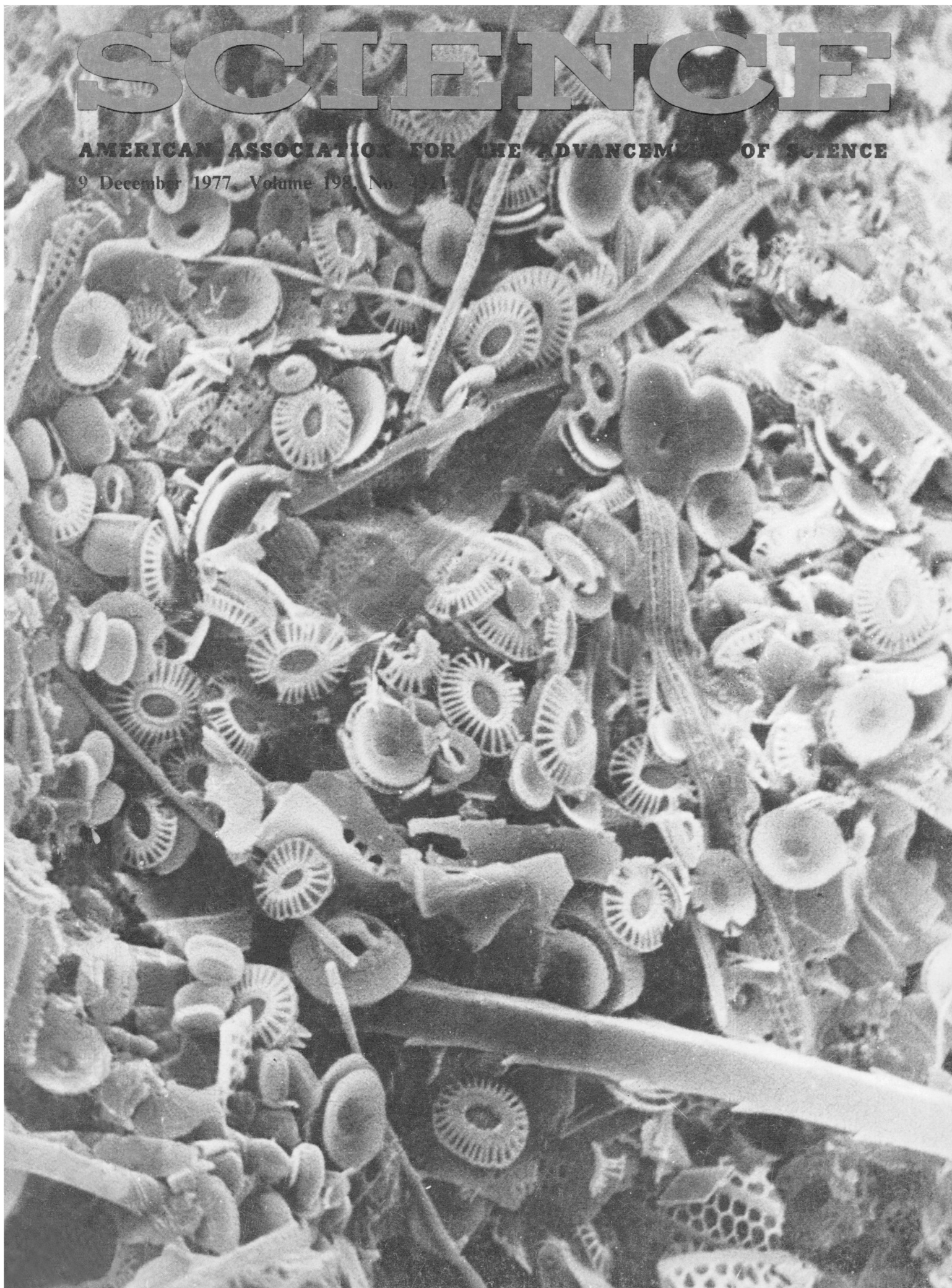


# SCIENCE

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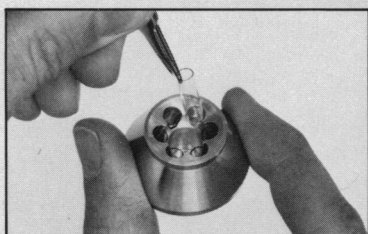
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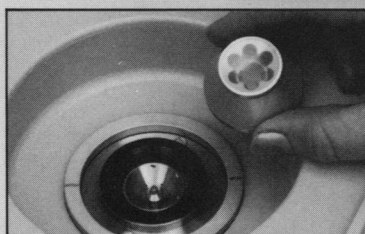
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# SCIENCE

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Suspended material (scanning electron micrograph) collected by filtration of large volumes of Pacific surface waters (40°N, 160°E). Particles are a variety of microscopic marine plants (mostly coccolithophores and some diatoms) and animals. The most abundant coccoliths, 3 to 4 micrometers in diameter with rays, belong to the species *Emiliania huxleyi*. Hard skeletal parts of biogenic particles fall from surface to deep waters. At all depths, they dominate the suspended phases and their dissolution and attrition, in course of settling, has an important effect on the chemistry of seawater (field of view: about 45 × 50 micrometers). See page 997. [V. G. Shah, Physical Research Laboratory, Ahmedabad, India]

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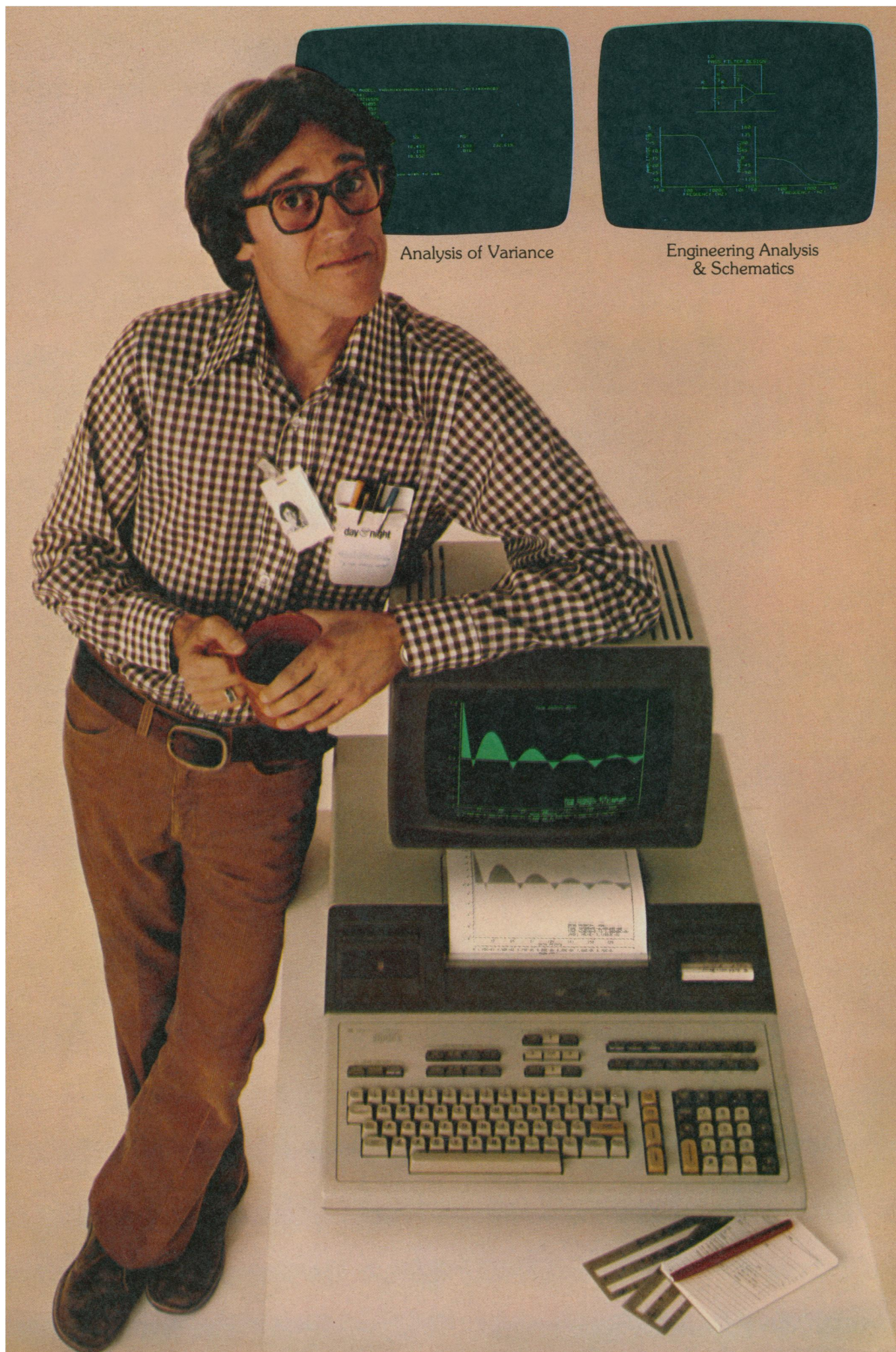
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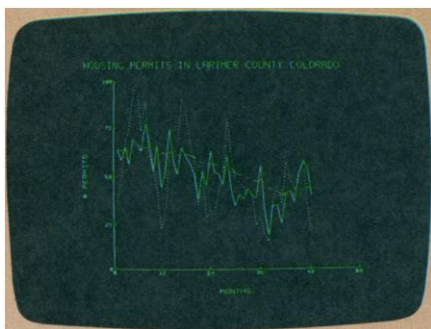




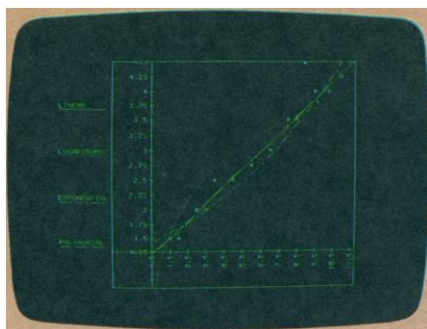
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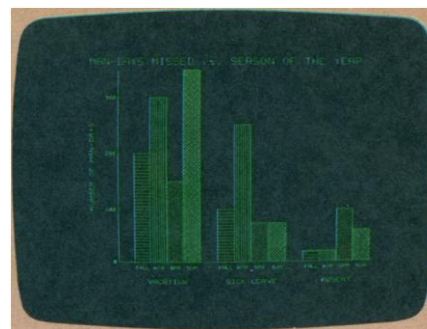




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These papers were originally presented as a symposium on Crop Resources at the 17th Annual Meeting of the Society for Economic Botany in Urbana, Illinois, June 13-17, 1976. Most of them have been subsequently revised.

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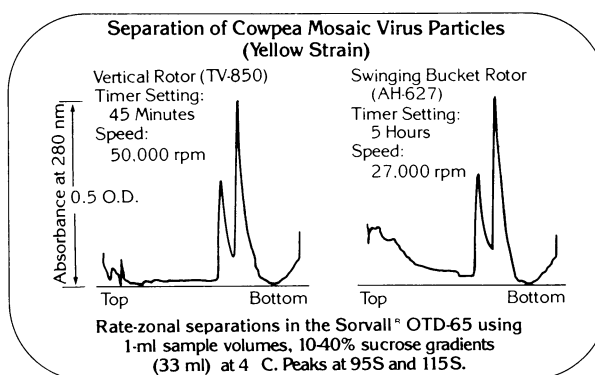
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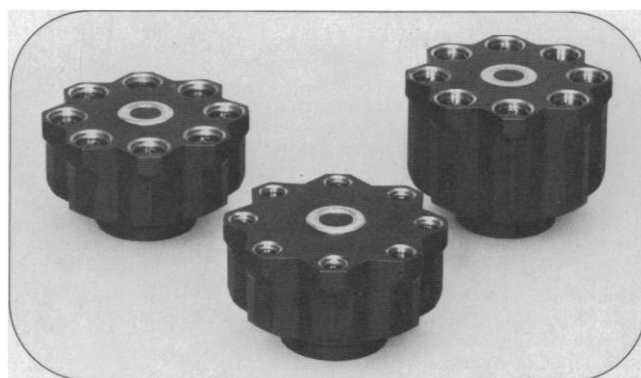
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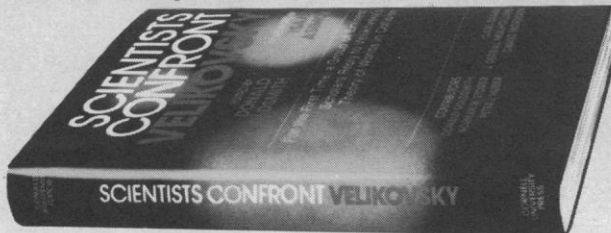
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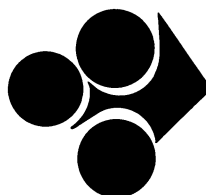


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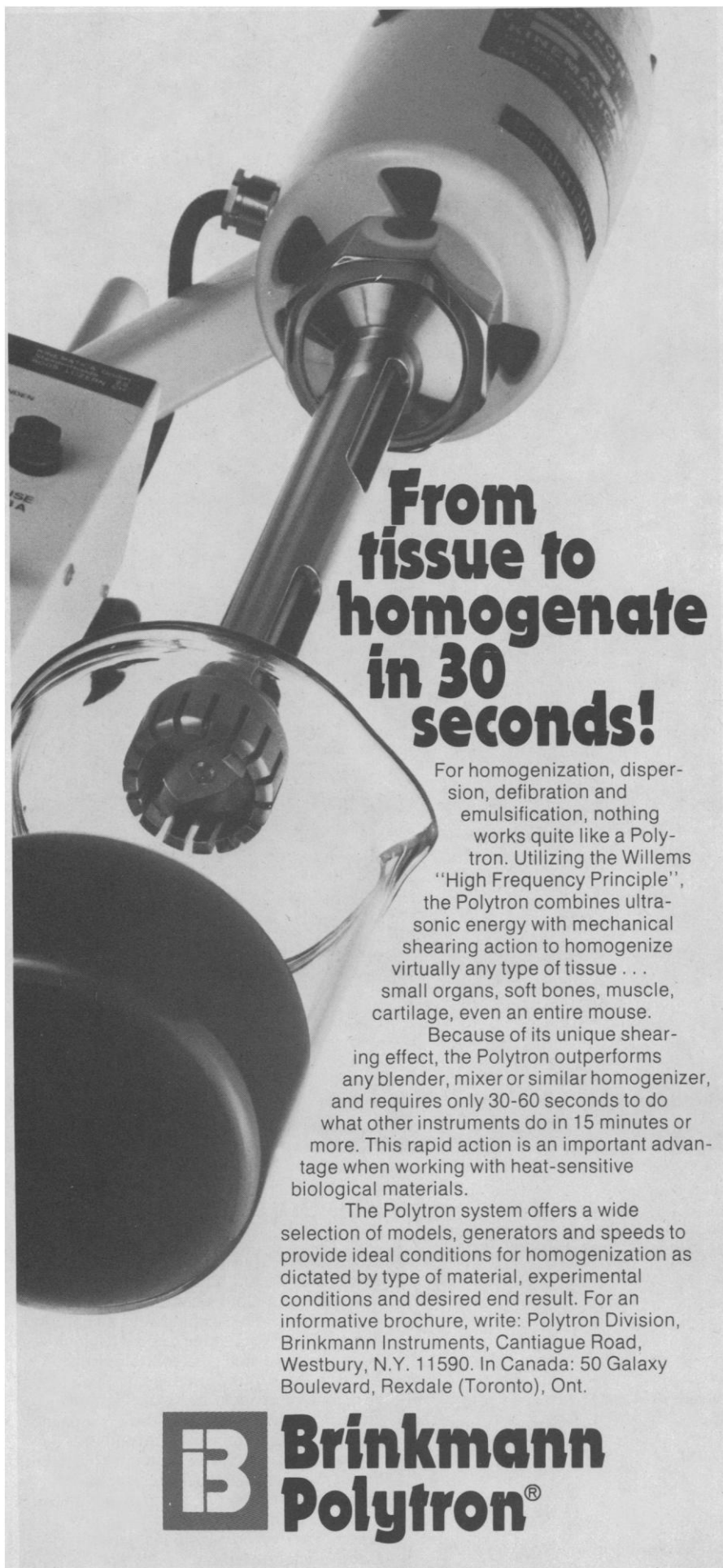
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## LETTERS

### Intergovernmental Science Panel

William D. Carey (Editorial, 25 Nov., p. 785) is incorrect in stating that, as a result of President Carter's reorganization of the White House, "the Intergovernmental Science, Engineering and Technology Advisory Panel [ISETAP] came to a premature close when it was abolished and its functions 'transferred to the President.'" ISETAP is active and, in fact, the reorganization is designed to strengthen it. The Carter Administration is committed to maintaining and supporting this link with state and local governments concerning science and technology matters.

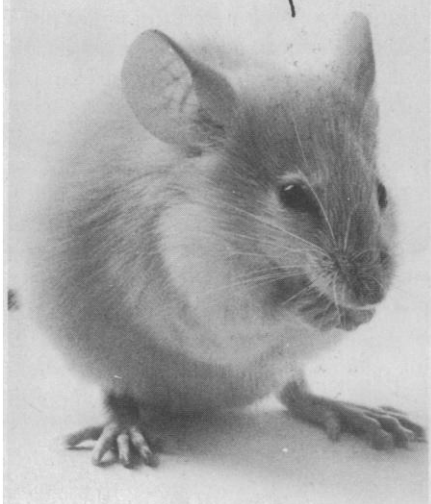
ISETAP is being rechartered as an advisory committee by Executive Order. Responsibilities for the central staffing are being transferred to the Office of Management and Budget (OMB), primarily to strengthen ties between ISETAP and OMB. The acting director of OMB voiced his strong support for ISETAP in a letter to the heads of eight of the major federal departments and agencies with extensive domestic research programs. He requested that the agencies submit their plans to him for how they intended to work with ISETAP. Federal agencies are cooperating with five ISETAP task forces and are providing staff support to the panel.

The task forces are working with the agencies to strengthen ties between the federal government and the state and local government community. They are also holding briefings at which senior officials from various federal agencies are describing their R & D and technology transfer programs and the ways in which they involve state and local governments in setting R & D agendas. Briefings have been received from the Department of Housing and Urban Development and the Department of Health Education, and Welfare. Others are scheduled to be received from the National Science Foundation (in December) and from the Department of Transportation and the Environmental Protection Agency (early next year).

ISETAP now has a staff of five full-time professionals, all with extensive state or local government backgrounds, and I expect there will be at least two more by the end of the year. Staff members currently include a former mayor, city manager, director of research for a regional government, director of research for a county human services agency, and an administrative assistant to a governor.



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The panel was in fact abolished by the reorganization plan as a congressionally mandated arm of the Office of Science and Technology Policy. Its reappearance in another form is reassuring. What counts is that Press evidently intends to seek results.—W.D.C.

### **Solar Energy: The Prospects for OTEC**

The Research News article on ocean thermal energy conversion (OTEC) by William D. Metz (14 Oct., p. 178) discusses an important renewable energy source for the United States and the world. We feel that it gives an unnecessarily pessimistic appraisal of the prospects for OTEC as a commercially competitive, base-loaded (24 hour a day) source of electric power. As an industry participant in the Department of Energy OTEC program, we are convinced that a 100-megawatt OTEC demonstration plant can be operating by about 1985 and that OTEC can supply a significant part of U.S. electric power at affordable rates by the year 2000.

Much of the information in Metz's article is drawn from a recent review of OTEC by the Panel on Ocean Thermal Energy Conversion of the Assembly of Engineering's Marine Board. The panel review is explicitly based on information available through December 1976, and several of the technical questions that it raises are in the process of being answered—most notably the fear that biofouling would bring OTEC operation to a quick halt. The Department of Energy is also taking steps to remedy the management deficiencies noted by the panel.

The Marine Board panel does not question the technical feasibility of OTEC, merely the time scale of development and the economic viability of the commercial OTEC plants. It is true that there are engineering problems to be solved and that OTEC may not be fully competitive until second or third genera-

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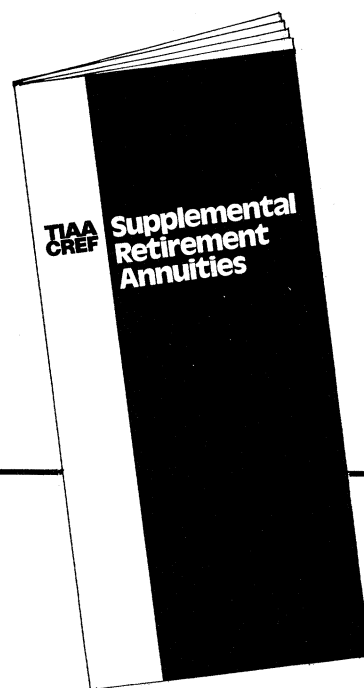
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to promote developments which disturb their present favorable institutional arrangements, but DOE's mission is to create additional energy sources. Industrial interest in producing ammonia by means of OTEC also provides an immediate impetus to proceed with a pilot plant. If OTEC proves cost effective, as current studies indicate, an investment comparable to the current investment in nuclear power would be more than justified. As Metz observes, "The longer the task takes, the more it will cost." So let's get on with it!

W. H. AVERY

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I have enjoyed the series of excellent Research News articles on solar energy. In this field, the major point of debate is invariably economics. Such debates often leave the reader puzzled as to what or whom to believe. I would like to point out that cost *comparisons* are often easier to make (and believe) than cost estimates. Taking the proposed ocean thermal energy conversion (OTEC) power plant as an example, one could compare its cost goal to the cost of an existing land-based, coal-fired power plant using an equal amount of thermal energy. Modern power plants are about 40 percent efficient at converting thermal input to electricity. OTEC, on the other hand, would have an efficiency of 2 percent or less. In both cases, the cost of electricity is dominated by amortization of the capital investment. To a first approximation, then, the cost of a competitive OTEC power plant would have to be 20 times less than the cost of an equivalent land-based power plant.

At present, the cost of mining and transporting coal contributes about 25

percent to the cost of electricity. Under the kindest assumption, the equivalent "fuel cost" of OTEC can be taken to be zero. This reduces the capital investment ratio that OTEC is up against to  $0.75 \times 20 = 15$ . From this point of view, then, it appears that OTEC supporters claim to be able to build and maintain a floating or submerged power plant that would be 15 times cheaper than a land-based power plant.

In view of the implausibility of such a scenario, it is disconcerting to see one-fifth of the Department of Energy's solar electric budget allotted to OTEC, when other much more promising approaches receive little or no support.

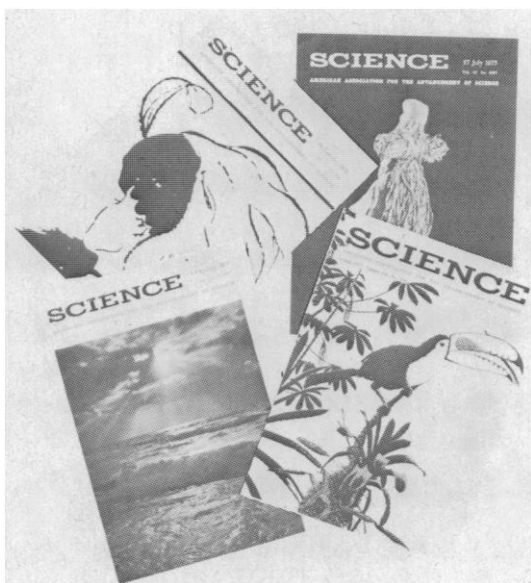
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Concerning an issue as controversial as the OTEC program, there are few observers on the middle ground. The foundations for the present program were laid by the large ocean-engineering groups at Lockheed and TRW at a time when the technical strength of the OTEC program office was quite limited. In fact, until late 1976, the OTEC office had only one professional staff member. In the circumstances, the Energy Research and Development Administration called upon the outside services of the Marine Board for a program review. The review panel included a director of the Scripps Institute of Oceanography, an official of a major offshore drilling company, a Westinghouse steam turbine expert, an authority on marine heat exchangers who worked on the submarine *Nautilus*, and engineers from several universities. The panel was well qualified and well balanced in its institutional origins. It found the OTEC concept attractive but the implementation subject to "many critical problems." The cutoff date for the panel's extensive literature search was December 1976, but it is hard to outdate the status of a 50-year-old technology in a few months.

With respect to the specific points raised by Avery, the statement about the effects of  $\frac{1}{4}$  millimeter of slime fouling was checked with Fetkovich before publication, and he agreed it was a fair characterization. The relevance of the ARCO barge is obscure. There is no concrete barge in the Lockheed or TRW design, and in the Johns Hopkins design the barge contributes only 25 percent of the projected cost of the system. Heat exchangers alone cost significantly more. The unpredictability of OTEC economics comes from the many components of uncertain design that have never been built before.—W.D.M.

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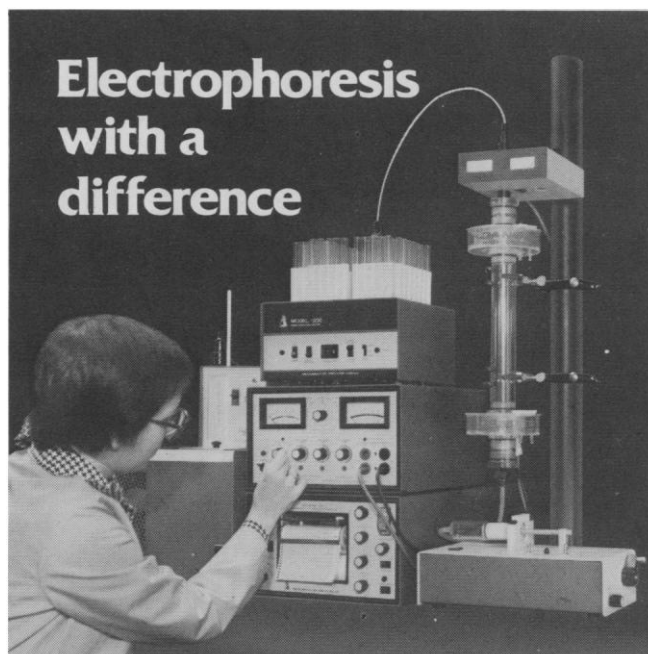
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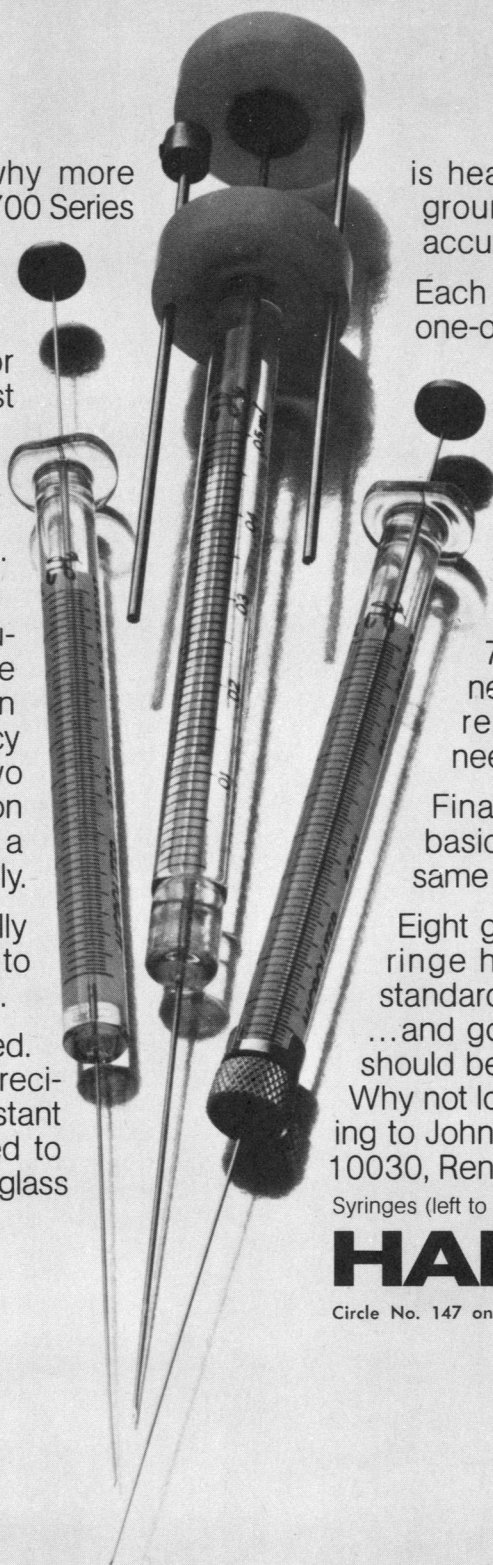
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## Is There a Crisis of Confidence in Science?

Scientists have repeatedly expressed concern that there is a crisis of confidence in science. There are some good reasons for concern, but all too often the conclusion that there is a crisis of confidence is based on only part of the evidence. If one considers only the respondents to opinion polls who have a "great deal" of confidence in science, claims of a crisis seem warranted. Throughout the 1970's, according to the Louis Harris and National Opinion Research Center surveys, much less than a majority of Americans reported a great deal of confidence, a marked contrast to the 56 percent in 1966 who had such a high level of trust.

However, to conclude that this means there is a crisis of confidence ignores other facts. The 1970's have seen a gradual improvement in the percentage with great confidence, from 32 percent in 1971 to 41 percent in 1977. The earlier shift was not from great confidence to little confidence; no more than 10 percent at any time during the 1970's reported hardly any or no confidence. Furthermore, similar fluctuations in confidence have been reported for all major institutions, including religion, and science has generally fared better than most.

Those concerned about a confidence crisis typically assume that the public has lost interest in knowing about science and technology. Recent newspaper readership studies at the Newspaper Advertising Bureau challenge this assumption as well. In 1971, 47 percent of a wide range of listed newspaper topics had a greater readership than the category of science and invention. In 1977, only 26 percent of the same topics received higher reader interest ratings than science and invention. Energy problems headed the list of topics that were very interesting to readers, and health, social problems, and environment were among the most interesting topics.

In the 1977 readership study the national sample of adults were also asked how much space they would give to 34 different subjects if they could tailor a newspaper to suit their own interests. Even though science was not on the list of subjects, the results are instructive for scientists as well as editors. Health, nutrition, and environment were among the subjects that would be given "a lot of" space in a tailor-made paper. Articles on mysterious events, psychic predictions, astrology, and horoscopes were near or at the bottom of the list. Religion fell in the middle range. Furthermore, both young and older adults would give a great deal of space to health and nutrition. Those under 30 gave more space to environmental issues than did older persons, but were no more likely than older persons to give as much space to astrology, mysterious events, and psychic predictions.

These data do not indicate a breakdown in the social acceptance of science. On the other hand, knowledge of the public's understanding of science is too limited to justify firm answers to questions about public appreciation of science. It has now been two decades since the last major survey of the public's understanding took place, so we should not be surprised by the disparate opinions about what is going on among citizens.

Meanwhile, the meager data available suggest several general conclusions: (i) ambivalence, not rejection, best describes public attitudes; (ii) science is of considerable interest to Americans, but the scientific community should, when possible, relate science increasingly to problems of health, environment, energy, and society in order to maintain and expand this interest; and (iii) scientists and funding sources should encourage communication of science through the media (fewer science-related items appear in newspapers than the interest ratings indicate should be there, and only 11 percent of the daily newspapers in the nation have science editors).—CLYDE Z. NUNN, *Senior Project Director, Newspaper Advertising Bureau, Inc., 485 Lexington Avenue, New York 10017*

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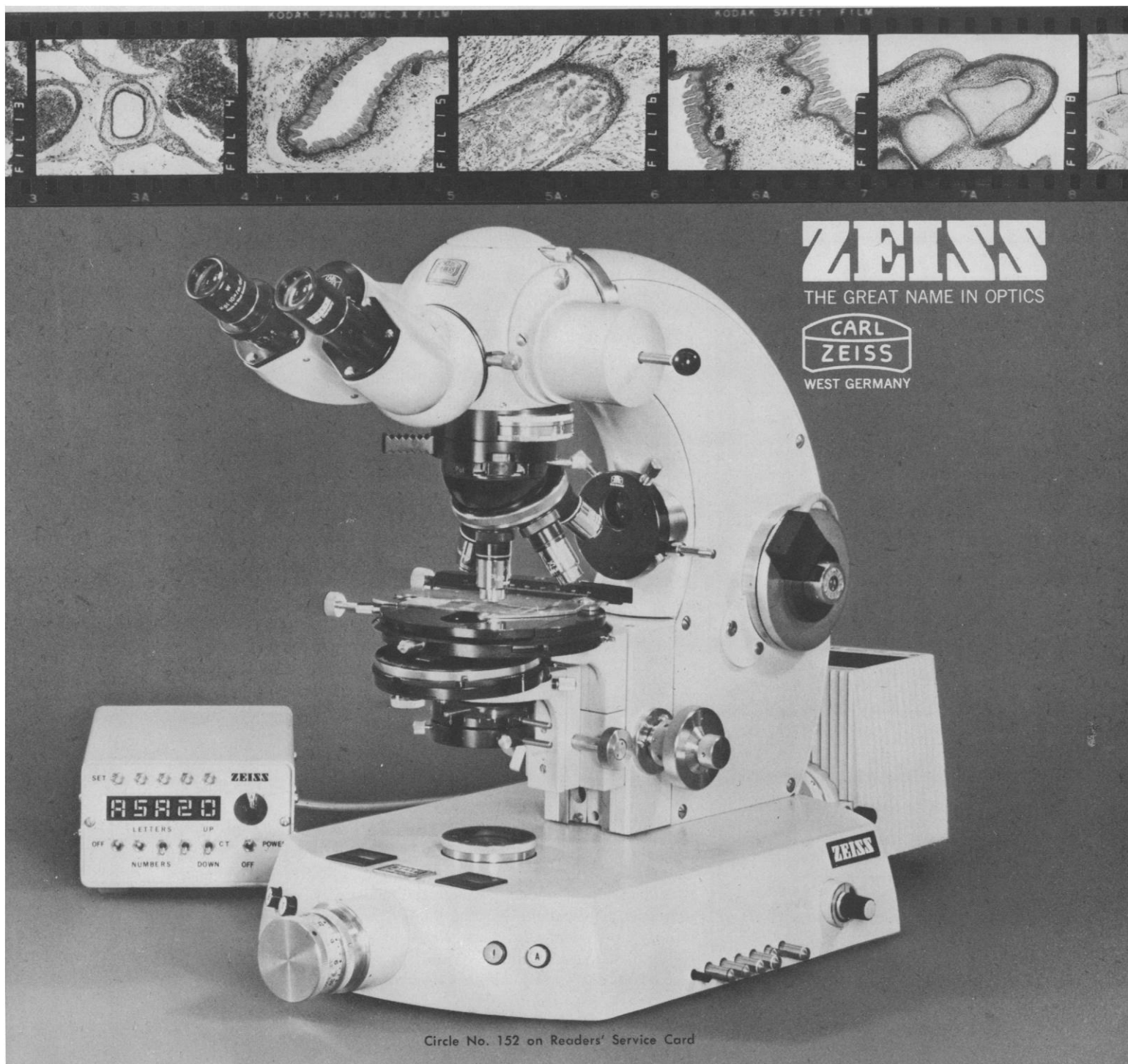
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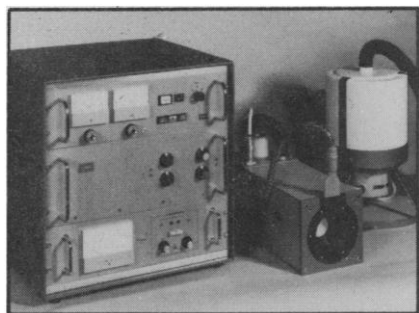




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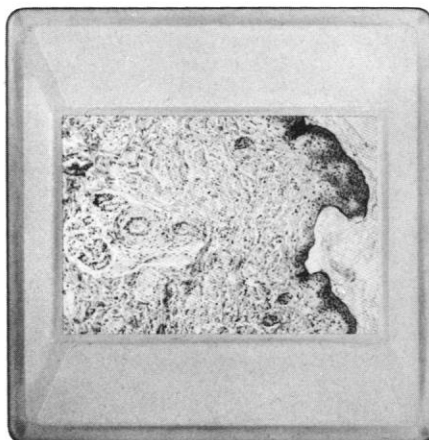
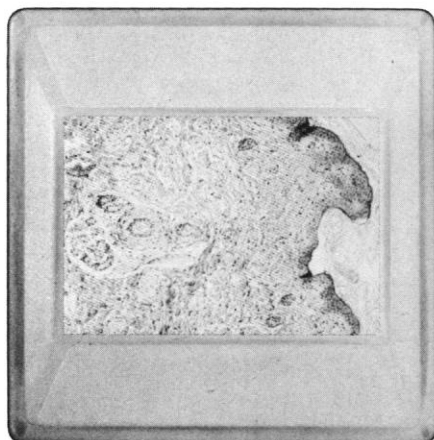
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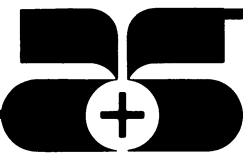
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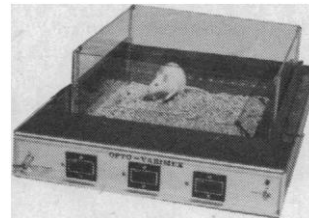
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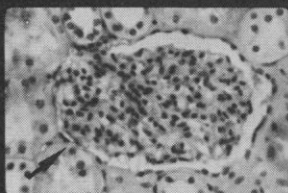
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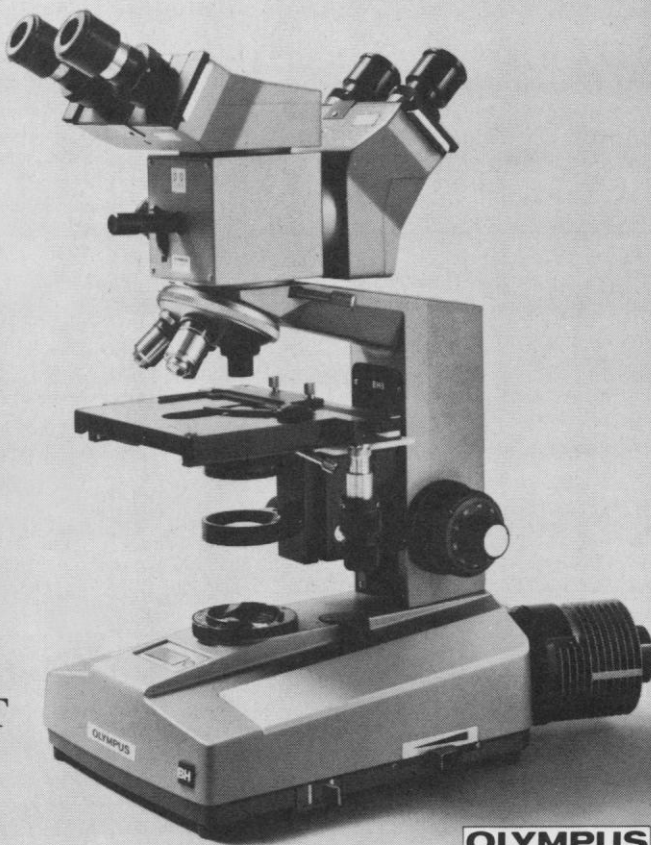
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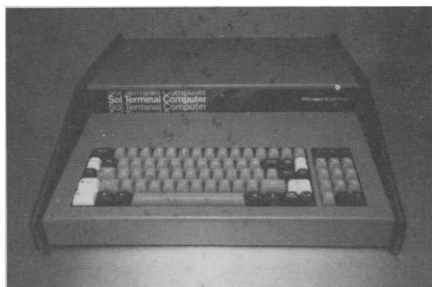
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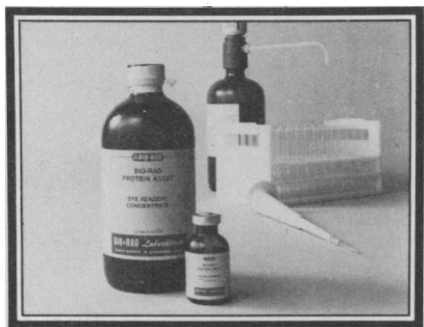
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