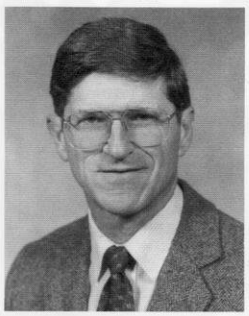


FROM THE CHAIRMAN



THE BALANCE SHEET for our department in 1994 was generally favorable. Chemistry scored a grand slam in the competition for university awards. Larry Dahl received the Hilldale award for the physical sciences; Fleming Crim was chosen for a University Houses Chair, Lloyd Smith was the Romnes awardee, and John Wright received a university teaching award. John's award was the third time in four years that a department faculty member has been so honored. The department acquired new NMR and mass spectrometric equipment. Research grant funding rose again. We also received one of the four NSF grants for curriculum reform, confirmation to us, at least, that we are leaders in the area of chemical education. So, guardedly, we remain optimistic. The base of strength of our department is its faculty, who are continuing the tradition of excellence that has long been recognized by students, by the university and by the profession.

P.M.Treichel

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Promotions

The three tenure cases that came up in the department last year went through successfully. In addition, there were two promotions from Associate Professor to Professor.

Laura Lerner became the first tenured woman faculty member in the department. Her background includes broad training in both engineering and biophysics. She has a Ph.D. in biomedical engineering from Johns Hopkins and worked as a postdoctoral fellow in the NIH before coming to UW-Madison in 1988. Her NIH supported research program here studied carbohydrates using NMR techniques and ranged widely across experiment and theory. Accomplishments included unraveling peptide hyaluronan interactions and the conformations of hyaluronan, studying conformations of carbohydrates, using model compounds to study ring dynamics in large molecules, and performing ab-initio structural calculations and molecular modeling calculations. Laura taught one section of Chemistry 565 and general chemistry. One of her contributions to Chemistry 565 was bringing a series of eminent scientists into class, a project funded by the Brittingham Foundation.

Robert J. McMahon came to UW-Madison in 1988 after Ph.D. work at UCLA and postdoctoral study at MIT. His research program is directed to fundamental problems in organic and organometallic reaction mechanisms with three primary areas of concentration: the study of reactive organometallic species by cryogenic matrix isolation and low temperature NMR experiments, the study of reactive organic intermediates (principally carbenes and diradicals) by matrix isolation techniques, and the development of new conceptual approaches to non-linear optical materials. Bob teaches undergraduate and graduate organic classes. He received a PYI award early in his faculty career and was awarded a Sloan Fellowship a few weeks before tenure consideration began.

Gil Nathanson also arrived at UW Madison in 1988, with a background that included a distinguished graduate record at Harvard and postdoctoral study at Berkeley. The central theme of his research program was to understand the interactions of molecules with liquid surfaces. In an experiment some scientists thought would not be possible, Gil proved that it was possible to probe these interactions by scattering a beam of molecules from a liquid surface in a vacuum chamber, monitoring their scattering angle and recording molecular energies. From these experiments, it was possible to gain an insight on how molecules share energy as they strike the surface and how different intermolecular forces control interactions. Besides doing exceptional research, Gil is one of our most popular teachers in physical and general chemistry. A year ago he received an Upjohn Teaching Award. Gil also has PYI and Dreyfus Teacher Scholar Awards on his vita.

Rob Corn, Bob Hamers, and **Ned Sibert** are now full professors, having been promoted in spring of 1994. Promotions from Associate Professor to Professor may not seem so eventful as tenure cases but they are important: they represent acknowledgement of the continued growth of the stature of a faculty member in teaching, research and service. The procedures are simpler, needing a recommendation by the department and approval by the dean. The three strong cases moved rapidly to approval.

Departures

Glen Dirreen retired after over 20 years in the department. Glen came to Wisconsin for a summer institute for teachers in the late 60's and stayed on as a graduate student. He received his Ph.D. in 1972 working with Paul Treichel, and then took over the newly created position of General Chemistry Laboratory Director. Over the years he had a number of different departmental roles; he moved to General Chemistry Coordinator in the mid 80s, a position he held concurrently with his position of Associate Director of the Institute for Chemical Education. He was also called on to serve as a lecturer in general chemistry during several semesters.

Lynn Hunsberger (PH.D. '90, ELLIS) moved to the U. of Louisville where she is now an Assistant Professor of Chemistry. Lynn had served ably as interim General Chemistry Laboratory Director for two years. One of Lynn's big accomplishments during this time was the total overhaul of our General Chemistry Laboratory manual, and the introduction and modification of numerous experiments. Replacing her for the 1994-5 academic year on an interim basis is **Dr. Jacquie Scott** (PH.D., '94, CRIM).

Other News

Chuck Casey was inducted into the American Academy of Arts and Sciences in October, 1993, and the National Academy of Sciences in April, 1994. He was the National Science Council Distinguished Lecturer in Taiwan in June. He is currently the Editor of a volume of Comprehensive Organometallic Chemistry on Mn, Tc, and Re.

Fleming Crim presented talks at the International Conference on Overtone Spectroscopy and Dynamics in Brussels, Belgium in April and the International Discussion Meeting of the Deutsche Bunsengesellschaft fur Physicalische Chemie, Grainau, Germany in August. In addition he spoke at the Ohio State Spectroscopy Symposium and the Gordon Conference on Molecular Electronic Spectroscopy over the summer. He serves as a member of the National Research Council Panel on Free Electron Lasers.

Art Ellis was the Technical Coordinator for the ACS Satellite Show on Materials Science which aired during National Chemistry Week.

John Harriman continues to serve as Associate Chair of the Department. He is also current chair of the campus Committee on Graduate Assistants and the campus Committee on Faculty Governance. In August, 1994 he attended a meeting in Brest, France to give two talks at a workshop on the relationship between densities and density matrices.

John Moore had another busy year. In January he talked at the Chem. Ed. Gordon Conference. He spoke at a number of universities, including Indiana State where he was hosted by Larry Rosenhein (Ph.D. '81, Treichel). In June he organized a symposium for the Joint Great Lakes-Central Regional Meeting on the topic, "Is Curricular Change: (a) Desirable; (b) Essential; (c) Feasible; (d) Well Underway; (e) None of the Above?" On campus, he presented three talks: at a Chemistry Department Colloquium, at the Wisconsin Center for Educational Research, and at the Department of Curriculum and Instruction. John is a member and vice-chair of the ACS Committee on Education and member of the Executive Committee of the Division of Chemical Education. He is also Chair Elect of the Division of Chemical Education, which means that he will chair the Division in 1996. Last year saw the publication by Saunders College Publishing of The Chemical World: Concepts and Applications, a general chemistry textbook of which John is co-author. In the middle of the big summer workshop rush, John received an invitation from the White House to participate in a planning meeting for the GLOBE (Global Learning and Observations to Benefit the Environment) program. GLOBE is an initiative of Vice President Al Gore whose aim is to allow students around the globe to participate in real science by collecting data and reporting it to research labs via the information superhighway. There are a great many types of data (acidities measured using pH paper, for example) that young students can collect. The large numbers of data points require computer analysis and visualization, and could contribute to monitoring of global change. In the next few years ICE and ICE workshop participants will almost certainly be involved in this effort.

Gil Nathanson delivered a seminar at the 38th Robert A. Welch Symposium in Houston. This year's meeting was titled "The Chemical Dynamics of Transient Species"; Gil described his research on "Bouncing Gases off Liquids: Molecular Beam Studies of Transient and Not-so-Transient Solvation."

During the summer, 1994, **Steve Nelsen** spoke at the EUCHEM Conference on Free Radicals in Champercy, Switzerland and the IUPAC Conference in Padova, Italy.

Dan Rich was named to the International Advisory Board for AIMES 95, the international medicinal chemistry symposium sponsored by the Asian Federation of Medicinal Chemistry. He is on the Editorial Board of the journal Peptide Science.

For new building progress report please turn to page 9.

Jim Skinner used his Humboldt and Guggenheim Fellowships to spend three months in Bayreuth, Germany, where he collaborated with low-temperature experimental physicist Dietrich Haarer. While in Europe he gave talks in Munich, Freiberg, Ulm, Bad Honnef, Zurich, Leiden, and Groningen. He also presented talks at a Gordon Conference, a Telluride Conference, a laser conference in New York, and at several national labs and U.S. universities.

A highlight of **Lloyd Smith's** year was a two week trip to Japan and China during fall. He was in Japan for four days where he gave an inaugural lecture for the opening ceremony of the Kazusa DNA Research Institute in Chiba prefecture, and then he flew to mainland China where he visited the Shanghai Institute of Biochemistry and the Wuhan University and Beijing University Chemistry Departments over 10 days, giving a series of lectures. The start up company that Lloyd co-founded last year, Third Wave Technologies, Inc. (see BC # 38) is progressing well. The company has been awarded a $2 million grant from the Advanced Technology Program of the Department of Commerce, for the development of novel methods for DNA diagnostics, and a $500,000 Small Business Innnovation Research grant from NIH for the commercial development of automated DNA sequencing instrumentation. The company presently has six full-time employees but will be expanding to 14 over the next few months as hires are made to carry out the R & D associated with the above awards. Lloyd and six year old Easton Smith are taking karate lessons which has spiced up family disputes considerably. They have both earned their white belts, qualifying them solidly for "beginner" status.

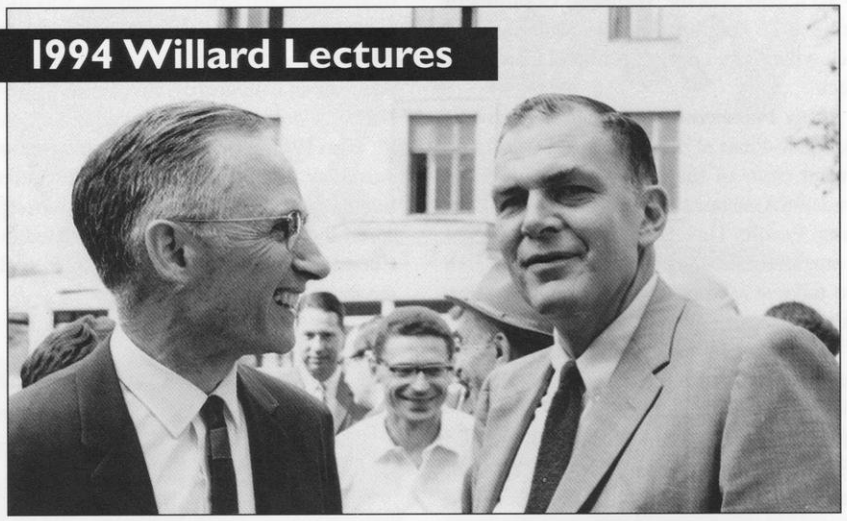
During 1994, **Bob West** traveled to Norway, Holland, Germany, and Japan. In Japan, he was the featured speaker at the Sendai Organosilicon Symposium. In addition while there, he gave a 30 minute talk on education to the citizens of Sendai in Japanese. He continues to travel in the U.S. by small airplane and now has 1,500 hours of pilot-in-command time. In research, the major recent development is the synthesis of the first stable silylene with postdoctoral colleague Dr. Michael Denk.

In February, **Hyuk Yu** was invited to the International Workshop on the structure of monolayers at Heron Island, Great Barrier Reefs, Australia, organized by the University of Queensland. In March at Pittsburgh, he received the 1994 High Polymer Physics Award of at a meeting of the American Physical Society with a symposium and a dinner, organized by **Charles Han** (PH.D. '73) of NIST, and **Eric Amis** (PH.D. '83) of USC. The award ceremony was attended by many of Hyuk's current and former students and friends from different parts of the world. Two former associates from Japan, **Takashi Norisuye** (PD,'78-'79) of Osaka University and **Hideo Takezoe** (PD '82-'83) of Tokyo Institute of Technology, joined Charles and Eric to lead this program. Several weeks later, Hyuk received congratulatory letter from the White House with the presidential signature, sent to him via the APS headquarters. In the middle of May, Hyuk and Gail moved their household to Cologne, Germany, for the second installment of his residence at the Institute of Physical Chemistry, as a part of an Alexander von Humboldt Senior Scientist Fellowship. While in Cologne, Hyuk taught a short course on polymers and collaborated with a couple of graduate students on polyelectrolytes. He also managed to travel some within Germany and western Europe. He spent a couple of days at the Centre de Recherche sur les Macromolecules (now known as Institut Charles Sadron) in Strasbourg; two weeks at Bayreuth at the invitation of Professor Heinz Hoffmann to deliver a series of lec-

tures on recent research and learn all about Hoffmann's novel surfactant systems, but leaving there on the starting day of its Wagner Festspiel; a visit to the Physics Department of the Technical University of Munich, to give a talk on polyelectrolytes; two days at the Institut fur Polymere of ETH-Zurich, Switzerland, with a lecture on monolayers research of his group. On the way home from Cologne, he stopped by the ACS national meeting at Washington and participated in the symposium honoring Prof. Ziya Akcasu of Michigan. In the fall, he was the John T. Major Lecturer of 1994 at the Chemistry Department of U. Conn. at Storrs, Connecticut, and gave a departmental colloquium at the University of Arizona at Tucson in December.

Howard Zimmerman attended the IUPAC Symposium on Photochemistry in Prague last summer. While in Europe, he lectured at Universities in Duisburg, Essen, Braunschweig, and Wurzburg, at the Humboldt U. in Berlin, at Marburg and at the Max Planck Institut fur Strahlenchemie in Mulheim. Also during 1994, Howard talked at the annual Canadian Institute of Chemistry meeting. He is co-chair for the Photochemistry Symposium at the PACIFICHEM 95 meeting in Honolulu along with former colleagues Professor **Hiizu Iwamura** (PD '67 - ' 69) of the U. of Tokyo and Professor **Jerry Scheffer** (PH.D, '69) of the U. of British Columbia. European travel gave Howard a chance to visit with a number of chemists having Wisconsin ties including **Dietrich Dopp, Frank Klarner, Henning Hopf, Carsten Bohm, Reinhard Hoffmann, Ulrich Koert, Axel Griesbeck, Helmut Quast,** and **Sigfried Hunig.**

1994 Willard Lectures



f. Sherwood Rowland, Donald Bren Professor of Chemistry at the University of California at Irvine, was the 1994-5 Willard Lecturer in Chemistry. John Willard and Sherry Rowland have had a long professional association through research in hot atom chemistry and radiochemistry.

Professor Rowland is a world expert in atmospheric chemistry. He and his colleague Mario Molina were first to warn that chlorofluorocarbons released into the atmosphere were depleting Earth's critical ozone layer. Their work eventually lead to the Montreal Protocol banning production of these materials.

Sherry Rowland's distinctions are numerous. He is presently Foreign Secretary of the National Academy of Sciences and has served as the President and Chairman of the Board of the AAAS. Prizes include the Debye and Tolman Medals of the ACS, the Albert Einstein prize of the World Cultural Council, the Global 500 Honor Role of the UN Environmental Program, and the Japan Prize for Environmental Science and Technology.

Professor Roland's two lectures, "Stratospheric Ozone Depletion by Chlorofluorocarbons" and "Chemistry of Remote and Urban Atmospheres", were delivered to packed lecture rooms; they left the feeling that atmospheric pollution can be abated, but only by dedicated efforts from citizens throughout the world.

The John E. Willard Lectureship was established in 1978, the year of Willard's 70th birthday, from funds donated by former students, colleagues, and friends, in recognition of his distinguished career of teaching, research, and public service at Wisconsin. Professor Willard has been a member of the department since 1937. He served as department chair from 1970 to 1972 and as Graduate School Dean from 1958 to 1963.

Photo: John Willard and Sherry Rowland in Moscow in 1968, on their way to a conference on free radical chemistry in Novosibirsk.

OTHER NEWS

Laboratory Modernization Funded

The Department received major internal funding for its instructional program during 1994. Laboratory Modernization came through again, with $400,000 to upgrade General Chemistry laboratories. Plans are underway to create a new type of laboratory setting to be used by our chemistry majors. This lab will be mostly open space within which students can move between strategically placed equipment. The lab is expected to be ready in the fall of 1995. Instructional Computing Equipment was also obtained using a competitive grant from UW's Division of Instructional Technology in a competitive grant. A total of $30,000 was provided to purchase Power Macintosh computers and CAChe molecular modeling software. This grant also contained matching funds for an external grant from CAChe Scientific to John Moore and Paul Schatz for additional molecular modeling software for use in undergraduate courses. The result is a small basement facility where students can sit at their Macs, build molecules on the screen, carry out molecular modeling calculations and predict properties and display results graphically. In addition, several of the faculty have been using CAChe in their lectures to show things like energy changes during rotation around a single bond, where the molecular structure and the energy are simultaneously displayed using computer graphics.

Curriculum Reform:

"Establishing New Traditions"

Late in 1993 we received a $50,000 grant from NSF for planning curriculum reform. We were one of fourteen institutions out of 104 applications to be funded, so we were happy but not nearly as happy as when we

received word in mid November of 1994 that NSF will fund our major proposal for a 5-year curriculum reform project!

You will hear lots more from us about this project in the next five years. In addition, we hope that many of our alumni in academic institutions will want to work with us. The proposal we wrote subdivided our efforts into the following areas, with the named individuals representing the Leadership team in this project:

Student-Focused Active Learning: John Wright and Joanne L. Stewart, Hope College;

Guided-Inquiry/Open-Ended Labs: Steve Burke, and James N. Spencer, Franklin & Marshall;

Interdisciplinary Course Clusters: Denice D. Denton, Elec. and Comp. Engr., Ann Burgess, Biology Core Curriculum, and Richard Brualdi, Mathematics, all at UW;

Topic-Oriented Approach: Clark R. Landis, Chemistry, and Diane Bunce, Catholic University;

Information Technology/Computer Tools: John Moore and Maureen Scharberg, San Jose State Univ.;

Evaluation: Susan Millar, UW LEAD Center;

Dissemination/Communication: John Moore and Paul Treichel.

In addition the project has a National Advisory Board to assist in the overal direction of the project. Expected to meet at least once annually, this group includes some very well known chemists and educators: J. J. Lagowski, Chemistry, U. of Texas and current Editor, Journal of Chemical Education; Fred Newmann, Professor of Curriculum and Instruction, UW-Madison; Richard Nicholson (Ph.D. '64, Shain) current Executive Director, AAAS; Robert Nowak, formerly Director of Research at Dow and current President, Michigan Molecular Institute, Midland, MI; Robert Parry, Professor of Chemistry, University of Utah and previous ACS President; George W. Parshall, retired Director of Chemical Science, DuPont Central Science and Engineering Laboratories; Angelica Stacy, Professor of Chemistry, U. of California, Berkeley; Tamar Y. Susskind, Professor, Oakland, MI, Community College; Philip Uri Treisman, Professor of Mathematics, U. of Texas at Austin; Paul Williams, Professor of Plant Pathology, UW-Madison.

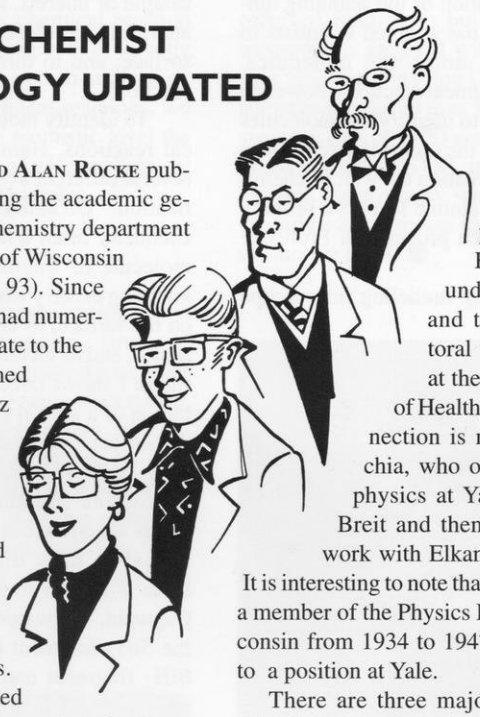
And now comes the hard part of the project, doing something that has a major and lasting effect. Our challenge for the next five years was nicely put by an attendee at our planning conference:

"If you could implement a truly new curriculum at Madison it would serve as an exemplary model of what can be done at a major research university as well as demonstrate that it is possible for a reseach institution to implement such a change .... reform is much more than simply a question of how to teach differently. It involves questions of what should we teach; why should we teach it; how will we know it works; how does this fit in with courses in other departments; how does this meet the needs, interests, and abilities of our students; and how can we actually get faculty to buy into the change."

(From the Conference Proceedings; hard copies are still available from that meeting from ICE; or you can access this information through the Journal of Chemical Education Internet Gopher).

BADGER CHEMIST GENEALOGY UPDATED

by Paul F. Schatz



In 1979 Aaron Ihde and Alan Rocke published an article describing the academic genealogical tree for the chemistry department faculty at the University of Wisconsin (J. Chem. Ed., 1979, 56, 93). Since then our department has had numerous additions and an update to the original genealogy seemed to be in order. Paul Schatz took charge, creating the document which is included as an insert with this year's *Badger Chemist*.

Most of the data and conventions from the original tree are retained, but there are some small differences. The original tree included only tenured faculty; the new tree has been expanded to include all tenured faculty, past and present, and current junior faculty members. All Wisconsin faculty members are indicated by a bold box outline. Current faculty members are located along the left margin. As with the original tree, lines are traced through a doctoral thesis advisor wherever possible. For individuals who have a doctorate in a field other than chemistry, the lines are traced through post-doctoral relationships with a chemist when possible. John Wright obtained a Ph.D. in physics at Johns Hopkins under H. Warren Moos and then did post-doctoral work with chemist Francis K. Fong at Purdue. John Schrag obtained a Ph.D. in physics at Oklahoma State under G. B. Thurston and then did postdoctoral work with John Ferry at Wisconsin. Arun Yethiraj, a theoretical chemist and our newest faculty member, obtained a Ph.D. in chemical engineering at North Carolina State under Carol K. Hall and then did post-doctoral work with Kenneth S. Schweizer at Illinois.

Laura Lerner's lineage is convoluted. Laura obtained her Ph.D. in medical physics at Johns Hopkins University under Daniel Torchia and then did post-doctoral work with Ad Bax at the National Institutes of Health. The chemical connection is made through Torchia, who obtained a Ph.D. in physics at Yale under Gregory Breit and then did post-doctoral work with Elkan Blout at Harvard. It is interesting to note that Gregory Breit was a member of the Physics Department at Wisconsin from 1934 to 1947 before he moved to a position at Yale.

There are three major branches in the chemistry genealogical tree (chemistree?), to Wohler, Liebig, and Vauquelin. The lines can be traced to earlier chemists and natural philosophers as described in the original Rocke and Ihde article. Three faculty members do not connect with any of these branches, James Skinner, Arun Yethiraj, and Robert Corn. Their lines trace back through chemical physicists to physicists and mathematicians. Geneologies for James Skinner and Arun Yethiraj both are linked to Nobel laureate in physics (1977) John H. Van Vleck of Harvard. Here too are Wisconsin connections. John Van Vleck was the son of Edward Van Vleck, a professor of mathematics at Wisconsin. The mathematics department here resides in a building named in honor of Edward Van Vleck. John Van Vleck received his baccalaureate degree from Wisconsin in 1920 and was a member of the Physics Department from 1928 to 1934 before moving to Harvard. Rob Corn traces back to Peter Debye, a chemistry Nobel laureate (1936). Debye obtained his doctorate in mathematical physics at Munich in 1906 under Arnold Sommerfeld.•

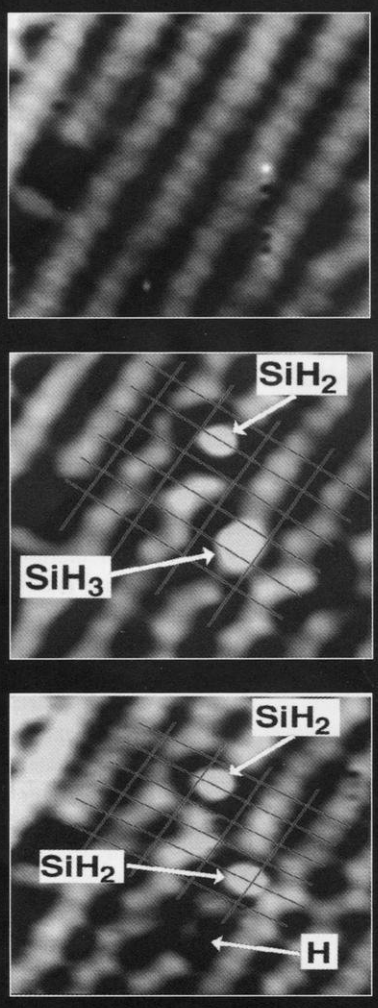
Frontiers of Research

Bob Hamers: Watching Molecules in Motion

THROUGHOUT the history of chemistry, we have continually visualized chemical reactions through ball-and-stick model. In the last ten years, the invention of the scanning tunneling microscope has enabled scientists to image individual atoms and molecules. Inorder to study chemical reactions, however, it is also necessary to identify the molecules present. Exploring the contrast mechanisms and using this information to "watch" chemical reactions at the atomic level is a primary focus of the research program of Professor Robert Hamers.

In the scanning tunneling microscope (STM), the tunneling of electrons from an atomically-sharp tip to the solid surface is used as a measure of "distance". By scanning the tip above (but not touching!) a sample of interest, it is possible to create an atomically-resolved map of the atoms of the surface, and to directly visualize chemical reactions.

Figure 1



To identify molecules and watch chemical reactions, Hamers' group is exploring several different avenues to chemical identification. On semiconductors, coordination chemistry often tells us how many bonds a molecule or fragment wants to have. By knowing exactly where a fragment is bonded on the surface, its coordination can be determined, and its identity inferred. For example, figure 1 shows three STM images of a single region of a silicon surface. Before exposing the surface to disilane (Si_2H_6), the surface is clean (top); after exposing to a small amount of disilane (middle), there are two fragments which have different bonding locations appear to have different heights; one of these is a SiH_2 fragment and one is a SiH_3 fragment. A few minutes later (lower image), the SiH_3 fragment has decomposed into an SiH_2 fragment and a H atom (the H atom appears dark).

In effect, these images show the decomposition of a single SiH_3 group into an SiH_2 group and a H atom!

While watching molecules permit us to glean information about the fundamental interactions of molecules on surfaces, the chemical systems studied by the Hamers group also have some very important technological applications. In the semiconductor device industry, fabrication of integrated circuits involves chemical reactions of molecules such as Si_2H_6, B_2H_6, PH_3, and O_2 on silicon surfaces. As integrated circuits continue to shrink in size, it becomes increasingly important to understand and control reactions on ever-shrinking distance scales. Our ongoing work is using STM to study the reactions of these technologically-important molecules at the atomic level.

Hamers' group is also exploring the application of STM to study molecules on metal surfaces. In order to do this, it is necessary to "freeze" the molecules in place at low temperatures. Hamers' group has built one of only a handful of instruments in the world which can perform STM experiments below room temperature, down to about 110 Kelvin. At these low temperatures, molecular diffusion is slow and the molecules are "frozen" into place long enough for them to be observed.

Chemists have long known that chemical reactions on surfaces often take place on only a small fraction of the total surface area, and have proposed that there are special "active sites" in which the surface atoms have some unusual chemical or structural arrangement. With the STM, it is now possible to directly observe these active sites. For example, Figure 2 shows a silver surface which has been exposed to molecules of thiophene. Near the center of the image is a small "pit", one atomic layer deep, which is roughly hexagonal in shape, while at lower left is an atomic step. The thiophene molecules are visible as round ball-like features, and are observed only at the upper edge of the step and the edge of the pit. Virtually no molecules are visible on the flat atomic terraces. This demonstrates that thiophene molecules indeed bond preferentially at certain locations on the surface, and that the preferred location is at a step edge. Atoms at the step edges are expected to be more reactive because the silver atoms there have lower coordination than the silver atoms on the flat terraces, but understanding this at a molecular level is one of the ongoing goals of this research.

THE CONTRAST IN STM is somewhat complicated, but is intimately connected with both the geometric shape and the electronic structure of the molecule and the underlying surface. To investigate how the molecular shape is revealed in the STM images, we have also studied a related molecule, 2,2-bithiophene. STM images of this molecule, as shown in fig. 3, now also begin to reveal the molecular shape. As in the case of thiophene, the molecules of bithiophene preferentially bond at step edges. Instead of appearing as round balls, however, the molecules of bithiophene now appear as cigar-shape features, all with the long axis approximately parallel to the step edge. In this case, we find that the molecules on the surface rotate into a particular configuration in which the aromatic rings lie parallel to the step edge. This research has direct application to the area of heterogeneous catalysis, in which the surfaces of transition metals are used as reactive sites for a wide variety of chemical reactions.

A third area in which the STM can make important contributions is in understanding

reaction chemistry at the solid-liquid interface. Using specially-fabricated STM tips which are insulated to within about 1 micron of the end, it is possible to obtain STM images of surfaces immersed in electrolyte solutions, and even to image electrochemical processes in "real time". The Hamers group has been using STM to study the fundamental chemical and electrochemical processes occurring at the surfaces of metal sulfides such as PbS, FeS_2, and CuS, which occur naturally as the minerals galena, pyrite, and covellite, respectively. The reactions of these minerals are of great environmental importance but are not well understood at an atomic level, and we are working with Professor Jillian Banfield in the Dept. of Geology to use STM to investigate these environmentally-important issues.

In this research we are directly imaging chemical and electrochemical reactions in liquid solutions. For example, the top two images in fig. 4 show two successive images of a PbS (galena) sample undergoing oxidative dissolution in $HClO_4$. A comparison of the top and middle images shows that the circular pit at top left has increased in size, the step edges at lower right have moved toward the center. In addition, there are numerous new pits which have formed in the central region of the sample, at the center of which is a small white feature. By comparing such images, we are able to show that dissolution occurs almost exclusively by removal of atoms from step edges (not from flat atomic planes). Under oxidation, however, we are able to show that trace amounts of natural impurities in the galena can dramatically increase the dissolution rate by initiating the formation of etch pits. Surprisingly, it is possible to achieve atomic resolution on mineral surfaces even while immersed in strongly acidic solutions. The bottom image in fig. 4 shows an atomic-resolution image of PbS in dilute sulfuric acid; each bright protrusion here is a sulfur atom, and the dark holes are either vacancy defects or reacted sites on the surface. Even seemingly "simple" processes like dissolution can be quite complicated at the atomic level; however, the insight provided by such images is leading to new atomistic models for how chemical and electrochemical reactions occur at the surfaces of these minerals. Understanding *where* dissolution and redox processes occur at surfaces is fundamentally important if one is to develop a quantitative theory for chemical reaction rates at surfaces. By being able to directly image the surface atoms and to study their chemical and electrochemical reactions, we have to understand at an atomistic level the fundamental chemical and electrochemical behavior of these natural samples.

Horizons

Connecting the microscopic information from STM with the macroscopic structural and chemical information obtained with other techniques is an area of increasing importance, particularly for surface chemistry applications. Many of our newest efforts are now aimed at trying to combine the atomic-level information from STM with the chemical sensitivity of "macroscopic" analysis techniques such as infrared spectroscopy and photoelectron spectroscopy. We have recently completed an STM system which incorporates a high-quality Fourier-transform Infrared Spectroscopy system which is capable of measuring the vibrational frequencies of the molecules adsorbed at the surface; correlating the chemical information obtained from FTIR with the atomic-level information from STM as molecules are adsorbed and/or reacted greatly enhances the utility of either technique. Likewise, we have just received funding to build a system which incorporates an STM with an ESCA (Electron Spectroscopy for Chemical Analysis, sometimes referred to as X-ray photoelectron spectroscopy, or XPS) system. With the combined arsenal of STM, infrared, and photoelectron spectroscopy, we will be well poised to study even complex chemical reactions at the atomic level. ■

Figure 2

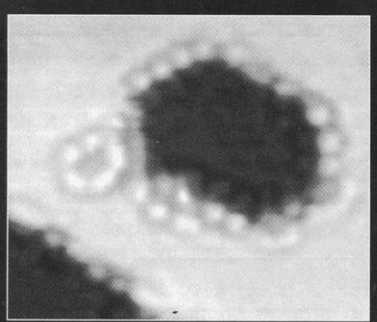


Figure 3

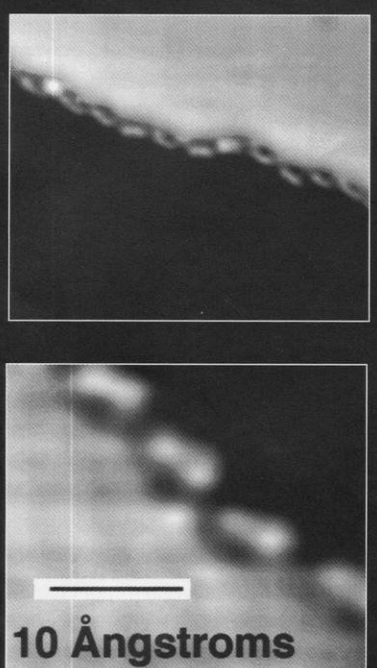
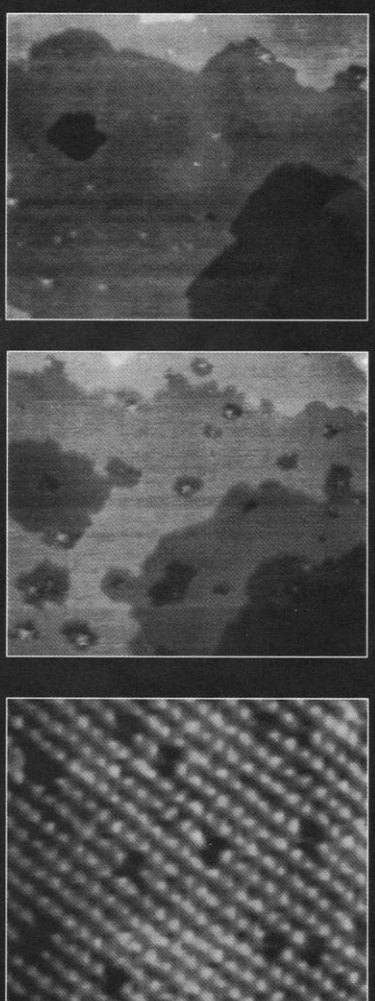


Figure 4



New Building Takes Shape....

THE 10% DESIGN REPORT for the new building appeared at about the time that the Badger Chemist went to press last year. We were able to bring our readers up to date by adding an insert to BC #38, providing an artist's sketch of the plans. The plans included a 9 floor research tower: the 5 top floors for synthetic research, the first floor for a lobby and lecture room, the second floor for the instrument center, third floor and basement for utilities. There was a small instructional wing on the southeast corner of the building that housed the Learning Center and computer lab..

Although the 10% design report was ready for the State Building Commission in April, it apparently took until mid-summer to gain approval. So we surmise, at least, because it was August before further noticable design activity occurred.

The next target was a 35% design report, that is, the plans would be 35% complete and then reevaluated. Across the early fall, further detail was added to the plans; in particular the hood issue was given major topic. We gained approval for an 8 foot hood per occupant, with restrictions on the quantity of air that was needed by the inclusion of hortizontal sliding sashes. About this time two major problems began to come into focus. The first was the anticipated cost, the second the efficiency factor, the percent of usable space; both had been underlying issues since the start of the project.

A total of $22.75 M had been allocated in this project for the hard costs of construction. Arbitrarily, as far we can tell, the state had decided to reserve $6 M for remodeling. Apparently, politics were behind this decision; the university and the state are always feuding, and the project had been sold to the state based on the unsafe conditions that exist in the present building so fixing this situation was deemed a top priority. However, this left $16.75 M for the new building and the estimates of costs were far higher. The instructional wing, the three story segment on the Mills-Johnson corner, which had never been fully accepted, went on the block first; then the architect took off one of the five research floors in the tower. Even this was insufficient and so discussion moved to "shelling space", which meant leaving an unfinished floor, an empty shell available to be converted to functional labs when additional funds were obtained. The final plan scaled out with about 48,000 asf and a cost of about $18 million. The smaller size was a disappointment since we had been led to expect a minimum of about 60,000 asf in much of the early planning. Whether the higher cost figure would be accepted has not yet been ascertained, but the department was very reluctant to cut further .

The building efficiency is an even bigger problem. With the design report on new construction almost complete, the architect team reported a building efficient of 42%, that is, only 42% of the total square feet in the new space were assignable. An acceptable minimum value would be about 55%, and excellent design about 65%. For two weeks we operated on the assumption that the plan was dead. Then the architects introduced additional small modifications, changes that affected the calculation but not the actual content of the building. The penthouse (housing mechanical equipment) was taken out of the calculation and several minor changes in air handling were introduced. A new value of 52.5% was calculated and we were back in business again.

Considerable time was spent on plans for the second floor, on design for both new and remodeled space. This space is primarily designated for the Instrument Center, and there were many technical issues. In particular, the need to separate NMRs and to insure relatively low vibrations for the most sensitive equipment proved most difficult. In the new building, the floor directly above was dedicated to large air handling equipment, the consequence was that it would not be possible to locate new NMR and high resolution mass spectrometric equipment in this part of the building. We lost the opportunity to set aside part of the basement for very high field NMR instruments, since the it was determined that this space was needed for building utilities. This remains a concern; we do not have a part of the building that is capable of housing a high field (>600 MHz proton) NMR.

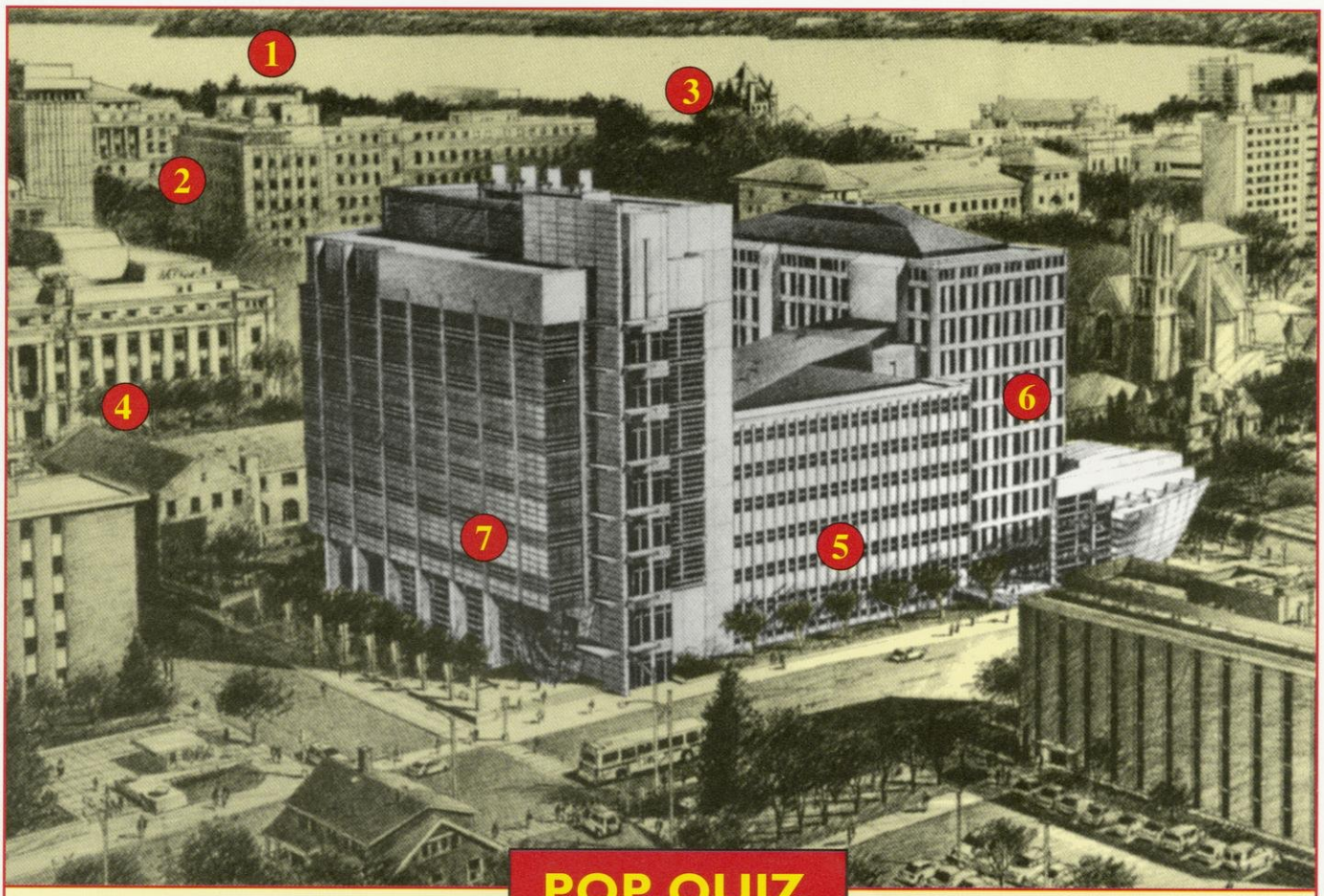
WORK ON REMODELING plans began as design for new space approached a conclusion. There were three parts to this part of the project. The conversion of synthetic labs to physical/analytical space was fairly straightforward. Upgrading synthetic labs represented the second and hardest part of the plan. Finally, there was the need to try to meet a few needs in the instructional area. This design project dragged on across the spring, and final plans have not yet appeared as this article was written. But presumably they will be finalized shortly.

With completion of these plans comes yet another hurdle. Once again the State Building Commission will scrutinize the plans. Their approval is hardly a certainty. The low building efficiency, currently hovering around 51.5% and the split between new construction and remodeling, $18 M to $4.5 M, will be examined. These concerns are being attributed to the small site; a small "footprint" results in a higher than desired proportion of spaced committed to halls and mechanicals.

Such concerns are also shared by university administrators who want to get the most building for the money invested. Even as plans move forward, there are renew negotiations to acquire the Methodist church property. If that negotiation were to succeed, it is likely that the plans will be put aside in favor of this site for new construction. University officials say that a mid-1996 start of construction is still a possibility.

Fund raising a priority...

The Chemistry building project is formally under WISTAR, a state-university partnership for facilities on the Madison campus set up by former Chancellor Donna Shalala in 1991. WISTAR specified that the State would provide $150 million over an 8 year period to match an equal amount of non-state funding. This meant that there is an obligation to raise $15.7 M toward Chemistry's $31.4 M project. The Vilas Trust will provide $10 M, leaving $5.7 M to be found from other sources. The Chemistry Department and the UW Foundation have set forth on a campaign seeking these funds. One of the first steps will be to seek alumni support, beginning this summer.



POP QUIZ

The drawing above includes all previous Chemistry department homes since 1877. Can you identify them?

1. **North and South Hall**, where earliest chemistry instruction took place in the 1850's.

2. **Bascom Hall**, then called University Hall, was used for chemistry research and teaching after 1860.

3. **Science Hall** was completed in 1877 and chemistry occupied the basement and first floor. It burned down in 1884. A group of smaller buildings between Science Hall and the lake (not shown, and no longer standing) were then built and occupied by chemistry in 1888.

4. **The "old" chemistry building** on University Avenue. It was built in three stages. The center section was occupied in 1906, the west addition (not visible here) in 1912, and the east addition in 1930. The building is currently used by Physics and Pharmacy.

5. **The "Chemistry Research Building"**, now called the Mathews Building, was completed in 1961, the first of a proposed five stage project.

6. **The Daniels Building** represented stages 2, 3, and 4 of that plan; it was completed and occupied in 1968. The 5th stage (an extension of the Mathews building to the west) was never followed through, but reappears in our present plans.

7. **The present plan.** The small section on the Mills-Johnson corner was deleted from the plan when costs were too great.

Background information is from Aaron Ihde's "Chemistry as Viewed from Bascom Hill," 1990. A few copies are still available through the Department.

THE OVERVIEW

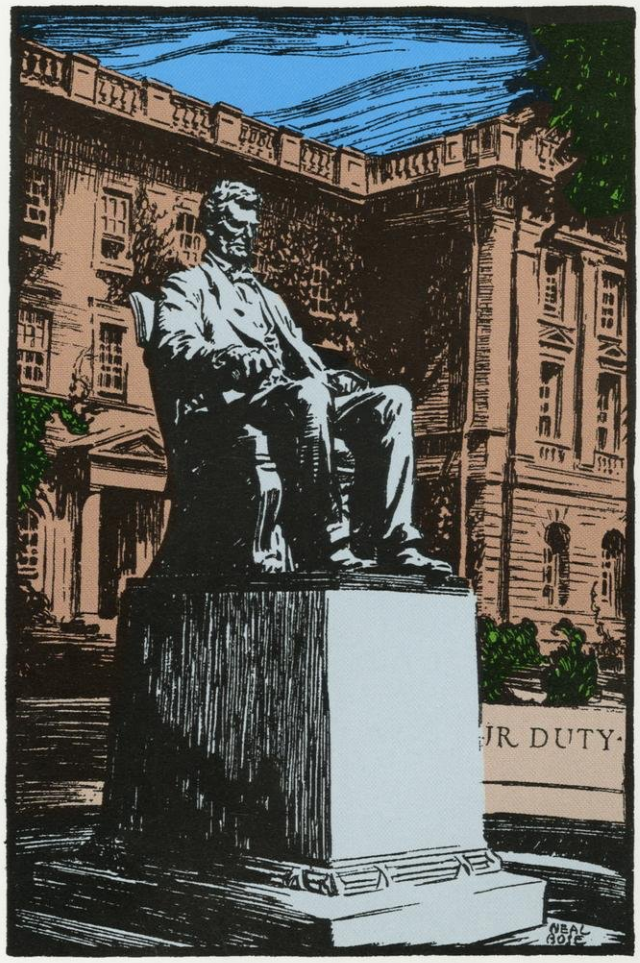
Budget Problems

THE UW HAS FARED BETTER budgetarily than many other institutions during the last several years. On the other hand there have been some concerns. In last year's BC, we described the ongoing strategic planning exercise, in which the Department was scheduled for a decrease in base budget over a five year period equated to three faculty positions. Motivation for this exercise was largely based on an overcommitment of resources in the College (L & S) that had developed over a number of years. This cutback was a significant problem for us, but even as we moved ahead on plans there were further problems appearing on the horizon.

The university system currently receives about $1.8 billion, a third of it biennial budget, from state funding. The remaining funds are from tuition, gifts and grants, and revenue generation (for example, through athletics revenue and hospital services). The UW Madison budget is quite different from the other state universities. Whereas state tax dollars represent the majority of the budget of the other schools, the UW Madison, with major external funding, derives only about 22% of its budget from state funding.

State funding is budgeted on a two year cycle. The next biennial budget for the state is for the 1995-7 biennium. Planning has been underway since mid-1994, with legislative action and governor's approval anticipated sometime during summer, 1995.

Problems in the forthcoming budget cycle have been expected by University officials. High property taxes have been viewed as a problem in the state for some time, and this became a political issue in last fall's election. Governor Thompson declared that a major position of his program would be to institute property tax relief, accomplished by transferring a part of the burden to the state budget. However, he also declared opposition to any kind of tax increase. If both positions were upheld, it was apparent that state funding of other programs would have to suffer. General discussions across the summer suggested that a 5% reduction in funding to state agencies would result each year.



In late August, the UW Regents approved a budget for the university. Reflecting the anticipated problems, this was termed a "zero-increase" budget, although there was provision for small growth in tuition revenue, and a resolution that identified six "supplementary initiatives" that the university would undertake if additional state dollars were available. A month later came a surprising announcement: that the Governor would exempt the university from the anticipated 5% budget cuts. A representative for the Governor was quoted as saying that the university could not sustain deep budget cuts in the face of projected increased enrollments, and that cuts would be "futile" and "impossible" if the state wants to "maintain the quality and integrity" of the UW.

Nonetheless, as time passed it became apparent that these positions would be difficult to sustain. In January, 1995, the State directed the UW to return 1.25% of its GPR (General Purpose Revenue) funds, amounting to $7.2 million. This was called a one time cut, and it was in current (1993-5) biennium. The UW-Madison's share of this cut was $2.78 million, and the timing was particularly bad since most of the funding for second semester was already locked into place. John Torphy, the UW-Madison's Budget Director indicated "while this reduction was identified as a 'one time' cut, it is likely there will be permanent reductions in the Governor's 1995-7 budget". Then in February, the Governor announced that the 1995-7 budget for the university would contain cuts in "institutional support" to the university representing 5% each year of the biennium. Funds in this category are used in various ways, to support administrative activities concerned with management and long range planning, space management, and transportation services. One part of this proposal was to merge the UW's Planning and Construction (P&C) with the State Department of Facilities Design (DFD). P&C oversees campus building plans, and among its current projects is the new Chemistry facility. A second part of the Governor's proposal merged the UW-Madison and State Computing systems. Both ideas have been the cause of great concern here, and the UW has been strongly opposing these suggestions.

A long time still remains before the next UW budget will become reality. The only certainty seems to be that the university will re-

main under considerable pressure to survive on less funding for some time to come. In a discussion recently with a selected group of department chairs, L & S Dean Phil Certain voiced the opinion that we should expect annual budget cuts of about 1% for the next six years.

Enrollment Management III

The budgetary picture is interesting from another standpoint, that being the projection of forthcoming enrollment increases.

The number of students graduating from Wisconsin high schools has been dropping slowly for more than a decade. Projections indicate that 1995 is at or near the lowest point and that the number is now expected to rise steadily. The number of Wisconsin students seeking to enroll in colleges and universities could increase by as much as 15 to 20% by the year 2002, a prediction based primarily on current secondary school enrollments. With a few assumptions (for example, that the 32% of graduating high school students who go on to college remains constant), it appears that this prediction will be quite accurate.

The UW System has been studying enrollment and developing strategies to meet changing patterns since the late 1980s. The plans identified as Enrollment Management I and II (EM-I and EM-II) were approved by the UW Regents in 1987. EM-I and EM-II, intended to bring enrollments in line with the State's declining allocation of resources, led to a decrease of 13,000 FTE system wide. This was done in part by raising admission standards on the various campuses. One of the results was a substantial increase in the retention rates of undergraduates, and especially of freshmen.

Enrollment Management III, a plan that was approved by the University Regents in May, 1994, describes how the UW will respond to the anticipated enrollment increases. It makes some basic assumptions: 1) that the demand for quality education will increase, 2) college-bound population will be more diverse, 3) no new campuses will be built, and 4) it will not be possible to get large increases in State funding in the coming years.

Current (1994-5) enrollment within the UW-System is 126,025 FTE. The report indicates that the UW would be able to add more students (3,950 FTE) without additional state funding through "productivity gains". An additional 6,050 students could be accommodated if there is increased state funding and tuition increases. Under this plan, the UW-Madison enrollment would be scheduled to increase slower than the remainder of the system, but there would still be a 2% to 3.8% increases in the two scenarios.

Larger classes and higher teaching loads would be a component of the anticipated productivity gains, along with a higher efficiency expected from new technology. In addition, there is mention of finding ways to cut back on "excess credits" taken by students. It is common for students to accumulate more than the 120 - 130 credits needed to graduate, and in some instances the number of credits is significantly higher. UW President Katherine Lyall commented, "The state doesn't have the responsibility to pay for the luxury of excess credits."

For 1994-5, the UW-Madison enrollment was right on target. Data showed a decline in enrollment for the fifth consecutive year. The enrollment in fall, 1994, stood at 40,305 (34,558 FTE), a decline of 1.5% from the previous year and a decline of 7.6% from fall 1988.

The enrollment issue is particularly critical to the Chemistry Department. We teach well over 5,000 students each semester. The large majority of these students are in our general chemistry and organic chemistry classes. Furthermore, our totals have run counter to the university trends. Since 1990, there has been an 25% increase in the number of students taking organic and general chemistry along with smaller increases in other areas. More alarming however, is the fact that we have reached the capacity of laboratories in our current building. This is particularly critical in undergraduate organic chemistry. For several years, now we have been unable to accommodate all the students who need organic chemistry in the spring; now, in fall, 1994 these labs also reached saturation. A consequence of the problem is the rapidly increasing number of students who take organic lab in the summer, which has more than doubled in the last few years. Also in fall, 1994, we reached saturation in the general chemistry labs.

The university has just released figures that project an unexpected increase in freshman enrollment in fall 1995. Over 5,000 new freshmen are scheduled to enroll, compared to the EM-II goal of 4,500. This translates to an additional 250 students who will seek to take general chemistry, one additional lecture section and 12 sections for laboratory. In fall, 1995, we will almost certainly have to turn away students for the first time in several years though fortunately there is still space in spring to accommodate these students.

Other News

Delegated authority: For several years L & S has been talking about giving more budgetary authority to departments. "Delegated Authority" is apparently going to begin next year for a group of departments including chemistry. Basically, Chemistry will be given a budget and told to make decisions on spending within the context of meeting its obligations. The department will not have to seek Dean's approval to hire lecturers and visiting faculty or to hire additional TAs to teach extra sections. But we will be constrained too; we won't be able to ask for additional funds for emergencies. And we will have to report annually, or more often, to document that we have met our obligations.

Post tenure review: The department completed its first round of post tenure review in the spring, 1994 and has just begun a second round. You will recall from BC-38 that the UW Regents mandated that tenured faculty undergo a comprehensive review once every five years. In 1994, a committee of four faculty and the chair collected documentation from Professors Farrar, Gaines, Woods, Wright, Yu and then met with these individuals. From this a written evaluation was created, a summary of which was sent to the Dean. The first time around on this program could be regarded as a qualified success. One important goal of the process is to focus attention on the way that a faculty member can contribute most effectively to the departmental mission. Another favorable perspective is that this review provides a unique opportunity whereby a pan-divisional group of faculty are able to become familiar with a faculty member's research program.

Research funding: We are happy to report that the UW-Madison was again among a select group of universities in the amount of research funding it receives. A report to the UW Regents in December indicated that the UW-Madison received $240 million and $87 million, respectively, in federal and non-federal research awards. A 5% increase in federal awards is noted. The federal funding ranked 9th nationally, and 2nd among Big 10 institutions. ■

AWARDS ♦ AWARDS ♦ AWARDS

Steve Burke was one of four prominent chemists in the U.S. to receive a 1994 Pfizer Central Research Award in Organic Chemistry. This is the second year of this program that recognizes faculty involved in biomedical discovery and development; it provides research grant support for unrestricted organic synthesis research.

Chuck Casey was selected as the second Steenbock Professor in Physical Sciences, October, 1994. This is one of the most prestigious awards of the university, providing substantial research support over a 10 year period. It is one of seven awards endowed by Mrs. Evelyn Steenbock in honor of her late husband Harry Steenbock, Professor of Biochemistry.

Fleming Crim now has the title John E. Willard Professor of Chemistry. He was awarded a University Houses Chair, one of two such awards to Chemistry faculty in last year's competition.

Emeritus Professor **Chuck Curtiss** continues to receive honors and awards for his work. In October, he received the Eringen Medal of the Society of Engineering Science at a banquet held at College Station TX. He gave the plenary lecture, and former students and colleagues participated in the symposium held in his honor.

Larry Dahl was selected by the UW Graduate School as the 1994 Hilldale Award winner in the Physical Sciences. One award is made each year. Larry was the second member of the department so honored; Howard Zimmerman had previously been selected for this award in 1990. Larry's work in synthesis and structure of organometallic chemistry, and especially his research in metal cluster chemistry in recent years earned him this award. As an eminent colleague said in a supporting letter "One suspects that when the history of chemistry is written for the 20th century, his work will occupy a far more prominent place than will a variety of other ... currently fashionable topics."

Art Ellis received the Chemical Manufacturers Association (CMA) Catalyst Award for excellence in teaching chemistry at the college level. Art is well known through important contributions to chemistry teaching that include the introduction of materials science into the general chemistry curriculum.

Larry Dahl
1994 Hilldale Award Winner

Bob Hamers was elected Fellow of the American Vacuum Society. This award recognizes the quality and importance of his research in vacuum science and technology. He received this honor at an October awards assembly.

Early in the year, **Bob McMahon** received an Alfred P. Sloan Research Fellowship, providing unrestricted research support.

Departmental Upjohn Teaching Awards went to **Art Ellis** and **Hans Reich**. This is the third year the the Upjohn Co. has sponsored by these teaching awards. At the award symposium in October, Art talked about his work involving solid state chemistry in the curriculum "Putting Solids in the Foundation: Elements of Chemistry Curriculum Reform." Hans, the first organic chemist in the department to be so honored, presented a talk about "Teaching NMR Spectroscopy", in which he talked about Chemistry 605, Spectrochemical Methods, a popular and highly regarded course for first year graduate students that he has taught for a number of years.

Laura Kiessling received a prestigious Beckman Foundation Young Investigator Award, providing significant research support.

A University Houses Professorship award also went to **Dan Rich**. Two such awards for the department in a single year is an almost unheard of occurrence. He chose the title Ralph F. Hirschmann Professor of Medicinal and Organic Chemistry, honoring chemistry alumnus Hirschmann (MS, '48, Ph.D. '50, Johnson; see article on Hirschmann on page 18). Dan was awarded the Paul Erlich Prize by the French Medicinal Society. He will present the award lecture in July, 1995 at the International Meeting of the Societe de Chemie Therapeutique in Lyon. He was also selected to receive the 1995 E. Volwiler Award from the American Association of Colleges of Pharmacy.

Lloyd Smith is the winner of the Graduate School's 1994 Romnes Award in Physical Sciences. Romnes awards go to faculty within four year's of achieving tenure. One award is made in each division, and provide unrestricted research funding. Lloyd's research program to develop methods for gene sequencing has been very successful.

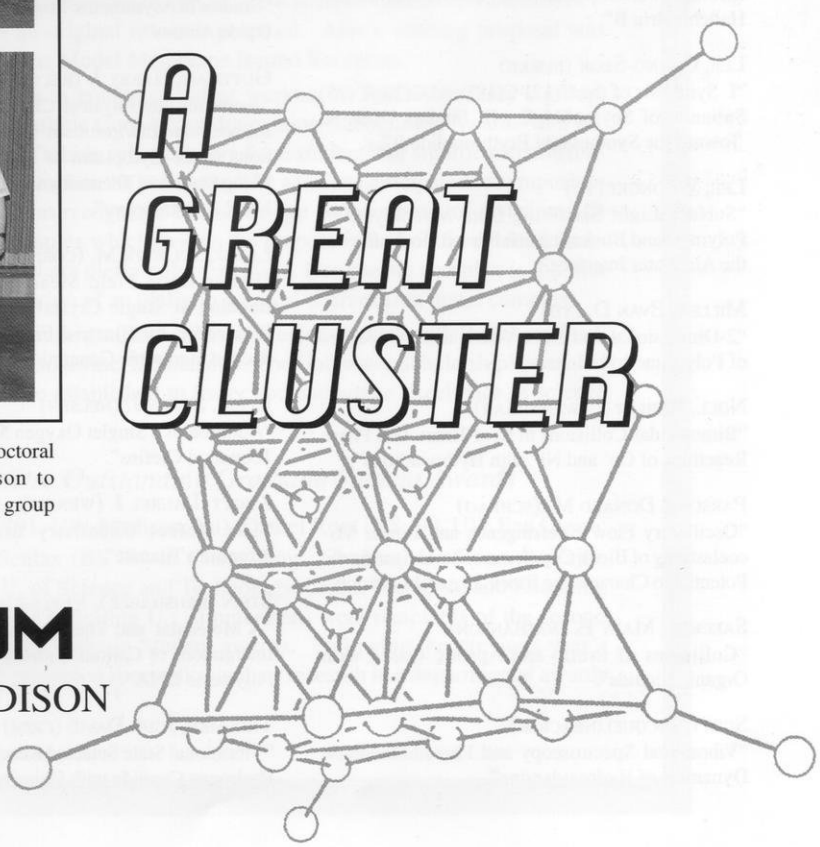
Jim Taylor was selected to receive the 1993 Alan Berman Research Publications Award by the Naval Research Laboratory. This annual award recognizes an outstanding publication from work supported by ONR within the past year. Professor Taylor's paper, with graduate student Doowon Suh and ECE faculty member Frank Cerrina as co-authors, describes self-assembled monolayer materials as resists for microcircuit applications.

John Wright continued the department's record of recognition for outstanding teaching. He was the tenth department faculty member to receive a university teaching award, since they were initiated in the 1950s. John's award resulted from creative ideas for instruction that he put into practice in undergraduate analytical chemistry.

THE DAHL GROUP

More then three-fourths of Larry Dahl's former graduate students and postdoctoral colleagues were among the 140 people who convened in Madison to celebrate Larry's 65th birthday. A series of three pictures include all Dahl group members in attendance.

Dale L. Wampler, Douglas Smith, Chin Hsuan Wei, Eugene Corey, H. Wallace Baird, Willi E. Oberhansli, Milton D. Glick, Kent A. Klanderman, Marcia F. Bailey, John F. Blount. Robert J. Doedens, Glenn R. Wilkes, Melvin A. Neuman, Judith M. Coleman, Donald L. Stevenson, Steven Watkins, JoAnn Norris, Paul W. Sutton, Richard W. Perry, Vernon A. Uchtman, Larry B. Handy, Eldrys Rodulfo de Gil, Earl F. Epstein, Linda R. Bateman, Charles E. Strouse, Alan S. Foust, Robert M. Sweet, Richard P. White, Jr., E. Gordon Muller, Joseph C. Calabrese, Phillip G. Vergamini, Toan Trinh, P. Douglas Frisch, Gary L. Simon, Philip M. Cook, J. Douglas Sinclair, Boon Keng Teo, Raymond M. Roder, James R. Huntsman, Robert S. Gall, Jeffrey L. Petersen, Charles F. Campana, Jane J. Strouse, Kathryn M. Wagner, Loren D. Lower, Robert C. Ryan, Robert W. Broach, Cynthia Chu, James P. O'Connor, Lance R. Byers. Robert E. Ginsburg, Michael Paquette, Charles R. Szmanda, Fred Lo, Don Washecheck, Larry Cirjak, Robert E. Johnson, Joseph A. Kocal, Joseph J. Maj, Lawrence L. Nelson, Ruth A. Montag, Mark A. Murphy, William Olson, Mark H. Englert, Robert Bedard. Charles P. Gibson, Dick A. Nagaki, Kimberly A. Martin, David F. Rieck, James Mahood, Holly A. Harris, Karl C. Kharas, Robert E. DesEnfants, Michael S. Ziebarth, Terry North, Jeffrey Zebrowski, Diana Tomchick, Gregory J. Lewis, Mary E. Barr. Jackson Ma, James Thoden, Arthur Kahaian, James A. Gavney, Alison J. Whoolery, Randy Hayashi, Agnes Lee Ma, Jeffrey Bacon, Peter Mlynek, John Bemis. Nguyet Tran, ...



THE DAHL SYMPOSIUM

UNIVERSITY OF WISCONSIN - MADISON
DEPARTMENT OF CHEMISTRY
SEPTEMBER 17, 1994

NEW BADGER CHEMISTS

PHD

MAY, 1994

CAMMERS-GOODWIN, ARTHUR W. (VEDEJS)
"Allene Driven Cope Ring Expansion of Carbocycles".

GOVONI, STEVEN T. (NATHANSON)
"Molecular Beam Investigations of Water Molecules Striking Concentrated Sulfuric Acid".

HAMILTON, JAMES (WRIGHT)
"Vibrationally Enhanced Infrared Four Wave Mixing".

HOLMBECK, SIGNE M.A. (LERNER)
"Nuclear Magnetic Resonance Studies of the Solution Conformation of Hyaluronan".

HORITA, DAVID A. (LERNER)
"Nuclear Magnetic Resonance Studies of Glycosaminoglycan Interactions and Dynamics".

JUNG, KYUNG WOON (BURKE)
"Tetrahydropyran and Tetrahydrofuran Syntheses via Radical and Anionic Cyclization and Synthetic Efforts Towards Avenaciolide, Isoavenaciolide and Halichondrin B".

LEE, CHANG-SEOK (BURKE)
"I. Synthesis of the C(12)-C(19) and C(20)-C(25) Subunits of Scytophin C. II. Studies Directed Toward the Synthesis of Erythronolide B".

LEE, WOONGKI (YU)
"Surface Light Scattering from Monolayers of Polymers and Buckminsterfullerene Derivatives at the Air/Water Interface".

MILLER, EVAN D. (YU)
"2-Dimensional and Bulk Viscoelastic Properties of Poly(dimethyl siloxane)".

NOLL, ROBERT J. (WEISSHAAR)
"Bimolecular Collisions in Real Time: Gas Phase Reactions of Co^+ and Ni^+ with Hydrocarbons".

PARSONS, DONALD M. (SCHRAG)
"Oscillatory Flow Birefringence and Linear Viscoelasticity of Block Copolymers: Investigating the Potential to Characterize Block Size and Location".

SAECKER, MARY E. (NATHANSON)
"Collisions of Protic and Aprotic Gases with Organic Liquids".

SCOTT, JACQUELINE (CRIM)
"Vibrational Spectroscopy and Photodissociation Dynamics of Hydroxylamine".

WRIGHT, LAURA (LERNER)
"Magnesium-DNA Interactions as Probed by Magnesium-25 and High-Resolution Proton Nuclear Magnetic Resonance Spectroscopy".

AUGUST 1994

BACON, JEFFREY W. (DAHL)
"Synthesis and Characterization of Nickel-Phenylphosphinidene and Palladium-Nickel Clusters".

BADENHOOP, JAY K. (WEINHOLD)
"Natural Bond Orbital Analysis of Resonance and Steric Interactions".

DOWD, RICHARD B. (VAUGHAN)
"Dielectric Relaxation of DNA in Aqueous Solutions by Time Domain Reflectometry".

FITZGERALD, MICHAEL C. (SMITH)
"The Analysis of Nucleic Acids by Matrix-Assisted Laser Desorption/Ionization (MALDI) Mass Spectrometry".

GARCIA-RIVAS, JOSE A. (VEDEJS)
"Studies in Asymmetric Protonations of Phosphine Oxide Anions".

GUTTMAN, HARRY J. (RECORD)
"Assessing the Physical Chemical Effects of the Intracellular Environment on Molecular Interactions in the Cytoplasm of Escherichia coli K-12 Using Statistical Thermodynamics and Quadrupolar NMR Spectroscopy".

LANTZ, JULIETTE M. (CORN)
"Electrostatic Field Measurements and Band Bending at Single Crystal TiO_2 Semiconductor Electrodes by Electric Field Induced Optical Second Harmonic Generation".

KLEIN, SUSAN J. (NELSEN)
"Addition of a Singlet Oxygen Mimic to Hindered Tetraalkyl Olefins".

KNOTT, LAUREL J. (WRIGHT)
"The Defect Chemistry of Erbium-Doped Strontium Titanate".

STEIN (BRUSHABER), VERONICA M. (RECORD)
"A Molecular and Thermodynamic Study of the Interactions of Cations with an Oligomeric and a Polymeric DNA".

THOEMKE, JOHN DAVID (CRIM)
"Vibrational State Selected Reactions of Water and Hydrogen Cyanide with Chlorine Atoms".

WILSON, DAVID W. (ZIMMERMAN)
"The Synthesis and Photochemistry of Acylazicines Vinylcyclopropenes".

DECEMBER 1994

BOHNSTEDT, ADOLPH C. (RICH)
"The Synthesis and Biological Activities of Novel Backbone-Modified Analogues of Cyclosporin A".

CHAPMAN, ROBERT W. (VEDEJS)
"Synthesis, Reactivity and Crystallization Driven Asymmetric Transformation of Boron Chelates".

CHEN, LING-JEN (NELSON)
"Synthesis and Study of N-Isopropylated Hydrazines and Hydrazine Radical Cations".

CICERONE, MARCUS T. (EDIGER)
"Dynamics in Supercooled Liquids: Rotational and Translational Diffusion of Probe Molecules in O-Terpenyl and Polystyrene".

ELLINGSON, PETER C. (YU)
"Polymer and Probe Diffusion in Thin Films and at Interfaces".

HAWI, SHARON R. (WRIGHT)
"Nonlinear Spectroscopy of Conjugated Polyenes: 1,8-diphenyl-1,3,5,7-octatetraene".

HOLLADAY, JONATHAN E. (REICH)
"Structure and Reactivity Studies of Allenyl-Propargyl Lithium Reagents".

JOHNSON, ARTHUR F. (SMITH)
"Fluorescence and Triple Helix-Based Methods for the Analysis of DNA and Proteins".

KING, MACKENZIE E. (NATHANSON)
"Studies of Surface Roughness and Gas Liquid Energy Transfer By Velocity Resolved Angular Distributions of Inert Gas Atoms".

LIN, SHOUZHONG (VEDEJS)
"I. Removable Arenesulfonyl Groups; Applications in Peptide Synthesis. II. Asymmetric Transformation in Synthesis; Chiral Glycine Enolate Equivalents".

MENESCAL, ROGERIO K. (WEST)
"Synthesis and Solid State Structure of Di-n-alkylsilylene Homo- and Copolymers".

REINHARDT, LAURIE A. (NELSEN)
"The Radical Cation Chain Oxygenation of Olefins and Dienes, the Physical Properties of Olefins and Dienes and Their Radical Cations, and the Conformational Analysis of Polyoxysulfides".

SCHLAX, PAULA JEAN (RECORD)
"Mechanisms of Gene Regulation: Repression of Transcription by lac repressorin vitro and in vivo".

SCHWARTZ, JOE LEO (FARRAR)
"Solution and Solid State NMR Relaxation Studies of Coupled and Decoupled Spin Systems".

WHITE, CHRISTOPHER C. (SCHRAG)
"High Frequency Viscoelastic Properties of Polymer Solutions".

WIDENHOEFER, ROSS A. (CASEY)
"Reactions of Small Molecules with Paramagnetic Tricobalt Hydride Clusters".

ZHU, ZHAONING (ZIMMERMAN)
"Solving the Mystery of Solid State Reactivity—Crystal Photochemistry of 4,4-Dienylcyclohexenones".

MS

MAY DEGREE

DOUGLAS JENKINS (WHITLOCK)
CHRISTOPHER C. LIU (GAINES)
TIMOTHY J. PARROTT (WHITLOCK)
HAO ZHANG (GELLMAN)

AUGUST DEGREE

KREGG T. BROOKS (HARRIMAN)
BRETTA F. KING (WEINHOLD)
GILBERT VOY (NELSEN)
YALING WANG (HAMERS)
JAMES ZDRODOWSKI (MCMAHON)

DECEMBER DEGREE

TODD E. EVERT (EDIGER)
STEPHANIE B. ROSS (RECORD)
KURT D. SCHLADETZKY (GELLMAN)

BS

MAY DEGREE

Bachelor of Arts
THOMAS JOHN BOERTH

Bachelor of Science
DALE JAY BERWANGER

Bachelor of Science (cont.)
CHRISTOPHER L. ETIENNE
STEVEN MARK GIBSON
JEFFREY PARKER HENDERSON (HONORS)
MAN HO KIM
JASON WELLS KLAUS
NICOLE MARIE LANGER
BONNIE LYNN LEIMER
KEVIN THOMAS MEHRING
WADE LEE MORETZ
JEFFREY JOHN RIPP
LEE A. RZENTKOWSKI
MARK JASON SEIERSTAD
PAUL HENRY SEVERIN
WILLIAM K. SIMEK
TAMMY CHRISTINE TUREK
ANN MARIE VETTER
CHRISTOPHER WILLIAM WEST
TARA JEAN WINTER
SHARI LYNN WOOLLEN
LAURA HAYES LOVE (EDUCATION)

AUGUST DEGREE

Bachelor of Science
CHRISTINA LEE MCCANN
DOROTHY LAURIE SCHULZ

DECEMBER DEGREES

Bachelor of Arts
JAMES A. BROCKILL

Bachelor of Science
BRUCE ALAN BAHMAN
QUYNH DIEM BUI (EDUCATION)
ANN MARIE CAPPELLARI
MICHAEL LEE KULBACKI
PATRIC MARK MELOY
RICHARD CHAPMAN PEACOCK
ROBERT L. WILD (EDUCATION)

Students Receive Awards

Alan Esker, a student in Professor Yu's group, was the recipient of a Henckel Corporation Research Fellowship in Colloid and Surface Chemistry. The two year fellowship is cosponsored by the ACS Division of Colloid and Surface Science. It requires an original research proposal. Alan's winning proposal was titled, "Calixarenes as Model Membrane Bound Receptors.

Susan Hallenbeck, a graduate student working in Professor Casey's group, received a Union Carbide Corporation Innovation Recognition Award. In a national competition, Carbide selects six graduate students for significant contributions to catalysis research as the awardees. The winners participate in a symposium at Carbide. Susan was recognized for her design and synthesis of a yttrium(III) pentenyl chelate complex which models the proposed alkyl-olefin d^0 metal intermediate in Ziegler-Natta olefin polymerization. Her chelate complex is the first example of coordination of an olefin to an alkyl-d^0 transition metal complex.

Ryan Skrupky, an undergraduate chemistry major working with Professor West, received a Barry M. Goldwater Scholarship. The Goldwater Scholarships, awarded based on merit, were established to foster and encourage excellence in science and mathematics.

Hoechst-Celanese Outstanding Graduate Student Awards

Alan Esker (BS, '91, UW-Madison; Yu), Daniel Root (BS '90, UW Eau Claire; Landis), Paula Schlax (BS '89 in Chem. Eng., Clarkson U.; Record), Yajun Wang (BS, '86, U. of Science and Technology, China; Hamers), and Zhaoning Zhu (BS '84, MS '87; Beijing U.; Zimmerman) were recipients of the second annual Outstanding Graduate Student awards. Following the previous year's format, awardees presented short talks on their research in a departmental awards colloquium

David Anderson (PH.D. '91, ELLIS) has a position at Motorola.

Bob Bird, UW Emeritus Professor of Chemical Engineering (PH.D. '50, HIRSCHFELDER) taught in the Technical University of Delft during spring, 1994. While there he met **Hans Wynberg** (PH.D. '52, JOHNSON). Wynberg had retired from the University of Groningen where he taught organic chemistry for many years. He currently is research director and chief executive officer of his own company, Syncom. Syncom does contract research in organic chemistry for companies in the chemical, pharmaceutical, and biochemical areas.

Homer Chang (Visiting Scientist, '63 - '64, Willard, is continuing to work in retirement with the data base and abstract journal of Chinese medicine in Hong Kong, which he initiated.

William Ehmann (BS, MS, '54, WILLARD; PH.D. CARNEGIE INSTITUTE OF TECHNOLOGY), Professor of Chemistry at the University of Kentucky, was awarded the Herty Medal in a ceremony in Atlanta during May. This award, given by the Georgia Section of the ACS, recognizes a top chemist in southeastern U.S. Professor Ehmann's early research includes study of lunar samples; in more recent years he has focused on possible relationships between trace elements and diseases including Alzheimer's disease.

Peter Gannet (PH.D. '82; NELSEN) was promoted to Associate Professor at the U. of West Virginia.

Louis Glasgow (PH.D. '70, WILLARD) and his wife Cheryl visited Madison in August and celebrated their 27th wedding anniversary here. He moved from Polymer intermediates R & D and is now Director of Chemical Sciences at the DuPont Experimental Station in Wilmington, DE. His new responsibilities range over many areas from computational chemistry to applied catalysis research.

Thomas Gover (PH.D. '60, WILLARD) spent a recent sabbatical leave from teaching and admistrative duties at Gustavus Adolphus to investigate changes in general chemistry teaching across the country.

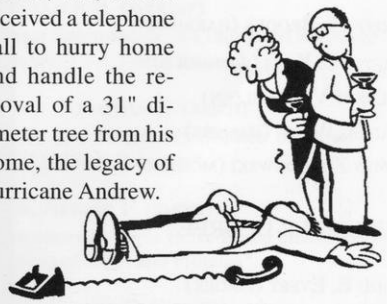
Axel Griesbeck (VISITING PROFESSOR, FALL '93) has moved to the U. of Koln as a C3 professor.

Liz Gron (PH.D. '89, ELLIS) is assistant professor of chemistry at Hendrix College, Arkansas.

Ralph F. Hirschmann (MS '48, PH.D. '50, JOHNSON) received the Carothers Award of the ACS Delaware Section. This award honors innovators that have made outstanding contributions to industrial chemistry. Hirschmann joined Merck Research Laboratories in 1950 and rose to the position of senior vice president of basic research. He retired from Merck in 1987 and currently holds concurrent appointments as research Professor of Chemistry at the U. of Pennsylvania and University professor of Biomedical Research at the U. of Pennsylvania and University Professor of Biomedical Research at the U. of S. Carolina. His research on steroids and peptides is highly regarded. In the 1960's with Robert C. Denkeweiler, he directed Merck's peptide group in the total synthesis of ribonuclease. He has received numerous honors including the Alan E. Pierce Award of the American Peptide Society, the Nichols Medal from the New York ACS Section, a Chemical Pioneer Award, and the 1993 gold medal of the Max Bergmann Kreis that is based in Munich.

Lynn Hunsberger (PH.D. '91, ELLIS; and General Chemistry Laboratory Director 1991-3) is an Assistant Professor at U. of Louisville.

James Johnson (MS '44, PH.D. '49, WILDS) provided an update on his activities: He retired from Exxon R & D Labs in Baton Rouge, LA in 1986 after over 29 years of service. In August, 1992 he visited Madison and toured the UW campus with Al Wilds. While visiting friends in New Berlin, WI, James received a telephone call to hurry home and handle the removal of a 31" diameter tree from his home, the legacy of hurricane Andrew.



Francis Johnston (PH.D. '52, WILLARD) has enjoyed continuing to teach in the fall and winter quarters, although retired from the chemistry faculty at the U.of Georgia.

Hong Yol Kang (PH.D. '66, WILLARD) has retired from his positions as President of the Korea Science and Engineering Foundation and Executive Director (battery R & D) at the Korea Institute of Standards and Science.

Susan Klein (PH.D. '94; NELSEN) is teaching at Roanoke College, VA.

Brian Laird (PD, '88 - '89, SKINNER; and Lecturer in general and physical chemistry, 1993) began an assistant professorship at the University of Kansas in January, 1994.

Surprise Meeting for Two Alumni

RECENTLY, two chemistry department alumni who hadn't seen each other for 20 years had a surprise meeting. **Steven Goldstein** (PH.D. '73, WALTERS) is the Sandia National Laboratory Deputy Project Manager for the Waste Isolation Pilot Plant (WIPP), a proposed Department of Energy Defense Programs nuclear waste depository in Southeast New Mexico. **Stan Kosiewicz** (MS '69, WALTERS, PH.D. '73, HASKINS) working in the Environmental Programs Division of the Los Alamos National Laboratory was selected as a member of a DOE Technical Review team to assess two test programs that were proposed for WIPP.

Stan and Steve recommended a new path forward that could open the repository sooner for waste disposal while potentially saving $100-200M. Interestingly, in 1967, the two alumni also completed BS theses under Howard Malmstadt (Walters' Ph.D. advisor) at the U. of Illinois.

Steve Lee (PH.D. '81, WRIGHT) writes from Walla Walla College (WA) last August: "Things are cooking at Walla Walla this summer. For the past month the temperature has hovered near 100 deg. F. every day. Despite the hot weather we have the taks of moving the chemistry department to new quarters. Unfortunately the air conditioning is not yet on line in the new building ...."

Ding Ping Lin (PD '71 - '73, WILLARD) visited Madison in May with his family to attend the graduation of his son Frank, who majored in Mechanical Engineering.

Ray Luebbe (PH.D. '58, WILLARD) is doing consulting and is publishing a new technology periodical.

Ronald P. Mason (PH.D. '72, HARRIMAN), a research chemist at the National Institute of Environmental Health Sciences in Research Triangle Park, N. C., was named to receive the ACS 1994 Southern Chemist Award. This award recognizes distinguished service to the chemistry profession in the southern U. S.

Richard Neddenriep (PH.D. '57, WILLARD) has retired from his position with the Betz Company.

Gerald Nicholai (PH.D. '93, CASEY) now has a permanent position as Maitre d' Recherche at the CNRS Institute for Catalysis Research in Lyon, France.

Dale Orth (PH.D. '94, SKINNER) is a faculty member at Wisconsin Lutheran College.

Mary Jane Oestmann (M.S. '48; PH.D. '54, WILLARD) visited campus in October, to present eight volumes of French Art books to the Elevehem Art Museum. She also reported on recent activities. She held a position of Senior Radiation Specialist with the U. S. Nuclear Regulatory Commission in 1987; she was the first woman Inspector for the Commission. Although she retired in 1987, she has remained active in the Chicago ACS Section and the American Nuclear Society in which she is a fellow and past member of the Board of Directors. In 1990, she was part of an official delegation to the People's Republic of China, where she lectured on the impact of Chernobyl and visited numerous nuclear facilities.

Peter Petillo (PH.D. '91, NELSEN, PD, 92-3, LERNER) is assistant professor at the U. of Illinois.

Stan Polichnowski (PH.D. '77, CASEY) was recently promoted to Director of the Chemical Research Division of Eastman Chemical Company at Kingsport, TN.

Josh Schantl currently Professor at the Univ. of Innsbruck, (Fullbright Scholar and Research Associate '66 - '68, Zimmerman; and Visiting Professor, '89) wrote to bring us up-to-date on activities. Currently, he has active group of 6 Ph.D. students. He recently traveled to Australia and Japan, spent two weeks at San Diego, and he is working on two chapters for Comprehensive Heterocyclic Chemistry.

Marietta (Haeg) Schwartz (PH.D. '88, WHITLOCK) was promoted to Associate Professor with tenure at the University of Massachusetts, Boston. She and Eric report that they have a son, Graham Thomas Schwartz, born November, 1993.

David Schissel (PH.D. '85 ZIMMERMAN) has moved from GE to Johnson Wax.

Eric Schwartz (PH.D. '88, VEDEJS) was recently promoted to Associate Scientist at Eisai Research Institute in Andover, MA.

Recent graduates from the Zimmerman group, **Jerry St. Clair** (PH.D. '88) and **Drew Weber** (PH.D. '88) are at DuPont.

Michael St. John (PH.D.) visited the department as a McElvain Seminar Speaker, presenting a seminar on "Structure-Activity Relationships for Polyelectrolyte Use in Paper Recycling Applications". He is currently a manager at Nalco.

Gerald Takacs (PH.D. '70, WILLARD) is completing his 8th year as Head of the Chemistry Department at Rochester Institute of Technology.

Jens Wolff (PD, 89 - 91, NELSEN) is completing his Habilitation at Heidelberg.

Zhaoning Zhu (PH.D. '93, ZIMMERMAN) has a postdoctoral position with Ron Breslow at Columbia.

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We're somewhat shy on news for TNT this time around. Help us out by keeping in touch. This feature depends on you! And don't forget that you can e-mail us at: CHEMDEPT@macc.wisc.edu.

Reunion

Winston Wayne (Ph.D. '44) sent us this picture, taken at Al Pavlic's home in late 1992. All of the men in the picture except Arch Barkdoll received Ph.D.s in chemistry from Wisconsin circa 1940 -1945.

Front row, kneeling: John Swanson, Mrs. Barkdoll, Arch Barkdoll, Alice Castle, Leona Pavlic, Al Pavlic, Winston Wayne.

Second row: Jean Wayne, Gerta Mortenson, Florence Schneider, Mrs. Hager, Mrs. Bente, Lillian Peterson, Jean Whitman.

Back row: Carl Mortenson, Art Lohr, John Castle, Gerry Whitman, Barb England, Glen Hager, Mrs. Swanson, Dave England, Russ Peterson, Paul Bente.

Looking for Martha Gunhild Week Scholars

"I learned recently that the Martha Gunhild Weeks scholarship fund still exists but that it supports a payout barely double the $25 per month that I received over 50 years ago. If the women who received Martha Gunhild Week Scholarships during the last 50 years would pledge to pay back what they received (and perhaps a little extra besides), future awards more appropriate to today's economics could be made. Contributions may be sent to the Department of Chemistry and would be tax deductible."

Sallie Fisher (BS '45, MS '46, PH.D. '49)

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(*Editor's note*: The Martha Gunhild Week Scholarship Fund was established in November, 1923, through the will of Ms. Weeks who had died about a year earlier. Ms. Week was the youngest daughter of Mrs and Mrs. John Week who conducted a lumbering operation in northern Wisconsin in the 1800s. The family lived in Stevens Point. Ms. Week attended the University of Wisconsin, graduating in 1884. The Trust Fund set up in her honor specifies that the fund's earnings be used for a scholarship for a woman majoring in chemistry. The first scholarship was award in 1925, and awards have been made each year since that time. Sallie Fisher received a Martha Gunhild Week scholarship in 1943-44. Along with her note, she provided a very handsome gift that more than doubled the value of the fund. We would greatly appreciated further gifts from past alumni and friends.)

IN MEMORIAM
1994 - 1995

reports coming to us from friends

James Paul Fugassi

Professor Emeritus at
Carnegie Mellon University,
died June 4, 1994, at the age of 84.
He received BS and MS degrees from Carnegie Tech and a Ph.D. in chemistry from Wisconsin in 1934 under the direction of Farrington Daniels. He had been a member of the Carnegie Tech-Carnegie Mellon faculty since 1961 and was widely known for research on gas kinetics, solution kinetics, electrochemistry, and photochemistry. During World War II, he was actively involved in the research effort to produce synthetic rubber.

Robert F. Kusel

(BS '36) died October 2, 1993.

James A. Koutsky

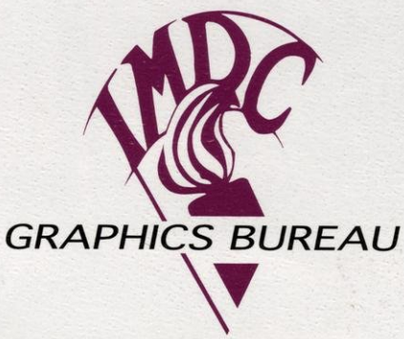
Age 54, Professor of Chemical Engineering, died on Friday, November 25, 1994. He had been a member of the UW faculty since 1966. His early research interests were in nucleation and the applications of microscopy to polymer crystallization. More recent interests have been in the development and recycling of plastcs, plastic/wood and composite materials, adhesives, and inorganic fibers produced by inviscid melt-spinning. He taught courses in the structure and properties of materials, polymer science, and adhesion science.

Richard George Werth

(MS '48, PH.D. '50, WILDS)
died July 12, 1993. He had been a faculty member at Concordia College, Moorhead, MN.

Charles Francis Williams

(BS '36)
died October 2, 1993.



University of Wisconsin-Madison School of Education