CHEMISTRY NOTATIONS

Washington State University Department of Chemistry and Department of Biochemistry/Biophysics

News From The Top

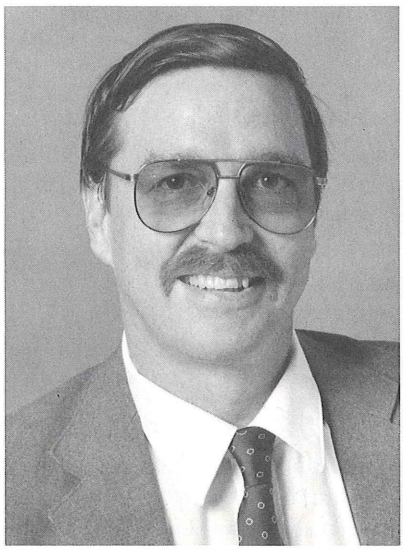
Department of Biochemistry/Biophysics

by Michael Griswold, chair

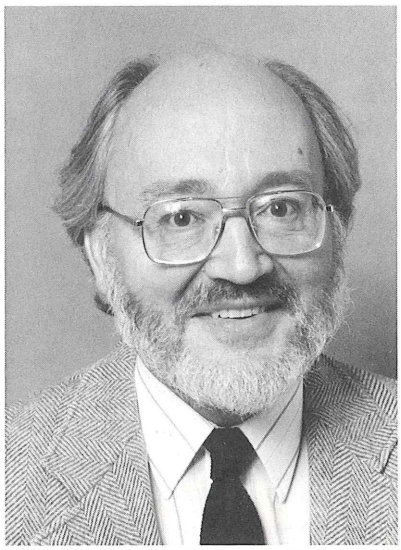
The members of the Department of Biochemistry and Biophysics extend our thanks to Professor Gerald Hazelbauer for his service as the acting chair during the past year. His efforts helped to facilitate our transition to department status. During that time period I was appointed as the acting dean of the Division of Sciences, a position which I have gratefully surrendered to the new Dean, Leon Radziemski. The members of the department elected me as chairman for another term. I accepted the position, primarily, because the high quality of the faculty and students makes the job of chairman quite easy.

As Professor Hazelbauer pointed out in the last newsletter, the department continues to grow and prosper. We have new research space and have added several new faculty members. We now have 16 faculty

(Biochemistry continued on page 2)



Michael Griswold



Royston Filby

Department of Chemistry

by Royston Filby, chair

I would like to extend thanks to all of you for your enthusiastic response to the first issue of our rejuvenated newsletter. We hope to keep improving and increasing our communications about activities at WSU and what you, our alumni and friends, are doing.

The past year has seen some significant changes in the "chemistry complex" at WSU. Biochemistry and biophysics is now a separate department but continues the close relationship with chemistry that has evolved over the years. We will continue to share faculty, staff, facilities and to jointly recruit students into our programs. The Chemical Physics Program (one of the first to be established in the U.S.) has now evolved into the Materials Science Program through the addition of faculty in materials engineering (College of Engineering) to the chemistry and physics faculty that made up the Chemical Physics Program. The new Ph.D. program in materials science has several options, including chemical physics, and will

(Chemistry continued on page 3)

New Record for Superconductors

The world's record for highest transition temperature (Tc) for an organic superconductor keeps getting broken. At Argonne National Laboratory, a team of chemists headed by WSU chemistry alumnus **Jack M. Williams** (PhD Chem '63) has made an organic superconductor with a Tc of 12.8 K *[Inorg. Chem.*, **29**, 3272 (1990)]. That's significantly higher than the "old" record Tc of 11.6 K set just recently, also at Argonne (*C&EN*, July 23, page 22). The new salt, $K(ET)_2Cu[N(CN)_2]Cl$, contains a polymeric copper-containing inorganic counterion in which ET is bis(ethylenedithio)tetra-thiafulvalene and $[N(CN)_2]$- is the dicyanamide anion. In fact, it's the chloride analog of the bromide compound that set the earlier record. As such, it's the first -phase ET-based superconductor with an isostructural counterpart. Thus, structure-property correlations for such organic superconductors are now within reach. Other teams headed by James E. Schirber at Sandia National Laboratory, and Myung-Hwan Whangbo at North Carolina State University were major collaborators in the work.

Jack Williams

The work of Dr. Williams and his colleagues has been recognized by the 1990 Materials Sciences Research Competition sponsored by the Division of Materials Sciences, Office of Basic Energy Sciences, Office of Energy Research. The winners in the Outstanding Materials Chemistry category include two of our alumni. Congratulations Cougars!

- "New Benchmarks in Organic Superconductivity"- Argonne National Laboratory, **J.M. Williams** (PhD Chem '63), M.A. Beno, K.D. Carlson, **U. Geiser** (PhD Chem '85), A.M. Kini, H.H. Wang, and W.K. Kwok.❖

(Biochemistry continued from page 1)

members with full or partial appointments in the department. The graduate faculty includes 9 additional members from the Institute of Biological Chemistry and the Department of Chemistry. We currently have over 50 PhD graduate students which is the largest number for any unit in the Division of Sciences and one of the largest at WSU. Our research programs continue to be well funded and our total external funding continues to set the standard at WSU.

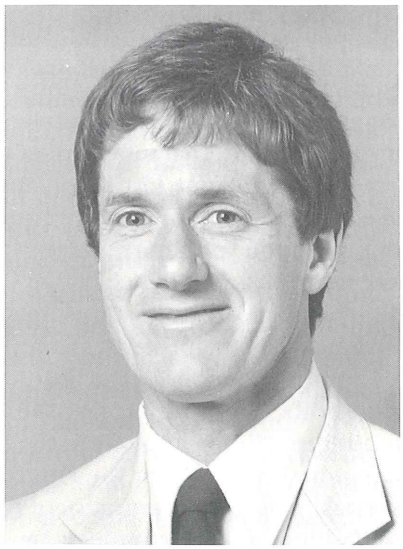
We have established a number of new goals for the coming year. We are currently undergoing revision of some of our courses in order to meet the changing needs of our students. We have decided to build in the area of macromolecular structure and we are laying the ground work for hiring one or two X-ray crystallographers. The new training grant in biotechnology headed by Prof. Hazelbauer, has been very beneficial to the department and we will continue to seek more training support for our graduate program. We plan to build up the Jim Magnuson Memorial Fund by donations so that it can be used for support of students.

As I attend various meetings and give seminars at different schools, I am continually impressed with our former undergraduate and graduate students I meet. Most of them are doing very well in whatever way they chose to practice biochemistry. The quality of these young men and women make us proud of our teaching and research program. Specifically, I want to acknowledge and offer congratulations to **James Wells** (PhD, 1979) who won the 1990 Pfizer Award for enzyme chemistry. This national award has been won in the past by a prestigious group of scientists including 6 Nobel prize winners. The annual award is given to an outstanding scientist not over 40 years of age by the Division of Biological Chemistry of the American Chemical Society. Jim is currently a staff scientist in the Department of Biomolecular Chemistry at Genentech, Inc. where he has developed and utilized methods for cassette mutagenesis to examine the function of enzyme active sites. Jim worked with Professor Ralph Yount on myosin (see article on page 8) during his graduate studies at WSU.❖

Mopper Joins Analytical Faculty

Our most recent addition to the chemistry faculty is Kenneth K. Mopper. He joined the analytical division last fall as a full professor. For the past seven years, Professor Mopper has been at the University of Miami's Rosenstiel School of Marine and Atmospheric Science. Ken established an outstanding program on the chemistry of trace organic compounds in aquatic systems at the University of Miami. He will strengthen our teaching and research activities in environmental chemistry which continues to attract the interest of many graduate students.❖

New IBC Director



Norman G. Lewis

Norman Lewis has been named director of the Institute of Biological Chemistry. He is an international authority on lignin biochemistry, a field that is important in the advanced use of wood and wood-like materials. He comes from Virginia Polytechnic Institute and State University in Blacksburg.❖

(Chemistry continued from page 1)

provide an additional avenue for graduate students who are interested in the chemistry of new materials. Chemistry continues to be the core science and thus we provide the nucleation for new departments and programs.

We continue to bring new faces into the department. This past Fall, Kenneth Mopper, an internationally known analytical chemist and oceanographer from the University of Miami joined our faculty as a full Professor Ken brings an outstanding program to our department and his interests in aquatic and environmental chemistry provide additional breadth to our analytical division. His research area is particularly attractive to students with interests in environmental chemistry. This appointment continues the "exchange" of personnel with the University of Miami – they got a football coach and we got a Professor of Chemistry, but we got the better deal!

Most of us have comfortably settled into our new buildings which provide truly exceptional space for research. Visitors from other universities are invariably envious of our facilities and I urge all alumni to pay us a visit and tour our new buildings – you will be impressed! The new NMR Center (500 MHz solutions and 400 MHz solids instruments) is now functional and a major NIH grant, written by Professor Jim Satterlee for the 500 MHz instrument was successful. As noted elsewhere, we continue to be highly successful in obtaining funding for other state-of-the-art instrumentation. NSF has funded a major upgrade of our EPR (ESR) Laboratory (Dave Cleary, PI) and a $380,000 grant was obtained from the Murdock Charitable Trust to enhance our capabilities in analytical chemistry.

Please write, or call, and let us know about changes in your career - promotions, job change, etc. Our alumni are a source of pride to the entire faculty and have played a major role in establishing the high reputation of WSU in the chemical sciences.❖

Standing Room Only

A standing-room-only audience attended "Biotechnology: Practice and Promise" October 13 on the WSU campus. The one-day symposium was sponsored by the Training Program in Biotechnology (see Notations Summer '90). The program is part of our growing effort to provide multidisciplinary training in biotechnology with particular emphasis on a campus-wide strength in protein chemistry. The symposium was a great success; it brought together representatives of basic research, engineering, biotech firms and Washington State.

The symposium began with Bud Ryan providing an impressive overview of his work "Plant Defense Genes: From Basic Science to Practical Applications". The number of potentially important practical applications arising from basic research about proteinase inhibitors is astounding.

One of the highlights of the meeting was the talk by Michael S. Urdea (PhD BC/BP 1979, Legg) who is currently Director of Nucleic Acid Systems at Chiron Corporation in Emeryville, CA and a member of the Industrial Advisory Board for the Training Program. Speaking about "Life in a Biotechnology Firm", Mickey began by explaining that it was nothing like he expected and proceeded to tell a series of stories, many humorous, all fascinating, about his nine years in the biotech industry.

Neil Ivory, a member of the bioprocessing group in the Chemical Engineering Department, spoke about "New Purification Technologies for Proteins" and Marvin Gorman, Managing Director of Oncogen, a major Seattle biotech firm, and also a member of our Industrial Advisory Board, addressed the issue of "Biotechnology, Mixing Science and Business".

A session of posters presented by students in the twenty training labs was very popular and provided an overview of the quality research being done in the spectrum of disciplines related to biotechnology.

The program was organized by Jerry Hazelbauer, the director of the training program and Jim Satterlee took care of the local arrangements. Some fast action and unabashed begging on Jim's part produced 50 extra lunches on very short notice when it became clear that attendance had exceeded even our most optimistic estimates.

After lunch and the poster session, Robert T. Abbott, founder of the Seattle-area firm NeoRx Corporation, gave the keynote address: "Biotechnology in the State of Washington: Preparing for the Future". He was speaking as a representative of the State of Washington Biotechnology Targeted Sector Advisory Committee which is currently preparing a comprehensive study of biotechnology in the State.

The symposium will be an annual event. Anyone interested in receiving information about future symposia or about the Biotechnology Training Program is encouraged to contact Gerald L. Hazelbauer in Biochemistry/Biophysics.❖

Operation Progress

The XIth Biennial Conference on Chemical Education was held in Atlanta, GA in August. A contingent from Washington State ran a series of workshops for 80 high school chemistry teachers employed in the southeast. Those teachers who were teaching chemistry out-of-field and those instructing large numbers of students traditionally under represented in the sciences were targeted by the program. The operation was directed by Professor G. A. Crosby and managed by Jane Crosby of the WSU Department of Chemistry. Helping the Crosbys run the event were four high school teachers from Washington - Dana Beatty (Oak Harbor), Jerry Breymeyer (Kirkland), David Trapp (Sequim), and George Johnson (Pullman). Also assisting were Leonard Henscheid (WSU), Charles Templeton (Professor of Chemistry at Whitman College), Alan Crosby (University of Washington chemistry graduate student), and Karen Crosby who served as the technical editor for the proceedings of the workshop program.

The Washington crew ran a series of sessions demonstrating the uses of the computer in teaching chemistry and a cluster of lab sessions designed to introduce new demonstrations based on the use of consumer chemicals and materials.

OPERATION PROGRESS was funded by the National Science Foundation, Camille and Henry Dreyfus Foundation, Proctor & Gamble, Council for Chemical Research, American Chemical Society and the Division of Chemical Education of the ACS. Plans are underway to stage a sequel to this program at the XII Biennial Conference that will be held in Davis, California August 1-6, 1992.❖

Molecular Modeling Center

The Center for Visualization, Analysis and Design in the Molecular Sciences (VADMS) has been developing at WSU since 1987 under the direction of Keith Dunker, professor of chemistry and biochemistry. Key to the development of VADMS has been the expert technical assistance of Susan J. Johns; the financial support from the Graduate School, National Institute of Health, and Department of Energy; and gifts from the Battelle Memorial Institute, Columbia University, Tektronix, Apple, Digital Equipment, Evans & Sutherland, AT&T, and Silicon Graphics. The value of hardware and software in the center is over $900,000.

The VADMS facilities are not centralized, but dispersed, including a central "mother" laboratory located in the Computer Center, 9 outlying public-access terminals spread across campus, and a teaching, research and modeling laboratory in Fulmer Hall with 14 workstations. In addition, numerous faculty members access the VADMS Center software from personal computers or workstations within their offices or laboratories.

The philosophy of the VADMS Center is to support computer-aided molecular science research across a broad spectrum. Biochemists use VADMS for searching databases such as GenBank, the Protein Data Bank, and the Protein Identification Resource, whereas the chemists find the Cambridge Crystal Structure Database useful. Molecular structures of interest can be displayed on high resolution computer graphics screens and rotated in real-time. Molecular properties can be estimated using quantum mechanics or approximated using molecular mechanics as appropriate. Molecular dynamics simulations provide insight regarding the time-dependent fluctuations of macromolecules. Molecular docking experiments are being used to explore the complex interactions between enzymes and substrates as well as between adhesive polymers and surfaces. Computer aided genetic engineering can be used to plan and test strategies for the construction of new DNA molecules. As the VADMS staff like to say, "we can help you with your computational, database and visualization needs, from *ab initio* calculations to Z-DNA."

The technology represented by the VADMS Center is becoming essential for research in chemistry and biochemistry and for the teaching of our students. Readers interested in applications of advanced versions of this technology can consult the article on drug research in the *Wall Street Journal*, Tuesday, August 14, 1990, page B1.❖

Fellowships Awarded

Scot Fitzgerald, a PhD student in the Department of Chemistry, has been awarded the Battelle Pacific Northwest Laboratories Energy Related Research Fellowship for 1990-91.

Each unit in the Division of Sciences at WSU was invited to submit one nomination and the final decision was difficult to make, due to the high quality of applications received. Mr. Fitzgerald was chosen by a faculty selection committee to receive this prestigious $15,000/yr. fellowship.

Mr. Fitzgerald's research involves the mechanisms of formation and decomposition of metal complexes in petroleum. Such complexes are used in geochemical exploration methods of finding new petroleum deposits. Fitzgerald is a graduate student in Professor Roy Filby's research group.

Durwin Striplin, first-year graduate student in the Department of Chemistry, has been awarded a Department of Defense National Science and Engineering Graduate Fellowship. Approximately 120 fellowships were presented to outstanding graduate students across the nation. The three-year fellowship includes an annual stipend of $15,000, tuition and an additional $2,000 to support his research.

Mr. Striplin is engaged in the study of chemical compounds that show promise as active elements in device technology. Mr. Striplin is a graduate student in Professor Glenn Crosby's research group.

Mark W. Roberts, a research associate with WSU's Institute of Biological Chemistry, was one of 10 scientists selected in national competition by the National Science Foundation as a Minority Postdoctoral Research Fellow. The postdoctoral program was initiated in 1989 by NSF's Biological, Behavioral and Social Sciences Directorate to increase the number of research scientists from minority groups.

Roberts is interested in determining how the expression of plant genes is regulated during plant development. This currently is done by isolating genes, transferring them back into plants and using appropriate tags to monitor their expression. He is attempting to develop an in vitro, or test tube, assay.❖

Measuring Dopamine

Psychiatrists are faced with a dilemma in the treatment of psychoses. Antipsychotic drugs (APDs) are effective, but the treatment often leads to movement disorders.

Most drugs that alter mood or behavior do so by inhibiting or enhancing the neurotransmitter system. Neurotransmitters are chemicals that transmit nerve impulses across synapses. APDs work by blocking the receptor for the neurotransmitter dopamine in the brain.

Jim Schenk, chemistry professor, and his research team, with others, are trying to determine what APDs do to the dopamine system that makes psychotic people better. In turn, they are looking for a medicinal agent that will alleviate psychoses without causing movement disorders.

Out of approximately 1,500 APDs tested, only two show a possible lack of side effects. Only one - clozapine - is used in the United States. Schenk is comparing it to other APDs in order to determine what causes the movement disorders.

Lack of knowledge of APDs and their effects on dopamine balance stems largely from an inability to accurately measure the dopamine release. Schenk and his research team are currently working on a tiny probe 30 microns in diameter (or the size of a nerve cell) that can be inserted in the brain to directly and accurately measure chemical fluxes of neurotransmitters, particularly of dopamine. Currently, samples of dopamine must be extracted from the brain and analyzed separately, thus reducing the relevance of the chemical information. An imbalance of dopamine in the brain also can cause movement disorders such as Parkinson's disease and Huntington's chorea. Schenk's research is funded by the National Institute of Mental Health.❖

Faculty and Staff News

Professor **Ursula Mazur** was an invited attendee at a Gordon Conference on "Properties of Electronic Materials" in Ventura, CA. She and Professor Tom Engle, chairman of the University of Washington Chemistry Department, were the only representation from Washington State. Professor Mazur presented a very popular poster talk on "The connections between microscopic structure and macroscopic properties".

K.W. Hipps just received a new grant from the U.S. Environmental Protection agency. He will be studying the possible application of metal-insulator-metal diodes as gas phase chemical sensors.

Professor **Donald S. Matteson** has received a grant from the National Institutes of Health to study Boron analogs of hereditary material which might be useful in treating AIDS and cancer. The grant covers a three year period and is funded for approximately $95,000 per year. Another NIH project Professor Matteson is working on builds on the NSF project explained in the article on page 14 of this newsletter. The $360,000 NIH grant addresses a more complicated antibiotic structure. It is a challenge for synthetic methods and should produce an understanding of how molecules of this type behave.

Dave Cleary, **Kerry Hipps** and **Roger Willett** have received a National Science Foundation matching grant for a new electron spin resonance spectrometer. Bid requests are currently being submitted.

Paula and Ed Broemmeling at their wedding reception.

August was a month for love in the Department of Chemistry. We had two staff members who were married — to other people that is. **Tom Martin** and Lynne George were married on August 4 in Hawaii. Lynne teaches elementary school in Troy, ID. **Paula Nelson** was married to Ed Broemmeling on August 17th. Paula did a good job of keeping it quiet until the deed was done, but we didn't let that stop us from giving them a reception to celebrate their marriage.

Tom and Lynne Martin cut the cake!

Emeritus Professor **Randall Hamm** did such a wonderful job of pictorally documenting all the additions to Fulmer Hall that Shea Construction has now hired him to photograph construction progress on the new additions to Holland Library and the Food Science and Nutrition building.

Two little ones were added to the chemistry/biochemistry family this fall. In September **Toshiko Ichiye** and Brad Pate (physics) had a baby girl named Monica. **Karen Brewer** and her husband Gary, also had a baby girl named Nichole.

William Wacholtz, a former teaching postdoctoral fellow of the Chemical Physics Program has just completed his first year as a faculty member in the Department of Chemistry at the University of Wisconsin, Oshkosh. While teaching at WSU Bill also carried out research in the area of closed-shell metal complexes in the laboratory of Professor Crosby. Ms. Wacholtz is the former **Margaret Kelnhofer**, who was employed as an administrative secretary in the WSU chemistry department.

Ursula Mazur recently added a new postdoctoral fellow to her group. Dong X. Wang received his Ph.D. in Physics from the University of Minnesota. His wife is a graduate student in Chemical Engineering and they just had their first child. Professor Mazur and Dong are currently exploring the connection between the chemical structure of the film and its macroscopic properties. They are finding that the physical properties

(Faculty & StaffContinued on Page 14)

LBB Receives Murdock Grant

The M.J. Murdock Charitable Trust has provided a grant of $379,992 to buy additional analytical instruments for the second unit of WSU's Laboratory for Bioanalysis and Biotechnology (LBB). The equipment will support biotechnological, environmental, materials and agricultural research and teaching programs at WSU and other institutions. The proposal was written by Herb Hill and other analytical faculty and the laboratory will be under the supervision of the analytical division.

The laboratory will provide technical support to a wide range of research projects, from the study of genetic resistance of plants toward insects to regulatory systems in living cells and environmental analysis.

Most scientists who study the basic processes of life work by disassembling organisms at their molecular level and trying to determine the function of each part. The LBB provides the equipment required for this process.

The Murdock Charitable Trust considers the progress of higher education a major priority. An earlier grant by the Trust helped establish the first unit of the LBB in 1988.

The principal functions of the LBB Unit 1 involve protein and DNA sequencing and ligonucleotide and peptide synthesis. The LBB Unit 2 will provide analysis of small to mid-size organic molecules and metal ions.

"This lab augments the capability of the first lab," said Roy Filby, chair of the chemistry department. "The function of the first lab is to deal primarily with very large molecules. This lab is designed to determine smaller molecules of biological and environmental significance."

During the 1980's, a new generation of analytical equipment was developed that helps answer vital questions about biochemistry, materials and the environment. Much of this equipment has not been available to Northwest scientists, but will now be provided in part by the Murdock funding.

The facility will support the work of approximately 100 molecular science research faculty at WSU. Unique in the Inland Northwest, the facility also will be available to the University of Idaho in Moscow, WSU's Health Research and Education Center in Spokane, Battelle Pacific Northwest Laboratories in Richland, and other institutions.

Among the equipment made possible by the Murdock grant are a mass spectrometer with liquid introduction capabilities, a plasma emission spectrometer and a capillary supercritical fluid chromatograph.❖

How's Your Myosin Actin?

Ralph Yount's goal is straightforward – to answer the question "how do your muscles work?"

But the question itself is the only thing simple about the subject. In fact, no one knows for sure. The prevailing theory holds that muscles contract because of the interaction between actin and myosin, both proteins. Skeletal muscle is composed of muscle fibers. When the muscle contracts, intertwined thin and thick filaments slide past each other. The thin filaments are primarily composed of a protein called myosin. The myosin molecule has a thick "head" at one end that reaches up and binds to the actin. The combined shortening of millions of these myosin molecules leads to the muscle's contraction.

But what makes these proteins do what they do? At the core of the problem is how chemical energy, contained in a chemical called ATP (adenosine triphosphate), is converted to mechanical energy.

"ATP is the universal currency, the dollar bill, of the cell," says Yount. His specialty is creating not-quite-identical copies of ATP. He uses these "analogs" to catch muscle contraction through various stages, thus moving closer to identifying the chemical and mechanical relationship between events.

By the way, slime mold, simple organisms similar to fungi, move across the damp forest floor with the aid of actin and myosin molecules very similar to those in certain human muscles.

"They still have the same basic structure," says Yount. "It really makes you a believer in evolution. It is what really makes science fascinating."❖

Alumni News

The following information has been sent in by our alumni or submitted by current faculty members. We love hearing from our alumni and encourage you to send us information about what you are doing in the enclosed postage paid envelope.

Ann L. Ames (McKenney) (Touchet, WA, City of College Place, records clerk) (BS Chem '69) is also a deputy coroner and works for her husband. They both worked at the state crime lab in Seattle before moving "east".

Gary Van Berkel (PhD Chem, Filby) has been appointed staff scientist in the Mass Spectroscopy Section at Oak Ridge National Laboratory. He was a postdoctoral associate at ORNL after completing his PhD work at WSU.

Frederick W. Bollinger (Westfield, NJ, Merck & Co., Inc., senior chemist (retired)) (PhD Chem '57) informed us that he is the co-inventor of Sinemet for Parkinsons's disease which has enjoyed $100 Million plus sales for the last four years consecutively.

Gary J. Bracken (Richland, WA, US Dept. of Energy-Hanford, chief, Waste Operations) (BS, MS Chem '74) reports that his wife Elizabeth is the Chief of Environmental Policy & Permits for the Department of Energy at Hanford and they have a 3 year old son, Andrew.

J. Robert Clark, M.D. (Spokane, WA, Private Practice, neurologist) (BS Chem '69) has been in private practice in Spokane since 1978 and is currently medical staff president at Holy Family Hospital and a member of the Board of Trustees at Dominican Health Services. He and his wife, Carol (Baker) (WSU '69), have a daughter, Sara, who is a senior at Gonzaga Prep.

Patrick F. Coleman (Edmonds, WA, Genetic Systems, senior program manager) (BS BC/BP '70) reports that his training at WSU prepared him very well for a successful career in biotechnology.

Neil Cutshall (Raleigh, NC) (BS Chem '86) is currently working toward a graduate degree in organic chemistry at North Carolina State University.

Laura L. Dahl ('86 BC/BP) has received an MD from the Medical College of Wisconsin at Milwaukee.

Michael A. Dewey (Spokane, WA, University of Utah, graduate student) (BS Chem '86) expects to receive his PhD in 1991!

Otis W. Fortner (Baton Rouge, LA, retired chemist) (MS Chem '41) who taught in the chemistry department during the war in 1942-43 (it was WSC then) is looking forward to his 50th class reunion in 1991.

Ken Konzak (Walnut Creek, CA , CA Dept. of Justice, criminalist supervisor) (BS BC/BP '70) is currently enrolled in the Comparative Biochemistry Program (PhD) at Univ. of Cal, Berkeley.

Gregory Needham (Greenfield, IN, Eli Lilly, scientist) (PhD Chem '80, Willett). Who would have thought he would be studying proteins?!

Lawrence E. Nielsen (Redmond, OR, retired) (MS Chem '42) has just had his third book published. It is entitled "Roads of yesterday in Northeastern Oregon".

Curtis Palmer (Reston, VA, US Geology Survey, senior scientist) (PhD Chem '83, Filby) is taking a sabbatical year as Visiting Professor at Principia College.

Mark L. Peterson (Maryland Hts., MO, Monsanto Agricultural Co., senior r research chemist) (PhD Chem '87, Matteson) is finishing his last year of postdoctoral work at the University of Minnesota Dept. of Medicinal Chemistry. He was awarded a National Research Service Award from the NIH.

L. Myles Phipps (Spokane, WA, West Valley High School, teacher) (PhD Chem '71) will believe in a shortage in chemistry grads and advanced degree holders when he sees salaries and job offers increase in response. For every job he has ever heard of, there are many applicants and much competition!

Russell Pylkki (Arcadia, CA, Caltech, graduate student) (BS Chem '80, MS '81) is working with Fred Anson and Nate Lewis. The project they are working on is shifting away from STM to Electrochemistry (positioning ultramicroelectrode with a scanning tunneling microscope).

Despina Strong (Seattle, WA, WA State, ecology supervisor) (Tooulakou, Chem MS, PhD '86, Filby) has been promoted to Chemist IV in the Department of Ecology. She supervises the General Chemistry Unit in the Environmental Lab at Manchester, WA.

Mark A. Suwyn (Greenville, DE, DuPont, senior vice president) (PhD Chem '67, Hamm) was recently promoted to Sr. Vice Pres. and is responsible for Medical Products, Imaging systems, and Corporate Marketing.

Larry Taylor (Ann Arbor, MI, U of MI School of Medicine, staff scientist) (BS Chem '69, PhD BC/BP) is using 3-D computer graphics to model a variety of peptide/protein/receptor/ligand interactions. The computer predictions/models are used to determine sites of mutagenisis or peptides of synthetic interest.

Diana R. Tomchick (Madison, WI, Institute for Enzyme Research, postdoctoral fellow) (BS Chem '83) received her PhD in inorganic chemistry from the University of Wisconsin, Madison in June of 1990. She is presently employed by Ivan Rayment at the Institute for Enzyme Research (also Univ. of Wisconsin, Madison) as a postdoctoral research associate, where she is training to become a protein crystallographer.❖

Randall Gives Distinguished Faculty Address

Portions reprinted with permission from *hill-Topics* April/May 1990, Vol. 21, No. 3

Biochemist Linda Randall dramatically explained how proteins are transported through cell membranes when she presented the 56th Distinguished Faculty Address in January. Randall's talk, "Where to Go and How to Get There: A Biochemist Looks at Molecular Barriers in Life," was supported by music, art and dance much to the delight of a near-capacity crowd of 300 in Kimbrough Hall auditorium.

"Randall's research has dramatically altered the signal hypothesis dogma."

Randall used slides to project images of furry jellyfish and ax-wielding executioners to illustrate the complex process of protein transport. "All cells have one thing in common," she said, "a barrier, or membrane, between themselves and everything else." In order to perform their work, proteins must somehow pass through the membrane of the cell within which they are produced. Previously this process was partially explained by the "signal hypothesis," which was often printed as fact in textbooks.

Biochemist Linda Randall is presented with flowers and the Distinguished Faculty Address placque by fellow participant in the dramatization, WSU President Samuel Smith.

Randall's research has dramatically altered the signal hypothesis dogma. Her research group of biochemists has found that the "leader" of an unfolded protein chain keeps the protein from "folding" and allows a "chaperone" protein to bind to the unfolded protein. If it folds, a protein cannot pass through the membrane.

The chaperone guides the unfolded protein to the cell membrane, where a cleaving protein cuts off the leader, thus allowing the protein to fold after it passes through the membrane. Once in the outside world, the folded protein performs its designated work, she explained.

Randall's work has major implications for the understanding of hormone production, antibody secretion and immune function, toxin production by bacteria, cell surface structures, propagation of viruses, and other areas.

"If we can understand this process," said Randall in an earlier interview, "it will be very valuable because there are many medically important proteins that are limited." Cells can be programmed to produce specific proteins. Examples are human insulin and the human growth hormone, which is used to treat growth disorders.

The grand finale of Randall's presentation was a dance interpretation of protein secretion. Randall's colleagues portrayed protein chains, chaperone proteins and scavenger proteins. The dancing proteins were accompanied by original "molecular music" composed by WSU music professor Charles Argersinger. WSU President Samuel Smith made a debut performance as the ax-wielding cleaving protein.

A WSU faculty member since 1981, Randall won the WSU President's Faculty Excellence Award for Research in 1988. The Distinguished Faculty Address is sponsored by the university to honor faculty members for outstanding scholarship, teaching and research.❖

Chemistry Group Develops New Electron Microscope

A husband and wife team, Chemistry and Chemical Physics Professors Kerry Hipps and Ursula Mazur, and students Glenn and Dale Fried have designed and built a new electron microscope system to conduct experiments at the sub-atomic level. Their system is a scanning tunneling microscope which will allow them to explore properties of atoms.

Commercial equipment, which does only some of what their system will accomplish, is available for around $65,000. However, their expenses have only been $5,000, which includes the cost of a microcomputer.

Equipment to conduct electron microscope analysis of atoms at atmospheric pressure under super-cooled temperatures is not commercially available.

"To really understand what's going on with materials on an atomic scale, such as whether atoms are chemically or physically bonded, we need this type of system," Hipps said. "Since there wasn't anything on the market, we decided to try building our own."

Another factor making such precision work possible is the new vibration-isolation research facility. The underground annex to Fulmer Hall houses their new system. To provide enhanced isolation from the building's low natural vibration, the team added a pan of pea gravel and a small rubber innertube later replaced by a laser table.

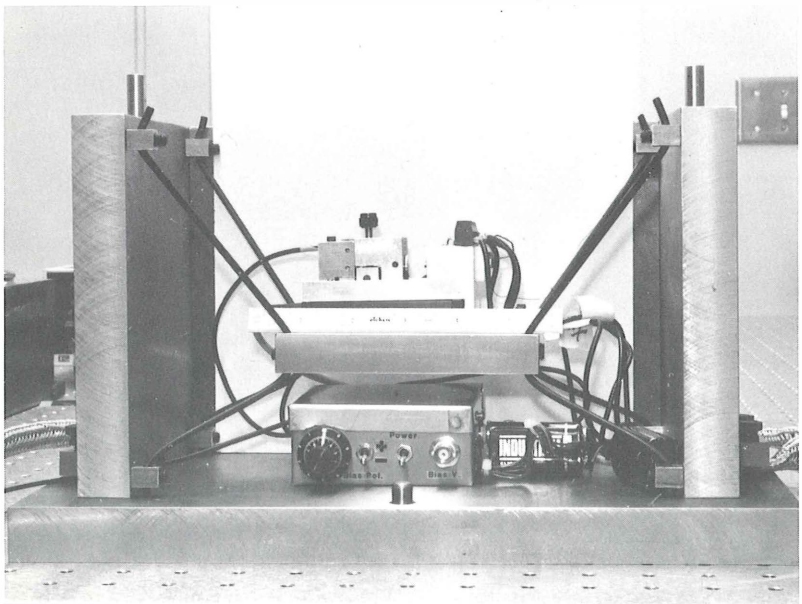
Data from the tunneling microscope analysis of specimens are collected by computer and reproduced by a color printer in images that appear, to an untrained eye, as impressionist art prints.

> *"To really understand what's going on with materials on an atomic scale we need this type of system."*
>
> *—Kerry Hipps*

Suprisingly, when this project began the Fried brothers were not chemistry majors. Dale, the younger of the two brothers, a Glenn Terrell Distinguished Scholar and an engineering and physics major, had attended a lecture by Mazur when she talked about the couple's research interest and their need for a new kind of tunneling microscope. He decided it was something he wanted to work on, recruited his older brother, Glenn, a senior in materials science engineering, and the consortium was formed.

Dale fabricated and connected most of the electronic control panels and Glenn assembled the business end of the microscope, a needle-sized tip which scans the surface atoms of materials. The motion of the tip is converted into graphic representations of the surface. Since the microscope was completed Glenn has received his degree in materials engineering and is now an M.S. student in Chemistry.

The group will analyze a layered material produced by another professor for use as a component of a gas detector and will also study metal corrosion on an atomic scale.❖



The Scanning Tunneling Microscope is capable of resolving single atoms!

Student Stars

First Julian Culberton Teaching Fellow

Joseph Hoagland, a third year graduate student, was recently awarded the first Julian Culbertson Teaching Fellow. This recognizes, in a formal way, Joe's assignment to teach Chemistry 532, which in itself is a mark of the high regard in which he is held by the faculty, especially the faculty in physical chemistry.

It is particularly appropriate that the name of Julian Culbertson is associated with this recognition, since Professor Culbertson was a distinguished physical chemist at WSU and was for many years the chair of the Department of Chemistry. He was especially noted for his concern with teaching. The funds to support this fellowship are derived from the Culbertson endowment.

Mr. Hoagland has passed prelims in physical chemistry and his research is off to a good start. He won two awards last year (the SX_i speaker competition and the GPSA paper/poster competition) based on his work. Congratulations Joe! And a special thanks to all of our alumni and friends who made this fellowship possible by contributing to the Julian Culbertson Fund!

Brian Scott was accepted as a participant at the NATO-Advanced Study Institute on the Application of Charge Density Research to Chemistry and Drug Design, April 17-27 in Spain. He was awarded $450 from the University of Pittsburgh, Department of Crystallography in addition to an NSF travel grant.

Mark R. Pressprich was awarded travel support from the U.S. National Committee for Crystallography to attend the 15th Congress of the International Union of Crystallography in Bordeaux, France. He presented a paper entitled "Incommensurate Phases, Phase Transitions and Structural Chemistry of $[Pn(CH_3)_4]_2MX_4$ Salts.

Donations at Work

Due to the generosity of our many alumni and friends, the Department of Chemistry was able to award ten undergraduate and three graduate scholarships for 1990-91 school year. It could not be done without you and we send our sincere thanks to those that have made it possible! Listed below are the scholarship recipients.

- **Harry K. Batey Scholarship**
  Tim R. Mhyre
- **C. Glen King Scholarship**
  Milo W. Hatch
  Richard N. Mattis
  Patrick Grealish
  Geoffrey Lee
- **Chemistry Development Fund**
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  Janet M. Cloutier
  Darin J. Gustin

Student Spends Summer in Chem Lab

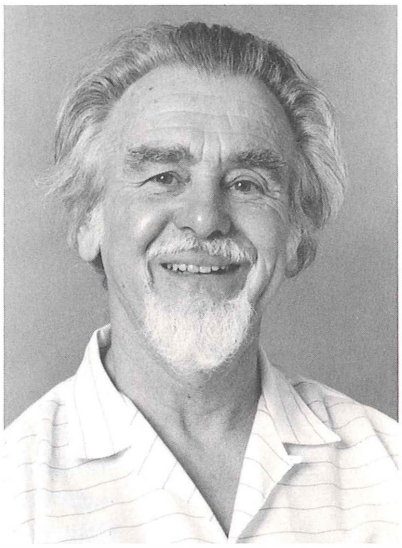
Alex Chung, a Pullman High School student, spent last summer working in the lab of Professor Maurice W. Windsor.

Alex was supported by an Academy of Applied Science Research and Engineering Apprenticehsip Program Grant (REAP). The REAP program is designed to encourage high school students to pursue careers in science and engineering by giving them hands-on laboratory experience in a research lab.

Alex is a very promising student. He has just entered the University of Washington and will major in Pre-Med and Computer Science. ❖

Pioneering Contributions Recognized

Chemistry professor Maurice Windsor was recognized recently in a special report and cover story on Photosynthetic Reaction Centers in *Chemical and Engineering News* (July 30, 1990). The article, written by James Mom and Marianne Schiffer of Argonne National Laboratory, recognizes Windsor's pioneering contributions in the mid-70's to unraveling the primary charge separation steps in photosynthesis. Research activity in photosynthesis is at a peak right now, stimulated by the award of the Nobel prize for chemistry in 1988 to three German scientists (Deisenhofer, Huber and Michel) who successfully crystallized the photosynthetic reaction center and determined its detailed molecular structure by X-ray crystallography. Photosynthesis is arguably the most important photochemical process on our planet. It is responsible for producing all our foodstuffs, forest products used in construction and clothing industries, and the oxygen that we breathe. Scientists hope that, by gaining a detailed understanding of photosynthesis, they may be able to design artificial systems or genetically engineer plants and bacteria that are more efficient and more versatile than the natural organisms.❖



Maurice W. Windsor

Future Cougar Day

More than 2,300 students and families participated in the Future Cougar Day activities that were held September 8. This special day gives junior high and high school students and their parents an opportunity to visit the WSU campus. In the morning chemistry professor, Glenn Crosby gave his famous "Color of Chemistry" demonstration to many of the visiting students. Later that morning a festival was held on the intramural field adjacent to Martin Stadium which featured scores of displays from university departments and student activities. Of course, the chemistry department and the biochemistry/biophysics department had a display at the festival and Professor Kirk McMichael was there to answer questions from prospective students and their parents. After visiting the festival, students and their parents were invited to attend the WSU-University of Wyoming football game and barbeque. Finally, the Pullman's Summer Palace featured their production of "Kiss Me Kate" to conclude the day's activities.❖

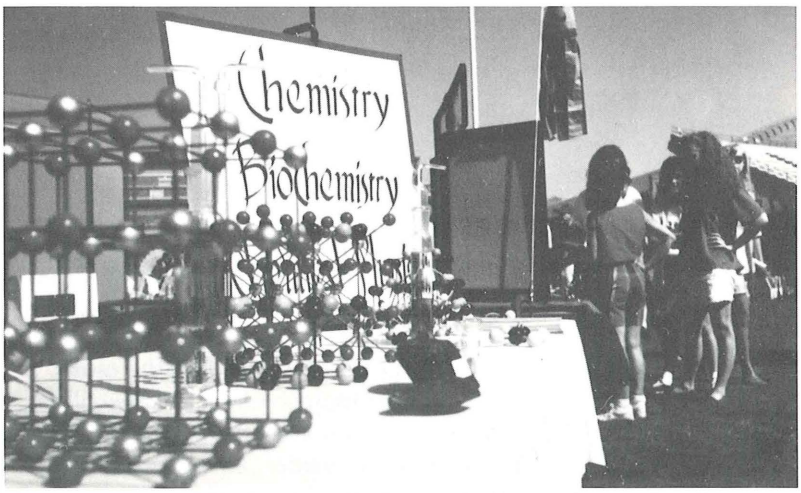
Recent Publications

"A Scanning Tunneling Microscope with a Wide Sampling Range". K.W. Hipps, Glenn Fried, and Dale Fried. *Rev. Sci. Instrum.* **61** (1990) 1869.

"Infrared and Tunneling Spectroscopy Study of AlN Films Prepared by Ion-Beam Deposition". Ursula Mazur and Ann Cuneo Cleary. *J. Phys. Chem.* **94** (1990) 189.

"Hydroxyl Radical Photoproduction in the Sea and Its Potential Impact on Marine Processes". K. Mopper and X. Zhou. *Science.* **250** (1990) 661.

"Pressure Dependence of the Kinetics of Photoinduced Intramolecular Charge Separation in 9,9'-Bianthryl Monitored by Picosecond Transient Absorption: Comparison with Electron Transfer in Photosynthesis". M.W. Windsor, W. Rettig. *J. Phys. Chem.* **94** (1990) 4550-4559.❖



The chemistry and biochemistry display at the Future Cougar Day Festival.

THE MIRROR MAY BE LYING

Reprinted from Chemistry Leads - Research News from the National Science Foundation and the American Chemical Society, January 1991.

Alice in Through the Looking Glass wondered whether looking-glass milk would be good to drink. The chemist's answer is "no." Biologically active molecules such as sugar and protein in milk must have the right shape and handedness. The mirror-image milk is indigestible, unless Alice were converted into her own mirror image on her imaginary entry into the looking-glass world.

That's how Professor Donald S. Matteson approaches a description of the research he and his colleagues are doing at WSU. They are working to deliberately control the shape and handedness of molecules they make, including antibiotics and insect lures that would be environmentally safe and highly effective in pest control.

They have found a new way to synthesize many types of biologically active molecules with 99 percent or greater control of the handedness of the chains of carbon atoms which make up their backbones. Handedness refers to whether molecules are left- or right-handed just like human hands. You can place your hands together - palm to palm - and they "fit." Otherwise - palm to back - they don't. They are mirror reflections of each other.

Handedness (the technical term is chirality) is extremely important in chemistry. For example, a right-handed version of a molecule may have some useful properties, whereas its left-handed version may be useless. Most syntheses yield a mixture of both versions, and it is usually very difficult to seperate out the one of choice. Matteson's method is not the only one for making a particular version, but it appears to be one of the most effective and efficient.

What makes the process all the more critical is that many biological molecules have several points where the right/left choice must be made. To understand what would happen without some kind of spatial control imagine an auto manufacturer that could not control whether the steering wheel was put on the right side or the left, and also got the dashboard instruments on the same side as the steering wheel only about half the time. If there were several more random connections in the engine and the drive train, only a tiny fraction of those cars would work, and half of those that did would have to be shipped to England. Synthetic chemistry used to be that difficult.

With a grant from the National Science Foundation, his team has developed a synthetic method in which a connection is made between the molecule being made and another molecule derived from a natural source - like a pine tree. The latter serves as a template for right/left control. The connecting atom is boron. The boron-carbon connection is a weak link in the structure that allows additional carbon atoms to be inserted, and the template group controls the direction of the assembly.

Matteson's group has used this chemistry to make four different insect pheromones. These are odor chemicals which insects use for communication, and which may be used to control insects in future. "The molecular shape has to exactly match the natural material in order for the insects to detect the odor and respond to it. When the chemist gets everything right, the synthetic material will be absolutely identical to the natural insect odor.❖

(Faculty & Staff Continued From Page 7)

of thin films can be dramatically affected by very small changes in chemical composition. When pure aluminum nitride (AlN) is deposited by ion beam methods onto mica, it produces highly symmetrical blister patterns (nice photos available on request). The addition of only 2% of H_2 to the ion plasma totally inhibits adhesive failure and very smooth films are produced.

Chemistry Professor **James Satterlee** recently received a $400,000 equipment grant from NIH to purchase the 500 MHz solutions multinuclear instrument for the newly established NMR center. Jim has also received a 3-year, $270,000 NSF grant to study protein engineering.❖

Honor Roll Of Our Special Friends

The Honor Roll of Donors is our way of saying "thank you" for supporting the Department of Chemistry and the Department of Biochemistry/ Biophysics. Your generosity enables us to build programs of distinction and provides direct support to our outstanding students and faculty through scholarships and fellowships, research and equipment grants, visiting lecturers and in many ways which build ongoing excellence in our programs. We deeply appreciate the involvement and support of our alumni and friends.

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New Course A Success!

A new course, Molecular Biology Computer Techniques, was taught for the third time in the Fall, 1990 by Professor Keith Dunker. Thirty-one graduate and undergraduate students completed research projects and presented their results at a "Poster Session Final Examination." Four scientists from the private sector attended to assist in the evaluation of the posters, namely: David Anderson, NeoRx Corporation; Perry Fell, Oncogen; Harvey Kriloff, Boeing; and Gary Schweikhardt, Washington Biotechnology Funding, Inc and Director, Washington State Biotechnology Association.

Professor Frank Loewus of the IBC attended the poster session at the invitation of his senior honors biochemistry student, Robert Suto. Loewus remarked "I was totally unprepared for the originality, imaginative interpretations, and top quality workmanship I encountered. This was a first class demonstration of scholarship that had taken advantage of the cutting edge in computer science." The posters ranged from molecular models of gene splicing to semantics in the work place. Virtually all of them revealed an understanding of the steps from experimental modelling to technicalities of presentation. In a way, it was a dress rehearsal of the challenge a student must face when presenting data and results at a professional meeting.

Robert Suto is an undergraduate who exposed his skills in the midst of graduate students. Better training cannot be found. He chose a problem from his senior honors thesis research, and made use of skills learned in this class to extend his understanding of the molecular structures involved.

This class with its integration of molecular biology and computer science, and with its "Poster Session Final Examination" may be unique. Even more important, this course emphasizes the use of the computer tools in actual research projects and thus is a demonstration of WSU's continuing commitment to **both** innovative teaching and state-of-the-art research .❖

Help make the difference in someone else's life!

Please participate in our phonathon this spring. Your news is important to your fellow alumni and your generous gifts make our scholarships possible.

Say yes, and . . . **Help the College of Sciences and Arts and the Departments of Chemistry and of Biochemistry/ Biophysics maintain their tradition of excellence.**

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