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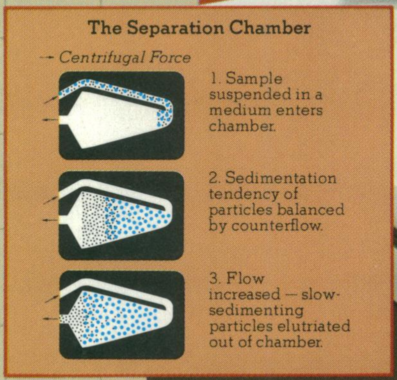

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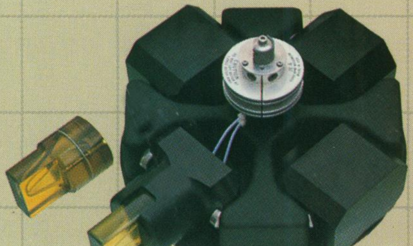

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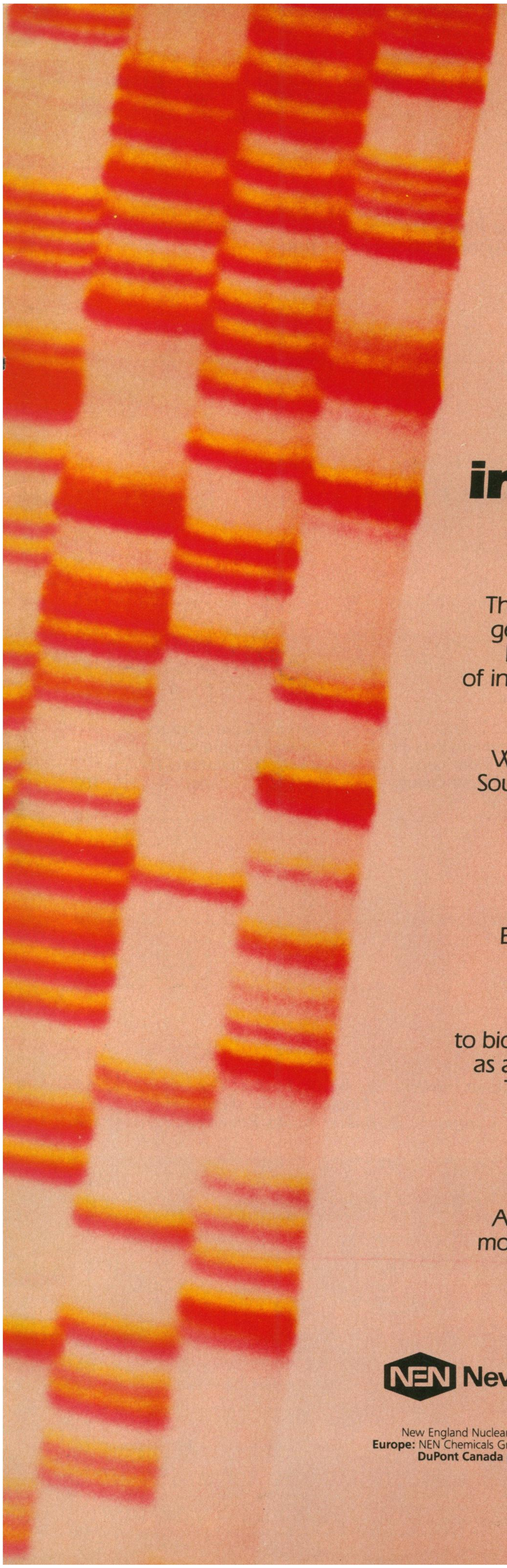

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Klyvchevskaya Spoka volcanic complex located on the Kamchatka Peninsula, Union of Soviet Socialist Republics (56° 05′ N − 160° 34′ E). This is the tallest (4750 meters) of the Kamchatka volcanoes, one of the world's most active volcanic areas. The Kamchatka River meanders around the volcanic complex. Photo was taken from Columbia spacecraft during the 24th orbit of the earth, 30 November 1983. [NASA–Lyndon B. Johnson Space Center, Houston, Texas 77058]

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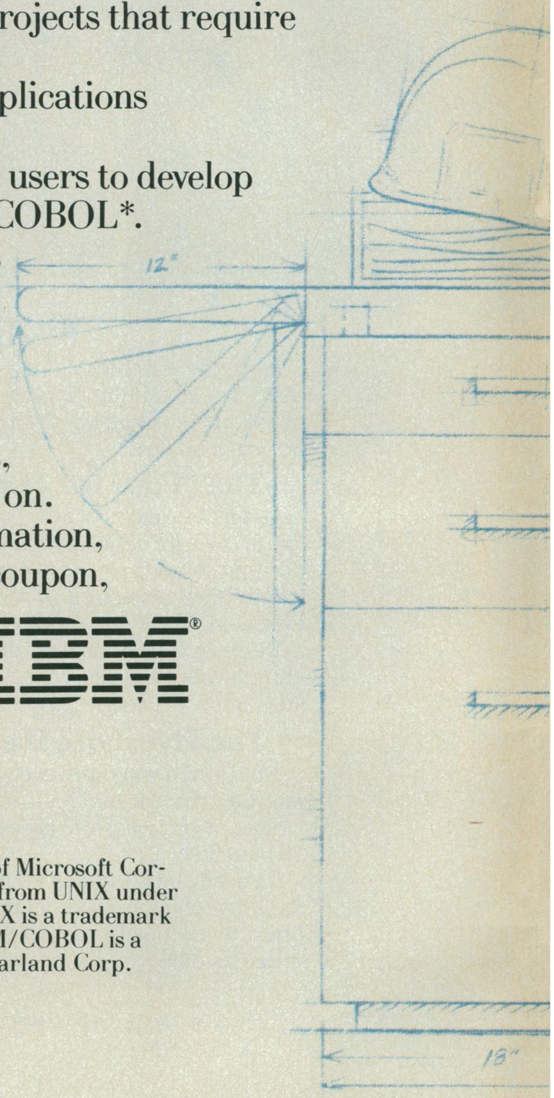

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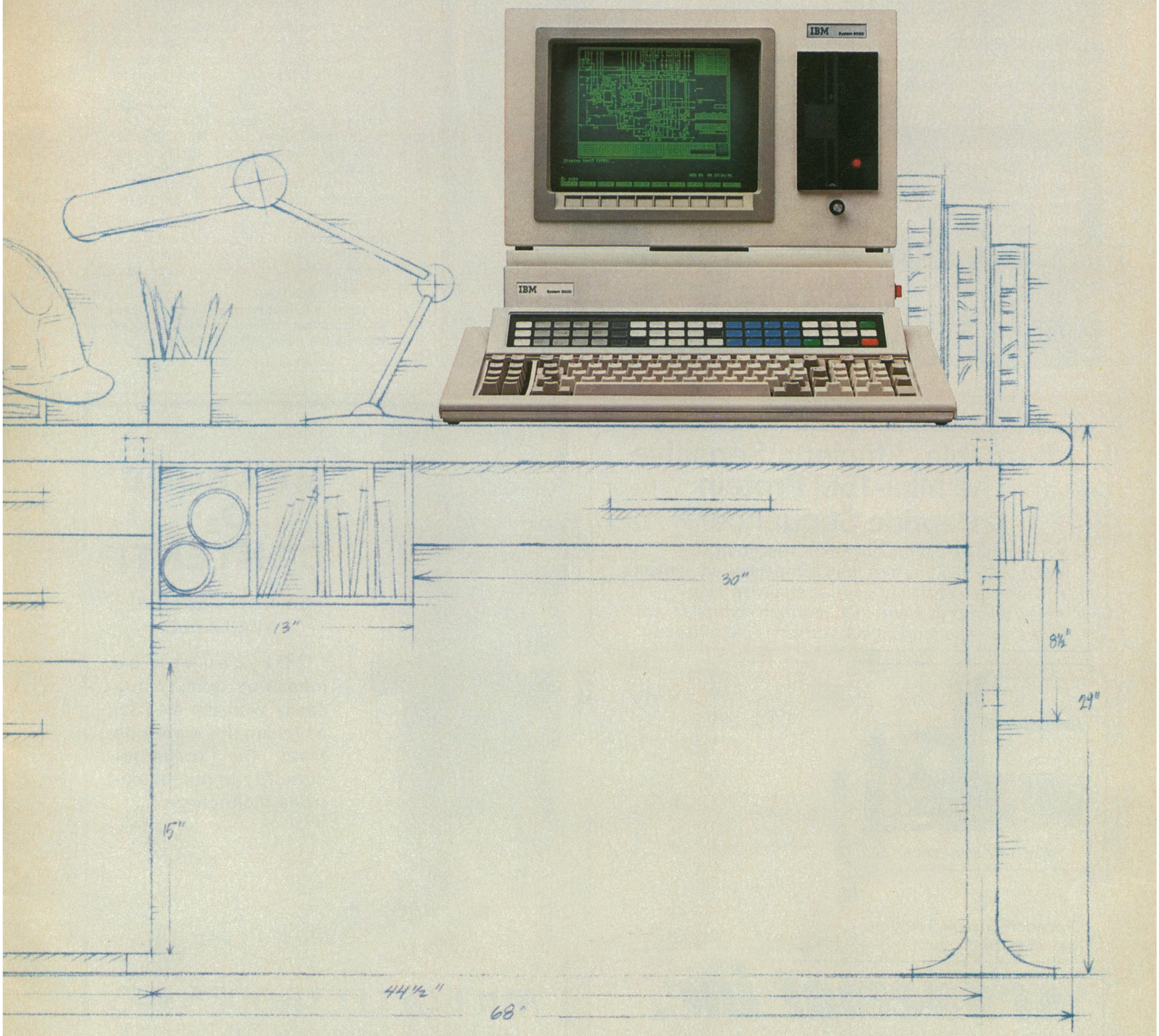

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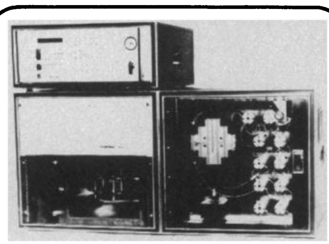

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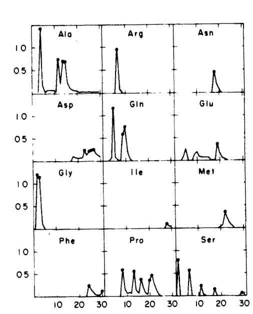

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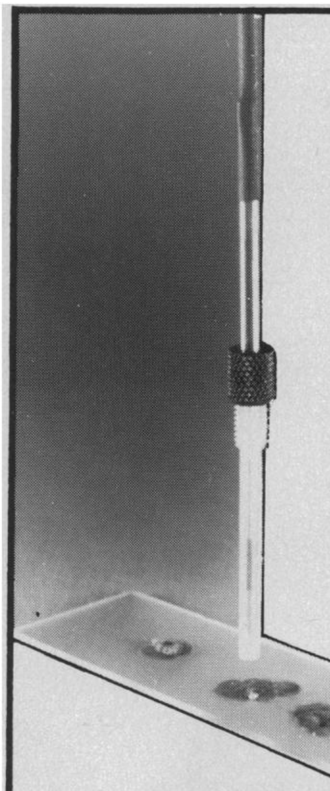

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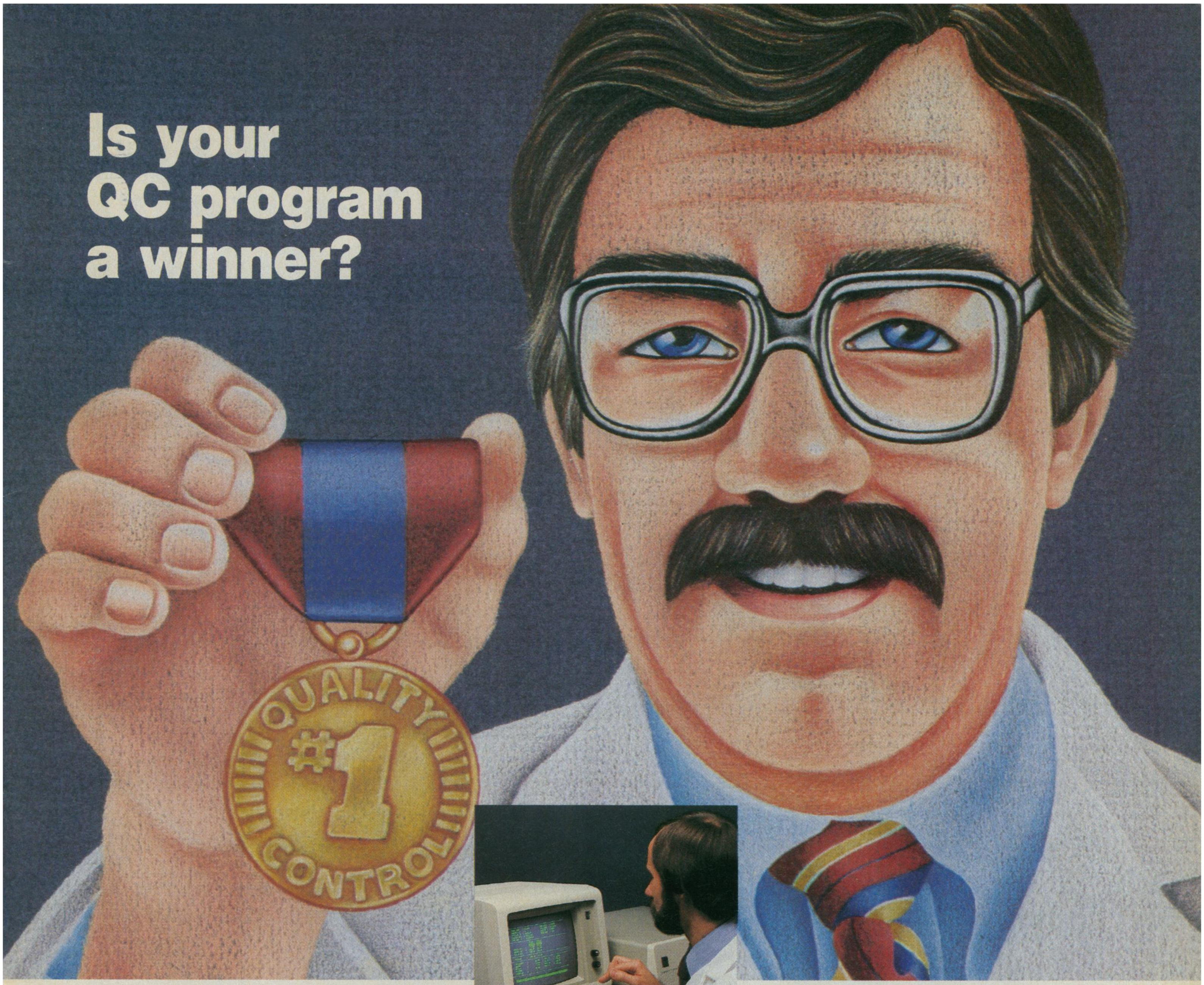

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Laboratory Decontamination

I read with great interest the article "Prudent practices for disposal of chemicals from laboratories" by Robert M. Joyce (4 May, p. 449). I fully agree that the first step in reducing the problems of disposal is sound planning of every experiment, including minimizing the amount of chemicals ordered to conform with the quantities required. I also agree that the second step is planning of laboratory destruction of the wastes. The problem of disposal is especially acute in the field of cancer research. At the International Agency for Research on Cancer (IARC), we are acutely aware of this and organized a meeting of experts in 1978, at which the participants reached the same conclusions (*1*).

On the recommendation of this group, to conduct "research into methods for the destruction and disposal of chemical carcinogens," the IARC in 1979 initiated, with the support of the Office of Safety of the National Institutes of Health of the United States, a project to test published methods and to elaborate methods for those compounds for which no published method was available (*2*).

The following criteria were established for a method to be considered acceptable.

1) A degradation technique should lead to disappearance of the carcinogen, as analyzed by conventional analytical techniques.

2) The products of degradation should have no adverse biological effect. Although it was recognized that long-term animal experiments are the ideal method for testing such effects, short-term testing using the Ames *Salmonella typhimurium* mutagenicity assay was selected in order not to impede research.

3) The method should be reproducible and applicable in all laboratories. It was decided, therefore, to organize collaborative studies for the validation of all the proposed methods. The groups taking part in these collaborative studies were convened in small meetings with the task of discarding or amending, as required, all the methods they had tested and ranking them with respect to ease of utilization, danger of the reagents used, efficiency, and manpower involved.

So far, seven classes of chemical carcinogens have been investigated, and five volumes have been published on, respectively, aflatoxins, nitrosamines, polycyclic aromatic hydrocarbons, hydrazines, and nitrosamides (*3*); two volumes, on haloethers and aromatic amines, are in press.

Pooling efforts in this field will help solve the problem of waste disposal in small-scale laboratory investigations, as well as the acute problem of the treatment of spills, which has also been looked into in these publications. These monographs can be obtained through the Oxford University Press in New York or Oxford, United Kingdom.

M. CASTEGNARO
Unit of Environmental Carcinogens and Host Factors, International Agency for Research on Cancer, 150 Cours Albert-Thomas, 69372 Lyon Cédex 08, France

References

1. R. Montesano *et al.*, Eds., *Handling Chemical Carcinogens in the Laboratory: Problems of Safety* (Scientific Publ. 33, International Agency for Research on Cancer, Lyon, France, 1979).
2. E. A. Walker and M. Castegnaro, *Nature (London)* **284**, 210 (1980).
3. M. Castegnaro *et al.*, Eds., *Laboratory Decontamination and Destruction of Aflatoxins B_1, B_2, G_1, G_2 in Laboratory Wastes* (Scientific Publ. 37, International Agency for Research on Cancer, Lyon, France, 1980); *Laboratory Decontamination and Destruction of Carcinogens in Laboratory Wastes: Some* N-*Nitrosamines* (Scientific Publ. 43, International Agency for Research on Cancer, Lyon, France, 1982); *Laboratory Decontamination and Destruction of Carcinogens in Laboratory Wastes: Some Polycyclic Aromatic Hydrocarbons* (Scientific Publ. 49, International Agency for Research on Cancer, Lyon, France, 1983); *Laboratory Decontamination and Destruction of Carcinogens in Laboratory Wastes: Some Hydrazines* (Scientific Publ. 54, International Agency for Research on Cancer, Lyon, France, 1983); *Laboratory Decontamination and Destruction of Carcinogens in Laboratory Wastes: Some* N-*Nitrosamides* (Scientific Publ. 55, International Agency for Research on Cancer, Lyon, France, 1983).

Science and Technology Awareness Month

During the past 3 years I have been director of the Office of Energy Research, I have testified before several congressional committees on various aspects of some of the Department of Energy's (DOE's) science and technology programs. A recurrent theme of the questions asked by the members of these committees has been, "What are we getting for our money by supporting basic research?" In reply, I have used what I now call the "standard argument." I usually cite some of the federally supported basic and applied research conducted 10 or 20 years ago. I then point out how many of our present goods, services, products, health care benefits, and so forth can be traced to that support. For DOE it is an impressive list that includes nuclear power, nuclear medicine, and radiation processing. It is clear that some substantial portion of our gross national product comes from this kind of activity. Unfortunately, this ex-

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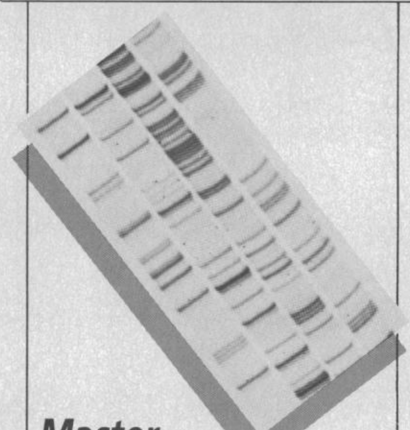

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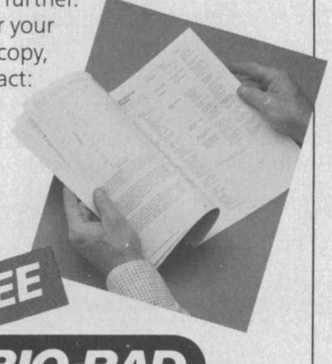

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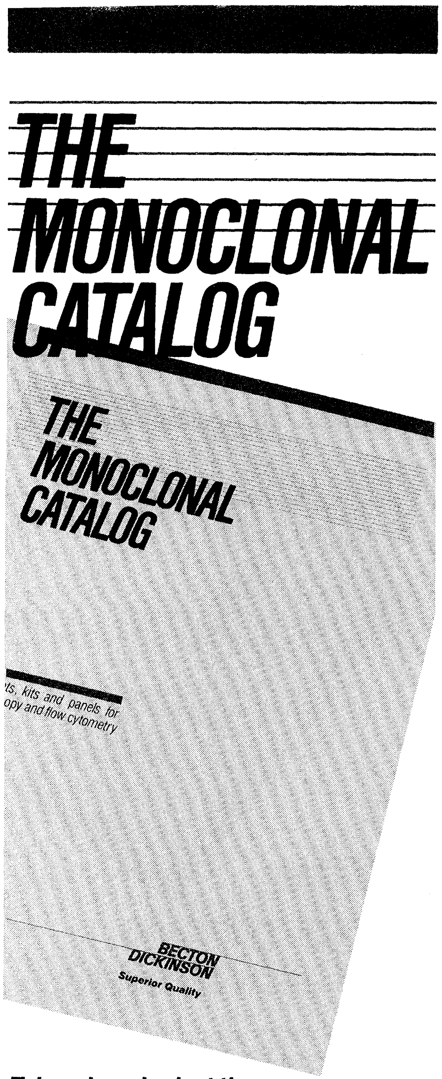

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planation is not particularly useful to a representative or senator seeking ways to explain to the nonscientist constituent why the present levels of government support for basic and applied research are essential for the *future* economic growth in certain technical areas where the United States must remain among the leaders. Without such support, we could easily lose our ability to compete internationally in these areas.

The importance of having members of Congress informed on this issue cannot be underestimated. Those of us who testify help in the process of keeping them informed. But they are busy, and science and technology are not always their highest priority. For this reason, I believe that in the final analysis it may be more important for a substantial number of our citizens to have a better appreciation of the fact that virtually everything that they eat, drive, fly, view, take, wear, and so forth exists in its present form in part due to past government support of basic and applied research. Industrial support of applied research and development is also essential to this process and needs to be encouraged. However, at the moment, I am more concerned with the government role in the basic end of the activities.

I have a suggestion on how to improve this situation of public understanding of the role of science and technology in our lives. I believe that it is time for scientists and engineers to take more responsibility for explaining science and technology in ways the rest of our citizens can understand and appreciate. That is, we need to convince *them* that science and technology are important to our nation's future. How to accomplish this? Pamphlets, television, radio, and other media events help. Traveling lecturers who give excellent views of technical subjects in entertaining ways help. However, in my opinion there is no substitute for person-to-person contact between scientists and engineers and members of the rest of the community in which they live.

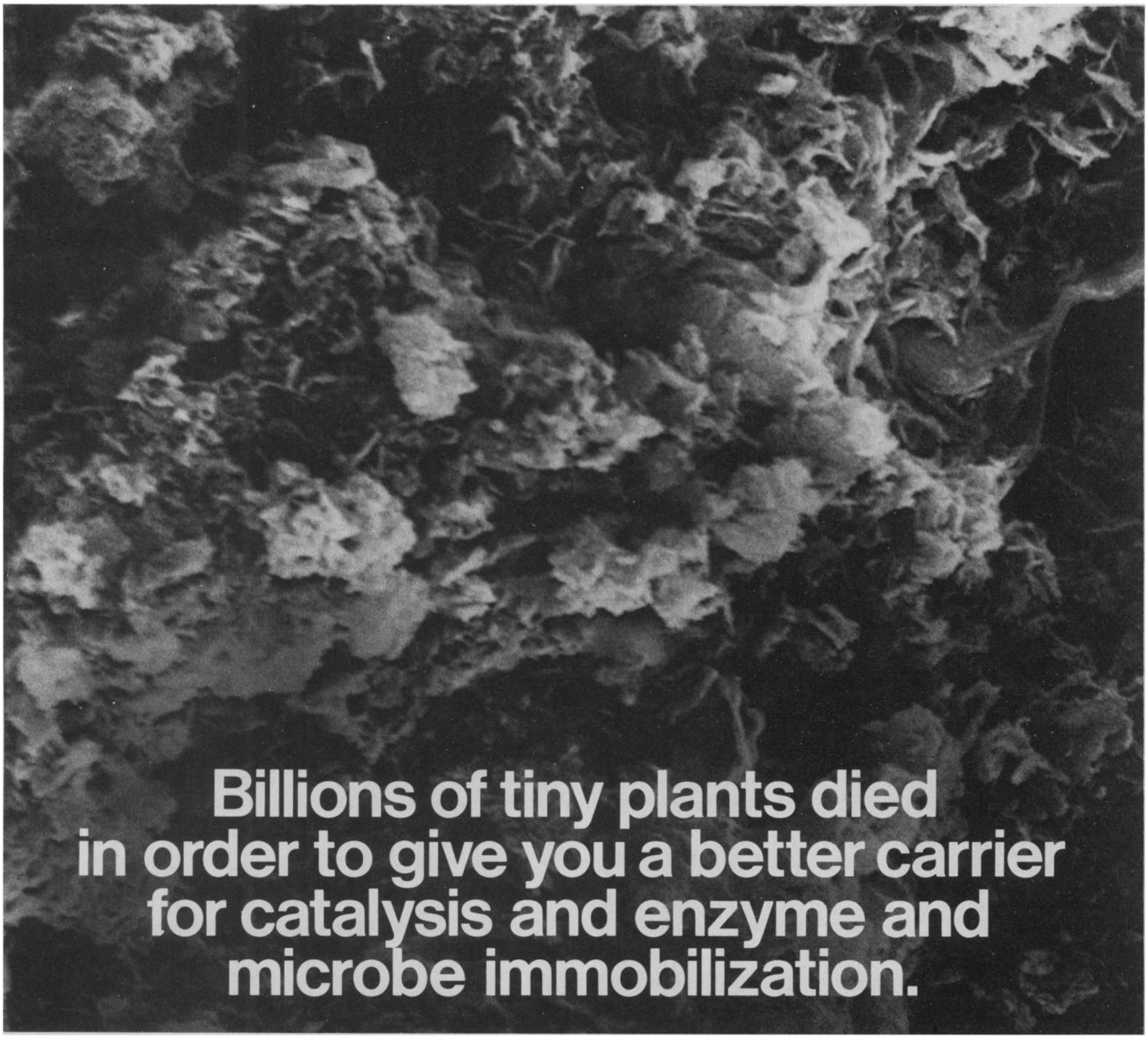
Therefore, I propose that October be designated "Science and Technology Awareness Month." What this means is that members of the AAAS, the American Institute of Aeronautics and Astronautics, the Society for Industrial and Applied Mathematics, the Institute of Electrical and Electronics Engineers, the American Physical Society, the American Nuclear Society, the American Chemical Society, and so forth volunteer to give a simple, jargon-free talk on what they do and why they believe it is important to our nation. They should give these talks to their local chapter of the Lions, Kiwanis, or Rotary clubs; Chamber of Commerce; or any other appropriate civic or service organization. Far from being put off, the public I come in contact with is fascinated by science and technology and is willing to learn about them and the benefits they produce. It helps if things are put in terms that they understand and the explanation comes from a friend or neighbor.

My objective is to cause the greatest possible mixing of those who earn a living as scientists or engineers with those who do not. If this kind of interaction is to occur, it needs to be stimulated but need not be too highly organized. In my attempt to try to stimulate this activity, I am sending this same letter to several civic service clubs and booster organizations in the hope that they will contact the various local or national technical professional societies to make arrangements to have volunteers talk to them. Those who believe that a better informed public is important for the health of U.S. science and technology should volunteer to help make conditions better by giving such talks to their local service club, high school PTA, or civic clubs. Mayors, councilmen, representatives, and senators should also be invited. They might enjoy the talk and add some thoughts of their own. Since this is being suggested in the spirit of volunteerism, I will give a talk on DOE's basic research programs to the first service or civic club that invites me.

ALVIN W. TRIVELPIECE
Office of Energy Research,
Department of Energy,
Washington, D.C. 20585

Animal Rights Movement

Sharon Lynn Campbell's recent letter (8 June, p. 1043) clearly demonstrates that few lessons have been learned from the challenges of the animal rights movement. Campbell rejects Jeffrey L. Fox's wise counsel that "scientists should not use dramatic testimony from patients who have benefited from animal research" and criticizes the animal rights movement with the comment that "they are not often open to reason." Campbell does not acknowledge that there are now large and growing professional associations of lawyers, veterinarians, psychologists, scientists, physicians, and others, all based on and supporting the animal rights philosophy. These are reasonable, articulate, intelligent individuals who share a common perception that (i) animals have rights independent of humans and that (ii) our traditional homocentric



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bias is no longer a valid world view or justifiable foundation for biomedical research.

The biomedical research establishment is increasingly reacting to the challenge of the animal rights movement in ways that are often hyperemotional, nonobjective, and uncharacteristically unscientific. This is a disturbing trend, since the same individuals continue to castigate the animal rightists for using such tactics.

What is needed in this continuing debate is objective analysis and discussion of the strengths and weaknesses of both sides of the issue. We are doing this. The phenomenal growth, increasing intellectual vigor, and legislative victories of the animal rights movement clearly demonstrate that we have made an acceptable case to the general public.

Until the biomedical research community is ready to accept that their traditional approaches to research and health care are not infallible, that change is needed and desirable, and that the legitimate concerns of the public must be seriously addressed, they will continue to encounter a high level of opposition.

JOHN E. MCARDLE
Humane Society of the United States, 2100 L Street, NW, Washington, D.C. 20037

EDB Alternatives

The issue of grain fumigation has been addressed in *Science* (News and Comment, 17 Feb., p. 671; Letters, 30 Mar., p. 1354) and elsewhere (*1*) in recent weeks. Commentators have described a retreat to more traditional chemical treatments of grain as the result of controversy and rulings over ethylene dibromide (EDB). We are concerned that this may stimulate a perception that the alternatives mentioned are safe or safer than EDB. The truth is that compounds such as aluminum phosphide, methyl bromide, and especially carbon tetrachloride mixtures (usually with carbon disulfide) are highly toxic. Grain terminal workers and grain inspectors are at special risk. We have documented serious multifocal nervous system damage among grain terminal workers, which we attribute to exposure to the carbon tetrachloride–carbon disulfide mixtures in particular (*2*). In practice, worker protection cannot be ensured. Uncontrolled fumigation of incoming grain cargoes and inadequate labeling of shipments according to prior fumigation are two important risk factors.

Our concerns and conclusions over the safety of grain fumigation are reinforced in the findings of a recent General Accounting Office investigation (*3*).

We hope that the EDB controversy spurs a broader examination of the safety and efficacy of the predominant chemical methodologies for insect control in the grain industry.

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L. J. CHAPMAN
Department of Preventive Medicine, University of Wisconsin Medical School, 504 Walnut Street, Madison 53706

H. A. PETERS
C. G. MATTHEWS, R. LEVINE
Department of Neurology, University of Wisconsin Medical School, 600 Highland Avenue, Madison

References

1. S. King, *New York Times*, 25 March 1984, p. E9.
2. M. Peters *et al.*, *Am. J. Indust. Med.* **3**, 317 (1982); S. Sauter, paper presented at the American Industrial Hygiene Association Conference, Portland, Ore. (1981).
3. *Grain Fumigation: A Multi-faceted Issue Needing Coordinated Attention* (General Accounting Office, Washington, D.C., 1981).

Gene-Splicing Experiment

Colin Norman's article "Judge halts gene-splicing experiment" (News and Comment, 1 June, p. 962) contains an incorrect assessment of the proposal submitted by Advanced Genetic Sciences, Inc. (AGS), to the Recombinant DNA Advisory Committee (RAC) for their consideration. The proposed biological control experiment does parallel that previously approved by the RAC for Steven Lindow and Nickolas Panopolous, but differs substantially in target crops and bacterial strains. The statement on page 963, "the company has been funding Lindow's research and now wants to test his modified bacteria on several different crops," is inaccurate and establishes a negative and detrimental viewpoint toward our scientific objectives and company interests. The strains cited in the AGS proposal were isolated and characterized at AGS independently of Lindow's efforts. Our proposal was in no way an effort to avoid the current litigation and injunction delaying Lindow's field application.

TREVOR SUSLOW
Plant Pathology/Bio-control Group, Advanced Genetic Sciences, Inc., 6701 San Pablo Avenue, Oakland, California 94608

Erratum: In the article "Windows on a new cosmology" by George Lake (18 May, p. 675), the caption for figure 4(b) on page 680 was incorrect. The photograph shows the electric dipole moment apparatus at the Institute Laue-Langevin in Grenoble, France [courtesy of N. Ramsey].

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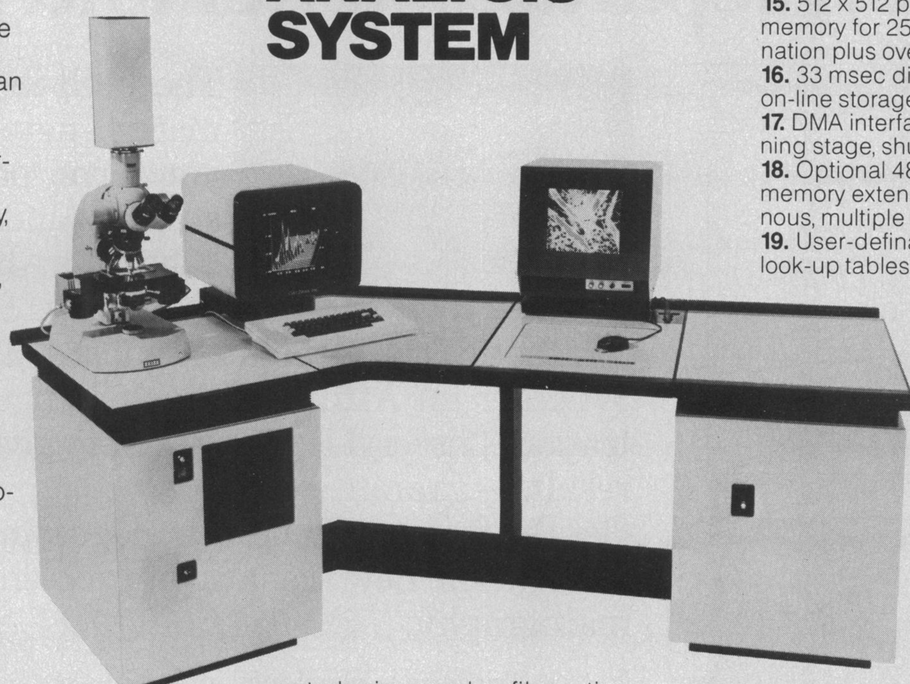

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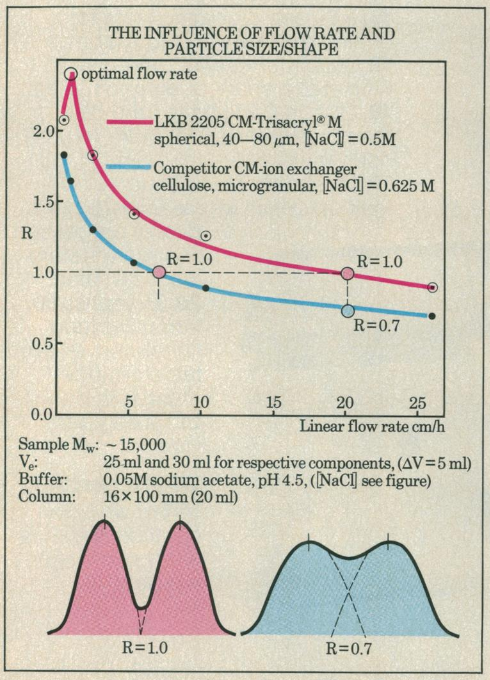

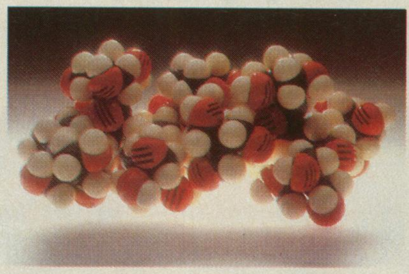

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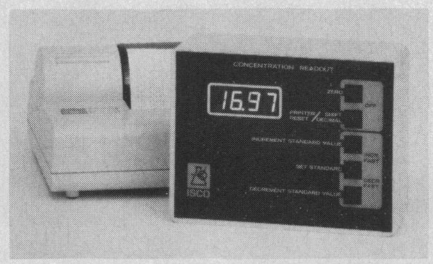

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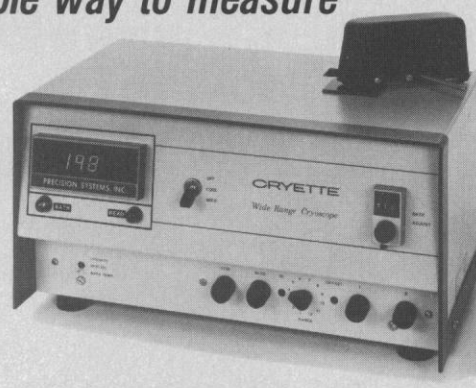

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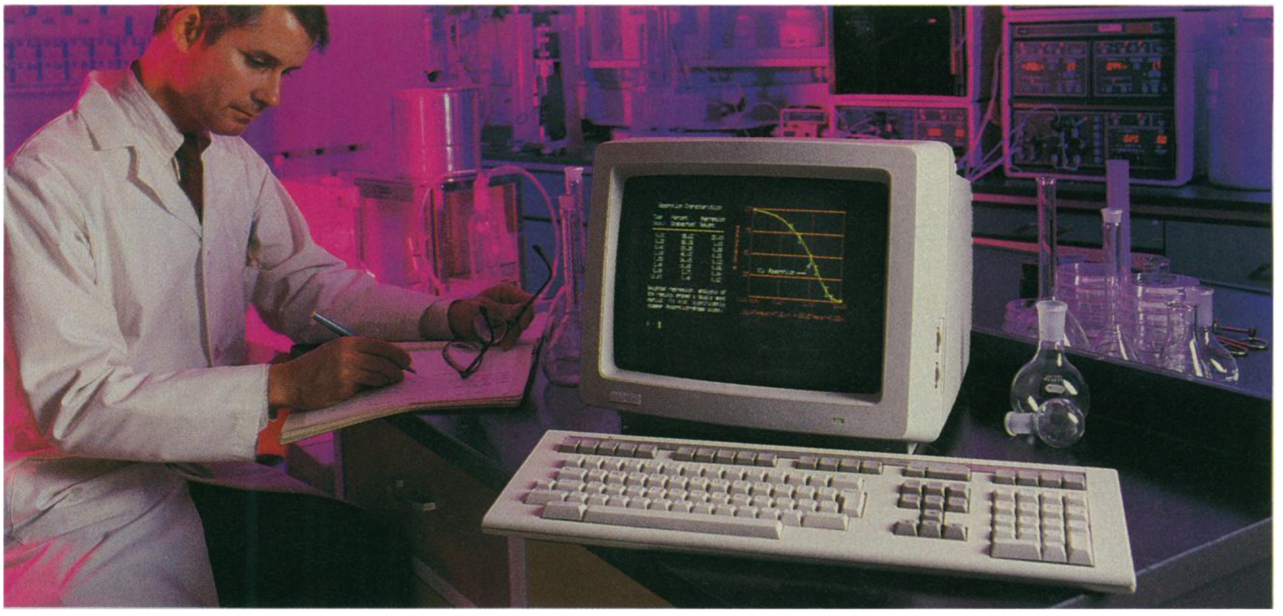

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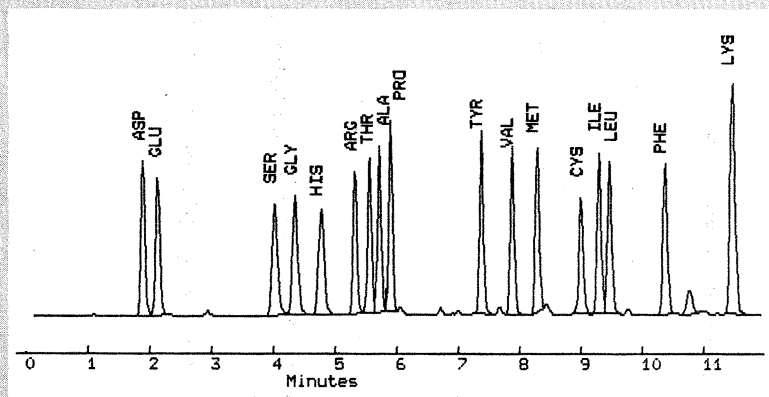

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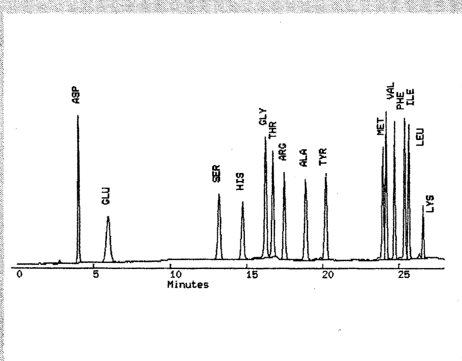

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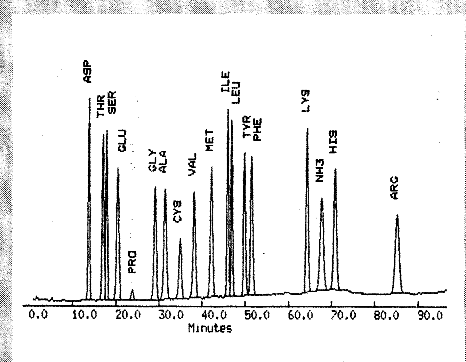

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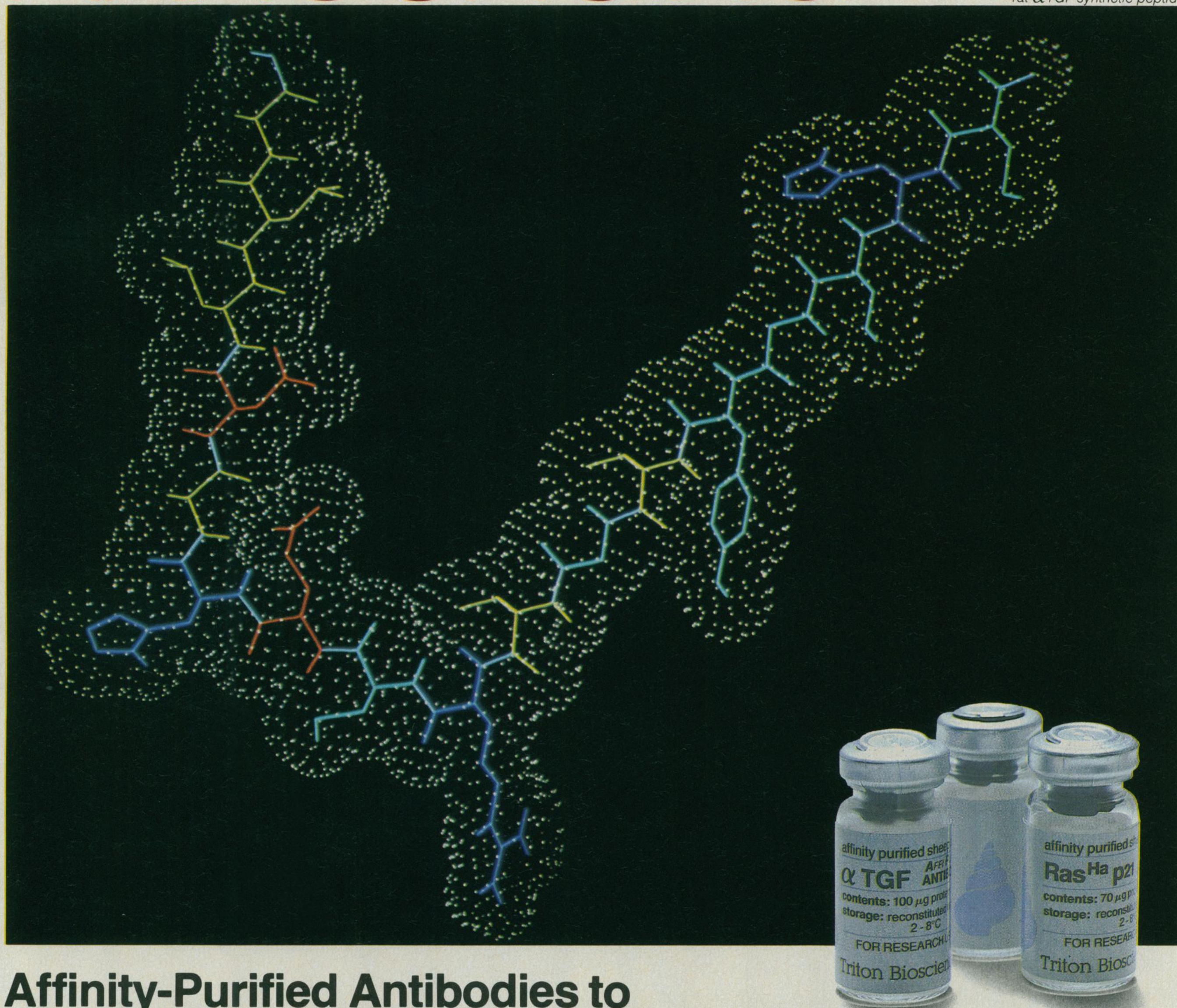

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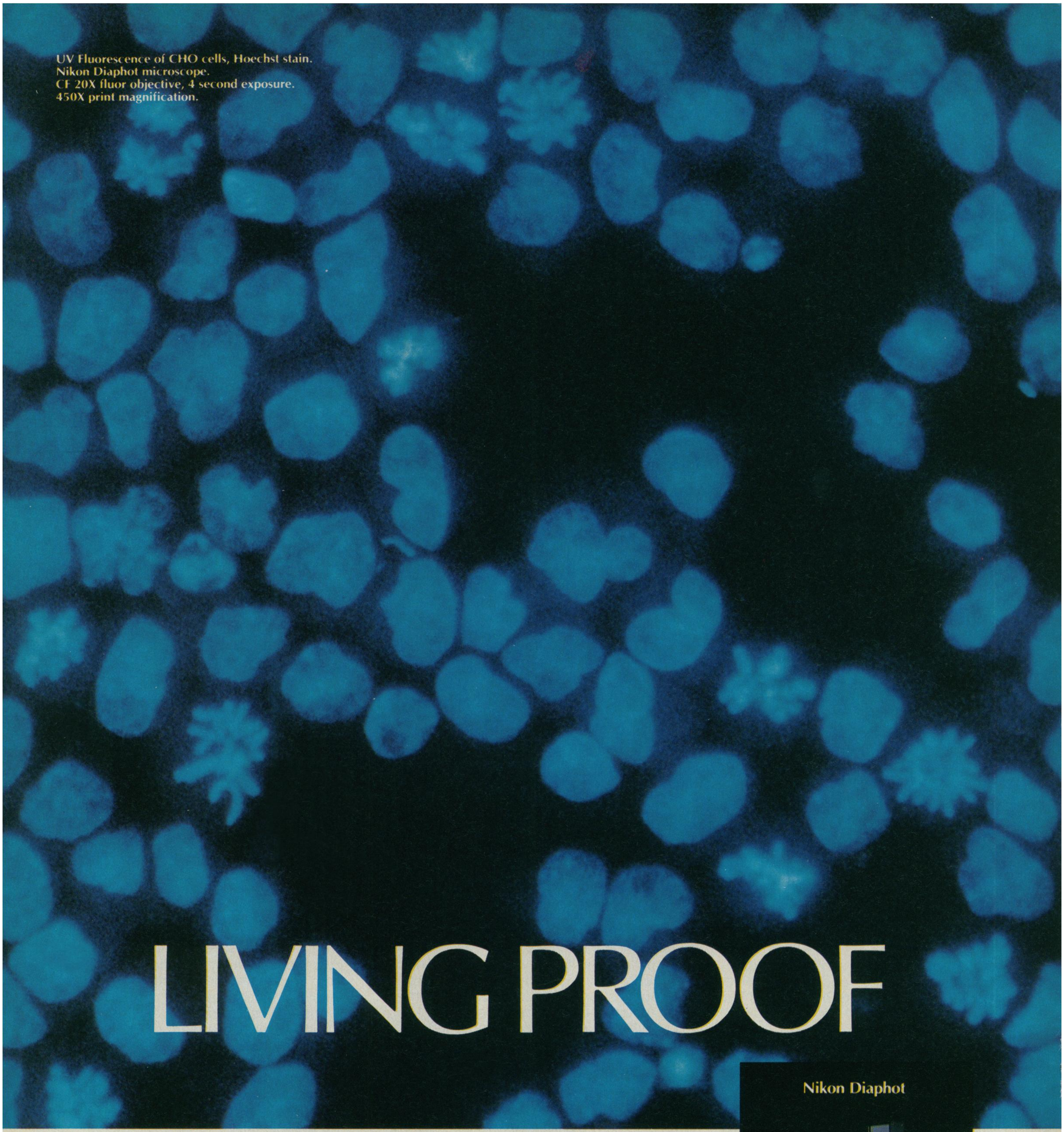

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Spacelab 1

This issue contains the first scientific reports of results obtained with Spacelab 1 during its flight of 28 November through 8 December 1983. The mission was the first of many in which a complex laboratory designed and built by the European Space Agency will be used. Accordingly, although experiments were conducted, a primary purpose of the mission was to prove out the thousands of structural, mechanical, and electronic parts that make up the laboratory. For example, the Spacelab structure and the laboratory components were monitored during ascent and descent when they were being subjected to maximum accelerations and vibrations. More than 200 sensors situated throughout the Spacelab were used.

The Spacelab consists of two major elements: a pressurized, habitable laboratory called a module in which scientists can work without cumbersome space suits and unpressurized pallets designed to support instruments which require direct exposure to space. The particular module used in Spacelab 1 had a diameter of 4.26 meters and was 7 meters long.

Spacelab was a multidisciplinary mission with five major areas of scientific research represented: astronomy and solar physics, space plasma physics, atmospheric physics and earth observations, materials science, and life sciences. The laboratory contained 38 different experimental facilities. Sixteen were situated on the pallet and 20 in the module; two had components both on the pallet and in the module. Some of the experimental facilities operated automatically, while others were operated from the ground or remotely by the scientific crew through the computer. Other experiments in the module were operated directly by the crew.

The 38 experimental facilities were used to conduct more than 70 investigations. These experiments were selected from more than 400 proposals solicited by NASA and ESA in 1976. An international panel selected the experiments to be conducted on the basis of scientific merit and suitability for flight on the Spacelab-shuttle. A minority of the investigators are located in the United States. In this issue about two-thirds of the reports are authored by European scientists.

Overall the facilities in the Spacelab functioned quite well. There were some problems, but most defects could be corrected or circumvented by the scientific crew. The major disappointment was the delay in the launch of the shuttle Columbia for more than a month.

Communication between Spacelab 1 and ground was excellent. Real-time television images from orbit were available for long periods, permitting close interaction of the scientific crew with principal investigators on the ground. As the mission progressed results poured in, and the new information was used to alter procedures for experimentation later in the mission.

Some investigations produced results immediately. This was especially true of the life science experiments. Other studies involved collection of enormous amounts of data that were stored electronically for complete analysis later. In addition, results are available from only a few of the materials science experiments. The full story awaits detailed study of samples returned from the mission.

Long-term support for Spacelab missions will depend on perceived possibilities of practical applications. The potential that has been most talked of is materials processing. On Earth, when substances crystalize they have a density different from the liquid and hence the crystals move up or down. Under microgravity the crystals remain suspended. The usefulness of this phenomenon was demonstrated in Spacelab 1 when protein crystals with a volume 1000 times those obtainable on Earth were prepared.

Those who go into a laboratory for the first time to conduct an experiment under new conditions are lucky when they have any kind of a result to show for their efforts. The patient and careful planning for Spacelab 1 paid off in the many results reported in this issue. The achievements thus far are a good omen for further successes as the lessons learned to date are used in planning for later Spacelab missions.—PHILIP H. ABELSON

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