

24 February 1984 • Vol. 223 • No. 4638

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SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



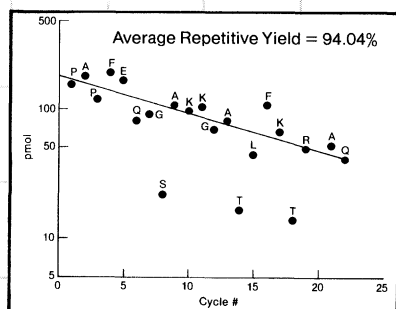
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You can count on:
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 ✓ Value and Economy

The data proves it. And, you can achieve enhanced microsequencing and autoconversion with our latest System 890M Sequencer or with your Model 890C and a performance upgrade kit.

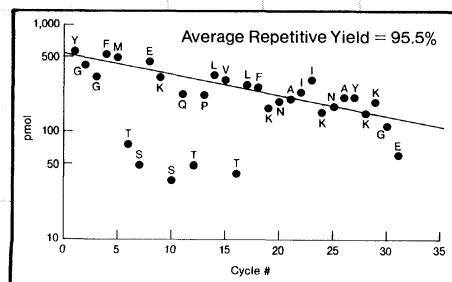
Cytochrome C — 200 Picomole Performance

From a loaded sample of 200 picomoles, a 94% average repetitive yield was achieved with an intercept sensitivity of 178 picomoles.



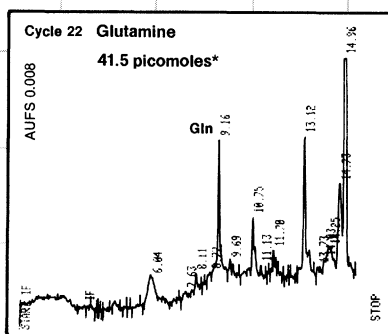
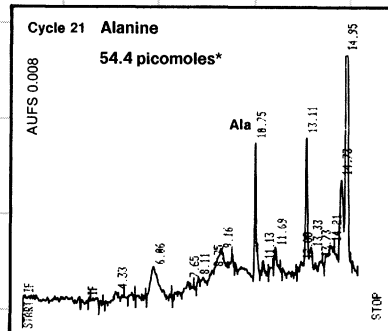
β-Endorphin — The Complete Sequence

Sequencing a peptide is a good measure of performance. Using β-endorphin, an average repetitive yield of 95% was attained. All 31 residues were clearly identified.



In-Line Autoconversion

With Beckman sequencers, conversion takes place in individual tubes in the fraction collector, *not* in an intermediate or common vessel. There is no extraction, no additional solvent and no loss of PTH amino acids. And, particularly important, there is virtually no chance of cross-contamination. HPLC traces show the quality of the resulting derivatives.



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If you own an earlier Model 890C, you can get enhanced microsequencing and autoconversion for less than one-third the cost of a new sequencer! If

it's a new instrument you need, System 890M comes equipped with all the up-to-date microsequencing, autoconversion and software features.

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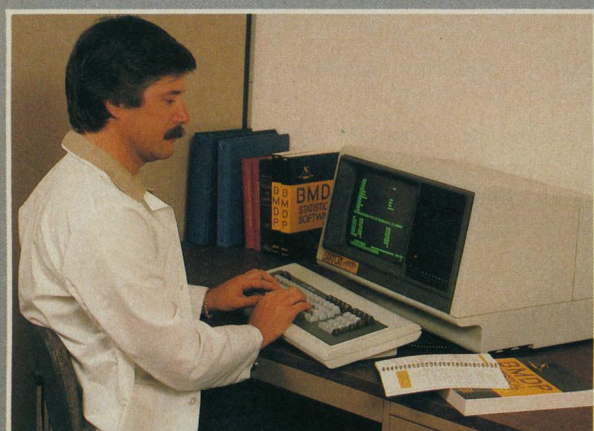
COVER

Lower part of the Western Cwm of Mount Everest showing part of Nuptse (background) and crevassed glacier with climbers (foreground). This was part of the route used by the 1981 American Medical Research Expedition to Everest; more than 2 tons of equipment passed through this region en route to the main laboratory camp at an altitude of 6300 meters. During the expedition, the first physiological measurements on man were made on the summit (altitude, 8848 meters). See page 784. [Photograph by Jeff Lowe, Latok Mountain Gear, Lyons, Colorado 80540]

American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to demonstrate the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

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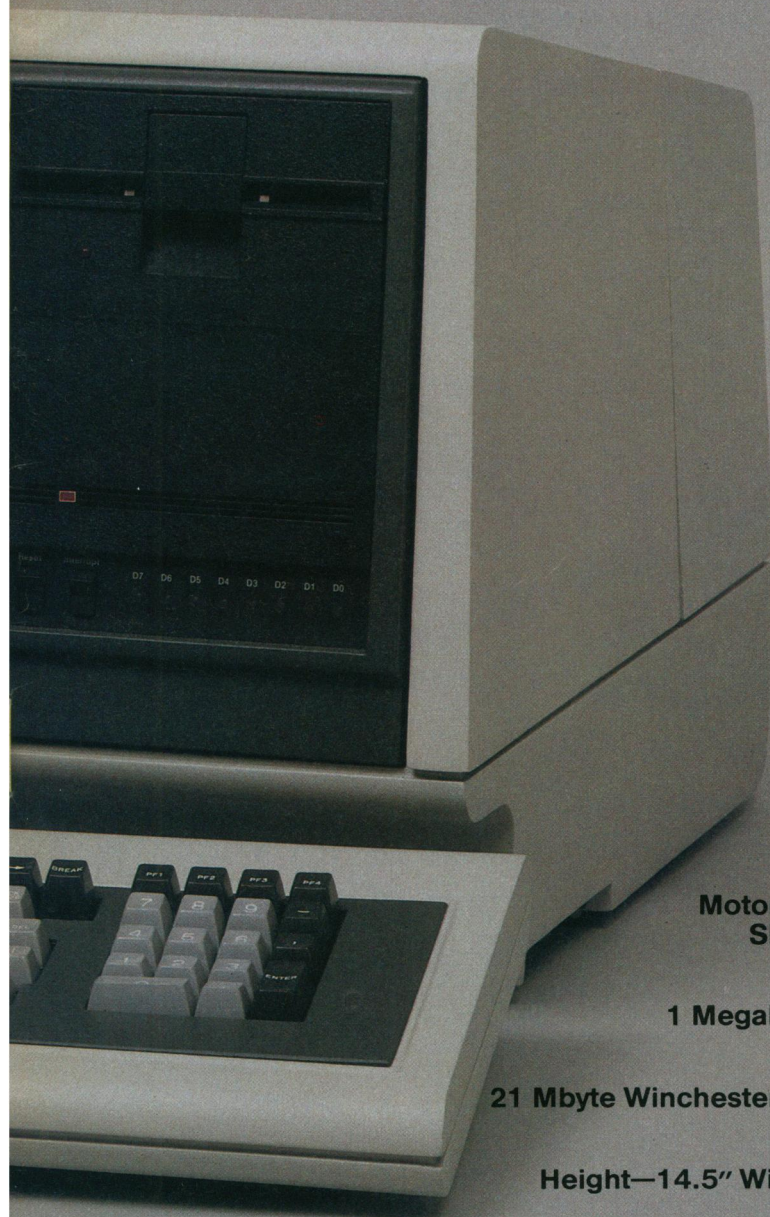
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SPECIFICATIONS

PROCESSOR:

Motorola 68000 CPU IEEE 796 Multibus Architecture, 8 Board Slots, 32 Bit Registers 16 Bit Data Bus, 24 Bit Address Bus

MEMORY:

1 Megabyte of Random Access Memory (Expandable to 2 Mbyte)

DISK STORAGE:

21 Mbyte Winchester hard disk is standard; a 43 Mbyte Winchester is optional

SIZE:

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Classification

Academic
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Commercial

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Academic	\$12,485	\$13,945	\$14,825
Gov't/Nonprofit	13,215	14,885	15,885
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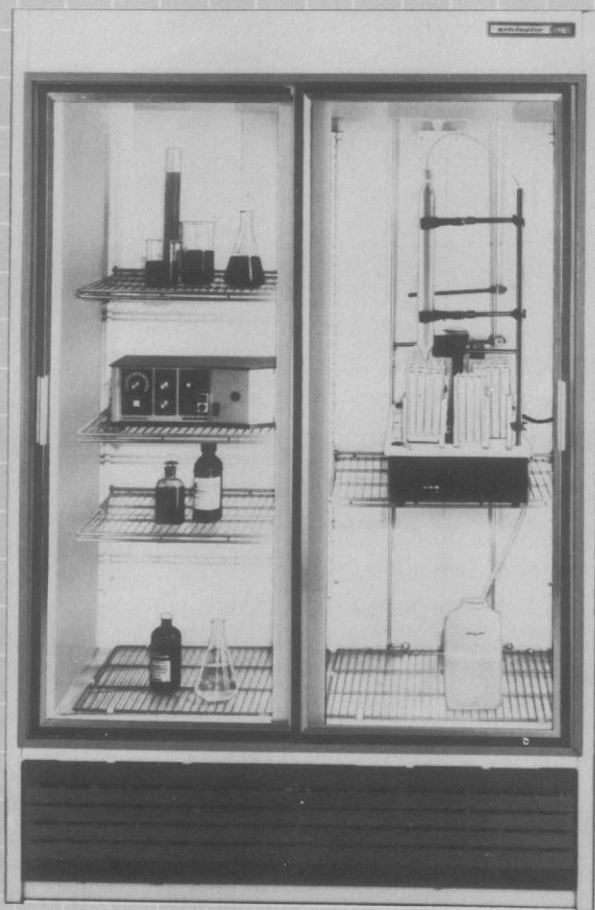
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R&D in FY 1985: Budgets, Policies, Outlooks

Ninth Annual AAAS Colloquium on R&D Policy

Shoreham Hotel • Washington, D.C.

29–30 March 1984

Budgets: Discussion will be based on *AAAS Report IX: Research and Development, FY 1985*, a timely and comprehensive analysis of the new proposals for R&D in the FY 1985 budget, prepared by AAAS and a group of its affiliated scientific, engineering and higher education associations. Registrants will also receive *Proceedings* following the Colloquium and *Congressional Action on R&D in the FY 1985 Budget* in the fall.

Policies: Trends and prospects for R&D in defense, energy, health, space and other areas will be explored by leaders from industry,

universities, agencies of the federal government, Congress, the White House and the scientific and engineering communities.

Outlooks: Perspectives will be provided on topics such as deficits and the overall budget climate, R&D and economic recovery, implementation of R&D programs, public and private sector roles in applied research, and strategies for industry-university cooperation.

For further details, write:
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Washington, D.C. 20036

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**9th AAAS R&D Colloquium
Washington, D.C.
29 & 30 March 1984**

**Advance
Registration
Form (S3)**

Thursday & Friday, 29 & 30 March, at The Shoreham Hotel, 2500 Calvert St., N.W., Washington, D.C.

Registrant's Name _____
(last name) (first name and initial)

Affiliation _____

Mailing Address _____
(street and number)

(city) (state and zip) (telephone number)

☐ Please check here if you need special services due to handicap. We will contact you prior to the meeting.

Enclosed is a check, purchase order, or credit card information (see below) for:

- ☐ \$125 Full Registration (sessions, three meals, three publications)
☐ \$ 90 Partial Registration (sessions, three publications)
☐ \$ 45 Student Registration (sessions, three publications; full-time graduate and undergraduate students only)

Separate Meal Tickets: Lunches, \$17.50 each; Breakfast, \$5. No refund for meals after 26 March.

☐ Lunch on Thursday, 29th ☐ Continental Breakfast on Friday, 30th ☐ Lunch on Friday, 30th

Packets will be mailed to preregistrants on 16 March. Registrations received after 16 March will be held at the AAAS Registration Desk at The Shoreham Hotel. All registrants will receive *AAAS Report IX: Research and Development, FY 1985* at or before the Colloquium, published *Proceedings* following the meeting, and a supplementary report, *Congressional Action on R&D in the FY 1985 Budget*, in the fall.

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(Reservations received after 28 February cannot be guaranteed)

Names and Addresses of All Occupants of Room:

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Room: _Single (\$78*) _Double (\$94*) _Twin (\$94*)

(* Plus 10% D.C. sales tax and \$1 occupancy tax.)

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Be sure to list definite arrival and departure date and time. Hotel reservations will be held only until 6 p.m. unless otherwise specified. Check-out time is 1:00 p.m.

Departure: Date _____ Time _____

Please indicate any special housing needs due to handicap _____

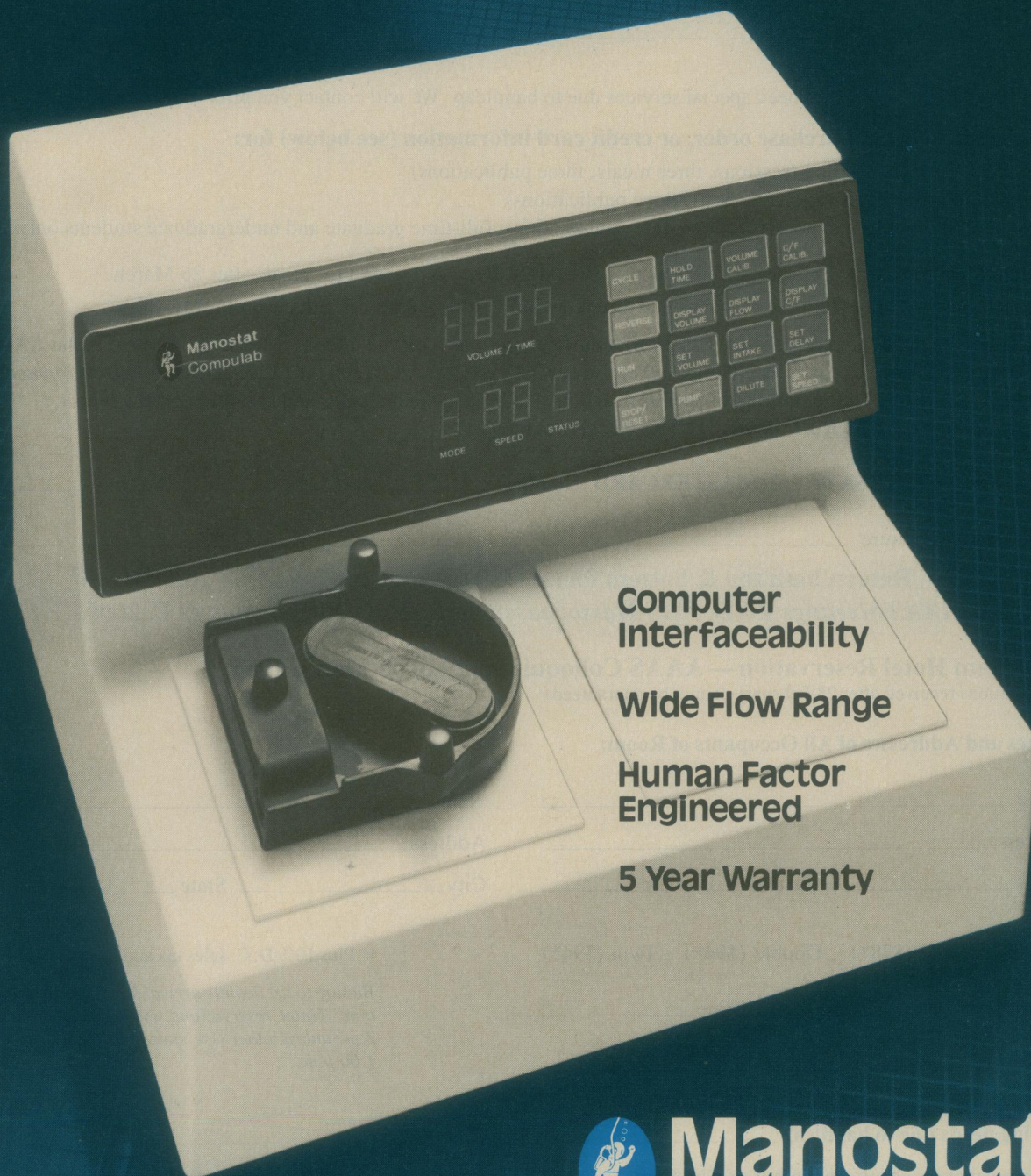
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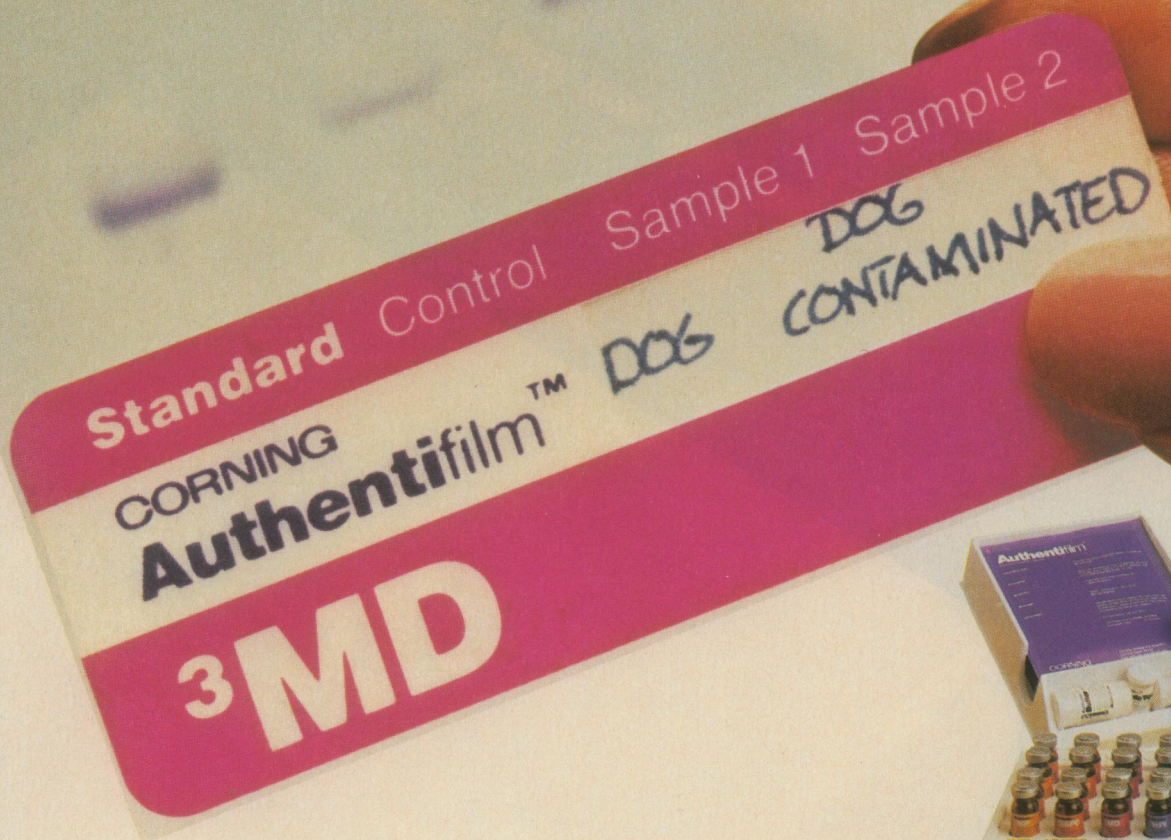
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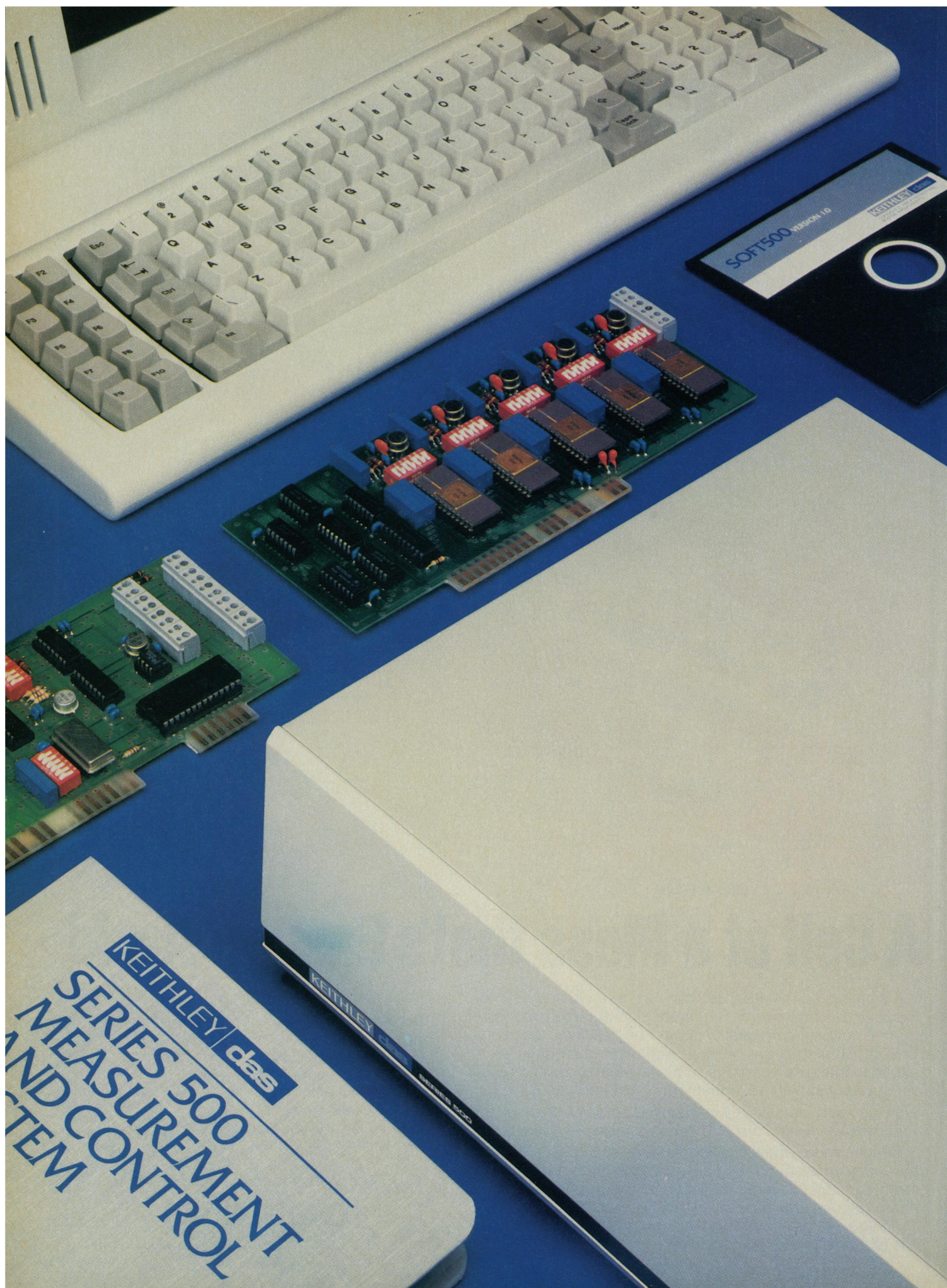
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Analog Input					
16 Channels	Yes	Yes	+ \$850	+ \$362 ⁽²⁾	+ \$2104 ⁽³⁾
Instrumentation Amplifier	Yes	+ \$700	+ \$700	Yes	Yes
± 0.035% Absolute System Accuracy	Yes	+ \$1100 ⁽⁴⁾	+ \$1100 ⁽⁴⁾	No	Yes ⁽⁵⁾
30 kHz Sampling	Yes ⁽⁶⁾	No	Yes ⁽⁷⁾	Yes	No
High Speed Programmable Ranges	Yes	No	No	Yes	No
Other I/O					
5 12-Bit Voltage Outputs	Yes	+ \$187 ⁽⁸⁾	+ \$937 ⁽⁹⁾	+ \$937 ⁽⁹⁾	+ \$2500 ⁽¹⁰⁾
16 Digital Inputs	Yes	Yes	+ \$175 ⁽¹¹⁾	+ \$330	+ \$530
16 Digital Outputs	Yes	Yes	+ \$175 ⁽¹¹⁾	+ \$350	+ \$710
4 120V AC Outputs	Yes	No	No	+ \$638 ⁽¹²⁾	+ \$265 ⁽¹³⁾
System Features					
Programmable Timers	Yes	Yes	Yes	Yes	+ \$555
Realtime Clock	Yes	Yes	No	Yes	Yes
Power Supply	Yes	+ \$350	Yes	Yes	Yes
Software System					
Data Acquisition BASIC	Yes	Yes	Yes	Yes	No
Foreground/Background	Yes	No	Yes ⁽¹⁴⁾	Yes ⁽¹⁴⁾	No
Data Analysis	Yes	No	No	No	No
Realtime Graphing	Yes	Yes	Yes	Yes	No
Engineering Units	Yes	No	No	No	No
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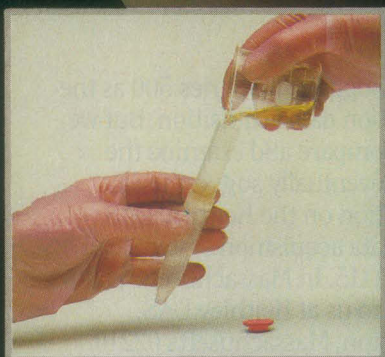
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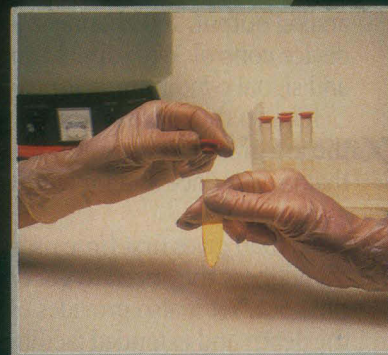
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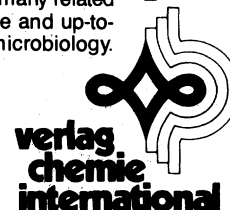
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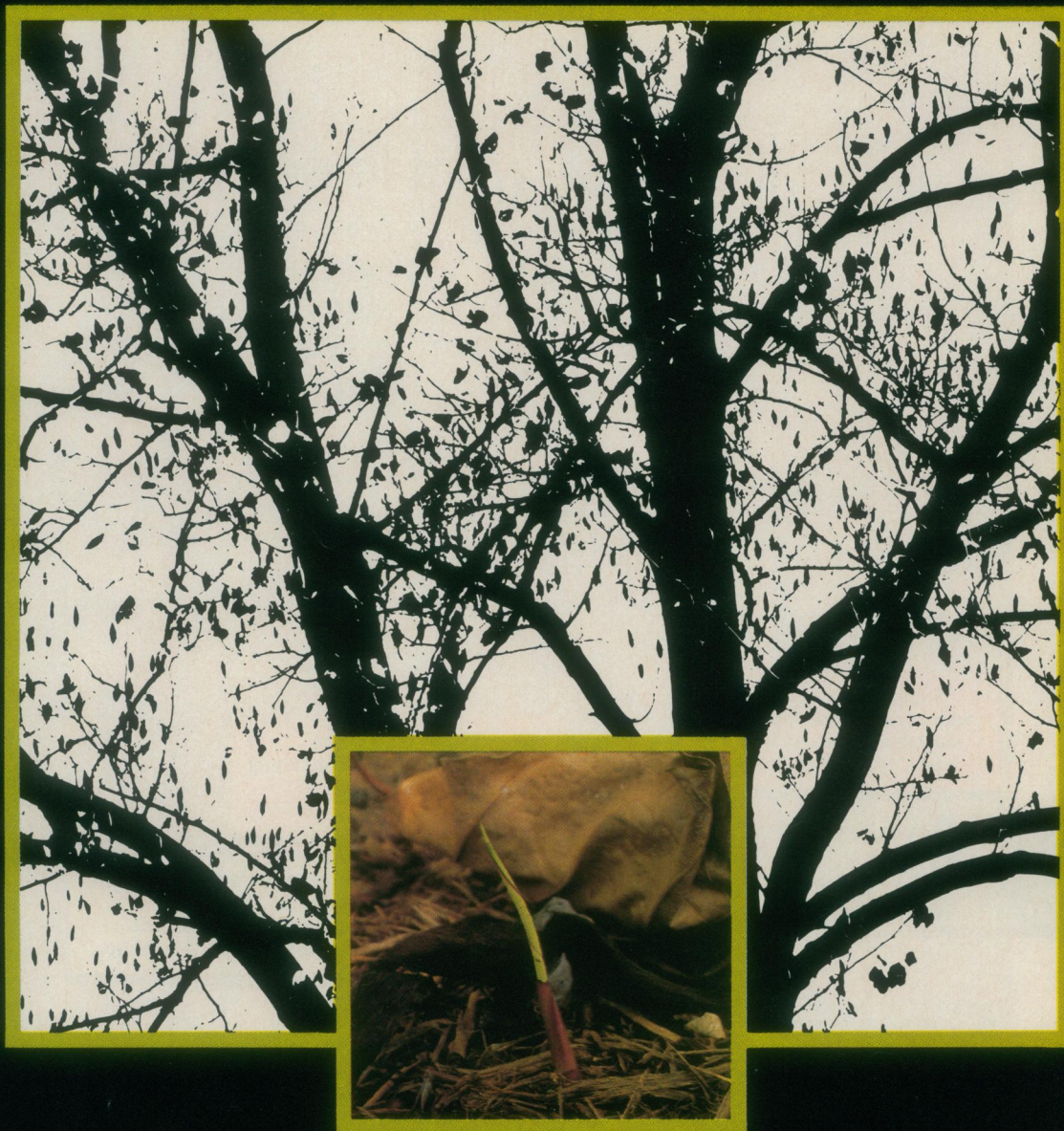
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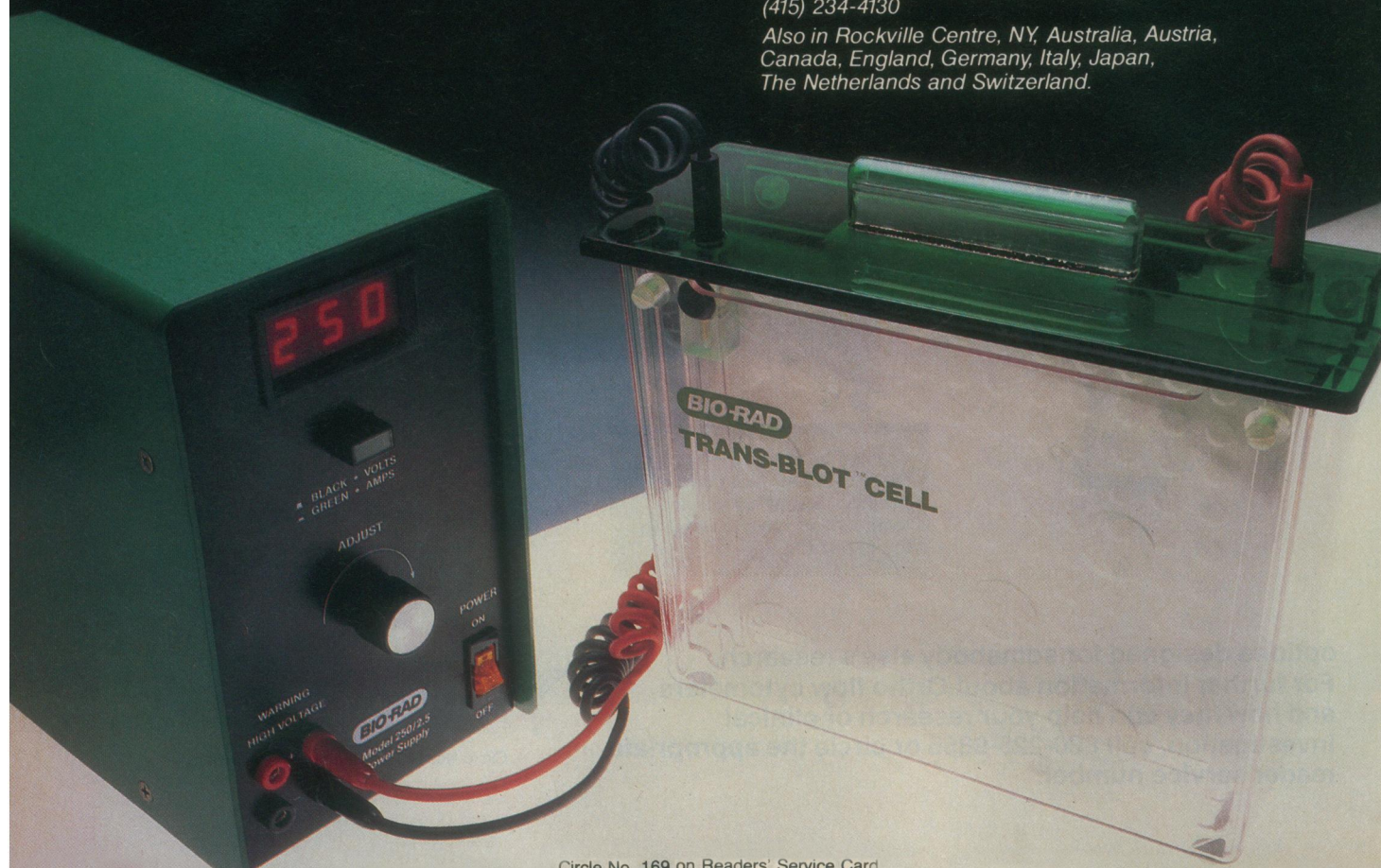
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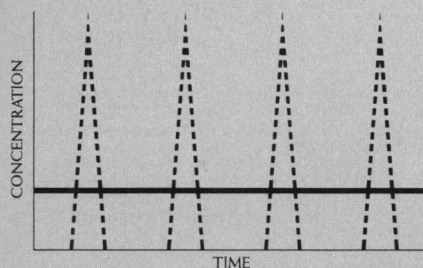


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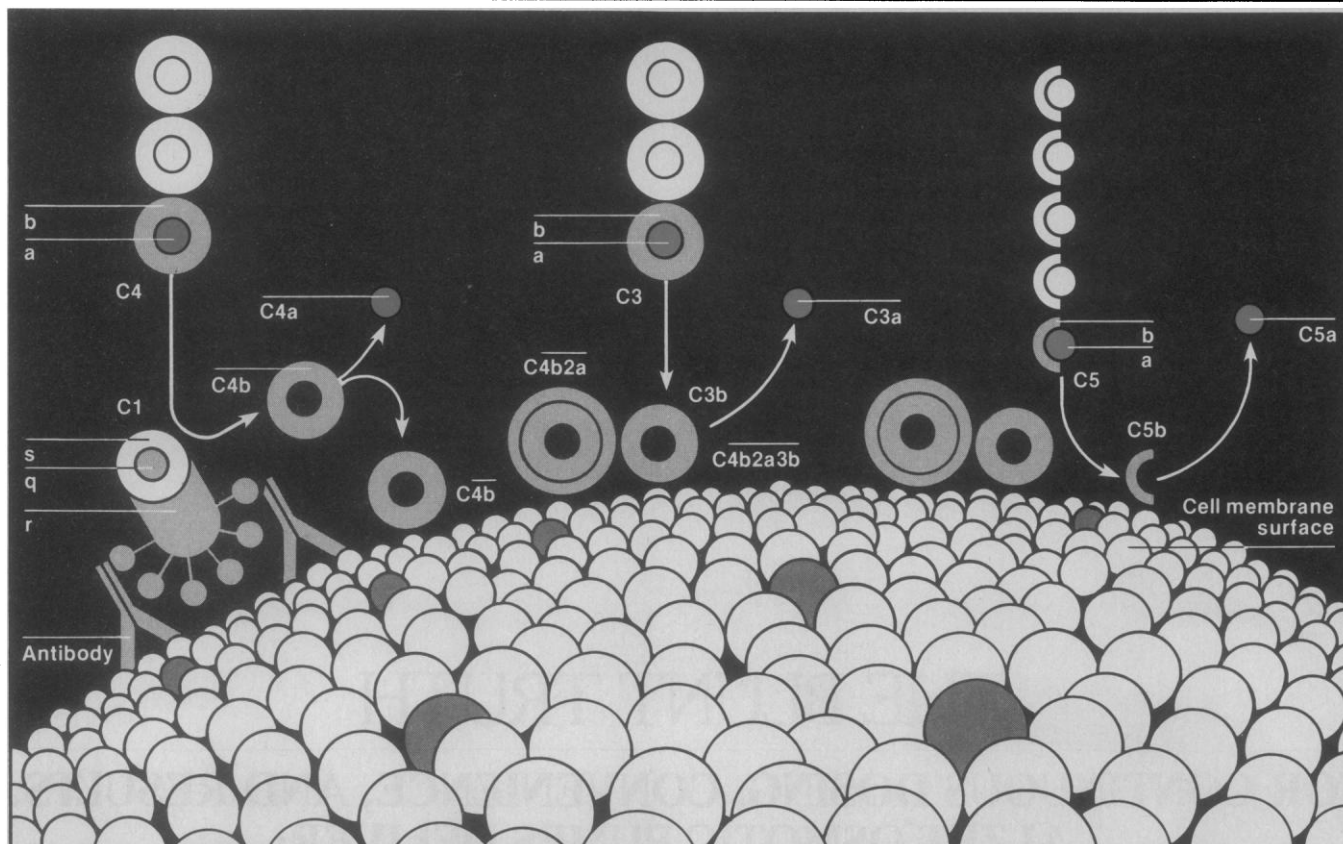


Illustration C3, C4, C5 activation in the classical complement cascade: Activated C1 (C1s), which binds to antigenic sites on the cell surface, cleaves C4 by limited proteolysis to yield C4a which is released to the fluid phase and C4b which binds to the surface of the cell. C4b2a cleaves C3 to yield C3a and C3b. The latter binds to the cell surface. Complexes of C4b2a and C3b form a C5 convertase (C4b2a3b) that cleaves C5 to yield C5a, and C5b which binds to the cell surface.

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- (1) Hugli, T. E., and Chenoweth, D. E., "Biologically Active Peptides of Complement: Techniques and Significance of C3a and C5a Measurement," *Laboratory and Research Methods in Biology and Medicine*, (ed. R. M. Nakamura, W. R. Dita, E. S. Tucker III; Alan R. Liss, Inc., 1980), pp. 443-460.
- (2) Gorski, J. P., "Quantitation of Human Complement Fragment C4a in Physiological Fluids by Competitive Inhibition Radioimmunoassay," *J. Immunol. Methods*, (47, 1981), pp. 61-73.

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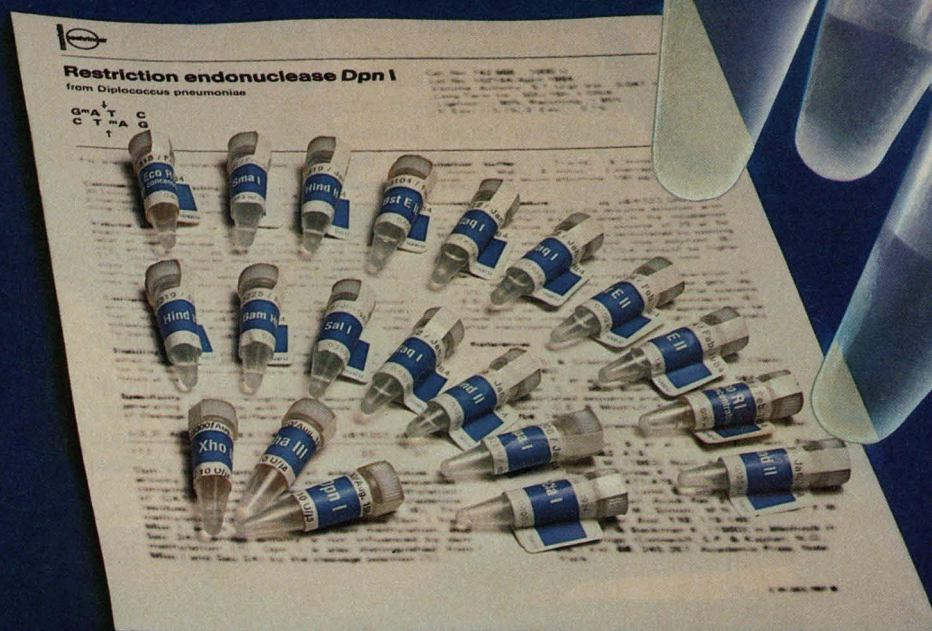
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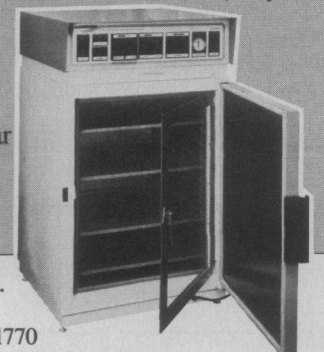
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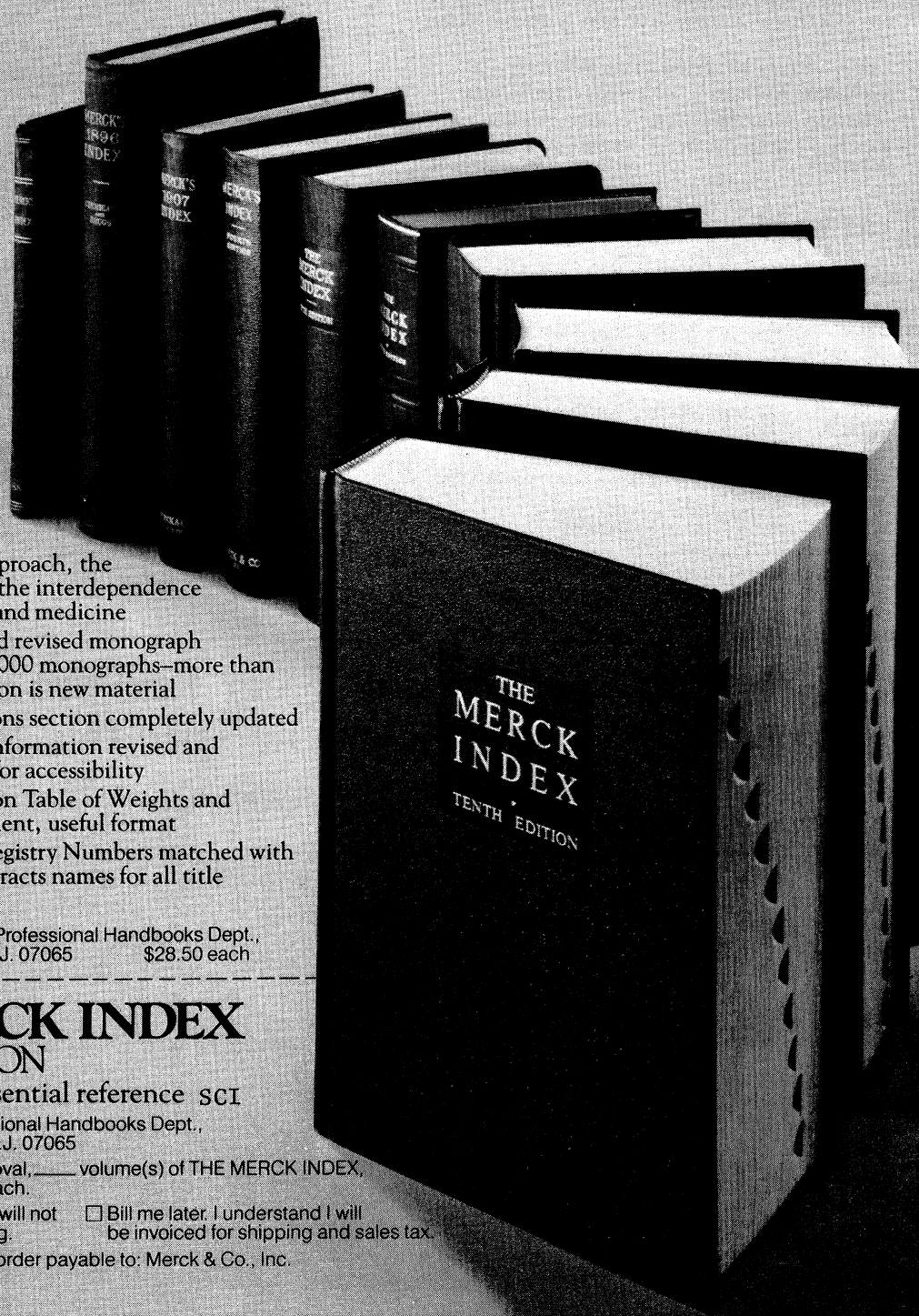
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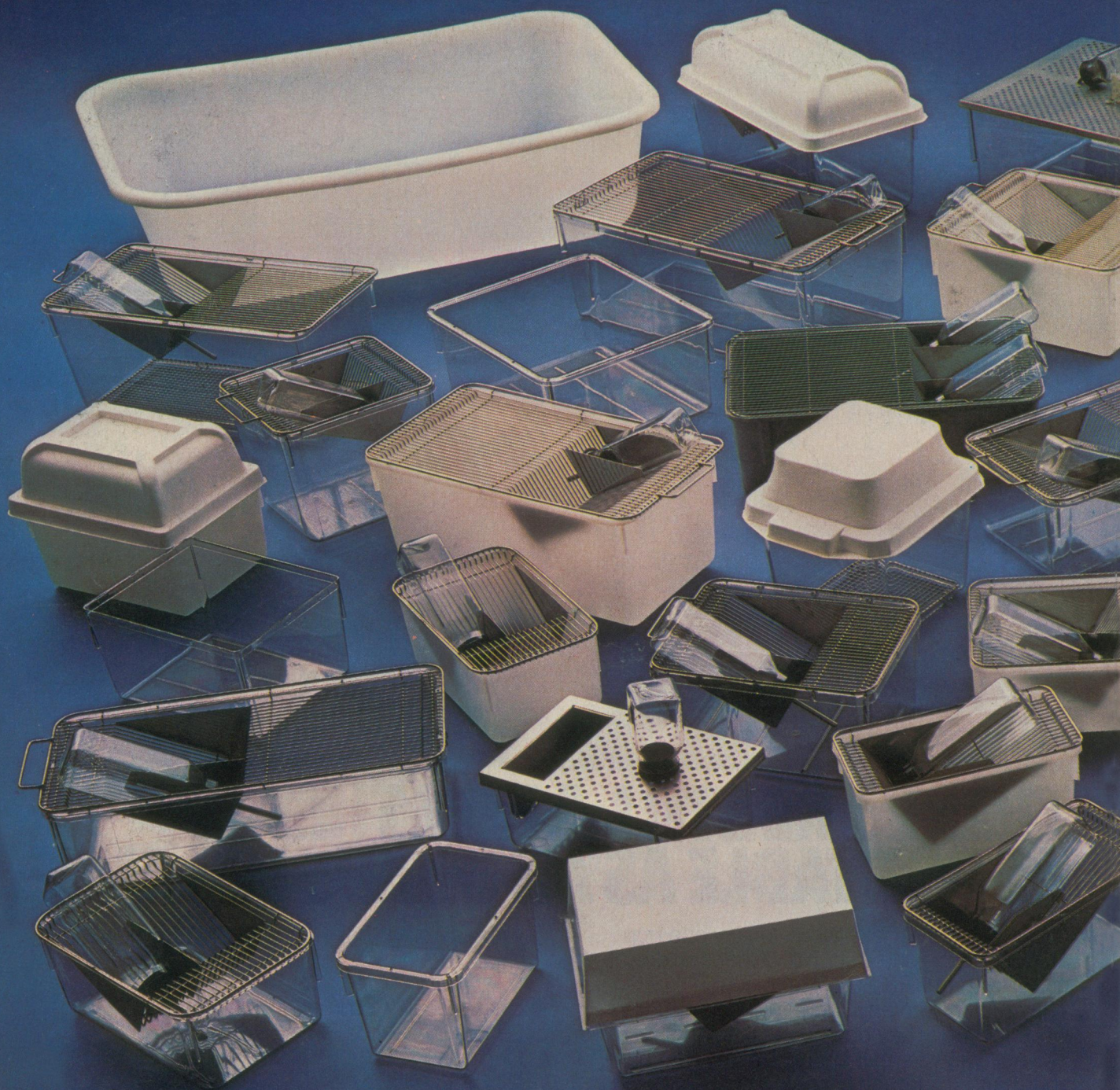


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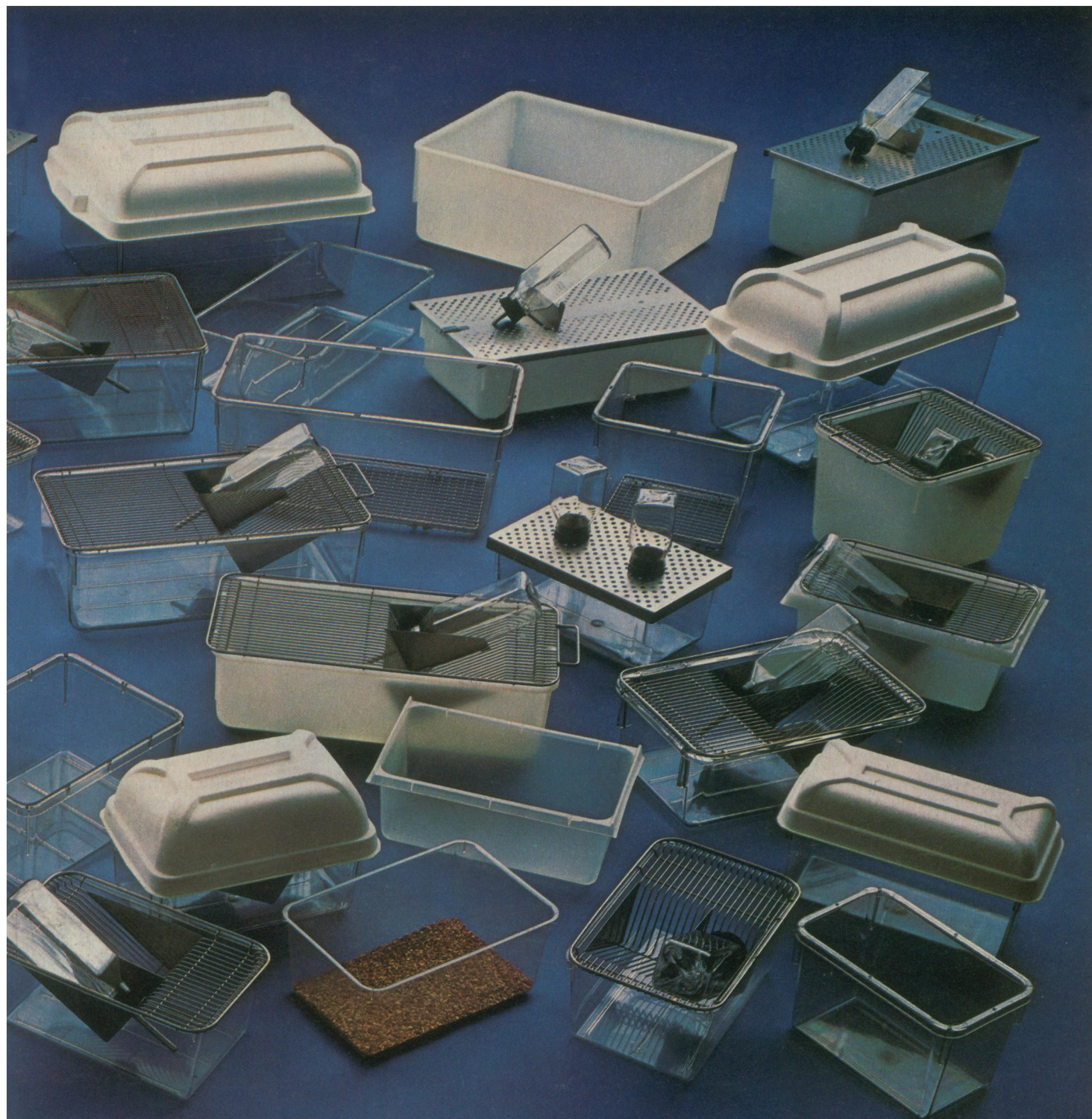
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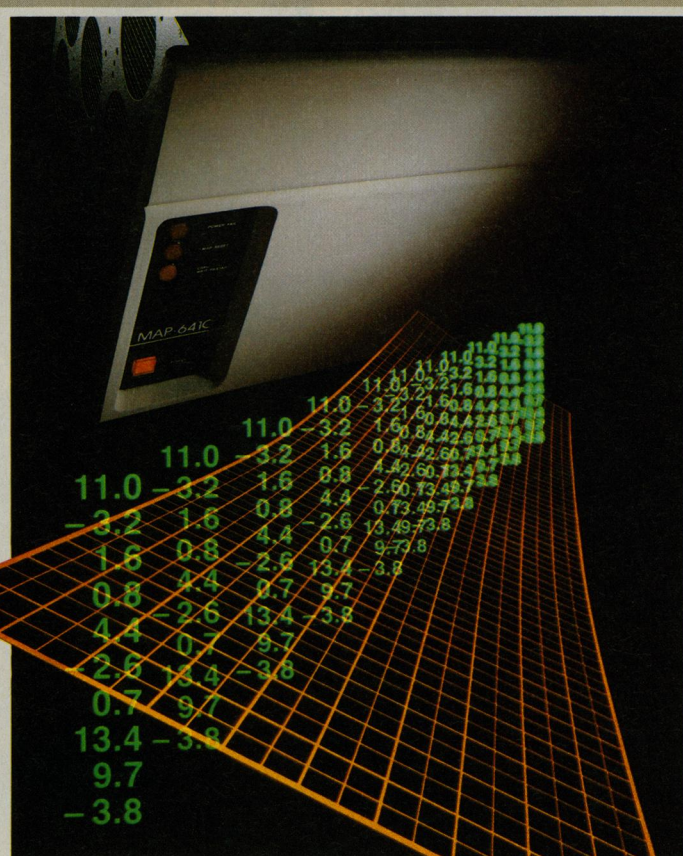
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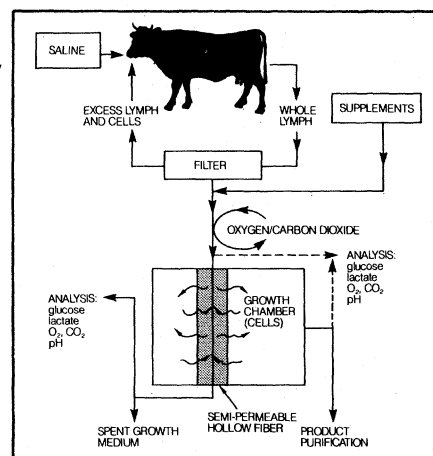
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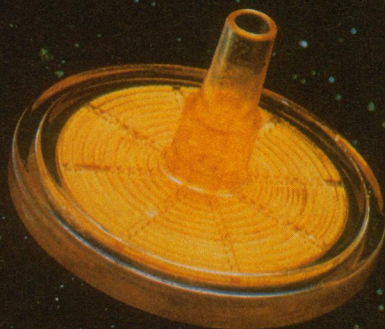
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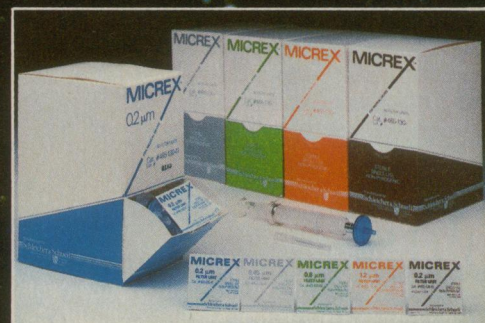
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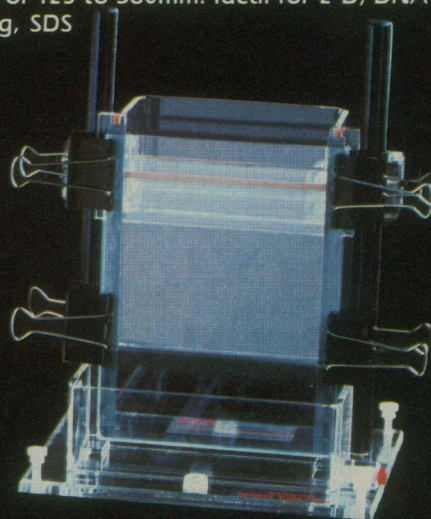
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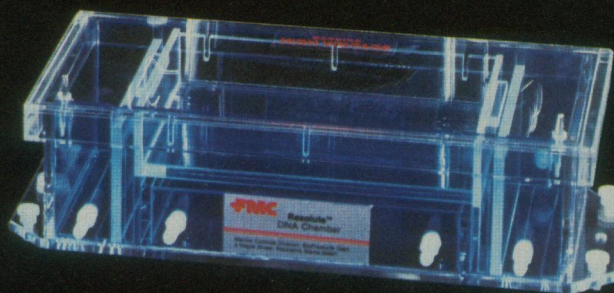
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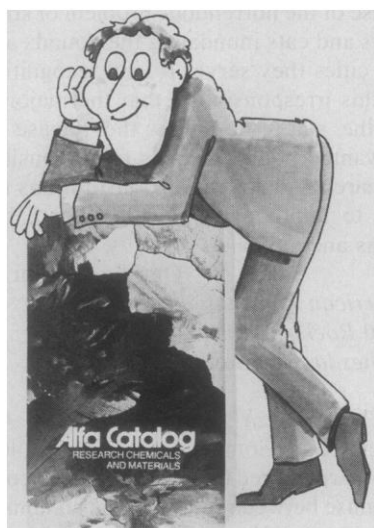
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expedite a resolution of this problem. We have received no answer to my wife's application or to my letter. Two years ago international support helped us in our struggle for the emigration of our son's fiancée who had become a hostage for my public activity. Now I am asking your support in the even more difficult and tragic struggle to permit my wife to travel abroad, a struggle that is vitally important on both the personal and public planes. I earnestly ask those who are concerned with my fate, who want to help me, to concentrate all their attention on this problem. I ask the heads of foreign delegations, I ask all participants in the Conference to support my appeal to Andropov through official, diplomatic channels as well as through private conversations which the Conference may make possible.

It is particularly important that Sakharov's scientific colleagues worldwide respond to his desperate plea for help. We urge them to write to the Soviet authorities, as well as to Soviet colleagues whom they know personally or by reputation, to appeal for intervention on behalf of the Sakharovs.

PAUL J. FLORY
MORRIS PRIPSTEIN

*Scientists for Sakharov, Orlov and
Shcharansky, Post Office Box 6123,
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Probing Titan's Surface

Recent reports (1) concerning the state of the surface of Titan indicate the need for new experiments and also provide an interesting example of the continual interplay between theoretical and experimental research. Theoretical considerations had led to suggestions that methane oceans cover Saturn's giant moon. In the Voyager project, detailed analysis of the radio measurements of the atmospheric temperature structure showed no effects of condensation, indicating that ubiquitous methane oceans could be ruled out. Theoretical arguments have now been presented favoring oceans, not of methane, but of ethane. Because of ethane's lower vapor pressure, such oceans would not have been detected by Voyager. Thus the stage is set for further experiments.

Radar would be an appropriate "next generation" remote probing tool. Radar signals would penetrate Titan's cloud cover, but would interact strongly with the surface, whether it were solid or liquid. Maps based on measurements of reflectivity, scattering from small-scale surface structure, topographic elevations, the unique signatures of ocean waves, and the electromagnetic polarizing properties of surface material could be obtained. In preliminary consider-

ations of new missions, plans have centered on a spacecraft monostatic radar system (where the radio transmitter and receiver are both on the spacecraft), such as the one carried to Venus by the Pioneer orbiter. Study by Earth-based monostatic radars may also become feasible if system improvements are made. There are other possibilities, however, based on transmissions from Earth with reception on the spacecraft (or vice-versa) in the so-called bistatic radar mode.

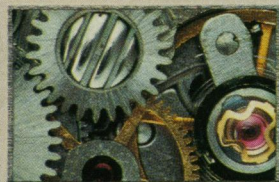
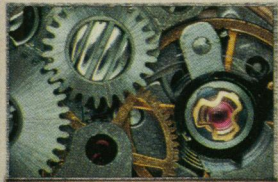
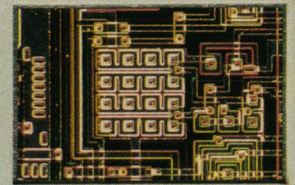
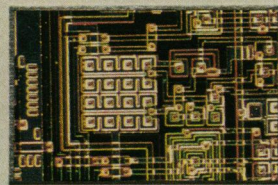
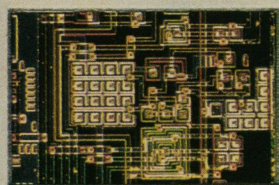
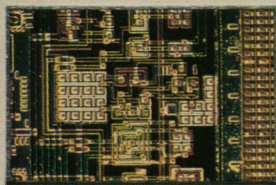
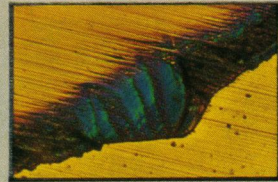
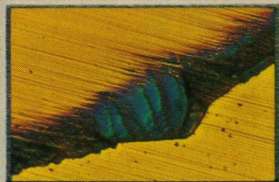
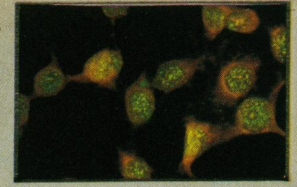
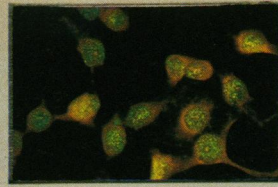
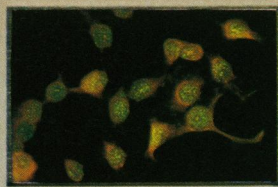
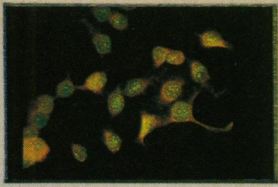
Such bistatic methods (which include the radio occultation technique used for the Titan atmospheric study in the Voyager project) have been in use for two decades. They have led to a number of discoveries and have provided fundamental information about planetary atmospheres, surfaces, and rings. A feature of essentially all these experiments that may not be generally appreciated is how little transmitter power has been used, at most a few tens of watts from spacecraft telecommunications transmitters (their maximum capability) to ground-based receivers, over distances of up to 1.5 billion kilometers. In principle, the experiments could have been based on the much greater capabilities of the existing ground-based transmitters that are located at the NASA/Jet Propulsion Laboratory deep space tracking stations. They have been commanding spacecraft for many years at power levels of up to several hundreds of thousands of watts. Most of this power increase could be realized for experimental improvements if dedicated spacecraft receiving systems were provided. This increase in sensitivity is just what would be needed for studies of the surface of Titan in the bistatic radar mode, with measurement abilities competitive with what might alternatively be done with a spacecraft monostatic system. A bistatic receiver on a Saturn orbiter that repeatedly encounters Titan could be used also for greatly improved occultation studies of the atmospheres of Titan and Saturn, and even of the densest parts of Saturn's rings.

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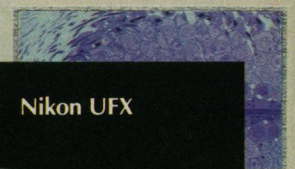
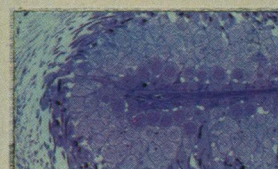
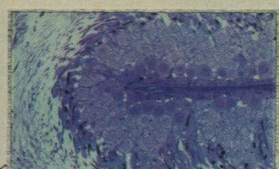
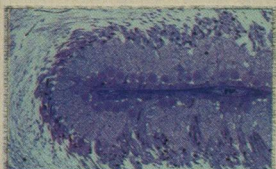
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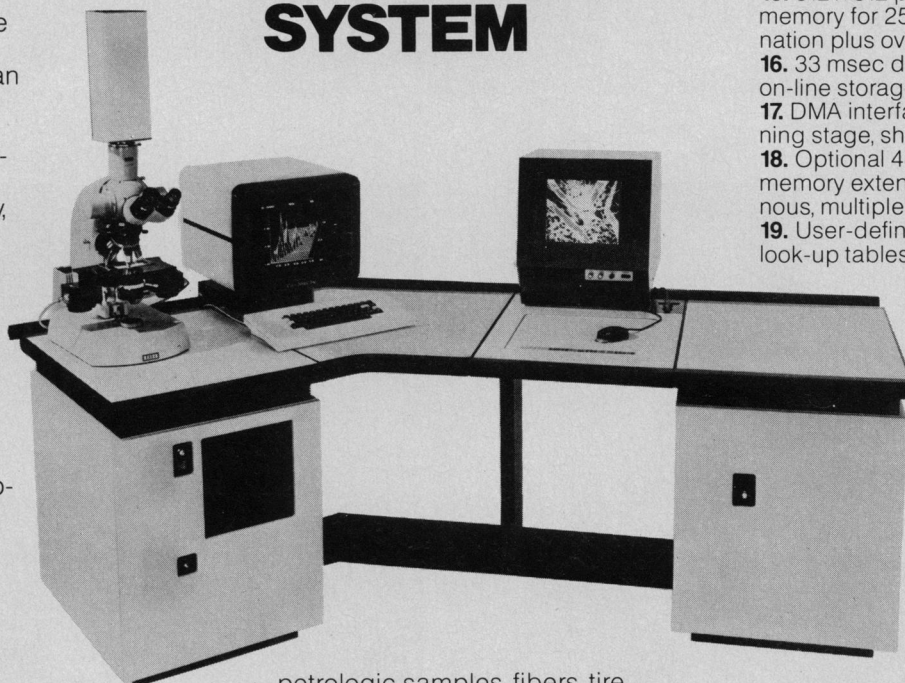
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Mutual Deterrence or Nuclear Suicide

The phrase "nuclear winter" has already become a part of our language, but the completely new strategic implications of the nuclear winter scenarios* have not yet received any great public attention or discussion. The prospect of a nuclear winter has been greeted as just one more chapter (a final chapter?) in the story of Armageddon that has been told to us so often in the past 40 years. We believe the story, but it no longer moves us. So what's new about nuclear winter?

What is new is that the nuclear winter scenario replaces the prospect of mutual destruction through the failure of mutual deterrence by the prospect of assured self-destruction through nuclear attack. If the analysis of the climatic effects of a nuclear strike is correct, then no nation can make a major nuclear attack even against an unarmed opponent without committing suicide—without itself receiving punishment as severe as that imposed on its intended victim. Nuclear weapons, by their guarantee of suicide, become their own deterrent.

The plausibility of the current doctrine, that mutual deterrence by arming to the teeth is a preventive for nuclear war, has been steadily eroding. As the payload of each power increases, so do the demands of its opponent for redundancy of its nuclear force, in order that ability to reply to an attack may be ensured. As warning times decrease to the vanishing point, not only does reprisal against the aggressor become less certain, but Strangelove mentalities become fascinated again with the possibilities of a "surgical" preemptive strike. And, of course, the opportunities for all kinds of unintended triggerings of nuclear exchanges multiply. Mutual deterrence is increasingly viewed as a bankrupt policy, which we cling to for lack of an alternative.

If nuclear weapons are suicidal, guaranteed to cripple or destroy the user even without a response from the targeted victim, then the futility of mutual deterrence is complete. A second strike is no more appetizing than a first, and a preemptive strike loses any gambling appeal that it might have had. Both powers have supplied themselves with mountains of suicidal weapons for which there is now no discernible use, either for deterrence or aggression.

But in these questions of human survival, we must not be precipitous. Neither the scientific basis for the nuclear winter nor its strategic implications have been examined in the depth that they require. It is too early to draw firm conclusions about what strategy should govern the deployment of a presumptively suicidal weapon. A plausible inference is that such a weapon is worse than none, either for attack or deterrence, and that the way is now open for nuclear disarmament, even unilateral partial disarmament. But that conclusion may be simplistic. It would be rash to proceed on it without a more thorough analysis of the nuclear winter than has yet been made and a careful study of alternative strategies.

The terms of the nuclear standoff have been changed—fundamentally changed. Awakened to that fact, we must proceed at once to an examination of the scientific reality of the nuclear winter and of the implications of this reality for our policies of arming for suicide and our fears that a suicidal weapon might be used by an aggressor against us.—HERBERT A. SIMON, *Carnegie-Mellon University, Pittsburgh 15213*

*R. P. Turco, O. B. Toon, T. P. Ackerman, J. B. Pollock, C. Sagan, *Science* 222, 1283 (1983); P. R. Ehrlich et al., *ibid.*, p. 1293.

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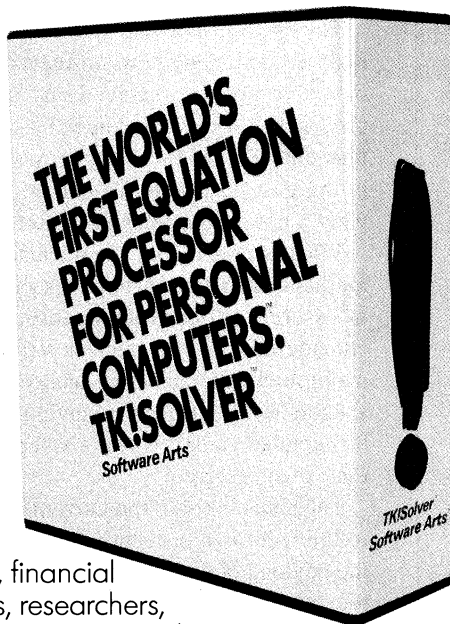
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