ALUMNI NEWS
School of Chemical Sciences
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## Interdisciplinary Specialization in Materials Chemistry

Beginning in the Fall, 1996, the School of Chemical Sciences will offer an integrated and flexible program of graduate study and research in materials chemistry. The program will emphasize the chemists' view of material science which differs from, but is complementary to, that of traditional engineers. With the burgeoning interest in new materials there is increasing need for scientists with expertise in molecular and atomic level engineering. Therefore the field of chemistry is primed for a program in materials chemistry and the University of Illinois is uniquely qualified to offer one.

We have a long history of interest in materials within the chemical sciences. The legendary Carl (Speed) Marvel and his pioneering work in polymerization is an

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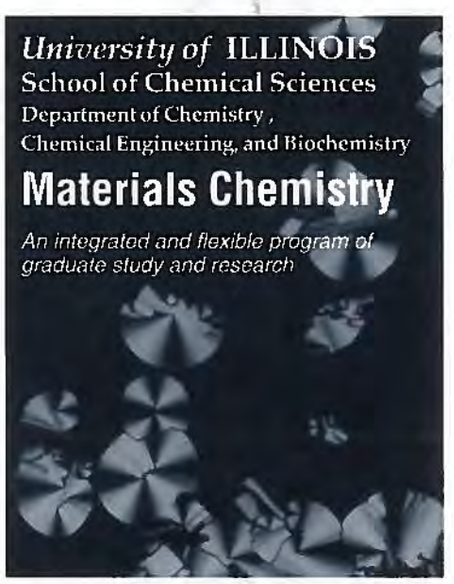



## Chemical Engineering Receives the Charles and Dorothy Prizer Chair

Charles Prizer, B.S. 1944 (ChE) has long been a loyal and generous friend of the Chemical Engineering Department at the U. of I. The Charles and Dorothy Prizer Chair is a culmination of their many gifts over many years. The Prizers have been generous of both their time and their assets. In 1984, Chuck became a charter member of the department's Resource Development Committee. He served for eight years, including two as chair. He helped the Department define the ChemE 2000 Capital Campaign and served as its Director from 1992-94.

Chuck retired from Rohm and Haas in 1986 as Group Vice President after 34 years with the Company. Subsequently, he founded CJP Enterprises, Inc., a consulting firm, the Mill Creek Company for hazard-

*Continued on page 2*

Charles and Dorothy Prizer

## INSIDE







## Materials Chemistry

from page 1

obvious example. In addition, this university has a strong Materials Science and Engineering Department and a nationally recognized Materials Research Laboratory which houses faculty from various disciplines, conducting research in materials sciences.

Students who enter this program in the School of Chemical Sciences will be able to select an advisor from the Chemistry, Biochemistry or Chemical Engineering Department. They will be required to take three units of core courses drawn from the following three areas: the physical chemistry of solids, synthesis of materials, and spectroscopy and characterization of solid state structure. They will also be expected to take two specialized courses related to materials chemistry either on specific types of materials, such as ceramics or biomaterials, or techniques, such as materials processing.

A wide variety of additional courses will be available to students in the program. A number of special topics courses related to materials chemistry are taught in one of the three chemical science departments. In addition, students will be encouraged to participate in the wide array of seminars that deal with aspects of material chemistry virtually across the campus.

The materials chemistry program will provide an umbrella to help students select an advisor with compatible interests and to structure their coursework to strengthen their preparation for the growing field of materials chemistry. Part of the impetus for the program came from the spectacular success of our biomolecular chemistry offering that has attracted an exceptionally large and well qualified student body to our graduate program.

*Both the biomolecular and the materials chemistry programs will bring the U. of I. graduate chemical science program into the forefront among schools that have led the way into the twenty-first century.*

Both the biomolecular and the materials chemistry programs will bring the U. of I. graduate chemical science program into the forefront among schools that have led the way into the twenty-first century. Backed by the strengths of the University of Illinois, especially in the sciences, and with the superb infrastructure of the School of Chemical Science, we fully expect that the materials chemistry specialization will become another marked success.

## Prizer Chair

from page 1

ous waste site cleanup, and Prizer & Wilkinson for technology transfer.

Chuck's career has been marked by imaginative approaches to manufacturing excellence, productivity improvement and people development. At Rohm and Haas he pioneered an organizational approach to productivity improvement through participative management and formulated strategies for safety, health, environmental affairs. All of these issues are of intense public concern. Chuck contributed to the education of young engineers through his lectures at the U. of I. and elsewhere.

The same leadership and organizational skills that Chuck demonstrated in his industrial career helped bring success to the ChemE 2000 campaign. Chuck's understanding of the needs of the Department led to the establishment of the Charles and Dorothy Prizer Chair, which will facilitate the Department's faculty recruitment drive.

Chuck and Dottie Prizer's philosophy can be summed up very simply: "Chemical engineers have been important contributors to the creation of wealth in America. It is important to support the continuation of that process for coming generations.'

# National Award Winners

Two students in Professor Andrzej Wiekowski's research group have received national awards. **Aliston Thomas** has received a graduate student award from the ACS Division of Analytical Chemistry. Only five of these fellowships are awarded annually. He also won second place in the poster competition sponsored by the National Association of Corrosion Engineers International at its meeting in Orlando, Florida.

**Yung-Eun Sung** received the 1995 Student Achievement Award of the Industrial Electrolysis and Electrochemical Engineering Division of the Electrochemical Society. Yung is the recipient of a summer research fellowship for 1995. The fellowship is given by the Electrochemical Society, Inc. and funded by the Department of Energy. In addition Yung won a General Society Student Poster Session Honorable Mention Award in Electrochemical Science and Technology in May, 1995.

(left to right) Yung-Eun Sung, Professor Andrzej Wiekowski, and Aliston Thomas

## Chemistry and Chem Engineering Doctoral Programs Rank Among Top 10 in US.

A four-year study by the National Research Council, an arm of the U.S. National Academy of Sciences, called *Research-Doctorate Programs in the US* rated graduate programs by two criteria: scholarly quality as measured by a national survey of faculty peers, and effectiveness in teaching of Ph.D. candidates. Both Chemistry and Chemical Engineering at the U. of I. ranked among the top US programs. Chemical Engineering ranked 5 and 6 and chemistry ranked 8 and 7 respectively on the two criteria used in the evaluation.

# Plans for the Future

*by Charles Zukoski, Head, Chemical Engineering*

Now that I have accepted the position as permanent head, I have given a good deal of thought to the future of the department and what I want to accomplish. My first priority is clearly to recruit additional faculty. In recent years, the size of our faculty has shrunk but our student body has not. Our current teaching level is not sustainable over the long run. We have been fortunate that despite the pressure, we have turned out a good product. Corporations like our students and those graduates who go to industry get real professional jobs along with good salaries.

Now that we have made a firm commitment to stay with the School of Chemical Sciences, I would like us to become more involved with the undergraduate instructional program. In order to help the School become, in all respects, the home of modern chemical science, we will need a more integrated educational program. I believe that minor modification of instructional tools and subject matter, introducing principles related to chemical engineering, will enhance the educational experience of all chemical science students. However, rethinking courses takes faculty time, something which we will not have until we have added to our staff. I hope that the School will define itself increasingly as an educational, not primarily as a research, institution and I have a number of concrete ideas that could move us in that direction.

*The corporations that hire our students are more interested in their ability to define and tackle problems than in any particular subject matter that the student has studied.*

Our department is ranked as one of the best in the country but I would like to see us expand our vision. I consider Chemical Engineering "the liberal arts of engineering." We will have to become generalists to develop skills for dealing with problems of every scale, from the largest to the molecular level. We will need special skills to deal with engineering problems in biomolecular chemistry. Possibly, we will be steering our undergraduate students into more biochemistry rather than just physical chemistry courses which have been required in our curriculum.

We will continue to emphasize problem solving skills at all educational levels. The corporations that hire our students are more interested in their ability to define and tackle problems in any particular subject matter that the student has studied. We have to keep in mind that our primary product is not our research but our students. That is why we have been successful in developing social skills along with scientific techniques. Our undergraduates work in teams of randomly assigned students. Their projects are graded as a team. Dealing with unpopular team members develops social skills that are highly valued in the market place.

I have ambitious plans for our development effort. Dick Alkire laid the groundwork over many years but we are working on some radically new approaches, while maintaining our traditional development programs, which have been so successful because we are blessed with a loyal and generous alumni group. This new direction is based on our research program and seeks to find new ways to interact with our corporate friends. We are concerned that our faculty have become too far removed from the technology problems faced by industry and we will work out mechanisms to reverse this trend.

On a one-on-one basis, we are designing mechanisms to open lines of communication between our faculty and their industrial counterparts. I hope that we will be able to encourage corporations to invite faculty to give seminars because I believe that these contacts will generate productive interchanges and collaborations. Some of these situations might lead to direct research partnerships; in other cases, someone on the industrial side may be able to help us by supporting our proposals when we go to federal agencies for funding.

I hope that these interactions will result in more active consulting arrangements. In addition, we are setting up industrial internships for graduate students. The students would take three months out of their graduate program to go to a corporation to work on a project. These students might have completed two years towards their Ph.D. degrees and would have an opportunity to learn something about an industrial environment. Even such a brief period would benefit the socialization process and would help our students to become more valuable to their future employers.

Charles Zukoski

Finally, we are talking to industry about developing short courses for their employees. These could be taught here or there or on the "web," whatever comes closest to fitting the requirements of all parties. Of course, we will have to solve some problems at our end to make these things happen. For instance, if we put together specialized educational programs we will have to deal with intellectual property rights and the allocation of costs and earnings. In a day of decreasing federal funds for research grants, this avenue might become an important revenue stream to support our research effort.

These are exciting projects with important ramifications. The most immediate is that they all require faculty input which translates into faculty time. Until I can hire more staff, we will have no faculty time to spare. For this reason, the new Prizer Chair is especially welcome because it will help me to get started on the all important process of faculty recruitment.

# Undergraduate Research Program Earns High Marks From Students, Faculty, and Alumni

Shelley Moore

The Ghaim Researchers (left to right): Erin McDearmon, Victoria Kutilek, Josh Ghaim, and Dorrie Cappalletti

Undergraduate research in the chemical sciences at the University of Illinois can be described as a core concept with many manifestations. The core is that of undergraduate students working in research laboratories, but, in practice, the experience is quite varied. Assignments can range from washing dishes and setting up experiments for an hourly wage, working on a limited "special project" in a 199 course, or completing a defined thesis project for academic credit, as in a 292 course. Students feel that the quality of the experience depends more on the aptitude and attitude of the student and the supervising faculty member than on the details of the project. In order to give focus to this article, we will restrict it to structured, formal undergraduate research, such as the 292 course, which is considered, by many, the capstone of our undergraduate program in the chemical sciences.

Each of the three departments offers "292 courses." Students can receive up to 10 credit hours for taking the course and become eligible for graduation with distinction depending on their overall record. The course is generally taken by seniors who have completed most of their coursework and may have developed special interests that they wish to pursue. The choice of a topic is usually a joint decision by student and supervisor and interested students typically interview several faculty members before deciding which laboratory to join. The course results in a formal thesis which meets the requirements of the faculty member, the department and the college. The departments support the program by offering prizes for the best theses, including the Marvel, Bailar, and Sidebottom awards.

## Faculty support

One of the most articulate supporters of the program is Robert Gennis, Professor of Biochemistry and Chemistry, who sees the undergraduate research program as a unique contribution of a major research university like the University of Illinois. As he points out, "The major research universities, including the University of Illinois, are often criticized for their 'second rate' undergraduate instruction. They are faulted for large class sizes and for their emphasis on research productivity at the expense of teaching. But what we can offer is a premier research experience which liberal arts colleges cannot offer to the same degree. Because we have internationally ranked, superb researchers, instrumentation and graduate students, we can give an extra dimension to our undergraduate education. The dichotomy between research and educational institutions disappears if we merge our research into our undergraduate educational experience."

"In many respects our undergraduate research program is equivalent to our graduate education. Having a formal research project culminating in a thesis is a good idea but not crucial. I believe that students can learn a great deal about the nature of research even when they are paid as hourly workers and many of those in my laboratory progress from taking a job to taking 292. Our program has never received adequate recognition for this very effective educational aspect."

The bulk of this article presents profiles of students currently taking undergraduate research. The first two represent more typical situations. Shelly Moore is about to begin her senior year which she plans to devote primarily to her 292 project. Josh Ghaim is a graduate student "intermediary" who is supervising the senior research of three undergraduate students who are conducting related projects. The other two cases are more unusual. Chris Treadway has already devoted two years to an extensive research project. James Farrell is a student at a liberal arts college who has been invited to spend a summer at the U. of I. to gain experience in a modern research laboratory. The final section will profile two alumni, one of whom has become a financial supporter of the program and the other who offers a retrospective on our undergraduate research program and a comparison with the one offered by the university where he is a faculty member.

## Shelley Moore will devote her senior year to her research project

In the summer between her junior and senior year as a biochemistry major, Shelly had just begun an undergraduate research project. In a sense, she has designed her entire program to maximize this research opportunity. She completed most of her coursework in the first three years, leaving her senior year virtually free to devote to her project. Last summer, she took no courses, spending about 50 hours per week in the lab.

Shelly is a member of the research group of Stephen Sligar, Professor of Biochemistry and Chemistry and Director of the School of Chemical Sciences. In the Biochemistry Department, the students interview faculty who are willing to accept undergraduates into their labs, both students and faculty rank each other and the department makes an assignment.

Shelly is working in the P-450 enzyme group because she has always been interested in the structure/function relationship of enzymes. Her project is on the substrate binding area of the P-450 enzyme. By taking out sections of the protein and substituting parts of other P-450 enzymes, she is attempting to discover what areas of the protein are important for binding and how these changes affect the binding

process. Eventually, she hopes to produce a series of random mutations which she will screen for their effect on substrate binding, a project which will enable the design of new enzyme function for environmental cleanup.

Shelly decided to do undergraduate research because she felt that there were benefits to going beyond course work. "The laboratory courses are fine," according to Shelly, "but they are designed for instruction. The student performs an experiment only once and it is designed to be successful. The real world of research is not that predictable."

Fortunately, Shelly had earlier worked in an organic chemistry lab which served as good preparation for her current project. Shelly expects that the undergraduate research will smooth the transition to graduate work. She plans to pursue a Ph.D. after graduation, probably in biochemistry, and recommends the undergraduate research option for anyone who is considering a graduate degree.

## Graduate student Joshua Ghaim supervises three undergraduate research students

Josh is one of nine Ph.D. students in the research lab of Robert Gennis, Professor of Biochemistry. As an experienced graduate student, he was put in charge of three biochemistry seniors all of whom have taken biochemistry 355, the main introductory laboratory course, and have many scientific ideas that they would like to explore.

Fortunately, the Gennis laboratory pursues a variety of studies so that the students have a wide array of research problems from which to choose. Some of the students work together on parts of their projects and some projects extend beyond the "life" of one undergraduate researcher and are taken up by a subsequent student entering the laboratory. Eventually, many of the research projects produce publishable results which lead to papers with both the graduate student supervisor and the undergraduate researchers as authors.

One of Josh's requirements for acceptance into his undergraduate research group is that the student have spent time in a laboratory before their senior year, either as an hourly employee or by taking an independent study course (199) that provides training akin to that of a technician. Students taking the senior research course (292) are more like graduate students, which many of them eventually become.

Victoria Kutilek, one of Josh's current undergraduate research students, is working on simplifying the current method of protein purification of the cytochrome bd complex from *E. Coli*. She is using the $Ni^{2+}$–NTA Affinity chromatography method that requires the insertion of a 6xHistidine-tag in the protein. Dorrie Cappalletti works with Vicky on cytochrome bd oxidase from *E. Coli*. She is engaged in insertional mutagenesis to introduce unique Sac I sites into cytochrome bd. She has been successful with some of her mutants and is now trying to introduce the $SH_2$ domain of the V-src gene into unique Sac I sites, which will be used for X-ray co-crystallization of the protein. Erin McDearmon has two projects. She is inserting a 6xHis-tag into the succinate dehydrogenase of *E. coli*, as another approach to finding a simpler method to purify the protein. Together with Vicki she is working on generating a library of antibodies specific to cytochrome bd and bo of *E. Coli*.

According to Josh, one of the most important features of undergraduate research is that the students learn to think for themselves. In the laboratory courses students are expected to perform a given set of experiments on a set schedule. Because of time constraints, the students get help from instructors so that they can complete the material. In the undergraduate research program, the students develop far greater independence in the lab and spend much more time, about 15-20 hours per week, for a maximum of 6 credit hours per semester. Therefore, the option is most appropriate for students who carry a relatively light course load during their senior year.

For the serious chemistry student, Josh thinks that the undergraduate research option is almost a necessity regardless of whether they are planning on graduate school or industry. According to Josh, "Today, getting your degree is not enough. Employers are looking for work experience in addition to book learning. Students can get all A's by memorizing the books without learning to think on their own. Today's job market requires that students have had real world laboratory experience and having one or more publications really helps a resume."

Chris Treadway

## Christopher Treadway has completed two years of undergraduate research

Now a senior, Chris has been doing undergraduate research since the end of his freshman year, including summers. His interest in chemistry stemmed from a good chemistry teacher in his small high school. On the basis of his placement exams he was awarded eight advanced placement credits even though his high school did not offer advanced placement courses.

Chris did so well in his freshman chemistry classes that Professor Zumdahl, director of the undergraduate program, offered him a Baxter fellowship to work in a laboratory the following summer. Chris first worked with one of the graduate students in the laboratory of Gregory Girolami, Professor of Chemistry. He thought that undergraduate research meant that he would just be helping out the graduate student and was surprised to find himself embarked on a very interesting research project of his own.

As his studies progressed, Chris focused on the synthesis of mixed metal cyanides that were magnetic at high temperatures. He helped develop the first known cyanide complex of titanium and has been carrying out spectroscopic and magnetic studies on this new complex. As a result of his undergraduate research, Chris will be one of the authors on at least three papers and he presented his work on the titanium compound in a poster at the Chicago ACS meeting in August 1995.

James Farrell

Wesley Burghardt

Chris thinks that he learned a great deal from the research experience, especially how to use sophisticated instruments and to design his own experiments. He can think of no better preparation for graduate school. His current plans are to apply to Stanford, MIT, and the University of North Carolina for graduate work. However, before he finishes, Chris plans to take some graduate (400 level) chemistry courses and possibly some other electives.

During his undergraduate years, Chris has taken a variety of courses outside of his chemistry major, including biochemistry, microbiology, nuclear engineering, classical civilization, psychology, kinesiology (ice skating and weight lifting) and a class in severe and unusual weather, "one of the most interesting classes I have had." Despite the wide range of his studies, Chris has maintained a straight "A" average.

To finish out his undergraduate career, Chris is now working as a teaching assistant in Chemistry 107, the most advanced in the introductory series of courses. Chris remembers having had an excellent undergraduate TA when he took the course and looks forward to honing his teaching skills.

## James Farrell came to the U. of I. solely for a summer of research

In contrast to other undergraduates described in this article, James Farrell had to compress his research program into a single summer semester. He is a student at Reed College who came to the U. of I. to undertake a summer research project. Working under the supervision of Patricia Shapley, Professor of Chemistry, James has been synthesizing organometallic osmium compounds with the ultimate goal of making an osmium alkylidene that may help to explain a certain type of polymerization process.

Because he became engrossed in his project, James wished that he had had more time to take it to completion. Pat Shapley, who has had considerable experience with undergraduate research, described James as an outstanding student who has made unusually rapid progress. James acknowledges that the experience was very beneficial for him. He had always assumed that he would eventually get a Ph.D. although he does not know at what school or in what field. Coming here gave him an opportunity to see a first rate research laboratory, which is not available in an undergraduate liberal arts college like Reed. As James says, "This was a hot place to come to. It has opened my eyes to see how science works."

Since he is just starting his junior year at Reed, he has time to make a decision about graduate schools. In the immediate future, James hopes to get involved in some form of research at Reed College this year. In addition he will be taking a heavy course load as an interdisciplinary major in chemistry and physics wherein he will be required to fulfill virtually all the requirements for each major separately. One of the long range options he is considering is to come to the U. of I for a Ph.D. Pat Shapley hopes he will join our program and assures him, "If he wants to come to grad school here, we'll be sure to save him a desk."

James is a Snyder Scholar, supported by a stipend, provided through an endowment raised by friends and former colleagues of the late Professor Harold Snyder. The program was designed especially to give students from liberal arts colleges the opportunity to work in a modern research laboratory to gain an appreciation for the challenge and satisfaction of a research career. The Snyder Scholars of the past have all continued on to graduate education and several have commented that if it had not been for the Snyder stipend they would have had to spend their summer working at a fast food restaurant instead.

## Ray Hauser has initiated the Hauser Scholars program to support undergraduate research

Ray Hauser, a 1950 BS graduate in Chemical Engineering, is senior scientist at Hauser Chemical Research Inc. in Boulder, Colorado. He did not have the opportunity to take part in an undergraduate research program while he was at the University of Illinois, beyond the senior project required of all chemical engineering graduates. But fortunately, he had a job after his junior year, working at a research station off campus.

The Hauser Scholars program, set up with a gift by Ray to the Department of Chemical Engineering, supplies stipends for undergraduate students who take a summer of research. Looking back, it seems to Ray that the Hauser Scholars program "is one in which I would have liked to participate, had it been available at the time." As he recalls, he did not learn how much fun research could be until he had begun his graduate education at Yale University and took part time work in a rubber laboratory.

Ray hopes that the Hauser Scholarships will provide selected undergraduate students "a flavor of what graduate research and academic life are all about." He hopes to inspire more students to undertake research and academic careers and believes that the program has succeeded. Follow up studies of former Hauser Scholars show that a fair proportion have gone on to graduate school.

Ray and his wife decided to make the gift to the University of Illinois because they feel that they derived considerable benefit from their years at the University. Ray especially remembers "Speed" Marvel's outstanding lectures on polymers which he found very helpful for his subsequent research on rubber, plastics, and adhesives. He also remembers fondly his many extra curricular activities at the University of Illinois including his involvement with the McKinley Foundation, a chorus part in a Gilbert and Sullivan operetta, work on the "Illinois Technograph" of which he was editor his senior year, and his experience in reviving the Engineering Open House after WWII. He and his wife were inspired to make a major charitable gift after taking

part in a Success Motivation Institute in which they explored their personal, family, spiritual, and financial life goals.

## Wesley Burghardt believes his undergraduate research experience shaped his career

Currently on the Chemical Engineering faculty at Northwestern University, Wes is in the unique position of being able to evaluate his undergraduate research experience of ten years ago and to compare it with similar programs at Northwestern. Wes completed his BS at the U. of I. in 1985 and his MS in 1986. He took a two semester undergraduate thesis program (292) with Anthony McHugh, Professor of Chemical Engineering, and became sufficiently enthusiastic that he stayed for an extra year to complete an MS with the same advisor.

Looking back, Wes credits his undergraduate research experience with far more than the opportunity to work on an independent study project which gave him extensive training in electron microscopy and polymer crystallization. His thesis became a published paper, which helped him to get into Stanford University for a Ph.D. Another outcome of the experience was that it cemented his interest in research rather than process engineering. As he says, "The choices I made at that time have remained with me and these include my disposition towards a research career." Even more specifically, he adds, "The area in which I work today is related to the research to which I was exposed in the course of my senior thesis. It captured my imagination."

Like many students who take undergraduate research, the experience gave him a foretaste of graduate school. He describes his research as six months of failure and two months of success and later learned that this was the real world of scientific research. Simply taking additional laboratory courses would not have provided this perspective.

He worked alone, without a graduate student for guidance and developed a close relationship with his advisor. Most students work primarily with an intermediary, a graduate student or a postdoc. Wes learned directly from his advisor, not just the techniques needed for his project, but also what it meant to be a university professor. He recalled visiting the laboratory very late on a Friday night and finding Professor McHugh hard at work on a problem. Wes was impressed with the dedication demonstrated by this episode which gave him a perspective that he would never have learned from observing a professor in the classroom. He believes that this experience influenced him in his decision to follow an academic career. Today, he is all too familiar with late night work.

The undergraduate research experience has had other long lasting effects. Wes is still collaborating with one of his fellow students from the McHugh laboratory. The students remain in touch with McHugh and with each other at annual get-togethers during the meetings of the Society of Rheology.

According to Wes, the undergraduate research experience can be excellent if the student is motivated and the expectations are high. He feels fortunate that McHugh set high standards for a thesis and knows that this is not universal. Also, the size of the U. of I. faculty precludes a large number of students from having the opportunity to undertake undergraduate research. At Northwestern, a larger fraction of students get experience in research labs, but often as work-study or paid research aides. Research reports are typically not as extensive as the thesis that Wes wrote as a 292 student at Illinois. Wes looks back on his undergraduate research as a seminal experience in his life that firmly planted him on the career path he has followed ever since.

## Conclusion

Broadly defined, undergraduate research has been part of the Illinois educational program for a very long time. Alumni from the '40s and '50s remember some form of undergraduate research, although the program was not as clearly delineated in its early days and frequently meant "working in the lab." The ACS Committee on Professional Training approved an option in 1962 for independent study or research as part of the advanced courses of the BS program to be offered "in partial satisfaction of the certification requirement." Finally, the 1977 guidelines recognized the value of a good research experience as part of the advanced courses of study and stressed "the importance of careful planning of projects, good supervision and a detailed student report."

Ken Rinehart, Professor of Chemistry, sums up the value of the program from the perspective of many years of supervising more than 50 undergraduate research

Ray Hauser

students. On his bookshelf he points to bound volumes of undergraduate theses which stand alongside those of his graduate theses. He thinks that the 292 experience is important for a student's maturity. However, it is not for everyone. To qualify, a student should have a minimum of a B average and show evidence of ability in a laboratory setting.

The experience gives a student a sense of independence, and an opportunity to publish and make a positive contribution to science. One of the great advantages of undergraduate research is that it provides an opportunity to test "far out " and highly speculative ideas. Whereas a graduate thesis requires a student to produce positive, publishable results in a limited number of years, an undergraduate thesis offers greater latitude in choice of subject. Furthermore, the student benefits from the experience of writing, and rewriting, a formal thesis which meets higher expectations than a "senior project."

According to Professor Rinehart, any student who plans to go to graduate school should seriously consider taking 292 because it offers excellent training. Moreover, a student who plans to go into industry will often find that a 292 project will improve his or her prospects of finding a good situation. Finally, the student gains the experience of interacting with a professor in a non-classroom setting, while the professor has the satisfaction of watching the student mature and achieve success as a scientist long after the 292 project itself has become history.

# Faculty Research

## Scanning Probe Microscopy Under Water

According to Andrew Gewirth, Professor of Chemistry, "The scanning tunneling microscope (STM) and atomic force microscope (AFM) are revolutionizing the way we view and study electrodes. Because these techniques enable us to see individual atoms and surface features such as steps, kinks, and terraces while the electrode is immersed in solution and under potential control, they provide information which is unobtainable by any other means."

With in situ electrochemical scanning probe microscopy you can "see" electrochemical processes being performed on a surface, even while those processes are taking place. By imaging a substrate with STM, then shifting the electric potential, you can visualize a new structure being formed almost instantaneously. The result, according to Philip Ross, senior scientist at the U. S. Energy Department's Lawrence Berkeley Lab is that in terms of our understanding of electrochemical interfaces, "We've had more progress in the last five years than we had in the previous 15." (*R&D Magazine*, Aug. 1993, p. 22.)

Using these new techniques, Gewirth has been advancing the field of electrochemical surface science. Scanning probe microscopy is a young branch of electrochemistry that was born with the invention of the scanning tunneling microscope in the early '80s. This was followed in 1986 with the discovery that the STM could be operated in an electrochemical cell which made it possible to examine heretofore invisible structures under water, at the interface where liquid and solid meet. The new studies demonstrated how a shift in the potential of the metal substrate affected the structures on the surface. These studies have shed important light on electrocatalysis, electrodeposition, corrosion, and the reactions that drive batteries and fuel cells.

According to Prof. Andrzej Wieckowski, "[Gewirth's] work is making pivotal contributions to 'in situ surface electrochemistry,' to catalysis, and corrosion protection science."

### What are scanning probe microscopes?

In a STM, the probe is made from a metal such as tungsten, and the tip-sample interaction is sensed by monitoring the rate of electron tunneling between the two. As the electron tunneling rate is strongly dependent on the tip-sample separation, this rate can be used to very finely position the tip above the surface using positioning devices made from peizoceramics. In an AFM, the tip is usually made from an insulating material. The tip is held at the end of a spring or cantilever which provides a restoring force to counter that obtained from the interactions between the sample and the tip, shown in Figure 1.

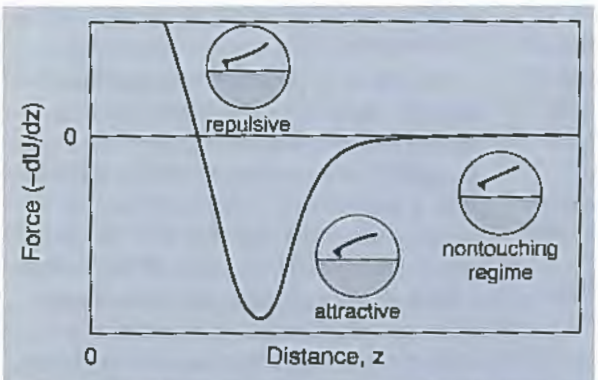



**Figure 1:** A force-distance curve. The insets show the tip curvature for (from left to right) tip in contact with the surface (repulsive interacion), tip and surface attracted (attractive interaction), and the non-touching regime (no interaction).

Changes in the deflection of the spring or cantilever are therefore equivalent to changes in tip-sample force. The force can be either attractive, usually observed at large tip-sample separations, or repulsive, found when the tip and sample are in contact with each other. The tip-sample deflection is typically monitored by optical lever or interferometric techniques. The insulating tip and the lack of specific electrochemical phenomena occurring between sample and tip allow stable imaging even when substantial faradaic currents are being passed at the sample surface.

For electrochemical work, the sample must be immersed in liquid and under potential control. Modification of both the STM and AFM for in situ work requires insulating the tip in the former and immersion of the cantilever in the latter. Resolution of atoms and steps in the electrochemical environment, even in strong acid and bases, is straightforward.

Gewirth has used STM and AFM in a variety of experiments and this report will focus on three lines of research. His earliest work focused on formation of monolayers of metals on surfaces. He found that these monolayers had different structures depending on the electrolyte and that these structures could be correlated with electrochemical reactivity. More recently, Gewirth has discovered the existence of oxygen adlayers that form during the process of corrosion of copper (Cu). The final example describes his work showing the initial stages of self assembly of silicotungstate molecules on a silver substrate, which is the first example of an inorganic molecule which self-assembles on a surface.

### Bismuth (Bi) monolayers on gold (Au)(111)

Monolayers of Bi deposited on Au surfaces act as catalysts for the electroreduction of $H_2O_2$ to $H_2O$. This process is important because of its utility in fuel cell systems where one electrode would typically oxidize a fuel and the other would reduce dioxygen. However, the Bi monolayer is active in only a limited potential range which corresponds to a specific Bi structure on the Au surface. The sequence through which Bi monolayers are deposited on Au is shown in Figure 2a. In the first panel we see the bare Au(111) surface. In the second, the Bi has formed an adlattice on the surface that has a specific atomic arrangement known as a (2x2) adlattice. The third panel shows the final Bi structure which is a full monolayer known as a (px$\sqrt{3}$) or close-packed adlattice.

Andrew Gewirth

Figure 2b shows the reactivity of different deposition stages, with reactivity plotted against potential. These stages correspond to the different structures described above. The two stages with low reactivity are the bare Au(111) structure and the close-packed adlattice. The middle stage, which is the catalytically active region, occurs only when the (2 x 2) adlattice is on the surface. The (2x2) structure is the only one which exhibits both Au and Bi sites and Gewirth hypothesizes that a heterobimetallic binding site has been formed which acts as a catalyst for electroreduction of $H_2O_2$ to $H_2O$.

These studies are pioneering because they show a direct correlation of a structure with a reaction on an electrode surface. The recent requirement that two percent of automobiles sold in California and other states starting in 1998 be "non-emitting," has prompted considerable interest in fuel cells, batteries, and other electrochemical devices. The insight gained from these studies could have important practical implications.

## Corrosion of Cu

Gewirth uses the AFM to study oxygen adlayer development on Cu surfaces, which is the first stage in the process of corrosion. Gewirth showed that an oxygen or hydroxide adlayer grows on Cu surfaces even in acidic solutions. Figure 3 shows a series of images starting with the bare Cu(110) surface seen at negative potentials. As the potential is swept back to more positive values, a monolayer of oxygen or hydroxide grows in on the surface, and ultimately forms a full monolayer. The same type of behavior is observed on other faces of Cu.

The Gewirth studies show that the surface chemistry is very different from the bulk chemistry of Cu. Bulk thermodynamic considerations suggest that oxide formation would not occur until a specific pH level — much higher than that used in this work — had been reached. These studies show that the adlayer forms in a much more acidic environment than anticipated. This means that the chemistry of Cu surfaces in acid is not that of the bare Cu surface — as had previously been thought — but rather that of the oxygen monolayer-modified surface. This observation has important implications not only in the process of corrosion but also in the process of deposition. In other work, Gewirth showed that the oxygen monolayer affected the process of deposition. Scraping away this monolayer with the AFM tip resulted in specific local sites where Cu preferentially deposited.

The study of corrosion and deposition has important economic implications. It has been estimated that the cost of corrosion to the U.S. economy is over $100 billion per year. Fundamental research into this phenomenon could yield important practical insights.

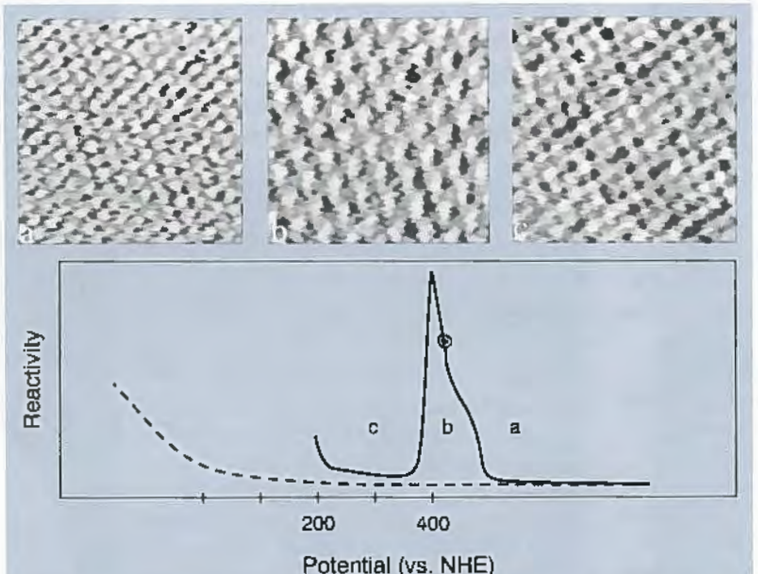



**Figure 2a:** AFM images (5 x 5 nm) of Bi upd on Au(111) in 0.1 M $HClO_4$. a) Au(111) surface found positive of Bi upd peaks. b) (2 x 2)-Bi adlattice found at +200 mV of bulk deposition. Atom-atom distance is 0.57 ± 0.02 nm. c) Uniaxially commensurate rectangular Bi adlattice found at 100 mV. Atom-atom distance is 0.34 ± 0.02 nm. **2b:** Reactivity plot of deposition stages.

## Modifying surfaces with self-assembled monolayers

One of the most exciting series of studies has recently been conducted by Gewirth and his colleague, Professor Walter G. Klemperer. In this work, they have developed a method of fabricating monolayers of transition metal complexes. They have found that by putting a silver (Ag) surface into an acid solution containing silicotungstate anion $(SiW_{12}O_{40})^{4-}$ they could produce an ordered, adherent monolayer of this molecule on the Ag surface as shown in Figure 4. The structure of this monolayer is controlled by the shape of the anion, and by the counter-ion present in the solution. This is the first example of an inorganic molecule which self-assembles on a surface.

Gewirth and Klemperer showed that the silicotungstate strongly passivates the Ag surface and protects it from corrosion. As these molecules appear to self-assemble on almost any oxophillic surface, they may provide a general method of corrosion inhibition. More broadly, these studies demonstrate a method of modifying surfaces which could provide support for

electrocatalytic and other functionality on electrode surfaces. The inorganic monolayers synthesized by Gewirth and Klemperer are significantly more robust than previous support systems and represent an important new method of surface modification.


**Figure 3:** AFM images of Cu(110) in 0.003 M $HClO_4$ (pH 2.5). The [001] direction is indicated in each figure. a) 6 x 6 nm bare Cu(110) at -340 mV vs. $Hg/Hg_2SO_4$. b) 9 x 9 nm image of 2 domain region with Cu(110) (upper right) and (2 x 1) rows (lower left) at -550 mV. Lines indicate registry between overlayer and substrate. c) 8 x 8 nm image of periodic (001) chain structures corresponding to (1 x 1), (2 x 1), and (3 x 1) rows.

**Figure 4:** 110 x 110 nm STM image showing submonolayer coverage of a $\alpha$-$SiW_{12}O_{40}^{4-}$ on an Ag(111) surface in 0.1 M aqueous $H_2SO_4$.

According to Prof. Ralph G. Nuzzo, "[Gewirth] is pushing the envelope more than anyone I know with regard to determining the atomistic structures which underlay rate processes at electrode surfaces. Perhaps even more exciting though is the fact that he and his collaborators are beginning to build an impressive literature which describes how the structure of the electrochemical interface can be manipulated microscopically via rational synthesis directed by assembly. It is particularly exciting to speculate, for example, that kinetics and function might be rationally manipulated or that corrosion and deposition microscopically engineered. Through [Gewirth's] work we are beginning to get the insights needed to do this."

Gewirth joined the U. of I. chemistry faculty in 1988, after completing his Ph.D. at Stanford in 1987 and postdoctoral research at the University of Texas at Austin in 1988. His many studies of electrochemical surfaces have received increasing recognition within the U. of I. and beyond. Since becoming a faculty member he received a Presidential Young Investigator Award in 1990 and a Sloan Foundation Fellowship in 1993. Also in 1993 he received the Award for Outstanding Accomplishment in Materials Chemistry from the Department of Energy. The U. of I. has recognized his accomplishments by appointing him a Fellow at the Center for Advanced Study in 1991 and in 1995 the university made him a University Scholar, the highest award given by the University to a faculty member.

# Leckband Focuses on Bioengineering

Deborah Leckband is the newest faculty member of the Chemical Engineering Department. She is a native Californian who came to the U. of I. from Buffalo, New York, where she was on the faculty at SUNY. She is bringing three graduate students and her Surface Force Apparatus which will form the nucleus of her new laboratory.

Her interests are fundamental and broad based. With her grant from the Whitacker Biomedical Foundation she is studying the molecular basis of biomolecular interactions with non-biological materials, e.g. how proteins and cells in body fluids interact with prostheses. Funding from the Office of Naval Research is used to investigate biosensor design, specifically, how the chemical composition of the sensor surface influences its performance. Her NIH grant is for basic research on structural functional relationships of proteins, and her NSF grant is for studies of interactions between cells and other materials, and focuses on the practical aspects of cell adhesion. Her fundamental goal is to identify the molecular forces that control biological behavior and ultimately to predict and control biomolecular and cellular interactions by manipulating these forces.

Leckband received her Ph.D. in chemistry from Cornell University in 1988. She then completed a postdoctoral program in chemical engineering at MIT and a second postdoctoral in chemical engineering at the University of California at Santa Barbara. During her three years as a faculty member in chemical engineering at Buffalo, she received an NIH FIRST Award in 1994 and an NSF Career Award in 1995.

Despite tempting offers from other institutions, Leckband chose the U. of I. because she senses that our campus offers outstanding research opportunities especially for interdisciplinary programs such as hers. During her previous visits she noted that at the U. of I. people interact and collaborate freely across disciplines and departments and even across college boundaries. She is impressed with the intellectual environment, the high quality of our students and our excellent infrastructure.

Deborah Leckband

# Cheng-Ming Chiang Will Investigate Transcriptional Regulation

From Taiwan, via the University of Rochester and Rockefeller University in New York, Cheng-Ming Chiang has joined the Biochemistry Department, arriving during the summer doldrums and an Urbana heat wave. With a generous package of startup funds, he is organizing his laboratory and anticipates that research initiatives and grant applications will follow rapidly.

Cheng-Ming's long range objective is to investigate the general mechanisms of tanscriptional regulation. He has been working on mammalian cells to define the protein factors involved. He is also interested in human papillomaviruses which cause a variety of human diseases, especially benign and malignant tumors including warts. His studies of E1 and E2 proteins have demonstrated that these are important for viral DNA replication and E2 is also a master regulator of viral transcription. The next step is to define the mechanism whereby the process is controlled. He anticipates significant progress by moving into in vitro studies which enable increased control over experimental variables.

During his eight years in the United States, Cheng-Ming has won a number of distinguished awards. At the University of Rochester he received the award not only for the best thesis in the Biochemistry Department but also the award for the best thesis in the entire Medical Center. During his postdoctoral years at Rochefeller University, he won both the Aaron Diamond Foundation Postdoctoral Fellowship and the Helen Hay Whitney Foundation Postdoctoral Fellowship for 1993-96.

Cheng-Ming Chiang

He chose Illinois over three other offers despite our aging physical plant. He plans to take advantage of the excellent resources at the University of Illinois and its Biotechnology Center. He has been very impressed with our fine hybridoma and transgenic mice facilities and the availability of flow cytometry in the Biotechnology Center.

## Alumni News

**Sydney Ross,** Ph.D.'40 (Chemistry with Clark) has been honored at a benquet given by the Colloid Division of the American Chemical Society. The new Sydney Ross Lectureship at Rensselaer Polytechnic Institute was announced at that event.

Sydney Ross

As a world leeder in innovative chemistry research, Ross hes been on the RPI faculty since 1948. In addition to his work in colloid and surface chemistry, Ross is also known for his scholarship in the history of chemistry. He has contributed to reseerch on the lives of Joseph Priestley, Michael Faraday, and Sir John Herschel, among others. Ross is the author of major books on physical adsorption, colloidal systems, the physics and chemistry of interfaces, and scientists of the 19th century. Dr. Ross is founder and cheirman of the Board of Trustees of the James Clerk Maxwell Foundation in Edinburgh, Scotlend. At AXE House at the U. of I. there are so many tales of his exploits that rumor has it that one evening a year was devoted to telling Sydney Ross stories.

## Alumni News

**Gunther Eichhorn, Ph.D.** '50 (Chemistry with Bailar) was honored with a symposium to mark his retirement as NIH Scientist Emeritus after 38 years of service. Gunther is best known for his pioneering studies on the biological effects of metal ions on nucleic acids, including the reversible folding and unfolding of nucleic acid helices. He provided explanations of how metals may cause mutations and errors in transcription.

### 1930

**Ben T. Briggs, Ph.D.** '38 (Chemistry with Rodebush) reports that he retired about 24 years ago and has remained busy with gardening, travel, and working with vision-impaired people in a retirement community.

**Glenn A. Nesty, Ph.D.** '37 (Chemistry with Marvel) retired in 1976 as Vice President of R & D at International Paper Co. From 1953-59 Dr. Nesty had served as Vice President, R & D with Allied Chemical Corporation, now Allied-Signal Corporation. He is currently a member of the Board of Toth Aluminum Corporation.

**Xing, Qiyi,** Ph.D. '36 (Chemistry with Adams) is Professor Emeritus of Chemistry at Peking University. He reports that Dr. Han-Ching Yuan (1932) and Ming-Chien Chiang (1944) were recently deceased. Of the seven Chinese Ph.D.s trained by Dr. Adams, he is the only one remaining.

**Harry Yale,** B.S. '37 (Chemistry) retired from Squibb Institute for Medical Research as a Senior Research Fellow in 1979, heving served the compeny since 1946. Dr. Yale received his Ph.D. from Iowa State College in 1940. At Squibb he was responsible for the discovery and development of six ethicel drugs. He was the first to synthesize Isoniezid in 1951, used for the treatment of tuberculosis, and received the Lasker Award in Public Health for his contribution. He was also the first to synthesize Prolixin, a potent antipsychotic drug, and Prolixin Enanthate and Prolixin Decenoate, both sustained-release antipsychotic drugs. From 1979-86 he consulted for several drug firms end was a Senior Investigator at the Waksman Institute of Microbiology at Rutgers University, whare he worked on new strains of Actinomycetes. Dr. Yale has been a Section Editor (Aliphatic Compounds) for *Chemical Abstracts* for over 25 years.

*Alumni News continues on the next page*

# Alumni News

## 1940

**David S. Hacker,** B.S. '49 (Chemical Engineering) is manager of the BIRL Research Laboratory at Northwestern University which offers specialized thermodynamic services. Prior to his current position Dr. Hacker had been Senior Research Engineer at Amoco Chemical Company and Professor of Chemical Engineering at the University of Illinois in Chicago.

**W. Ray Manning,** Ph.D. '44 (Chemical Engineering with Johnstone) has retired from Union Carbide. He has achieved 50 years of membership in the American Institute of Chemical Engineering.

**Edward Rzepecki,** B.S. '43 (Chemical Engineering) has retired as Professor Emeritus from the University of Saint Thomas in St. Paul, MN. From '92-94 he held the title of 3M Fellow and Distinguished Visiting Professor. He spent nine years as lecturer in Package Engineering at the U. of Wisconsin at Stout and worked for 3M for 36 years.

## 1950

**Sheldon Barnson,** B.S. '56 (Chemical Engineering) is Divisional Vice President for the Fermentation Business Unit with Abbott Labs in Chicago.

**William R. Foreshee,** B.S. '51 (Chemical Engineering) is President of Foreshee Consulting in Parkersburg, WV. He retired as plant manager from Union Carbide in 1985.

**Lun Hsiao,** Ph.D. '51 (Chemistry with Duffield) is Chairman, Science and Technology Committee, Institute of Atomic Energy, Chinese Academy of Sciences. He was General Chairman of the International Conference on Isotopes held in Beijing in 1995.

**James Kauer,** Ph.D. '55 (Chemistry with Curtin) is Co-Founder and Vice President of Chemical Technologies with Cephalon, Inc. in West Chester, PA. His company is a relatively young biotech firm specializing in neuroscience.

*Alumni News continues on the next page*

# Ralph Nuzzo Works on Materials Synthesis and Processing

When Ralph Nuzzo became a full time faculty member of the Chemistry Department he merely moved his primary affiliation across campus, from the Department of Materials Science and Engineering in the College of Engineering to the Chemistry Department in the College of Liberal Arts and Sciences. His research focuses on catalysis, the deposition of metals and ceramics using molecular precursors, and on the preparation of organic thin films, sometimes described as self assembled materials. His work on generating new surface properties, without affecting the bulk, has important implications for wetting and adhesion.

Ralph Nuzzo

Nuzzo received his B.S. from Rutgers University in 1976 and his Ph.D. in organic chemistry from M.I.T. in 1980. Thereafter he spent 11 years at Bell Labs in their Materials Chemistry R&D program. In 1987 he was honored with the designation of Distinguished Member of the Technical Staff in Materials Research.

At the U. of I. he has a well established laboratory with eight graduate students at present. He likes being a member of an educational establishment. "I like students," he says. "They are filled with energy and excitement. There is something to be said for youthful enthusiasm." And he likes the compliments from academic colleagues across the country who consider our students extremely well trained and prepared for graduate education.

In his view, the University of Illinois earns high marks as a place in which to work. As he says, "The university comes across as a collaborative, truly multidisciplinary institution. At Illinois you can even do interdisciplinary research across college boundaries, as I have done with students from the College of Engineering and from the College of Liberal Arts and Sciences. Perhaps, most important, at Illinois we have 'the culture of the possible'. People like big problems and are willing to let you work on them."

# Carter Fellowship Drive in High Gear

The Committee is in place, gifts are beginning to come in even before general solicitation has begun, and contacts with industrial firms where Carter consulted, are in process. Counting our initial generous gift from Dr. Mac McCormick and Eli Lilly, the fund stands at well over $100,000 in gifts, formal pledges, and written promises.

Herbert Carter

Several of the gifts have been accompanied by moving tributes. Mac McCormick eloquently echoed the general sentiments when he said, "That man got me started and no one can do more. After I left the U. of I. we never communicated scientifically but I knew he was always there if I needed him."

The Committee's telephone contacts will begin shortly and the general mailing to alumni should have reached you before the spring issue of the Newsletter. With the wide web of Herb's many friends and his superb reputation as a scientist, we are optimistic that the endowment for the fellowship will be raised successfully.

Further information can be obtained from Dr. Charles Sweeley in Williamstown, MI, campaign chair, or Ellen Handler, School of Chemical Sciences, U. of I. contact.

# Alum Sets Up Postdoctoral Fellowship

Dr. C.Y. "Tony" Shen Ph.D. '54 (Chemical Engineering with Johnstone) and his wife, Colleen N.H.Y. Shen have set up an endowment for a generous fellowship for postdoctoral students in the Department of Chemical Engineering. This is the first postdoctoral fellowship in the Department or in the School and fills an important need since public funds for postdoctoral studies have been severely cut back.

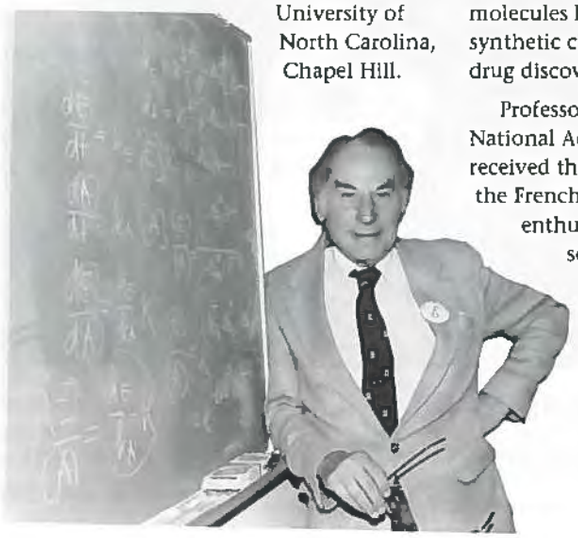
Dr. Shen himself immigrated from China and received his graduate education in the U.S. He has devoted most of his professional career to the Monsanto Company. He is a pioneer and inventor in new products and new processes. He has received many U.S. and foreign patents in the field of phosphorus chemicals, sequestration and chelations agents, and surfactants and detergent products. In recognition of his achievements, Dr. Shen was appointed a Fellow at Monsanto in 1960 and a Senior Fellow in 1967. In 1987 Dr. Shen set up a consulting firm to help China carry out research in detergents and surfactants.

Dr. C.Y. "Tony" and Colleen N.H.Y. Shen

Dr. Shen has been a firm friend of the U. of I. for many years and the postdoctoral fellowship will become an important addition to the offerings of the Chemical Engineering Department.

# Eliel Wins 1996 Priestley Medal

Ernest Eliel, Ph.D. '48 (Chemistry with Snyder) has been awarded the ACS highest honor. He is a former president of the ACS and W.R. Kenan Jr. Professor Emeritus at the University of North Carolina, Chapel Hill.



As a scientist, Eliel is best known for his study and understanding of the three-dimensional shape of molecules and the role of that structure in chemical reactions. His textbook on the stereochemistry of molecules has had a profound impact on synthetic chemistry, especially in areas like drug discovery.

Professor Eliel is a member of the National Academy of Sciences and has received the Laurent Lavoisier Medal from the French Chemical Society. He is an enthusiastic teacher and has won several teaching awards. These include the Chemical Manufacturers Association College Chemistry Teacher Award, the Amoco Teaching Award at UNC, and the George C. Pimentel Award in Chemical Education, sponsored by Union Carbide Corporation.

# Alumni News

**Stanley Kirschner,** Ph.D. '54 (Chemistry with Bailar) was a recipient of the 1995 Henry Hill Award of the ACS Division of Professional Relations. Kirschner has recently retired from Wayne State University and has been involved in ACS activities for more than 25 years. He has been a member of the ACS Board of Directors and served on many committees, most recently as Chairman of the Board Committee on Professional and Member Relations.

**John Murray,** B.S. '55 (Chemical Engineering) took early retirement after 37 years with USI/Quantum.

## 1960

**Harry Dimopoulos,** Ph.D. '67 (Chemical Engineering with Hanratty) is Director of Strategic Marketing for the Gases and Equipment Group at Air Products and Chemicals.

**Steven Goldstein,** B.S. '67 (Chemistry) is Deputy Project Manager for the Waste Isolation Pilot Plant for Sandia National Laboratory. He completed his Ph.D. at the U. of Wisconsin in Madison in 1973.

**Leonard V. Interrante,** Ph.D. '64 (Chemistry with Bailar) is editor of a recently established ACS journal, *Chemistry of Materials*. He has been Professor of Chemistry at Rensselaer Polytechnic Institute since 1986. In 1992 he was Co-chairman of an ACS symposium on "Materials Chemistry-An Emerging Subdiscipline."

**Melvin D. Joesten,** Ph.D. '62 (Chemistry with Drago), Professor of Chemistry and Education at Vanderbilt University, was named Harvie Branscomb Distinguished Professor. For his work on K-12 science education, Dr. Joesten has received a Faculty Buick Volunteer Spirit Award and a Tennessee Department of Education Award.

**Jaan Laane,** B.S. '64 (Chemistry) is Professor of Chemistry and Associate Dean of Science at Texas A&M University in College Station, TX. He earned his Ph.D. from MIT in '68. Since 1994 he has been Editor of the *Journal of Molecular Structure*. In 1979 he received the Alexander von Humboldt Senior Scientist Award and in 1982 he received a Texas A&M Distinguished Teaching Award.

*Alumni News continues on the next page*

# Alumni News

**James S. Percy,** M.S. '69 (Chemical Engineering) left DuPont after 25 years to start up Percy Associates, Inc. which provides business research and developmental services.

**Craig Plassmeyer,** B.S. '67 (Chemistry) has started a bank and health care consulting firm specializing in fraud investigations. He received an MBA at the U. of I. in 1969.

**Roy Swaringen,** Jr., Ph.D. '69 (Chemistry with Leonard) has retired from Burroughs Wellcome Co. where he had served as Director of Chemical Development for the last 14 years.

## 1970

**W. Dan Covey,** Ph.D. '73 (Chemistry with Brown) has retired because of illness after teaching chemistry for 20 years at LA Pierce College.

**John Guccione,** B.S. '70 (Chemical Engineering) has his own consulting business, Eminent Engineering, and is working on an M.S. in environmental work at Southern Illinois University at Edwerdsville.

**Michael Hanley,** B.S. '76 (Biochemistry) has been promoted to Associate Professor of Medicine at the University of Colorado Health Science Center in Denver, CO and was named Acting Head, Division of Pulmonary and Critical Care Medicine at Denver General Hospital. Dr. Hanley received an American Institute of Chemists Award in 1976.

**Douglas Lauffenburger,** B.S. '75 (Chemical Engineering) has been appointed Director of the Center for Biomedical Engineering at MIT. He has also been named the J.P. Mares Professor of Chemical Engineering and Health Science.

**Timothy McCarthy,** B.S. '76 (Chemical Engineering) practices product liability law with Rittenhouse, Malek & McCarthy in Chicago.

**David Miller,** B.S. '71 (Chemical Engineering) works for Atlantic Richfield where his main responsibility is licensing of oxygenated fuels technology.

*Alumni News continues on the next page*

# Facilities Update

*by James Spese, General Engineer*

Progress on all fronts has been dramatic since the last newsletter was published. As of September the new Chemical and Life Science Laboratories have reached 94% completion, not counting cosmetic features. Actual completion is expected by March, 1996. One month has been set aside for testing,. The turnkey event is slated for the middle of April when the chemistry labs will start moving.

California Street, which has been closed since construction began, will reopen in its new guise. It will no longer be a street but a walkway which will offer a straight path and an admirable view from the quad to the sweeping steps of the Krannert Center for the Performing Arts on Goodwin Avenue. When the sod, trees, artwork, sidewalks and courtyard are completed, we expect to have a building that will provide not just desperately needed research space but also an attractive addition to the physical plant of the University of Illinois.

Meanwhile, remodeling has been moving forward in all three chemical science buildings. The famous, or infamous 218 Noyes Lab, will become a modern laboratory suite for Biochemistry. The benches and hoods will be computer controlled and students will receive instruction with equipment similar to that of an industrial laboratory. At the other end of the building, 219 Noyes will undergo a similar transformation and become the instructional space for the organic chemistry program.

The big 101 lab in Chemistry Annex will receive its renovation by Spring semester as well. One of the important changes is that the room will be divided into two parts with centrally located instructors' offices so that the laboratory will be usable for one or two courses at a time. The other is air conditioning!

Finally, two sections of Roger Adams Lab are being extensively renovated. On the third and fourth floor the Biochemistry administrative offices and laboratories for new faculty are being renovated to meet the research requirements of the experimenters. On the lower floors of the building, the Chemical Engineering Department is renovating labs as well as the 116 lecture room. With alumni support from the ChemE 2000 campaign the Department is using the space of the two story bay area to build small conference rooms for preparing group presentations, minority student study areas, etc.

Our long range plans depend on funding. We have many excellent uses for vacated spaces in Noyes Lab. The chemistry library will clearly expand but the extent of the expansion will depend on alumni generosity, and we actively seek your support. We hope to have many named areas of our new and old buildings before the present cycle of building and renovation is completed.

# Teaching Awards, 1994–95

Bottom (left to right): Shaun Stauffer, Kathleen Kolbert, Aravind Immaneni. Second row: Eileen Thiessen, Diane Durbin, Professor Anthony McHugh. Third row: Paul Blowers, Sandra Mattick. Fourth row: Don DeCoste, Professors Steven Zumdahl and Martin Gruebele. Professor Ana Jonas not pictured.

# The First Bailar Teaching Fellows

Thanks to the generous contributions of students, friends and colleagues of the late John C. Bailar, the chemistry department has been able to offer Bailar Teaching Fellowships to four incoming graduate students. Asked what the fellowship has meant to them, Jesse Jefferis echoed the sentiments of the group when he wrote as follows:

"Several teachers throughout my educational experience have cultivated in me the desire to become a teacher. As a high school chemistry teacher for three years, my love for teaching grew. If imitation is truly the highest form of flattery, then my love for teaching is an admirable reflection on the teachers who have influenced my life. It is no doubt that it was in this spirit that the John C. Bailar Fellowship was established. This fellowship is influential in allowing me to further pursue my goal of becoming a chemistry professor."

The 1995 Bailar Fellows (left to right): Richard Cesati, Alan Gengenbach, Gregory Kufner, and Jesse Jefferis

# Biochem Med Scholars Win Awards

Two Ph.D. students working for David Kranz, Professor of Biochemistry, have won fellowships from the U. of I. Medical Scholars Program. Carol Schlueter, is the first recipient of a Busboom Fellowship, which guarantees her an annual stipend for the duration of her studies. Carol completed her undergraduate work at Valparaiso University with a double major in Chemistry and Biology. She graduated with a straight "A" average and won the Outstanding Chemistry Student Award. In her research studies Carol is working on measuring the interaction between genetically engineered T cell receptors and their ligands on target cells.

Meegan Gruber is the first recipient of the Carle Cancer Center Research Scholarship which also provides an annual stipend during her MD/Ph.D. studies. For the clinical component of the award, Meegan interacts with oncologists at the Carle Cancer Center Clinic. Dr. Patricia Johnson, a Carle physician, is herself an MD/Ph.D. and serves as a mentor and role model for Megan.

Megan received her bachelor's degree from the University of California at Berkeley. She completed a double major in molecular cell biology and ethnic studies and chose to come to medical school because of her personal interest in cancer. For her Ph.D. she is attempting to engineer antibodies which will target tumor cells.

Carol Schlueter (left) and Meegan Gruber

# Alumni News

**Sean O'Connell,** B.S. '77 (Biochemistry) is Executive Vice President and Chief Operating Officer of Heartland Biotechnologies, a yeast-based drug discovery, biotechnology company. He received a Ph.D. in Immunology from Rutgers University, the Waksman Institute of Microbiology, followed by a postdoctoral fellowship in the Department of Toxicology at the Center for Advanced Biotechnology and Medicine. He was subsequently appointed Assistant Professor and Head of the Surgical/Oncology Research Lab/Flow Cytometry Facility. He was at the R.W. Johnson Medical School, University Medical and Dental School of New Jersey from 1989 to 1994 when he moved to his current position.

**Denise (Riesland) Vollmer,** B.S. '79 (Chemical Engineering) is a Senior Environmental Engineer at Flexel, Inc.

## 1980

**Hatem Al-Mosa,** B.S. '84 (Chemical Engineering) is a Process Design Engineer at Amoco Corporation in Houston, TX.

**Beth-Ellen Breuer,** Ph.D. '84 (Chemistry with Schuster) reports that she has moved to Israel.

**William Burton,** Ph.D. '89 (Biochemistry with Gumport) has been elected President of the Leukemia Research Foundation in Oak Park, IL. Dr. Burton is a science writer and media relations manager at the University of Chicago Medical Center.

**Matt Chapman,** B.S. '82 (Chemical Engineering) has been working as a project engineer for Mallinckrodt Medical since 1992. He hes racently returned from a two-year assignment in Dublin, Ireland where he was lead project engineer on a new pharmaceutical plant tha company was building in the Dublin suburbs.

**Michael Grigus,** Jr., B.S. '82 (Chemical Engineering) is an engineer at Niro Hudson, Inc. in Hudson, WI.

**Lynn Hunsberger,** B.S. '85 (Chemistry) has taken a position as Assistant Professor at the University of Louisville. She completed her Ph.D. at the University of Wisconsin in Madison in 1990 and has been interim General Chemistry Laboratory Director since completing her studies.

*Alumni News continues on the next page*

# Alumni News

**Kurt Koppi,** B.S '88 (Chemical Engineering) has been assigned to the Designed Thermoplastic Research Department of Dow Chemical Co. in Midland, MI.

**Jennifer Larson,** Ph.D. '88 (Chemistry with Scheeline) is research manager for the Adhesives Department of Kimberly-Clark in Neenah, WI. In 1988-91 she did postdoctoral research at the University of Wisconsin in Madison.

**Rebecca Li,** B.S. '89 (Chemical Engineering) is an Associate Scientist with Cytotherapeutics, Inc. in Rhode Island. She earned her Ph.D. at Johns Hopkins University in 1994.

**Robert McMahon,** B.S. '80 (Chemistry) has received tenure at the U. of Wisconsin in Madison. He completed his Ph.D. at UCLA and postdoctoral study at MIT. He has received a PYI award and a Sloan Fellowship.

**Charles Meyer,** B.S. '84 (Chemical Engineering) is a Process Development Engineer with Ciba Geigy Corporation in Delaware.

**Craig Myers,** B.S. '87 (Chemical Engineering) is a Senior Engineer with Nalco Chemical Co. in Naperville, IL. He received his Ph.D. from the University of Wisconsin at Madison in 1993.

**Michael Olgren,** MS '87 (Chemistry) is an emergency physician at St. Mary's Hospital in Grand Rapids, MI. He completed his MD degree from Loyola Medical School in 1991 and a residency in emergency medicine in 1994. Of his emergency department he says, "Sometimes it is just as hectic as they show on 'ER' on TV."

**Ruth Anne Patterson,** B.S. '86 (Chemical Engineering) is working in the property accounting area of Quaker Oats Company. She completed her M.S. in Accounting at UIC in 1994.

**Joseph Peterson,** B.S. '85 (Chemical Engineering) is a Senior Engineer with RADIAN Corporation. He is also teaching undergraduate courses in thermodynamics at the University of Texas. Dr. Peterson completed his Ph.D. degree at the University of Texas in 1990.

*Alumni News continues on the next page*

# In Memoriam

## Alan McClelland Has Died

Alan McClelland , Ph.D. '50 (Chemistry with Bailar) died in June, 1995. For 30 years, he worked for DuPont, beginning as a researcher in polymers, and later moving into personnel administration and recruitment. Before joining DuPont, he carried out postdoctoral research at the University of Birmingham in England and taught chemistry for four years at the University of Connecticut.

McClelland had a lifelong interest in science education. He helped DuPont develop a curriculum resource for elementary school students. The resulting publication, *Understanding Our Environment*, is dedicated to him for "his commitment to advancing the understanding of the sciences (which) has influenced thousands of lives and careers around the world."

After retiring from DuPont in 1987, he worked for the National Science Foundation in Washington, and later became Executive Director of the Science Alliance. In 1995, Dr. McClelland received a special tribute from the Science Alliance to recognize his outstanding efforts in enriching science, math, and technology education for Delaware students. He also served on the board of the Delaware Museum of Natural History which set up the Alan L. McClelland Educational Resource Center in his honor.

Alan McClelland

**Geoge Austin,** B.S. '36 (Chemical Engineering) died in October, 1994. He had received a Ph.D. in 1943 from Purdue University and was Professor and Head of Chemical Engineering at Washington State University.

**John Calvin Brantley,** Ph.D. '49 (Chemistry with Moeller) died in February, 1994.

**Cecil Denny,** B.S. '32 (Chemical Engineering) passed away in September, 1994. He had worked for International Harvester-Navistar as a material controller. until his retirement in 1971.

**Clifford L. Dickinson,** B.S. '52 (Chemistry) died in June, 1995. Until his retirement in 1985, he was at Central Research at the DuPont Co. He worked on cyanocarbons, then in the life sciences, and managed chemical activities and information services at the Haskell Toxicology Lab. He earned his Ph.D. at the University of Rochester.

We have learned of the death of **William R. Gurolnick,** B.S. '52 (Chemical Engineering). He had been Vice President of Manufacturing for Eagle Products in Chicago, IL.

We have learned of the death of **Miles E. Hess,** B.S. '36 (Chemistry).

**John Lee Marsh,** Ph.D. '41 (Chemistry with Fuson) died in 1994. He had worked for Ciba-Geigy in Summit, NJ for 42 years, until his retirement in 1982. He was coinventor of an experimental drug Su-1906 for the treatment of tuberculosis and tropical diseases, including leprosy.

We have received word that **Harry E. Mueller**, A.B. '48 (Chemical Engineering) died in 1988.

**John Sagura**, Ph.D. '53 (Chemistry with Leonard) died in October, 1994. He had retired eight years earlier from Patent Services at Eastman Kodak.

We have received word that **Florence Shaw**, A.B. '26 (Liberal Arts) died in 1993.

**Ward Southard**, A.B. '31 (Liberal Arts) died in January, 1995.

**Gardner W. Stacy**, Ph.D. '46 (Chemistry with Price) died on April 30, 1995. He had retired from Washington State University in 1988 after 40 years of service as Professor of Chemistry. Dr. Stacy had also been very active in the American Chemical Society and served as its president in 1979. He received the Petroleum Research Fund's International Award (Australia and New Zealand, 1963-64) and the Department of the Army, Commander's Award for Public Service in 1986. Dr. Stacy had done postdoctoral research with Vincent du Vigneaud, an Illinois alumnus, who later won a Nobel Prize.

**Herbert Tilton**, B.S. '22 (Chemistry) died in January, 1995.

We have received word that **Wiliam S. Witzke**, B.S. '47 (Liberal Arts) died in 1992.

**Flavius W. Wyman** , Ph.D. '44 (Chemistry with Snyder) died in 1992. He had been a patent attorney with Allied Chemical Company.

# Faculty Honors

Three faculty of the School of Chemical Sciences have been appointed University Scholars for 1995, receiving the highest form of recognition presented to faculty by the University. **Eric Oldfield** and **Andrew Gewirth**, Professors of Chemistry, have received the award. **Stephen G. Sligar**, Lycan Professor of Biochemistry, Professor of Chemistry, Physiology, and Biophysics, and Director of the School of Chemical Sciences, has been named a Mr. and Mrs. James R. Martin Scholar. This is a named University Scholar award.

**Anthony McHugh**, Professor of Chemical Engineering, has been appointed the Janet and William H. Lycan Professor of Chemical Engineering. The Lycan Professorships were set up in 1993 by Dr. William and the late Janet Lycan. Dr. Lycan received his Ph.D. in '29 under the supervision of Roger Adams and went on to a distinguished career. He retired as Vice Chairman of Johnson & Johnson International in 1970 and was awarded the Gold Medal of the Society of Chemical Industry for his many contributions to the profession and to industry.

The other Lycan professors are Stephen Sligar, Lycan Professor of Biochemistry, and Peter Wolynes, Lycan Professor of Chemistry.

**Eric Oldfield**, Professor of Chemistry, has received the 1994 Royal Society of Chemistry Award in Spectroscopy.

**Kenneth Rinehart**, Professor of Chemistry, has been elected President of the American Society of Pharmacognosy.

**Yi Lu**, Professor of Chemistry has won an NSF Faculty Early Career Development (CAREER) award. This award replaces the former PYI, NSF Young Investigator, and Presidential Faculty Fellow awards of previous years.

Professor Lu has also received an NIH FIRST Award

**Jonathan Sweedler**, Professor of Chemistry, has been named an Alfred P. Sloan Research Fellow.

**Richard Braatz**, Professor of Chemical Engineering, has been named a DuPont Faculty Fellow.

**Martin Gruebele**, Professor of Chemistry, has been appointed a Fellow in the Center for Advanced Study.

**Paul Lauterbur**, Professor of Chemistry and Director of the Biomedical Magnetic Research Laboratory, has been granted honorary membership in the German Roentgen Society.

**Barbara Whitmarsh**, Lecturer in General Chemistry, has received an AMOCO Foundation Award for Innovation in Undergraduate Instruction.

# Alumni News

**David Pettijohn**, B.S. '83 (Chemical Engineering) is Director of the Institute for Local Self-Reliance. The Institute promotes plant matter-based biochemicals, fuels, energy, construction materials, and fibers/textiles.

**John Schnake**, B.S. '89 (Chemical Engineering) is an Applications Engineer with Honeywell, Inc. in Arizona, working in the Field Instruments Marketing Group of Honeywell's Industrial Automation Control Division.

**Nasios Tsipouras**, Ph.D. '86 (Chemistry with Pirkle) has been promoted to Research Fellow in the Natural Products Chemistry Department at Merck Research Laboratories in Rahway, N.J. Dr. Tsipouras has created a C-13 similarity (SIMSER) based VAX database which has shortened the identification of known and occasionally novel natural products to merely the time needed to record a C-13 NMR spectrum.

**Kenneth Vasquez**, B.S. '80 (Chemical Engineering) is an Enforcement Project Engineer for the County Sanitation Districts of Los Angeles County.

**Wanda Walczak**, M.S. '89 (Chemical Engineering) is doing postdoctoral research at LSU in the area of DNA stiffness using time-resolved fluorescence. She earned her Ph.D. from the University of Massachusetts at Amherst in 1993.

## 1990

**Carolyn Bahling**, B.S. '92 (Chemical Engineering) is a Senior Engineer for the International Paper Company in Selma, AL.

**Tani Chen**, B.S. '93 (Chemical Engineering) is a graduate student at MIT.

**Angela Grygiel**, B.S. '94 (Chemistry and Chemical Engineering) is a Process Development Engineer with Occidental Chemical Corporation in Dallax, TX.

**Deanna Heffron**, B.S. '93 (Chemical Engineering) is a Reguletory Chemist at Nalco Chemical Co. in Naperville, IL.

**Cristi Hamilton Hunnes**, Ph.D. '90 (Chemistry with Scott) is an Assistant Professor of Chemistry and Biology at Rocky Mountain College in Billings, MT.

*Alumni News continues on the next page*

## Alumni News

**Michelle Janet,** B.S. '93 (Chemical Engineering) is a chemical engineer at Monsanto Chemical Company.

**Daniel Kanemori,** B.S. '95 (Chemical Engineering) is a project engineer for National Starch and Chemical in Salisbury, NC.

**Laura Krebs,** B.S. '93 (Chemical Engineering) is a package development engineer for Proctor & Gamble in Cincinnati, OH.

**Gordon Kwan,** B.S. '91 (Chemistry) has accepted a position as Environmental Specialist with McRoberts Associates, P.C. His company provides environmental review and due diligence of properties.

**Tom Malony,** B.S. '91 (Chemical Engineering) is a production engineer with Monsanto in Missouri.

**Michio Namikoshi,** Postdoc with Rinehart, 1987-94 is Associate Professor at Tokyo University of Fisheries, Department of Marine Science and Technology.

**Michael Ostendorf,** B.S. '93 (Chemicel Engineering) is an account executive with the Richard Michael Group in Chicago.

**Thomas Schneider,** B.S. '94 (Chemical Engineering) is a project engineer with Phoenix Chemical Company in Illinois.

**Mike Swift,** B.S. '91 (Chemical Engineering) is working with the Division Engineering Group of 3M in St. Paul.

**Xiaolong Joe Zhou,** Ph.D. '92 (Chemistry with Leuterbur) was appointed Assistant Professor in the Department of Radiology of the University of Pittsburgh Medical Center in 1994. Dr. Zhou received postdoctoral training in the Department of Radiology at Duke University Medical Center from 1992-94.

# "How Close I Came to Winning A Nobel Prize: a Bit of Early Illinois Fantasizing"

*by William Lycan, Ph.D. '29 (Chemistry with Adams)*

In my last two years of graduate school I shared a laboratory in the east wing with Wendell Stanley, Ph.D. '29, Wendell Moyer Ph.D. '29 and Catherine (Kate) Steele, a Scottish postdoctoral who worked for Roger (Adams) and later married a graduate student whose name I can't remember.

In that golden year of 1929 when there was a chicken in every pot and the stock market went hog wild, jobs for emerging Ph.D.'s were not only plentiful; they pursued you. It was a heady time! I recall that I made a swing in February or early March to visit a number of my favored prospective employers. Among others were General Electric, DuPont, and, surprise, Rockefeller Institute on Avenue A in New York.

As it turned out, of course, I chose to go to DuPont, a decision I never regretted. It provided the best postdoctoral training in America in those days. Besides, they offered me $250 per month, an amount to bogle the mind of a small town boy from rural Illinois.

It wasn't all that easy, however. I was sorely tempted to accept an offer from Rockefeller Institute, at about $125-150 per month. In the end, of course, greed won out but I remember to this day the exciting day-long visit, the work I saw in progress, and the people with whom I talked.

In the meantime, Stanley elected to accept an opportunity to pursue a year's postdoctoral with Wieland in Munich. He was not uninterested in money. In fact, on occasion he was extremely commercial. He was one of the better poker players in our regular week-end games at Gamma Alpha where he won far more often than he lost.

It was simply that the lure of adventure abroad was too great for him to resist. After all, he could wait a year to cash in, the money would still be there and he would be even better qualified. Alas, it did not work out that way. The roof caved in and when he came home in the summer of 1930, the great depression was in full swing.

William Lycan

All of those wondrous jobs in industry were gone with the wind. Salaries plummeted and cuts that were the hallmarks of the next several years in industry were starting to break out all over. In the meantime, Rockefeller Institute, which had had slim pickings in 1929, was still hiring in 1930 for the program I had found so tempting the year before.

Stanley, who had never been uninterested in money, accepted one of those jobs at what I am sure he considered starvation wages. The rest is history. Stanley went on to become one of the world's earliest and greatest virologists. Sixteen years after he went to Rockefeller, he stood before King Gustaf in Stockholm to accept the Nobel Prize for work that he might well never have done had he stayed home in 1929.

*(Editor's note: Wendell Stanley was co-winner of the Nobel Prize in Medicine in 1946 for his work on the purification and crystallization of viruses, thus demonstrating their molecular structure.)*

# Excellence Needs Your Help

Help us to maintain and expand our programs by supporting Chemical Science Funds. We have listed below the most active funds in the three departments. If you would like to contribute to a fund not listed, please enter the name beside OTHER.

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***Mark the appropriate box. If sending a check, please make it out to UIF/(fund name). A preaddressed envelope is enclosed for your convenience.***

- ☐ *School Facilities Fund:* Upgrades infrastructure, such as the chemistry library, machine and electronic shops, NMR, micro analytical, and mass spectrometry laboratories.
- ☐ *Carter Fellowship Fund:* Supports the first named fellowship in Biochemistry.
- ☐ *Roger Adams Fund:* Supports the Roger Adams Professorship and funds teaching awards, relocation allowances, and undergraduate scholarships.
- ☐ *Carl Shipp Marvel Fund:* Supports the annual Marvel Lecture and undergraduate research awards.
- ☐ *The ChE2000 Fund:* Supports educational enhancement in Chemical Engineering.
- ☐ *The Chemical Engineering Annual Fund:* Provides seed money, instructional and research support.
- ☐ *Unrestricted Fund/Chemistry:* Provides start-up funds for new faculty and for other vital needs.
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# Two Undergrads Receive ACS Minority Scholarships

Among the inaugural group chosen for the ACS Minority Scholars Program are two U. of I. chemical engineering students. The award was given to only 201 students in a national competition based on academic performance and financial need.

Diana Vivanco was born in Chicago of Mexican parents. She is a freshman who describes herself as "really ambitious and hard working." As she says, "I like to set goals and meet them but I am careful to set my goals only after talking to different people." She has joined several engineering clubs and a community service organization that is providing service to migrant workers. During her high school career she won many awards including National Honor Society 1991-95, inclusion in *Who's Who Among American High School Students*, and a President's Scholar Award.

Roberto DePaz was born in El Salvador and lives with his family in the Chicago suburbs. He decided to major in chemical engineering because he enjoys both mathematics and chemistry. He is a junior and has made Dean's list every semester. Roberto is already planning to attend graduate school after he completes his BS degree. Because of his interest in research, he has taken an independent research project for the last nine months and hopes to continue for at least another year.

Diana Vivanco

Roberto DePaz

Susan Arena Zumdahl, the director of the Merit Program for Emerging Scholars in the Chemistry Department, will provide support services the students may need "to avoid the potholes and make it through the system." The ACS recognizes that financial support is not sufficient and has included a mentoring program in its guidelines.



SCS Alumni Newsletter
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