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A Message from the Dean

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Cover

Physics student in foreground uses computer for problem solving. The program guides the student through several steps to lead him to the solution. In the background, an assistant records test scores, which are then stored in the computer memory for statistical studies.

Photo by Ted Rosenbalm

Although the College of Science faced serious fiscal problems in 1982-83 as predicted, we nevertheless have achievements to report. The most exciting news is that OSU alumnus Milton Harris has generously endowed a chair in polymer chemistry, the first such endowment at Oregon State University.

The forecast for 1983-84 is more optimistic; we look for modest growth in several academic areas and the restoration of some semblance of normalcy in financial planning.

The dismal fiscal record for 1982-83 can be summarized with a series of numbers. For the first time in the memory of anyone, expenditures of state funds in the College of Science decreased from one year to the next—from $11.2 million in 1981-82 to $10.6 million in 1982-83. Overall expenditures, including grants and contracts, were approximately constant at about $18.8 million because the skill and ingenuity of our faculty in obtaining outside funds resulted in an increase from $7.6 million to $8.2 million. Details are found on the back cover.

We taught less in 1982-83 compared to the previous year: 196,000 student credit hours to 207,000. But the graduating class in June 1983 was the largest ever in Science, with 529 BS/BA degrees, 99 MS/MA degrees, and 59 Ph.D. degrees. Science was the largest academic unit on campus as the academic year 1982-83 came to a close with 2956 majors (undergraduate plus graduate); Engineering was next with 2705.

We start 1983-84 with 3181 majors, down 3 percent from 3276 in 1982-83, but once again the largest unit at OSU. These totals conceal the dramatic shift in student interest within the College of Science. In 1979 about 10 percent of undergraduate Science majors were in Computer Science. By 1982 that figure had risen to 25 percent; data for 1983 are not yet available, but there is little doubt of a continuing overwhelming interest in computer science.

A broadly based university-wide committee was convened in 1982 at the request of the OSU Foundation to determine priorities for a capital gifts campaign that the Foundation planned to undertake beginning in 1983. Among the four programs recommended by the committee, two have their roots in Science: molecular genetics and materials science. These are both highly interdisciplinary fields, as has been discussed by Ralph Quatrano and John Gardner in recent issues of the *Science Record*, but the impetus for creating these programs came from some energetic Science faculty. One of the consequences of these new initiatives is the ability to hire new faculty in advance of vacancies. In 1983-84 new appointments in gene-related areas are expected to be made in Microbiology, Biochemistry, and Botany.

We were pleased to see that accomplishments of Science faculty will be recognized in some new ways. An award for achievement in basic research was created in 1982 and funded through the generosity of Milton Harris. A symposium in honor of Harold Evans, the first recipient, was held in October 1983.

Another new award has been announced for 1984 to recognize a sustained record of scholarly achievement by a member of the Science faculty. This award will be named for former Dean of Science Francois Gilfillan who passed away in 1983. Dean Gilfillan's family and friends are underwriting the award, details of which will be announced later.

The faculty and staff of the College of Science are to be congratulated for their dedication, cooperation, and help in 1982-83. Somehow we have managed to survive a most difficult year.

Microcomputers and Science Instruction

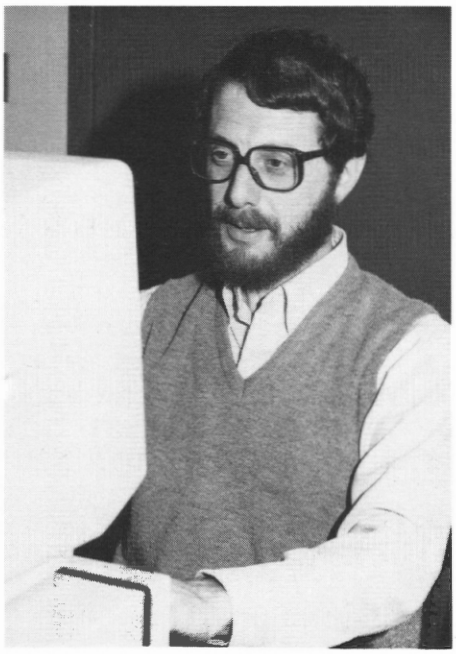
by Kenneth S. Krane

In 1959 I helped a friend assemble a magical computing machine for a high school science fair project. Filled with relays, vacuum tubes, switches, and flashing lights, the machine was as big as a car and consumed so much power that the lights in our school dimmed noticeably when it was running. In the early mornings before classes, students would gather in awe around the machine to warm their hands and watch as it noisily performed its sole function—multiplying three-digit numbers.

It was not until 1966, when I began my Ph.D. research, that I first had a close look at a real computer, an IBM 7094. I was able to use it only in the "batch" mode—I would carry my boxes of punched cards half-way across campus and leave them at the input counter. A day or so later, if I was very lucky, I would get back most of my cards and perhaps even some output. Despite all the tribulations, I can still recall my first glimpse at it, even though it was only through a glass partition. Mesmerized by the precision of the spinning tapes and the cool efficiency of the line printer, I envied those who were allowed close approach and who could caress the knobs and switches and feel the machine respond. A year or so later when I had my own IBM 360 to operate, I was hooked. From midnight until 6 a.m. was my time with the machine, and together during those private night-time hours we reached heights of ecstasy that are perhaps best left undescribed.

Even at that time, in the mid-1960's, the computer was basically a device for processing research data. Today there is hardly a research program in physics or in most other disciplines that does not make extensive use of computers, from on-line data acquisition and analysis to actual control of the experiment itself.

This revolution in the techniques and hardware of science has been brought about primarily by the development of the technology of large-scale integration (LSI), which permits the equivalent of thousands of discrete circuit elements to be placed on a single chip of silicon. Complete computers in the $100-$1,000 range, no larger than an ordinary typewriter, now offer as much computing power as a room-sized "main-frame" did 20 years ago. Computers have become consumer items like TV sets and stereos; every major variety and department store now has a computer section, and computer magazines abound in the news stands.



Kenneth S.Krane

Those who are selling these devices as consumer items generally take either of two approaches: (1) Every household should have one to balance the checkbook, keep the recipe file, remember Aunt Bessie's birthday, and turn the lights on and off at random times when you are away from home. (I often wonder whether burglars are lurking about with their own personal computers, doing statistical analysis on the timing of my lights to discover if it is truly random.) (2) Having a computer is necessary to give your children a chance for future success and to keep them from standing in welfare lines with the other computer illiterates. Here parental guilt is the object; lack of a home computer, according to this argument, will stunt your children's intellectual development in much the same way as lack of Calvin Kleins will stunt their social development. Neither of these justifications seems terribly compelling, but in the past couple of years sales of home computers have boomed.

The last few years have similarly seen a dramatic increase in the number of small computers purchased by the University for instructional use. Excluding specialized single-board computers and microprocessors used in research equipment, there were more than 200 small computers (Apple II, IBM-PC, TRS-80, etc.) on campus in the spring of 1983. The new uses of these computers have little to do with the traditional teaching of computer programming or with the processing of research data; instead, they exploit the availability of the computer as an instructional tool.

Let us examine some of these instructional uses and how they are (or could be) incorporated into science instruction at OSU:

(1) Computer-assisted instruction (CAI). The 250 students in our introductory physics course encompass a broad range of abilities, and although the lecturers generally strive to maintain a level of presentation suited to the average student, perhaps 20 percent of the students are sufficiently far below that level to need additional help. Often the instructor can, through pointed questioning and through observing the student's methods of problem solution, identify the source of the difficulty and suggest remedies. Yet, to spend even a minimum of one hour per week with those 50 students would tax our instructional staff beyond its limits.

Programmed for instruction, the computer asks the same sort of probing questions that a truly Socratic instructor would ask, basing its next question on the previous response. After receiving correct responses to a few problems, the computer promotes the student to problems at a higher level of difficulty. If the student responds incorrectly, the computer guides the student step by step through the solution and then branches to selected problems at a lower level of difficulty. The computer identifies those topics that are giving the student trouble and provides a printed record of the session for the instructor. Perhaps 75 percent of the students who need special attention can be helped with this method, leaving the instructor more time to work with the remaining students whose difficulties may require more personal approaches.

The software for the complete physics curriculum is not yet available, but textbook publishers are beginning to develop and market software for instruction in physics and in other sciences. What is most exciting and important about this new system is that it allows the student, not the instructor, to control the content, schedule, pace, and sequence of the learning experience.

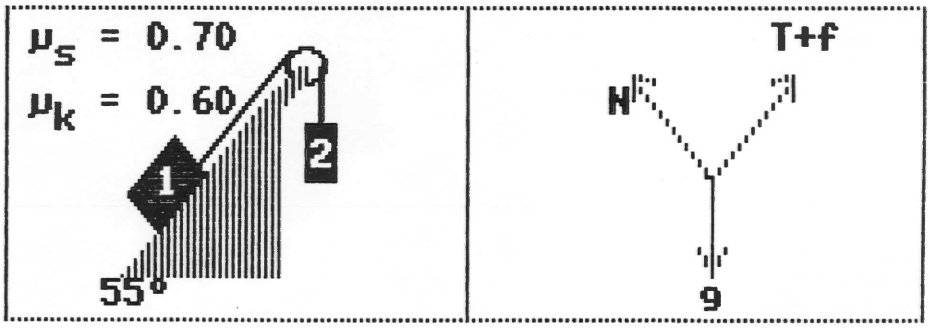
(2) Laboratory instruction. In the typical laboratory experiment, designed to illustrate

and complement material covered in the lecture, the student makes a few measurements and records them on a data sheet, which is then taken home to be analyzed in preparation of the lab report. Often a student records the data incorrectly or omits an essential datum, in which case the data cannot be analyzed and the entire purpose of the laboratory exercise is lost. It would be far better for the student to complete the analysis during the lab period under the watchful eye of the lab instructor.

We have experimented with such an approach in Physics 211 for the past few years, generally with satisfactory results. In our simple pendulum experiment, for example, the students measure the dependence of the period of a pendulum on its length. The computer can then make a log-log least square fit of period against length to determine the functional relationship. First-year students are often not able to do such an analysis "by hand," and even so, such time is better spent by students in more productive learning activities. Our computers display the fitted slope and its experimental error in order to train the student to think critically: Do "theory" and "experiment" agree within limits of error?

In many other experiments, a computer can be directly interfaced to a piece of laboratory apparatus. Readings from analog devices (voltmeters, thermometers, etc.) can be taken and stored by the computer, and automatic manipulation of laboratory gear (motors and switches) can be done. Applications of such techniques go far beyond science, particularly to areas such as agriculture or forestry where remote measurements must be periodically made. Beginning in the spring of 1984, we will offer an undergraduate physics course to teach interfacing techniques to students from all disciplines. Professor Carl Kocher has recently received a donation of diagnostic and testing equipment worth $40,000 from Tektronix Corporation for this course.

(3) Record management. Using computers to keep track of student records is a great convenience in large classes. For our physics courses, we have developed the record management software that keeps track of test scores problem by problem. A histogram of total scores is printed for each examination. At the end of the term, letter grades can be assigned based on levels set by the instructor. One advantage of this system is the access it gives to the scores on each problem; if we wish to place a problem on a test to measure a particular aspect of student achievement, we have available the scores on that problem for statistical analyses.



6. The mass of block #1 is .5 kg. What is the minimum mass the second block can have if the blocks are not sliding?

Which of these forces on the first block have components along the incline?

1. Tension
2. gravity
3. Normal
4. friction

This "screen dump" shows an example of an interactive session with the computer on the subject of introductory mechanics. In this case, the student was not able to solve the original problem, so the computer drew the "free-body" diagram at the right and is prompting the student along the path toward the proper solution.
(From *Concentrated Physics Concepts* by David Alexander and Richard Cornelius, copyright 1983, John Wiley and Sons. Used with permission.)

(4) Demonstration. Illustrating complicated calculations and geometrical constructions is difficult in lecture classes. With a computer terminal, the instructor can display the output of programmed routines on a TV monitor for viewing during the lecture, rather than putting such displays on the blackboard. Several mathematics instructors are presently using such techniques in their classes.

(5) Problem solving. University-level CAI is only a small part of the total use of computers in education; computer use has grown rapidly in primary and secondary education as well. Elementary school resource centers, which were called "libraries" when I was in school, now feature computers programmed to challenge children's language and mathematical skills. Intermediate schools and high schools have computer rooms often containing a dozen or so computers. Unfortunately, this new technology has not yet had its full impact because many teachers lack training in the use of this resource. Even those who are comfortable with computers perhaps have not considered how basic instructional strategies must be modified to integrate the problem-solving potentials of the computer. Perhaps in this area, more than in any other, the computer can offer fundamental changes in our instructional strategies; we should see the computer not as a super programmable pocket calculator, but as an extension of our own intellect, capable of helping us learn new techniques of attacking problems. The place to begin applying this new epistemology is in the primary and secondary schools; here at OSU, we offer training of teachers through mathematics and science education courses taught by Professors Margaret Moore and Gary Musser.

Professors Receive Awards

Two professors in the College of Science were singled out for special recognition at Faculty Day ceremonies on September 16, 1983. Keith F. Oles, professor of geology, received the Dar Reese Award for "excellence in advising"; and Leo W. Parks, professor of microbiology, was named Elizabeth P. Ritchie Distinguished Professor.

Keith Oles joined the OSU Department of Geology in 1961 as associate professor, after establishing a successful career in the petroleum industry. Dr. Oles has graduate degrees in geology from the University of Washington. His talents as a gifted teacher were recognized in 1966 when he received the Carter Award from the College of Science and the Mosser Award from the legislature of the State of Oregon in the same year.

As chief adviser for the Department of Geology, he has become well known to students for his understanding of their problems and his concern for personal goals as well as academic achievements. He is readily available to students, and he considers each of them unique individuals. To quote the official citation for the award, "His tireless efforts in helping students make appropriate academic choices, exploring career options, and in resolving personal concerns have gained him high respect and appreciation."

Leo Parks has been a member of the OSU Department of Microbiology since 1958. He earned a master's degree in bacteriology from Indiana University and a Ph.D. degree in microbiology and biochemistry from the University of Washington.

Dr. Parks is a recognized authority in the fields of microbial physiology, fungal metabolism and biochemical genetics. His contagious enthusiasm about his discipline has permeated his classes. The award nomination notes that "He is described by both colleagues and students as an enthusiastic, innovative and knowledgeable teacher whose strong commitment to undergraduate education is underscored by a high degree of involvement with students in the classroom and in the laboratory."

Parks received the Carter Award for "inspirational teaching" in 1976. Along with his commitment to teaching, Parks has been very active in the university community. He has been a member of many committees, and he has been president of the Faculty Senate. He is presently in Washington, DC, for one year on a special assignment with the Office of Naval Research.

Keith F. Oles (left) and Leo W. Parks
Photo by Bob Henderson

Microcomputers (cont'd)

(6) Testing. It is particularly important in introductory courses that students form good study habits by keeping pace with the lecture and textbook and by learning to solve the suggested homework problems. Yet paradoxically such courses are so large that it is impossible for instructors to give weekly quizzes and grade homework. Here a computer can become an essential part of the instructional effort. The computer can take over the entire testing process, making possible weekly quizzes in classes of any size by selecting questions from files stored in its memory; it also can grade the student's response and maintain records of the student's performance. Such a file of test questions already has been developed by the mathematics department for use in teaching calculus and by the chemistry department for its introductory chemistry course.

In this article I have presented a brief survey of some of the computing activities in the College of Science. Many other applications of computing have been omitted, as for example the possible extension of artistic horizons by the computer's graphic and musical capabilities and the special visual, audio, and manipulative techniques that can be used by students with physical disabilities to participate more fully in the instructional process.

The power, versatility, and low price of small computers are bringing a revolution in instructional strategies and techniques. We at OSU cannot join that revolution until we overcome the limitation of our insufficient number of small computers. The ideal university environment would feature a personal computer on every faculty desk and learning centers with one computer for every ten students on campus. To achieve this goal we must increase the present number of systems at least tenfold, and we should be prepared to supply the necessary support functions such as faculty training, software, purchase advice, and maintenance services. Without a substantial commitment of the University's resources to this goal, we will surely lose our role as the major provider of technologically sophisticated science training in Oregon. □

Kenneth S. Krane is associate professor of physics.

Donald A. Pierce

A Statistician's Work in Hiroshima

Donald A. Pierce has recently returned from Japan after spending 18 months at the Radiation Effects Research Foundation (RERF) in Hiroshima on an assignment for the U.S. National Academy of Sciences. He is a professor of statistics whose recent professional interests are in biostatistics and development of new statistical methods for biomedical data, particularly in toxicology and cancer research. His interests are largely inspired by the vital role that biomedical applications play today in the advancement of general statistical theory, similar to the role once played by agricultural research.

RERF is a joint U.S.-Japanese institution whose primary function is to study the long-term health effects of exposure to radiation as observed in the survivors of Hiroshima and Nagasaki. It was formed in 1975 to replace the former Atomic Bomb Casualty Commission, which had been established by the United States in Hiroshima in 1947. Today RERF has approximately 500 permanent employees—most of whom are Japanese. Most American scientists involved with RERF are on temporary assignments as was Pierce. Half of the funding for RERF is provided by the U.S. through the National Academy of Sciences with funds from the Department of Energy.

"I was assigned to RERF because of my research activities in survival, or response-time, analysis," says Pierce. "Primarily I was to help update the statistical methodology used in its cancer research and to extend the theory to meet other needs at the foundation. Three other statisticians were recruited to assist in this effort during my stay in Hiroshima."

A major concern at RERF is the study of the incidence of cancer caused by radiation and the analysis of response-times—that is, the time lapsed between exposure to radiation and the incidence of cancer in the population being studied. The goal is to relate the incidence of cancer to the level of radiation exposure, adjusting for other important factors, such as age-at-exposure and sex.

Pierce notes that the survivors of Hiroshima and Nagasaki are the world's most important source about information on the effects of radiation on humans. The ultimate objectives of the RERF study are to learn more about radiation carcinogenesis and to enable public health officials to make sound decisions regarding peacetime risks of radiation, such as the advisability of various types of diagnostic X rays and radiation therapy; the establishment of regulations for occupational exposures; and the evaluation of environmental risks, as presented by nuclear power plants and radioactive wastes. Two very influential documents describing the state of knowledge in this area and the role of data obtained in Japan are the 1980 Report of the U.S. National Research Council Committee on the Biological Effects of Ionizing Radiation and the 1977 Report of the United Nations Scientific Committee on the Effects of Atomic Radiation.

"Data obtained from the Japanese group," explains Pierce, "are overwhelmingly important for three reasons: the large size of the study population under lifetime follow-up (over 100,000 individuals); the fact that a precise level of exposure has been estimated for each individual; and the complete range of exposures from zero to potentially lethal doses represented in the study group. Other important populations studied are subjects who have undergone radiotherapy for various diseases. These groups are much smaller and lack either adequate range and determination of exposure levels or adequate control subjects at zero dose. Groups exposed to radiation through occupational or environmental hazards ordinarily have not received high enough levels of exposure to provide useful estimates of excess risks."

The study population at RERF was selected in 1950 to consist of nearly all survivors who were within 2 kilometers of the explosions and who still lived in the cities in 1950 (approximately 50,000 individuals). That population was supplemented by a control group of equal size made up of individuals who were between 2.5 and 10 kilometers of the blasts. In addition to lifetime follow-up of this sample, a subsample of about 20,000 individuals was selected for biennial clinical examinations. Researchers have also carried out extensive clinical examinations and cytogenetic studies of subjects born to exposed parents and of those exposed *in utero*.

What has been learned so far?

"The clinical examinations of survivors so far have revealed surprisingly few late health effects, other than cancer, that show a relation to exposure," notes Pierce. "Investigators have found radiation-induced cataracts in some individuals, some growth retardation in those subjects exposed at a very early age, and some mental retardation and related problems among those exposed *in utero*. Children of exposed parents so far have exhibited no effects at all. Exposed subjects show chromosomal aberrations with a consistent dose-response, but there is no clear evidence at present that these aberrations are related to health problems."

For those individuals exposed to high levels of radiation, the increased risks of contracting cancer are substantial. The risk of developing leukemia for an individual who has received an exposure of 150 rads is about 5 times the normal rate (the rad being a unit of absorbed radiation dose); that figure increases to 8 times the normal with an exposure of 250 rads. For all other cancers as a group, the increases at these two exposure levels are currently about 25 percent and 40 percent, respectively. These would be very high levels of exposure, however. A person receiving 100 rads would probably require medical attention for acute effects; exposure to about 400 rads would result in a 50 percent chance of death.

	Exposure Level (Rads)					
	0	1-10	10-100	100-200	200-300	>300
Original Number of Subjects	58,099	23,073	19,167	3,128	1,381	1,526
Leukemia	6.0	4.3	9.5	22	46	90
All Other Cancers	231	218	247	268	314	323

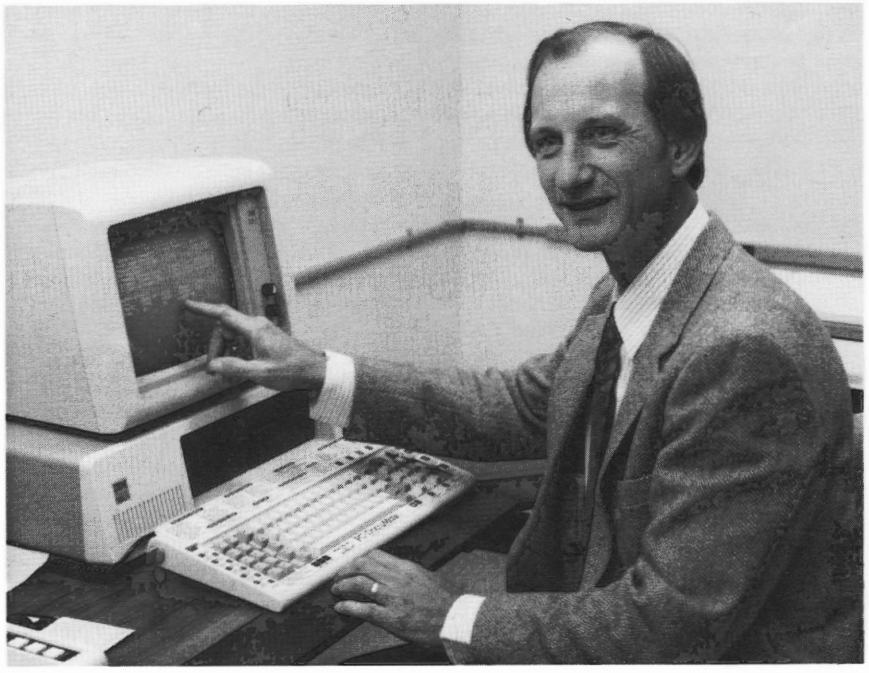
DISTRIBUTION OF EXPOSURES AND CANCER MORTALITY RATES PER 100,000 PERSON-YEARS AT RISK (1950-78). Table shows the original number of subjects entering the study in 1950, by categories of whole-body exposure. The crude cancer mortality rates given are numbers of deaths divided by the collective time the subjects were alive in 1950-78, times 100,000. Scientifically useful rates, however, must be computed in much more complex ways, adjusting for age and sex in particular.

It has been estimated that the radiation exposure has resulted in approximately 250 of the 5,000 cancer deaths that have occured during 1950-78 in the study group of 100,000. RERF publishes complete reports every four years on the cumulative experience, with the most recent report covering the period 1950-78. A report through 1982, which is now being prepared, uses new statistical methods developed by Pierce and his colleagues.

Statisticians working with these problems are concerned with developing mathematical models that will extrapolate estimates of cancer risk to lower levels of radiation exposure from those obtained at higher levels. Exposures on the order of 10 rads are significant in public health considerations. There is little chance of estimating relevant risks at such levels from direct observation of human populations. On the other hand, the data obtained in Japan provides useful estimates of excess risk for exposure of 100 rads or more.

"Some numbers may help clarify this statistical problem," explains Pierce. "For a high level of exposure where the total cancer rate might increase by about 50 percent over normal levels, control and exposed samples of 1,000 individuals each might be expected to provide an estimate of the increase to within about 25 percent error—a level of precision that would be useful in this area. For exposures in the range of 10 rads, however, the expected increase would be less than 5 percent over normal levels. To estimate a 5 percent increase by direct observation, to within 25 percent error, would require control and exposed samples of roughly 100,000 persons each—a number far beyond the scope of any epidemiological investigation."

Pierce was involved in studying the roles played by time and age in the incidence of cancer caused by radiation. At this point the statistical theory of response-time, or survival, analysis comes into play for two primary reasons. First, it is important to understand how the excess incidence of cancer is distributed in relation to time lapsed since exposure. Secondly, since an individual's natural risk of contracting cancer increases with age, adjustment for this variation is an important consideration in assessing the extent of excessive risk.



Donald A. Pierce is professor of statistics at OSU, where he has been a faculty member since 1966. He received an M.S. in engineering and a Ph.D. in statistics from Oklahoma State University. He was a postdoctoral fellow at Johns Hopkins University in 1965-66; and he has been a visiting professor at the University of Kent, England, and Stanford University. Pierce is an elected Fellow of the American Statistical Association and the Institute of Mathematical Statistics, and an elected member of the International Statistical Institute. He is currently associate editor for the journals of the first two organizations. His OSU research on statistical methods in cancer research is supported by the National Cancer Institute.

On the first point, one might ask whether the excess risk appears within a few years of exposure and then subsides, which seems to be the case for leukemia; or whether it continues to increase during the entire follow-up period, which seems to be the case for most other types of cancer. This point is important both in understanding the mechanisms of cancer caused by radiation and also in estimating lifetime risks. The analysis is seriously complicated by the fact that subjects were exposed at different ages. It requires careful analysis to separate the natural increase of cancer risks caused by age and the excess caused by exposure to radiation. Further complications occur because the actual effect of radiation exposure seems to depend on age-at-exposure.

"The next ten years in this follow-up study will be the most important," says Pierce. "Those individuals who were young at exposure are moving into that stage of life when one expects naturally occurring cancer and perhaps further radiogenic excess cancer. Proper statistical methods are becoming much more crucial now than in the earlier years. Development of these methods, along with the collection of important data, will be an ongoing project. I plan to continue to contribute my efforts to the solution of these problems." □

Presidential Scholars

Last year President MacVicar took steps to establish a special program intended to encourage academically talented high school students to remain in Oregon and attend Oregon State University. The incentive is a $1,000-a-year scholarship awarded through the OSU Foundation. Today the program is a reality thanks to the generosity of a number of donors. Twenty-four students, known as Presidential Scholars, were selected from high schools in Oregon on the basis of their academic ability and potential for leadership. The students accepted for 1983 have an average GPA of 3.92 with an average SAT score of 1,342 (of a possible 1,600).

Seven of the 24 Presidential Scholars at OSU are enrolled in the College of Science. They are: **Jennifer Barnes, Carla Davidson, Michelle Joseph, Carolyn Platt, Janet Spindler, Kawai Lau,** and **John Morris.**

These young people seem to be typical high school students. A look at their personal sketches reveals that they have varied interests and that they are involved in many school activities from athletics to music, theater, chess, and school newspapers. What stands out, however, is that they have already formed firm goals and are determined to achieve them. To that end they have prepared well for higher education by taking solid courses in English, mathematics, chemistry, physics, and foreign languages.

Jennifer Barnes, a graduate of Sheldon High School in Eugene, plans to major in physics. When asked why she wants to major in physics, Jennifer has a marvelous answer: "The idea that everything in the universe can be described with a few simple equations fascinates me." Physics, however, is not her sole interest. She plays four musical instruments, and she was a member of the symphonic and stage bands in her school. She found time to letter in soccer for three consecutive years, play tennis and volleyball, along with being active in student government.

Four students would like to become veterinarians and are enrolled in the preveterinary program in the College of Science: **Carla Davidson**, Cottage Grove High School; **Michelle Joseph**, Newberg High School; **Carolyn (Carrie) Platt**, Hillsboro High School; and **Janet Spindler**, Tillamook High School.

Carla Davidson was very active in Future Farmers of America, becoming reporter and later president of her chapter. In the last two years of high school she became interested in foreign student exchanges and was able to spend two semesters as an exchange student in Australia. She considers this experience the most important in her life. "While I was there," she says, "I learned not only about the Australian way of life but also about the American way of life."

Michelle Joseph loves animals and likes science classes, but she also received special recognition as a member of the speech team. In addition, she was active in the YMCA Youth Legislature. In summarizing her philosophy of life, she notes: "I am concerned in my life with doing the best that I can both for myself and others."

Carrie Platt has been an honor roll student since seventh grade. In high school, she took as many advanced classes as she could manage. "My interests at this point seem to be divided between politics and animals," she says. Carrie has been heavily involved in the YMCA Youth Legislature and in 4-H work. She was secretary, vice president, and president of her 4-H Club. She has worked as a volunteer at the Washington Park Zoo caring for the animals. Right now she intends to become a veterinarian, specialize in large animals, and practice in a rural area.

Janet Spindler has prepared herself seriously for her college career while working part-time in a dairy farm, sometimes working 14 hours a week milking cows. She has also volunteered her services in a veterinarian's office. In her senior year, her involvement with the dairy farm brought her recognition and she was elected Tillamook County's Dairy Princess.

Kawai Lau, a graduate of Beaverton High School, is a biochemistry major and a premed student. A native of Hong Kong who has been in this country only 8 years, Kawai is surprisingly well adjusted to the ways of his new country while at the same time continuing to treasure the traditional ethics valued by his parents. "Honesty, integrity, and selflessness" are important in his life. Hard work and determination to succeed helped Kawai overcome the difficulties of adjusting to a new culture and a different language. He made the National Honor Society while holding positions of leadership in student body government, Boy Scouts, German Club, chess team, and other activities. He also worked as a research apprentice at Reed College for one summer. Described by teachers as an enthusiastic young man, Kawai is well prepared to meet new challenges as he progresses toward his goal of becoming a physician.

Olaf Boedtker (left), head adviser of the College of Science, and Kawai Lau, one of the presidential scholars, visit at a pre-game gathering in the LaSells Stewart Center.

John Morris is a graduate of South Albany High School who plans to major in mathematics or physics. He is a scholar and an athlete. He played football, basketball, baseball and went out for cross-country while working on the school newspaper, and he still maintained excellent grades. His interest in books and mathematics started early. "I read my first book, *The Little Red Hen*, at four. I cannot remember learning to count," he notes, "but I used to go over my brothers' math problems every day when they brought them home from school." John is the third son in a family of six children. As a senior in high school, he was a National Merit Scholarship Semi-Finalist.

All these students and the others who were selected to receive Presidential Scholarships have outstanding qualities. Their presence on campus will contribute in a significant way to the University and to the College of Science. □

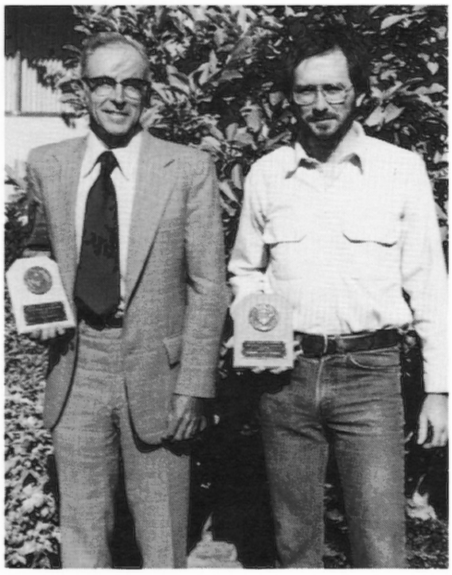
Endowed Chair in Polymer Chemistry

The first endowed chair at Oregon State University will be established in the Department of Chemistry with funds generously donated by Milton Harris—an OSU alumnus who for many years has been a strong supporter of Science at OSU.

His substantial gift will create a chair in polymer chemistry—a field closely related to work done in materials science, an established interdisciplinary area of research at OSU. Scientists in different disciplines including chemistry, physics, mathematics, electrical engineering, and forestry have been conducting research in this expanding field and are now cooperating to form a Center for Materials Science.

The College of Science and its faculty have become familiar with Dr. Milton Harris, a former Oregonian who now resides in Washington, DC. He has been a friend and a benefactor to OSU and to the College for a long time. He graduated in 1926 from what was then Oregon State College, and he received a Ph.D. degree in chemistry from Yale University in 1929. His research on fibers, textiles, and polymers was very successful, and he developed new processes for treating fibers that helped revolutionize the textile industry. He was founder, and for many years president, of the Harris Research Laboratories. His distinguished career in chemistry also included service with other private industry and the National Bureau of Standards. Throughout his life and his scientific career, Dr. Harris has promoted and supported education and the advancement of science.

Carter Awards



William H. Taubeneck (left) and Robert L. Higdon

Robert L. Higdon, assistant professor of mathematics, and **William H. Taubeneck**, professor of geology, received the 1983 Carter Awards for their outstanding performance in teaching. The announcement was made by Associate Dean John D. Lattin at the meeting of the College of Science faculty, September 19, 1983.

The College of Science recognizes special talent in teaching with two Carter Awards every year—one for undergraduate and the other for graduate teaching. Four finalists for each category are selected by student votes, with winners chosen by a faculty committee composed of previous recipients of the award.

Robert Higdon, who received the Carter Award for undergraduate teaching, is a recent addition to the faculty, having joined the Department of Mathematics in September 1982. During his first year at OSU, he taught courses on numerical analysis, linear algebra, calculus, and differential equations.

Higdon earned a Ph.D. degree in mathematics at Stanford University and spent a year as a postdoctoral research associate at the Mathematics Research Center, University of Wisconsin, before coming to OSU. His research interests are partial differential equations, numerical analysis, and applied mathematics.

William H. Taubeneck, who was selected to receive the Carter Award for graduate teaching, was also a finalist for the award in the undergraduate category. Over the years, he has been selected by students seven times.

Taubeneck has been associated with the OSU Department of Geology since 1949. He joined its faculty in 1951. He received his master's degree in geology with a minor in mining engineering from OSU and a Ph.D. in geology from Columbia University. During his long career at OSU he has taken several leaves from the university to pursue his varied interests in geology and to be a consultant on several projects. In 1963-64 he was a Guggenheim Fellow at Oxford University, England; and in 1974 he was a member of the American expedition to Skaergaard, East Greenland.

His major research interests have focused on the petrogenesis of granitic rocks and the stratigraphy, structure, and petrochemistry of Columbia River Basalt. He was employed by the United States Geological Survey during the summers of 1978-1982 as part of a study of the feasibility of using Columbia River Basalt as a repository for the storage of nuclear wastes.

Taubeneck was Graduate Adviser and also supervisor of the teaching assistants in the Department of Geology in the period 1971-1982. "My associations with graduate students and our teaching assistants," states Taubeneck, "will always remain among my most pleasant memories of Oregon State University."

NEWS AND NOTES

COLLEGE OF SCIENCE

The College of Science honored **Harold J. Evans**, the first recipient of the Milton Harris Award in Basic Research, at a special symposium on October 13. Professor Evans received the award last March for his research in the area of symbiotic nitrogen fixation. He discussed that topic as the principal symposium speaker. Other speakers were **Frank C. Cannon**, program director of Plant Molecular Biology, Biotechnica International, Cambridge, Massachusetts, and **Donald R. Helinski**, professor of biochemical genetics at the University of California at San Diego. They respectively presented talks on "The Genetic Manipulation of Nitrogen Fixation" and "Plasmids and the Manipulation of Genes of Agricultural Importance." The symposium, which was opened by **President MacVicar** and **Dean Sugihara**, was well attended by students and faculty.

ATMOSPHERIC SCIENCES

Steven K. Esbensen participated as chairman of a working group in the heat sources workshop for the Monsoon Experiment (MONEX) at Colorado State University in late October. The workshop was sponsored by the U.S. MONEX Panel of the National Academy of Sciences.

In mid-September, **W. Lawrence Gates** presented an invited paper on the role of climate models at a Study Conference on the Sensitivity of Ecosystems and Society to Climate Change, sponsored by the United Nations Environment Program and the World Meteorological Organization (WMO) in Villach, Austria. In October, Dr. Gates attended the annual meeting of members of the University Corporation for Atmospheric Research in Boulder, CO, where he later participated in the meeting of the Advisory Panel of the Scientific Computing Division of the National Center for Atmospheric Research. In early November, Dr. Gates was in Montmorillon, France, to attend the fifth meeting of the Working Group on Numerical Experimentation, sponsored by the World Climate Research Programme of the WMO.

Professor Emeritus **E. Wendell Hewson** received the Award of Excellence from the American Wind Energy Association (AWEA) for his significant contributions to the development of wind resource assessments. The honor was awarded at the annual meeting of the AWEA in San Francisco, October 17-19.

Larry Mahrt presented an invited paper on soil hydrology and transpiration at an International Workshop on General Circulation Modelling, Air Force Geophysics Research Laboratories, Cambridge, MA, in late October. He later worked for two weeks on a joint boundary-layer project at the Risø National Laboratory, Denmark.

Steven A. Rutledge attended a meeting at the University of Wisconsin in late October to discuss field plans for the upcoming STORM project.

BIOCHEMISTRY AND BIOPHYSICS

Dr. Irving Isenberg chaired a session on Spectroscopy in Biochemistry at a symposium organized at Woods Hole, MA, in honor of the 90th birthday of Nobel Prize winner **Albert Szent-Gyorgyi**. Three other Nobelists participated in the symposium.

W. Curtis Johnson served on a special study section of the National Institutes of Health in Bethesda, MD, in August. In early September he attended the Discussions on Excited States of Nucleic Acid Bases held in Mammoth Lakes, CA.

Two members of the department presented seminars in the Biochemistry-Biophysics Program at Washington State University. On October 13, **George Pearson** spoke about initiation of adenovirus DNA replication, and on November 10, **Christopher Mathews** spoke about multienzyme complexes in DNA precursor biosynthesis. **Dr. Mathews** also presented a seminar in late October at the School of Pharmacy, University of California at San Francisco. In September, Dr. Mathews reviewed research programs at the Samuel Roberts Noble Foundation, Ardmore, OK.

Kensal van Holde was an invited speaker at the NATO Course on Biostructure and Function of the Genetic Apparatus at Erice, Sicily, in late September. Graduate student **Thomas Yager** also attended the course.

BOTANY AND PLANT PATHOLOGY

H. Melvin Couey and **Ulrike Schaper** have joined the laboratory of **Dr. Richard H. Converse**. Dr. Couey, a USDA/ARS research plant physiologist from Hilo, Hawaii, is spending fall term as a visiting associate professor to prepare antibodies against some post-harvest fruit rotting fungi of papaya. Dr. Schaper, from Heidelberg, Germany, has a two-year appointment as a research associate (courtesy) to work on production of monoclonal antibodies against some small fruit viruses. Dr. Schaper is an expert in rapid detection of plant mycoplasmas by fluorescence microscopy.

Duane L. Coyier received the Henry E. Heiner Award and a check for $500 from the Joseph H. Hill Memorial Foundation for his outstanding leadership in research for the rose industry at the annual convention of Roses, Inc., held in Salt Lake City in early October.

Robert G. Linderman was presented with the Norman J. Coleman Award for outstanding achievements in horticultural research by the American Association of Nurserymen at the 108th Annual AAN Convention and Trade Show in Montreal in July.

Dallice I. Mills was an invited speaker at seminars at Advanced Genetic Sciences, Inc., Oakland, CA, and the Department of Plant Pathology, University of California, Davis, in late September. His talks discussed "Tn5 mutagenesis and plasmid-chromosome recombination in *Pseudomones syringae*."

Larry W. Moore presented two invited papers on his work with *Agrobacterium* strains at the Fourth International Congress of Plant Pathology, University of Melbourne, Australia, in late August. Dr. Moore was an invited speaker on instrumentation needs for biotechnology at the Biotechnology Commission of the National Association of State Universities and Land Grant Colleges in Washington, DC, in mid-November.

CHEMISTRY

Professor **Dwight D. Weller** and graduate students **Steven A. Bolkan**, **Socorro I. Montalvo**, and **John T. Salinas** received the 1983 Milton Harris awards for excellence in teaching chemistry. Selection of winners is based on student responses and on evaluations by other faculty members. Dr. Weller, an organic chemist, joined the faculty in 1978 after doing postdoctoral work at the University of Illinois. He has a Ph.D. degreee from the University of California at Berkeley. Steve Bolkan is working for a doctorate in inorganic chemistry; Socorro Montalvo, for her doctorate in analytical chemistry; and John Salinas, a high school teacher with the Josephine County school district, is working toward a master's degree in analytical chemistry.

Edward H. Piepmeier presented invited symposia papers at the Tenth Annual Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies in Philadelphia in late September and at the 30th Annual Conference of the Spectroscopy Society of Canada in Vancouver, BC, in early October. He also gave papers about his newly invented multi-electrode plasma sources at both meetings. In late October he presented a paper entitled, "Three-electrical-phase multi-electrode plasma sources for atomic emission spectroscopy," at the 1983 Pacific Conference on Chemistry and Spectroscopy in Pasadena, CA.

James D. White was a Visiting Fellow of the Japanese Society for the Promotion of Science during September and October. He gave invited lectures at eleven universities and five research institutes during a four-week tour that began in Hokkaido and ended in Hiroshima. He was also plenary speaker at the Third Symposium on Synthetic Organic Chemistry held in Kyoto, September 13 and 14. At the invitation of the Chinese Academy of Sciences, Dr. White traveled to the People's Republic of China where he gave four lectures on his research at the Shanghai Institute of Organic Chemistry.

COMPUTER SCIENCE

Bella Bose presented papers at the IEEE International Symposium on Information Theory at St. Jovite, Quebec, in late September and at the 21st Allerton Conference on Communication, Computers, and Control at the University of Illinois, Urbana, in October.

Toshimi Minoura presented a paper at the Third Symposium on Reliability in Distributed Software and Database Systems at Clearwater Beach, FL, and a colloquium at the University of Kansas in mid-October.

ENTOMOLOGY

Norman H. Anderson attended the Sigma Xi National Convention in Toronto, October 28-31, as president and delegate of the OSU chapter. He also visited the Biosystematics Research Institute in Ottawa.

Victor Brookes and **René Feyereisen** attended the Second International Symposium on Bio-

synthesis, Metabolism, and Mode of Action of Invertebrate Hormones in Strasbourg, France, in late August. Dr. Brookes also attended the International Conference on Invertebrate Reproduction in Tubingen, Germany.

GENERAL SCIENCE

Paul L. Farber presented a paper, "Theories for the Birds,"in a symposium entitled "Parallel to Darwin: Botanical and Zoological Group Studies, 1809-1859" at the annual meeting of the History of Science Society, Norwalk, CT, in late October. Dr. Farber served as local chairman and organizer of the fall meeting of the West Coast History of Science Society, which met in Corvallis, November 12. The theme of the meeting was "U.S.-German Scientific Interaction."

Robert C. Worrest was the director of a NATO Advanced Research Workshop entitled "The impact of solar ultraviolet (UV-B) radiation upon terrestrial ecosystems. I. Agricultural systems." The workshop was held in Bad Windsheim, West Germany, in September. Dr. Worrest was coauthor of a paper presented by **Deborah L. Brooker** at the Seventh Biennial International Estuarine Conference in Virginia Beach, VA, in October.

GEOGRAPHY

Robert E. Frenkel was awarded the National Oak Leaf Award for outstanding service by the Nature Conservancy at its national meeting in Tucson, AZ, in late October. Nature Conservancy is a national organization dedicated to the protection of ecological reserves.

Charles L. Rosenfeld spent July 29-August 16 as a staff researcher on the Juneau Icefield Research Program in Alaska.

GEOLOGY

The Department is dedicating the guest speaker seminars to **Professor William H. Taubeneck**, who is retiring on December 31, 1983, after 32 years of distinguished service. In keeping with Professor Taubeneck's knowledge of igneous petrology and the rocks of Oregon and western Idaho, the topic of the series will be granite petrology with emphasis on the Idaho batholith.

Allen F. Agnew was awarded the Certificate of Merit of the American Institute of Professional Geologists at its annual meeting in September. The award was given for outstanding contributions to the Institute's program over the past 18 years.

Arthur J. Boucot chaired sessions of Project Ecostratigraphy, International Geological Correlation Program, in Glasgow, England, in mid-September. He presented an invited paper on Project Ecostratigraphy and another on early land plants at the meetings of the Geological Society of America in early November.

LABORATORY FOR NITROGEN FIXATION RESEARCH

Richard Haugland, Michael Cantrell and **Harold J. Evans** presented a poster paper, "Characterization of recombinant cosmids containing hydrogen uptake genes from *Rhizobium japonicum*," at the Fifth International Symposium on Nitrogen Fixation held in Noodwijkerhout, The Netherlands, in early September. Over 600 scientists, including chemists, biochemists, microbiologists, geneticist, agriculturalists, and forest scientists participated in the conference. The next International Symposium on Nitrogen Fixation will be held at OSU in August 1985.

MATHEMATICS

F. Tom Lindstrom participated in the Gordon Research Conference on Modeling in New Hampton, NH, in early August. He was an invited speaker on mathematical modeling of the transport and fate of toxic organic chemicals in landfills at NIEHS, Research Triangle Park, NC, in early September.

Edward C. Waymire presented a paper entitled "Trend effects on long time scales" at the 44th meeting of the International Statistical Institute in Madrid and at the Second International Institute of Statistical Climatology in Lisbon, Portugal.

MICROBIOLOGY

Adolph J. Ferro presented an invited talk, "The fate and function of methylthioadenosine," at the Gordon Conference on Polyamines in Meriden, NH, in mid-July.

John L. Fryer presented an invited paper at the International Helgoland Symposium, Helgoland, Federal Republic of Germany, in mid-September: "Isolation and characterization of a new subspecies of *Mycobacterium chelonei* infectious for salmonid fish" (**Cindy K. Arakawa**, coauthor). He gave another paper on bacterial diseases of cultured marine fish (**John S. Rohovec**, coauthor) at a round table discussion at the same symposium. Later in September, he participated in the meetings of the European Association of Fish Pathologists in Plymouth, England. During September and October, he consulted with scientists and presented seminars at Torry Research Station, Aberdeen, Scotland; the Laboratoire National de Pathologie and the Laboratoire d'Ichthyopathologie in Thiverval-Grignon, France; the Kuwait Institute for Scientific Research; Cairo University and the University of Alexandria, Egypt; and research facilities in Singapore. He also presented seminars and consulted with scientists in Korea under an NSF cooperative grant between the U.S. and Korea.

Dennis E. Hruby, a new faculty member in the department, presented a seminar, "Perspectives in poxvirus research" at North Carolina State University in early November. **Dr. Richard A. Maki**, LaJolla Cancer Research Foundation, has been a visiting scientist in Dr. Hruby's laboratory. Both scientists are collaborating to construct recombinant vaccinia viruses that contain and express antigens of immunological interest.

William E. Sandine was invited to teach a course at the Center for Reference on Lactobacilli in Tucuman, Argentina, in August. While he was there, he was awarded an honorary doctorate degree by the National University of Tucuman. Dr. Sandine attended a meeting on Lactic Acid Bacteria in Foods held in The Netherlands in early September. He also lectured and consulted with scientists at University College and at the Agricultural Institute in Cork, Ireland, and with scientists of Aplin-Barrett in London. In early November, he presented a paper on bacteriophage at the 9th Food Microbiology Research Conference in Chicago.

PHYSICS

Charles W. Drake gave a presentation on "Parity violating effects in atomic physics" at Reed College in early October.

Rubin Landau gave a seminar on kaon physics at the Swiss Institute for Nuclear Research near Zurich in mid-August. He later presented two papers at the Tenth International Conference on Few Body Problems in Physics held at the Technical University of Karlsruhe, Germany: an invited paper on "Proton interactions with the three-nucleon system" and another one on kaonic hydrogen. He presented this same paper at the International Conference on Nuclear Physics in Florence, Italy, in late August. In July and August, Dr. Landau visited TRIUMF in Vancouver, BC, where he conducted research in theoretical physics. He gave a paper at the University of Alberta/TRIUMF workshop in mid-July.

STATISTICS

Jeffrey L. Arthur presented an invited paper at the joint national meetings of the Operations Research Society of America and the Institute of Management Sciences (TIMS) in Orlando, FL, in November. He also assumed office as Vice Chairman of the TIMS College on Engineering Management.

H. Daniel Brunk contributed a paper on Bayes least squares linear regression at the Second International Meeting on Bayesian Statistics held in Valencia, Spain, in September.

Youngjo Lee joined the departmental faculty this fall. He received his M.S. and Ph.D. in statistics from Iowa State University. Dr. Lee is a member of Phi Kappa Phi, a national honor society, and Mu Sigma Rho, the statistics honor society. His research interests include linear models, experimental design, multivariate analysis, and time series analysis.

Donald A. Pierce gave an invited paper on modeling for analysis of the incidence of cancer in the A-Bomb survivors at the September meeting of the Society of Industrial and Applied Mathematics, Institute for Mathematics and Society in Alta, UT. He also presented seminars on this topic at the University of Texas at Austin and at Dallas in early December. His presentation in Dallas was part of a series of Distinguished Visiting Lecturers in Statistics. Dr. Pierce was recently elected to membership in the International Statistical Institute.

ZOOLOGY

Christopher J. Bayne, Carl A. Boswell, and **Mary A. Yui** attended the joint December meeting of the American Society for Parasitologists and the American Society for Tropical Medicine and Hygiene in San Antonio, TX. Dr. Bayne organized and convened the Presidential Symposium on the Genetics and Immunology of the *Biomphalaria glabrata - Schistosoma mansoni* relationship. Dr. **Eric S. Loker**, who recently left this department to join the faculty at Virginia Commonwealth University, presented recent results of relevant work done in Dr. Bayne's laboratory.

Arthur J. Boucot attended sessions of the Systematics Association devoted to the evolution of the lower phyla at the British Museum in London in September.

Philip H. Brownell and **Mark Schaefer** presented a paper at the annual meeting of the Society for Neuroscience in Boston, in early November. Dr. Brownell and **Sheryl Furgal** gave another paper at the same meeting.

Jane Lubchenco presented two seminars on "Plant herbivore interaction and community structure" at the University of New Mexico in early November.

Bruce A. Menge gave seminars on habitats in a tropical rocky intertidal region at Hopkins Marine Station, CA, and at the Department of Biological Sciences, University of California, Santa Barbara, in October.

The Budget of the College of Science, 1982-83

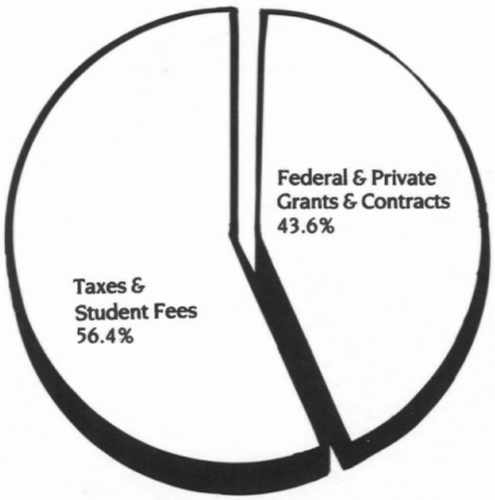


Figure 1: Major Sources of Funds for the College of Science, OSU, 1982-83 (Total $18,705,232)

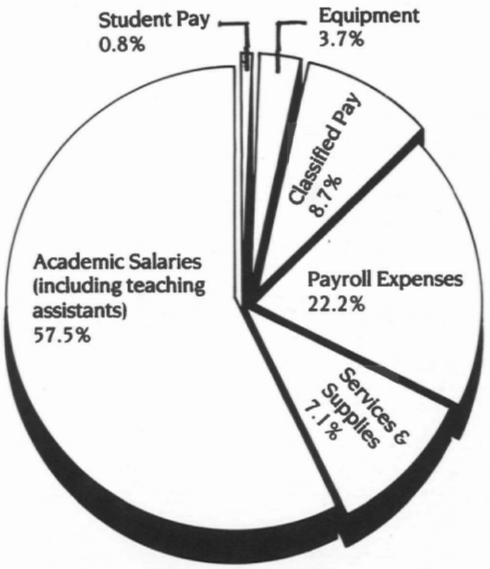


Figure 2: Expenditure of Taxes & Student Fees for the College of Science, OSU, 1982-83 (Total $10,554,035)

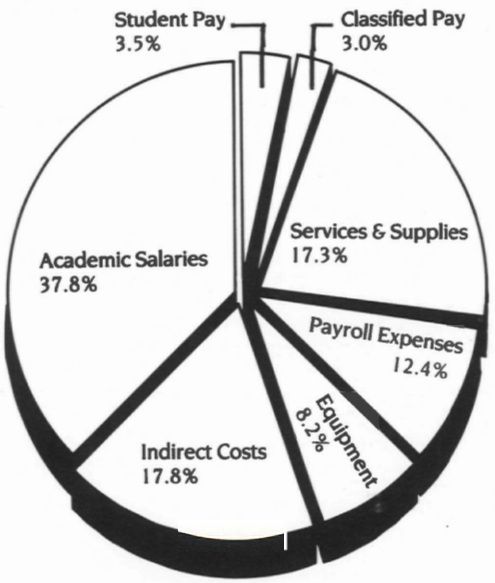


Figure 3: Expenditure of Federal & Private Grants & Contracts for the College of Science, OSU, 1982-83 (Total $8,151,197)

The diagrams on the left show the sources of the funds and the expenditures of the College of Science during the 1982-83 fiscal year. These diagrams are similar to those that have appeared in previous fall issues of the *Science Record*. The expenditures totaled $18,705,232 for 1982-83, down slightly from the 1981-82 figure of $18,770,927. Although the totals are similar, the percentages derived from the two broad categories differ. Approximately 56 percent of these funds came from taxes and student fees (down from 59.8 percent in 1981-82) and 44 percent from private, state and federal grants and contracts (up from 40.2 percent in 1981-82).

Dean Sugihara has already noted the six percent decline in instructional expenditures over 1981-82 (Figure 2), the first such decline in recent years. The projected reduction in the recurring budget described last year became a reality. The percentages of the instructional expenditures devoted to academic salaries and classified wages remained essentially the same, whereas payroll expenditures continued to increase. Expenditures for services and supplies decreased more than $361,000 from the preceding year, while expenditures for equipment increased.

Figure 3 shows that $8,151,197 were spent from private, state and federal grants and contracts—an increase of $601,041 (8 percent) over the preceding year. The increase last year over 1980-81 was 2.8 percent. The percentages spent in most categories remained about the same except for a decline in money spent for services and supplies (from 21.6 percent to 17.3 percent) and an increase in the percentage spent on equipment (5 percent to 8.2 percent). The continued increase in grant support over previous years reflects the quality of the research being conducted by the faculty of the College of Science. The number of faculty remains the same but the level of support continues to increase. Competition for grant funds from all sources is keen and will remain so. Faculty members of the College of Science will continue to be competitive and successful in obtaining outside research support. These funds play a vital role in our research and graduate programs. The monies also provide opportunities for undergraduate students to participate in many research projects.