can for the greatest number of people. Before the field assignment, neither had any thoughts about becoming a lobbyist. Near the end of the session their attitudes had changed. Sue told the reporter, "We're invested in this thing. What we do is for our future, our livelihood." Clare acknowledges that as a result of the experience, she hopes always to work in some connection with the legislature.

The students feel seasoned now, but confess that they, like the new delegates, were green when the session began. Early this year they spent time reviewing the legislative process, studying the bills they were to support and oppose and mapping out the area in Annapolis. By keeping notes on their experiences, they have been able to see connections between the usage of social strategy techniques in the field and what they have studied in class. The field placement has also allowed them to make professional contacts and to apply principles useful in effecting social change.

"A significant thing that's come out of the whole experience in Annapolis is a reassurance that people really can exercise some degree of control over the laws that will influence their lives," Sue comments.

"You have to operate on the assumption that you are providing useful and needed information to the legislators," comments Clare. "By varying degrees, they are dependent on you for it. On occasion, legislators have drawn us out of committee meetings to ask about the various ramifications of a bill. Of course, the lobbyist is going to be one-sided, but will at least explain that one side thoroughly.

"I definitely feel that our work had some influence on getting the social work licensing bill passed. We had excellent support from NASW. That's most important for any strategist—to have the support of the group you're working for."

Clare stresses that the strategist must be flexible, adaptable and aggressive. "One must know when to take risks and when to keep one's mouth shut. Above all, one must realize that the worst thing that can happen when asking for honest support of any cause is that someone can say 'no'."

People who have been related to social work have always done social strategy tasks," says Velva Spriggs. "That's because social strategy is sometimes lobbying, sometimes working with groups. In some social work circles, the

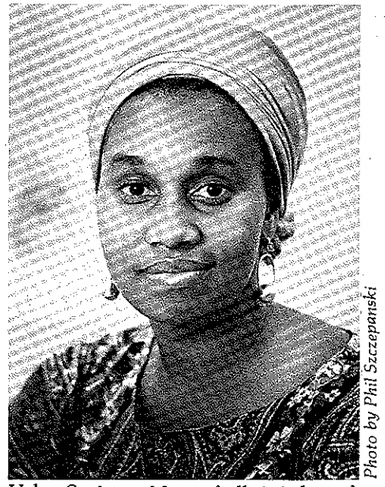


Photo by Phil Szczepanski

Velva Spriggs: *Most of all, it is hoped that the student will develop some respect for the client population and its ability to be engaged in the process of self-determination.*

concept is better known as community development, community organization or social planning. 'Social strategy' is a term that Dean Daniel Thursz developed at the University of Maryland School of Social Work and Community Planning to encompass all of these areas."

The school has taken national leadership toward an emerging model in which skills traditionally associated with these areas combine with a disciplined use of self in a professional person. Established in 1969, the program is developing rapidly and presently enrolls 40 to 50 students each year. According to Dr. Ephross, approximately one-fourth of the social work and community planning student body is enrolled in the concentration. The school has one of the largest strategy enrollments in the country, according to Dr. Ephross.

"People are beginning to realize that many parts of systems can be changed and that there are some very substantial things that do have impact on the client community," says Ms. Spriggs. "The extent to which effective change can be accomplished really depends on how skillful the practitioner is and whether he is able to use himself and the system effectively.

"A lot of people came out of the conflicts of the 60s turned on to working with large groups in order to help them realize their potential," Ms. Spriggs continues. "To them came some understanding as to how effective that kind of problem solving can be.

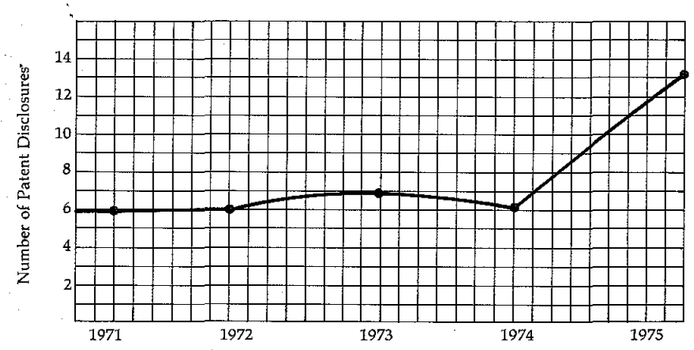
"At the same time, many clinical social workers have been practicing and working with clients and have perceived that some of the problems of individuals are related to systems. They have come to feel that to be of some substance to the individual, something must be done so that he won't have to deal with systems not conducive to problem solving.

"I believe that in part the appeal of the program is due to the commitment of the dean and the faculty to the development of social strategy as a legitimate and important part of the profession of social work. Students have been impressed by the willingness on the part of the faculty to place them in field settings where they are involved in genuine tasks of the profession." The fact that the school is close to Washington, D. C. and Annapolis allows field placement in areas where major decisions are made, and this too may add to the student appeal.

The intent of the concentration is to develop the social strategist as a specialist in the area of social work. Theory and methods are combined with opportunities for specialization that are in keeping with the particular interest of students in substantive social problems. "I would not say that we aim our students toward any particular specialization," says Ms. Spriggs. "What we feel is important is that some basic skills be developed that are required in any social strategy area."

She continues that one thing a student must pick up in school is an understanding of how complicated and intact organizations and systems are. "Finding solutions is not such a simple matter of identifying problems and issues, then tackling them. In any such attempt, you have to be aware of what resources are available, the policies involved, the kind of leadership provided, what decision-making mechanism governs the situation—a lot of factors which must be considered as the practitioner tries to develop an appropriate strategy."

According to Dr. Ephross, most social strategists who work in Maryland are graduates of the School of Social Work and Community Planning. They may be employed by institutions such as urban renewal and housing programs, planning departments, settlement houses and neighborhood centers, government bureaus and departments, federations and social agencies, offices of civic and political leaders, labor organizations, community groups and as consultants.



DISCLOSURES DOUBLE IN '75

Researchers at the University of Maryland are responding positively to the patent awareness program being conducted by Research Corporation.

Since the inception of the NSF program on patent awareness conducted by Research Corporation (*Chronicle*, December 1974 and May 1975 issues), invention disclosures at the University of Maryland are up 100% over previous years. The University registered six disclosures with Research Corporation in 1971, six in 1972, seven in 1973, and six in 1974. Thirteen disclosures have been submitted thus far in 1975, ten of these since the Research Corporation patent awareness seminar series last April.

Financial considerations prompted the University's original "open end" patent assistance agreement with Research Corporation in 1960; lack of funds with which to evaluate inventions, pursue patent applications and provide professional advice and skills in licensing patents put the university inventor in a difficult situation. Research Corporation currently has patent assistance agreements with over 250 colleges, universities and non-profit research institutions. The University of Maryland is one of eight universities involved in the current patent awareness program. As was previously reported in the *Chronicle*, the patent awareness program is being supported by a three-year $198,700 grant from the National Science Foundation, and involves four phases: a review of ongoing institutional research, a seminar series designed to educate university staff about patent procedures, a program of continuing support through monthly visits to the campuses by Research Corporation patent associates, and a report of results at the program's conclusion.

Of the thirteen disclosures submitted to Research Corporation this year, one has been accepted and a patent has been applied for, five are still pending a decision from technical evaluators at Research Corporation and six have been rejected. Recommendations against filing patent applications are usually based on one or more of the following reasons: (1) the invention is old and has already been patented; (2) the invention is sufficiently similar to one already patented that meaningful patent protection is not likely to be obtained; (3) the invention, although interesting and unique, is at too early a stage of development to provide a basis for strong patent claims; (4) the anticipated market for the patent is such that there is little justification for spending the necessary funds to obtain a patent; and (5) licensing of the patent may be too difficult or impractical.

In those instances that Research Corporation decides not to pursue patenting, the University ordinarily releases to the inventor such rights as it may have in the invention and the inventor is free to make patent application at his own expense if he cares to do so. In cases in which research leading up to the invention has been sponsored by a government agency or other outside funding source, additional clearances may be necessary.

A University-wide open meeting on patent procedure is tentatively scheduled for the beginning of the spring semester.

PATENT DISCLOSURES
University of Maryland
1975

1. Herbert Levitan, *Zoology*, and Stanley I. Rapoport, *National Institutes of Mental Health*
2. Larry L. Augsberger, *Pharmacy*, and Henry P. David, *Psychiatry, School of Medicine*
3. Jorge Davila, *Pedodontics, School of Dentistry*, Rodger F. Sisca, *Restorative Dentistry*, and D. Vincent Provenza, *Anatomy, School of Dentistry*
4. Neal M. Barnett, *Botany*
5. Nicholas D. Mass, *Physics*
6. Paul H. Mazzocchi, *Chemistry*, and Aline M. Harrison, *Chemistry*
7. Frank T. Buckley, Jr., *Mechanical Engineering*
8. Robert W. Newcomb, *Electrical Engineering*
9. D. N. Ennis, *Horticulture*, and Amihud Kramer, *Horticulture*
10. Patrick S. Callery, *Medicinal Chemistry, School of Pharmacy*, Malcolm D. Cooper, *Nuclear Medicine*, and Michael D. Loberg, *Medicinal Chemistry, joint appointment: School of Medicine and School of Pharmacy*
11. Carroll D. Arnett, *Medicinal Chemistry, School of Pharmacy*, Jeremy Wright, *Medicinal Chemistry, School of Pharmacy*, and Nicholas Zenker, *Medicinal Chemistry, School of Pharmacy*
12. Rita R. Colwell, *Microbiology*, and John D. Walker, *Martin Marietta Corporation*

University Responses to CGS-GRE Survey

Indicate Stability In Numbers

Data from the individual campuses have recently been reported to the Office of the Vice President for Graduate Studies and Research in response to Part I of the Fifth Annual Graduate School Enrollment Survey of the Council of Graduate Schools and the Graduate Record Examinations Board. This first part of the survey deals with total enrollment figures and requests data for both 1974 and 1975 in order to provide comparative information. The results of the University of Maryland compilation provide insight into local trends and will prove especially valuable when national figures are available for comparison.

Total graduate student enrollment at the University is up very slightly over last year (2.04%) with significant increases at UMAB (12.4%) and UMBC (52.0%) being largely offset by a miniscule drop (.08%) in UMCP's large graduate student population.

First-time enrollees at the University account for approximately 26% of the total enrollment of graduate students. This group of new enrollees represents approximately 29% of the applicant pool (41.5% at UMAB, 44.7% at UMBC, and 26.0% at UMCP) compared with 32% in 1974. Applications for graduate study were up 10.2% overall; UMCP accounted for most of the increase, while UMAB saw a slight decline from last year's total.

Financial support for University of Maryland graduate students appears relatively stable, with the number of available assistantships slightly higher than in previous years and the number of fellowships and other non-service appointments slightly lower. The percentage of students receiving financial aid at each campus is 36.3% at UMAB (down 4% from 1974), 28.3% at UMBC (stable) and 23.7% at UMCP (up slightly from last year's 22.6%). Approximately 58.4% of the graduate students enrolled at the University are part-time students and therefore ineligible for most forms of financial assistance.

Comparing the number of full-time students and the number of supported students, the report indicates that 54.3% of full-time students at UMAB are being institutionally supported, 69.3% at UMBC and 62.18% at UMCP. The full-time to part-time student ratio at the University has remained stable (approximately 2:3) for the past two years.

Degree awards have also increased over 1974 figures, master's degrees up 2.27% and doctoral degrees up 16.6%.

The second portion of the CGS-GRE survey, currently being completed by participating universities, requests breakdowns of the enrollment figures by sex, ethnic group and academic discipline, and breakdowns of the support and degree award figures by academic discipline.

	UMAB	UMBC	UMCP	Total	UMAB	UMBC	UMCP	Total
	October 15, 1974				October 15, 1975			
1. Total graduate school enrollment	950	121	7507	8578	1068	184	7501	8753
2. Total number of first-time enrollees	548	99	1627	2274	521	101	1653	2275
3. Total number of applications for graduate study received from which enrollment was generated	1262	209	5632	7103	1256	226	6345	7827
4. Number of graduate assistants (service required) on appointment	24	35	1610	1669	32	51	1698	1781
5. Number of fellows or trainees (no service required) on appointment	365	0	86	451	356	1	78	435
6. Enrollment by								
a. Full-time	725	42	2830	3597	714	75	2856	3645
b. Part-time	225	79	4677	4981	354	109	4645	5108
	July 1, 1973–June 30, 1974				July 1, 1974–June 30, 1975			
7. Total number of master's degrees awarded	317	4	1395	1716	331	8	1416	1755
8. Total number of doctoral degrees awarded	7	0	336	343	15	0	385	400

Ken, was something like this: A client is waiting for his unemployment or welfare application papers to be processed and cannot afford to pay his gas and electric bill. Someone else has no food but has not qualified for food stamps. Another person may need clothing in order to attend school or go to work. DSS is aware of these problems as well as the need for additional resources, but because of agency guidelines or a backlog of applicants, it cannot respond.

Enter the social strategist.

As an agent for DSS, Ken worked with a group of ministers in the district to help set up a program sponsored by the neighborhood churches to provide for some of the emergency needs of the community.

The social strategist alone cannot make these types of things happen, Ken stresses. "I acted mainly as a facilitator. By working with both DSS nd the neighborhood residents, I was able to identify agency deficiencies and specific community needs and we could then begin to tailor a program that would meet some of the needs.

"But without the support of community leaders, the program would never have come into being," he contitinues. "The strategist is an initiator *and* an advocate. After you come up with an idea, you still have to go out and convince people that it will work."

Ideally, the social strategist works for the benefit of both the agency and the community. "Sometimes you run into conflict. While DSS handled part of the emergency service problem many people throughout the city felt all emergency needs should be handled by DSS, so I was simultaneously working with others to convince DSS to take on more of the responsibility rather than relying on private organizations. We could have been faced with a community group who wanted to pressure the department to provide the services. The strategist, recognizing the problems of both components, is in the middle. Ultimately, it is his function to enhance the community."

Social strategy field instruction placements are made in a great variety of settings in an effort to provide the student with the opportunity to work in the type of setting that best advances his learning and often his career goals as well. Velva Spriggs, an assistant professor at the School of Social Work and Community Planning, cites some of the criteria for selecting a particular field setting.

"We want the student to be in touch with systems as well as community groups so they can begin to develop group management skills and to test their strategy development and group relationship skills. Working with the student, we generally try to select an agency that is conducive to problem solving and one which will allow him to make some impact on the client population through the practice of strategy techniques."

Some overall purposes of the field placement are to enable the student to develop effective decision making and analytical skills and to help him gain a sense of how systems work.

Ms. Spriggs continues, "It is expected that at some point the placement will enable the student to make a commitment to work with people, to be an effective social worker, community organizer and community developer.

"But most of all, it is hoped that the student will develop some respect for the client population and its ability to be engaged in the process of self-determination."

Another important aspect of training for all social strategists is the development of an understanding of how the legislative process works. During the 1975 session of the Maryland General Assembly, strategy students Sue Castle and Clare Leibling worked in Annapolis on a field assignment as registered lobbyists for the National Association of Social Workers. A major concern for them during the session was House Bill 1026 which established a Board of Examiners and licensing procedure for social workers. The bill passed in the Assembly and was signed by the governor during the spring.

In an interview with *Evening Sun* reporter Sharon Dickman, Clare explained the experiences at the capital like this: "Our approach to lobbying is a social work approach. We're trained to be introspective of ourselves and situations. We study the roles people play and their views of legislation. And more important, we respect where they're coming from even if we're not in agreement."

Sharon Dickman describes the two as bold, effervescent lobbyists, without expense accounts, who see the General Assembly as a moonstruck planet with glamorous personalities, most of whom are earnestly trying to do the best they

Dr. Paul Ephross is chairman of the social strategy concentration at UMAB.

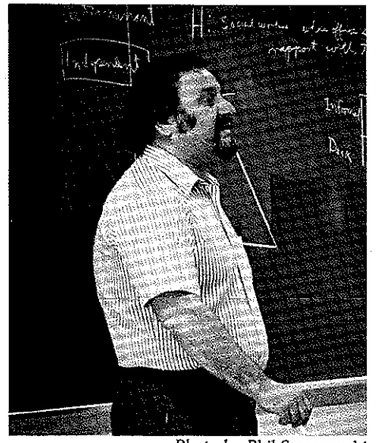


Photo by Phil Szczepanski

A number of social strategy students are enrolled in Dr. Howell Baum's class on health care planning at the University's Baltimore campus.

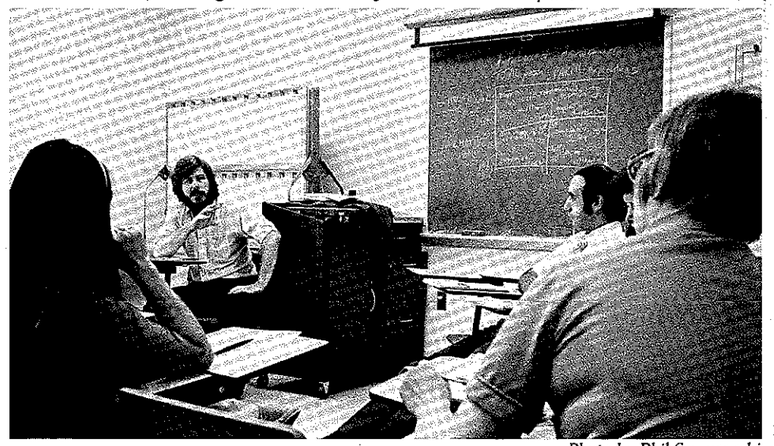


Photo by Phil Szczepanski

SOCIAL STRATEGY:

Making the System Work for People

by Christine Plater

"A key problem of the next 25 years will be to make systems of social service work," says Dr. Paul Ephross, chairman of the social strategy concentration at the University of Maryland at Baltimore's School of Social Work and Community Planning.

"When you ask people what is wrong in the country, 'Things don't work,' is a frequent answer. But how do we structure a corrections system that corrects, a welfare system that is responsive? How do neighborhood people begin to organize so they can be heard?"

So another entry is made in the lexicon of social work terminology—*social strategy*. Social strategy encompasses those professional social work activities which aim to solve social problems and improve human lives by planning, designing, changing and intervening in service delivery systems. The strategist works with a client system composed of citizens, officials and/or professional deliverers of service in all of the functional fields which a complex society requires.

Social work generally encompasses two major approaches to improving human lives. One is a clinical approach in which the practitioner is concerned with providing direct services to individuals, families or groups. The other, which is rapidly evolving under many different names, is the concept of social strategy.

The social strategy concentration of the School of Social Work and Community Planning focuses on the provision of training in community organization and in the analysis of social problems. It also involves students in program planning and evaluation, intervention in complex social systems and other related professional activities. The social strategist views individual and family problems not only as the result of intrapsychic processes, but as linked with the operation of social systems.

"In the long run, the social strategist is just as concerned about the individual as is the clinician; however, the strategist works more indirectly," Dr. Ephross continues. "The social worker who is a strategist generally conceives that most big problems that affect people are not always centered around the individuals themselves, but evolve, in many instances, from the way society works. For instance, a man who is out of a job may be the victim of an employment system that is not hiring. A child who does not acquire a good education may be the product of a school system that is not providing quality education."

The social strategist is concerned with changing laws, policies and organizations so that these types of situations do not perpetuate themselves. This means working with government departments, citizen groups, private agencies and various other organizations ranging in scale from voluntary neighborhood associations to legally and culturally sanctioned institutions, some national or international in scope. The ultimate goal is to effect the changes that provide people with the types of goods, services and opportunities that they need in order to be responsive and productive citizens.

Instruction in a practice setting is an important feature in the social strategy concentration. The graduate internship with its careful field instruction allows the student to apply classroom knowledge and development skills that professional work will require.

Ken Gelula, a second year student in the concentration, describes his field assignment with a district office of the Baltimore City Department of Social Services (DSS) as a community approach to solving social problems. Ken worked to establish a community emergency services organization to supplement the efforts of the Social Services' Emergency Program. The situation, says

Clare Leibling (left) and Sue Castle discuss House Bill 1026 with Lt. Governor Blair Lee; the two students lobbied in favor of the bill in 1975.

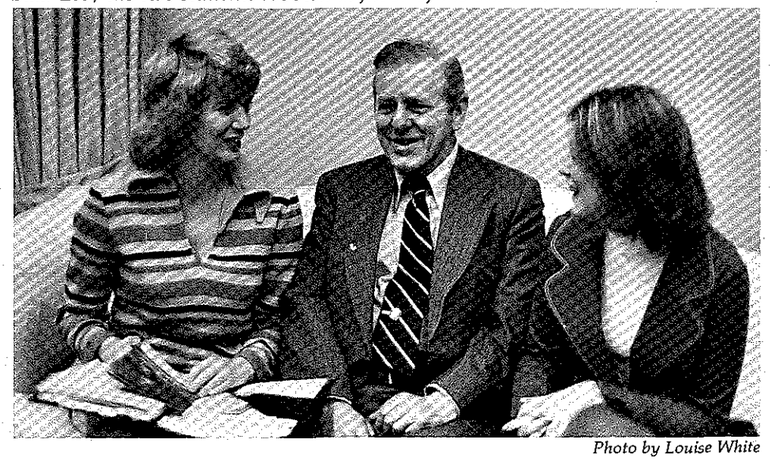


Photo by Louise White

GRE *Sample Aptitude Test Available; New Directions Sought for Test*

At its September 1974 meeting the Graduate Record Examinations Board authorized the publication and sale, for the first time, of a sample GRE Aptitude Test to give students an accurate view of the scope of the test and the types of questions asked and thus make them more at ease with the test. A full-length sample assembled from previously used forms of the Aptitude Test is now available at a cost of $1.25, first-class postage paid. In addition, a sample Aptitude Test has been included in the most current edition of the *Graduate Programs and Admissions Manual*, a four-volume set providing information about over 700 graduate schools in the United States. Orders for the sample GRE Aptitude Test in booklet form should be accompanied by payment and addressed to GPAM, Box 2606, Princeton, N.J. 08540.

The Aptitude Test may undergo some changes in the near future. The GRE Board is now investigating ways to make the test more useful to students and institutions, primarily by including measures of characteristics as yet untapped by the GRE. The purpose of contemplated change is four-fold: (1) to broaden the definition of scholastic talent, thus enabling students with abilities relatively independent of verbal and quantitative skills to demonstrate their strengths; (2) to tailor portions of the test to groups for which the measures are most appropriate, thus individualizing the test as far as possible in a standardized setting; (3) to increase the predictive validity of the test; and (4) to provide for the possibility of future guidance instruments to help applicants make better choices of programs and careers.

Proposals to modify the test assume that it should be an instrument responsive to changing needs and testing capabilities. Thus, a measure of scientific thinking (covering such skills as formulating hypotheses, drawing inferences from data, and evaluating results of experiments) and an index of "cognitive style" or approach to study that may eventually lead to a guidance instrument related to choice of career and academic discipline are now in early stages of research. (**Source:** *GRE Board Newsletter*, Number 21, September-October 1975.)

ON THE MOVE

The Graduate School is on the move at two of the University's campuses.

The UMBC Graduate School office is now located on the lower level of the library building. Reference room L005 houses materials on research grants, graduate catalogs from most universities in the United States, other general information on attending graduate school, and catalogs and application forms for admission to the University of Maryland Baltimore County graduate programs. In addition to previously available facilities, a graduate student lounge is expected to be completed at UMBC sometime this year. Dr. Joseph F. Mulligan, Director of Graduate Studies and Research, and his secretary Mrs. Helen Cook, can be reached by telephone at 455-2537.

At UMAB, the Office of the Dean for Graduate Studies and Research has moved from the School of Social Work and Administration Building and is now located in Room 101, Whitehurst Hall (624 W. Lombard Street). Acting Dean William J. Kinnard, Jr., and his secretary Mrs. Gayle Knott, can be reached at 528-7131.

Graduate Internship Funded by State Department of Transportation

As part of its recruitment and personnel development program, the State of Maryland's Department of Transportation (D. O. T.) sponsors a number of student intern grants which allow graduate students in transportation-related areas to simultaneously pursue their formal education and gain practical work experience with D. O. T.

The first institution of higher education to be included in the internship program was Morgan State College. In the spring of 1973, D. O. T. Secretary Harry R. Hughes asked Dr. Everett Carter of the University of Maryland's Department of Civil Engineering to serve on the advisory council for education and training grants. In 1974, the advisory council decided both to broaden the scope of the training program beyond the original study area of community planning and to include other schools in the internship program. Both The Johns Hopkins University and the University of Maryland were approved for internships, and the total number of internships available to graduate students at the three schools combined was increased to thirty.

Dealing with Mr. Alfred Watts, Equal Employment Opportunity officer for the Maryland Department of Transportation, Dr. Carter solidified arrangements for one internship at the University of Maryland for 1975-1976. It is not yet known how many internships will be available through the University of Maryland next year.

Administered by the Transportation Studies Center, the internship lasts two years and requires two full working days per week with D. O. T. Time commitment arrangements are made on an individual basis so that class schedules and work schedules are compatible and so that examinations are not missed. The salary is the same as that of a graduate teaching assistant, tuition and fees are remitted, and a small book allowance is provided.

Initial screening of the applicants for the internship is done by the Transportation Studies Center Advisory Committee. The University provides D. O. T. with the names of twice as many candidates as can be accommodated in internships, and D. O. T. decides which students will be awarded the training grants. Priority is given to Maryland residents.

The University's first intern is a graduate student in the Department of Geography. Mr. Joseph C. Nessel, III, is working in the D. O. T. Secretary's office in systems planning and development. Future internships may involve work in any one of D. O. T.'s branches (i.e. port authority, highway commission) touching upon many units within that branch in the course of the two years.

Eventually an arrangement may be effected which would allow those individuals who pursue internships with D. O. T. to be automatically offered full-time positions upon completion of their studies, but no future employment arrangements have yet been solidified.

chemical evolution

Life in a test tube? Well, yes!

The fundamental question of how and when life began is being confronted daily on the third floor of the Chemistry Building at the University of Maryland's College Park campus. And scientists at Maryland are not alone in their search for answers to questions about the history of the solar system and about chemical evolution.

The Laboratory of Chemical Evolution, under the direction of Dr. Cyril Ponnamperuma, recently hosted the second annual College Park Colloquia on Chemical Evolution, a three-day conference sponsored by the National Aeronautics and Space Administration, the Ames Research Center, and the National Science Foundation. This year's session focused on the chemical evolution of the early Precambrian era and attracted more than 75 geologists, chemists and biologists from the United States and several foreign countries.

Two Nobel Prize winners were among the conference participants. Dr. Lars Onsager, who received the Nobel Prize in 1968 for his contributions to the field of physical chemistry, presented a paper on the evolution of molecules into cells. Featured speaker at the meeting was Dr. Willard F. Libby, director of the Institute of Geophysics and Planetary Physics at the University of California at Berkeley and winner of the 1960 Nobel Prize in Chemistry. Dr. Libby is responsible for the development of radiocarbon dating, a method of determining geological age by measuring the amount of radioactive carbon-14 in organic or carbon-containing objects.

As part of the conference program, an open house was held in the Laboratory of Chemical Evolution on October 31, 1975. The laboratory encompasses facilities for study in organic geo-chemistry (including a lunar clean room), planetary chemistry, biochemistry, organic chemistry and mass spectrometry. The staff of the laboratory, international in origin, relies heavily in its research efforts on cooperative agreements with other UMCP departments, with the Space Sciences Laboratory on campus, and with NASA's Goddard Space Flight Center in Greenbelt.

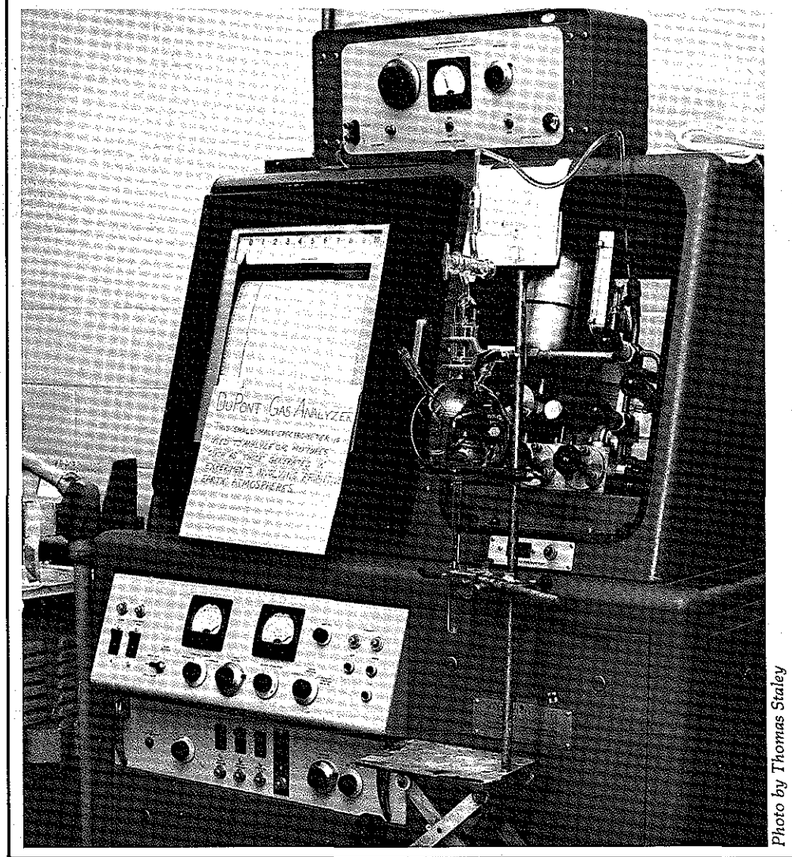


Photo by Thomas Staley

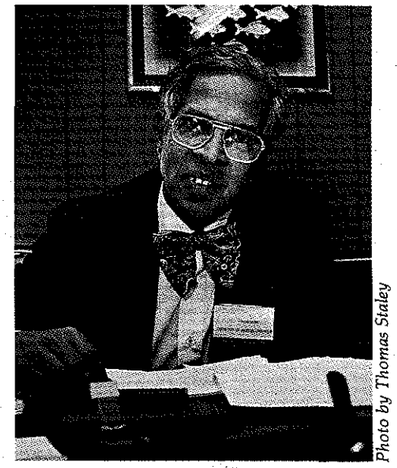


Photo by Thomas Staley

Above: *Dr. Cyril Ponnamperuma, director of the Laboratory of Chemical Evolution, pauses briefly in his office during the laboratory open house.*

Left: *In the mass spectrometry laboratory, this Dupont gas analyzer utilizes a small mass spectrometer to analyze gas mixtures such as those generated in experiments involving "primitive earth" atmospheres.*

Distribution of full-time graduate students, by sex, level of study, and area of science, 1974

Sex of student and level of study	Total number	Percent distribution						
		Total	Engineering	Physical sciences	Mathematical sciences	Life sciences	Psychology	Social sciences
Total	195,196	100.0	17.6	15.0	6.7	26.7	9.4	24.7
Men	148,640	100.0	22.1	17.3	7.1	24.9	7.4	21.2
First year	53,558	100.0	26.7	13.4	6.8	24.4	5.9	22.8
Beyond first year	95,082	100.0	19.4	19.5	7.2	25.2	8.2	20.4
Women	46,556	100.0	3.3	7.4	5.3	32.5	15.8	35.7
First year	20,001	100.0	4.1	6.3	5.6	34.4	12.3	37.3
Beyond first year	26,555	100.0	2.7	8.2	5.2	31.2	18.4	34.4

[1]Based on data received from 7,505 graduate science departments in 1974.

SOURCE: National Science Foundation.

Results

Fall 1974 graduate science enrollment in institutions of higher education granting science and engineering Ph.D.s increased almost 6 percent over the previous year. The gain in enrollment is the first since 1969, the peak year; however, when long-term trend data are examined in index terms, the increase represents a return to approximately the same level as in 1967.

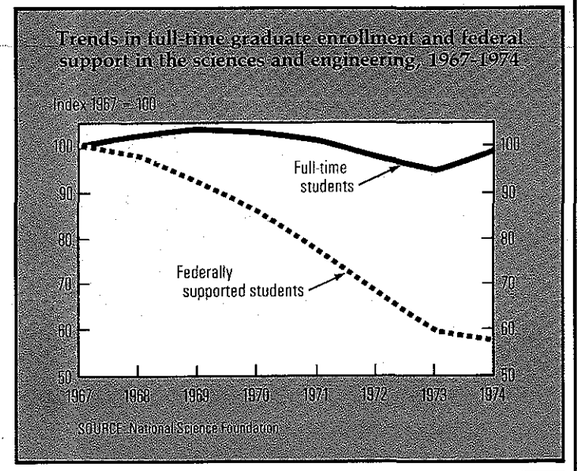
The 1973-1974 increase occurred in both full-time and part-time enrollment, up 5 percent and 9 percent, respectively. Almost one-third more students attended on a part-time basis in 1974 than in 1967. Of the approximately 265,800 students enrolled in graduate science programs in the fall 1974 term, about 195,200, or 73 percent, were full-time students.

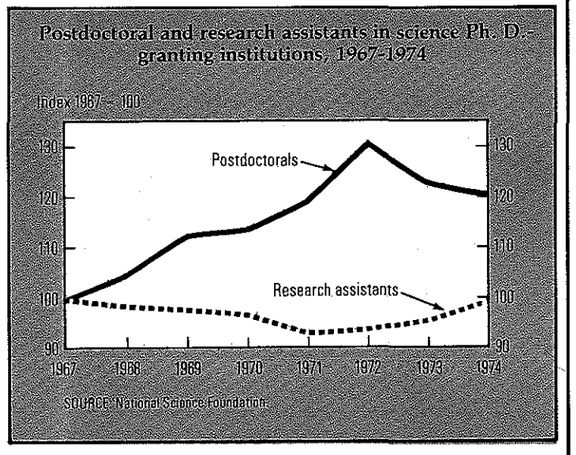
The number of science and engineering students in their first year of graduate study rose 9 percent between 1973 and 1974 and the increase was felt in every area except the mathematical sciences. More first-year students went into the life sciences than into any other area.

More full-time students supported themselves through their own financial resources than in previous years. The number of self-supported students rose 14 percent between 1973 and 1974; those receiving support from their own institutions or state and local governments increased by 3 percent. Only the number of federally sponsored students declined.

The number of women enrolled full time in graduate science programs went up almost 13 percent, while men increased by only 3 percent. In 1974 women represented 24 percent of the graduate science population, up from 19 percent in 1973.

While graduate science enrollment increased in 1974, the number of postdoctorals appointed in science departments declined. The 2-percent drop was heavily influenced by the decline in postdoctoral appointments in the life sciences, indicating a shift to research assistants for the conduct of this research.





excerpts from

Science Resources Studies HIGHLIGHTS

Division of Science Resources Studies
National Science Foundation

October 22, 1975

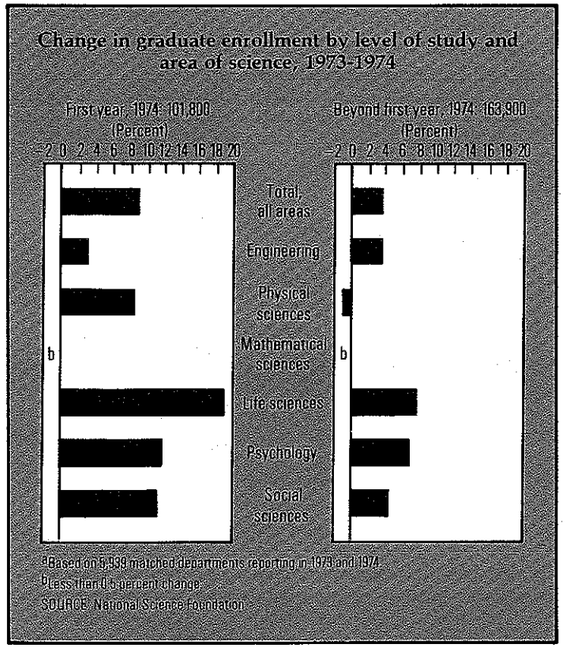
Percent change in graduate enrollment, 1973-1974

Area and field of science	1973	1974	Percent change
Total	200,708	211,826	5.5
Engineering	49,041	50,671	3.3
Civil	7,839	8,706	11.1
Electrical	13,022	13,655	4.9
Mechanical	6,789	7,108	4.7
All other	21,391	21,202	– .9
Physical sciences	31,060	31,509	1.4
Chemistry	13,663	13,019	– .3
Geosciences	5,436	5,943	9.3
Physics	9,743	9,672	– .7
All other	2,818	2,875	2.0
Mathematical sciences	17,798	17,742	– .3
Applied mathematics	4,756	4,935	3.8
Mathematics	11,395	11,049	– 3.0
Statistics	1,647	1,758	6.7
Life sciences	43,477	48,400	11.3
Agriculture	7,489	8,434	12.6
Biochemistry	3,259	3,478	6.7
Biology	5,908	6,312	6.8
All other	26,821	30,176	12.5
Psychology	17,260	18,647	8.0
Social sciences	42,072	44,857	6.6
Economics	8,927	9,194	3.0
Political science	10,757	10,993	2.2
Sociology	9,407	9,872	4.9
All other	12,981	14,798	14.0

[1]Based on full- and part-time enrollment in 5,939 matched departments reporting for 1973 and 1974.

SOURCE: National Science Foundation.

Change in graduate enrollment by level of study and area of science, 1973-1974



[a]Based on 5,939 matched departments reporting in 1973 and 1974.

[b]Less than 0.5 percent change.

SOURCE: National Science Foundation.

Sources

The Division of Science Resources Studies of the National Science Foundation has conducted a Survey of Graduate Student Support and Postdoctorals for three successive years. The survey is directed to all science Ph.D.-granting institutions in the United States and their medical school components. Both Ph.D. and master's students are included. In 1974, replies were received from 354 of the 355 institutions surveyed, including 104 medical schools, and data were compiled from 7,505 graduate science and engineering departments. Trend data for the period 1973 to 1974 were derived by combining, through indices, data obtained on applications to the NSF traineeship program for the period 1967 through 1971 with survey data for the remaining three years.



Photo: Ames Research Center/NASA

Left: *This fragment of the Murchison meteorite was discovered in Australia in 1969. Analysis of the Murchison meteorite proved conclusively, for the first time, the existence of extraterrestrial amino acids.*

Below: *In the planetary chemistry laboratory, experiments are devised which simulate primordial planetary conditions and the solar nebula so that scientists can better understand the processes of primordial organic chemistry. This apparatus simulates the atmosphere of planet Earth.*

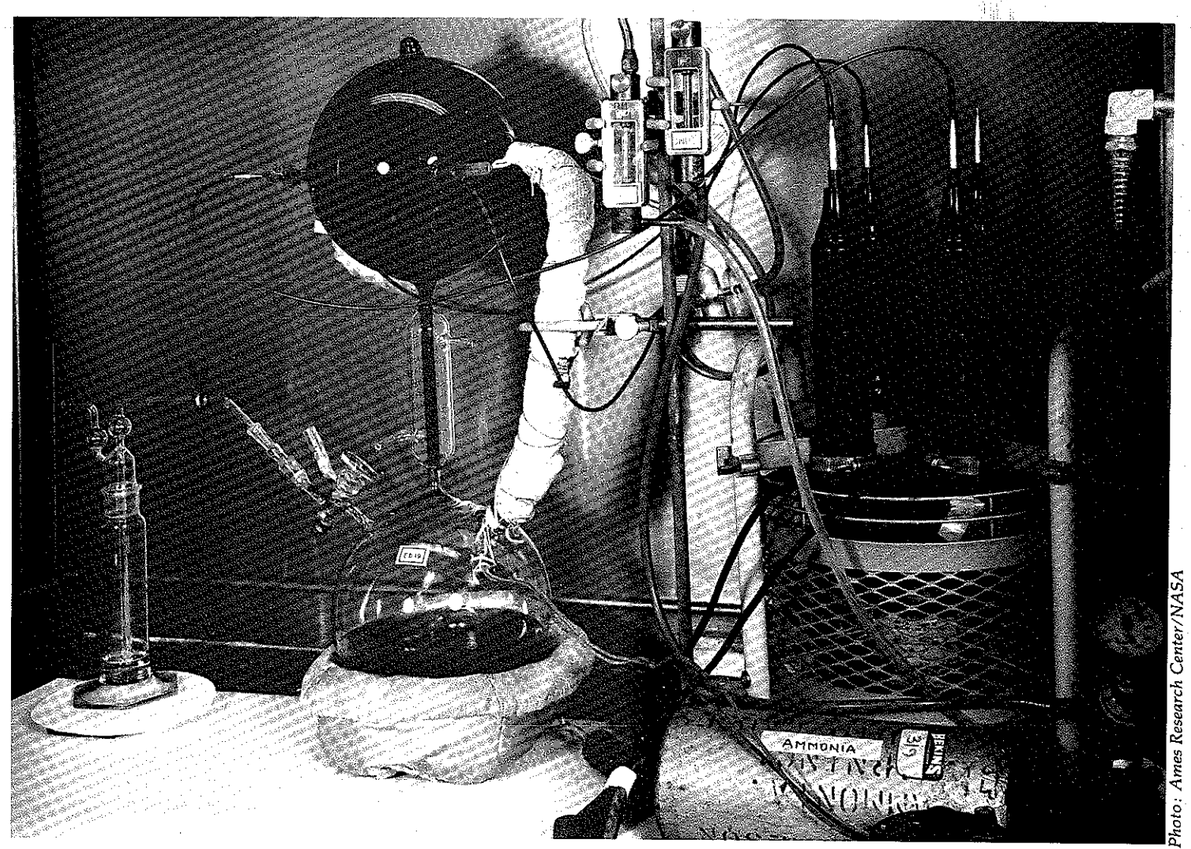


Photo: Ames Research Center/NASA

THE FIELD SWITCHERS

mo·bil·i·ty: the ability to change rapidly or easily, as in response to different moods, feelings, conditions, needs, or influences; flexibility, adaptability, etc.

Between spring 1972 and spring 1973 about 5,000 Ph. D.s in science and engineering switched from their doctoral specialties to a different broad field of employment, 1,200 of them leaving the field of science altogether.

In the past several months, many studies have been done on this phenomenon of "field switching." The Commission on Human Resources of the National Research Council is spearheading the effort to obtain and correlate the data, and reports on the results of such efforts are now finding a place on the bookshelves of educators and administrators nationwide.

The 1975 report of the Committee on a Study of National Needs for Biomedical and Behavioral Research Personnel notes that attention is now being paid to the field mobility of biomedical and behavioral scientists. "Whether biomedical and behavioral scientists will be mobile enough to meet future demands and whether extensive training will be necessary are important issues to be investigated."

Whereas mobility is of prime concern in assuring satisfactory supply to meet societal needs, in many fields, mobility is also the key to survival of the individual doctorate holder in the face of a market crunch. Notes the National Academy of Sciences report *Nuclear Science: A Survey of Funding, Facilities and Manpower* of the recent recipients of doctoral degrees in physics: "The high rate of production of Ph. D.s in physics during a period of decline in employment of Ph. D.s resulted in a substantial exodus of physicists from traditional areas of physics and even from physics itself. Each physicist has had to plot his own course through largely uncharted border areas between scientific fields to obtain a position of intellectual equity with his original expectations."

Interfield migration is common in all academic fields at this time. Outward migration is the case in chemistry, physics, social sciences and the biosciences, as indicated in Figure 1. Psychology and engineering have an approximately equal number entering and leaving; mathematical sciences and earth sciences have greater numbers of Ph. D.s entering than leaving.

Figure 2 provides an overview of physics employment in 1973. Only 62% of those doctoral scientists who received the Ph. D. in physics between 1930 and 1972 are currently employed in physics.

Perhaps the most extensive report on field-switching among doctorate recipients in science and engineering is currently being prepared by Betty D. Maxfield of the Commission on Human Resources. Dr. Maxfield utilized a variable sampling ratio to select a sample of 59,086 individuals according to year of doctorate, sex, field of Ph.D., size of doctoral institution and degree category (U.S. science, U.S. nonscience, foreign doctorate). Her report, soon to be published by the Commission on Human Resources, National Research Council, is intended to be descriptive rather than interpretative; data will be presented on general field mobility, primary work activities, sex, citizenship, salaries, and racial minority/majority comparisons of field switchers and retainers.

REFERENCES

Nuclear Science: A Survey of Funding, Facilities and Manpower. (Reports by Three Ad Hoc Panels of the Committee on Nuclear Science, Assembly of Mathematical and Physical Sciences, National Research Council), National Academy of Sciences, Washington, D. C. 1975.

Personnel Needs and Training for Biomedical and Behavioral Research. (The 1975 Report of the Committee on a Study of National Needs for Biomedical and Behavioral Research Personnel), National Academy of Sciences, Washington, D. C., June 1975.

Field Mobility of Doctoral Scientists and Engineers, Betty Maxfield, Commission on Human Resources, National Research Council, National Academy of Sciences, in press.

Figure 1

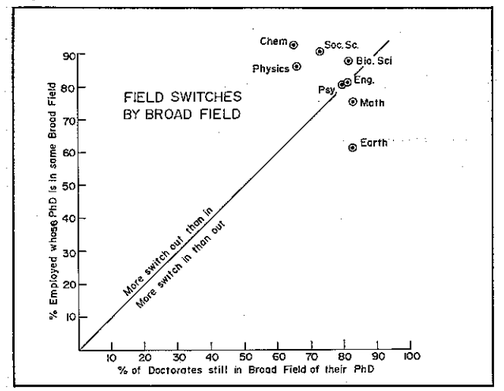
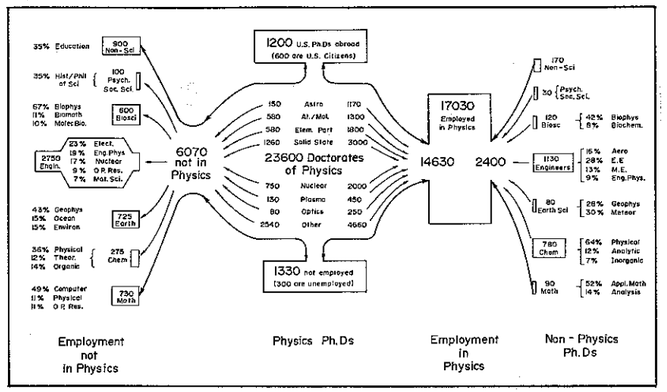


Figure 2



Source: *Survey of Doctoral Scientists and Engineers, National Research Council, 1973.*

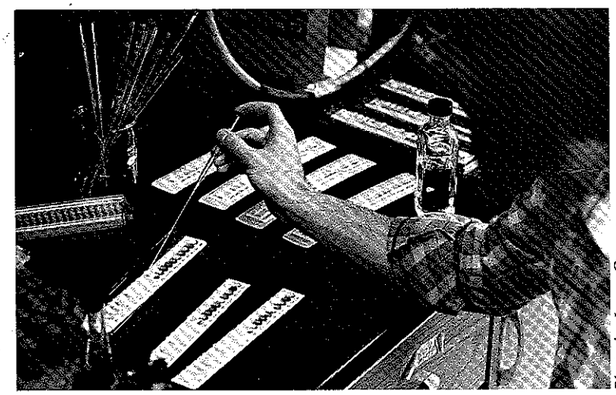


Photo by Larry Crouse

Left: *Doctoral student Steve Orndorff transfers cultures for identification using a miniature test series.*

Below: *Dr. Aaron Mills, a postdoctoral fellow, utilizes a gas chromatograph to analyze petroleum degraded by microorganisms.*

Bottom Right: *Sharon Berk, a graduate student in Dr. Colwell's laboratory, studies specimens under the microscope as part of her research on bacteria-protozoa relationships.*

Martin Marietta Corporation, while Dr. Jayne Carney, who was with Dr. Colwell until August 1975, is working for Biospherics Co. in Rockville, Maryland. Jim Faulkner, who did a master's thesis in microbiology, went on to law school, having developed an interest in environmental law.

In addition to a research team of about five postdoctoral fellows and five graduate students, Dr. Colwell also provides research opportunities for honors undergraduates in her laboratory. She is especially proud of the accomplishments of some of these students, among them Martin Quigley and Christine Carty. Quigley studied deep sea bacteria with Dr. Colwell as an undergraduate, went to medical school, and is now a practicing physician. Described by Dr. Colwell as "unsure of her career goals," Carty received her bachelor's degree from Maryland in general biology, but was so "turned on" by marine microbiology that she completed a second bachelor's degree in microbiology and was awarded a prestigious NSF predoctoral fellowship to pursue her Ph.D. at Rutgers University.

Rita Colwell sees a bright future for microbiology. She notes that public understanding of the need for the sort of information provided by microbiologists is on the upswing and that the public's comprehension of the field is constantly being refined. Support in financial terms is available, although she mentions that some of the funding agencies to which microbiologists turn for support, among them the Environmental Protection Agency (EPA) and the Energy Research and Development Administration (ERDA), are made up almost entirely of engineers who sometimes lack a comprehensive understanding of the microbiological implications of the problems they face. Dr. Colwell sees this as a surmountable barrier, however, affirming the presence of support for basic research, despite the need to couch the proposals for such research in terms of relevancy and potential application.

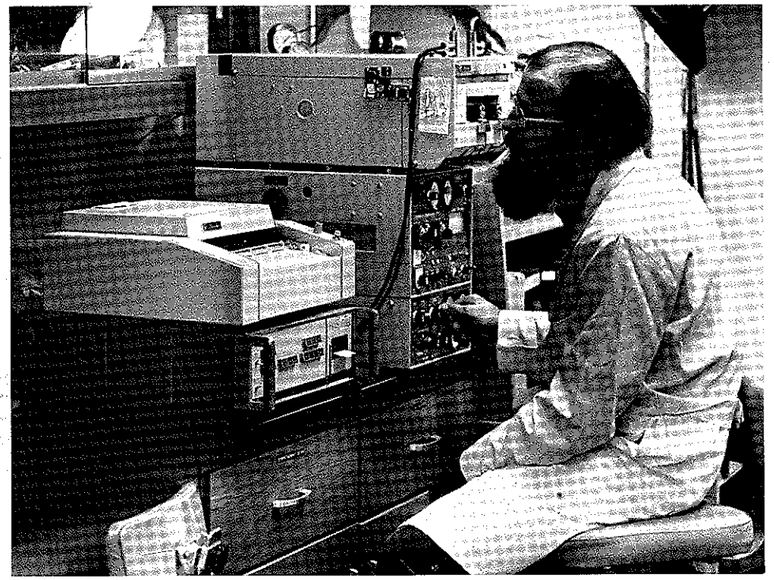


Photo by Larry Crouse

Dr. Colwell says that "as in all fields, women are exploited in microbiology—they are too often technicians instead of doctoral level scientists," but she qualifies her statement somewhat. "At Maryland, that is not the case; this department is blind with respect to race and sex—professionally, with respect to the latter, that is. Microbiology is simply an excellent field for women—and for men!"

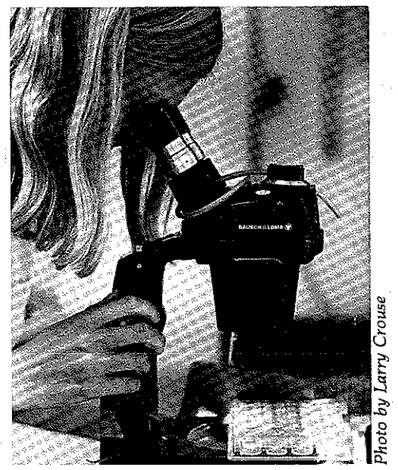


Photo by Larry Crouse

in microbiology

"There are jobs waiting out there—we have placed all of our graduates. Everyone may not have gotten the specific job that he or she wanted, but no one is driving a taxicab."

While national organizations and educational associations pour forth seemingly endless reports on the dismal state of the job market for advanced degree holders, the "Ph.D. glut," the "new depression in higher education," and discouraging manpower projections, Dr. Rita Rossi Colwell, professor of microbiology at the College Park campus and a specialist in microbial ecology, literally bubbles with enthusiasm and urges students with whom she comes into contact to study microbiology, if it is a field that interests them, to get advanced degrees, and to take those jobs.

The enrollment of students in the Department of Microbiology's undergraduate program has increased by 25% per year for the past five years, and one of Dr. Colwell's major concerns is that the Department lacks adequate resources to handle this burgeoning population of would-be microbiologists as effectively as it would like. Noting that a recent study by the American Society for Microbiology confirms her contention that training microbiologists at the current rate will result in severe shortages over the next few decades, she says she sees little possibility of the kind of Ph.D. glut experienced in other fields such as astronomy, physics and many of the humanities.

Dr. Colwell calls microbiology "an outstanding field." "Microbiology is both a very practical and a highly theoretical science. From it comes our understanding of how to make good Roquefort cheese as well as the unraveling of the mysteries of the genetic code and the mechanisms of DNA."

A basic science in that the study of microorganisms provides great insight into the makeup and mechanisms of higher organisms, microbiology is essential in understanding the molecular biology of viruses, in studying gene action and mutation, and in investigating the causes of cancer development in organisms.



Photo by Larry Crouse

Dr. Rita Rossi Colwell

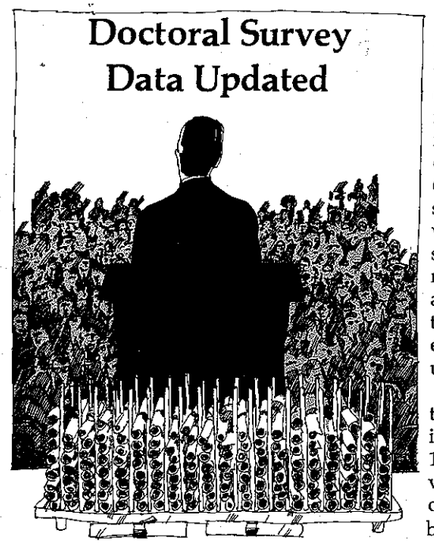
On a more obviously practical level, microbiology may provide a solution to the world's food shortages—"The tons of grain rotting in ships might be salvaged if we understood more clearly the destructive properties of certain microorganisms."—and to deficiencies in health care delivery systems—"People will always be getting sick and the vast majority of illnesses can be traced to microbial causes; a major part of our health care delivery system is clinical laboratory work." Laymen often take for granted the contributions of microbiology to their everyday lives. Notes Dr. Colwell, "People are still using yeast to brew beer. When people stop drinking beer, perhaps microbiologists will then have to start worrying about unemployment!"

Dr. Colwell's enthusiasm is backed by her students' outstanding "track record." The graduate students and postdoctoral fellows who have worked in her laboratory over the past several years have garnered attractive teaching and research positions in both university and industrial settings.

Ron Sizemore (Ph.D., August 1975), whose thesis with Dr. Colwell dealt with plasmids isolated from antibiotic-resistant marine bacteria, is now an assistant professor at the University of Houston, where he is continuing the work done for his Ph.D. dissertation. Former student James Oliver holds a faculty position at the University of North Carolina. Another former student, Dr. T. Kaneko, is currently in the Arctic studying the effects of the Alaskan pipeline development on the Arctic ecosystem.

Postdoc Gary Sayler is at the University of Tennessee where he is an assistant professor in the Department of Microbiology, while former graduate student Minnie Sochard is an assistant professor at Catholic University where she heads a research group in microbiology. Lily Wan, who held the post of faculty research assistant in Dr. Colwell's laboratory, has her own environmental microbiology laboratory in the Department of Sanitary Engineering at Howard University.

Now out of academia, former postdoc John Walker is employed by the



Doctoral Survey Data Updated

Since 1971-1972, the Graduate School *Chronicle* has conducted an annual survey of doctoral recipients in order to determine their employment status immediately following graduation. The results of the 1974-1975 survey appeared on page 29 of the October issue of the *Chronicle*; those results were tabulated somewhat earlier than figures from previous years, and therefore the comparison chart suggests a somewhat higher relative rate of unemployment than is actually the case. In addition, the October chart contained some typographic errors which have been corrected in the updated chart reproduced below.

Most of the former students listed in the 1974-1975 figures as "actively seeking employment" were recipients of May 1975 doctorates. Many of these individuals obtained positions through late openings at universities and colleges, both in teaching and in research, while other doctorate holders solidified arrangements over the summer months for employment with government agencies and industrial firms.

Additional responses to the survey of doctoral employment, received between July 1 and October 1, indicate that the unemployment rate for University of Maryland Ph. D.s (calculated using those individuals actively seeking employment and unable to find suitable positions) now stands at 1.7%. Our report as of July 1 indicated that twenty-seven of the 399 doctoral recipients from 1974-1975 were actively seeking employment; as of October 1, that figure stood at seven.

Plans are currently underway to provide information on the employment status of master's degree recipients. Assuming a reliable sampling device can be designed, the 1975-1976 degree recipients will be the first group surveyed.

DOCTORAL EMPLOYMENT SURVEY

Field of Employment	Total by Academic Year				1974-75 by Academic Division					
	1971-72	1972-73	1973-74	1974-75	Ag&LS	A&H	H&CR	MPSE	B&SS	Health
TEACHING										
University or College level	129	113	92	92	6	22	28	17	19	
Pre-college Level	8	6	4	14		3	10		1	
RESEARCH										
University or College Level	3	26	5	5	2	1	1	1		
Postdoctoral Appointment	37	34	16	36	14		2	13	3	4
Industry	26	24	23	37	11	1		22	1	2
Government	70	40	64	45	14	3	3	22	2	1
Other		1	8	1	1					
ADMINISTRATION										
Educational	25	20	22	32		2	30			
Industrial	1	7	7	2					2	
Governmental	10	18	13	15	1	3	6		5	
JOINT APPOINTMENTS										
Teaching/Research (University Level)	16	21	21	21	3		11	1	4	2
Teaching/Administration (University Level)	10	9	6	12			11			1
Research/Administration (Government)		3	4	4	1			2	1	
Research/Administration (Industry)			3	6	2			3	1	
Teaching/Research/Administration (University)			3	10			9			1
Other	2			10	3		4		2	1
OTHER										
Practicing Psychologists/Therapists	17	11	18	15			9		6	
Extension Education Specialists	3	1		3	3					
Military	2	1		4		1	1	1	1	
Miscellaneous	5	2	8	5	1	2	1		1	
UNEMPLOYED										
Actively Seeking Employment	7	10	18	7	1	3	3			
Not Actively Seeking Employment	2	3	1	4		2	1		1	
Insufficient Information	10	9	4	17		2	6	5	2	2
Further Education		4	1	1						1
Deceased		1	1							
Retired				1			1			
TOTAL	*383	364	342	399	63	45	137	87	52	15

*Information forms for all 404 doctorates for 1971-1972 were sent to the departments and graduate advisors to determine the professional activities of the former students. A total of 383 completed responses were returned.

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In Dr. R. R. Colwell's laboratory in the Department of Microbiology at College Park, faculty research assistant Betsy Conrad studies results of a study of a South American oil spill. See story on page 2.

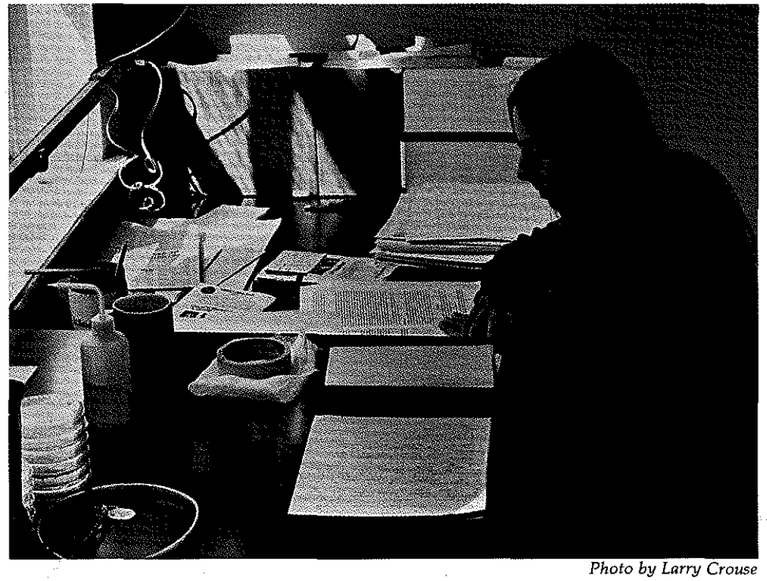


Photo by Larry Crouse

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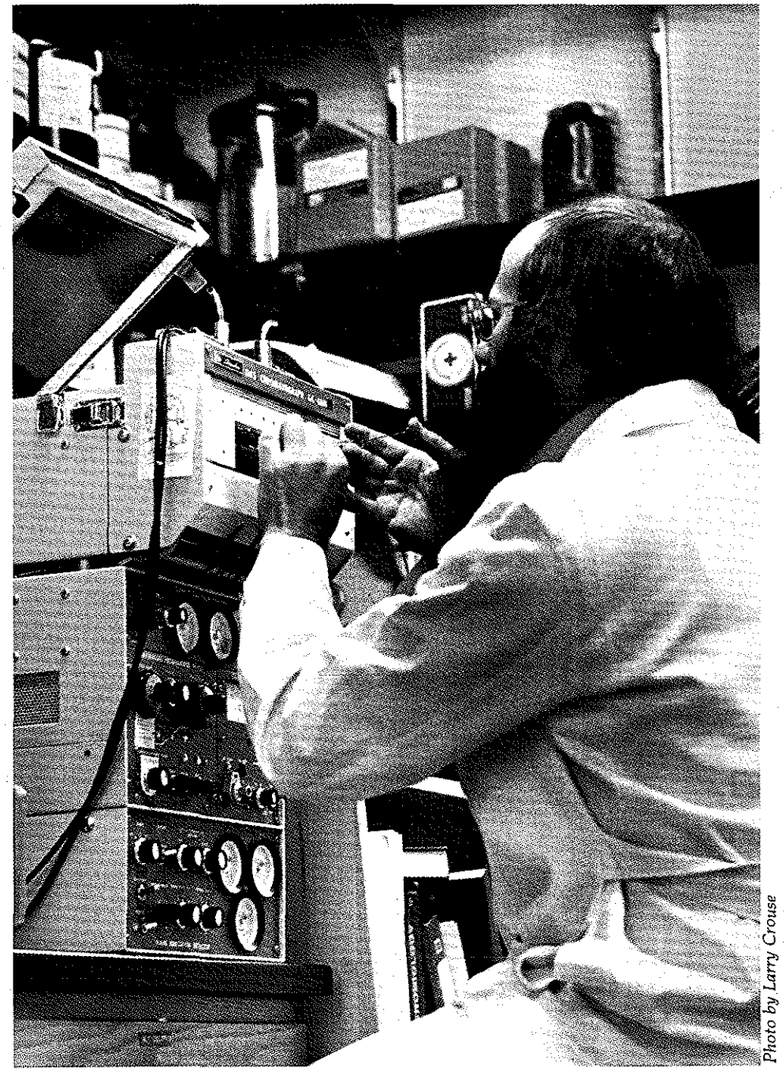


Photo by Larry Crouse

In This Issue:

MICROBIOLOGY *page 2*
Professor Rita Colwell reports abundant employment opportunities for microbiologists.

NSF EXCERPTS *page 4*
According to a recent study, graduate science enrollment in 1974 shows first increase since 1969.

STRATEGY *page 6*
UMAB's concentration in social strategy equips students to deal with social service delivery systems.

PATENT DISCLOSURES *page 9*
Patent disclosures at the University have doubled this year.

ENROLLMENT *page 10*
Graduate student enrollment at the University of Maryland is up in 1975.

CAPSULES *page 11*

CHEMICAL EVOLUTION *page 12*
Experts on the origin of life gather at UMCP to discuss chemical evolution of the Precambrian.

MOBILITY *page 14*
National organizations study the mobility of doctoral scientists among fields of employment.

DOCTORAL SURVEY *page 15*
Survey of doctoral employment at University of Maryland reveals 1.7% unemployment as of October 1975.

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