20 June 1980 • Vol. 208 • No. 4450 $1.50

SCIENCE

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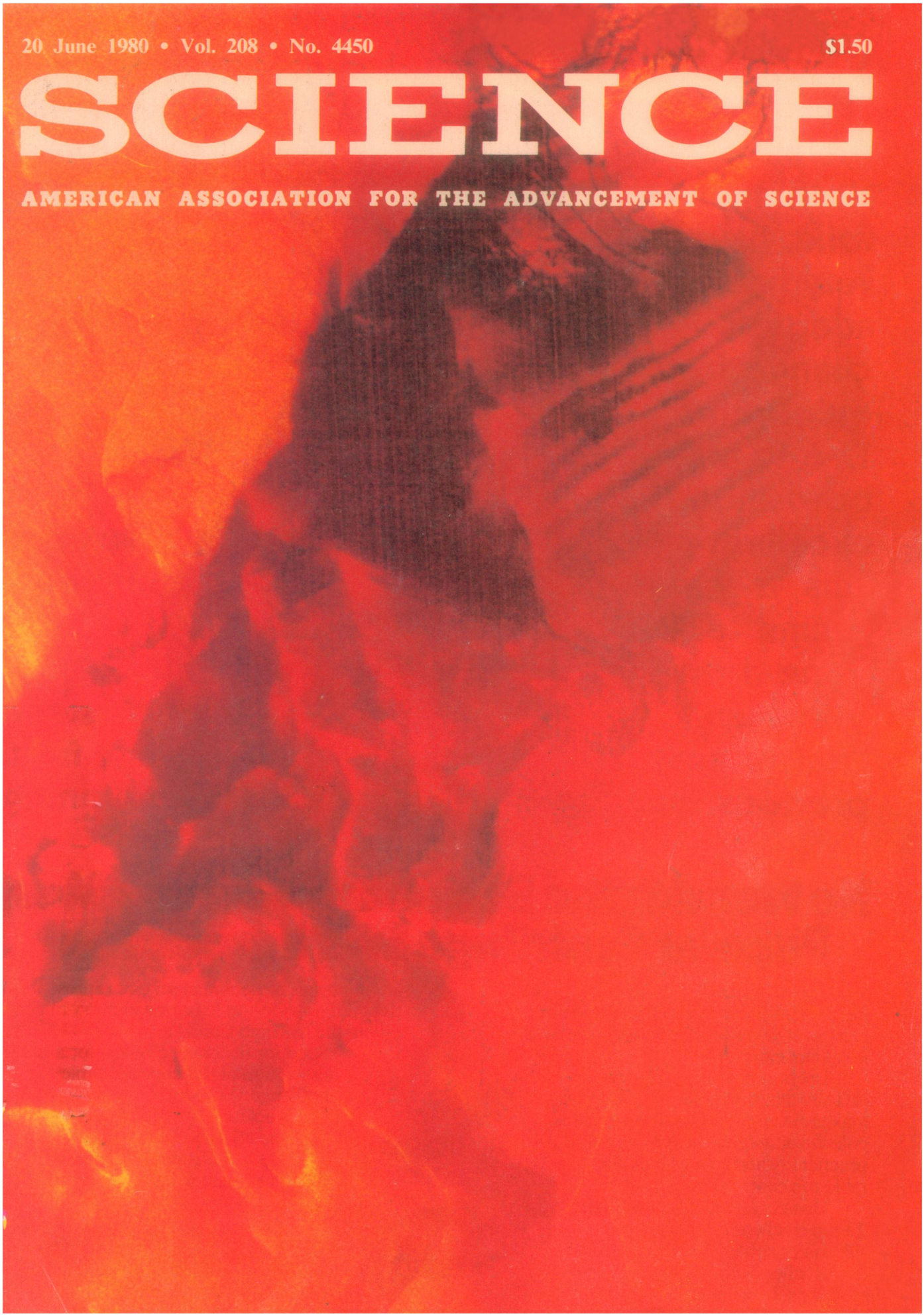

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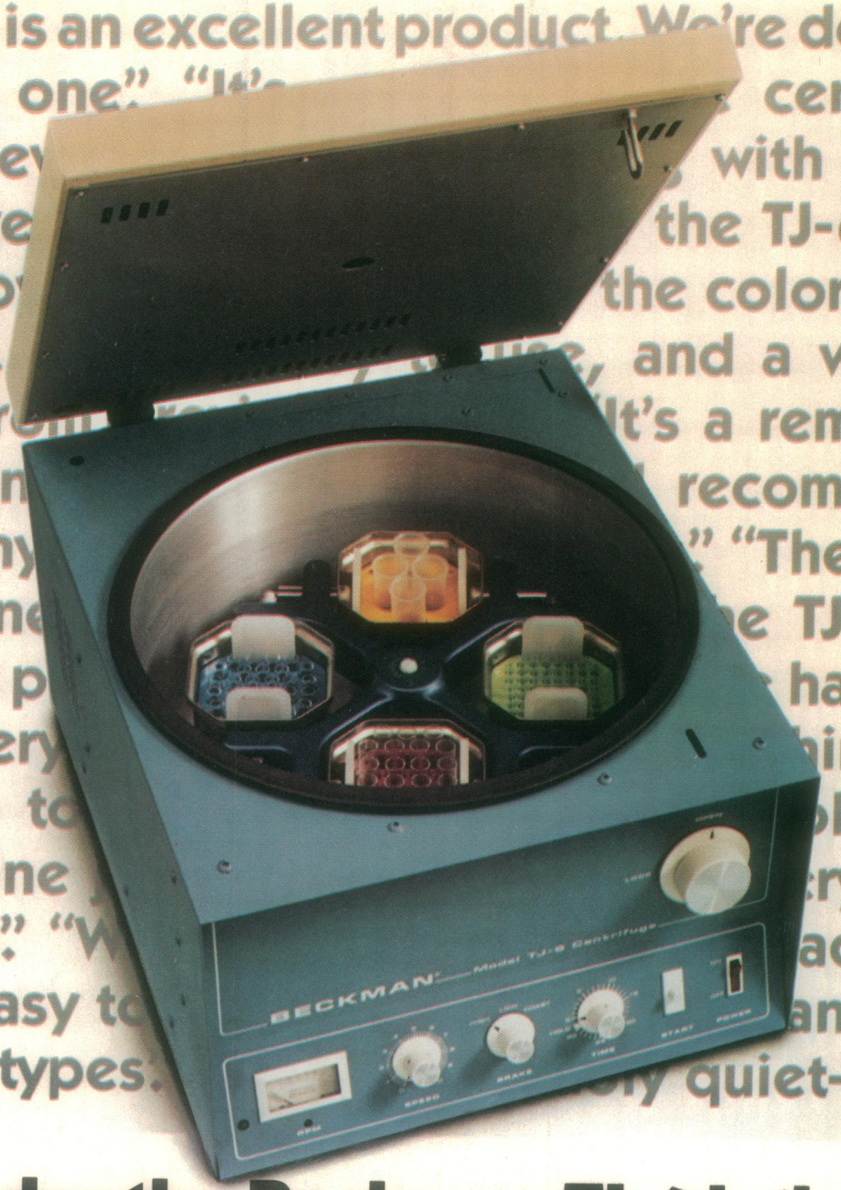

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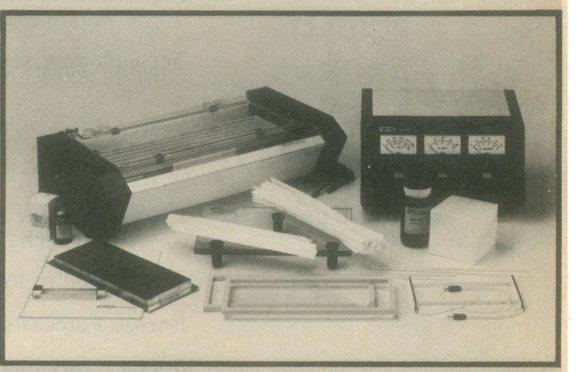

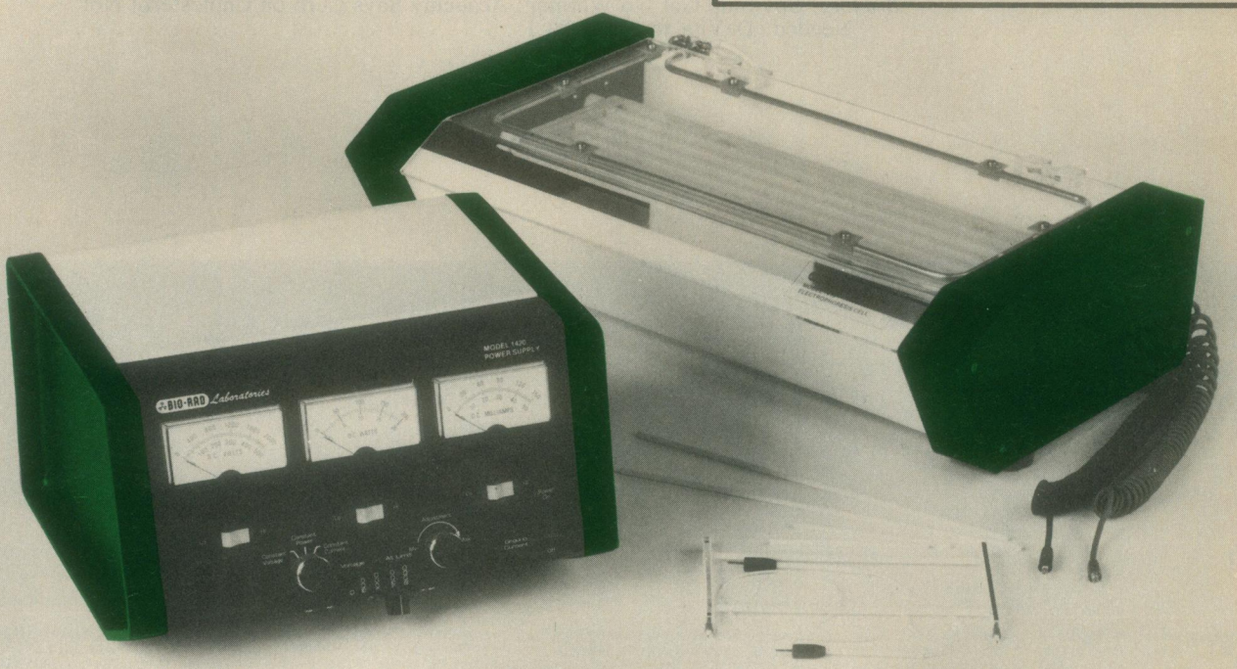

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SCIENCE

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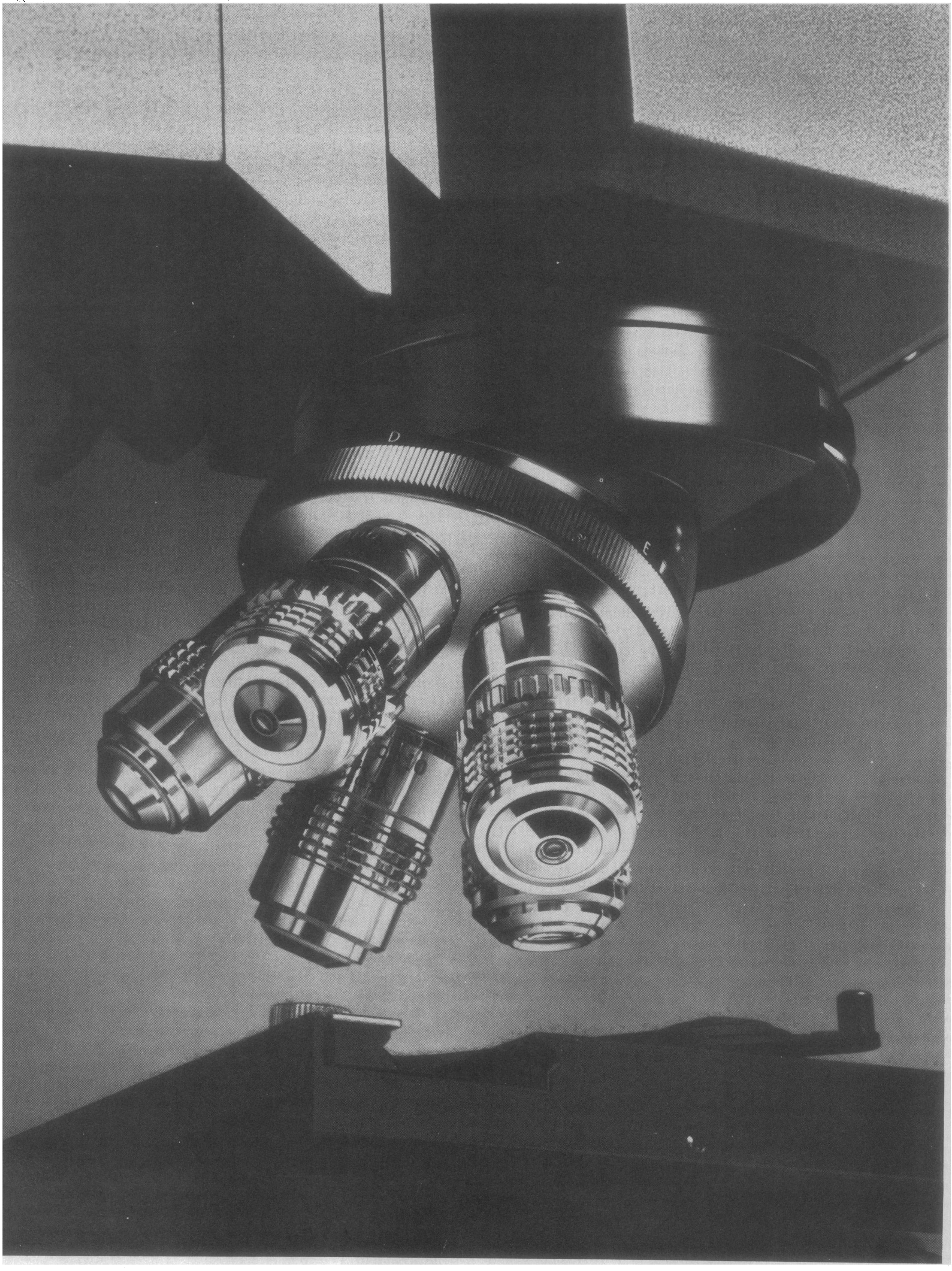
COVER

Complex radar backscatter patterns in a nearly calm region of the ocean located just outside the mouth of the Chesapeake Bay (taken on 28 September 1978 by Seasat Synthetic Aperture Radar). Horizontal dimension is equal to 100 kilometers; inherent resolution in both dimensions is 25 meters. See page 1373. [C. Wu, Jet Propulsion Laboratory, Pasadena, California]



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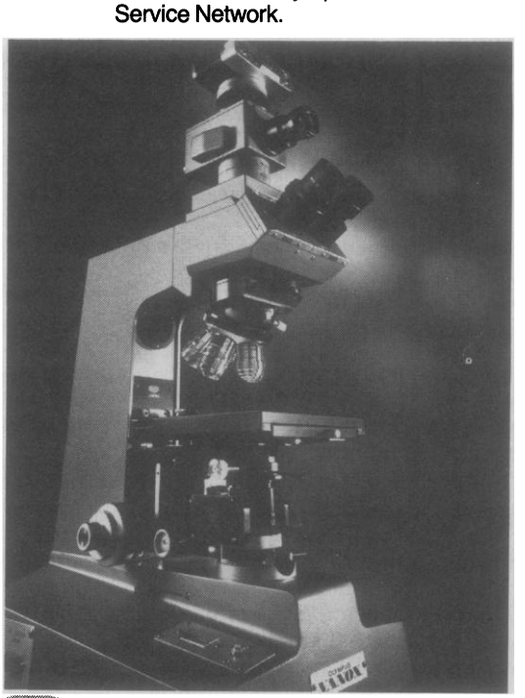

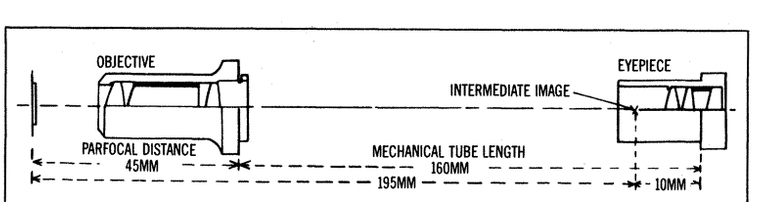

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Contribution to the Ellipsoid Algorithm

The recently publicized polynomial time ellipsoid algorithm for linear programming has generated much excitement and activity among both researchers and press (News and Comment, 2 Nov. 1979, p. 545). We wish to add some historical remarks concerning the genesis of these ideas.

The Khachian paper (*1*) refers to earlier works of Shor (*2*) and of Judin and Nemirovsky (*3*). However, because the paper by Judin and Nemirovsky has not yet been translated, the full significance of their work and its major contribution to the polynomial time solution of the linear programming problem is only now becoming apparent. One of our aims in this letter is to stimulate the translation of this and other of Nemirovsky's works.

We summarize here the linear programming problem and the contribution of the papers by Nemirovsky and the head of his division, Judin, to its solution.

The problem is to find a solution with a given accuracy of a system of linear real inequalities or to determine its unsolvability. In the discrete version the coefficients are rational, and it is required to determine the exact solvability. As is well known, this is equivalent to the approximate solvability with a high enough accuracy. The required accuracy is easy to find, since the set of solutions forms a polyhedron, whose vertices are rationally expressible in terms of the coefficients of the system. Judin and Nemirovsky's 1976 paper (*3*) gives the ellipsoid algorithm for solving the continuous version with an *explicitly* stated polynomial upper bound on the number of steps. The formulation of the results is suitable not only for linear but also for convex inequalities. The paper refers to an earlier paper of Shor (*2*); however, Shor's gradient descent method was not sufficiently developed or specified to provide a polynomial upper bound. The main contribution of Khachian's paper (*1*) was a reformulation of Judin and Nemirovsky's paper for the discrete case.

Since the publication of Khachian's paper, and its explication by Gács and Lovász (*4*), many researchers have proposed improvements of the ellipsoid algorithm. We note, however, that improvements were already presented (*3*, *5*) (sphere method, dimension reduction, and so forth). We believe this parallelism

shows how unfortunate it is that Nemirovsky's papers are unknown and untranslated. Perhaps this is because Nemirovsky does not have the advantage of working in a well-known institution, nor of having these papers published by well-known journals.

Nemirovsky is a scientist of the highest caliber whose major field is pure mathematics, in particular, functional analysis. We urge our colleagues to seek out and translate his papers and books.

LENORE BLUM
Departments of Mathematics and *Computer Science, Mills College, Oakland, California 94613*, and *University of California, Berkeley 94720*
PETER GÁCS
Department of Computer Science, University of Rochester, Rochester, New York 14627
LEONID A. LEVIN
Laboratory for Computer Science, Massachusetts Institute of Technology, Cambridge 02139

References and Notes

1. L. G. Khachian, *Dokl. Akad. Nauk SSSR* **244**, 1093 (1979), translated in *Sov. Math.* **20**, 191 (1979).
2. N. Z. Shor, *Kibernetika* **6**, 80 (1970), translated in *Cybernetics* **6**, 102 (1970).
3. D. B. Judin and A. S. Nemirovsky, *Ekon. Math. Metody* **12**, 357 (1976).
4. P. Gács and L. Lovász, "Khachian's algorithm for linear programming," distributed in preliminary form at the 10th International Symposium on Mathematical Programming in Montreal, Canada, 27 to 31 August 1979; available as Report CS 750, Computer Science Department, Stanford University, Stanford, Calif.
5. D. B. Judin and A. S. Nemirovsky, *Ekon. Math. Metody* **12** (No. 1), 128 (1976); *ibid.* **12** (No. 3), 550 (1977).

Confidentiality: Rights and Responsibilities

The article by Gordis and Gold on privacy and confidentiality in medical records research (11 Jan., p. 153) is an excellent statement about the rights and obligations of scientists in a search for an equitable balance between the information needs of the biomedical research community and the individual rights of patients and research subjects to confidentiality and privacy. It is made even more valuable by its original presentation as congressional testimony on behalf of the professional societies whose members' activities are directly affected by such ethical and legal issues, and as such it is a noteworthy public contribution by these societies.

The article does not mention, however, a new policy question that has emerged in the context of balancing researchers' rights with the public's right

to know. The request (*1*) by the National Institutes of Health to the Department of Health, Education, and Welfare Ethics Advisory Board for a review of a proposed additional exemption to the Freedom of Information Act (FOI) for epidemiological and clinical research data raises a topic of concern that should be brought to the attention of the broader scientific community and the public beyond the researchers and the government agencies immediately affected. In the proposed FOI exemption for preliminary research data, the traditional rights of scientists to analyze incomplete data outside the arena of public review are recognized. This would minimize the premature release of misleading and incomplete research findings. Researchers and the government also have a responsibility, however, to make available for review and criticism evidence supporting scientific claims used in formulating public policies. The "timing" of access to preliminary research data may place this right and responsibility in conflict.

The AAAS Committee on Scientific Freedom and Responsibility has identified this issue of proposed FOI exemptions for research data as an important topic for future discussion. The committee invites individuals from the scientific community and the public to express opinions on the proposed exemptions in correspondence to the committee office at the AAAS address. These opinions will be used as a basis for future examination of this issue and will be forwarded to appropriate government offices when and if the proposed exemption is drafted.

JOHN T. EDSALL
AAAS Committee on Scientific Freedom and Responsibility, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005

References

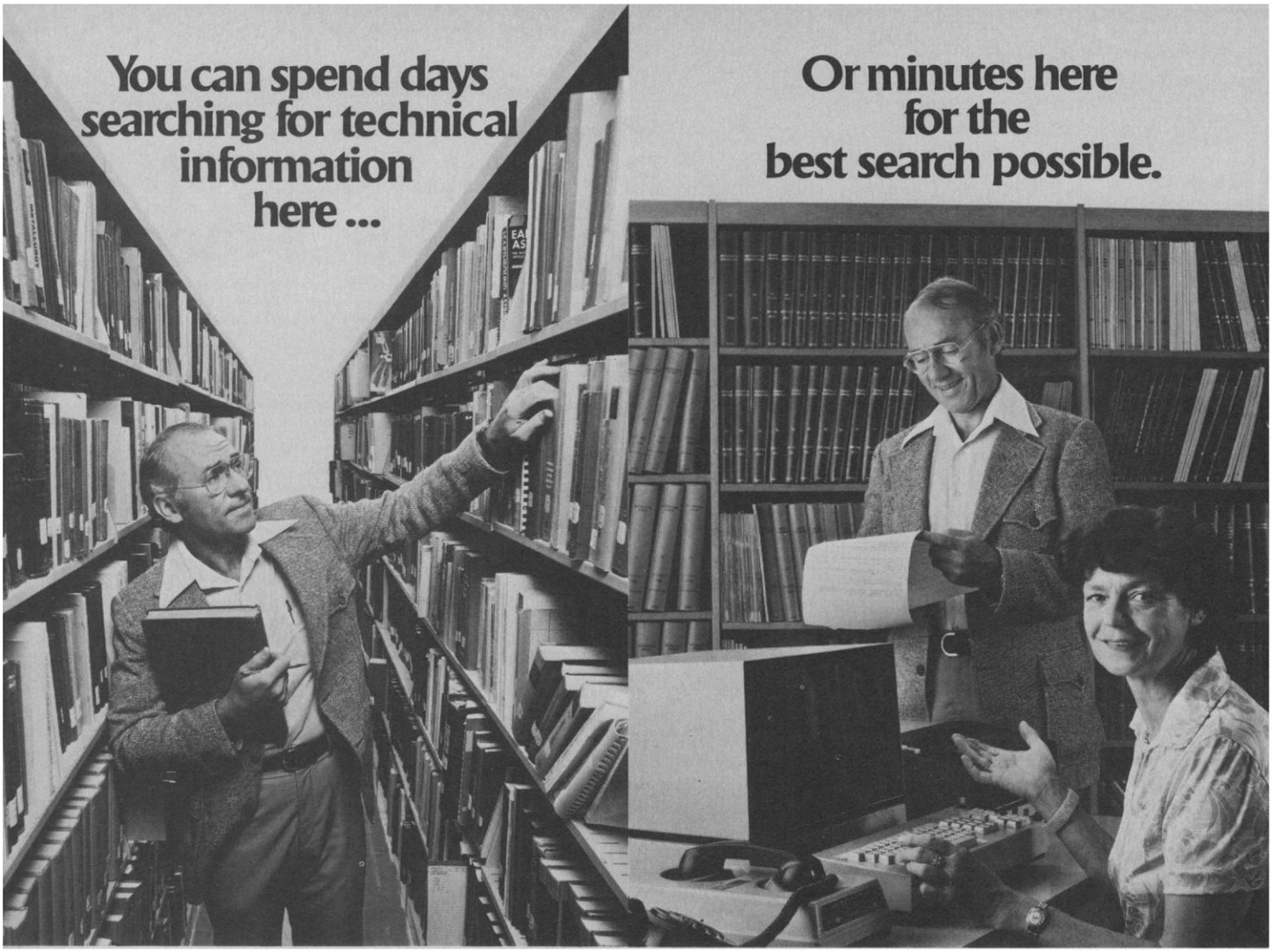
1. *Fed. Reg.* **44**, 45252 (1 August 1979).

Automotive Research

In view of the "progress" in American automotive research (Letters, 9 May, p. 550) the Cooperative Automotive Research Program (CARP) might be renamed the Program for Automotive Research Cooperation.

RETO ENGLER
1329 F Street, NW, Washington, D.C. 20002

Erratum: The title of the report by K. Robie-Suh *et al.* (30 May, p. 1031) was incorrectly printed. It should have been "Aryl hydrocarbon hydroxylase *from humans* is inhibited by antibody to rat liver cytochrome P-450."



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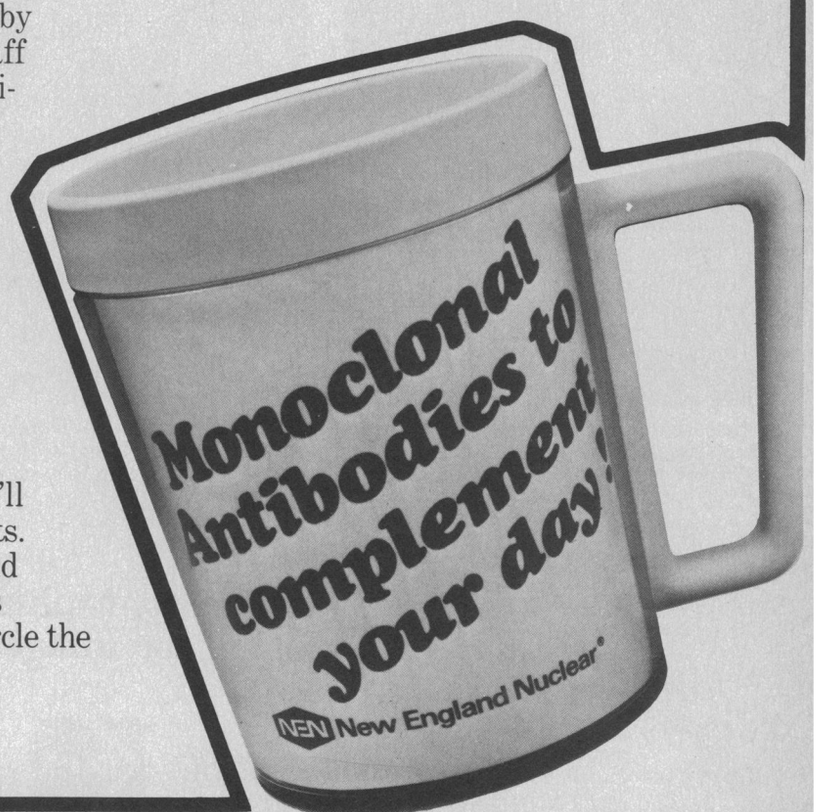

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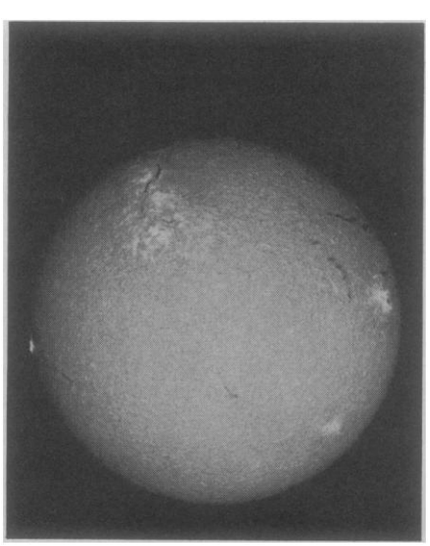
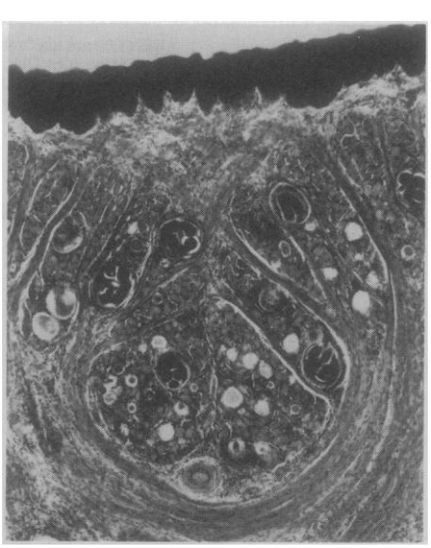
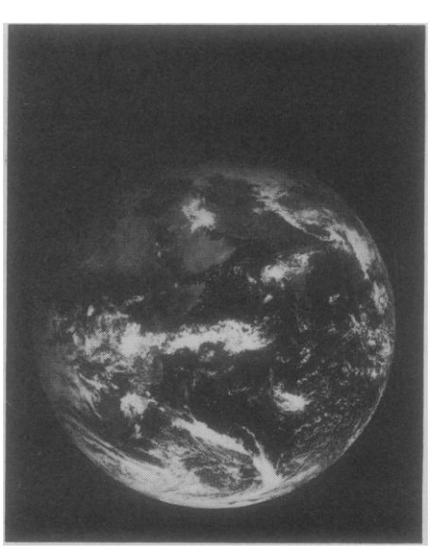


Hydrogen-alpha photograph of solar flares. Sacramento Peak Observatory, Sunspot, N.M.



Photomicrograph of *trichinella spiralis* in muscle, 175×. Tungsten-halogen source (3200 K) with KODAK WRATTEN Filter No. 58.



Meteorological imagery from geostationary satellite. VIZIR laser-beam recording by Société Européenne de Propulsion (France).

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20 June 1980, Volume 208, Number 4450 **SCIENCE**

Energy from Biomass

Many countries are showing increasing interest in obtaining larger fractions of their energy from biomass. Their efforts were described when leading experts in bioenergy from 76 countries met on 21 to 24 April in Atlanta to conduct a World Congress and Exposition on Bio-Energy. At the meeting it was evident that Brazil, China, Sweden, and the United States are leaders in the field. The Brazilian program is impressive, especially in the production and use of alcohol. At present, most Brazilian automobiles burn gasohol, which in their case usually contains 20 percent alcohol. But the Brazilians are moving beyond gasohol to employ only alcohol as a motor fuel. This year, Brazil plans to build 250,000 cars that are designed to burn alcohol and will convert another 70,000 or 80,000 existing automobiles to use it. The source of their fuel is fermentation of sugar from sugarcane, and scores of distilleries are being built in rural areas. The Brazilians are also looking to other sources such as cassava roots and eucalyptus trees.

Another interesting effort to expand the use of biomass is being made by Sweden, which is in the initial stages of a program to shift away from 70 percent dependence on imported oil. The Swedes face a very difficult situation; they have no coal, no oil, no natural gas. Prudence and economics dictate that they adapt to other energy sources. Fortunately, a large area of the country is covered with trees. At the congress they stated that there is sufficient forest potential to shift to wood as a prime source of energy, and they can even visualize that the gross national product could increase while they do so. They plan to grow fast-rotation trees that can be harvested every 3 to 5 years and are experimenting with willow and birch. The trees are mowed down and the wood is collected in the winter. The next spring, new shoots arise from the stumps, so that the tree does not have to use energy in establishing a new root system.

The efforts of the People's Republic of China to produce methane from biomass wastes are very impressive; they have about 7.5 million biogas installations. In many developing countries, a shift to production of biogas methane would take away pressure to use forest products. One of the dark things that is happening today in many countries is that the forests are being cut down for cooking fuel, with consequent deforestation and ultimate soil erosion. In the southern part of the People's Republic of China, replacement of wood with methane derived from human and animal wastes helps make it feasible to have a program of reforestation.

In the United States we are conducting at least 600 or 700 different research and development projects that are aimed at increasing use of bioenergy. New results are being obtained, but to me the most impressive thing at this conference was the display of equipment at the exposition. Particularly noteworthy was a machine that could reduce a sizable tree, branches and all, into chips, each about the size of a dollar, in about 30 seconds. Other pieces of equipment were designed to handle the collection and processing of biomass. One item was a portable device that encompassed all phases necessary to obtain alcohol from grain, including grinding, making the mash, fermenting it, and distilling the alcohol.

One of the problems of processing biomass is that the material usually must be collected and hauled to a production plant. Transportation costs can be high. Why not bring the processing to the biomass? It was amusing to see an exhibit of a piece of mobile equipment that could pyrolyze crop waste residues to combustible gas, fuel oil, and char. The gas is used to furnish heat and power to the equipment, which is then self-sufficient.

Many of the other exhibits at the exposition were items capable of playing a role in small, decentralized energy systems. These displays made it evident that soon other ingenious and useful devices will be available that will make the processing and use of biomass much easier and more practical, thus facilitating the transition to a larger role for bioenergy.

—PHILIP H. ABELSON

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