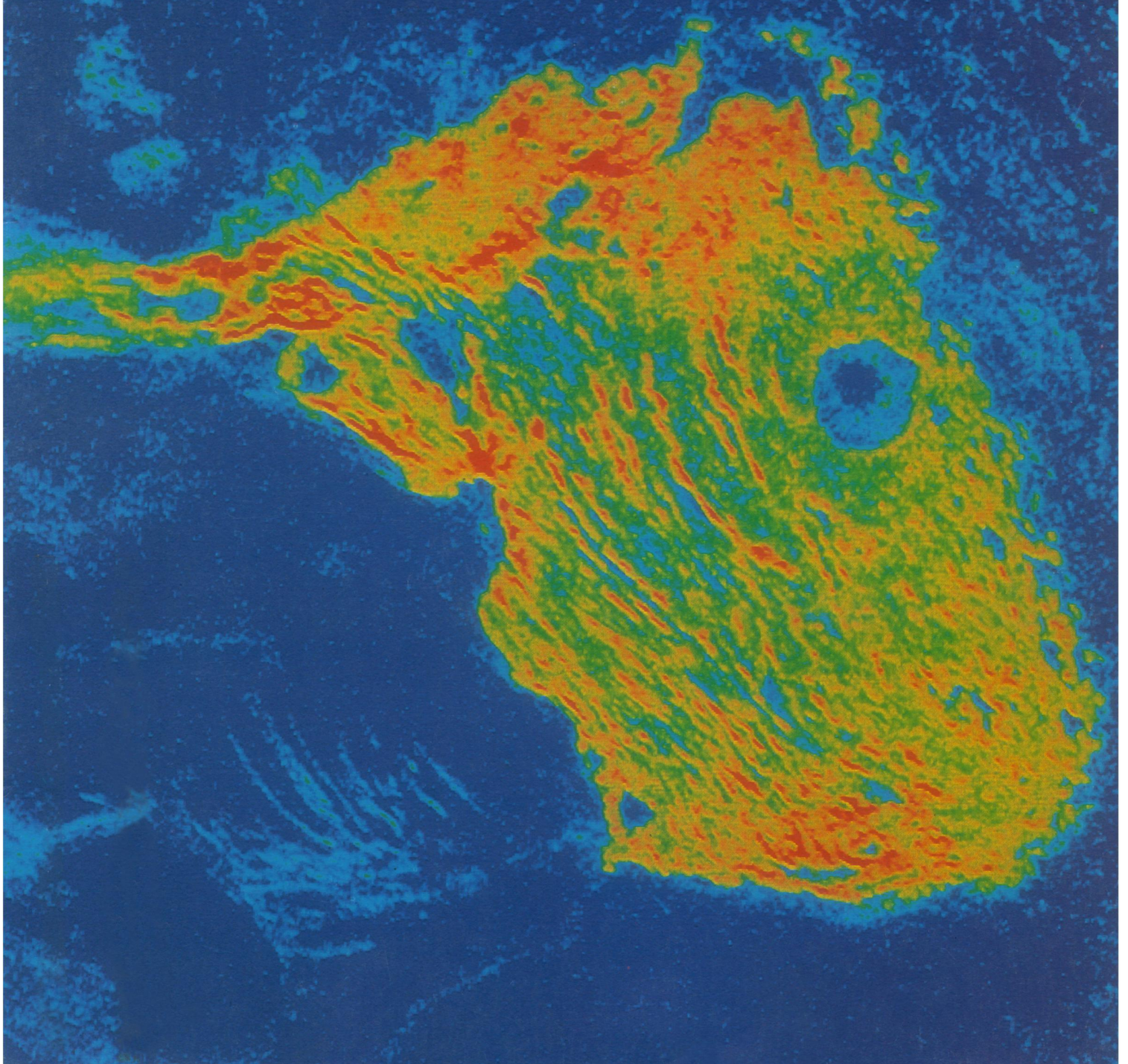
12 AUGUST 1983 · VOL. 221 · NO. 4611 $2.50

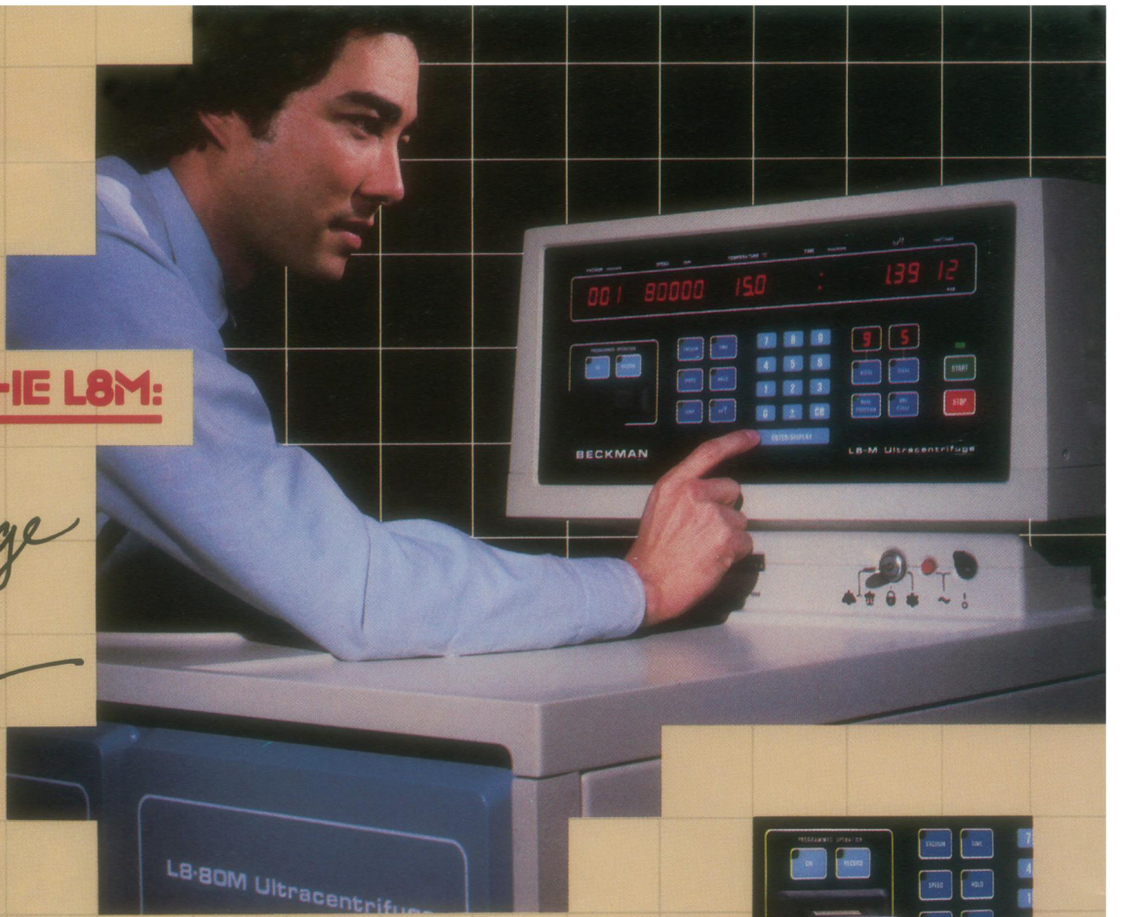
SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



INTRODUCING THE L8M:

The ultracentrifuge evolution continues



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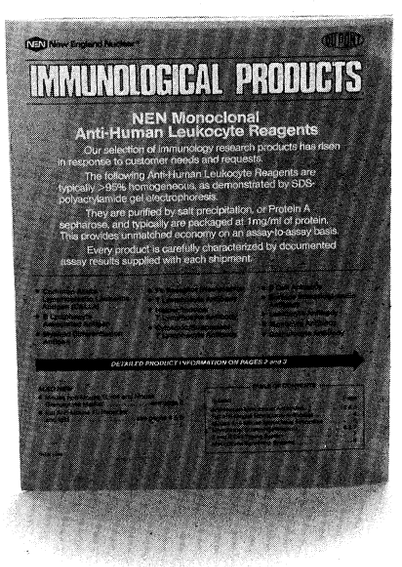

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ISSN 0036-8075
12 August 1983
Volume 221, No. 4611

SCIENCE

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with **The Scientific Monthly**® Domestic individual membership and subscription (51 issues): $53. Domestic institutional subscription (51 issues): $90. Foreign postage extra: Canada $24, other (surface mail) $27, air-surface via Amsterdam $65. First class, airmail, school-year, and student rates on request. Single copies $2.50 ($3 by mail); back issues $3 ($3.50 by mail); Biotechnology issue, $5 ($5.50 by mail); classroom rates on request. **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. **Postmaster:** Send Form 3579 to *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Radar image of the Maxwell Montes, a mountain range rising 12 kilometers above the mean planetary radius of Venus. The range, which is about 1000 kilometers long, shows alternating bands of high backscatter (reds and yellows) and low backscatter (blues) in patterns comparable to those of tectonic features (folds and faults) on Earth. The image was taken with the 12.6-centimeter wavelength radar system at Arecibo Observatory, Puerto Rico. See page 644.

Hotpack/Heinicke
Pulsonic 4000 Washer
Solid State Microprocessor Controls
Four baskets

OUR NEW WASHERS KEEP THE PRESSURE HIGH, COSTS LOW, AND CONTAMINATION OUT OF YOUR GLASSWARE.

Our washers have always had a spotless reputation for keeping lab glassware immaculate. Now, our new Pulsonic® washers do it even better! Featuring unique solid-state push button controls with digital readout for automatic selection of wash cycles and water temperature, they fight contamination three ways.

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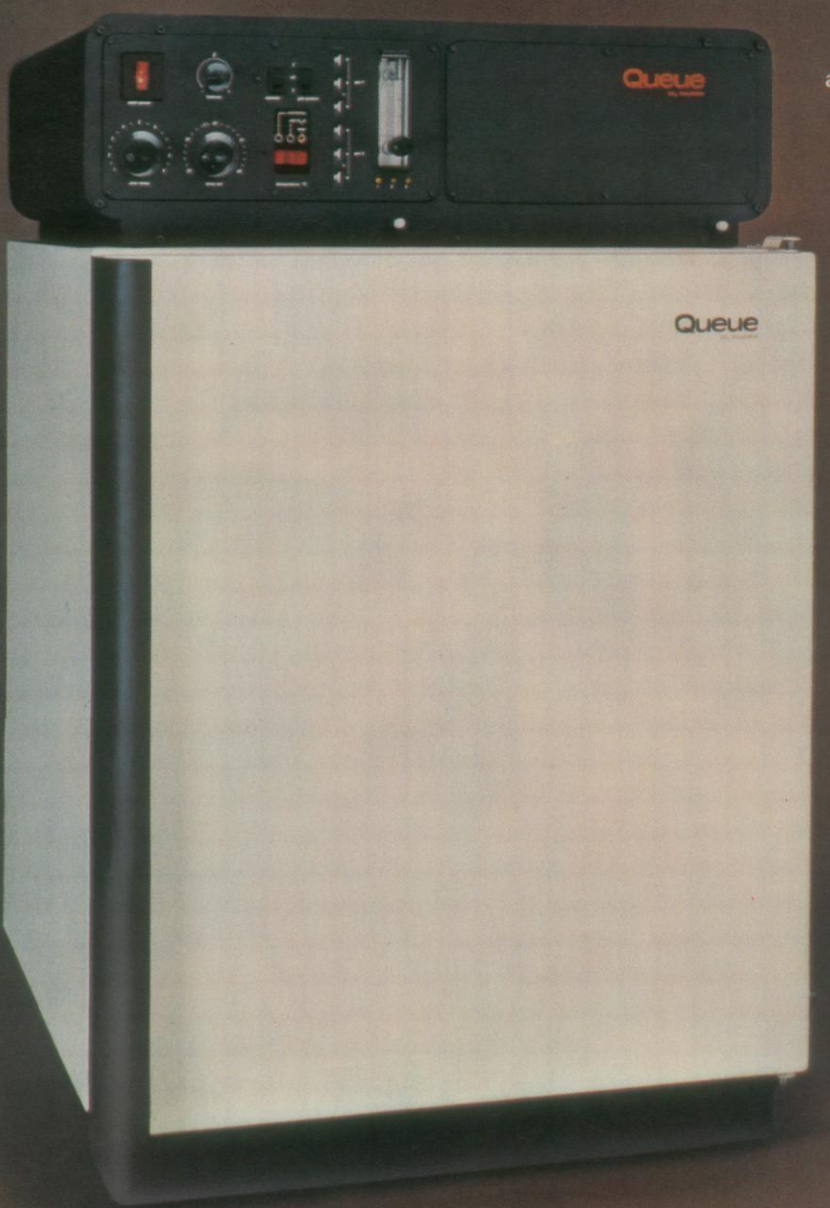

Model 2210/2211
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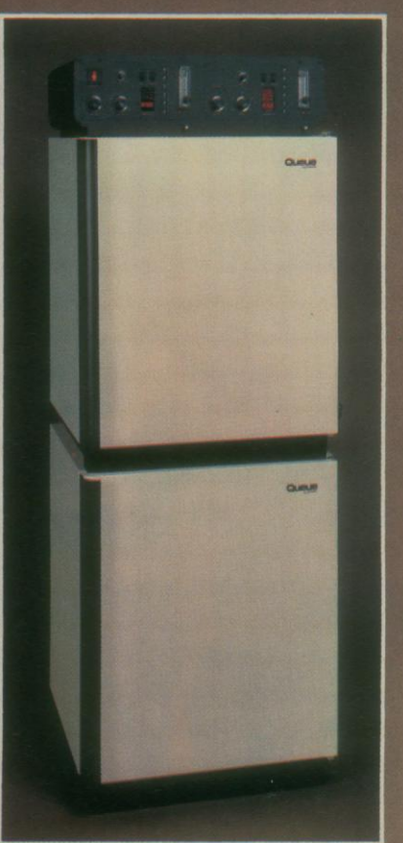

Model 2220/2221
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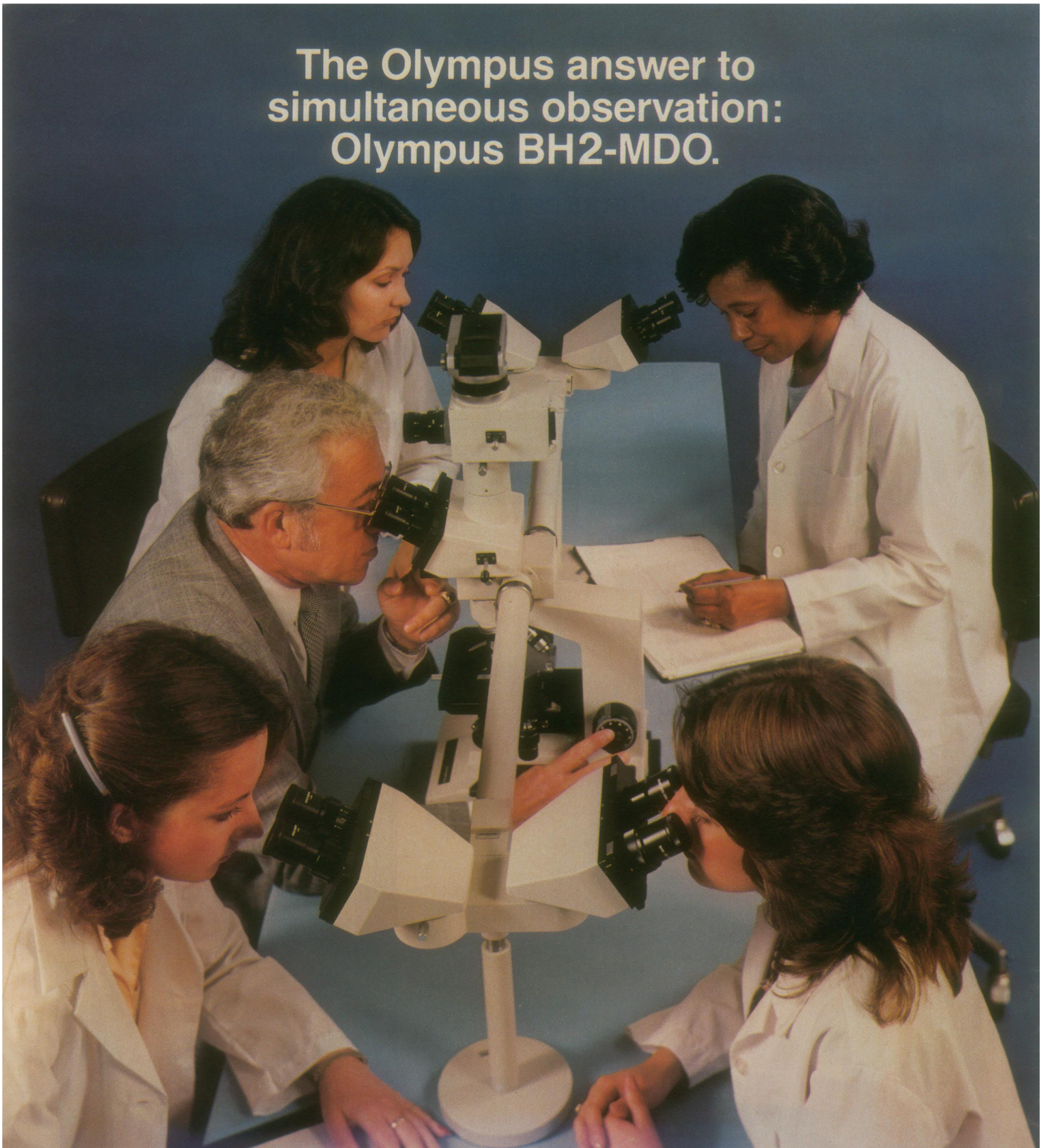
The Olympus answer to simultaneous observation: Olympus BH2-MDO.



Olympus introduces the most advanced system for simultaneous viewing of a single specimen, with identical brightness, magnification, visual field and specimen orientation. It's the Olympus response to the growing need for superior training and consultation instrumentation. Totally versatile, the BH2-MDO permits the use of three to five observation stations and photomicrographic camera, with an illuminated transparent pointer that can be positioned anywhere in the field of view.

The Olympus BH2-MDO is part of the sophisticated new BH-2 System Microscope, worthy of your examination. To arrange a demonstration, contact the Olympus Microscope Dealer listed in your Yellow pages, or Olympus Corporation of America, 4 Nevada Drive, New Hyde Park, NY 11042.

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TIAA announces

MOD ONE...

a brand new concept in personal life insurance protection for families in the academic community that

- cuts first-year premiums up to 50%
- gives discounts of 33⅓% to 40% on large policies

Is digging up that first premium stopping you from providing all the financial protection your family deserves? Then here's really good news. With the introduction of MOD ONE* October 1, 1982, Teachers Insurance has cut up to 50% from initial premiums on term policies of $100,000 to $249,000. And we've trimmed off even more for policies of $250,000 and above. This means you now need only about half as much premium money "up front" to start a large new TIAA policy. Putting it another way, for roughly the same outlay as before you can now begin a new policy that provides twice as much immediate protection for your family!

Here's what men and women aged 35, for example, now pay for 5-Year Renewable Term policies of different amounts:

First-Year Premiums for TIAA 5-Year Renewable Term Policies

Policy Amount ▶	$50,000	$100,000	$150,000	$200,000	$250,000
Issued to men aged 35					
First-year premium	$126.75	$169.00	$253.50	$338.00	$380.25
Premium per $1,000	$2.53	$1.69	$1.69	$1.69	$1.52
Issued to women aged 35					
First-year premium	$110.25	$147.00	$220.50	$294.00	$330.75
Premium per $1,000	$2.20	$1.47	$1.47	$1.47	$1.32

As you can see, premium rates for policies of $100,000 to $249,000 are ⅓ less than those for smaller policies, and for policies of $250,000 or more, they're 40% less. Substantially lower first-year premiums for all ages and big discounts for larger policies encourage everyone to consider the higher levels of family protection they may have felt they just couldn't afford until now.

Premiums for MOD ONE policies increase beginning with the second year, but generous dividends, credited concurrently, will automatically reduce those premiums. Under the present dividend scale, expected payments for the second and subsequent years of the 5-year policy period in the examples above will be identical to the premium for the first year shown. While dividends cannot be guaranteed for the future, of course, TIAA has paid dividends on life insurance each year since 1918.

To receive personal illustrations of new MOD ONE policies, mail the coupon; or phone the TIAA Life Insurance Advisory Center Toll Free at 800-223-1200 (in New York, call collect 212-490-9000). No one will call on you as a result of your inquiry.

Eligibility to apply for TIAA life insurance is extended to employees of colleges, universities, private schools, and certain other nonprofit educational and research institutions. The employee's spouse is also eligible provided more than half of their combined earned income is from a qualifying institution.

Note to present TIAA policyowners: MOD ONE premium rates apply only to policies issued on or after October 1, 1982, but cash dividends payable in accordance with the 1982 scale will continue to provide equitable treatment for policies issued prior to that date.

*Modified first-year premium.

TIAA Established as a Nonprofit Service Organization by the Carnegie Foundation for the Advancement of Teaching

S308

Life Insurance Advisory Center
Teachers Insurance and Annuity Association
730 Third Avenue, New York, NY 10017

Please mail me the facts about new TIAA MOD ONE life insurance policies with personal illustrations of low-cost Term policies for my age.

Name _____ Birthdate _____

Title/Position _____

Home Address _____

City _____ State _____ Zip _____

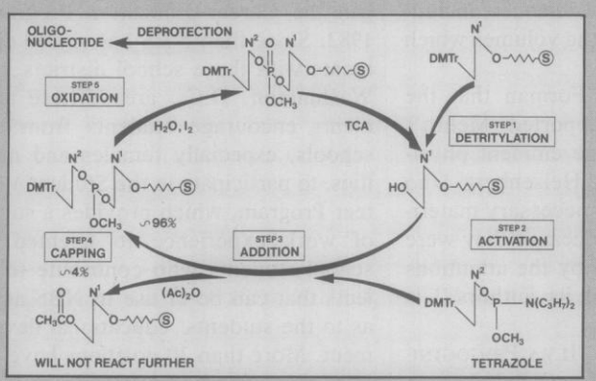
Nonprofit educational or scientific employer (college, university, private school, etc.) _____

If your spouse is also eligible according to the rules at left, please fill in: _____
Spouse's name _____ Birthdate _____

BIOSYSTEMS UPDATE

Major Progress Announced in DNA Synthesis

Improvements in phosphoramidite chemistry, as implemented by Applied Biosystems, make it the fastest, most efficient, and most economical means of synthesizing DNA. If you haven't made DNA with our diisopropyl phosphoramidite nucleosides, you may not be aware of the many advantages this method has to offer.

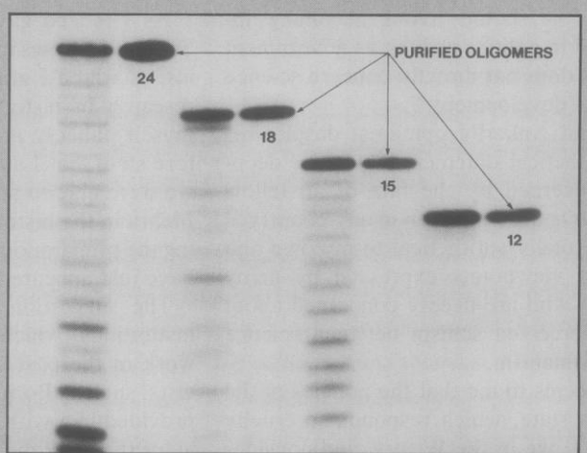


Synthesis cycle for phosphoramidite chemistry gives high yields of easily purified oligonucleotides.

Phosphoramidite chemistry provides 95-97 percent coupling efficiency and yields three to ten O.D. of purified DNA when synthesizing at only the one μmole scale. Oligonucleotides of greater than 50 bases have been synthesized using this method and 30-40 base fragments are routine.

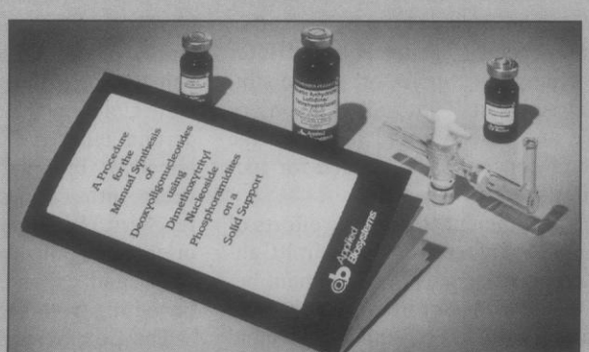
Recent price reductions allow synthesis for only $3-4 per base addition and the phosphoramidites have virtually unlimited shelf life, so waste is also eliminated. Even in solution, they are stable for weeks. The phosphoramidite chemistry also saves time—only 15-20 minutes are required for each complete base addition cycle.

This new chemistry is so convenient you'll never go back to older procedures. No dimers or trimers are ever needed. No pyridine is used and no redistillation is required. All reactions are carried out at room temperature so side products are minimized.



Autoradiogram of crude isolates and corresponding purified oligonucleotides. Purification is facilitated by a capping reaction which minimizes the longer chain impurities in the crude products.

Applied Biosystems has the total solution for your DNA synthesis needs. We provide ultrapure, highly stable reagents, the key to success using this reliable method. In addition, we provide a detailed procedure for manual DNA synthesis. As your requirements for custom DNA increase, our Model 380A DNA Synthesizer can make it automatically in your laboratory.



Write for our synthesis procedure and Model 380A DNA Synthesizer brochure. Circle #74

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Basic Tool of the Biotechnologist's Art: S&S Nitrocellulose

Research in hybridization and recombinant DNA technology has already yielded practical results in diagnostics, pharmaceuticals, and in the chemical and food industries. S&S products are now being used in key research techniques to develop new microbes that have advanced the applied field of fermentation biotechnology. For example, S&S BA85 nitrocellulose is widely used to screen bacterial lawns for specific DNA—containing colonies (shown left).

Typically, S&S products have helped establish the applications of DNA/RNA hybridization technology. For example—screening for genetic diseases such as sickle cell anemia has become a faster, surer procedure. Or, an improved identification technique is now under development for detecting the toxins produced by disease-causing bacteria.

S&S products helped develop the microbes used by pharmaceutical companies to make interferon, insulin and human growth hormone. And, the use of genetically altered microbes in the production of alcohol for fuel is now being explored.

To learn more about S&S products for genetics research, request Bulletin #301—"Products for Nucleic Acid and Protein Research."

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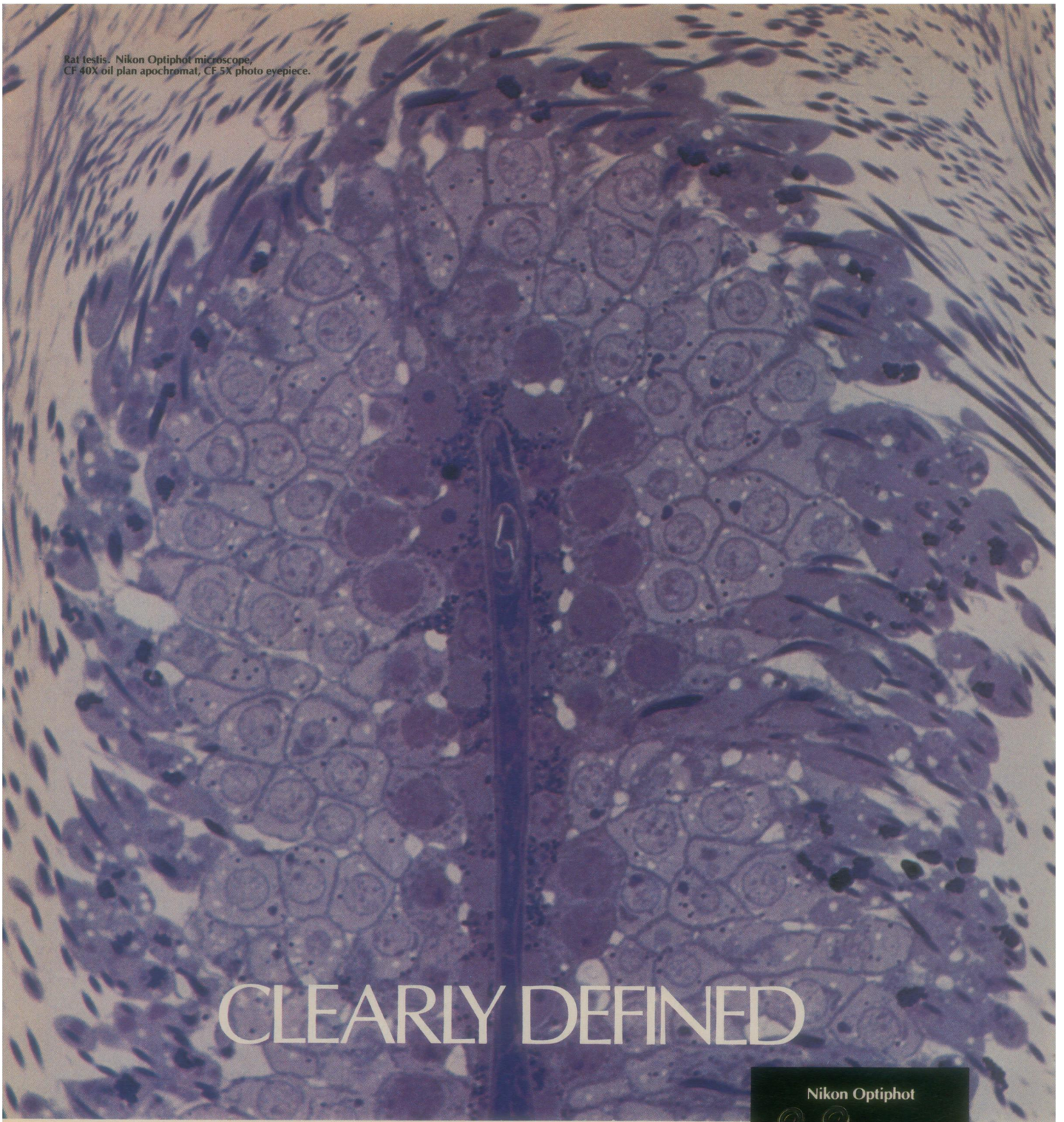

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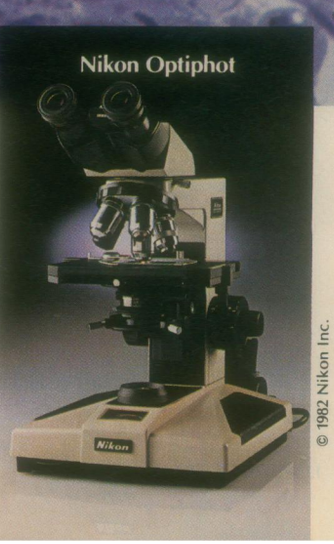

For information circle reader service number 102
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12 August 1983, Volume 221, Number 4611 **SCIENCE**

Science and the Atari Generation

Is it necessary to be an electrical engineering or computer science major to participate in the computer revolution? This generation of students must believe so, judged by the bulging enrollment in EE/CS programs compared to enrollments in science, in liberal arts, and even in other engineering fields. Massachusetts Institute of Technology provides a laboratory in which to observe this phenomenon. The students in its freshman class are admitted without regard to intended major and have a free choice of majors in the natural and social sciences, engineering, management, architecture, planning, and the humanities. From 1973 to 1983 at MIT the course preference of new undergraduate students for physics declined from 19 to 8 percent, for mathematics from 18 to 6 percent, and for chemistry from 8 to 2 percent, while preference for EE/CS increased from 14 to 32 percent and for other engineering fields or engineering with field undecided from 16 to 35 percent. Whereas in 1973, 38 percent of the students were engineering majors, today nearly 75 percent are, with about 35 percent in EE/CS. In addition, the students who do not choose science are among the best. Here and at other universities, ways to improve the balance of enrollments across departments are being considered.

Of course, enrollments in engineering are traditionally cyclic, responding to demand. However, most observers believe that the present situation is the result of a combination of cyclic change and a more permanent component of change caused by the computer, which is revolutionizing work in all fields of science and engineering and in the professions and society at large. What are the implications of this revolution for science education at the undergraduate level? What message is being conveyed to prospective science majors about the value of the B.S. degree, and will this message remain valid as the computer revolution continues?

Those in the natural sciences have not warmly embraced the computer as an essential component of their field. It is an important, sometimes necessary, and sometimes welcome adjunct to a research program. But not having been essential to the discovery of any new physical laws, it has not generally come to be viewed as a full partner or a subject for study in its own right. The computer belongs to the man-made world rather than to the natural world, and thus is more an object of study for engineers than for scientists. What are the implications of an undergraduate program in science devoid of serious intellectual involvement with the computer?

An undergraduate science degree is not considered a final degree but rather a preparation for something else. What this something may be is a crucial issue today. It is unquestionably a preparation for graduate study in science, the Ph.D. being the final degree. But not all students who receive the B.S. will continue to the Ph.D. With the costs of education at private schools exceeding $14,000 a year, the total cost of the Ph.D. degree in science will probably exceed $100,000—an amount not likely to be justified by future job prospects. In the past, a B.S. was considered basic technical preparation for a wide variety of professions. Will this continue to be true if science departments do not enthusiastically use the computer to enhance their undergraduate educational program? While some efforts to do this are under way, science faculties still seem reluctant to consider the computer an important part of undergraduate education.

It is likely that the intensity of the current enrollment shifts will moderate somewhat. But this generation of students must be met on its own ground, and that is very likely to be in front of a cathode-ray tube display. Once experienced, the expansion of personal intellectual power made available by the computer is not easily given up; it must have an important place in the teaching of science. Given the present state of the computer revolution, it is difficult to say that the students are making a mistake in wanting to be a part of the action.—SHEILA WIDNALL, *Chairman, Faculty Committee on Undergraduate Admissions and Financial Aid, Massachusetts Institute of Technology, Cambridge 02139*

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