American Association for the Advancement of Science

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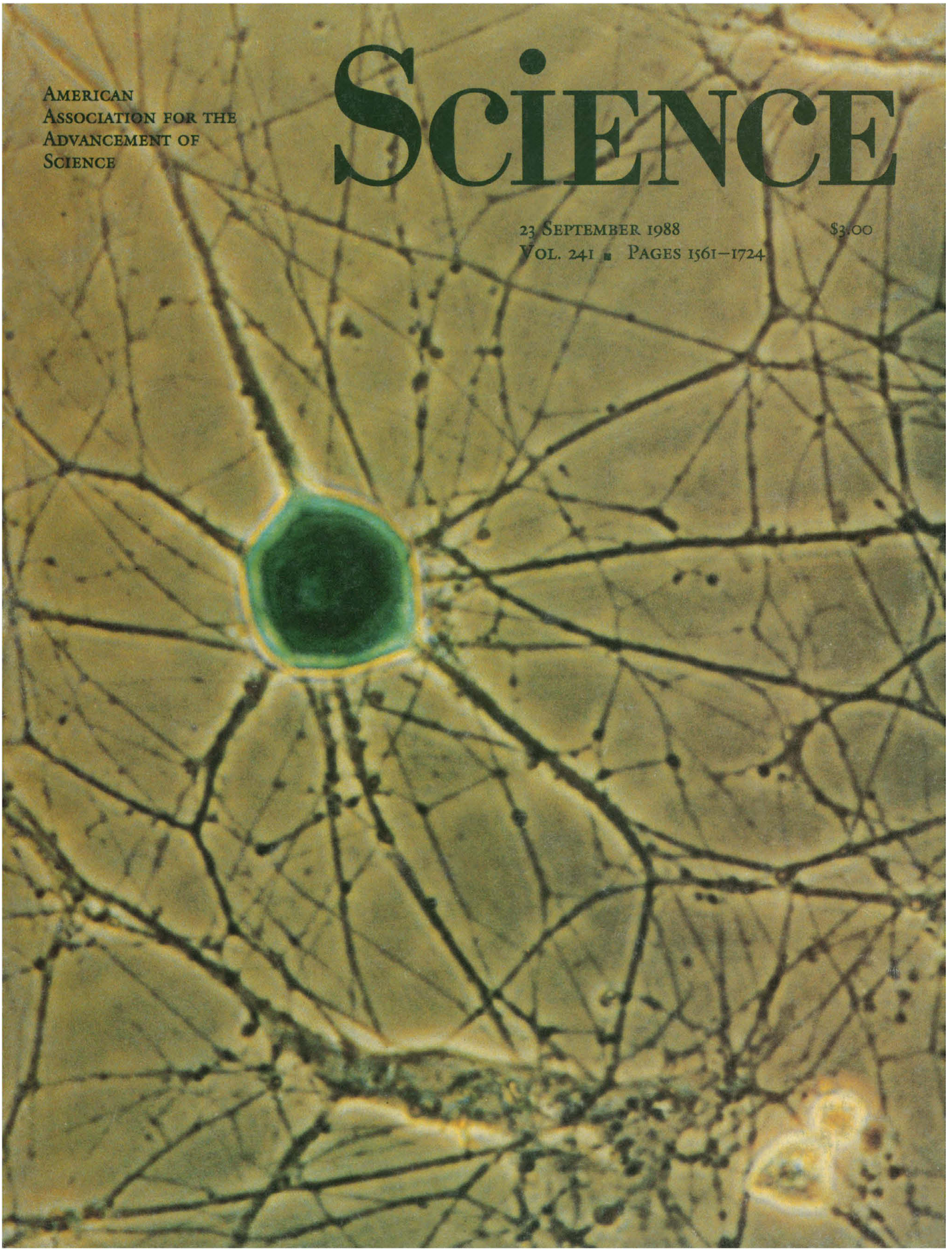

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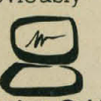

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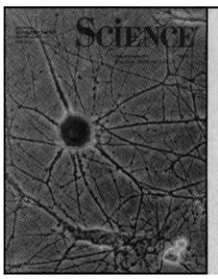

COVER Photomicrograph of a cultured rat sensory neuron 24 hours after infection with pHSViac, a defective herpes simplex virus 1 (HSV-1) vector that expresses *Escherichia coli* β-galactosidase (blue, X-gal reaction product). HSV-1 vectors have the potential to introduce any gene into a neuron to perform gene therapy or study neuronal physiology. See page 1667. [Alfred I. Geller, Massachusetts General Hospital, Boston, MA 02114]

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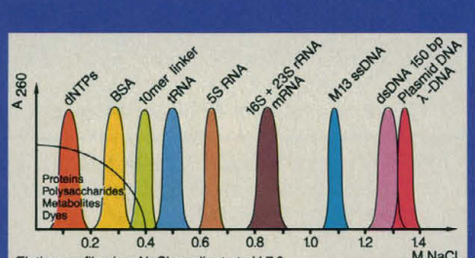

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This Week in
SCIENCE

Remote sensing and the oceans

PICTURES of the ocean surface taken by satellites are contributing to an understanding of the fluxes of carbon and other biogenic elements in the seas (page 1613). Ocean-dwelling phytoplankton engage in photosynthesis, and this process is a major contributor to the flux of carbon. The abundance of the phytoplankton in the water column directly affects the reflection of light in the upper layers of the ocean and thus the color at the ocean surface. Platt and Sathyendranath argue that models for estimating regional and global primary production from satellite imagery should be based on an understanding of phytoplankton physiology and on the biologic structure of the water column at local scales. Although the carbon cycle is complex and many factors contributing to it cannot now easily be factored into the models, a physiologic approach may yield accurate information as data on the dynamic properties and local biologic structure of ocean ecosystems become available. Knowledge of the buffering capacity of the oceans for carbon is of course crucial for better evaluating the greenhouse phenomenon.

Of mice and men

A new approach has been taken for studying the human immune system: SCID mice, a strain with severe combined immunodeficiency disease, are given human cells and tissues and then go on to live healthy lives, apparently no longer susceptible to the opportunistic infections that usually kill them before they are 4 months old (page 1632). The mouse-human chimeras were developed by Mc Cune *et al.* and are produced by transplanting into mouse hosts human fetal liver hematopoietic cells (a source of lymphoid precursor cells) and human fetal thymus and lymph node tissue (the environments in which the stem cells can differentiate, proliferate, and apparently function). Both human antibodies and human lymphoid cells were detected in the circulation of the mice several weeks after the tissues had been transplanted. The characteristics of SCID mice that make this model workable and the anticipated uses of the chimeras for studying the normal and pathologic workings of the human immune system—with AIDS being perhaps the chief disease to which the system is relevant—are discussed by the authors and by Yancopoulos and Alt in their Perspective (page 1581).

Strong glasses

THE properties and structures of a group of aluminum-rich (up to 90 atomic percent), strong, and flexible glassy metals are described by He *et al.* (page 1640). A series of alloys of aluminum, iron, and cerium were prepared; compositional variations were introduced by altering the relative amounts of the elements, by replacing the iron with cobalt, nickel, or rhodium, and by replacing the cerium with yttrium, hafnium, or various lanthanides. The amorphous materials were made into melt-spun continuous ribbons having widths of 1 to 2 millimeters and thicknesses of 15 micrometers. As a group, these amorphous alloys were unusually formable, and their tensile strengths were so great that they exceeded the strengths of the strongest commercial aluminum alloys. The aerospace industry is likely to be among the first to make use of these new superstrong materials.

Cyclosporine A effects

CYCLOSPORINE A ranks as one of the top immunosuppressive drugs, yet under certain circumstances—in irradiated hosts that have been transplanted with matched bone marrow cells—it does not suppress but actually induces immune reactions; the reactions that occur are those that are directed against "self" tissues. An explanation for this autoimmune phenomenon has been sought at the cellular level in the studies of Jenkins *et al.* (page 1655). The drug, apparently working during the time when T cells are maturing, was found to prevent most of the T cells from becoming fully mature to the so-called "single positive" cells. Furthermore, the subpopulation of cells that actually did develop to maturity was able to bypass the normal screening procedure by which those cells that are self-reacting regularly get eliminated. Thus, T cells enriched in a population of self-reactive cells are left to mature and proliferate in lymphoid organs. This explains why, once drug treatment ends, the cells engage in typical T cell activities, in this case reacting against host tissues to which they should be tolerant.

Gene transfer and expression in neurons

A number of strategies have been used for introducing specific genes into specific cells that will then express the transferred genes; so far, the methods have required that the "transgenic" cells would be able to divide. Now Geller and Breakefield describe procedures for introducing a foreign gene into nondividing rat neurons in culture and for getting gene expression within those cells (page 1667). A vector derived from a herpes simplex virus was used that caused no damage to the neurons when gene expression occurred. The test gene, one coding for the production of the enzyme β-galactosidase, was from the bacterium *Escherichia coli* and was stably expressed by the genetically modified neurons; the enzyme produced by the cells could be detected by histochemical staining procedures (cover). With this vector system, it should be possible to assess the roles in normal neurophysiology of neuronal genes that have been cloned and of the regulatory elements associated with them, and, in addition, it might be possible to alter gene defects in neuronal diseases. Because herpes simplex infects many types of cells in both mammals and birds, this virus could be used for developing vectors for transferring genes into a range of postmitotic cells for both experimental and clinical uses.

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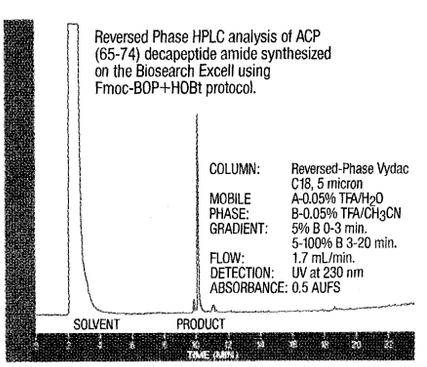

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Rural and Urban Ozone

In the United States substantial improvements have been made since 1970 in the levels of most of the principal air pollutants. An exception has been a failure to achieve compliance with the National Air Quality Standards for ozone. At least 60 major urban areas experience peaks for 1 hour that exceed 120 parts per billion (ppb) more than once per year averaged over a 3-year period. The summer of 1988 has been among the worst on record for ozone. Lack of success of the program and evidence of the role of biogenic hydrocarbons in producing ozone are causing some geophysicists to question whether a continuation of current policies of the Environmental Protection Agency will achieve control of ozone levels.

Ozone is formed as a product of a complex series of photochemical events that involve reactive organic gases and NO_x. Both components are required. In attempting to control ozone, the EPA has relied on reducing the level of anthropogenic hydrocarbons such as those associated with motor vehicles. It is currently estimated that in the United States about 18 million tons of nonmethane anthropogenic hydrocarbons are added to the atmosphere each year. At the same time 30 to 60 million tons of biogenic hydrocarbons are emitted with maximum rates of production on hot summer days coincident with ozone peaks. In the past the accepted view has been that the natural hydrocarbons made a minimal contribution to ozone because their abundance in city centers was small in comparison with anthropogenic sources. But a recent report of the Office of Technology Assessment states that peak ozone concentrations occur during mid- to late afternoons about 30 miles downwind from centers of cities. At such locations the levels of biogenic hydrocarbons may approach those of anthropogenic origin. Another factor that may not have been fully weighted is the comparative reactivities of the two types of hydrocarbons. The gases from motor vehicles tend to be largely saturated hydrocarbons such as butane and isopentane with only about 10 percent olefins and 20 percent aromatics such as benzene. In contrast, the biogenic hydrocarbons are mostly unsaturated olefins. Smog chamber experiments have shown that the olefins are prolific sources of ozone.

Extensive measurements by gas chromatography have shown that all vegetation emits hydrocarbons. Deciduous trees mainly produce isoprene (C_5H_8), which has two double bonds. Emission of this chemical occurs only during daylight hours and the rate increases rapidly as temperature rises. The principal hydrocarbons of the evergreens are the olefins, α-, and β-pinenes. These are emitted throughout the 24 hours, but again the peak is associated with high temperatures.

Measurements at Scotia,* a rural site in central Pennsylvania, are producing solid evidence on the role of biogenic hydrocarbons in forming ozone. Source gases and some of the intermediate products are carefully monitored. Only small amounts of anthropogenic hydrocarbons, such as propane, butane, and pentanes, are found. Isoprene is the principal hydrocarbon present at times of high levels of ozone. In 1986 a peak of 110 ppb of ozone was observed. In 1988 peaks of 130, 130, and 150 ppb were noted.

Biogenic hydrocarbons are likely to have a substantial role in urban areas of the Southeast.† For example 60 percent of the Atlanta urban area is forested and about 400 tons of biogenic carbon are estimated to be produced each summer day. This is an amount comparable to the total of anthropogenic hydrocarbons emitted in the urban area. During the past decade the amount of anthropogenic hydrocarbons has been substantially reduced without a corresponding reduction in ozone. To obtain compliance with ozone standards may require reduction in NO_x emissions.

Crucial factors in other places differ. The geometry and meteorology of the Los Angeles Basin make ozone control there almost intractable. No single cure will suffice.

Those who are engaged in research on formation of ozone appear to be virtually unanimous in calling for more instrumentation to monitor the inputs, intermediates, and products. In comparison with the costs of controls on emissions, the amounts devoted to state-of-the-art monitoring are trivial. If EPA is to regulate intelligently, it must be better informed about the differing circumstances and mechanisms that exist in the various rural and urban areas.—PHILIP H. ABELSON

*M. Trainer *et al.*, *Nature* **329**, 705 (1987). †W. L. Chameides, R. W. Lindsay, J. Richardson, C. S. Kiang, *Science* **241**, 1473 (1988).

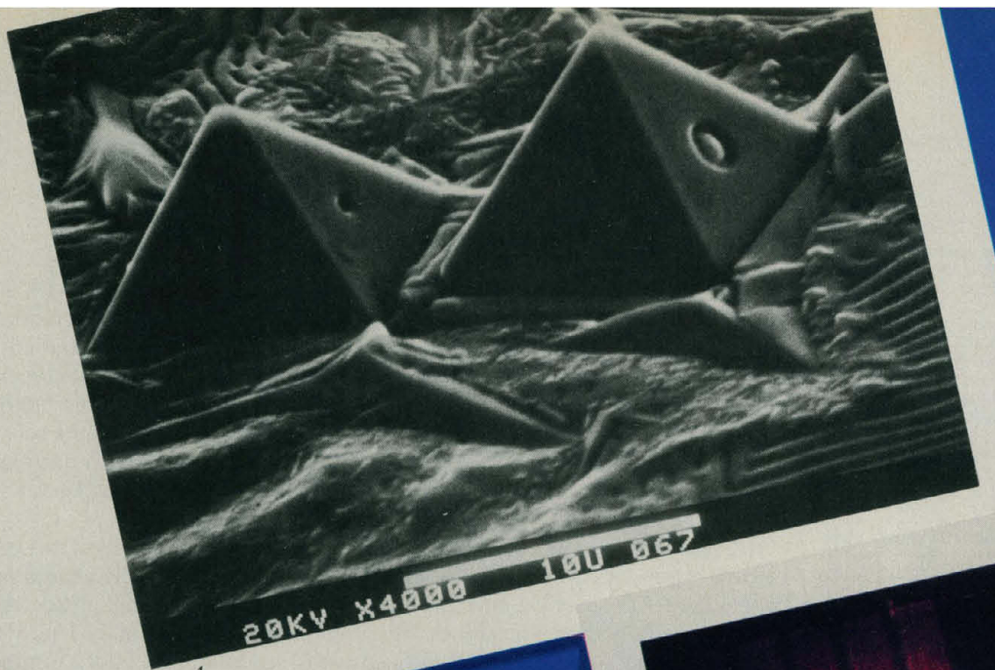
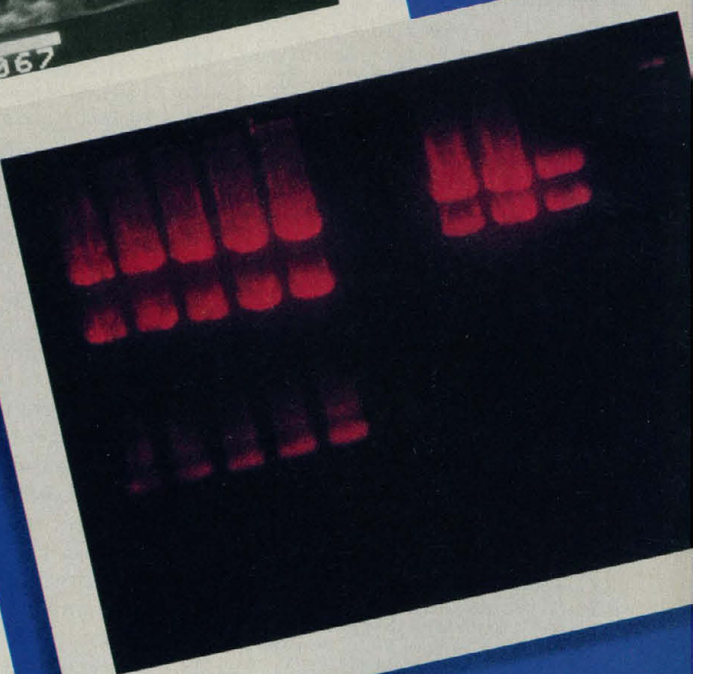


Fig. 1



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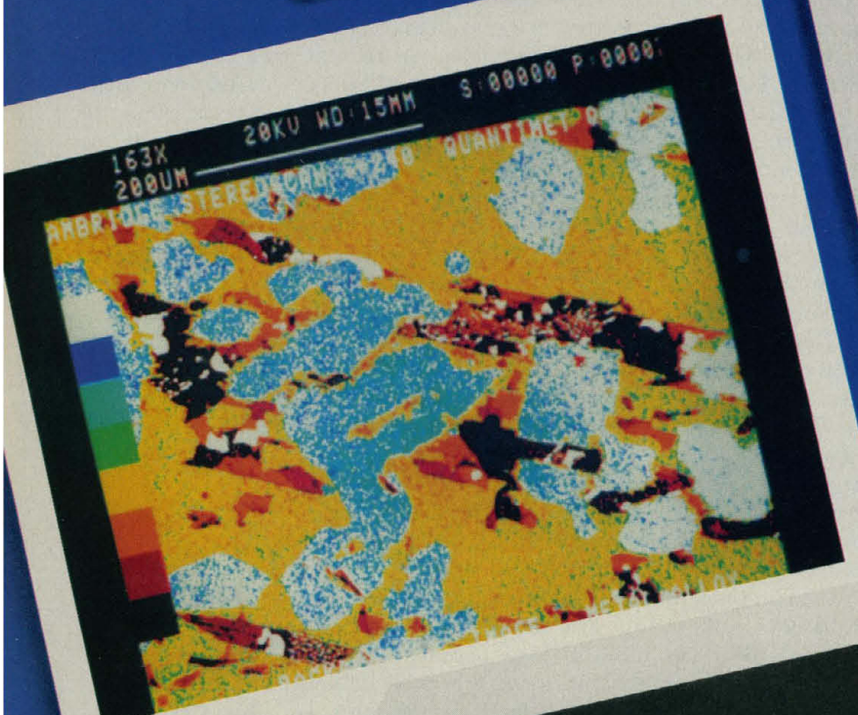

Fig. 3

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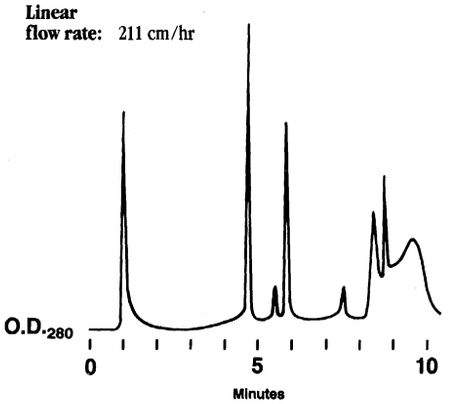

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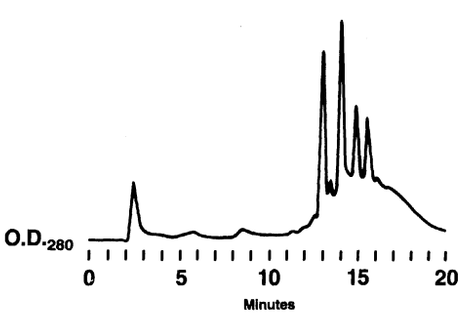

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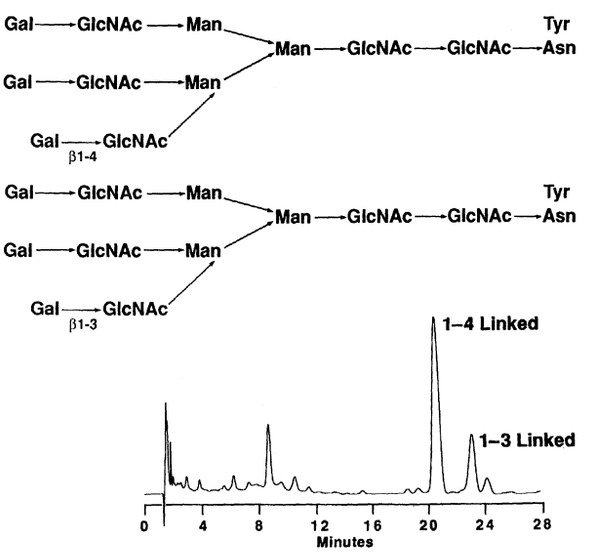

Sample Courtesy of Dr. R. Townsend, Biology Dept., The Johns Hopkins University, Baltimore, MD

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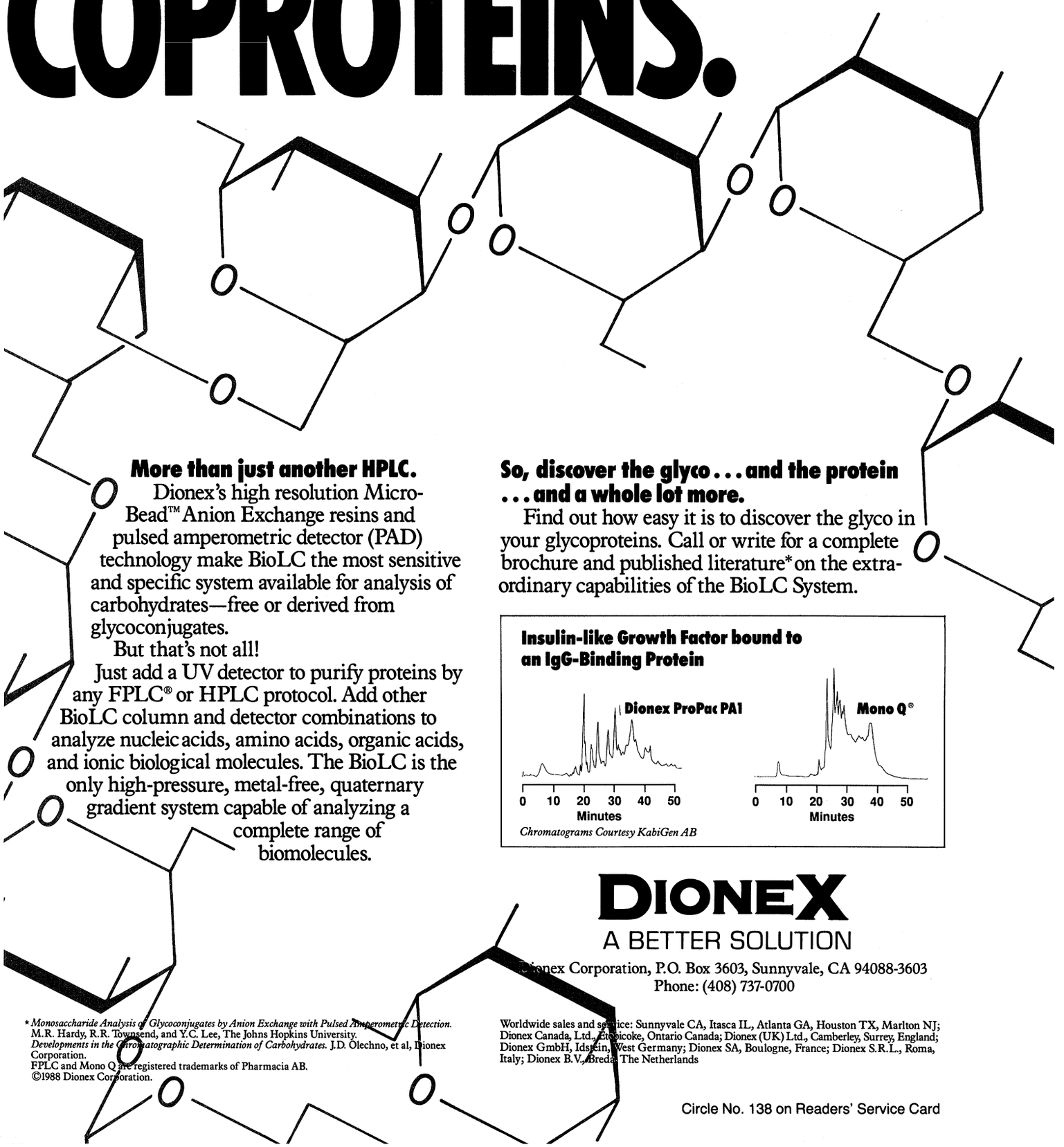

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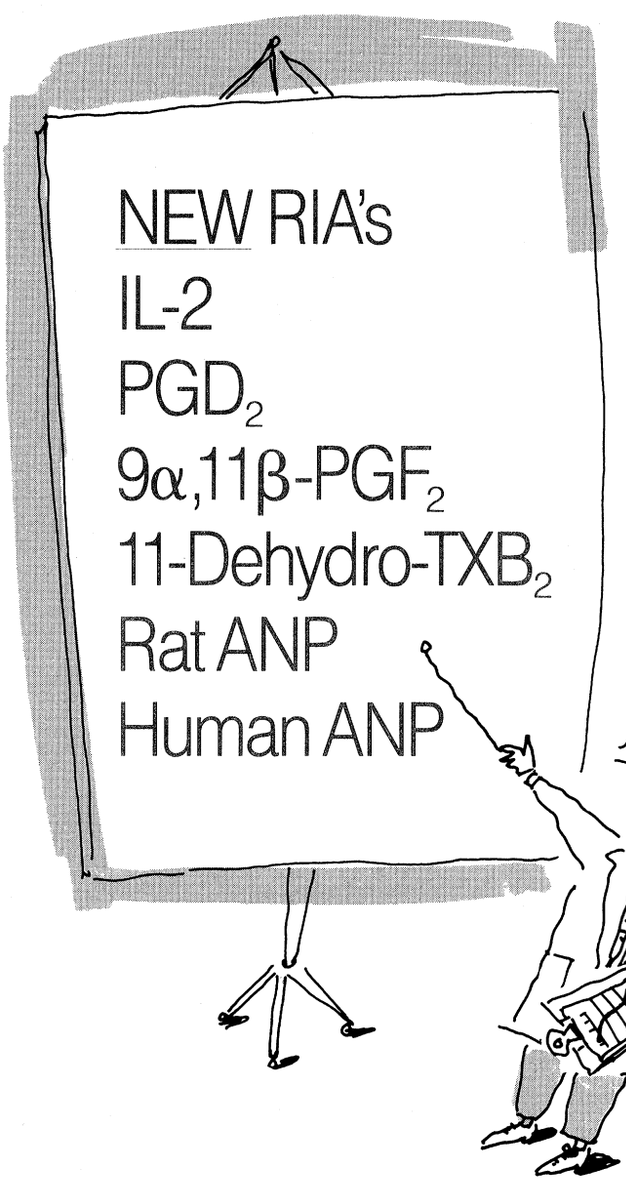

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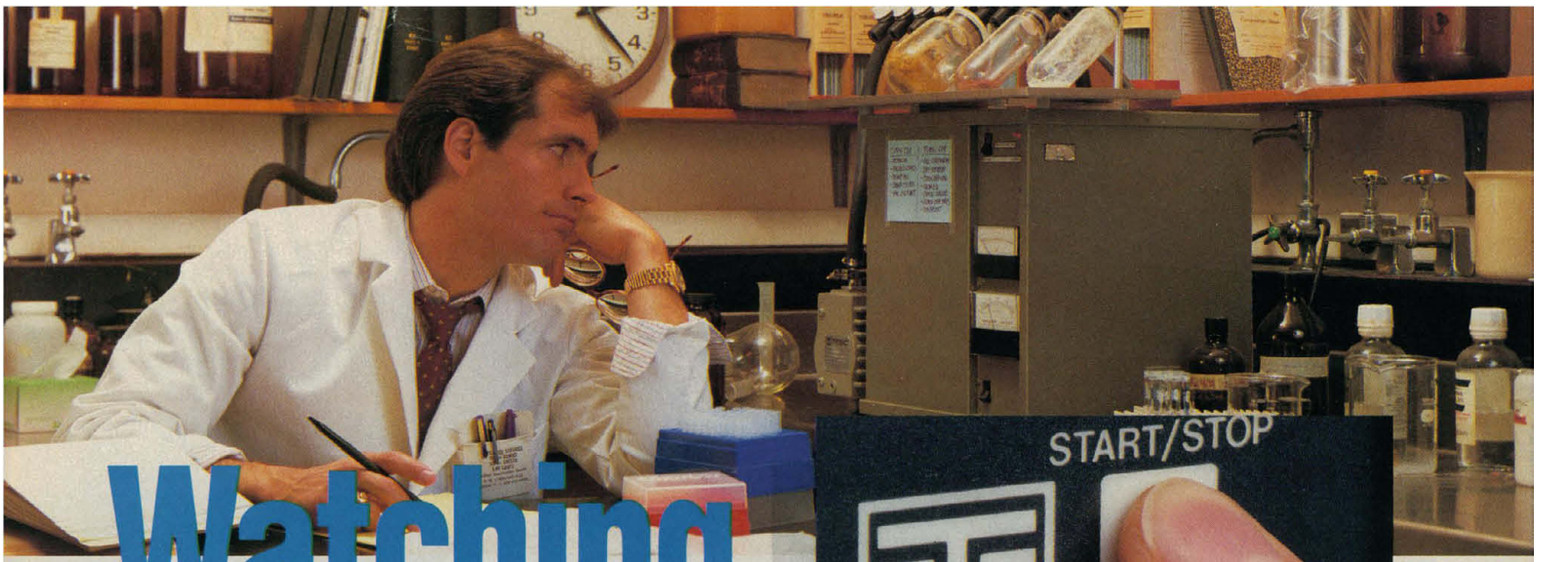

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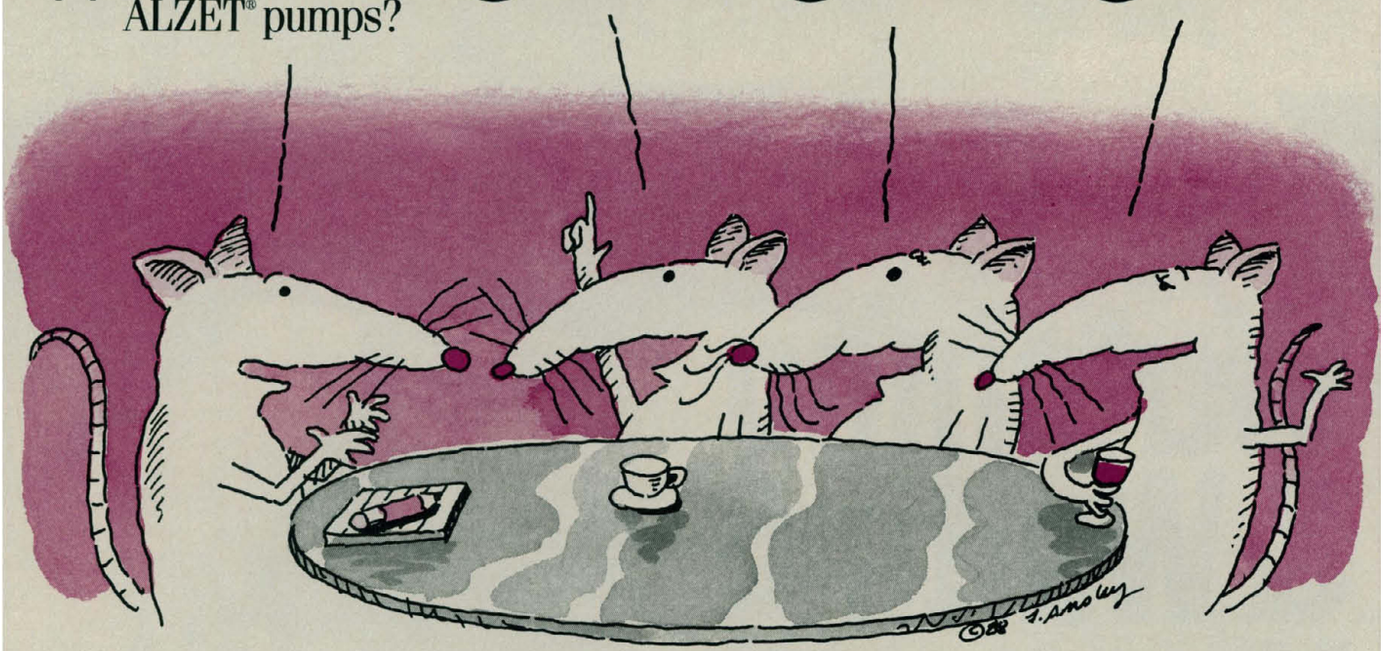

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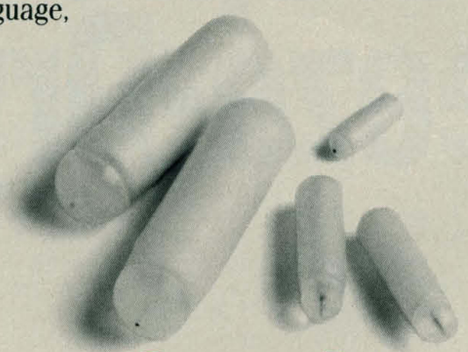

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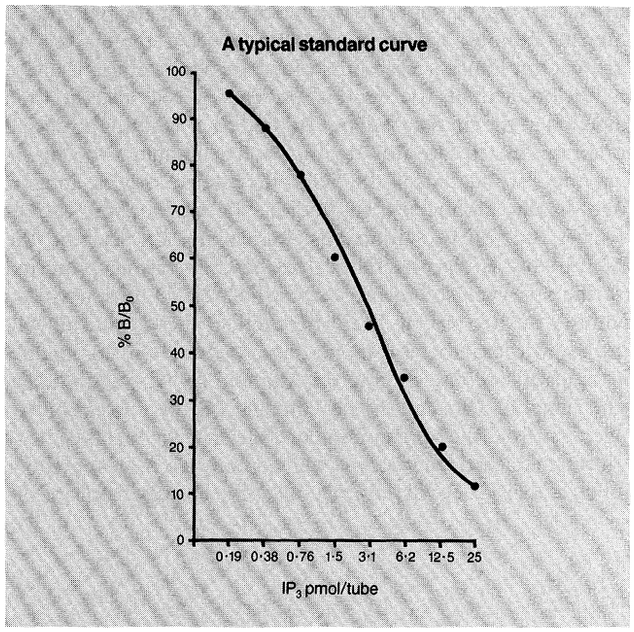

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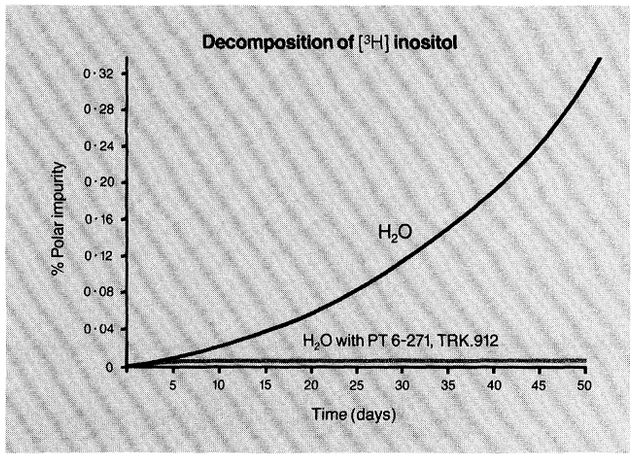

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ment of our "Benveniste affair" (Research News, 5 Aug., p. 658) are inappropriate?

If correctly reported, Relman believes that an editor's function is to ensure that contributions are "rigorously and fairly reviewed"; he refers darkly to the "conflict of interest" that, in his view, must arise when editors are more directly involved in assessing the quality of what they are asked to publish.

That recipe may suffice for archival journals, although even they have recently shown signs of alertness to their readers' interests. *Nature*, which is proud to publish much first-rate science, has always taken a more active role. Thus my first predecessor, Sir Norman Lockyer (editor, 1869–1919), was deeply engaged in the controversy on whether the solar corona is an attribute of the solar or terrestrial atmosphere (he backed the wrong side) and in 1904 commissioned from R. W. Wood a damning investigation of the spurious phenomenon of N-rays.

I believe our readers will have been instructed on three important points by the Benveniste paper and its sequel: how easily authentic science may be simulated by the careful selection of data and the judicious use of language, how even "rigorously and fairly" reviewed papers may embody defects recognizable even by people whom Benveniste (rightly, in the context) calls "amateurs," and—more alarming—how likely it is that much second-rate science finds its way into print somewhere.

But there is no reason why Benveniste should still be saying, as you report him, that he "would be happy" to learn of procedural errors accounting for his unbelievable conclusions. Our report gives a detailed and sufficient explanation. If Benveniste persists in counting stained basophils as a measure of anti–immunoglobulin E activity, he will avoid error only if he first acknowledges that sampling errors are unavoidable (not mere "theoretical objections," as he described them to us), if he controls sampling errors by the standard procedure of replicating measurements, and if he eliminates observer bias by arranging that everything is counted blind. Then, alas, as we found, his conclusions will be unremarkable.

JOHN MADDOX
Editor, Nature,
4 Little Essex Street,
London WC24 3LF, England

Erratum: In Gregory Byrne's Random Sample "Love story" (22 July, p. 420), the name of Acadia National Park was misspelled; in the same piece, the Cornell (University) Medical Center was incorrectly located in Queens, New York. The medical center is actually in Manhattan.

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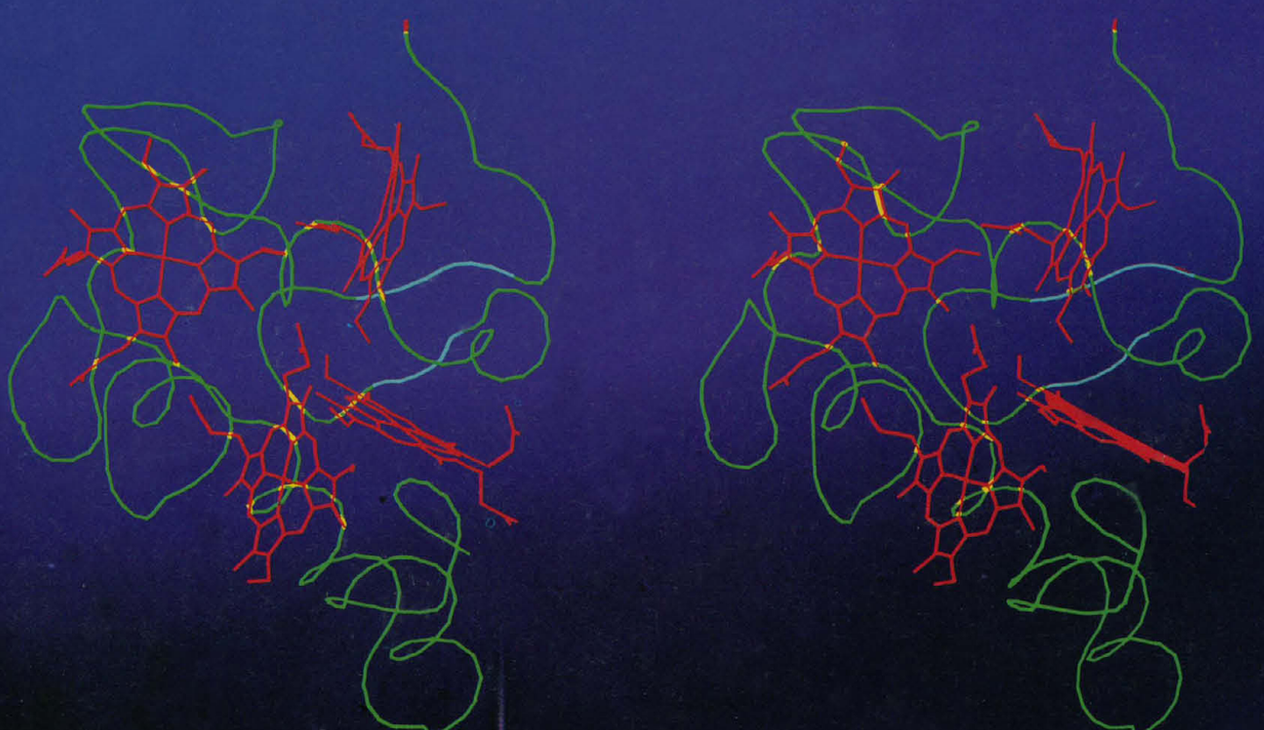

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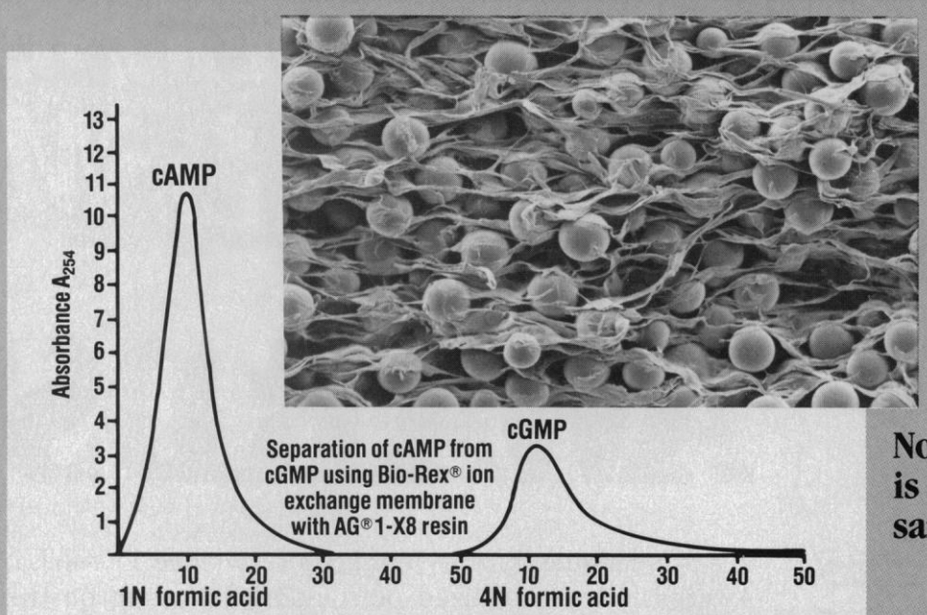

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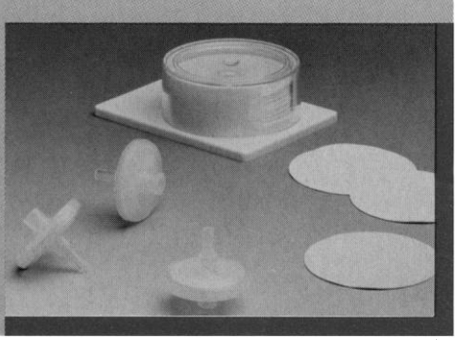

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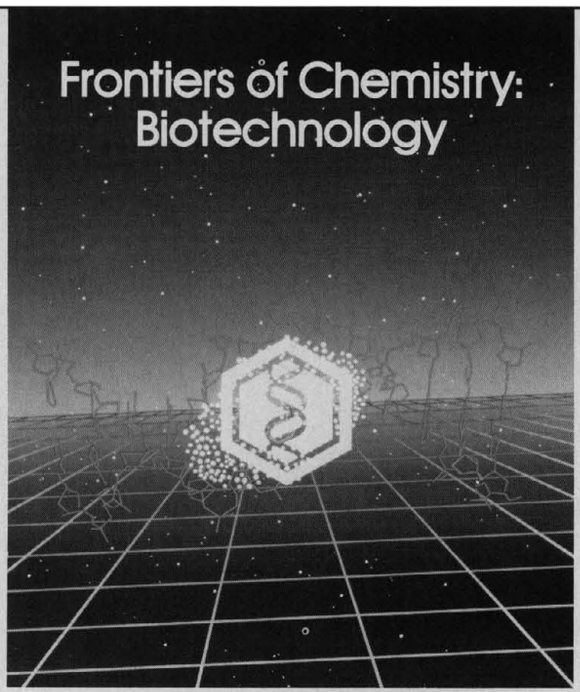

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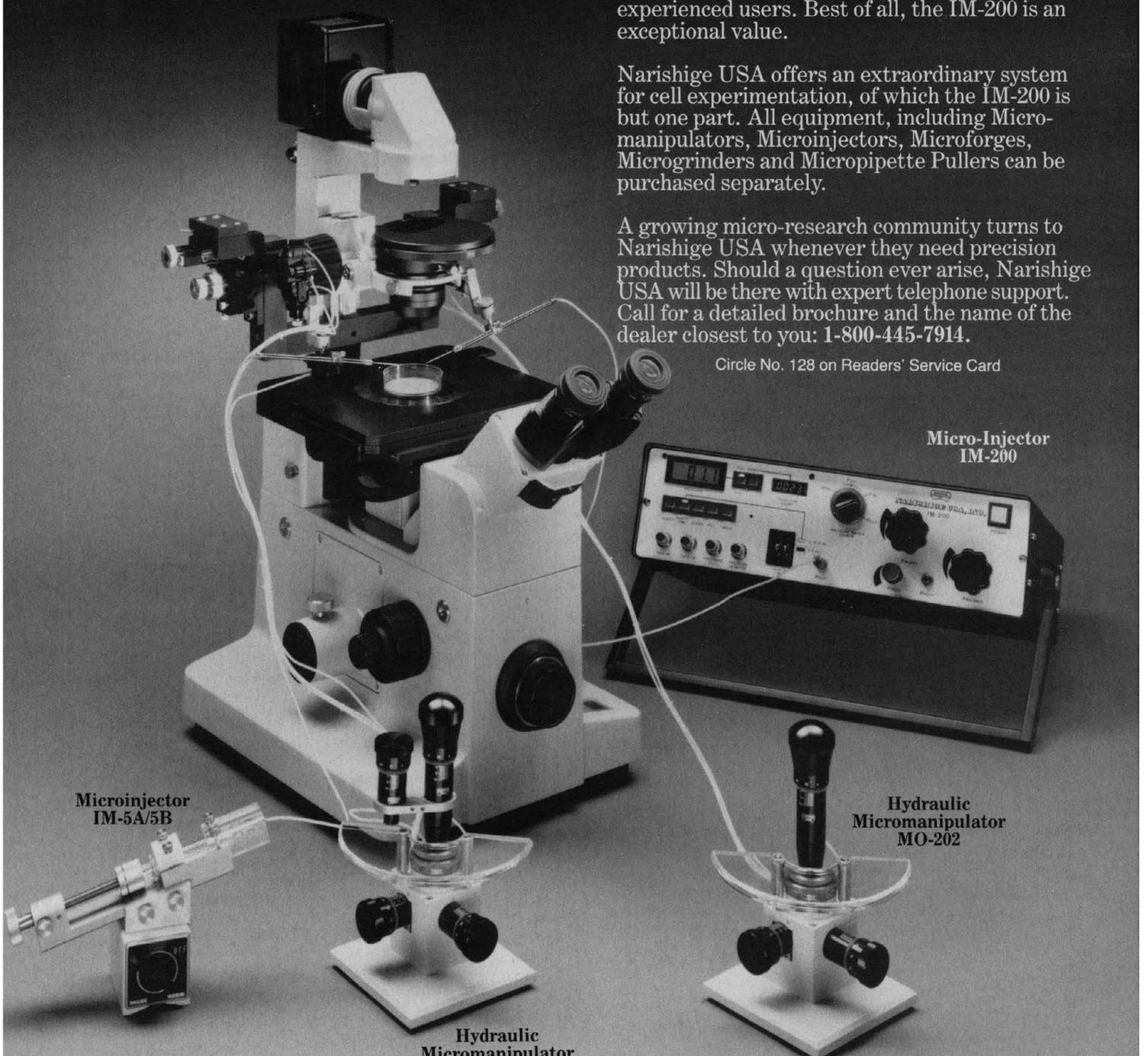

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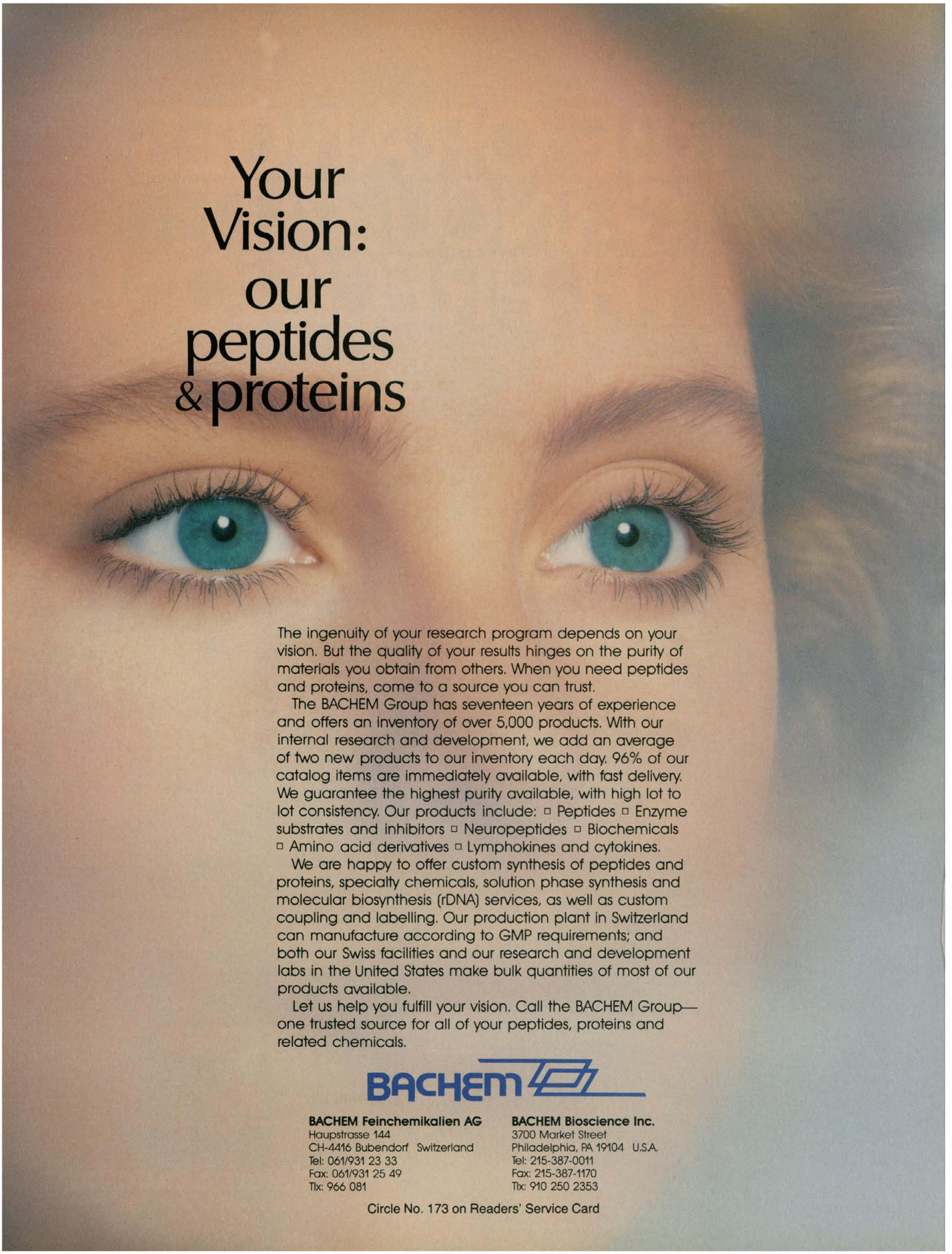

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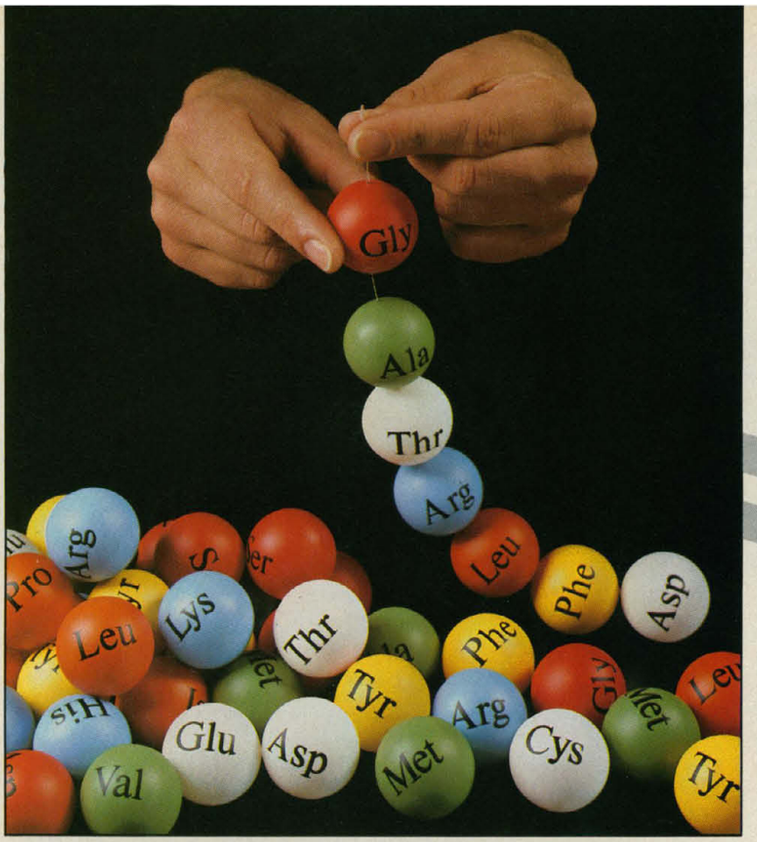

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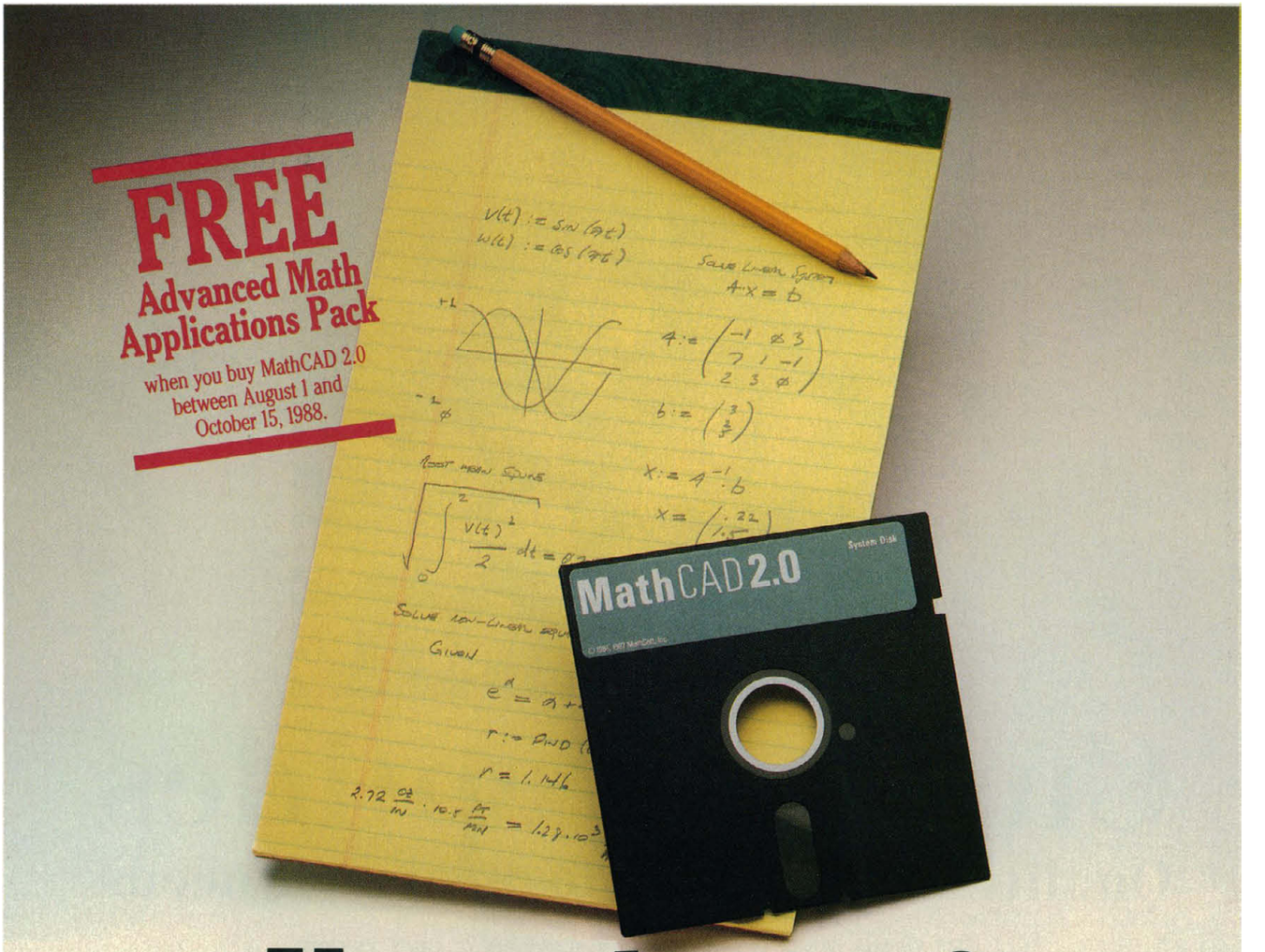

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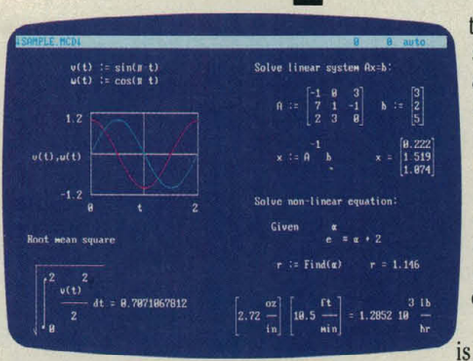

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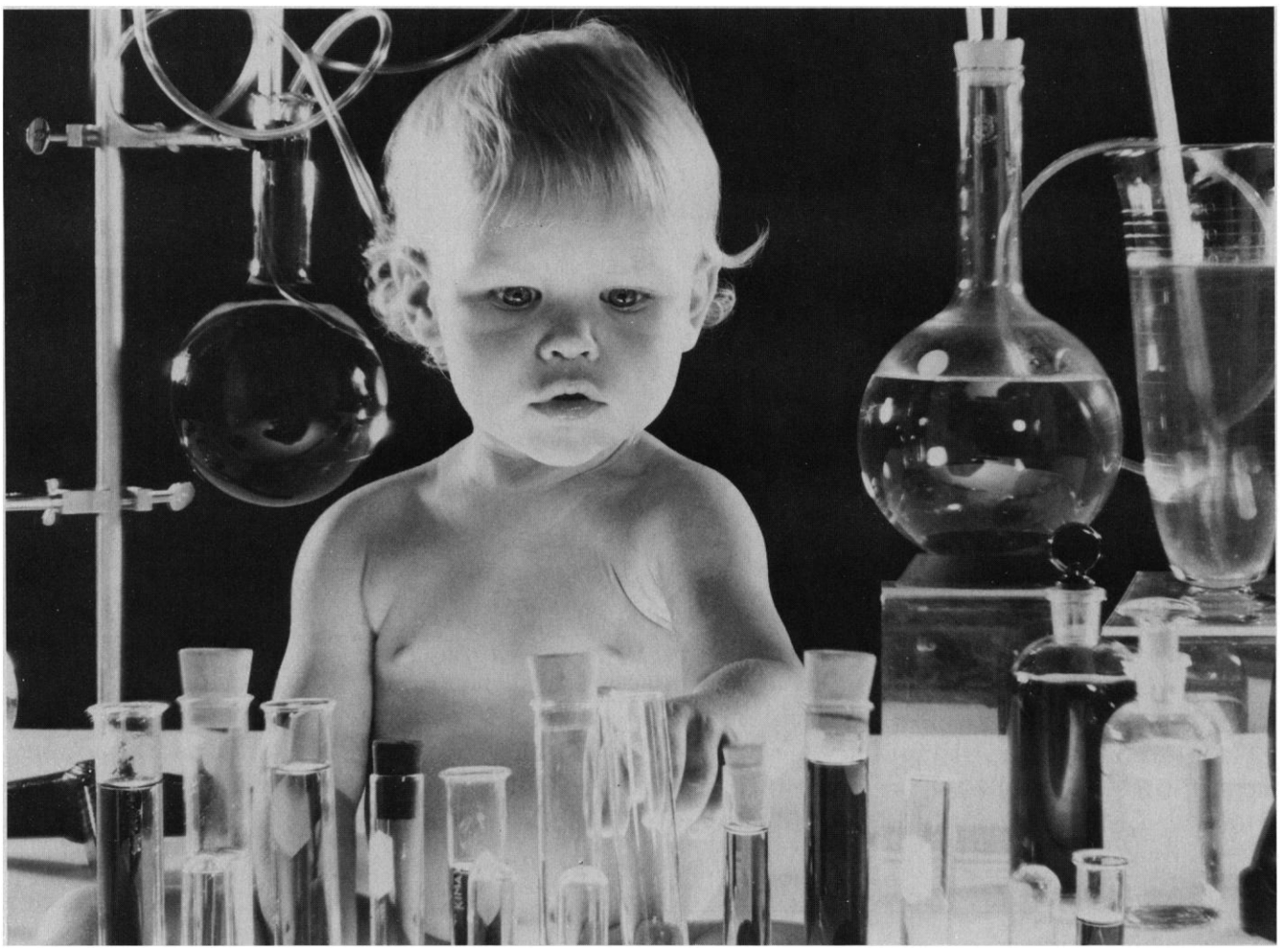

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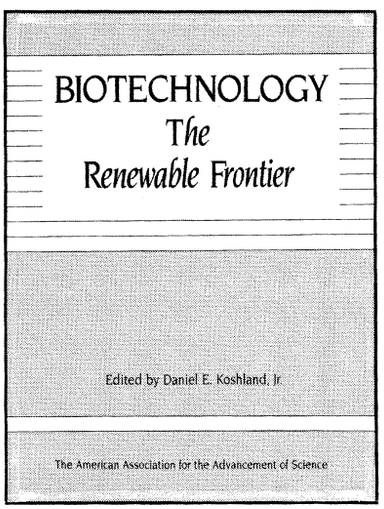

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PROGRAM

Monday, October 31, 1988

9:00 **JACK S. JOSEY,** *Welcoming of Guests*
9:05 **W. O. BAKER,** *Introductory Remarks*

PRINCIPLES OF ELECTRON FUNCTION IN COMPOUNDS AND CRYSTALS

9:15 **P.W. ANDERSON**
Discussion to be led by **JEREMY K. BURDETT**

CONCEPTS OF CHEMICAL BONDING: APPLICATION TO SYSTEMS OF MATERIALS AND BIOLOGICAL INTEREST

10:45 **WILLIAM ANDREW GODDARD III**
Discussion to be led by **JOHN A. POPLE**

VALENCY IN MOLECULES AND CLUSTERS

1:45 **LOUIS E. BRUS**
Discussion to be led by **WILLIAM P. SLICHTER**

VALENCY AND CHARGE DISTRIBUTION IN ALKALIDE AND ELECTRIDE SALTS

3:00 **JAMES L. DYE**
Discussion to be led by **FRANCIS J. DISALVO, JR.**

Tuesday, November 1, 1988

VALENCY IN STRANGE DIMENSIONS

9:00 **DUDLEY HERSCHBACH**
Discussion to be led by **HARRY G. DRICKAMER**

VALENCY CONSIDERATIONS IN NOVEL INORGANIC STRUCTURES

10:30 **ARTHUR W. SLEIGHT**
Discussion to be led by **RICHARD E. SMALLEY**

12:00 *Luncheon*

1:00 **RICHARD B. BERNSTEIN,** 1988 WELCH AWARDEE

VALENCY AND ELECTRON TRANSFER IN BIOLOGICAL SYSTEMS: BIRDS DO IT, BEES DO IT

2:15 **GEORGE L. MCLENDON**
Discussion to be led by **NORMAN SUTIN**

Wednesday, November 2, 1988

VALENCE FORMATION IN CHEMICAL DYNAMICS

9:00 **RICHARD B. BERNSTEIN**

VALENCY IN THE PERIODIC TABLE—CONCERNING THE LIMITS OF OXIDATION OF THE ELEMENTS

10:30 **NEIL BARTLETT**
Discussion to be led by **KONRAD SEPPELT**

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- ☐ Membrane Supports for Peptide Synthesis
- ☐ Covalent Protein Sequencing–Development of Advanced Instrumentation and Materials

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Seattle, WA	Executive Inn	Oct. 28
Chicago, IL	Hillside Holiday Inn	Nov. 1
St. Louis, MO	Clayton Holiday Inn	Nov. 3
Houston, TX	Marriott Med Center	Nov. 8
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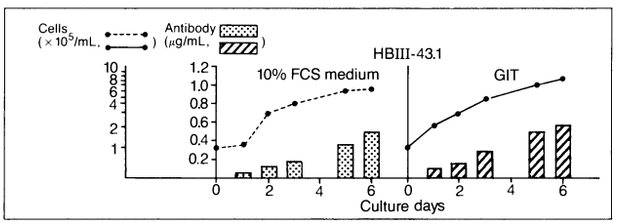

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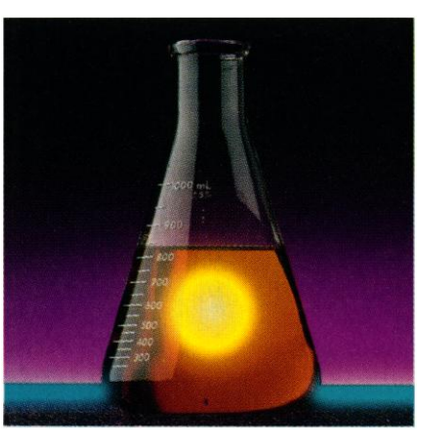

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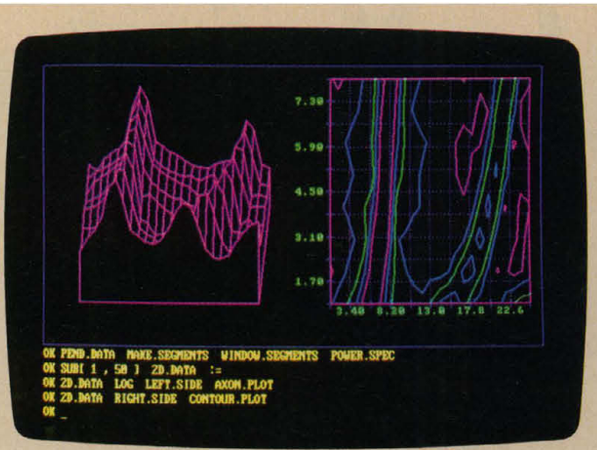

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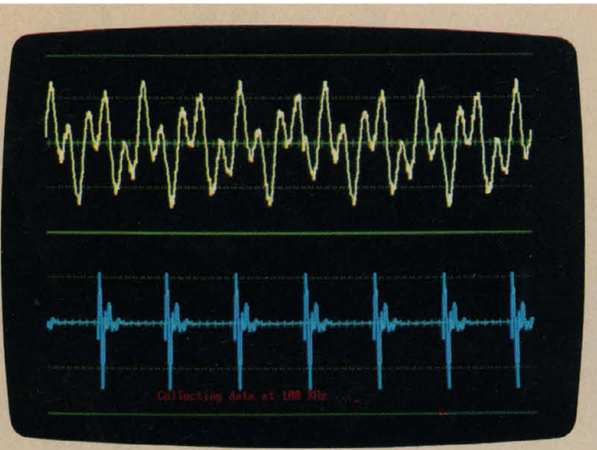

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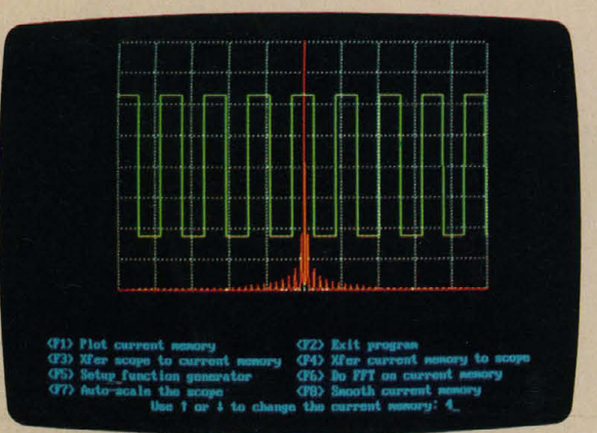

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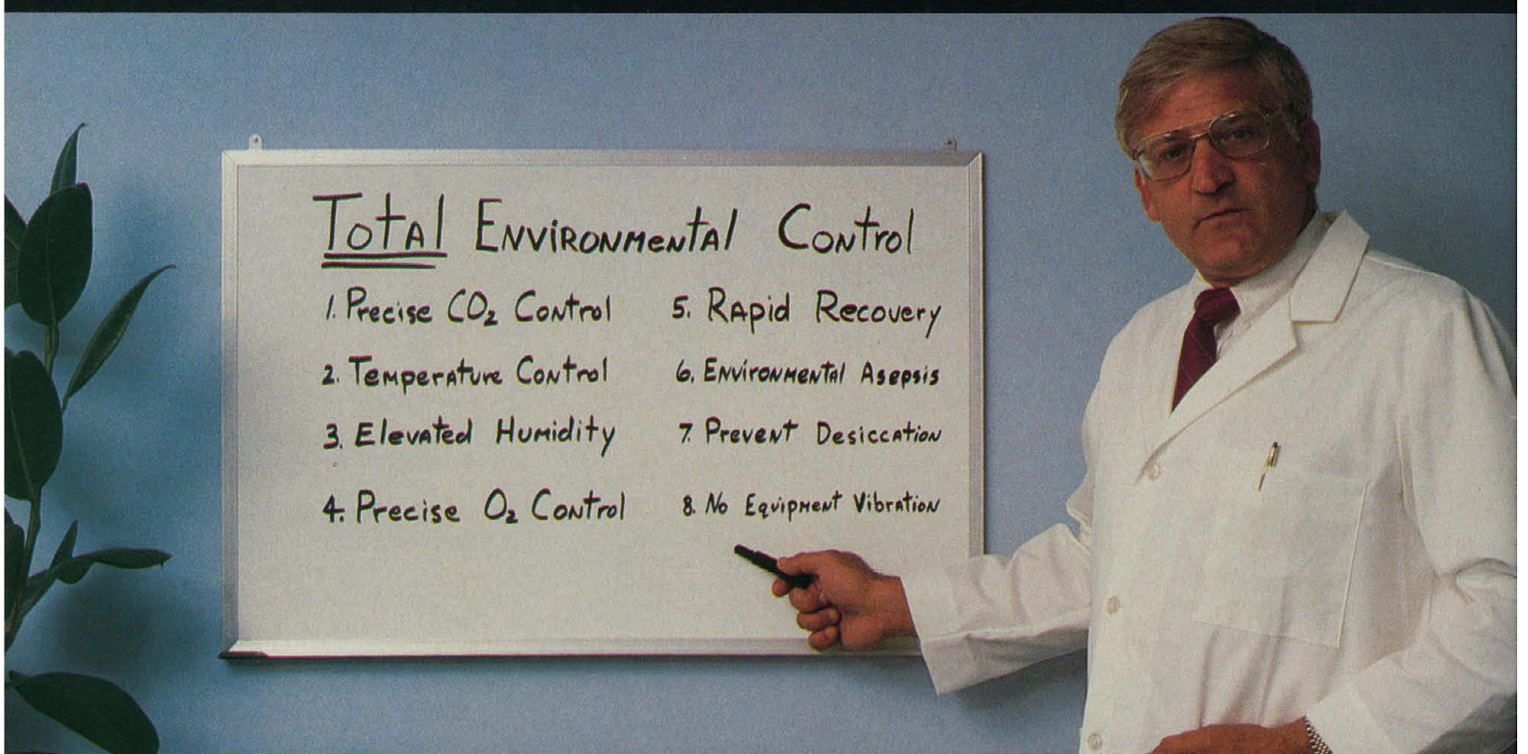

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"596" to mark the year and month of the formal cancellation of Soviet nuclear aid.) Indeed, especially as the program neared its successful conclusion, the project directors repeatedly pushed the pace of their efforts, on occasion having to overcome skepticism on the part of the political military leadership. As the authors conclude, "In most instances the nature and level of the programmatic demands emanated from the experts themselves" (p. 225).

Third, the Chinese undoubtedly benefited from the fact that other countries had gone before them. Systematic collection and scrutiny of Western literature enabled identification of promising paths and avoidance of costly mistakes. Premier Zhou Enlai, who assumed a crucial oversight role throughout the program's history, advocated an approach that he termed "one-time test, overall results." The authors describe this as "a method in which the stages of theoretical research, experimentation, engineering, and production were considered together and undertaken as a whole. . . . The Chinese . . . shunned full scale experiments except when absolutely necessary" (p. 107). Time and cost imperatives also contributed to a more risk-taking, improvisational approach that at times compromised safety and that placed a lower premium on exactitude and sophistication.

Fourth, the Chinese made extremely effective use of the equipment and design data the Russians left behind. The unavailability of uranium hexafluoride proved the major inhibiting factor in the production process, and the authors describe the completion of the partially finished gaseous diffusion plant at Lanzhou as "a national crusade" (p. 125). Indeed, the fact that the Chinese managed to install all the Soviet-supplied equipment at the plant by late 1962 undermines the blanket assertion about total disarray in the aftermath of Moscow's aid withdrawal: the plant was far from finished when Soviet assistance ceased. The Chinese were also able to use fragmentary Soviet data that proved vital to design of the implosion device employed in the first nuclear test.

The fifth and final factor deserves special note: the Chinese were able to devise a highly effective system for program management. As the commitment to develop nuclear weapons accelerated in the late 1950s, Chinese leaders "became convinced that the time had come to impose a central, military-type organization on the entire strategic program and thereby eliminate, or at least minimize, the overlapping leadership systems and populist interference" (p. 53). The soundness of this approach was repeatedly demonstrated in ensuing years.

The dominant figure in this process was Marshal Nie Rongzhen, who as head of the Defense Science and Technology Commission assumed principal responsibility for overseeing the program as a whole. The leadership's commitment to simultaneous pursuit of all key aspects of weapons development underscored the need for such a decision-making body. As a result, decisions could be made and implemented in a timely, effective fashion, even when they entailed major reallocation of resources. The April 1960 decision to emphasize enriched uranium rather than plutonium as the near-term source of fissionable material is one example: it is difficult to imagine a decision of this sort in the absence of an authoritative management system.

However, the authors also offer revealing glimpses of an intense intra-bureaucratic struggle during the early 1960s, when some of China's most powerful leaders allegedly sought to discontinue or delay the nuclear effort in the aftermath of China's "three lean years." Although Mao ultimately ruled in favor of nuclear development, other bureaucratic constituencies and leadership networks were able (through the creation of a 15-member Central Special Commission in late 1962) to impinge somewhat on Nie's prerogatives. The marshal's ability to carry the program to successful conclusion and within the agreed-upon timetable was a vivid testimonial to the management arrangements and procedures introduced at his behest. As the authors further note, a quarter-century later Nie and his key subordinates maintain predominant influence within the Chinese nuclear weapons and space bureaucracy.

Despite the limitations of the available evidence and some intermittent analytical problems, *China Builds the Bomb* is a landmark study. In detail and scope it vastly surpasses all previous research on this topic, and it seems certain to remain the definitive treatment for many years to come. Perhaps most important, Lewis and Xue have demonstrated the rich potential of sustained collaboration between American and Chinese scholars. All students of nuclear strategy and of Chinese politics will remain in their debt.

JONATHAN D. POLLACK
Political Science Department, RAND Corporation, Santa Monica, CA 90406-2138