5 March 1982 • Vol. 215 • No. 4537

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SCIENCE

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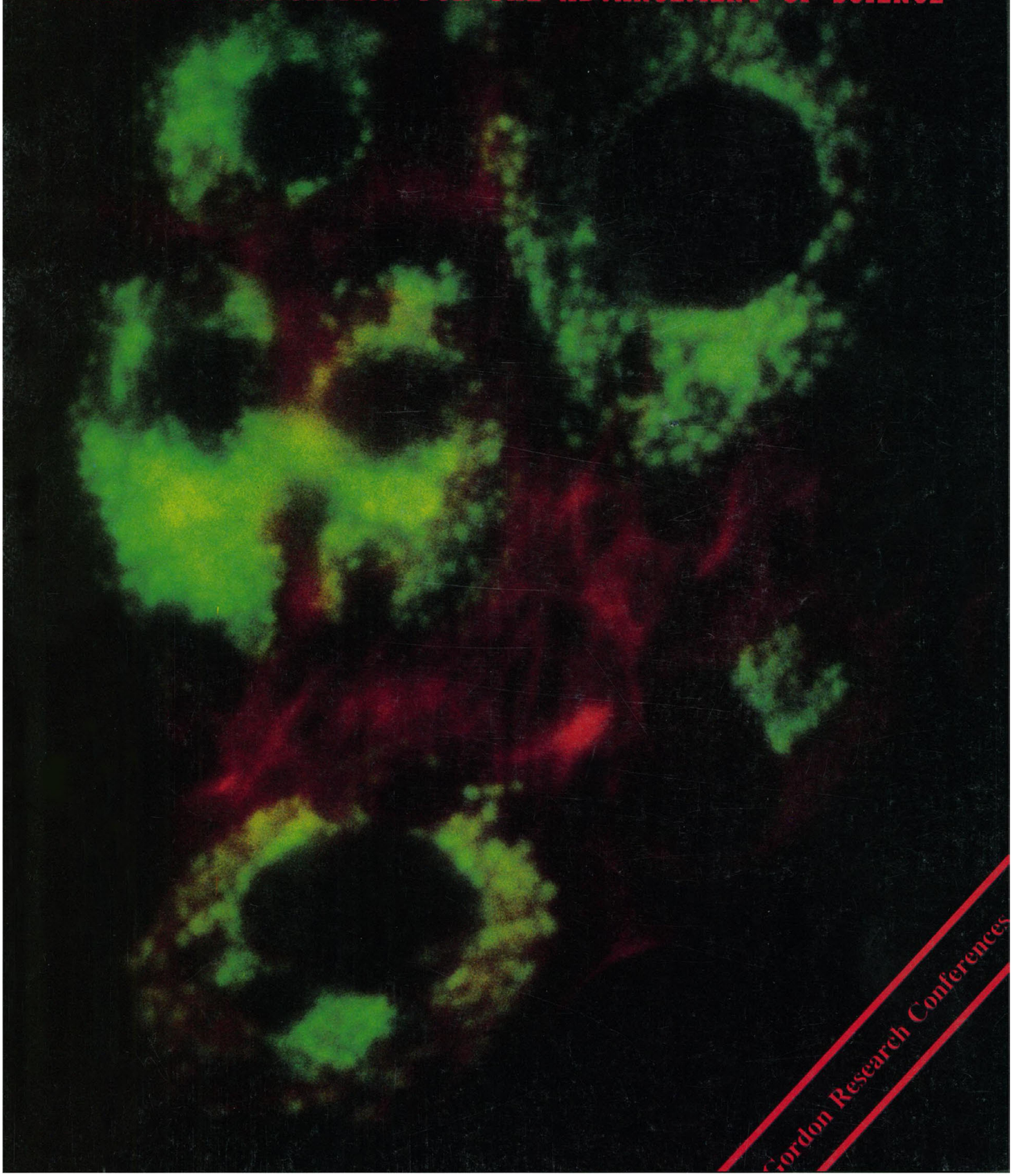
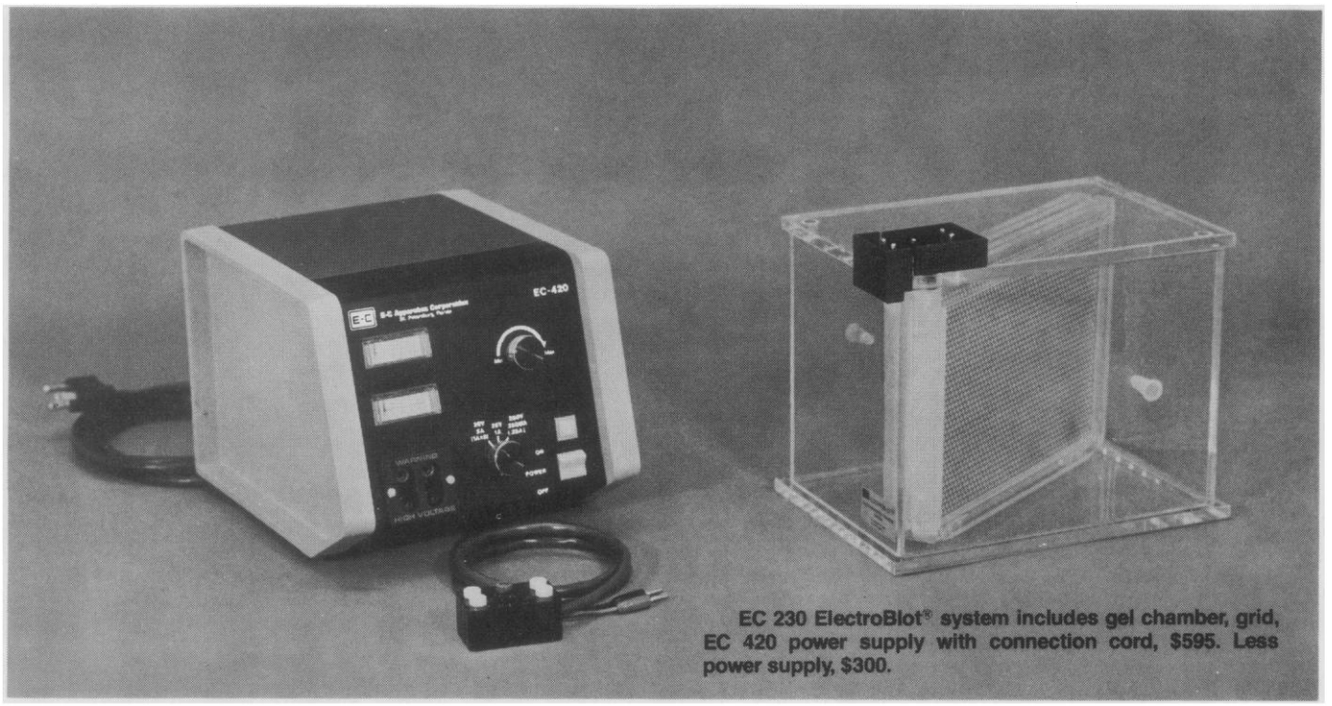


Gordon Research Conferences



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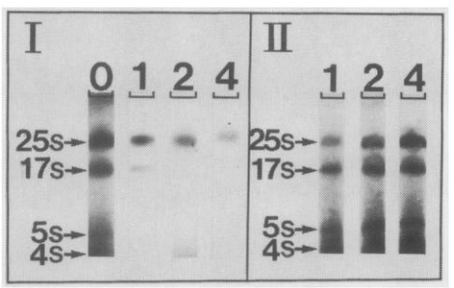
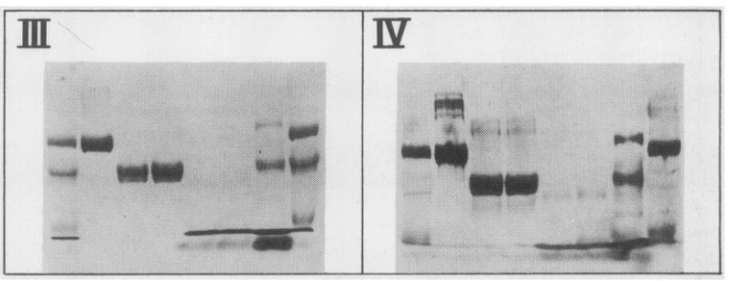


Autoradiogram comparison shows rapid rate of RNA transfer from original gel I to DBM paper II. Numbers above gel and paper indicate hours of transfer.



Protein separated on an SDS gel (III) stained with a Coomassie Brilliant Blue R250 and a nitrocellulose ElectroBlot (IV) of a similarly separated gel stained with Amido Black 10B
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- Stellwag, E. J. and Dahlberg, A. E., *Nucleic Acias Res. 8:* 299, 1980
- Towbin et al., *Proc. Nat. Acad. Sci. (US) 76:* 4350, 1979

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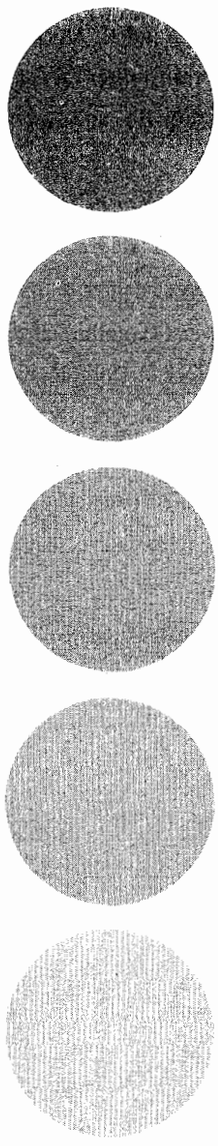

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5 March 1982

Volume 215, No. 4537

SCIENCE

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with **The Science Monthly**. Domestic individual membership and subscription (51 issues): $43. Domestic institutional subscription (51 issues): $80. Foreign postage extra: Canada $24, other (surface mail) $27, air-surface via Amsterdam $55. First class, airmail, school-year, and student rates on request. Single copies $2.50 ($3 by mail); back issues $3 ($3.50 by mail); classroom rates on request. **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. **Postmaster:** Send Form 3579 to *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

COVER

Localization of matrix products in and around cartilage cells. Although both fibronectin (red) and type II collagen (green) are being synthesized by these cultured cartilage cells, only fibronectin is found deposited extracellularly. Type II collagen (seen intracellularly within cytoplasmic vesicles) is synthesized and secreted, yet is not deposited in an extracellular matrix. Products are visualized using double indirect immunofluorescence reactions on fixed cells. [Barbara M. Vertel, Department of Biology, Syracuse University, Syracuse, New York 13210] See Gordon Research Conferences, page 1275.

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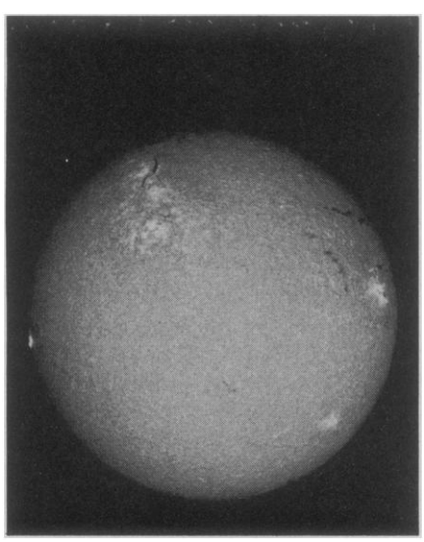
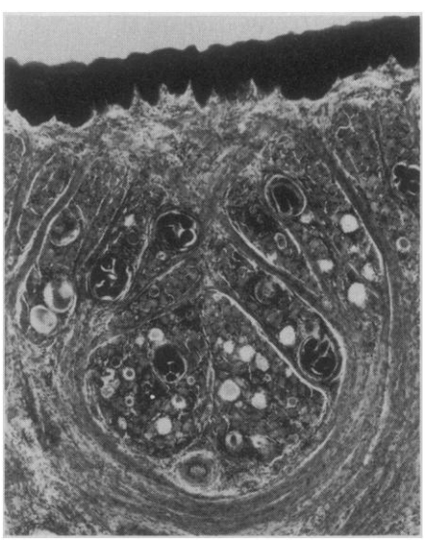
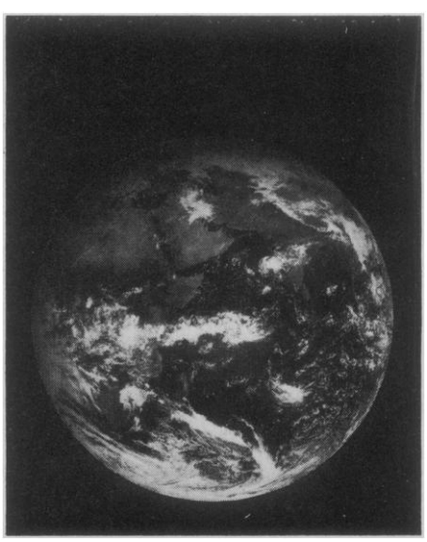


Hydrogen-alpha photograph of solar flares. Sacramento Peak Observatory, Sunspot, N.M.



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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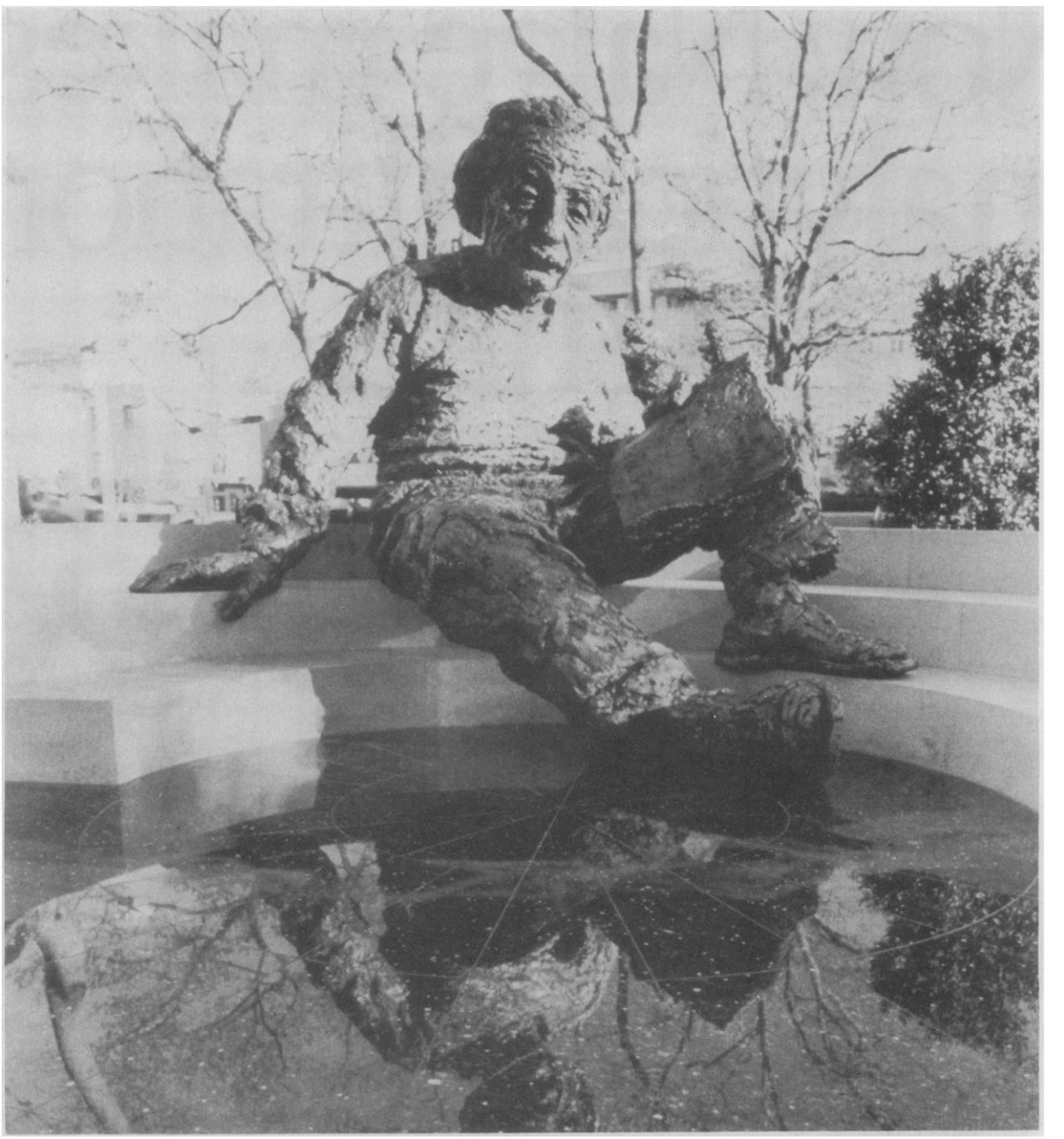

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(Program abstract included with each title)

SCIENCE/SCOPE

Solar-powered ion propulsion will be demonstrated on a spacecraft in the near future. Compared to conventional chemical propulsion, ion propulsion saves weight and is better for spacecraft control and interplanetary travel. It generates small but exact thrust for long durations. Hughes has developed a mercury ion thruster system having a specific impulse of 2500 seconds. It is being incorporated for NASA into a prototype Ion Auxiliary Propulsion System (IAPS) to be launched from the Space Shuttle on the U.S. Air Force P80-1 spacecraft.

A new all-optical logic device could make many electronics systems immune to effects of natural or man-made "noise," including lightning strikes and radio interference. Hughes scientists have fabricated a high-speed optical device that uses no electronic signals. It is made of discrete components, including four reflecting surfaces and a slab of non-linear material (gallium arsenide). The device has shown optical bistability (flip-flop behavior) with switching times of 3 nanoseconds and switch energies under 100 microjoules. Although propagation delays have kept the device's speed under the theoretical limit up to 10 gigahertz, the speed will be increased by further miniaturizing of the device on an integrated optic chip. The device could be used in fault-tolerance computers, flight control systems, and ultra high-speed signal processors.

A safely concealed gunner could guide a missile toward a battlefield target with a new fiber-optic communications system. The concept calls for a missile with an imaging seeker in its nose to be fired toward an enemy force. What the missile sees is relayed back to the gunner over a glass thread that pays out from a spool in the missile's aft end. The cable, unlike ordinary wire, can transmit broadband signals required for video. The gunner looks at a display and picks a target. Guidance commands are transmitted automatically to the missile over the fiber-optic link. Hughes and principal subcontractor ITT Electro-Optical Products Division are developing the Integrated Fiber-Optic Communications Link for the U.S. Army for possible use in a low-cost anti-armor missile.

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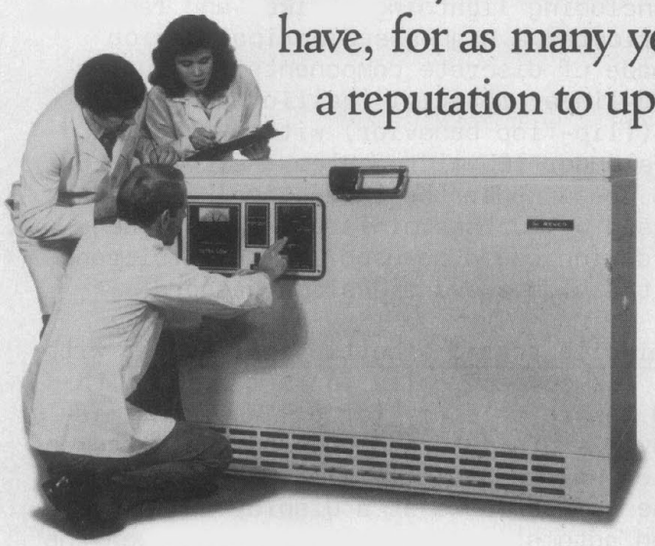

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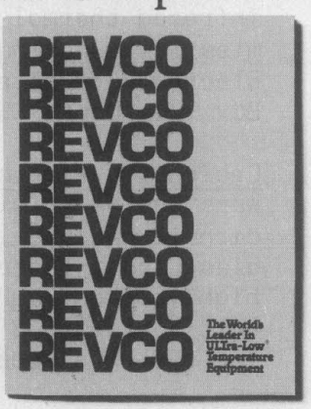

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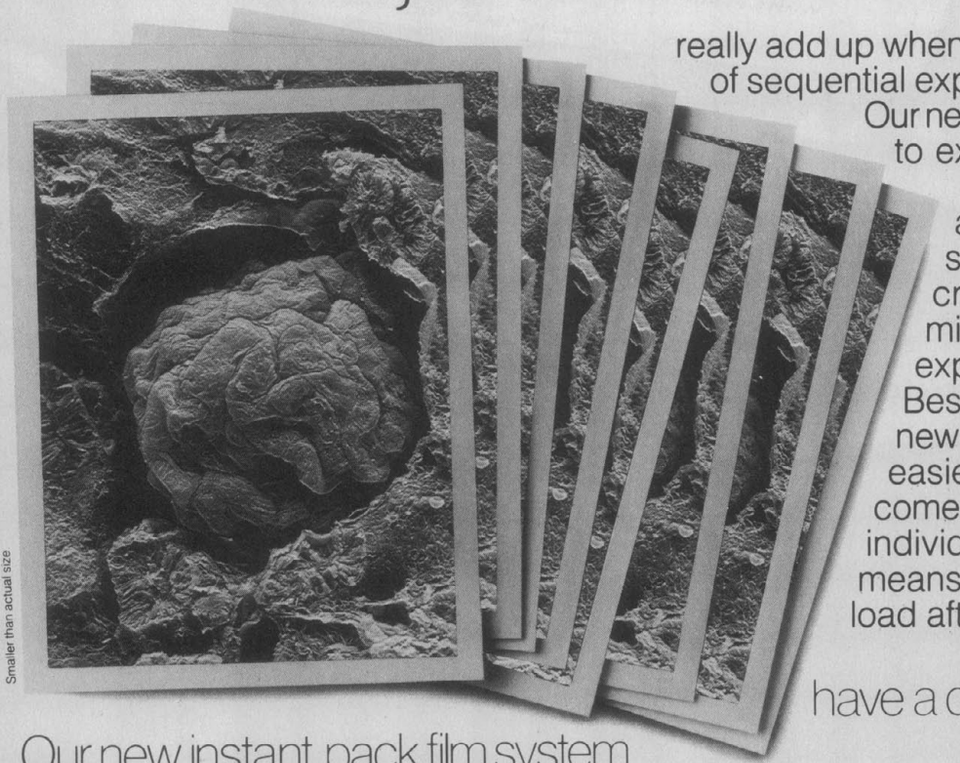

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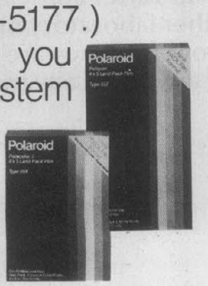

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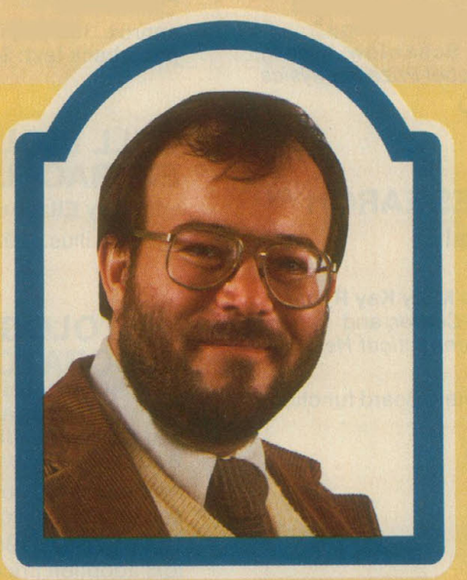

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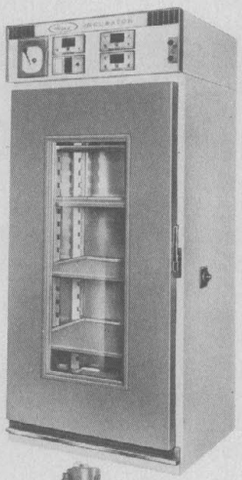

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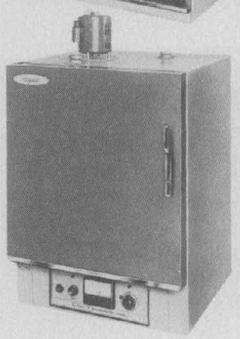

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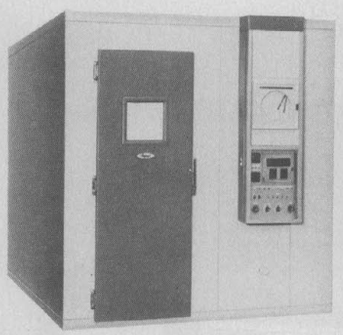

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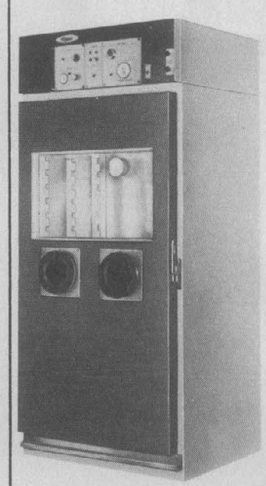

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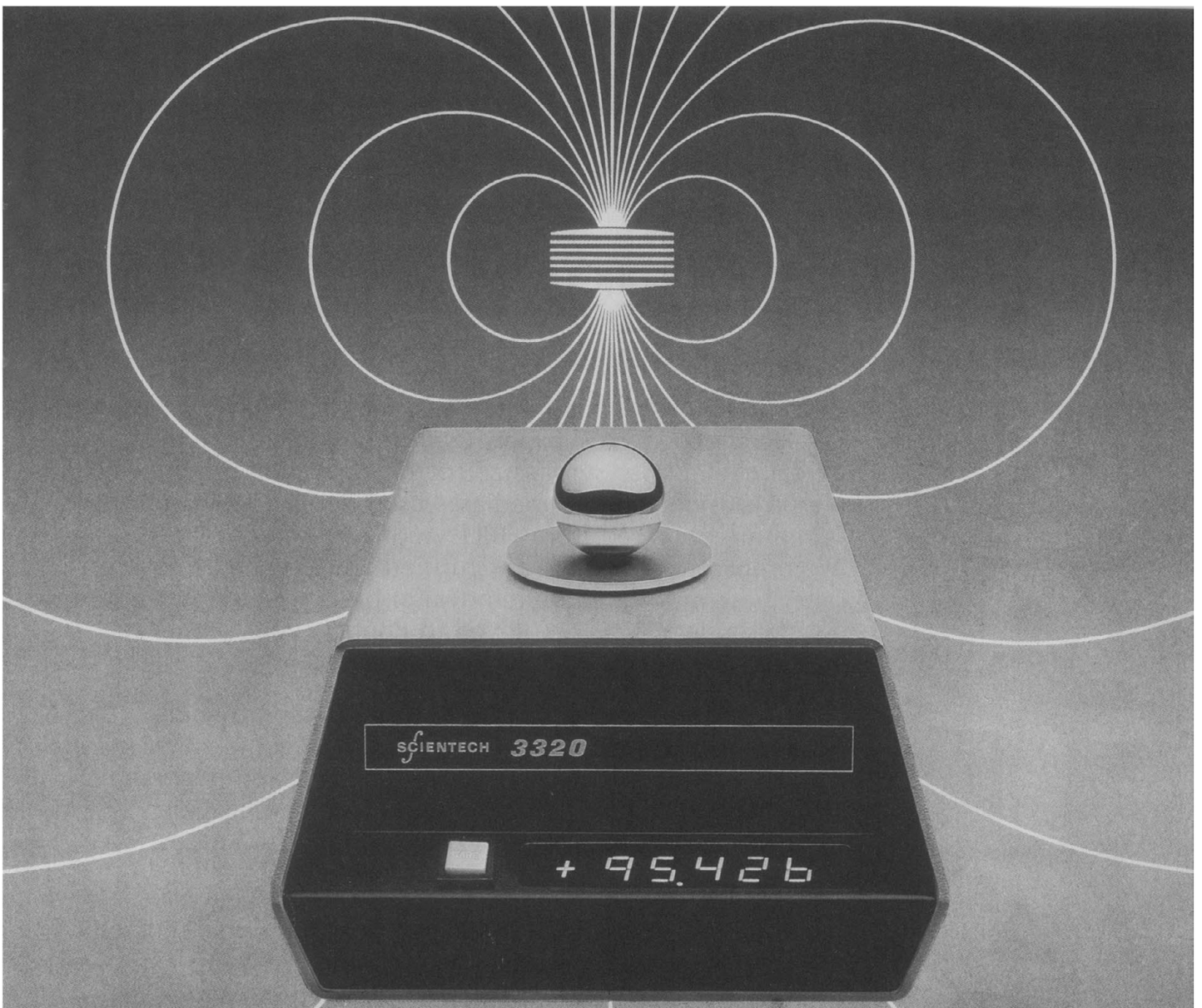

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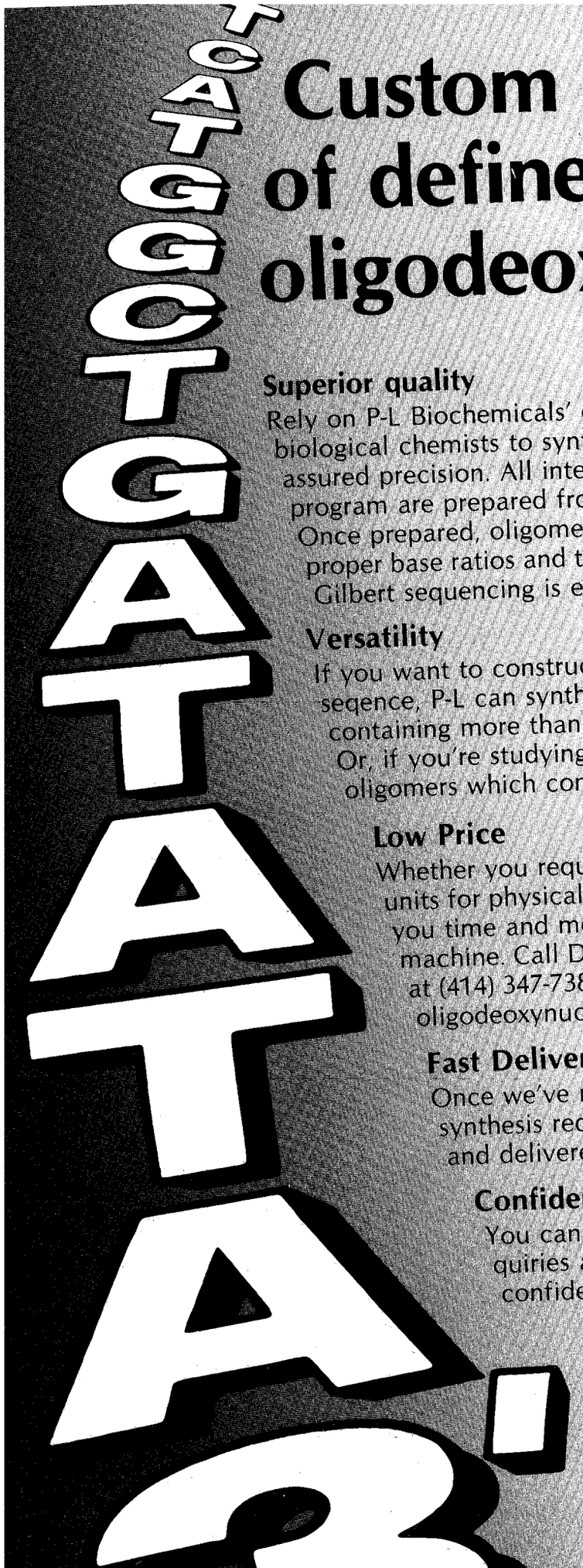

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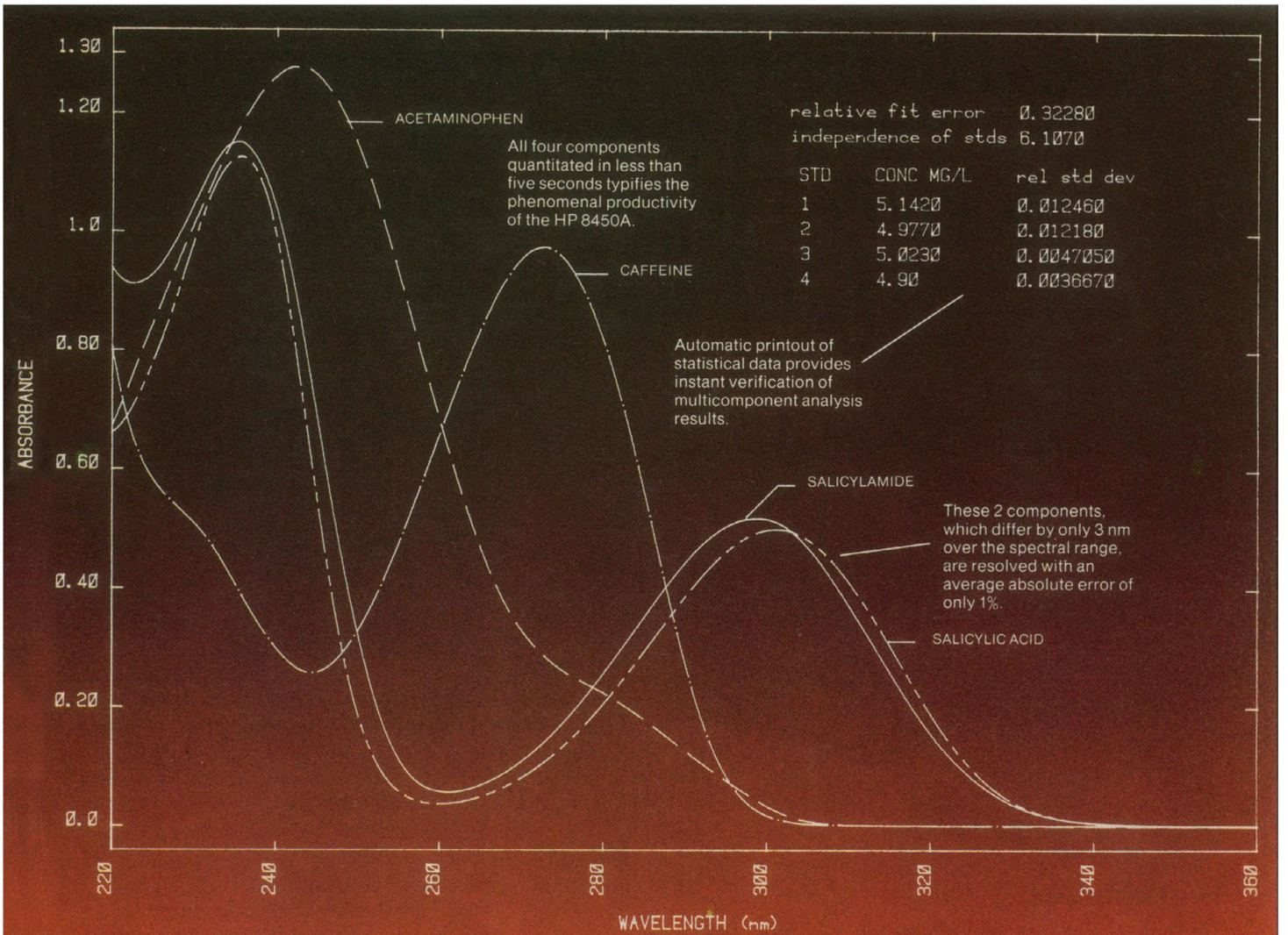

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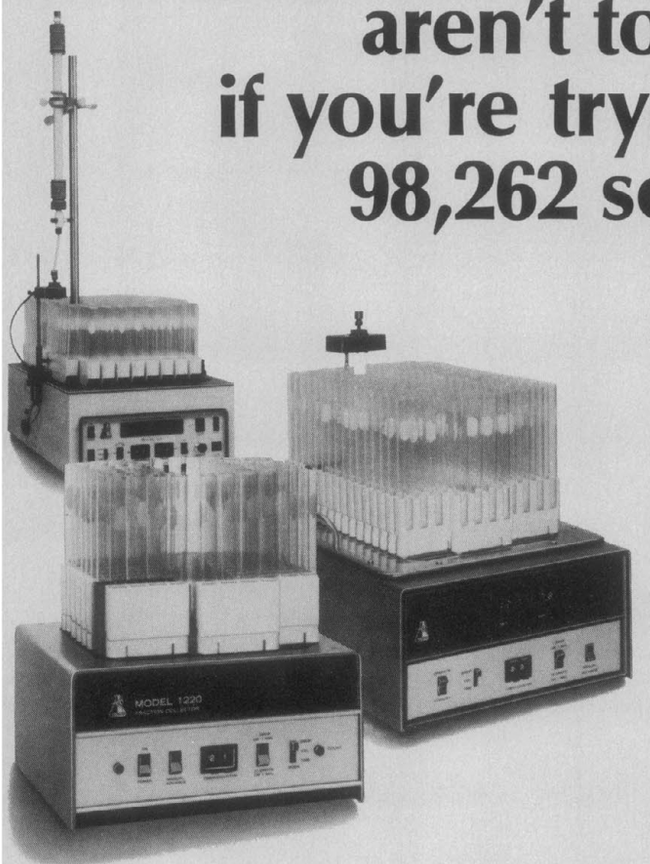

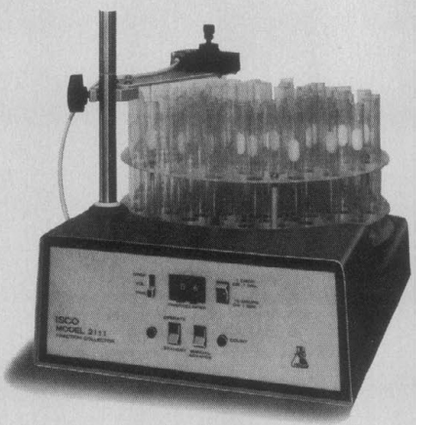

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The new Model 2111 is by far the least expensive fraction collector that collects by time, drop, volume, or pump pulse. Yet it has all metal construction, a built-in column mast, proven circuitry, and holds lots of tubes in a wide range of sizes.

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- ☐ The Retriever III is our fraction collector for big jobs. It can hold 25 mm (70 ml !) tubes too, and carries up to 380 smaller tubes. It's available with an LED readout and delay timer to synchronize tube changes with event marks on the absorbance record. The Retriever III collects from either one or two columns.
- ☐ The Model 1850 is the ISCO medium-sized linear fraction collector. It holds up to 210 tubes, collects from up to four columns, and also has an LED readout.
- ☐ Our baby is the Model 1220—it's only about the size of this page, but it still holds up to 114 tubes.

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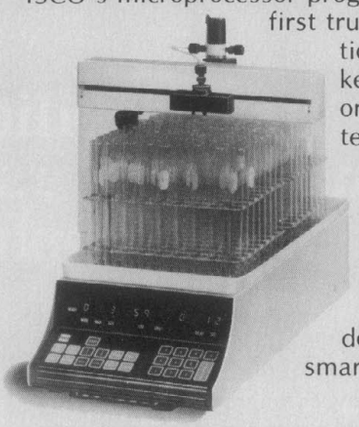

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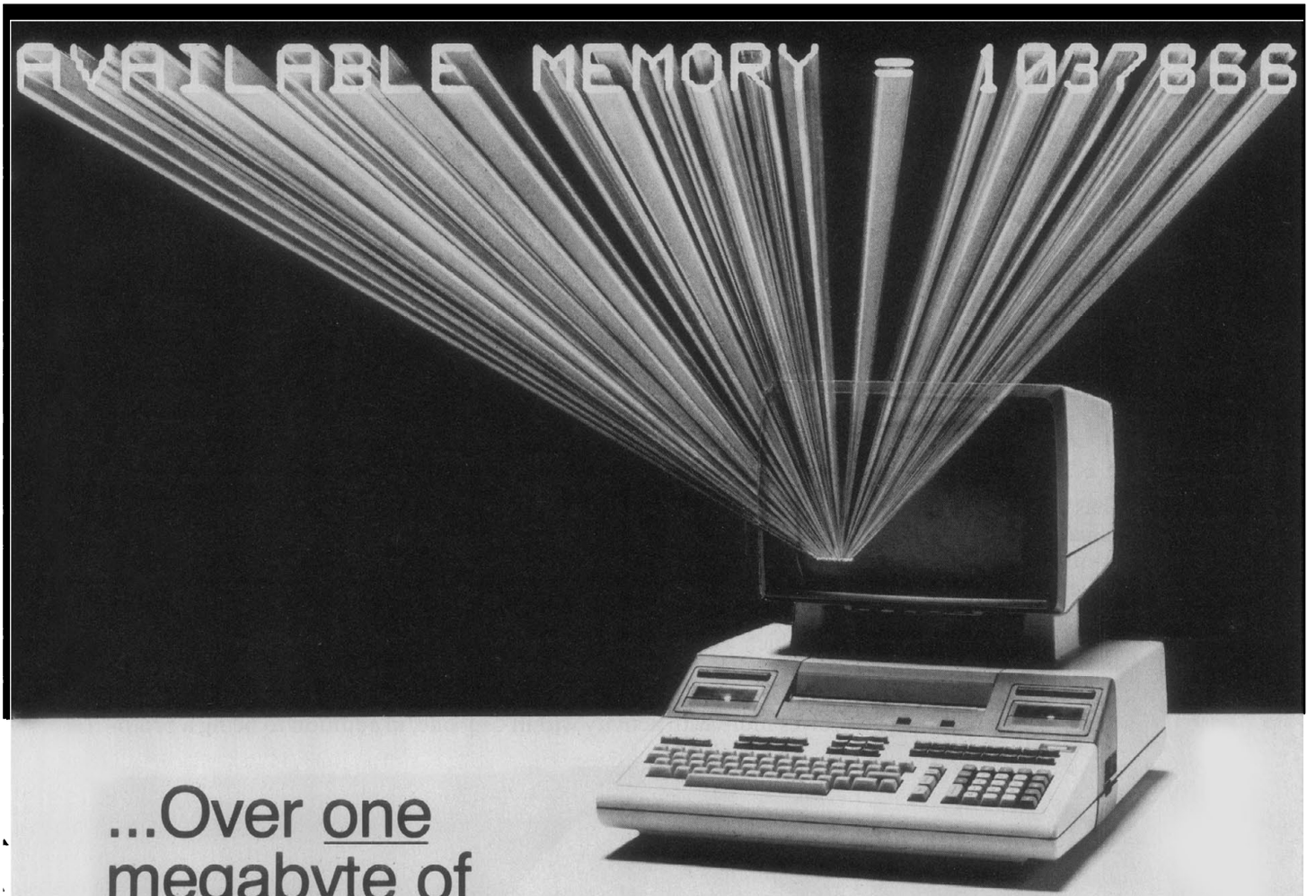

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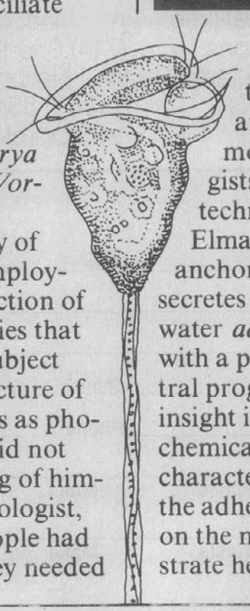
Vorticella's secret

Is it worth knowing?

Jim Elman has convinced us that it would be smart to pay him to do what he would want to do even if he had no job. It is not a typical story.

At the edge of the Genesee River, just outside his office at the Kodak Research Laboratories, Elman engages in an activity he began as a high school sophomore. He is collecting material to start yet another culture of *Vorticella* sp., an ubiquitous ciliate protozoan usually pictured thus:



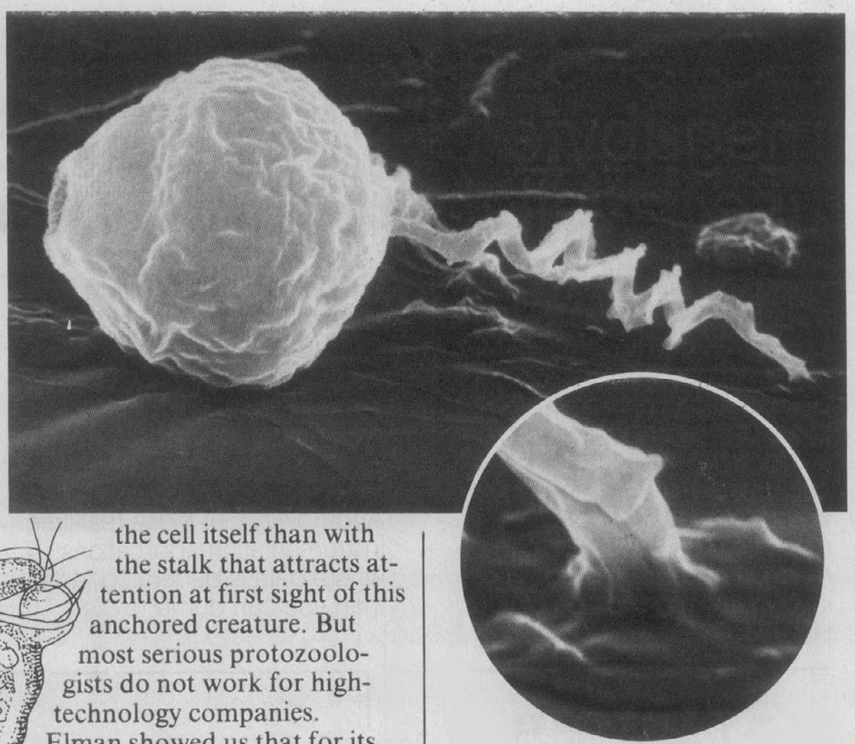
When Elman finished up a senior project on SEM studies of *Tokophrya* (a protozoan similar to *Vorticella)* at St. Michael's College of the University of Toronto, he accepted employment at Kodak in the section of the Research Laboratories that works on adhesives, a subject pertinent to the manufacture of such multilayer products as photographic film. Elman did not thereupon cease thinking of himself as a serious protozoologist, even if the adhesives people had to be made to realize they needed a serious protozoologist.

Elman solved this problem without—at least not immediately—diverting himself from his assigned duties. The adhesive disc on which *Vorticella* stands provided his solution. Most serious protozoologists concern themselves more with activity within the cell itself than with the stalk that attracts attention at first sight of this anchored creature. But most serious protozoologists do not work for high-technology companies.

Elman showed us that for its anchor this one-celled creature secretes an instant-acting underwater *adhesive.* He then came up with a plan for two different spectral programs to provide some insight into what's going on there chemically. And he demonstrated characteristic configurations of the adhesive buildup, depending on the nature of the synthetic substrate he presented to *Vorticella.*

Additionally, Elman pointed out that the infrared spectrum of the adhesive used by the protozoan *Stentor* for anchoring *its* foot bears a remarkable resemblance to that of ionized polyglutamic acid.

Elman talks like an industrial research chemist because now he is one, in addition to being a protozoologist.



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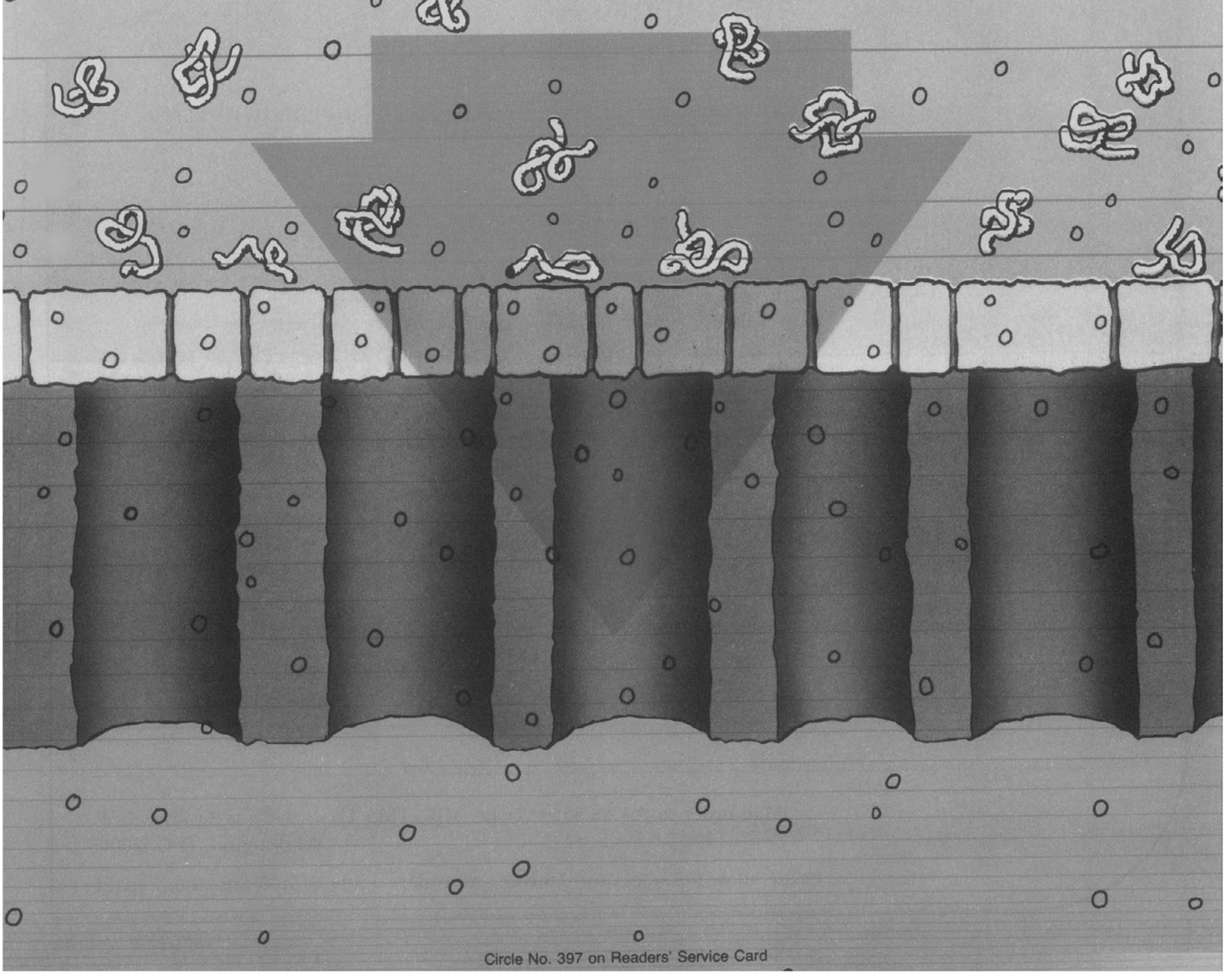

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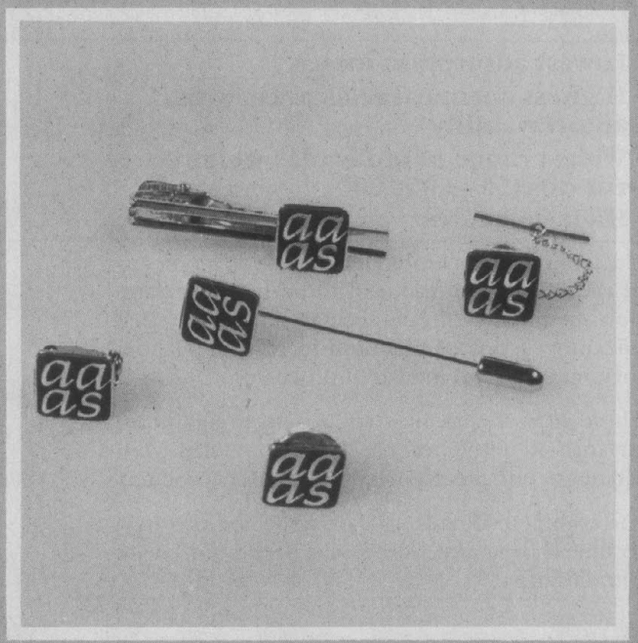

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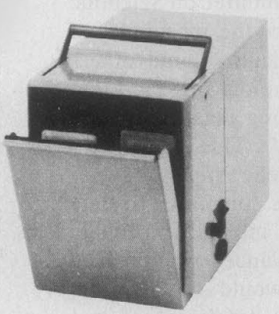

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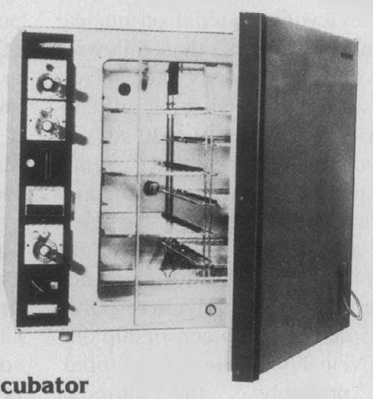

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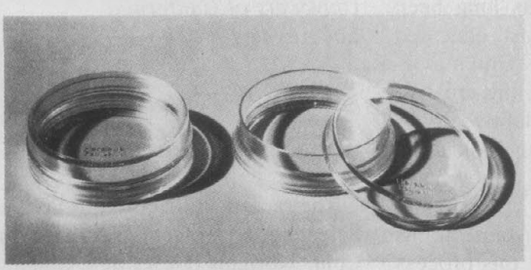

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pruning of a tree can promote . . . its health," application of this philosophy to individual small science projects would undoubtedly be detrimental. Many modest continuing grant awards are already marginally operational because they lag behind inflationary pressures. Cutbacks in the total amount of federal monies available for competing renewals or new proposals would shrink the level of such activity, and rather than select for innovation could give rise to the survival of "safe" data accumulators. The net result of "pruning" 12 to 15 percent of federal basic research funds would be contrary to the national interest. The deliberate implementation of such a sustained policy would bring about the disappearance of the current cadre and the next generation of highly qualified, university-based, academic researchers; this would cause, in turn, the eventual dependence of the United States on foreign developments for its future agricultural, medical, energy, and defense technology transfers.

STUART W. TANENBAUM
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Scientific English

The report by B. J. LaBonte and R. Howard (20 Nov., p. 907) reassures me, not only that the sun's radius still conforms to specs, but also that scientific English is alive and well. After reading the second sentence in the third paragraph, I cannot resist adding:

Strange new words I relish
Like nectar or tonic.
I now know my line printer
Is boustrophedonic.

DAVID P. STERN
31 Lakeside Drive, Greenbelt, Maryland 20770

Newton's Malady

Leonard Goldwater's criticisms of the use of hair to demonstrate possible mercury poisoning of Isaac Newton (Letters, 13 Nov., p. 742) should not pass without comment. Numerous investigations into mercury in hair have shown that it is a reliable and sensitive method for assessing mercury ingestion. For example, when thousands of Iraqi peasants ate grain contaminated with extremely high doses of organic compounds of mercury there was a strong correlation between the concentration of mercury in their hair and the severity of the symptoms of mercury poisoning (*1*). People who have consumed fish contaminated by mercury (minimata disease) show very high hair concentrations of the element, as do those who have eaten contaminated meat (*2*). A study in Italy of workers exposed to mercury contaminations from industry showed that hair was a more sensitive method of monitoring than blood (*3*). It is difficult to believe therefore that the high levels of mercury in Isaac Newton's hair were not due to mercury poisoning.

I also question Goldwater's etymology of the phrase "as mad as a hatter." I can find no reference to the phrase "as mad as an adder" in any contemporary dictionary or in *Roget's Thesaurus*. Nor does it occur in the *Oxford Dictionary of Proverbs*, which, however, gives the date of the first recorded use of "mad as a hatter" as 1837. Although there are no contemporary references to the use of mercury in the treatment of felt hats before the middle of the 19th century, it

is generally agreed that the process had probably been in use since the early part of the century; therefore, the phrase "mad as a hatter" must have first appeared shortly after the use of the process became widespread. Before that the English simile for madness had always been "mad as a March hare," a phrase which the *Middle English Dictionary* traces back to at least the 14th century, but gives no mention of adders.

Finally, it is by no means a certainty that Alice's Mad Hatter was an Oxford furniture dealer. The increasingly frequent use of the phrase in the middle of the 19th century may well have been sufficient to have drawn it to Lewis Carroll's attention.

MARTIN R. LAKER
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University of Bristol,
Bristol BS2 8BJ, England

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2. A. Chatt, C. A. Secord, B. Tiefenbach, R. E. Jervis, in *Hair, Trace Elements and Human Illness*, A. C. Brown and R. G. Crounse, Eds. (Praeger, New York, 1980), pp. 69–70.
3. L. CignaRossi, G. F. Clemente, G. Santaroni, *Arch. Environ. Health* **31**, 160 (1976).

Polarization

The editorial by F. Karl Willenbrock (18 Sept., p. 1319) points to the decline of U.S. technological preeminence. This retrogression is not limited to steel, automobiles, and electronic devices. It also applies to nuclear power and components, big ship construction, dredging, and other fields.

How is the nation to mobilize its scientific and technological resources, granting that a tripartite effort by industry, government, and academe is needed? What common objective can give them a focus?

In the case of Sputnik, the common chord was the fear of a spacial overview and a threat to our national security. Is there a purely economic or "moral equivalent" of war? Can a long-range, relatively vague probability pump the necessary adrenalin into our social structure to enable us to surmount the rivalries and internal competitiveness that pervade the U.S. psyche?

It will first be necessary to alter the polarization that has crept into our attitudes. Industry now feels beleaguered by government; government feels it is the sole protector of the public; and academe is an orphan seeking "overhead" funds from industry and a few crumbs from the belt-tightening operations of

government. The permit process, that legislated gauntlet to be run in order for any large endeavor to be translated from concept to construction, is a typical example of this polarized attitude. In most instances, the academic sector provides ammunition for both sides.

It is essential that we begin to regard society's needs as matters for a different procedure—not adversary, but selective. A common need must be met by a concerted effort to find the best of many alternatives. None of these will be perfect, nor will all possible questions ever be answered. We must rewrite the National Environmental Policy Act in a positive vein and try to find the best alternative rather than attempting to avoid all evil.

Only in that way will we discover how to meet the challenge of international competition in all arenas.

EUGENE H. HARLOW
PRC Harris, Inc.,
4151 Southwest Freeway, Suite 395,
Houston, Texas 77027

Antinuclear Activism

Constance Holden's informative article of 12 February (News and Comment, p. 878) bears the title "Antinuclear movement gains momentum," yet it deals entirely with antinuclear *war* activism in the United States.

The distinction between the two is hardly trivial. As George Kistiakowsky recently said:

> [W]e have problems in trying to redirect the public fear of nuclear plants into fear of nuclear war. When you get emotional about nuclear plants and don't care about nuclear war, it's worrying about a pimple on your cheek when you have a goodly case of cancer.

WILLIAM SPINDEL
Office of Chemistry and Chemical Technology, National Research Council, Washington, D.C. 20418

Correction

An article reporting a congressional hearing on the National Cancer Institute (NCI) (News and Comment, 20 Nov., p. 887) incorrectly states that the institute allowed an unnamed individual to produce a preparation called "Jim's Juice" under what is known as a "compassionate investigational new drug" permit. The NCI, which does not have authority to issue such IND's, was not involved in the matter.

The article also refers to an internal memo written by an NCI researcher about the alleged misuse of an experimental drug called Mitoxantrone. The drug in question was one known as M-AMSA, a new agent against acute leukemia.

5 March 1982, Volume 215, Number 4537 **SCIENCE**

Cooperation in R & D: Whose Responsibility?

Spurred by competitive and financial pressures, U.S. research laboratories in universities, industry, and government are searching for collaborative agreements to improve their performance. Many successful arrangements are being expanded and new ideas put forward. The National Bureau of Standards (NBS) has had considerable experience in cooperative research arrangements, and some thoughts based on our experience may be useful to others.

While some U.S. institutions are finding it possible to agree on long-term and comprehensive multimillion-dollar research ventures, we have found that cooperative efforts need not be long-term nor restricted to "big ticket" items. The big national research facilities must be shared, as we share our research reactor, synchrotron radiation source, and other facilities, but these need not be the models for all cooperative ventures. Our Research Associate Program has fostered a variety of useful cooperative research programs, many of which require little in the way of unique facilities and are narrow in scope. Each agreement has been tailored to fit the work at hand and the capabilities and goals of the participant.

Over the past decade, NBS initiated a series of research projects to improve our knowledge of the properties of liquefied natural gas (LNG) mixtures, containment materials, and measuring techniques. About half the work was funded by relatively small-scale cooperative programs with industry, particularly under the aegis of the American Gas Association. At one point we put together a 19-member consortium of natural gas users, importers, and utilities for a single project to develop a good equation of state for LNG. One of the most successful projects, backed by NBS, the American Gas Association, the Maritime Administration, and the American Bureau of Shipping, was simply to produce a well-documented, easy-to-use handbook of data for LNG users. Typically, it took 9 to 18 months to make the arrangements for a project in the LNG program. Likewise, we recently announced a major cooperative program with the American Society for Metals to collect evaluated alloy phase diagram data and make the data available through a computerized information system.

These are only two examples of the variety of our joint research ventures. About 100 industrial research associates and 40 postdoctoral fellows are working today at NBS. More than 325 professors and students are stationed in NBS laboratories each year under various guest worker arrangements. We have education agreements with 100 universities and colleges and joint research programs with the Electric Power Research Institute, the Gas Research Institute, the American Dental Association, the American Society for Testing and Materials, and others.

In carrying out cooperative research programs, one must be persistent, attentive to detail, and involve both the technical staff and managers in the initial detailed formulations and the later critiques of progress. In all our agreements there has been no substitute for the involvement of bench scientists and engineers. Laboratories wishing to collaborate in research should seek the advice of all potential participants, whether they are in industry, universities, or government. At NBS all research managers are encouraged and expected to make such interaction a way of life. That concern is manifested by daily contact with university and industry peers and users and by a variety of formal evaluation panels involving scientists and engineers selected by the National Academy of Sciences and the National Academy of Engineering. This kind of regular interaction fosters an environment that is receptive to cooperative research.

The pluralistic nature of American society presents a real variety of opportunities for cooperation, and these opportunities should be imaginatively explored. It is up to managers and researchers to be ambitious and innovative in their planning for cooperative research and to have the will to work out seemingly small but nevertheless crucial details of mutual understanding.—ERNEST AMBLER, *Director, National Bureau of Standards, Washington, D.C. 20234*

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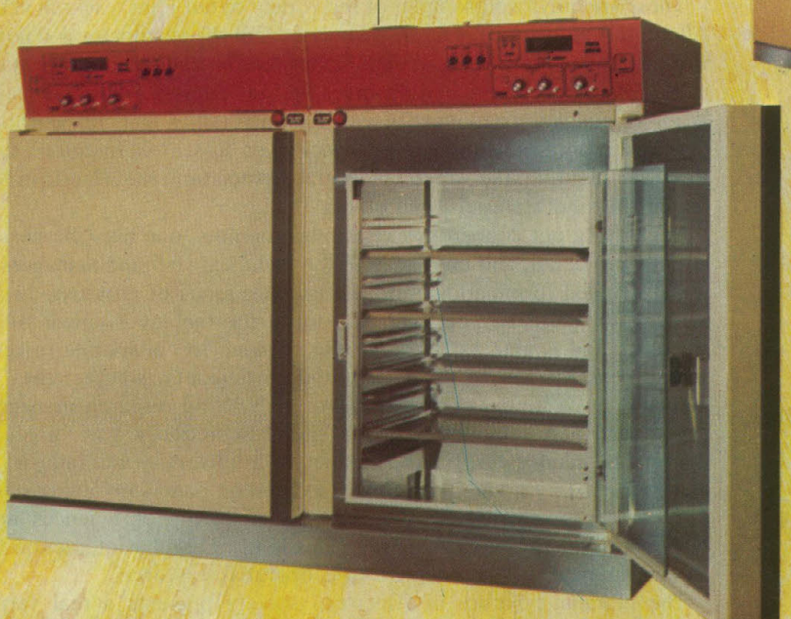

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