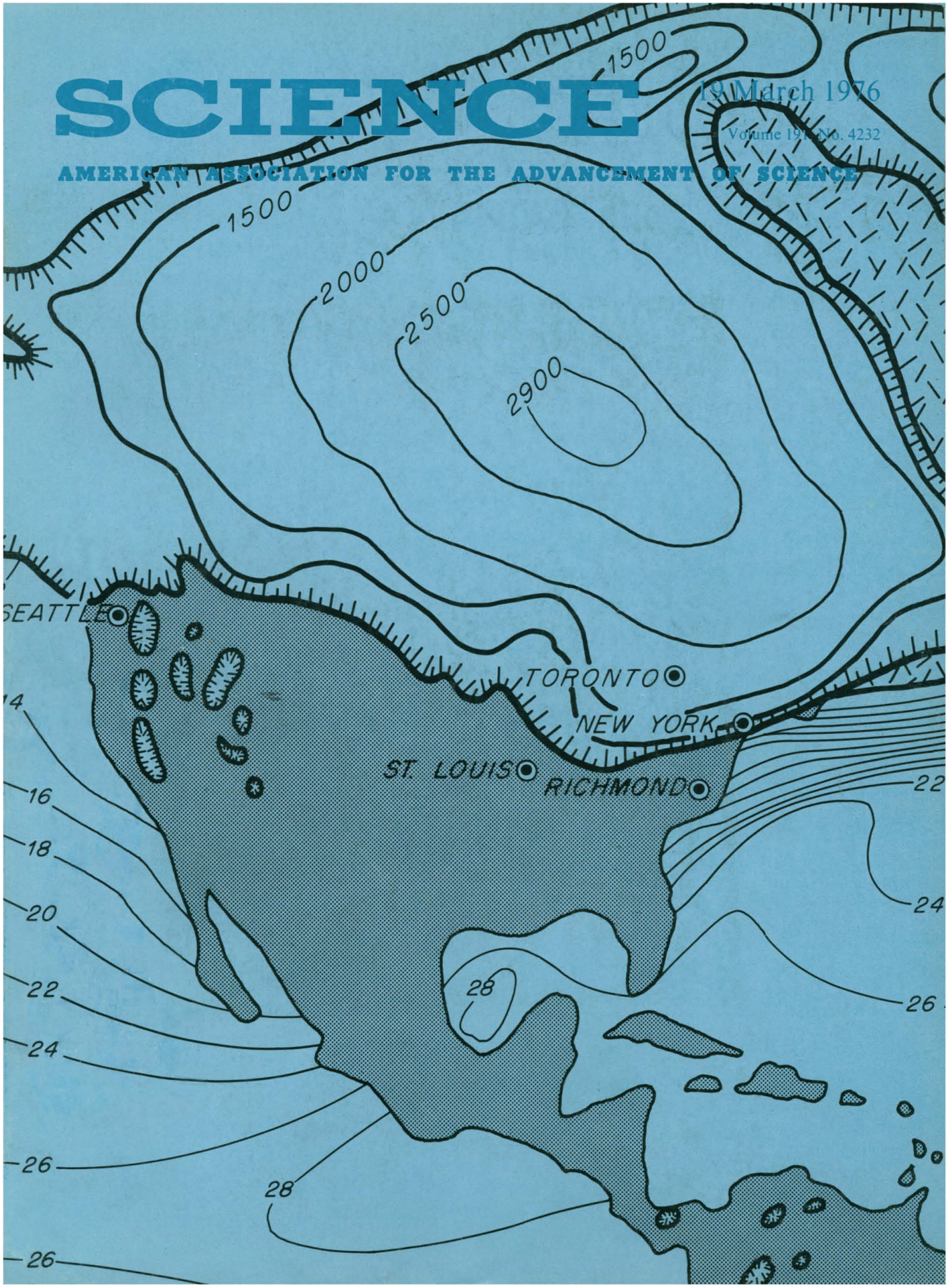
SCIENCE

19 March 1976

Volume 191, No. 4232

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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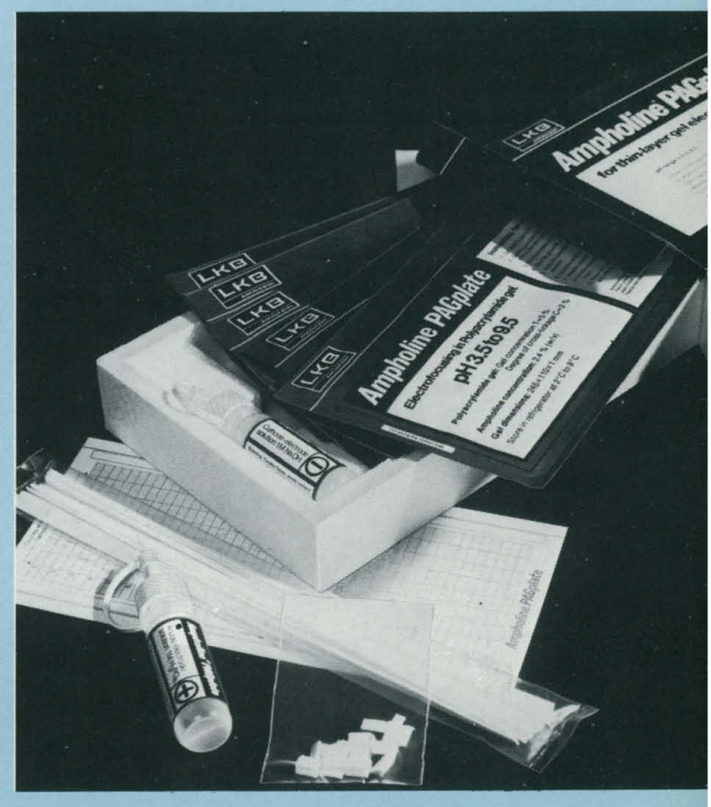

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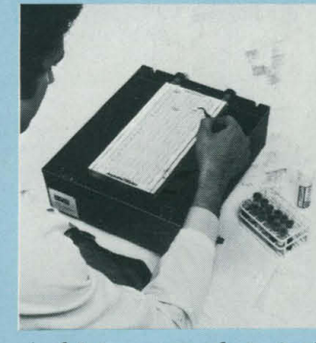

Applying your sample is simple and precise with the sample application pieces. Dip, soak for a few seconds in your sample solution, and then place on the gel surface.

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S-3-19-76

19 March 1976

Volume 191, No. 4232

SCIENCE

SCIENCE is published weekly, except the last week in December, but with an extra issue on the fourth Tuesday in November, by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Now combined with The Scientific Monthly. Second-class postage paid at Washington, D.C. and additional entry. Member rates on request. Annual subscription $50; foreign postage: Canada $10, Americas $12, overseas $14, air lift to Europe, $30. Single copies $2 (back issues $3) except Materials Issue (20 Feb. 1975) is $3 and **Guide to Scientific Instruments** is $6. School year subscription: 9 months $37.50; 10 months $41.75. Provide 6 weeks' notice for change of address, giving new and old address and zip codes. Send a recent address label. **Science is indexed in the Reader's Guide to Periodical Literature.**

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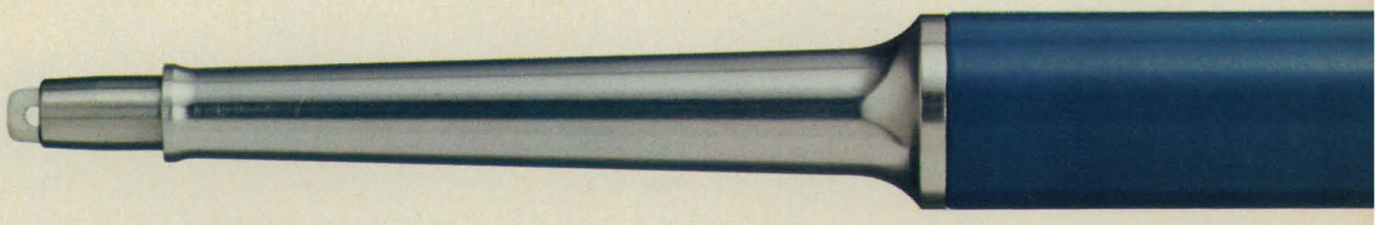
The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress. Postmaster: Send Form 3579 to SCIENCE, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005.

COVER

North America during the last major glaciation 18,000 years ago. A diagrammatic illustration of the extent and elevation of glacial ice, sea level lowered by 85 meters, and the pattern of oceanic surface temperature. See page 1131. [Andrew McIntyre, CLIMAP, Lamont-Doherty Geological Observatory, Palisades, New York]

The "pipetting



Sometimes it's hard to think of the typical pushbutton pipette as a precision laboratory instrument. Many don't look, feel or act the part. But the first time you pick up and try an MLA Precision or Precision "D-Tipper" Pipette, there'll be no doubt in your mind you're using a true *"pipetting instrument."*

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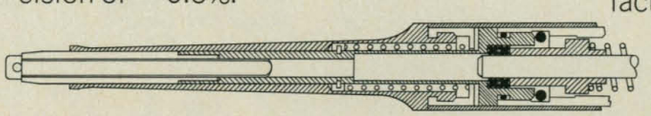

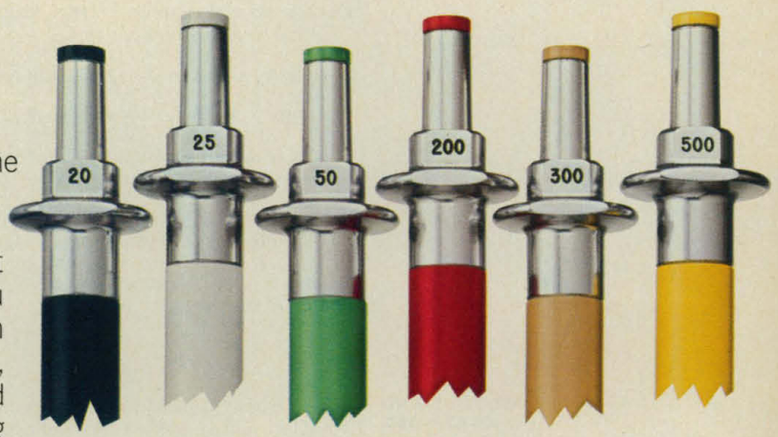

One-handed, Precision "D-Tipper"

All MLA Pipettes are made with advanced-design "Quad-ring" seals to provide multiple sealing surfaces...help assure a long, trouble-free life,...and permit low push-force, silky-smooth, one-stroke pipetting to insure less fatigue. There are no intermediate stops; each pipette is calibrated "to deliver" the stated quantity. All MLA Pipettes—with use of MLA Tip Trays and special outer package—also provide one-handed pickup, delivery and de-tipping for greater safety and convenience. In fact, Precision "D-Tipper" Pipettes detip automatically with just an upward flick of the bonnet. Your hand need never touch a contaminated tip.

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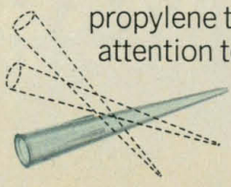

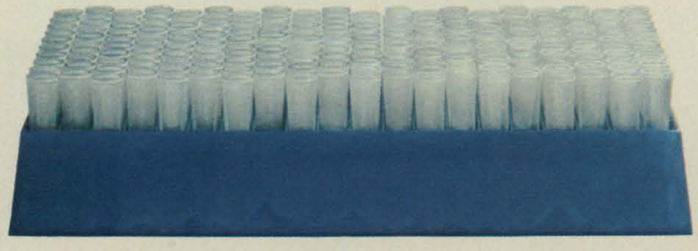

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By publishing the catalog every two years, we now inform Thomas customers of complete product line status twice as often as other full-line lab supply houses.

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Although it contains more pages than previous issues, Catalog 76 is slimmer and weighs less; it's easier to handle. We invite you to compare it with other catalogs.

Compare its product descriptions and illustrations, explicit in functional and dimensional detail, with accessories and replacement consumables listed for you.

Compare its encyclopedia-style organization, the numerical and alphabetical sequencing of items, the inclusion of reagent listings. Note particularly the concise, one-line product identifiers with time-of-publication prices; prefix this line with quantity required for easy order or requisition make-up.

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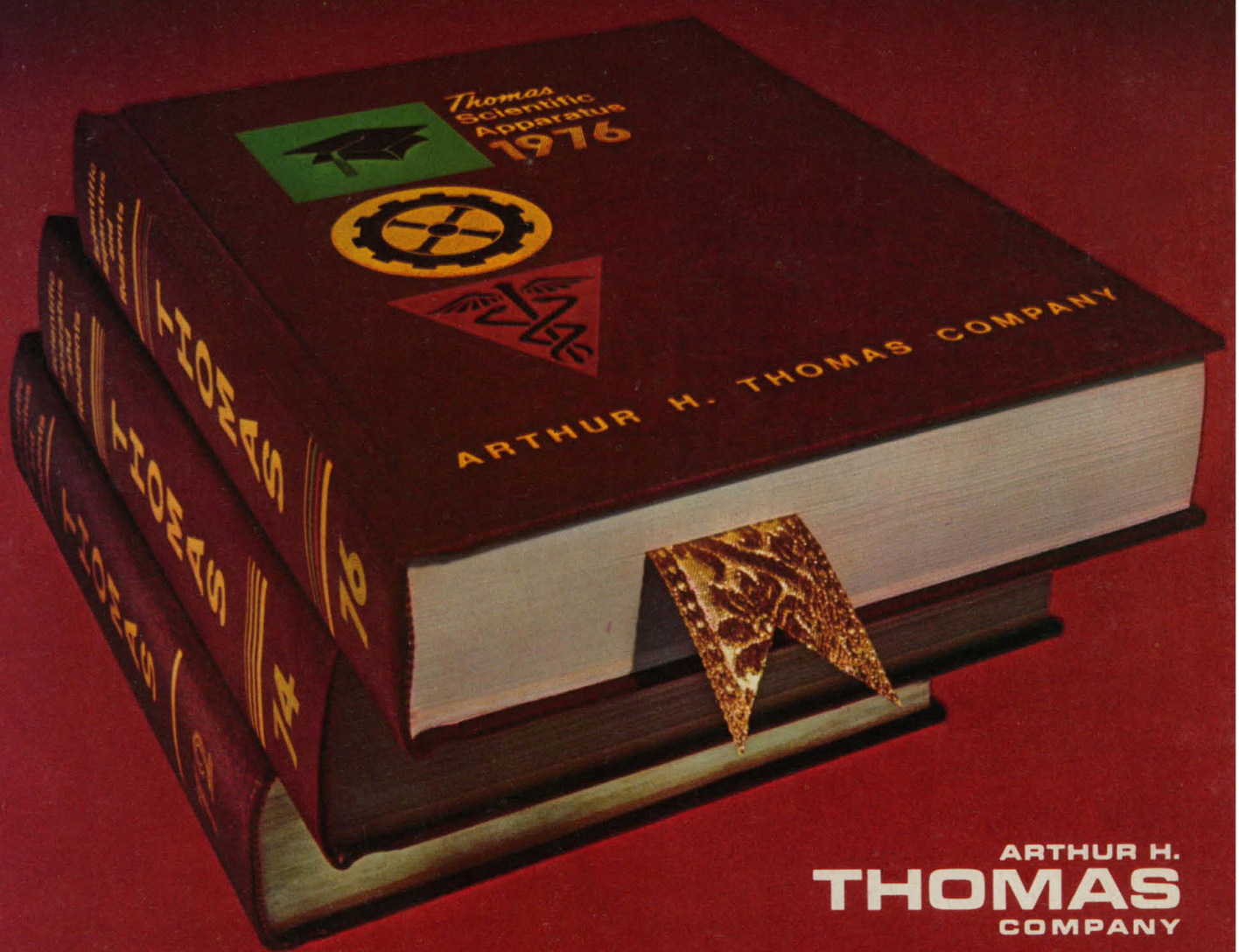

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COMPANY

TIAA Announces the Lowest Cost Life Insurance for Your Age...

...compared with what you'd pay for the same individual policies from insurance companies selling to the general public. That's not exactly a revelation for most educators, of course. They already know that TIAA is traditionally their best buy in life insurance. What's news is that...

New, lower premium rates now apply to TIAA policies issued beginning October 1, 1975.

In addition, with "quantity savings" dividends,

Net costs are less than ever before for the larger size policies educators are purchasing these days.

To illustrate the effect of the new rates and dividend scales, **A $100,000 20-Year Decreasing Term Insurance policy costs just $122 for a man aged 30 or for a woman aged 35.** Here are premium and dividend figures for this policy issued at different ages:

Age at Issue MALE / FEMALE	25 / 30	**30 / 35**	35 / 40	40 / 45	45 / 50
Annual Premium (Payable only 18 years)	$187	**$235**	$328	$487	$747
Cash Dividend End of First Year*	97	**113**	142	188	265
First Year Net Payment	$ 90	**$122**	$186	$299	$482

**Subsequent yearly dividends will be in the same amount, according to TIAA's current dividend scale which is not guaranteed.*

Decreasing Term policies provide their largest amount of protection initially, reducing by schedule over the years to recognize diminishing insurance needs and increasing savings, retirement benefits, etc. TIAA issues such policies for 15, 20, 25 and 30 year periods, depending upon age. Decreasing Term insurance is available in amounts of $20,000 or more to persons under age 56.

To use a different illustration,

$100,000 of 5-Year Renewable Term coverage costs only $180 for a 30 year old man or for a 35 year old woman.

Here are the cost figures for this policy issued at various ages.

Age at Issue MALE / FEMALE	25 / 30	**30 / 35**	35 / 40	40 / 45	45 / 50
Annual Premium	$258	**$288**	$373	$530	$774
Cash Dividend End of First Year*	101	**108**	140	185	254
First Year Net Payment	$157	**$180**	$233	$345	$520

**Dividends at end of years two through five will be in the same amount, according to TIAA's current dividend scale which is not guaranteed.*

A 5-Year Renewable Term policy provides a level amount of protection for a 5 year period at a fixed yearly premium. It is guaranteed renewable for successive 5 year periods to age 70 without medical reexamination at premiums that are based upon your attained age at the beginning of each renewal period. 5-Year Renewable Term plans are issued in amounts of $20,000 or more to persons aged 60 or less.

Eligibility for TIAA policies is extended to persons employed (full-time or part-time) by colleges, universities, private schools, and certain other nonprofit educational or scientific institutions, and to the spouse of the employee when more than half of their combined earned income comes from such an institution. Individuals can purchase low cost TIAA life insurance regardless of whether their college or other eligible employer participates in a TIAA benefit plan. Policyowners can retain their TIAA plans without any change in policy provisions whether they stay in educational work or not.

TIAA policies cost less than others because TIAA is a nonprofit service organization created by the Carnegie Foundation for the Advancement of Teaching in 1918; it insures without the expenses of sales personnel; most important of all, the limited group eligible to purchase TIAA life insurance enjoys favorable mortality experience, and individuals once insured rarely permit their TIAA policies to lapse.

Besides term insurance, Ordinary Life and other kinds of cash value insurance are available from TIAA at comparable savings.

Note to present TIAA policyowners. Although the new premium rates do not apply to policies issued prior to October, dividends will be adjusted to provide equitable treatment for similar policies issued under different rate bases.

Two Convenient Ways to Get More Information...

Either call collect... the TIAA LIFE INSURANCE ADVISORY CENTER— (212) 490-9000.

If you want *immediate* answers to your questions about TIAA's low cost life insurance policies call and ask for one of these Insurance Counselors:

Alan Fox, C.L.U. *Joan Scott, C.L.U.* *David Zacher*

Or send... this coupon to receive information by mail.

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Please send me a personal illustration of TIAA policies issued at my age based on the new, lower premium rates. I understand this request places me under no obligation, that no one will call on me and that the information will be sent by mail. 1/376

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To change the volume, just turn a knob.

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You'd expect a new dilutor-dispenser to be fast and accurate. The Eppendorf 5232 Dilutor/Dispenser is exactly that: 2.4 seconds per dispense, 6.4 seconds per dilution, with better than 0.5% precision.

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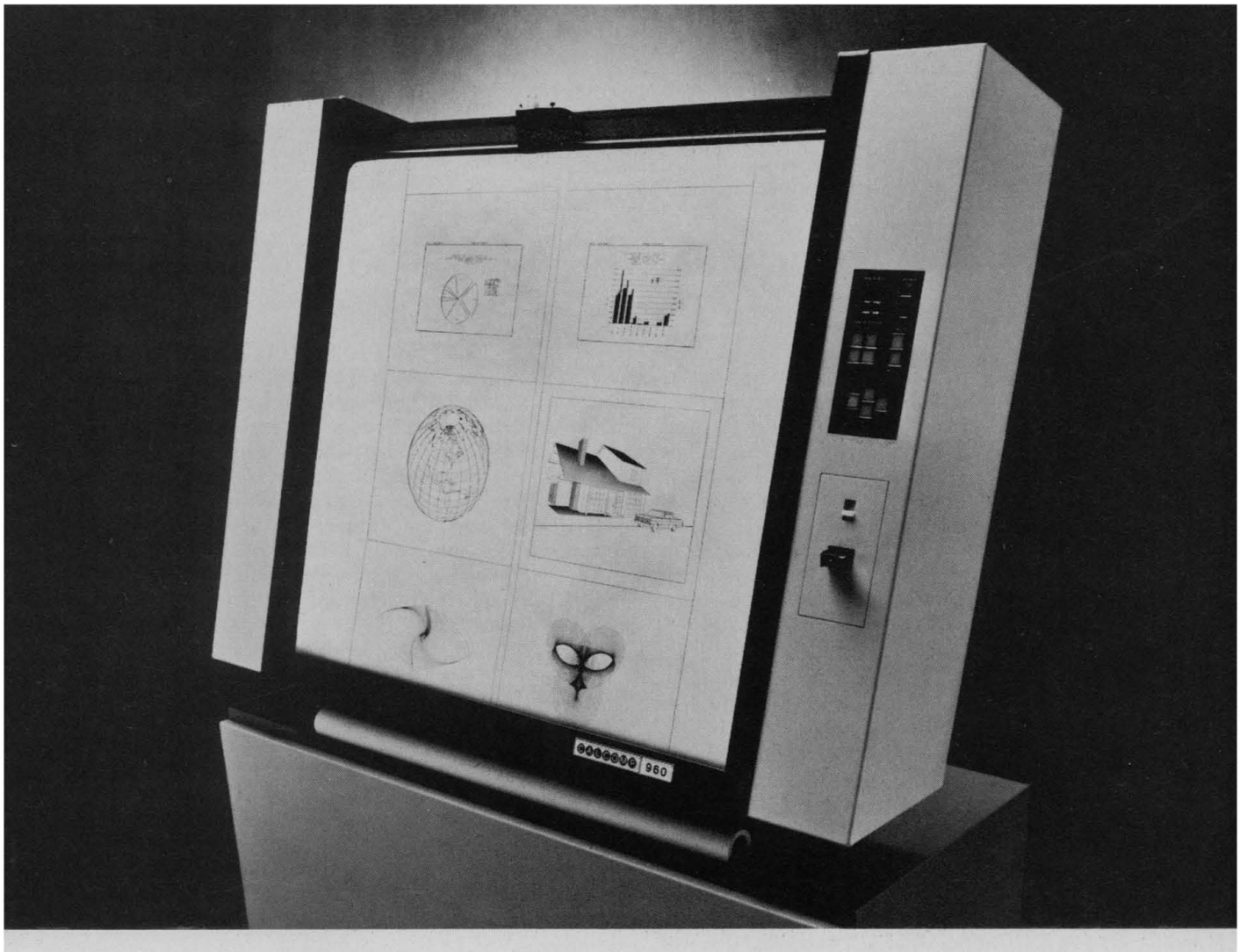

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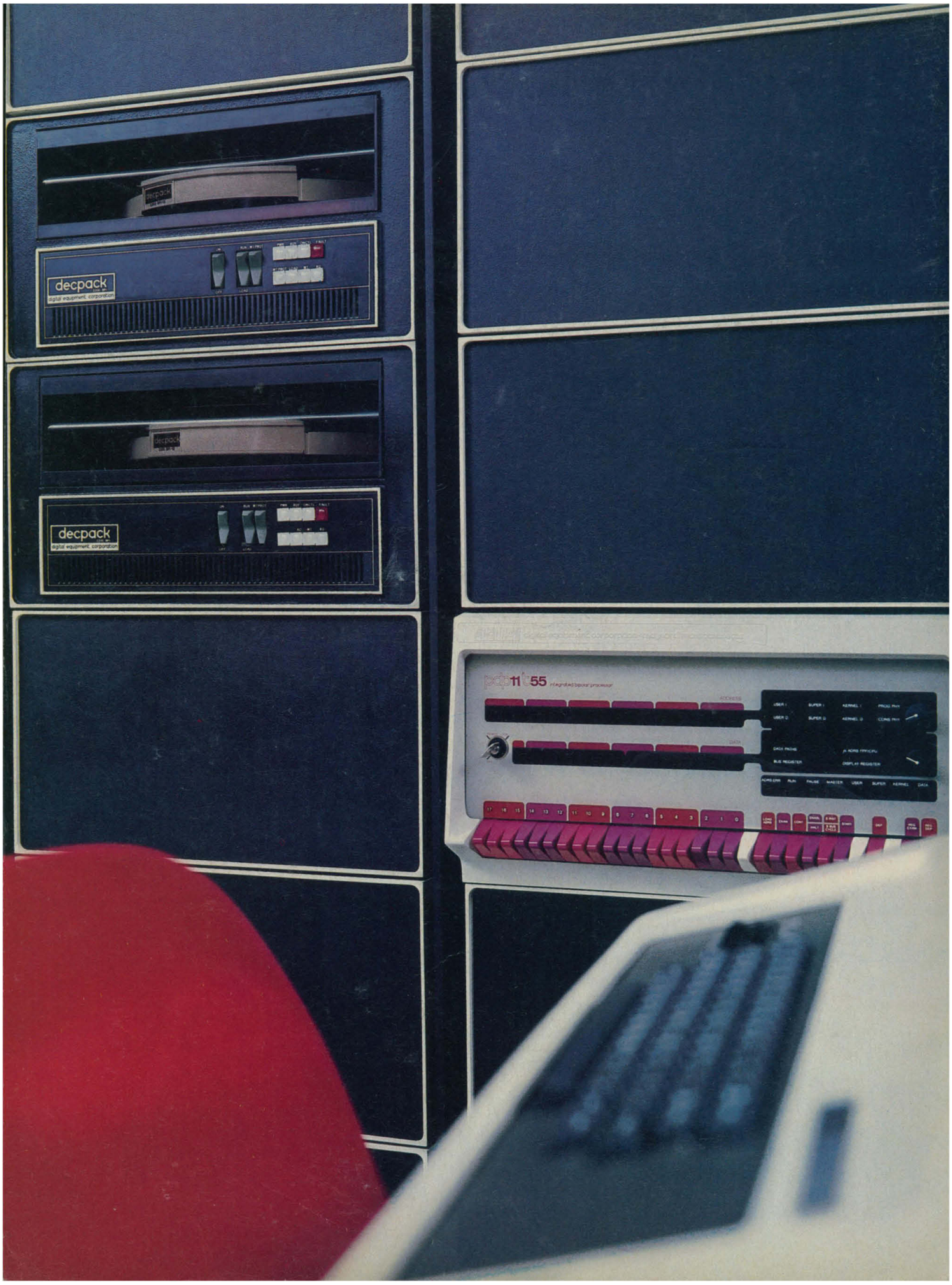
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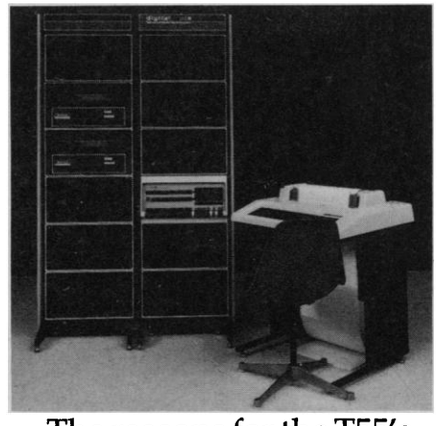
Introducing the PDP 11T55. From now on this is the FORTRAN machine to beat.

Digital's T55 is here. A complete, ready-to-run system that runs FORTRAN far faster than any system you've ever operated.

Mounting test evidence indicates the T55 is one of the fastest FORTRAN systems in the world. For example, the Whetstone Instruction Set is a series of tests developed by the British Government to test the FORTRAN speed of computer systems. These tests have been applied to a wide variety of systems ranging from minicomputer systems to multimillion dollar number crunchers.

To our knowledge, only three computer systems have had better results on the Whetstone than T55. They were the CDC7600, DECsystem 1080 and IBM 360/195. The T55, on the other hand, rated faster than systems such as the IBM 370/155 and the CDC 6400.

While the Whetstone has not been applied to all computer systems, the indication is very strong that nothing within ten times the cost can touch the T55 for FORTRAN execution speed.



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Plus 400 hardwired instructions that enable the T55 to collapse whole lines of FORTRAN into a few machine instructions. A new floating point processor that works in parallel with the CPU and performs double-precision divide operations in 6.75 μsecs. And FORTRAN IV PLUS, an optimizing compiler that balances the floating point and integer instruction loads to maximize system throughput.

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LETTERS

Astronomers' Petition

At the 147th meeting of the American Astronomical Society in Chicago, 191 astronomers signed the following petition to President Podgorny of the Soviet Union.

We, the undersigned members of the astronomical community, have been greatly concerned that the Soviet astronomer Kronid Lyubarsky, who is serving a five year term in Vladimir Prison, is in poor health and may not survive the remaining one year of his term. We therefore respectfully request that the remainder of his sentence and the subsequent exile period be waived so that he may resume his scientific work for the benefit of his country as well as the worldwide community of science.

Lyubarsky is a noted planetary scientist who was imprisoned for distributing the underground publication *Chronicle of Current Events*. His health was poor when he entered prison (three-quarters of his small intestine had been removed), and it has declined further.

Lyubarsky is the author of the books *Essays on Astrobiology, Cosmic Biology and Medicine* (1968) and *The Planets of the Earth Group—Mars* (1969), as well as numerous articles on meteors, planets, and space biology. In a letter published in *Science* on 5 April 1974, Valery Chalidze made an appeal for scientists to send reprints and preprints regarding Mars to Lyubarsky in prison. Andrei Sakharov specifically mentioned Lyubarsky in his book *On My Country and the World* and also in a telephone interview with a Paris newspaper in October 1975.

DAVID N. SCHRAMM, EDWARD ANDERS
S. CHANDRASEKHAR, PATRICK PALMER
EUGENE PARKER, J. A. SIMPSON
University of Chicago, Chicago, Illinois

The Ozone Controversy

The letter from Robert H. Cannon, Jr., concerning clean engines for stratospheric aircraft (6 Feb., p. 424) is misleading on two points.

First, his statement regarding the need for "strict engine-cleanliness standards in order to avoid significant worldwide reduction of the ozone layer" implies that no such standards exist. In fact, the Environmental Protection Agency has issued emission standards for all turbojet and turbofan engines which would be used in subsonic flight in the stratosphere, and it has issued a proposed standard for supersonic engines. These standards, and the proposed standard, are being used by those developing engines for use in the stratosphere.

Second, he states that the results of the

Climatic Impact Assessment Program (CIAP) have shown Johnston's concerns (*1*) regarding depletion of ozone by injection of oxides of nitrogen to have been valid ones.

The fact is that CIAP did not produce any evidence to confirm Johnston's estimates. The evaluations of ozone depletion were based on models and laboratory studies, not on field observations. The model used by CIAP to estimate ozone depletion is the arithmetic mean of two models developed by Chang and by Hunten. Of the CIAP models Hunten says (*2*): "There has been a lively debate about whose, or what kind of, model is best for predicting SST [supersonic transport] effects. The reasons we were reduced to that kind of thing is simple. We did not have enough data about the actual atmosphere to decide, and there was nothing left to do but hold a scholastic debate."

The most thorough review of the CIAP report is probably that of Hoffert and Stewart (*3*), who have concluded that extensive uncertainties characterize studies of the stratosphere's ozone shield, making hard and fast conclusions about man's effect on it through aerospace propulsion systems unsupportable.

All that can be said about the CIAP study without extensive qualification is that it did not produce evidence to refute with absolute certainty the NO_x-ozone depletion hypothesis. Thus the fear of skin cancer which played such a large part in public interest groups' opposition to the SST cannot yet be put to rest.

WILLIAM H. ALLEN
5024 Garfield Street, NW,
Washington, D.C. 20016

References

1. H. S. Johnston, *Science* **173**, 517 (1971).
2. D. M. Hunten, in *The Stratosphere 1975–1980, Report of a Workshop, May 28–30, 1975*, D. M. Hunten, Ed. (Goddard Space Flight Center, Greenbelt, Md., 1975), p. 2.
3. M. I. Hoffert and R. W. Stewart, *Astronaut. Aeronaut.* **13**, 42 (October 1975).

In his editorial "Science in the public forum: Keeping it honest" (30 Jan., p. 341), Alvin M. Weinberg mentions the proposal of Arthur Kantrowitz that a quasi-judicial scientific body be created to conduct inquiries into conflicting scientific claims as a possible method "for injecting more responsibility into scientific debate when it is conducted outside the scientific forum." He cites several such cases, including "the debate on depletion of the ozone layer."

Being familiar with the history and the substance of the debates on depletion of the ozone layer, I believe that certain major aspects of the ozone depletion problem are scientifically established (*1*). From the beginning, however, the multidisciplinary nature of the problem has posed difficulties. Chemists have made mistakes in meteorology, and meteorologists have made mistakes in chemistry. Some of these mistakes have been fatal and some nonfatal to the proposition that was being made. Some mistakes continue to be reiterated year after year, even though they have been corrected. A major problem is that sometimes concerned industries hire public relations firms who bombard newspaper science writers and others with distracting side issues, distortions, and half-truths (*2*). By a mass action effect, these slanted statements dominate the public's perception of the situation and keep some subjects "controversial" long after scientific conclusions about them have been reached.

A quasi-judicial scientific body, such as that proposed by Kantrowitz, could effectively judge this case, especially if it took on only a small number of well-defined components of the problem rather than considering all proposed mechanisms and consequences of man-made reduction of stratospheric ozone. To sharpen the issue, I make the following four-point (*3*) thesis.

1) In 1971, there was sufficient scientific evidence to establish *probable cause* (*4*) that 1.8 million tons per year of nitrogen oxides (as NO_2) injected by supersonic transports (SST's) at an elevation of 20 kilometers would reduce stratospheric ozone by a major amount—a global average of up to 20 percent and much more if all SST's flew in a narrow latitude band.

2) As of 1976, there is sufficient scientific evidence to *prove beyond reasonable doubt* (*4*) that 1.8 million tons per year of nitrogen oxides (as NO_2) injected by SST's at an elevation of 20 kilometers would reduce ozone by a major amount—a global average of 10 to 20 percent and about twice as much locally if all SST's flew in a narrow band at temperate latitudes.

3) Injections of nitrogen oxide smaller than 1.8 million tons per year lead in a reasonably well understood way to less ozone reductions. Nitrogen oxide injections at elevations lower than 20 kilometers (*3*) lead to less ozone reduction but involve greater uncertainty than injections at the same rate at 20 kilometers.

4) There is a *preponderance of evidence* that a long-term, systematic reduction of stratospheric ozone would cause an increase in human skin cancer (basal cell carcinoma, squamous cell carcinoma, and melanoma) unless the peoples of the world alter their sites of residence or life-styles.

I propose that a group of scientific "judges," supported by the AAAS or another appropriate organization, hear evidence on the propositions stated above.

HAROLD S. JOHNSTON
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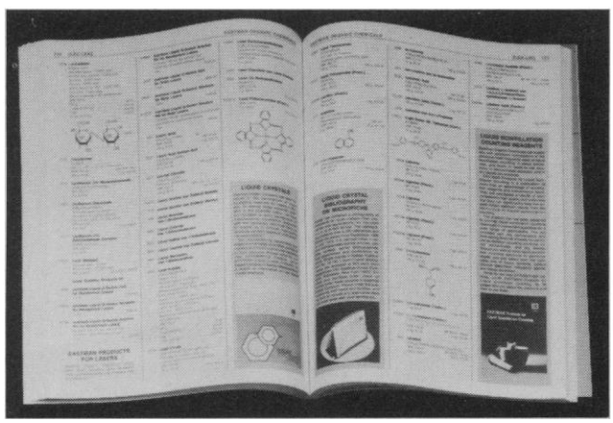

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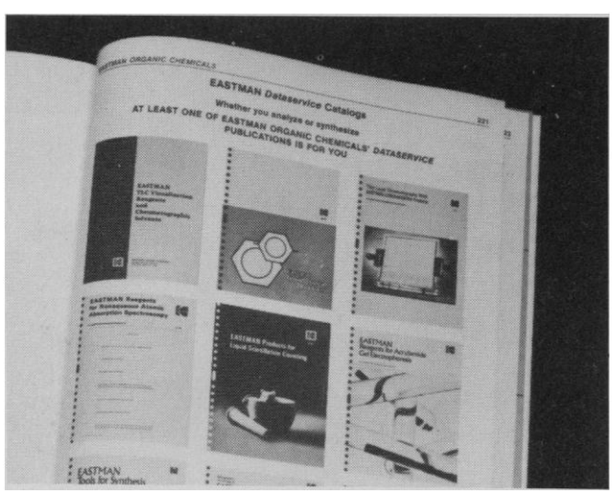

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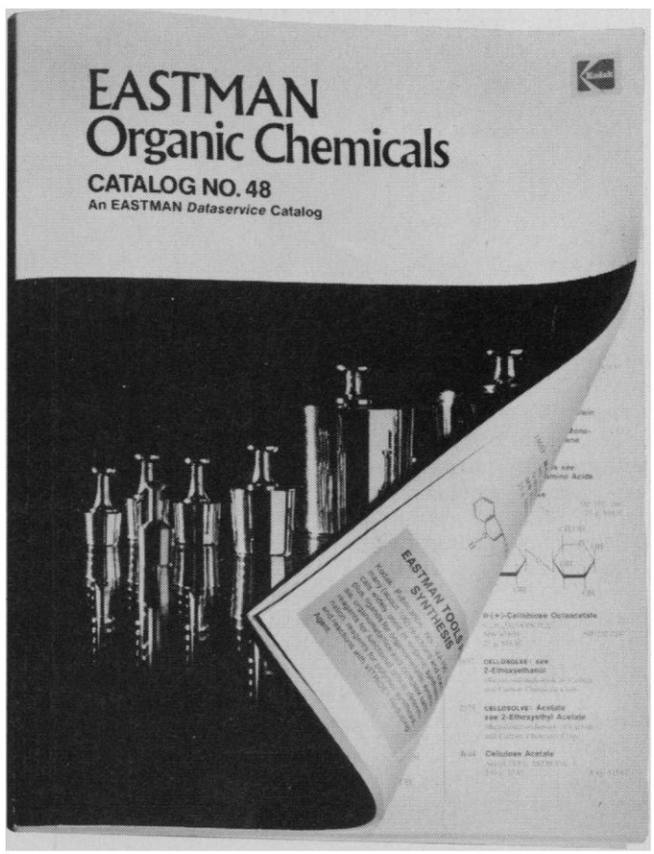

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19 March 1976, Volume 191, Number 4232

SCIENCE

Big University—Humane or Bureaucratic?

Modern science is frequently referred to as Big Science because of its large-scale character. Similarly, the term Big University might be used to describe today's large and powerful universities. The Big University is new enough that many of us still tend to think in terms of its predecessor when, in fact, it is a new institution with its own role to play and its own problems to solve.

With its roots in the past and its future not clearly defined, the Big University finds itself in the midst of conflicting influences and demands. Many of the problem-solving approaches that served well in the past are no longer useful, but new ideas have been slow to come forth. Attempts at solutions have been piecemeal—specific problems being dealt with as they arise and largely in the context of an enlarged version of the familiar Little University. This has often led to further growth of an already overgrown administrative superstructure and large-scale bureaucratization of the institution. In an age of diminishing financial resources, a larger and larger proportion of academic salaries is being spent on administration, rapidly creating a situation in which the support functions take precedence over the primary mission of education.

The problems of the Big University require more than short-term thinking. Traditional humanistic values and practices have to be reconciled with changing societal goals and priorities, the growth of knowledge, increased specialization, government involvement, and a whole range of other issues. What needs to be done and what should be preserved?

There seems to be general agreement about the need for improved fiscal controls and operational efficiency. But evaluating the efficiency of an institution of higher education raises some fundamental questions, related to the extent to which the educational process lends itself to quantitative measurement. Methods that work well for other types of organizations have only limited applicability. From the systems point of view, for example, efficiency may be measured in terms of the value of the output of the system compared to input costs. In a university, where both input and output are predominantly intellectual in nature, they can not be readily quantified. Attempts to use this approach lead to deceptively simple solutions, which often show an inadequate understanding of the educational process.

Academic practices designed to ensure scholarly excellence and intellectual independence need to be strengthened to retain their usefulness in the Big University environment. One of these practices is peer evaluation, the traditional method used to determine scholarly worth. Specialization and the trend toward interdisciplinary departments make it increasingly difficult to identify valid peer groups within an academic administrative unit. As a result, what should be an evaluation by a peer group often becomes an evaluation by colleagues in other fields. This tends to make the method vulnerable to competitiveness, professional jealousy, and personal likes and dislikes, creating a politically charged campus atmosphere that stifles creativity and leads to intellectual mediocrity.

There is a need for renewed—or even revived—recognition of the vital relationship between scholarliness and good teaching. Good teaching represents the synthesis and integration of a wide range of intellectual experiences and activities and cannot be described exclusively in terms of method and time spent. Frequently, failure of the professional bureaucrat to recognize this relationship really reflects his latent anti-intellectual attitudes. Nevertheless, we should be able to intelligently reconcile the intangibles related to the intellectual growth of both teacher and student with the justifiable demands for fiscal responsibility.

Imaginative and innovative approaches are needed to tackle these and similar problems. It is time to move from reacting to situations to anticipating them. Systematic study of the Big University should enable us to identify its characteristics and to understand their implications for the educational process. The success of this approach will ultimately determine whether the Big University will retain the humanistic character of its predecessor or will become an impersonal bureaucratic machine turning out graduates.—SUSAN ARTANDI, *Rutgers University, New Brunswick, New Jersey 08903*

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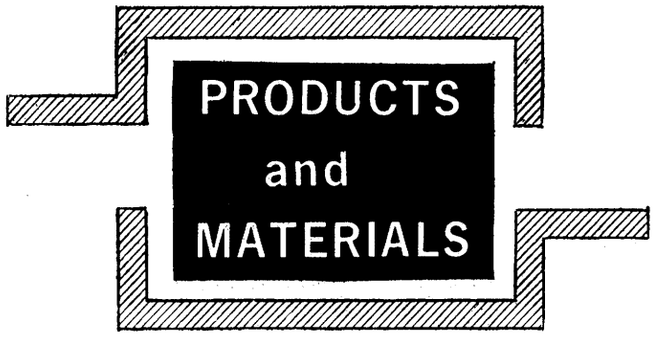

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The model LC-2A control unit is available both assembled and in kit form for selective amperometric detection of organic compounds in high performance liquid chromatography. When combined with a thin-layer electrochemical transducer, the instrument is suitable for trace analysis of phenolic natural products and selected pharmaceuticals in biological samples. Selectivity and sensitivity exceed those of ultraviolet monitors in some assays. Bioanalytical Systems. Circle 838.

Electrophoresis Destainer

The model 1200 supports gels horizontally between two replaceable moist ion exchange resin pads which contain the anode and the cathode and act as the current-carrying medium as well as the dye absorbant. The current travels only through the gel, because there is no solution. Gels destain rapidly. Gel rods up to 125 millimeters long may be accommodated. With an optional holder, gel rods up to 175 millimeters long are acceptable. Gel slabs up to 125 to 175 millimeters are easily destained. The system includes a destaining tank, power supply, upper and lower resin pads, gel rod holder, gel slab holder, and staining tray. Bio-Rad Laboratories. Circle 836.

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Laboratory Fermentor

The BIOSTAT fermentor is designed for the submersed, continuous growth of microorganisms on the chemostat and batch principle. Slide-in modules are available for *p*H and oxygen measurement and control, foam regulation, and six-channel recording. Standard equipment includes feedback-monitored stirrers, temperature regulation, a heat trap for nutrient solution intake, a dosage pump that cannot grow shut during operation and a sterile gas filter heater with humidifier and monitor. Culture vessels of 2, 6, and 12 liters have apertures for gas outtake; acid, alkaline, and antifoam agent addition; *p*H measurement; inoculation and removal of cell suspensions. Braun Instruments. Circle 839.

Research Microscope

The Biophot optical microscope combines chrome-free glass and multicoated surfaces with a precise, stable mechanical construction. Chrome-free glass permits maximum reduction of chromatic errors with fewer elements. The multiple coatings reduce internal reflection and glare. The nosepiece accommodates six objectives. The objectives have been lengthened for inclusion of optical elements to reduce aberration. Plan achromat objectives from 4 to 1000 power are available with a matching aplanat/achromat condenser with a numerical aperture of 1.4. Applications include phase contrast, Nomarski interference contrast, fluorescence microscopy, and others. Ehrenreich Photo-Optical Industries. Circle 835.

Chamber for Blood Processing

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Reagents for Paired-Ion Chromatography

Paired-ion chromatography is a liquid technique that provides an alternative to ion-exchange chromatography. Mixtures of strongly ionic species and mixtures of ionized and nonionized materials may be separated reliably. Packaged reagents are available. A vial is emptied into 1 liter of the mobile phase, the resulting liquid is stirred and filtered, and the sample is chromatographed. Temperature and *p*H adjustments are not necessary. Two reagents are available: PIC Reagent A (tetrabutylammonium phosphate) for treatment of acids and PIC Reagent B-7 (1-heptane sulfonic acid) for treatment of bases. Waters Associates. Circle 837.

Newly offered instrumentation, apparatus, and laboratory materials of interest to researchers in all disciplines in academic, industrial, and government organizations are featured in this space. Emphasis is given to purpose, chief characteristics, and availability of products and materials. Endorsement by *Science* or AAAS is not implied. Additional information may be obtained from the manufacturers or suppliers named by circling the appropriate number on the Readers' Service Card (on pages 1126A and 1190A) and placing it in the mailbox. Postage is free.—RICHARD G. SOMMER

Literature

Getter Pumps are the topic of a 10-page pamphlet. They are used in fusion reactors, gas lasers, electronic tubes, thin-film processing, and ultrahigh vacuum systems. Westinghouse Electric. Circle 825.

Instrument Rental Catalog lists over 700 of the newest, most frequently used test instruments grouped by product type and cross-referenced by manufacturers. Continental Leasing. Circle 827.

Waste Treatment System describes components and specific features of a system in use to aid a facility in meeting state and federal EPA requirements. Aqua-Aerobic Systems. Circle 830.

Digital Data Processor is devoted to the CP70A system and its uses and standard software packages. California Instruments. Circle 831.

PCS/TEXT describes an on-line word-processing system that is suitable to video, typewriter, or communicating magnetic card wordstations. Proprietary Computer Systems. Circle 832.

Optical Mounts, Positioning Slides and Accessories are included in a catalog of instrumentation for laser holography, interferometry, and other photo applications. Daedal. Circle 833.

Course Outlines includes Radioisotope Techniques, Plasma Protein Fractionation, Organic Chemistry Review, and others. Sadtler Research Laboratories. Circle 834.

Buffers is a bibliography of applications for most original (Good's) biological or zwitterionic buffers from many fields during the past 2 years. Amersham/Searle. Circle 843.

Quantitative Immunoelectrophoresis is a catalog of chemicals, antibodies, and equipment. There is a section that deals with techniques. Bio-Rad Laboratories. Circle 844.

A Chromatogram Should Tell You is devoted to the model 3380 A Reporting Integrator that records the data, lists peaks and retention times, and performs other calculations. Hewlett-Packard. Circle 846.

Handbook D-10-102 describes the design and layout of pipelines for oscillating reciprocating pumps with illustrations, schematic drawings, and charts. American Lewa. Circle 847.

Gas Safety Data Chart provides information on 75 industrial gases including hazards, handling techniques, and special characteristics. Scientific Gas Products. Circle 848.

Computerized Systems for Testing Materials, Components and Structures describes the 900 series data handling and control systems and their performance specifications. Instron. Circle 850.

RESEARCH NEWS

(Continued from page 1163)

nozzle and a "good fraction" of the molecules are left in the ground state.

The next step is to dissociate the $^{235}UF_6$ molecules, using one of several laser arrangements. Unfortunately, the Los Alamos researchers have not had powerful enough lasers at the proper infrared wavelengths to do any actual separation yet. What they presented in New York was an absorption spectrum, for light at a wavelength of about 16 micrometers, that showed a $^{235}UF_6$ feature clearly distinct from several $^{238}UF_6$ features. The spectrum was measured with a tunable diode laser producing only about 100 microwatts of power. The Los Alamos team is now soliciting bids on bigger lasers. They estimate that for early experiments they need at least a few milliwatts at the exact wavelength (still classified), and 100 watts for commercial applications. The molecular methods generally require a second laser of greater power, either ultraviolet or infrared, to dissociate UF_6.

The Los Alamos announcement was less dramatic than might have been expected. Richard Levy characterized it as "an interesting footnote to a process for which there are no obvious barriers to success."

Last year the Los Alamos researchers achieved successful laser isotope separation of sulfur hexafluoride (SF_6). In that case, the proof did not have to be held up for new laser development, because the SF_6 molecule could be dissociated by the infrared light of a carbon dioxide laser—the most powerful infrared laser now made. For uranium hexafluoride, proof of the method awaits the development of a powerful laser at a wavelength further into the infrared than any of the intense lasers now available.

Since atomic methods of uranium isotope separation can be done with lasers off-the-shelf, even though atomic method proponents would like more power, molecular methods seem to be a greater gamble. The appeal is that they eliminate a number of difficulties, such as the corrosiveness of high-temperature uranium vapor, and the tendency of ionized ^{235}U atoms to recombine before they can be isolated. The preparation and separation techniques of the molecular method would be chemical rather than physical, and this feature appeals to those who believe that chemical techniques are better suited for factories where a large flow of materials is essential.

The Los Alamos team is investing much money and manpower in proving that their methods are superior. The next few years should show whether the promise of the molecular approach is realizable.

—WILLIAM D. METZ

BOOKS RECEIVED

(Continued from page 1167)

Cosmic Biology. Minas Ensanian. Philosophical Library, New York, 1975. 160 pp. + plates. $12.

Cyclic Compounds. Springer-Verlag, New York, 1975. iv, 146 pp., illus. $25.40. Topics in Current Chemistry, 57.

Death Valley. Geology, Ecology, Archaeology. Charles B. Hunt. University of California Press, Berkeley, 1975. xii, 234 pp., illus. $14.95.

Dictionary of Scientific Biography. Vol. 12, Ibn Rushd—Jean-Servais Stas. Charles Coulston Gillispie, Ed. Scribner, New York, 1975. xvi, 620 pp. $40.

Dynamical Systems, Theory and Applications. Proceedings of a meeting, Seattle, 1974. J. Moser, Ed. Springer-Verlag, New York, 1975. vi, 624 pp. Paper, $19.80. Lecture Notes in Physics, vol. 38.

Effective Interactions and Operators in Nuclei. Proceedings of a conference, Tucson, Ariz., June 1975. B. R. Barrett, Ed. Springer-Verlag, New York, 1975. xii, 340 pp., illus. Paper, $12.90. Lecture Notes in Physics, vol. 40.

Electronic Circuits and Systems. J. D. Ryder and Charles M. Thomson. Prentice-Hall, Englewood Cliffs, N.J., 1976. xviii, 446 pp., illus. $16.95.

The Enduring Effects of Education. Herbert H. Hyman, Charles R. Wright, and John Shelton Reed. University of Chicago Press, Chicago, 1975. x, 315 pp. $12.50.

Essentials of Mathematics. Precalculus I. A Programmed Text. Algebra I. Vernon E. Howes. Wiley, New York, 1975. xxii, 672 pp., illus. + index. Paper, $10.95.

Essentials of Mathematics. Precalculus III. A Programmed Text. Trigonometric Functions and Applications. Vernon E. Howes. Wiley, New York, 1975. xiv, 530 pp., illus. Paper, $9.95.

Europe in the Era of Social Transformation. 1700-Present. Vincent J. Knapp. Prentice-Hall, Englewood Cliffs, N.J., 1976. xviii, 254 pp. Cloth, $10.95; paper, $6.95.

Experimental Psychobiology. A Laboratory Manual. Benjamin L. Hart, Ed. Freeman, San Francisco, 1976. x, 132 pp., illus. Paper, $5.95.

Fluid Behaviour in Biological Systems. Leonard Leyton. Clarendon (Oxford University Press), New York, 1975. xiv, 236 pp., illus. $31.25.

Fourier Series with Respect to General Orthogonal Systems. A. M. Olevskii. Translated from the Russian edition by B. P. Marshall and H. J. Christoffers. Springer-Verlag, New York, 1975. x, 138 pp. $33.60. Ergebnisse der Mathematik und ihrer Grenzgebiete, Band 86.

Friendship and Peer Relations. Papers from a conference, Princeton, N.J. Michael Lewis and Leonard A. Rosenblum, Eds. Wiley-Interscience, New York, 1975. xvi, 320 pp., illus. $18.95. The Origins of Behavior, vol. 4.

Graph Theory. An Algorithmic Approach. Nicos Christofides. Academic Press, New York, 1975. xvi, 400 pp., illus. $31. Computer Science and Applied Mathematics.

Growing Up in America. Fred M. and Grace Hechinger. McGraw-Hill, New York, 1975. xiv, 454 pp. $15. Aspects of American Life and Culture.

Health and Industrial Growth. Proceedings of a symposium, London, Sept. 1974. Associated Scientific Publishers (Elsevier, Excerpta Medica, North-Holland), New York, 1975. viii, 268 pp. $18.50. Ciba Foundation Symposium 32 (new series).

Inscape and Landscape. The Human Perception of Environment. Pierre Dansereau. Columbia University Press, New York, 1975. x, 118 pp. Cloth, $10; paper, $2.45.

Integrated Optics. T. Tamir, Ed. Springer-Verlag, New York, 1975. xiv, 316 pp., illus. $34.40. Topics in Applied Physics, vol. 7.

International Symposium on Mathematical Problems in Theoretical Physics. Kyoto, Japan, Jan. 1975. H. Araki, Ed. Springer-Verlag, New York, 1975. xii, 562 pp. Paper, $19. Lecture Notes in Physics, vol. 39.

Introduction to Kinship and Social Organization. Burton Pasternak. Prentice-Hall, Englewood Cliffs, N.J., 1976. viii, 168 pp., illus. Cloth, $10.95; paper, $5.95.

Introduction to Qualitative Research Methods. A Phenomenological Approach to the Social Sciences. Robert Bogdan and Steven J. Taylor. Wiley-Interscience, New York, 1975. xvi, 266 pp. $11.95.

Introduction to the Theory of Matroids. Rabe von Randow. Springer-Verlag, New York, 1975. x, 102 pp. Paper, $7.80. Lecture Notes in Economics and Mathematical Systems, vol. 109.

Laboratory On-Line Computing. An Introduction for Engineers and Physicists. John E. Brignell and Godfrey M. Rhodes. Halsted (Wiley), New York, 1975. x, 298 pp., illus. $24.50.

Language Origins. A Bibliography. Gordon Winant Hewes, Ed. Mouton, The Hague, ed. 2, 1975. Two volumes. xiv, 890 pp. Dfl. 225.

Laws of Hadronic Matter. Proceedings of a school, Erice, Italy, July 1973. A. Zichichi, Ed.

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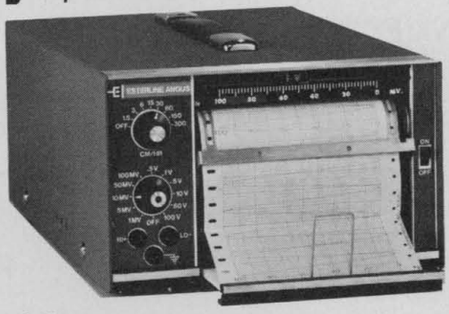

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REAR FANGED SNAKES

Dispholidus typus	W
Leptodeira ashmeadi rhombifera	W

VIPERIDAE
TRUE VIPERS

Atractaspis c. congica	Z
Bitis arietans	C
Bitis caudalis	R
Bitis gabonica	H
Bitis g. rhinoceros	J
Bitis nasicornis	D
Causus rhombeatus	D
Cerastes cerastes	T
Cerastes vipera	T
Echis carinatus sochureki	J
Eristicophis macmahonii	R
Pseudocerastes persicus	R
Vipera ammodytes	J
Vipera aspis	T
Vipera berus	T
Vipera r. russellii	C
Vipera r. siamensis	C
Vipera xanthina palestinae	R

HYDROPHEIDAE
SEA SNAKES

Laticauda laticauda	Z
Laticauda semifasciata	W

CROTALIDAE
PIT VIPERS

Agkistrodon acutus	L
Agkistrodon bilineatus	F
Agkistrodon c. contortrix	D
Agkistrodon c. laticinctus	E
Agkistrodon c. mokason	D
Agkistrodon c. pictigaster	L
Agkistrodon halys blomhoffii	D
Agkistrodon p. piscivorus	B
Agkistrodon p. leucostoma	B
Agkistrodon rhodostoma	I
Bothrops alternatus	E
Bothrops atrox	F
Bothrops b. bilineatus	N
Bothrops jararaca	H
Bothrops jararacussu	J
Bothrops lansbergii	R
Bothrops medusa	R
Bothrops nasuta	R
Bothrops n. nummifer	J
Bothrops schlegelii	R
Crotalus adamanteus	C
Crotalus atrox	C
Crotalus c. cerastes	H
Crotalus d. durissus	F
Crotalus d. terrificus (Colombia)	F
Crotalus d. terrificus (S. Brazil)	H
Crotalus d. totonacus	H
Crotalus h. horridus	C
Crotalus h. atricaudatus	D
Crotalus molussus	E
Crotalus ruber	D
Crotalus scutullatus	L
Crotalus tigris	L
Crotalus v. viridis	H
Crotalus v. abyssus	N
Crotalus v. cerberus	F
Crotalus v. helleri	J
Crotalus v. lutosus	J
Crotalus v. oreganus	F
Lachesis muta	T
Sistrurus catenatus tergeminus	F
Sistrurus miliarus barbouri	F
Trimeresurus flavoviridis	F
Trimeresurus mucrosquamatus	N
Trimeresurus okinavensis	L
Trimeresurus popeorum	L
Trimeresurus p. purpureomaculatus	J
Trimeresurus wagleri	P

FRACTIONS PURIFIED

- α Cobratoxin $7.50 per milligram
- α Bungarotoxin $10.00 per milligram
- β Bungarotoxin $10.00 per milligram

Add $1.00 each for multiple units of one milligram.

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NOTE: SEND FOR COMPLETE LIST IF REQUIRED

Inquire for availability of an unlisted species.

U.S. DOLLAR PRICE SCHEDULE — EFFECTIVE JAN. 1, 1976

GM	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1 00	35 00	40 00	50 00	60 00	70 00	80 00	90 00	100 00	125 00	150 00	175 00	200 00	225 00	250 00	275 00	300 00	350 00
50	19 25	22 00	27 50	33 00	38 50	44 00	49 50	55 00	68 75	82 50	96 25	110 00	123 75	137 50	151 25	165 00	192 50
25	10 50	12 00	15 00	18 00	21 00	24 00	27 00	30 00	37 50	45 00	52 50	60 00	67 50	75 00	82 50	90 00	105 00
10	5 25	6 00	7 50	9 00	10 50	12 00	13 50	15 00	18 75	22 50	26 25	30 00	33 75	37 50	41 25	45 00	52 50

R	400	S	450	T	500	U	600	V	800	W	1000	X	1200	Y	1500	Z	2000

R through Z may be purchased proportionate to the 1 gram price in any quantity

DISCOUNTS ▶ | 1 ~ 10 gm LIST | 11 ~ 30 gm -5% | 31 ~ 60 gm -10% | 61 ~ 100 gm -15% | 101 gm + -20% | ◀ UNASSORTED

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APPLICATIONS INVITED FOR AAAS CONGRESSIONAL SCIENCE FELLOWSHIPS

The American Association for the Advancement of Science invites applications for the fourth consecutive year of its Congressional Science and Engineering Fellow Program. (A full program announcement appeared in *Science*, 23 January 1976, page 244.) The deadline for applications is 31 March 1976.

Detailed information on the application procedure and other information about the program are available from **Richard A. Scribner, Director, AAAS Congressional Science Fellow Program, AAAS, 1776 Massachusetts Avenue, NW, Washington, D.C. 20036. Telephone (202) 467-4475.**

APPLICATIONS ALSO INVITED FOR APS CONGRESSIONAL SCIENCE FELLOWSHIPS

For the fourth consecutive year, the Council of the American Physical Society (APS) has allocated funds to support two physicists who will serve for a year as Congressional Science Fellows. A full description of the APS program, which is undertaken in cooperation with the AAAS, is given in *Physics Today* (November 1975, page 107).

Deadline for applications is 31 March 1976 (moved from 15 March). For further information contact **Carol Z. Rosen, Administrator, Congressional Science Fellow Program, the American Physical Society, 335 East 45 Street, New York, N.Y. 10017. Telephone (212) 685-9422.**