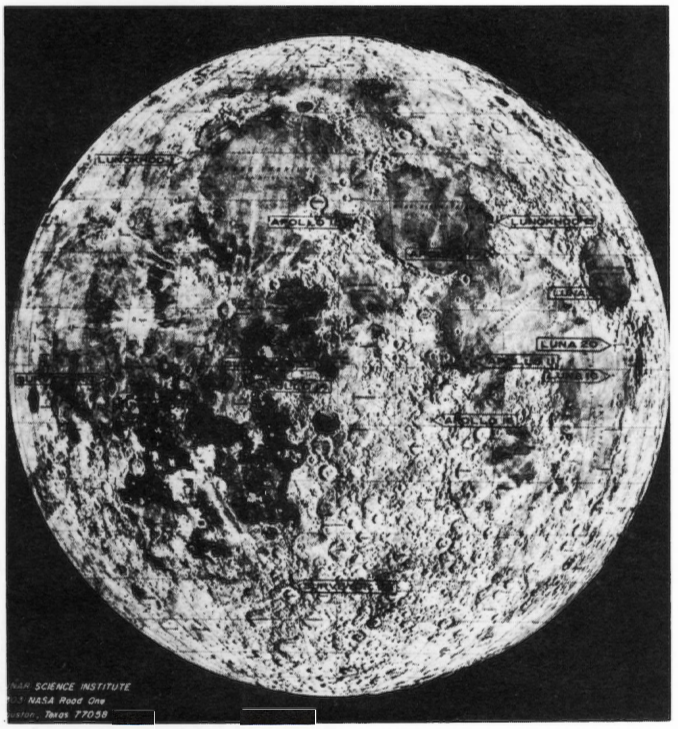
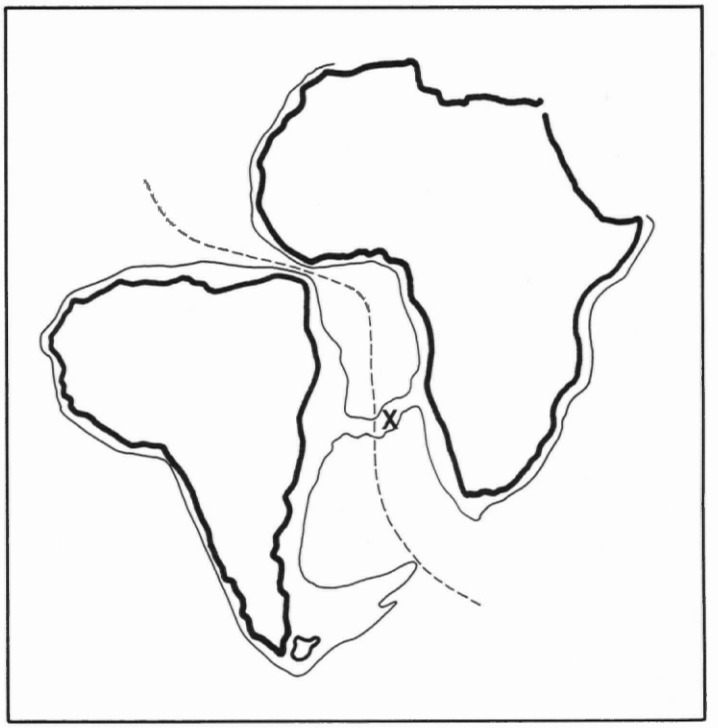
..the science record

Communications from the College of Science, Oregon State University

fall 81





The Science Record
College of Science
Oregon State University
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Volume 9, Number 1

THOMAS T. SUGIHARA, Dean
THERAN D. PARSONS, Associate Dean
EVA M. MILLEMANN, Editor

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Cover

A group of OSU scientists whose primary interest is cosmochemistry: (seated, front) ***Roman A. Schmitt,*** *(standing,from the left)* ***Monty R. Smith, M. -S. Ma,*** *and,* ***Y. -G. Liu*** *at the Radiation Center counting room. Two specific research areas by these chemists include the study of moon rocks and of a deep oceanic sediment and basalt core.* ***Upper left:*** *A reference mosaic of the moon shows locations of six USA manned and three USSR unmanned sample return missions.* ***Upper right:*** *The hypothesized positions of South America and Africa (about 54 million years ago), as inferred from analyses of a 650-m core recovered from the Walvis Ridge. The indicator (X) is the location where the core was drilled below 2,200 m of seawater. The heavy line indicates the two continents, and the contiguous light lines indicate the present continental shelves. Dashed line between South America and Africa represents the mid-Atlantic ridge "pushing" the continents apart.*

Oregon State University

The changing of an administration is an occasion that in some ways is like a birthday; it is a time for retrospection as well as looking into the future. Past issues of *The Science Record* have been helpful in giving me an impression of the way the College of Science has evolved and the manner in which the future was regarded in 1973 when edition number 1 of volume 1 appeared.

In the inaugural issue of *The Record,* Dean Robert W. Krauss noted prophetically that the development of the technological base of the United States was falling behind that of other nations. As we look around us in 1981, we see that prophesy has indeed been fulfilled. Our society is permeated with products characteristic of technological advances in Western Europe and Asia. Technical areas in which the United States pioneered are now the domain of other nations, and there is little reason to believe that this trend will be reversed in the foreseeable future.

Dean Krauss deplored also the inability of scientists to communicate their message effectively to the citizenry and especially to legislative bodies. The promise of science and the contributions made by academic science to society are seldom easy to convey to non-scientists. *The Record* was intended in this context to be a medium for describing the achievements of Oregon State faculty and staff in the College of Science and for recording their professional activities. We shall continue to pursue that goal.

Since 1973, *The Record* has been filled with revelations of new and unusual scientific results. In this issue, Roman Schmitt describes the new traits of order pertaining to continental drift that have unexpectedly emerged from his studies of rare earths in certain ocean sediments—studies undertaken for other reasons. Unforeseen applications or extensions of basic science are common and normal, frequently returning to enrich a sister discipline. For example, the principle of optical pumping that led to the laser was discovered by physicists; engineers in industry developed lasers in a wide variety of ways to make them useful in many new applications. The continuously tunable laser is now used by chemists to induce and study chemical reactions in remarkably selective ways—a delicate and microscopic probing never before possible.

For science to progress in the laboratory, scientists generally must have access to the technological devices that lie at the state of the art. The most interesting new results seem to arise from studies made under extreme conditions of temperature or pressure or size or accuracy or resolving power or some other physical, chemical, or biological property. One of the reasons U.S. science is falling behind that of Western Europe and Japan is that academic science today does not generally

have the resources to provide its world-class scientists with world-class equipment.

But science is not only seeking. It is also sharing. Every generation of academic scientists is expected to participate in the education and training of the next generation. Thus, the College of Science is dedicated in considerable measure to instruction—in classrooms, in self-paced study, in laboratories, by example, by computer-assisted means, on field trips, and in every imaginable way that knowledge can be transferred. In this College the tradition has been that all faculty members are expected in varying degrees to participate in both functions, i.e., to produce new science and to reveal the facts and principles of science to students, whether science majors or not. We see no reason to change this balance that has historically worked well.

In terms of numbers, the College of Science has grown as the University has grown. Oregon State University enrolled 13.8 percent more students in 1980-81 than in 1971-72. Science taught 12.7 percent more student credit hours in 1980-81 than in 1971-72. But the number of Science faculty has decreased slightly in this period. On the back page of *The Record,* we discuss the recent financial history of the College and note the difficult circumstances caused by inflation and the fiscal constraints imposed by the economy of the state and the nation.

While the near future looks bleak in a fiscal sense, the level of scientific activity in the College is impressively high. Interest in science among students, especially the high achievers, continues. From time to time we shall comment on the sociology and politics of science, as well as the substance of science, as the circumstances seem to require.

T. T. Sugihara

Roman A. Schmitt

Cosmochemistry—*viewing complex chemical differentiations in the early solar system*

What is the moon made of? How and when did it form? What is the chemical composition of meteorites and their origin? What do chemical differences in a deep core of oceanic sediment from the Walvis Ridge tell us about the separation of South America and Africa and the oxidation state of seawater millions of years ago? In the last decades, scientists have been able to attack such problems with a variety of techniques, often providing definitive answers and sound hypotheses.

Roman Schmitt, a professor of nuclear chemistry at OSU, has made significant contributions to our understanding of cosmochemistry by analyzing trace chemical elements in meteorites, lunar samples, and currently in an oceanic core, with an analytical technique known as instrumental and radiochemical neutron activation analysis (INAA and RNAA).

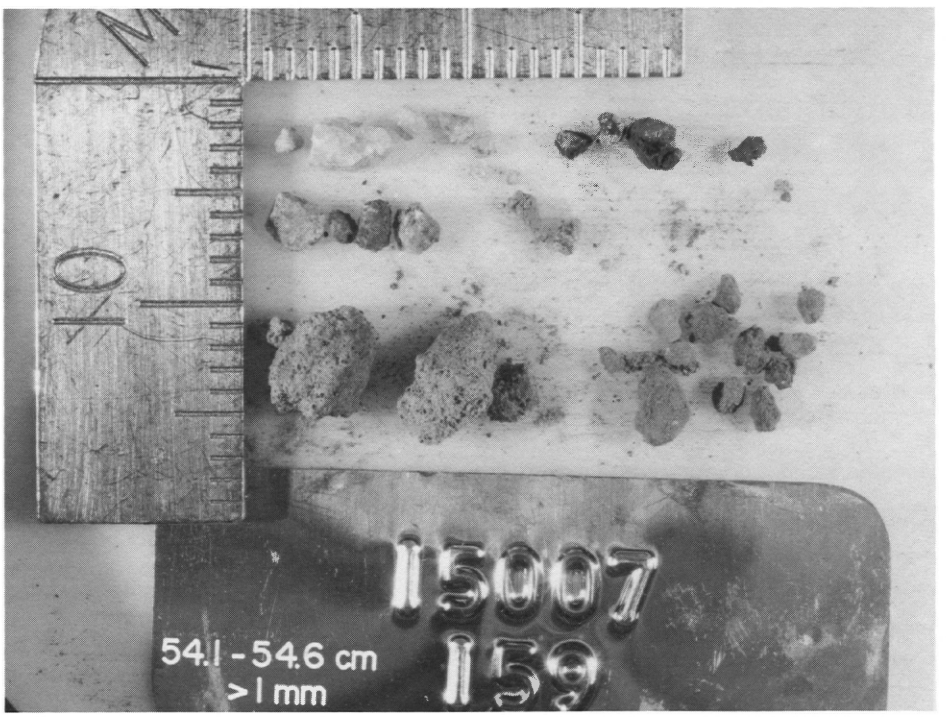
The technique, adapted by Schmitt for detection of the 14 rare earth elements while he worked for the General Atomic Division of General Dynamics Corporation, is relatively simple. "Samples to be analyzed," explains Schmitt, "are placed in the TRIGA reactor and irradiated with neutrons from a few minutes to several hours, depending on the chemical composition of the sample. During irradiation, many stable isotopes in the sample are transmuted into radioisotopes that subsequently decay, emitting characteristic radiations. Elemental concentrations are calculated from a computer-based analysis of the emitted radiation."

Instrumental neutron activation analysis has some distinctive advantages over other techniques since it is nondestructive and can be performed on very minute amounts of nearly any substance. For instance, recently some interplanetary dust particles weighing 0.1 μg were successfully analyzed by NAA. Once a technique is developed, the applications are varied, restricted only by the ingenuity of the scientist who uses it.

In addition to studies in cosmochemistry, Schmitt also directs the Radiation Center's neutron activation program, which provides consultation and service for OSU scientists and outside government agencies. Included in such services is the neutron analysis of forensic evidence. For example, the chemical composition of a bullet can be determined with sufficient accuracy to ascertain if it matches that of other bullets in the same production batch. Since different batches of lead will have different concentrations of trace elements (arsenic, antimony, copper, silver, and tin), bullets may be distinguished by the simple INAA application.

The principal thrust of Schmitt's research, however, has been directed toward understanding basic problems in cosmochemistry and geochemistry. In the late fifties, as a researcher with General Atomic, Schmitt was involved in analyzing impurity levels of a few rare earth elements present in the zirconium matrix of fuels to be used in TRIGA reactors.

A casual remark made to Schmitt by UCSD Professor Hans E. Suess at a Gordon Research Conference and some additional encouragement from the late Professor Harold C. Urey—a leader in meteorite and planetology studies—turned his attention from nuclear phenomena to cosmochemistry.



A few representative rocks recovered from the lunar soil (I.D. 15007, 159) at the Apollo 15 site (July 31, 1971). The black fragments are common volcanic basalt covering the black lunar maria. The white fragments are anorthosites, and the mixed black and whitish fragments are compacted mixtures (breccias) of anorthosites and iron and magnesium silicate rocks—both types of rocks that comprise the lunar highlands (mountains). The large soil clods at the lower left contain tiny green glass spherules. Millimeter ticks are on the ruler.

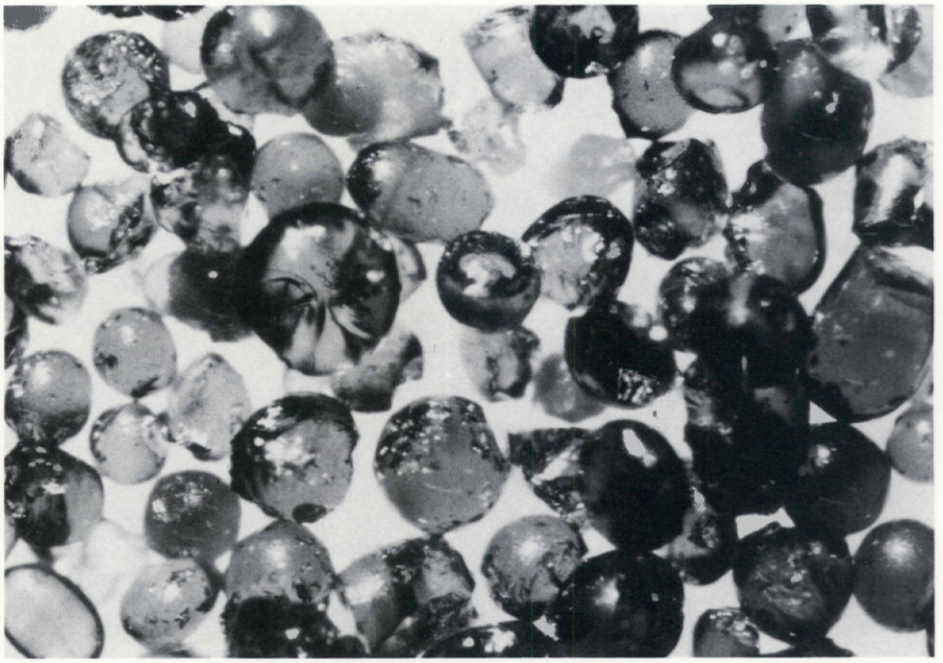
"At about the same time," adds Schmitt, "I began attending a fascinating series of seminars on cosmology and earth science at the Scripps Institution in San Diego. In 1958, I became actively involved with the initial group of UCSD scientists interested in cosmochemistry—many of whom were lured to the University of California from the University of Chicago—and began to analyze trace elements in meteorites using the RNAA technique."

Although in recent years enormous progress has been made in probing space with sophisticated devices, present technology so far has allowed the return to earth only of samples from the moon—the earth's own backyard. Meteorites obtained from recent or past falls on earth have been of great importance to science because they represent unique samples for studying the "geology of outer space"—its chemistry and physics. Accurate knowledge of a large number of trace elements present in meteorites provides important clues to understanding the earth's origin and that of the solar system. Such knowledge sheds light on the complex chemistries that must have occurred in primitive solar system matter billions of years ago.

"For example," points out Schmitt, "it is commonly believed that meteorites originated from collisional fragments of asteroids—those small planetesimals that move between Mars and Jupiter. During the past few years, our group has discovered that the compositions of some unique stone meteorites reveal extensive chemical fractionation suggestive of parent bodies much larger than asteroids—possibly as large as the earth itself or Mars. If these unique meteorites indeed originated from Mars, then this nearby planet has been sampled."

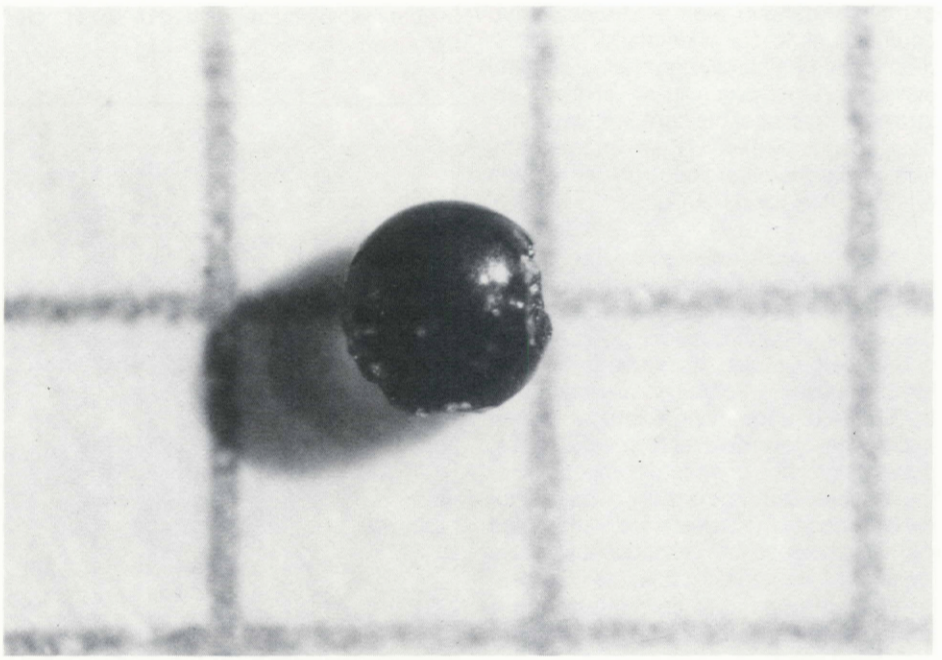
Recently, hundreds of meteorites have been found in the Antarctic, where they were first preserved in excellent condition by a cover of ice and later exposed by geological changes. The OSU group's interpretation of the trace element data from the recent analysis of a unique stone meteorite from the Antarctic suggests that it had originated in a large space body—perhaps larger than 1,000 km in diameter. Monty R. Smith, a doctoral student with Dr. Schmitt, is presently working on a theoretical model of the complex chemical differentiations that must have occurred during the solidification of a completely melted meteorite parent body with a diameter of 500 km or less.

It was only natural for Schmitt to become actively involved in lunar science once the Apollo missions began. In the last twelve years, his laboratory has analyzed about 700 individual lunar samples—soils, rocks, glasses, and mineral separates. They were collected at different moon sites during six American manned missions between 1969 and 1972 and three Russian unmanned missions between 1970 and 1976.



Representative lunar green glass spherules, 0.1 - 0.5 mm in diameter, were formed by the fire-fountaining of basaltic magma through fissures in the moon's surface about 3.35 billion years ago. These spherules may have been derived by the partial melting of cumulate minerals as deep as 400 km below the moon's surface.

Below: Close-up of a green glass spherule on a millimeter grid scale.



Early in the days of lunar sample research, Schmitt and postdoctoral student H. Wakita discovered that the europium content in lunar highland samples was abnormally high—a fact that complemented the abnormally low content observed in mare volcanic basalts. This observation supported the hypothesis that an oceanic silicate magma (hundreds of kilometers deep) existed approximately 4.6 billion years ago, before it differentiated into crust and mineral cumulates upon cooling.

Early work by Schmitt and Wakita concentrated on the study of lunar basalts. Such analyses of basalts collected from different sites revealed ten different chemical compositions, three of which were discovered at OSU. More recently, Schmitt and his group have analyzed volcanic lunar green glasses—spherules of glass (0.1-0.5

mm in diameter) believed to be the most primitive of all volcanic basalts. From their chemical concentrations, it is possible to deduce what minerals originally melted in the moon's depths to produce these glasses.

Dr. Schmitt, Dr. Ma, and Mr. Liu—the latter a graduate student from the People's Republic of China—have analyzed nearly 200 individual samples of green glasses by measuring the concentrations of 19 major, minor, and trace elements, including some key rare earth elements. Other red, yellow, orange, and black glasses found on the moon are believed to have originated from four compositional sources. The OSU group is testing that hypothesis.

Results from the analyses of lunar samples indicate that the moon has its unique chemical history—as complex as that of any large planet like the earth. Lunar research has shown that the overall composition of the moon is quite different from that of the earth.

More recently, Schmitt and Liu have turned their attention to oceanic sediments. They have been studying over 70 samples representing different depths of a 650-m core of oceanic sediment and basalt drilled from the Walvis Ridge in the South Atlantic Ocean—2,200 m below sea level and approximately 1,800 km northwest of Cape Town, South Africa.

Although these investigations were prompted by the general concern with possible burial of nuclear waste deep in the oceanic sediments, Schmitt has become particularly intrigued with the basic geologic findings and how they relate to the theory of continental drift. From the rare earth studies done by the OSU team, it is possible to deduce that approximately 54 million years ago the gap between the continents of Africa and South America became wide enough to allow sufficient communication between the North and South Atlantic Ocean masses—an event that changed the chemical conditions in the marine environment over the Walvis Ridge from reducing to oxidizing.

In addition, "fresh" (70 million years old) basalt near the lower section of the 650-m core has been found to have the same chemical composition as that of the Parana continental basalts from southeast Brazil—very different from oceanic basalts ordinarily found along the mid-Atlantic ridges. Trace element data suggest that the Walvis Ridge basalts were derived by the partial melting of garnet-bearing source matter at a depth of over 75 km.

In addition to continuing lunar and meteoritic studies, Schmitt and coworkers plan to pursue further these geochemical investigations by analyzing more Parana basalts from southeast Brazil, the Brazilian continental shelf, and from South Africa and Liberia to compare them to those found in the Walvis Ridge. Such data will be invaluable in modeling the origin of the Ridge—up to this point a geologist's enigma.

The Man Behind the Work

Roman Schmitt received his graduate training in nuclear chemistry-nuclear fission at the University of Chicago in the early fifties—an exciting time at that institution.

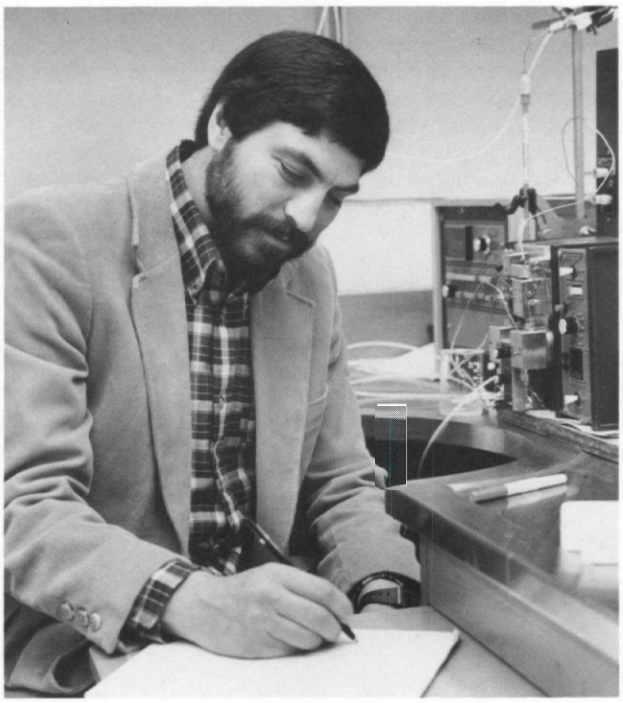
After a three-year postdoctoral stint at the University of Illinois, he became a research scientist of the newly formed General Atomic Division of General Dynamics in San Diego, where he remained till 1966. At that time the TRIGA reactor was being installed at the OSU Radiation Center, and he accepted a joint appointment in the Department of Chemistry and the Radiation Center.

In 1972, Schmitt received the George P. Merrill Award from the National Academy of Sciences in recognition for his pioneering work on analytical techniques and their applications for determining concentrations of the rare earth elements in extraterrestrial and terrestrial matter.

His research in cosmochemistry has received continuous support from NASA. Over the years, he has trained 11 postdoctoral fellows and many graduate students in cosmo- and geochemistry using applied nuclear chemical techniques of instrumental and radiochemical activation analysis. He has been an associate editor for several proceedings of Lunar Science Conferences and is also an associate editor of *Geochimica et Cosmochimica Acta.* He is currently a member of the Lunar and Planetary Review Panel.

Adolph J. Ferro

SAM—a regulator of cell division



Adolph Ferro, a molecular biologist in the Department of Microbiology, is attempting to understand the biochemical and genetic mechanisms that regulate the cell cycle and initiate cell division. Specifically, he has concentrated his efforts on studying the biosynthesis of an important biological compound that plays a key role in triggering cell division: S-adenosylmethionine (SAM).

The long-range implications of his findings could be significant since understanding the mechanisms that signal the cell to divide will allow, under certain conditions, their regulation. It may eventually be possible to stop growth of rapidly dividing tumor cells simply by turning off the inner signals that cause the cells to divide.

In addition to studying the biosynthesis of SAM, Dr. Ferro has investigated the activity of many of its degradation products. One in particular, which functions as a regulator of cell growth and has been synthesized in his laboratory, could prove a powerful agent in treating some forms of cancer.

Shortly after joining OSU in 1978, Ferro received a five-year Research Career Development Award from the National Cancer Institute. The award recognizes the merit of his work and supports in part his research efforts. Grants from the National Cancer Institute and the National Institutes of Health provide funds for these studies and eight collaborators, which presently include a postdoctoral student, four graduate students, and three technicians.

A keen interest in new developments in molecular biology enticed Ferro back to graduate school after a brief career as a high school teacher. He began research on the biosynthesis of SAM in the early seventies as a doctoral student at Washington State University under the guidance of Professor Kemet Spence.

"At the time, little was known about the function of S-adenosylmethionine," says Ferro, "except that it donated its methyl group in certain cellular reactions. Today, SAM is recognized as a key participant in many important reactions. My first project was to investigate the regulatory mechanism of SAM biosynthesis in yeast cells—single-celled organisms that are particularly suited to such research because their biochemical and genetic systems are well understood."

He continued his investigations as a postdoctoral fellow at the University of Illinois at Chicago at a time when the cell cycle and its specific sequence of events were becoming clearer.

"SAM's possible role in cell division intrigued me," adds Ferro, "because this compound was shown to be a precursor of certain substances (polyamines) found in large quantities in rapidly dividing cells. A high level of these substances, for example, is found in the urine of cancer patients. My next step was to clarify and characterize SAM's role during an important transition phase in the cell cycle—a phase when the cell appears to make some decisions about proliferation, integration of growth and division, and differentiation."

Significantly, Ferro established that SAM is necessary and its biosynthesis required before the cell can synthesize DNA—one of the first steps leading to cell division. He has further traced the function of SAM to believe that in some way it must be a signal to the plasma membrane to absorb more nutrients from the environment—another step necessary before the cell can divide. Modifications in the plasma membrane are one of the first noticeable changes in a cell undergoing transformation.

More recently, Ferro and his research team at OSU, in collaboration with Dr. A. A. Vandenbark of the Veterans Hospital in Portland, have investigated the function of several degradation compounds of SAM by carrying out experiments on mammalian cells and human lymphocytes—those white blood cells that multiply quickly to defend the body from extraneous agents. One of these products, 5'-methylthioadenosine (MTA), functions as a growth regulator. In laboratory experiments, MTA added to rapidly growing lymphocytes inhibits their growth.

"However, the inhibiting action of MTA is limited since it is quickly degraded by an enzyme," explains Ferro. "We have attempted to synthesize more powerful analogs of this degradation product in the laboratory and have been successful in synthesizing an MTA analog that is not as quickly degraded. Although we have administered this analog to mice without harmful side effects, much work still remains to be done before it can be tested on humans. In the future, additional analogs will be synthesized and tested in our laboratory."

An interesting offshoot of Ferro's principal research is a cooperative project on plant cells with Daryl Richardson of the OSU Department of Horticulture. Both scientists are intent on learning more about the mechanism governing the release of ethylene—a degradation product of SAM and a plant hormone that stimulates fruit to ripen (and flowers to wilt). Possible control of ethylene release is a new area of research that could prove of great practical and economic value to farmers.

Scholarship Awards, 1981-1982

The College of Science presented the largest number of scholarships ever awarded to 79 students, who were honored at a special luncheon on May 19, 1981.

Front row, left to right:
Karen L. Krantz, *Microbiology,* J. E. Simmons Memorial
Sonja Berge, *Biochemistry & Biophysics,* Jesse Hanson
Helen Walker, *Microbiology,* J. E. Simmons Memorial
Richard Cramer, *Computer Science,* Paul Copson Memorial
Kenneth Skach, *Geology,* Union Oil Co. of California
Andrew Macfarlane, *Geology,* AMOCO Foundation
Mark Erlandson, *Premedicine,* Alumni Physician
Karen Bloomquist, *Biology,* Jesse Hanson
Laura Benson, *Preveterinary Medicine,* Dora Krueger Memorial
Kathy Cook, *Botany,* Copson
Susan Schwartz, *Mathematics,* Paul Copson Memorial
Heidi Koiv, *Botany,* Jesse Hanson

Second row, left to right:
Laura Kunioka, *Computer Science,* Paul Copson Memorial
Michael Phillips, *Premedicine,* Jesse Hanson
Ronald Martin, *Chemistry,* Milton Harris
Richard Baertlein, *Premedicine,* Gombart Medical
Joseph Giffoni, *Preveterinary Medicine,* Dora Krueger Memorial
Paul Rose, *Premedicine,* Ralph H. Bosworth Memorial
William Gazeley, *Physics,* Paul Copson Memorial
Stephan Ames, *Premedicine,* Jesse Hanson
Peter Ryan, *Botany, Copson*
Russ Jacobson, *Preveterinary Medicine,* Dora Krueger Memorial
Mark Azevedo, *Botany,* Copson
Tracy Piazza, *Premedicine,* C. J. Meechan

Third Row, left to right:
Wayne Gilbert, *Premedicine,* Jesse Hanson
R. Todd Lorenz, *Microbiology,* J. E. Simmons Memorial
Nathan Dunsmore, *Biochemistry & Biophysics,* C. J. Meechan
Michael Moore, *Physics,* Jesse Hanson
Barbara A. Graham, *Premedicine,* Jesse Hanson
Katherine A. Barbour, *Microbiology,* J. E. Simmons Memorial
Douglas Campbell, *Mathematics,* Paul Copson Memorial
Angelo Vlessis, *Premedicine,* Jesse Hanson
Tammi Degner, *Premedicine,* Jesse Hanson
Anne Wang, *Biochemistry & Biophysics,* C. J. Meechan
Laura McClelland, *Biology,* Jesse Hanson
David Vandermolen, *Premedicine,* Jesse Hanson
Anne Lee, *Premedicine,* C. J. Meechan

Fourth row, left to right:
Peter M. Dawson, *Chemistry,* Longview Fibre Co. Pulp & Paper
Joseph Haberman, *Biochemistry & Biophysics,* C. J. Meechan
Kenneth L. Stanwood, *Mathematics,* Paul Copson Memorial
Thomas T. Tibbitts, *Biochemistry & Biophysics,* Milton Harris
Mark D. Hendricks, *Premedicine,* Jesse Hanson
Alan Yugawa, *Predentistry,* Jesse Hanson
Kim Erbes, *Preveterinary Medicine,* Dora Krueger Memorial
Linda R. Lorenz, *Premedicine,* Gombart Medical
James Brookins, *Premedicine,* Ralph H. Bosworth Memorial
Marcia Boonstra, *Preveterinary Medicine,* Dora Krueger Memorial
Jennifer Mathew, *Preveterinary Medicine,* Dora Krueger Memorial
Joseph Meyer, *Premedicine,* Jesse Hanson
Jeffrey McDonald, *Microbiology,* J. E. Simmons Memorial

Fifth Row, left to right:
Steven Brockett, *Physics,* Paul Copson Memorial
Scott Wilson, *Geography,* C. John Hunt Memorial
Jason Yohannan, *Geography,* C. John Hunt Memorial
Bryan Haynes, *Computer Science,* Paul Copson Memorial
David Teeter, *Predentistry,* Jesse Hanson
James Bluhm, *Premedicine,* C. J. Meechan
Richard Beyerlein, *Premedicine,* Benton County Medical Society
Carolyne Brown, *Zoology,* C. Robert Herrick, Jr., Memorial
Bruce W. Mueller, *Preveterinary Medicine,* Dora Krueger Memorial
Timothy Hardy, *Physics,* Copson
James Plamondon, *Geology,* Union Oil Co. of California
Curtis A. Meyer, *Physics,* Jesse Hanson
Michael E. Lewis, *Geography,* Copson

College of Science Scholarship winners not included in photograph above:
Catherine M. Brugato, *Biology,* Jesse Hanson
Sylvia Fromherz, *Biology,* Jesse Hanson
Kathy Rice, *Biology,* Jesse Hanson
Theodore LaPage, *Chemistry,* Jesse Hanson
Randy Nevin, *Computer Science,* Sait
Gregory Courtney, *Entomology,* Copson
Mark Darrach, *Geology,* S. M. Evans, Jr., Memorial
Ritchey Ruff, *Physics,* Copson
Maurice Golden, *Premedicine,* Jesse Hanson
Paul Harding, *Premedicine,* Jesse Hanson
Thomas Howard, *Premedicine,* Jesse Hanson
Philip Rose, *Premedicine,* Jesse Hanson
Geraldine Stark, *Premedicine,* Copson
Amy Fawver, *Preveterinary Medicine,* Jesse Hanson
Taylor Hyde, *Preveterinary Medicine,* Dora Krueger Memorial

news & notes

ATMOSPHERIC SCIENCES

James W. Deardorff presented a paper on experimental studies of mixed-layer entrainment using an annulus at the Third Symposium on Turbulent Shear Flows in Davis, CA, in September. In October, he attended a workshop on mixed-layer diffusion in Las Cruces, NM.

W. Lawrence Gates gave an invited paper, "Numerical modeling of climate," to the Portuguese Academy of Science in Lisbon in celebration of its 200th anniversary. Following this October meeting, Dr. Gates visited the European Centre for Medium Range Weather Forecasts, Reading, and the Climatic Research Unit at the University of East Anglia, Norwich, United Kingdom.

Richard W. Katz chaired one of the sessions and presented a paper at the Seventh Conference on Probability and Statistics in Atmospheric Sciences in Monterey, CA, in November. He was coauthor of two other papers presented at the same meeting.

Allan H. Murphy visited the European Centre for Medium Range Weather Forecasts, United Kingdom, for a month between September and October. Upon his return, he presented a paper at the AMS Seventh Conference on Probability and Statistics. Two other papers coauthored by Dr. Murphy were given at the same conference.

C. R. Nagaraja Rao attended the review meeting of the Solar Energy Meteorological Research and Training Site program at the Solar Energy Research Institute, Golden, CO, in September.

BIOCHEMISTRY AND BIOPHYSICS

James R. Allen, research associate in ***Dr. Christopher Mathews'*** laboratory, was an invited speaker in September at a symposium on Molecular and Cellular Regulation of Enzyme Activity at Martin Luther University in Halle, East Germany. Dr. Allen described research on multienzyme complexes in DNA precursor biosynthesis carried out by himself and colleagues in Dr. Mathews' laboratory.

Robert R. Becker is chairman of the Biomedical Sciences Fellowship Review Panel, National Institutes of Health.

Wilbert R. Gamble spent two weeks in Nigeria in July as a consultant on educational development to the Assistant to the President of Nigeria.

Gregory Ide, research associate with ***Dr. Kensal Van Holde*** , visited several laboratories in Europe during August and September. He presented a research seminar, "Transcription in isolated yeast nuclei," at the Max Planck Institute for Molecular Biology in Germany.

Donald J. Reed attended a symposium on Information Transfer in Toxicology in August and a meeting of the Toxicology Data Bank Review Committee in September at the National Library of Medicine.

Court Saunders, research associate with ***Dr. Kensal Van Holde,*** was an invited speaker at the annual meeting on Molecular Biology of Yeast at Cold Spring Harbor Laboratory, NY, in August. He described his research on control of gene expression in yeast at that meeting and later at research seminars at Texas Tech University and at the University of Kansas.

Michael I. Schimerlik described his research on physical characterization of the pig heart acetylcholine receptor at seminars at George Washington University and Tufts University in September. He also conferred with research colleagues at the University of Toronto, the University of Wisconsin, and the Sloan-Kettering Institute for Cancer Research.

Kensal E. Van Holde participated in a site visit review of a program project grant in cancer research at Tufts University School of Medicine in October.

BOTANY AND PLANT PATHOLOGY

Thomas C. Allen is the senior author of a paper on tobacco rattle virus and potato virus X that was presented by junior author ***J. R. Davis*** (University of Idaho) to the Conference of the European Association for Potato Research, Munich, Germany, in September.

Norman I. Bishop gave the opening address to the VII Midwest Photosynthesis Conference at Gull Lake, MI, in October. He also gave a seminar entitled "Mutational analysis as an experimental approach to understanding mechanisms of photosystem II in microalgae" to the Plant Biology Laboratory, Department of Microbiology, and the Program in Genetics at Michigan State University.

Everett M. Hansen, Peter A. Anguin, Philip B. Hamm, Paul E. Hennon, and ***Paul F. Hessburg*** attended the Western International Forest Disease Work Conference held in September at Vernon, British Columbia.

Harold J. Jensen became a Fellow of the Society of Nematologists at its 20th annual meeting in Seattle in August. This honor recognizes his numerous contributions to the science of nematology and to the Society. He has served on many committees and is a past vice-president and president of the Society.

C. David McIntire presented a paper, "Benthic primary production in the Columbia River estuary," at the Sixth Biennial International Estuarine Research Conference at Gleneden Beach, OR, in November.

Ralph S. Quatrano presented invited seminars on "Molecular approaches to the study of wheat embryogenesis" at Princeton University and the University of Delaware in September and October. In November, he was an invited speaker at a minisymposium on "The Plant Cell Genome" at the annual meeting of the American Society for Cell Biology, Anaheim, CA.

CHEMISTRY

Professors ***Carroll W. DeKock*** and ***Gerald J. Gleicher*** and teaching assistants ***Christopher Oertel, Claudia Seyfert, Arden Strycker,*** and ***Stephen Wuerch*** were awarded the first ***Milton Harris Awards*** for excellence in teaching chemistry at a department ceremony in September. Selection was based on student responses and on evaluations by other faculty members.

These awards have been made possible by a gift from ***Milton Harris,*** a 1926 OSU chemistry graduate who has had a long and distinguished career in pure and applied research, in academic and industrial chemistry, and in government service. Harris has maintained a continued interest in the welfare of Oregon State University.

Casey Bennett was employed from July to September 1981 by the Swiss Federal Institute for Reactor Research in Wuerenlingen, Switzerland. During this period, he worked with a radiopharmaceutical research and development group, developing a protocol for carrier-free, high specific activity fluorine 18 suitable for *in vivo* use or for labeling deoxyglucose.

Shih-Yue Hou joined the department in October as a postdoctoral fellow doing research on nonlinear spectroscopy with ***Dr. J. W. Nibler.*** A recent graduate of Columbia University, Hou is interested in the use of picosecond laser sources to study ultra-fast changes in chemical systems.

James D. Ingle gave invited talks on luminescence spectrometry at the University of Minnesota and the University of California at Riverside in November.

Walter D. Loveland contributed a paper on "Target fragmentation from 10 to 1,000 MeV/A" to the Tenth European Conference on Physics and Chemistry of Complex Nuclear Reactions at Lillihammer, Norway, in August.

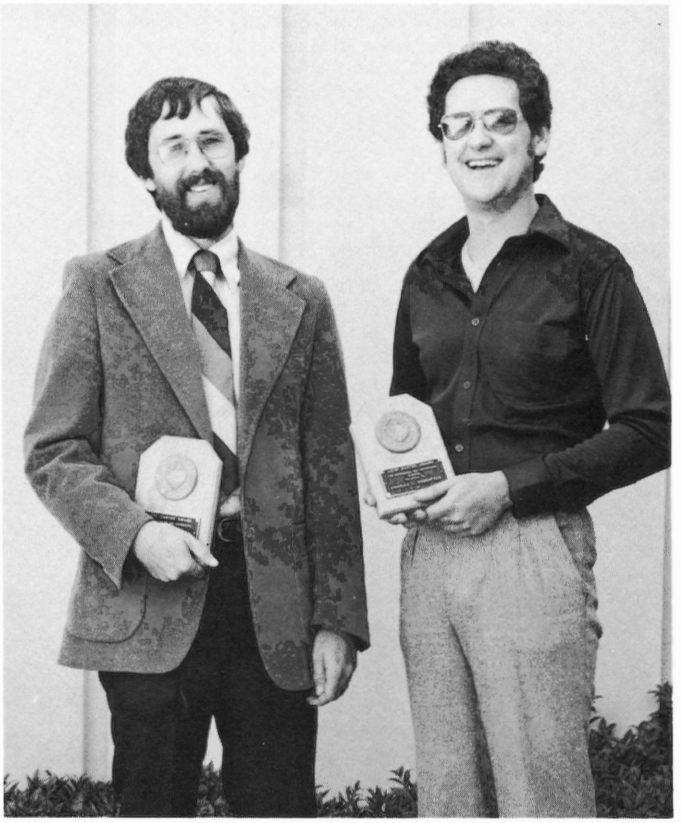
David and Clara Shoemaker contributed a poster paper to the 12th International Congress of the International Union of Crystallography in Ottawa, Canada, in August.

T. Darrah Thomas attended a meeting of the Rocky Mountain region chemistry chairmen in Denver in October and a meeting of the Council for Chemical Research in Rochester, NY, early in November. He gave a seminar on "Electron-electron coincidence measurements involving core electrons" at the Xerox Center for Technology in Webster, NY.

COMPUTER SCIENCE

Philip Cohen presented a paper, "The need for referent identification as a planned action," at the Seventh International Joint Conference on Artificial Intelligence, University of British Columbia, Vancouver.

Carter Awards



David A. Butler (left) and Charles L. Rosenfeld

David A. Butler, associate professor of statistics, and Charles L. Rosenfeld, associate professor of geography, received the 1981 College of Science Carter Awards at the first faculty meeting of the 1981-82 academic year. The awards are presented each year to two faculty members who have distinguished themselves for "outstanding and inspirational teaching" in either graduate or undergraduate instruction. A group of finalists is nominated by College of Science students, with final selection made by a committee of previous award winners. Butler and Rosenfeld are both former finalists for the Carter Award.

Butler, who was chosen to receive the award for graduate teaching, has been a member of the Department of Statistics since 1975. An OSU mathematics major who received his graduate training at Cornell University and Stanford University, Butler is primarily interested in reliability models, probabilistic decision processes, and applications of operations research to forestry. His research on reliability and maintainability is funded by a contract with the Office of Naval Research.

In addition to courses in the Department of Statistics, he has taught operations research in the OSU School of Forestry. He has worked closely with graduate students in that school and in his own department, where he was chairman of the graduate committee for three years. He recently was awarded special recognition by the organization of graduate students in the Department of Statistics for his meaningful contribution to their learning experience.

Charles Rosenfeld, a member of the Department of Geography since 1974, received the Carter Award for undergraduate instruction. This recognition comes at a time when his recent work on Mount St. Helens has already drawn attention locally and nationally.

Rosenfeld received his undergraduate and graduate degrees from the University of Pittsburgh. During his master's program, he spent a year in France at the Centre de Geomorphologie in Caen, where he worked closely with scientists from different countries delimiting the effects of climatic change on landforms. His interest in landforms has taken him to many remote areas, from the Canadian Northwest Territory and Alaska to the deserts of South America.

By his own admission, his greatest professional reward has been the bright responsiveness of undergraduates to new concepts in the earth sciences, especially in introductory physical geography courses.

Shortly after coming to OSU, he began flying reconnaissance missions over the Cascades for a U.S. Geologic Survey study of the region's volcanos. Later, he played a very active role in monitoring Mount St. Helens before, during, and after the May 1980 eruption. He has been an articulate speaker and author on the subject, recounting and elucidating the series of events occurring on Mount St. Helens for students, scientists, and lay groups. As a geomorphologist, Rosenfeld is now interested in observing how impacted areas will recover from the catastrophic events of May 1980.

ENTOMOLOGY

Ralph E. Berry participated in a symposium on injury thresholds and decision-making processes in pest management at the Pacific branch meeting of the Entomological Society of America, in Oakland, CA, in June. Research Associate ***Jack DeAngelis*** presented a paper at this meeting. In September, ***Dr. Berry*** participated in a review of a cooperative research project with the Centro Internacional de Agricultura Tropical in Costa Rica.

Joseph Capizzi attended a meeting of the Extension Committee on Policy Task Force on Pesticide Education in Denver, in September.

Bruce F. Eldridge was an invited speaker at the annual meeting of the Northwest Mosquito and Vector Control Association, in Medford, OR, in October.

John D. Lattin was elected Fellow of the California Academy of Science in September. Fellows are limited to 300, and appointments are for life.

GENERAL SCIENCE

Arthur G. Johnson has been appointed to a new advisory committee to the Oregon Department of Energy relating to implementation of Senate Bill 109. This bill establishes new requirements, including a permit program, for transporting radioactive materials, especially radioactive waste, in and through Oregon.

John P. Kelley attended the 67th Scientific Assembly and Annual Meeting of the Radiological Society of North America in Chicago in November.

Robert C. Worrest chaired a session on estuarine plankton at the Sixth Biennial International Estuarine Research Conference in Gleneden Beach, OR, in November. He also presented a paper entitled "The impact of solar ultraviolet radiation upon estuarine microcosms."

GEOGRAPHY

Robert E. Frenkel presented a paper, "Phytosociological classification of Pacific Northwest coastal salt marshes," at the Sixth Biennial International Estuarine Research Conference at Gleneden Beach, OR, in November. He also cochaired a session on primary productivity in West Coast salt marshes.

A. Jon Kimerling conducted a workshop on map production and reproduction at the meetings of the American Congress on Surveying and Mapping in San Francisco in September.

Keith W. Muckleston served as a discussant in the section on Water Resources at the Fourth Annual Applied Geography Conference at Arizona State University, Tempe, in October.

GEOLOGY

Lu Hua-Fu, a visiting associate professor of geology from Nanjing University in the People's Republic of China, will be at OSU for one year studying neotectonics—the geology of active faults—with ***Dr. Robert Yeats.*** Professor Lu has mapped in the Yunnan Province of southwestern China and along the Tan-Lu fault of northeastern China. The Tan-Lu fault, characterized by strong earthquakes, is considered one of the most destructive on earth because it crosses a heavily populated region. Professor Lu and graduate student ***Bryan Grigsby*** have been working on active faults northwest of Los Angeles.

Chen Yuan-Ren of the Department of Geology, Chengdu University, Sichuan, and ***Zhang Ning*** of the Institute of Geology and Palaeontology, Academia Sinica, Nanjing, P.R.C., are spending two years at OSU working with ***Dr. A. J. Boucot*** on problems of Paleozoic marine paleoecology and biogeography, as well as brachiopod studies.

Arthur J. Boucot's textbook for the course on Benthic Marine Paleoecology (G 541) was published by Academic Press in August 1981.

Cyrus W. Field, Harold E. Enlows, and ***Ronald G. Senechal*** and graduate students ***Mark W. Bartlett, Douglas T. Bonelli, Thomas S. Horning,*** and ***Gary B. Sidder*** traveled to Lima, Peru, in late June. The group visited various mine and prospect areas in the coastal region and the central and southern Andes as guests of Empresa Minera del Centro del Peru, the principal mining entity of the Peruvian government. This visit and subsequent field work by the students for the remainder of the summer marked the inception of a long-range collaborative research program between OSU and government-private sectors of the Peruvian mining industry to study polymetallic mineral deposits of the Andes.

Alan R. Niem was coleader of a geologic field trip to the Columbia River basalts in northwestern Oregon for the Pacific Northwest meeting of the American Geophysical Union in September.

MICROBIOLOGY

Lyle R. Brown was sponsored by a W. K. Kellogg Fellowship to pursue research on nitrogen fixation at the University College Cork in Ireland this past summer. Recombinant DNA research with cloned genes from *Rhizobium meliloti* was used for transcription studies on gene expression. Dr. Brown presented seminars on RNA polymerase biosynthesis at University College Cork and at the Institute for Microbiology, Johann W. Goethe University in Frankfurt, Germany. He was also an invited visitor to the University of Sussex in Brighton and to the John Innes Institute in Norwick, England. Dr. Brown attended the Conference on Molecular Cloning and Gene Regulation in *Bacillus* in San Francisco in June. He is now serving on the NIH study section for the Microbial Genetics Review Group. He attended a meeting of this group in October.

Ronald P. Hedrick collected samples from various fish hatcheries in Taiwan and consulted with scientists from National Taiwan University in November.

John S. Rohovec presented a paper at the meetings of the American Fisheries Society (Fish Health Section) in Starkville, MS, in July. During November, he collected samples from fish hatcheries in Japan and Taiwan and consulted with scientists from several universities in both countries.

John S. Rohovec, Ron Hedrick, and ***James Winton*** taught an intensive two-week course, Infectious Diseases of Salmonid Fish, at the Instituto Profesional in Osorno, Chile, in September. This is the second year that members of ***Dr. Fryer's*** laboratory have presented a fish disease workshop in Chile.

Richard Y. Morita presented a seminar on deep-sea microbes at the College of Marine Studies, University of Delaware, in September. In October, he was invited to speak on microbial metabolism at the NATO Advanced Research Institute in Lisbon. In November, he was also an invited participant at the National Academy of Sciences Workshop on Petroleum in the Marine Environment in Clearwater, FL.

Ramon J. Seidler, research associate ***David Tison,*** and graduate student ***M. Nishibuchi*** participated in a conference, sponsored by the Sea Grant Program, on Vibrios in the Environment at Louisiana State University in October. Invited speakers from the U.S. and Europe evaluated the ecology, epidemiology, pathogenesis, and molecular genetic aspects of cholera in U.S. coastal waters. In October, Dr. Seidler presented a four-hour workshop on the significance of pollution indicator microbes in water environments. The workshop was sponsored by the Oregon State Health Division, Portland.

Two foreign visitors will be working in ***Dr. Fryer's*** laboratory for several months. ***Simeona Eugenio,*** from the Philippines, is here under the sponsorship of the CIFAD office on campus. After her research experience in Dr. Fryer's group, she will return to the Philippines as a junior fishery biologist. ***Masahiro Sakai*** from Miyasaki University, Japan, is studying research carried out in Dr. Fryer's laboratory. He also attends the OSU English Language Institute.

Nick Aumen, research assistant in ***Dr. Peter Bottomley's*** laboratory, organized and chaired a workshop on Aquatic and Terrestrial Decomposing Fungi in July. The workshop, which included lecture, laboratory sessions, and a field trip to the H. J. Andrews Experimental Forest, was sponsored by the Departments of Fisheries and Wildlife, Soil Science, Microbiology, and Entomology and by research grants from the National Science Foundation and the Department of Energy. The 42 participants represented ten institutions in North America, Canada, Great Britain, and New Zealand.

PHYSICS

Victor Madsen this past summer pursued research at Lawrence Livermore National Laboratory in California and at the KFA (nuclear physics establishment) in Julich, Germany. In October, he attended the Conference of the Division of Nuclear Physics of the American Physical Society in Asilomar, CA.

STATISTICS

Lyle D. Calvin has been appointed dean of the Graduate School effective November 1. He will remain department head through December and will continue to serve as director of the Survey Research Center along with his appointment as dean of the Graduate School.

G. David Faulkenberry has been appointed acting chairman for the department until a permanent chairman is chosen.

David Birkes, Daniel Brunk, and ***Paula Kanarek*** visited the University of Arizona Health Science Center in November.

David A. Butler presented a paper cauthored by ***G. J. Lieberman*** and ***V. Rutenberg*** at the October joint national meeting of the Operations Research Society of America/ The Institute of Management Sciences, in Houston.

Lyle D. Calvin participated in a site visit at the University of California at Los Angeles for the National Cancer Institute in October.

G. David Faulkenberry consulted with research colleagues in Washington, DC, on a U.S.D.A nonsampling error project in September.

ZOOLOGY

Christopher J. Bayne, Mary Yui, Carl A. Boswell, and ***Eric (Sam) Loker*** attended the meeting of the Society for Invertebrate Pathology, in Bozeman, MT, in August. ***Mary Yui*** and ***Eric Loker*** presented papers respectively on bacterial clearance in the sea urchin and immunologic interactions between trematode *Schistosoma mansoni* and the host-snail *Biomphalaria glabrata.*

Edwin Bourget, a marine ecologist from the University of Laval, Quebec City, is spending his sabbatical year in the Department of Zoology collaborating with ***Jane Lubchenco*** and ***Bruce Menge*** on aspects of spatial heterogeneity and diversity patterns of intertidal organisms.

Robert Hard presented an invited paper on "Isolation and reactivation of highly-coupled newt lung cilia" at an international meeting on the Mechanism and Control of Ciliary Movement at Friday Harbor, WA, in September. In November, he also presented a paper at the annual meeting of the American Society for Cell Biology in Anaheim, CA. Graduate student ***Alice Weaver*** attended both meetings with Dr. Hard. She has received a Sigma Xi grant to support her studies of factors involved in intracellular coordination of cilia.

Jane Lubchenco and ***Bruce Menge*** are members of the Board of Directors and the Scientific Advisory Board of the West Quoddy Marine Research Station in Lubec, Maine.

Frank L. Moore has received a five-year Public Health Service Research Development Award for his investigations of the functional interactions between steroid hormones and neuropeptides.

Several members of the department attended the annual meetings of the American Society for Cell Biology in Anaheim in November. ***Frank Conte*** and ***Joel Lowey*** presented a poster paper on the structure and function relationships in salt transporting epithelium. ***John Morris, Sandra Potter,*** and ***Pat Buckley*** presented poster papers on the ultrastructure of hormone action on cultured uterine epithelium and on embryo-uterine epithelium interaction in culture.

NEW FACULTY APPOINTMENTS

The following scientists have joined the faculty of the College of Science: ***Robert E. Enns,*** Visiting Assistant Professor; ***Gregory Ide, Parthasarathy Manavalan, Michael J. Meredith,*** and ***Court Saunders,*** Research Associates, in the Department of Biochemistry and Biophysics; ***Dean W. Gabriel, Lawrence R. Griffing,*** Research Associates, and ***Mary E. Kentula,*** Instructor, in the Department of Botany and Plant Pathology; ***Satish C. Choudhry, Francis J. Conlan, Hollis S. Kezar,*** and ***Dimitris Petridis,*** Research Associates; ***Michael W. Schuyler,*** Associate Professor; and ***Lawrence G. Thomas,*** Assistant Professor, in the Department of Chemistry;. ***Alfred Boals,*** Visiting Associate Professor, and ***Philip R. Cohen,*** Assistant Professor, in the Department of Computer Science; ***Brian A. Croft,*** Professor, and ***Timothy D. Schowalter,*** Assistant Professor, in the Department of Entomology; ***Ralph F. Jostes,*** Assistant Professor, and ***Barrett A. Reeve,*** Instructor, in the Department of General Science; ***Philip L. Jackson,*** Assistant Professor, in the Department of Geography; ***George M. Haselton,*** Visiting Professor, in the Department of Geology; ***M. Carme Calderer, Dennis J. Garity,*** and ***William B. Jacob,*** Assistant Professors ; and ***Edward C. Waymire,*** Visiting Assistant Professor, in the Department of Mathematics; ***Edward B. Stephens,*** Research Associate, in the Department of Microbiology; ***David J. Kirby,*** Research Associate, in the Department of Physics; ***Steve P. H. Mandel,*** Visiting Professor, in the Department of Statistics; ***Larry Miller,*** Research Associate, and ***Paul D. Shirk,*** Assistant Professor, in the Department of Zoology.

The Budget of the College of Science, 1980-81

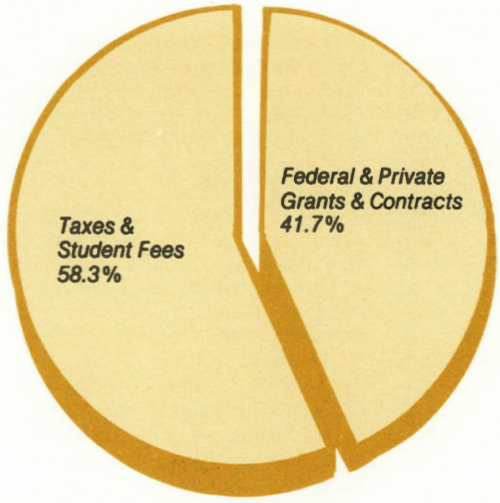


Figure 1: *Major Sources of Funds for the College of Science, OSU, 1980-81 (Total $17,613,132).*

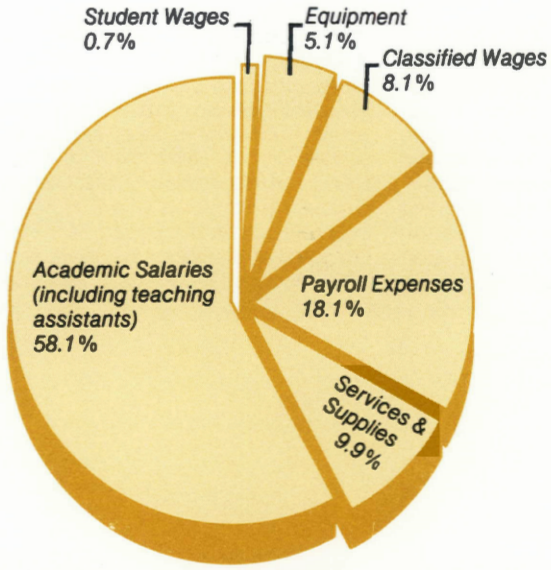


Figure 2: *Expenditure of Taxes & Student Fees for the College of Science, OSU, 1980-81 (Total $10,270,587).*

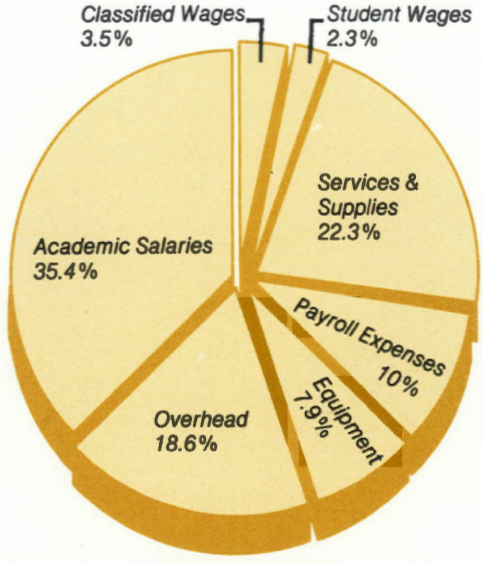


Figure 3: *Expenditure of Federal & Private Grants & Contracts for the College of Science, OSU, 1980-81 (Total $7,342,545).*

The 1980-81 expenditures from the College of Science accounts are portrayed in the accompanying diagrams. Figures 1, 2, and 3 are similar to diagrams representing the College budget that were published in the fall issue of *The Science Record* in previous years. Distribution of expenditures between instructional and grant funds and among the various budget categories in each area is much the same as last year.

Examination of expenditures over a five-year period reveals some trends important to the future of the College. The overall increase in budget for the five-year period has been $5,875,571 (50.1%). This consists of an increase of $2,741,143 (36.4%) in tax and student fee dollars and an increase of $3,134,428 (74.5%) in grant and contract funds in this time span. The compounded increase in the national consumer price index for a similar time period (January 1, 1976, to January 1, 1981) is 55.4 percent. Thus, grant and contract funds have out-paced inflation by a considerable margin while instructional budget funds have lagged severely. Enrollments in College of Science courses have also increased in the last five years so that faculty taught 10,263 more student credit hours in 1980-81 than in 1974-75. Cost per student credit hour increased from $38.64 to $50.07 but in terms of uninflated 1976 dollars decreased from $38.64 to $32.22. It is in these circumstances that we now must plan a 3.1 percent instructional budget reduction for 1982-83.

Faculty members are to be commended for their continuing ability to obtain grant and contract funds in the competitive national market place for research. These funds are the life blood of our research program and, in large measure, graduate education in Science. They will assume even greater importance in the future if instructional funding continues to suffer.