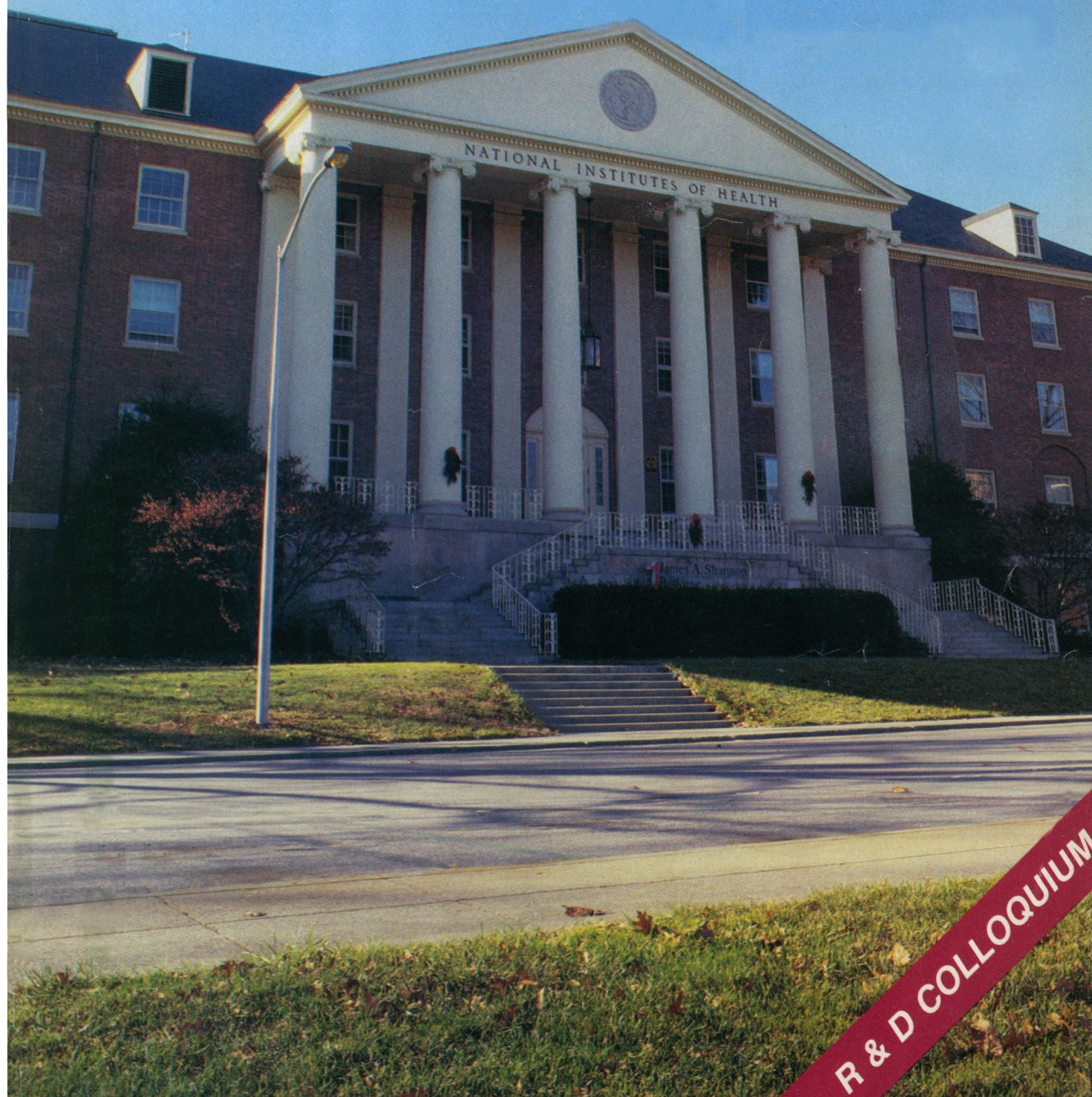


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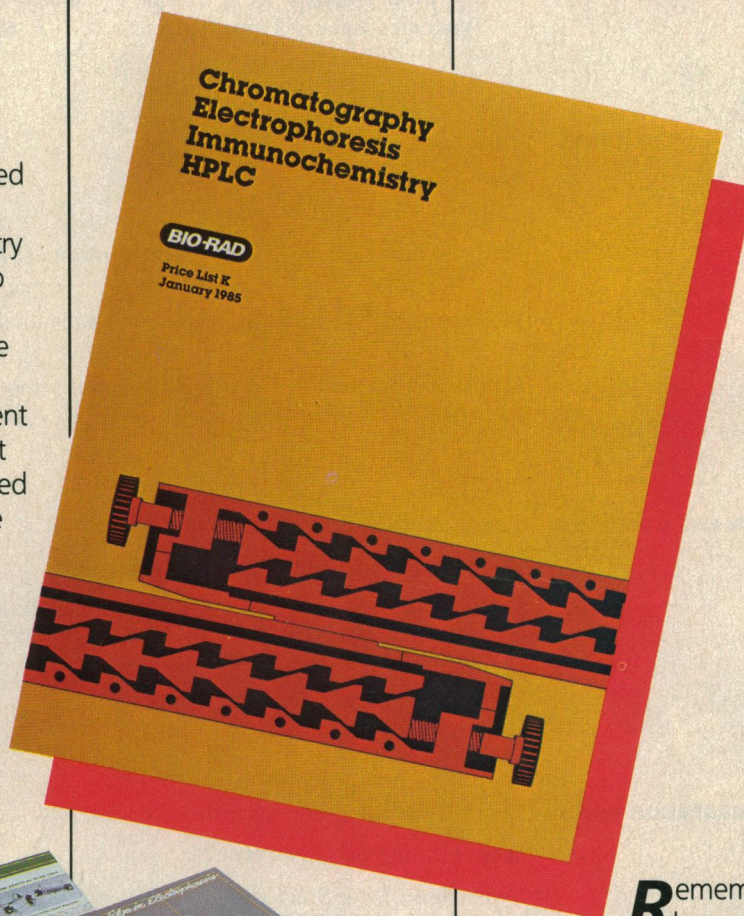


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## COVER

The National Institutes of Health (NIH) in Bethesda, Maryland, is the principal funding source for biomedical research in the United States. Congress appropriated a record \$5.5 billion in R&D funding for NIH in FY 1985, but under growing pressure to limit federal spending, the prospects for funding of biomedical research—and other areas of R&D—are uncertain. "R&D in FY 1986: The Outlook for the Next Four Years" is the theme of the Tenth Annual AAAS R&D Colloquium, 3 and 4 April 1985, Washington, D.C. See page 739. [Photo: Albert H. Teich, AAAS, Washington, D.C.]

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In effect, the MICRO-ISOLATOR System involves the use of durable filter-topped cages that function as "giant Petri dishes," which are only opened within a Class 100 workbench by personnel who observe aseptic technique at all times.\* There are many benefits to this unique miniaturization strategy. For example, animals from multiple sources with different microbiological profiles have been housed in the same room without cross contamination. Likewise, investigators can experimentally infect animals in different MICRO-ISOLATORS within the same room without interfering with one another's research ... and all of this can be accomplished without the inconvenience of requiring personnel to shower into or out of the room. Also, since

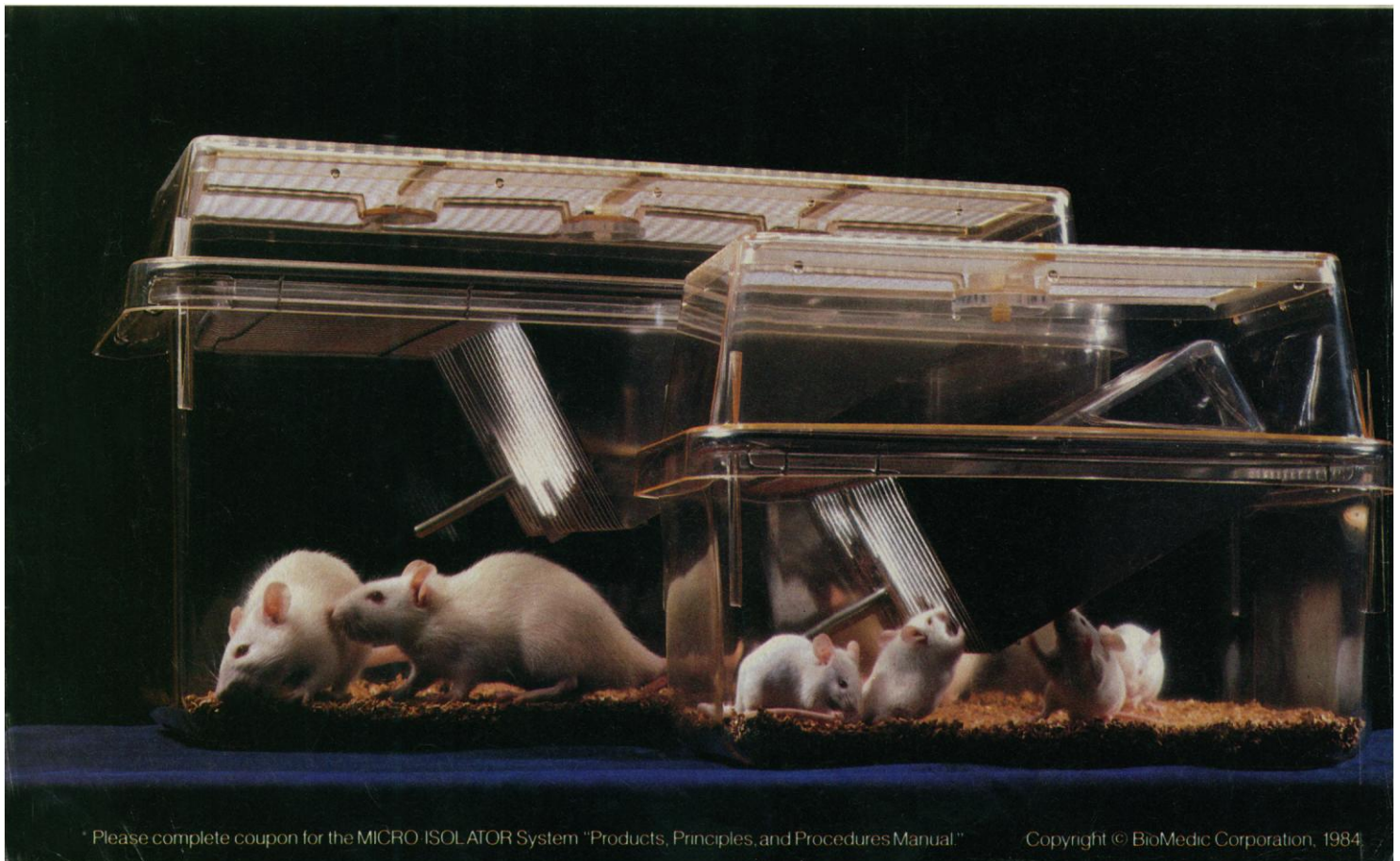
all manipulations are conducted in a Class 100 workbench, individuals allergic to animals are protected from dander and therefore are able to work in comfort.

The complete MICRO-ISOLATOR System consists of the individual MICRO-ISOLATOR housing units, the STAY-CLEAN™ Laminar Flow Workbench, and the service cart.

## **The MICRO-ISOLATOR Units**

This system consists of an autoclavable plastic cage and plastic filter frame with a static filter (now designed for rapid replacement of the filter material), plus the usual cage accessories. The plastic filter frame overlaps the bottom portion of the cage and effectively forms a giant Petri dish-like structure. Result: there is an effective protection against microbial contamination while still allowing for substantial gaseous interchange. The MICRO-ISOLATOR is, in other words, a protected microenvironment within any insect-controlled macroenvironment.

MICRO-ISOLATOR units, fabricated of autoclavable plastic material, are now available for mice, rats, hamsters, and guinea pigs.







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Patents applied for on the MICRO-ISOLATOR units and other elements of the complete system.

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### The Service Cart

The service cart completes the MICRO-ISOLATOR System by simplifying the movement of all necessary supplies to the laminar flow workbench for servicing the MICRO-ISOLATOR units.



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## SCIENCE/SCOPE

Communications satellites are helping Indonesia unite its 150 million inhabitants, according to a study conducted by the East-West Center in Honolulu. Indonesia's population, spread across a vast archipelago of over 13,600 islands, speaks more than 250 languages. Satellites have helped bridge the gap between the urban minority and the rural majority through improved telephone and television service. Since Indonesia inaugurated Asia's first and the world's third domestic communications satellite system in 1975, the number who can speak the national language, Bahasa Indonesia, has risen from 69% to 91%. Educational TV programs broadcast via satellite to rural areas have also prompted improved farming methods, including the use of new varieties of rice. Indonesia's Palapa satellite system was designed and built by Hughes Aircraft Company.

A klystron amplifier tube designed to operate 10 years—three times the current design life—is improving reliability and reducing life-cycle costs in Hughes' AML terrestrial microwave signal distribution systems. Key to its longevity is a coating layer of osmium ruthenium alloy for the tube's cathode, which allows the amplifying electrons to be emitted at lower temperatures. The resulting tenfold reduction in evaporation of barium from the cathode extends operating life. The technique, an outgrowth of work done for satellite communications amplifiers, is finding application with cable television companies.

An RF-excited waveguide carbon-dioxide laser has been introduced for use in medicine and industry. The compact 20-watt laser, designated the Series 3900, is the first RF-excited laser to be commercially available from Hughes. It features stable output and a clean mode for excellent control of the beam's cutting edge. "Hardseal" construction and advanced metal-ceramic processing techniques insure long life. The tube has a hardseal gas valve to permit factory refill. The laser is available in three configurations—air-cooled, water-cooled, and a bare tube that measures 1.75 inches in diameter, about the size of a conventional helium-neon laser.

In the last 20 years, over \$611 million in savings have been negotiated by Hughes and the Department of Defense as a result of engineering proposals for cutting costs of military systems. Since the inception of the Value Engineering program, Hughes has had 675 proposals accepted in 50 programs. The changes stemmed from advanced technology that was not available at the time the original contracts were signed. They resulted in substantial improvements in quality, reliability, producibility, and life-cycle costs. Savings amounted to 3% of Hughes sales during the period, with the U.S. government's share amounting to nearly \$500 million. The Value Engineering program is designed to encourage employees to look at the functions of a product and develop alternatives that cost less, perform better, and improve reliability.

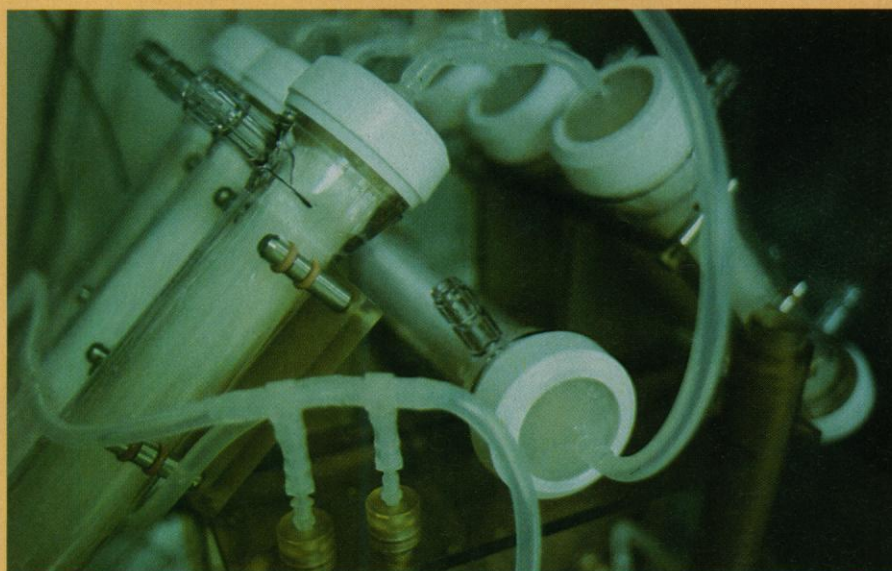
Hughes is seeking experienced engineers and scientists to further develop advanced spacecraft systems and components for communications satellites—successors to the 20 that will have been launched from the space shuttle by 1986. Openings are in the fields of: software, computers, and data processing systems; components and component survivability; microwave communications; space electronics; control electronics; spacecraft design and integration; engineering mechanics; propulsion and electrical power; guidance and control; spacecraft manufacturing; and systems test and development. Send your resume to Dan Frownfelter, Hughes Space & Communications Group, Dept. S2, S4/A300, P.O. Box 92919, Los Angeles, CA 90009. Equal opportunity employer. U.S. citizenship required.

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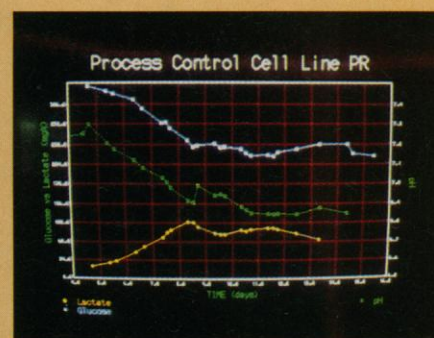
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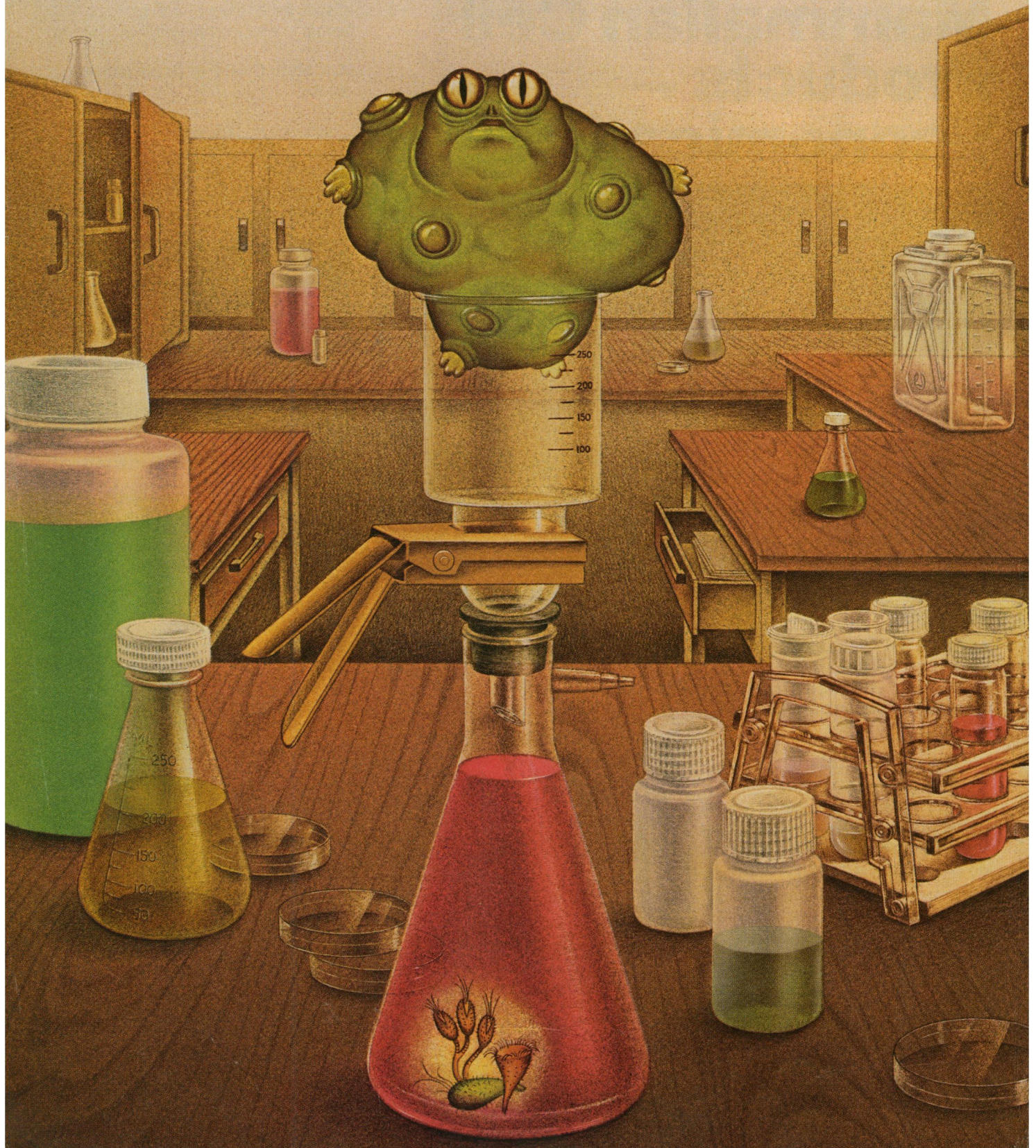
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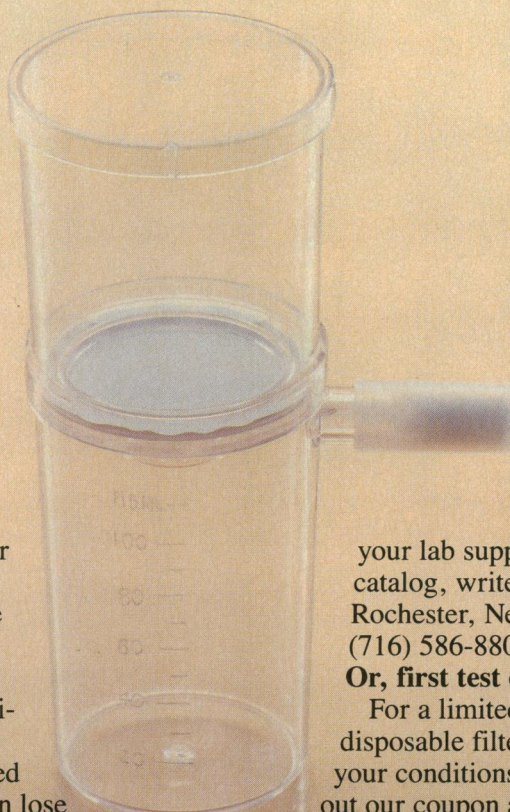


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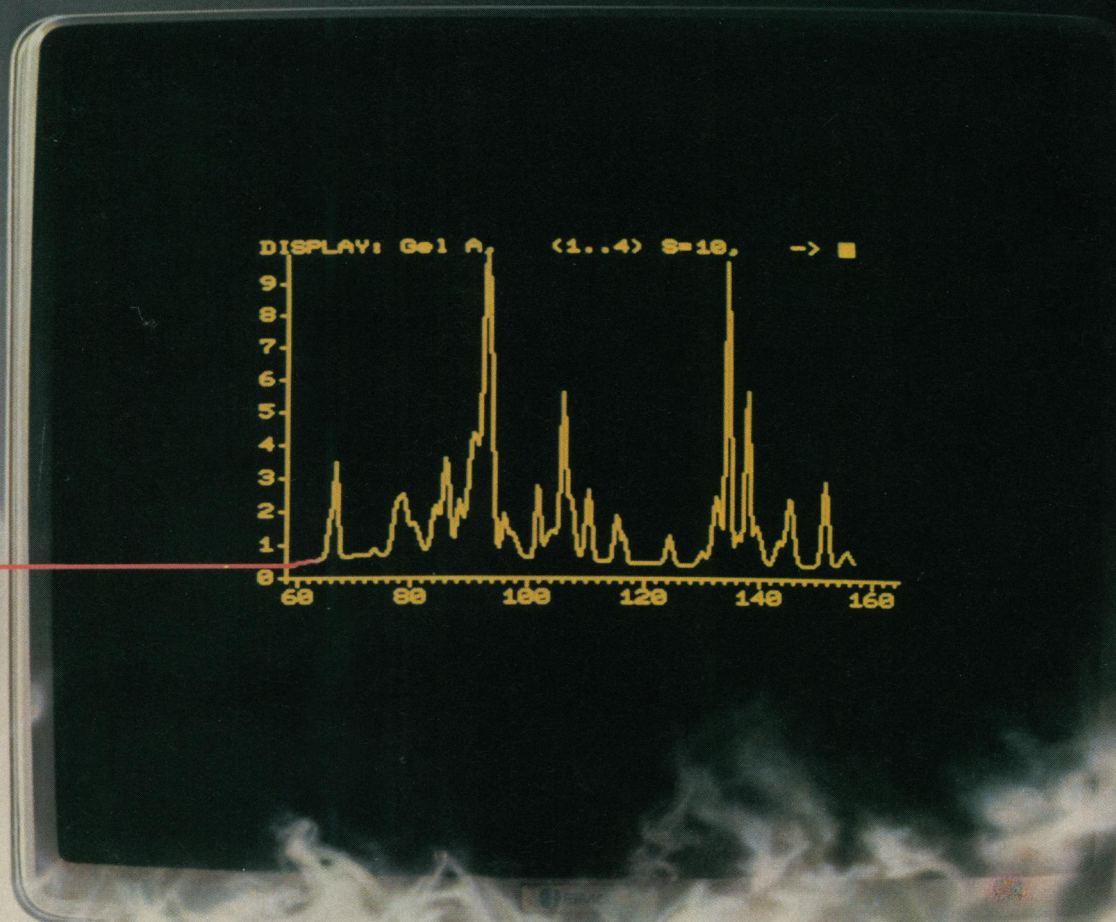
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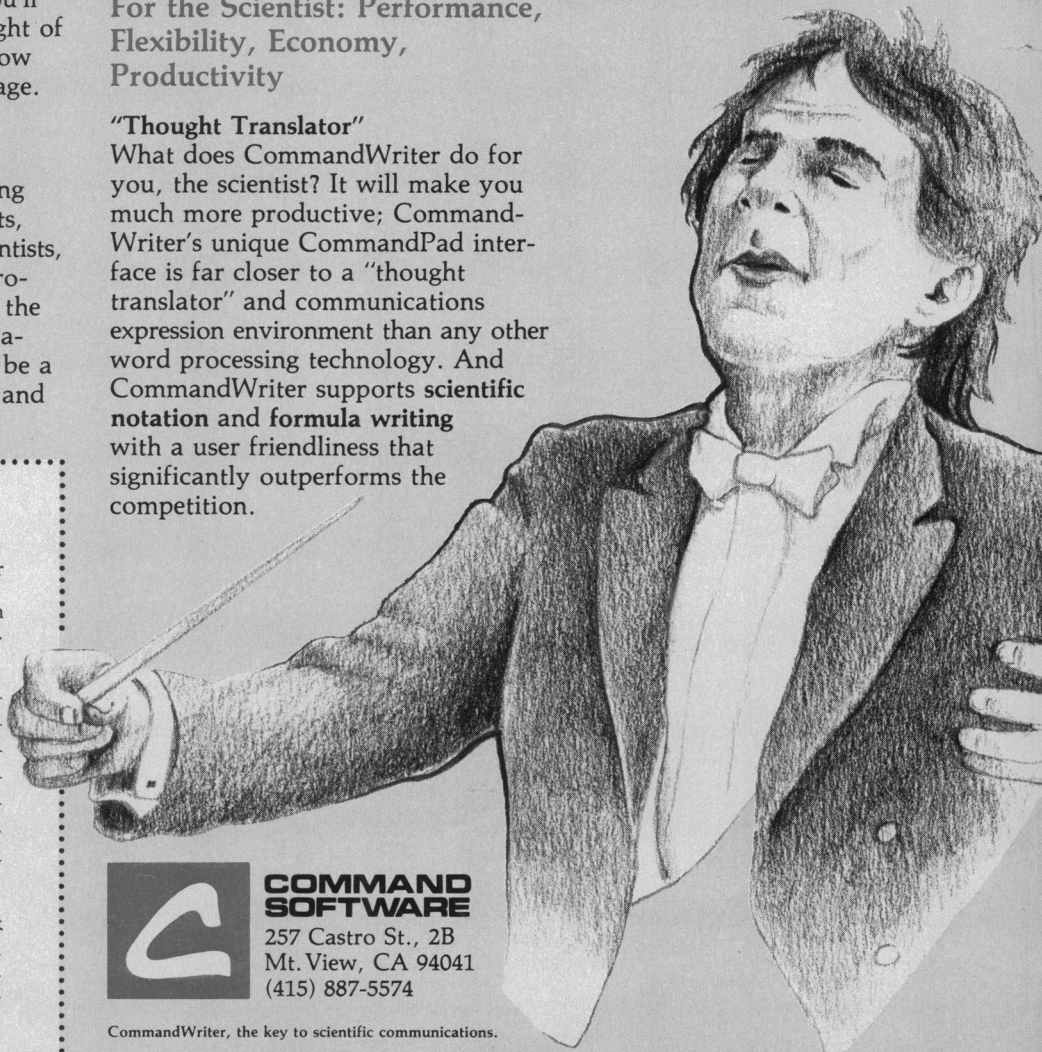
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## LETTERS

### Meteorological Satellites

The article "A silver lining for the weather satellites?" by M. Mitchell Wal-drop (News and Comment, 14 Dec., p. 1289) is timely in drawing attention to the problems besetting the operation and replacement of the weather satellites. Although the article correctly notes that the primary mission for both polar orbiters and the GOES geostationary satellites is in support of weather forecasting, it does not point out that such satellites are also vital in areas related to climate, where the loss of a satellite results in the irretrievable loss of data and a break in the climate record. Such losses can be devastating to climate studies and climate forecasts.

For weather forecasting purposes, the loss of GOES-5 on 30 July 1984 was mitigated by moving GOES-6 from its position over the Pacific Ocean to a location south of Texas. It seems that a replacement satellite is unlikely to go up before October 1985 at the earliest—a gap of more than a year. A similar previous loss of the GOES satellite over the Pacific occurred from 25 November 1982 to 28 April 1983, which happened to coincide with the largest El Niño event in this century (*Science*, 16 Dec. 1983, p. 1189). An El Niño signifies a substantial anomalous warming of the sea surface in the tropical Pacific Ocean. It coincides with substantial perturbations in cloudiness and precipitation in the same area and is linked to major anomalies in the global atmospheric circulation. At the time of the 1982–1983 El Niño, devastating anomalies in weather and short-term climate occurred all over the globe—ranging from drought in Australia, India, Indonesia, and Africa to floods in Peru and Ecuador, coastal flooding in California and along the west coast of South America, displaced storm tracks across the United States, and unusual hurricane tracks (with Tahiti's worst modern hurricane and a rare November hurricane in Hawaii). The GOES satellite over the Pacific potentially provides unique data on cloudiness, precipitation, winds, and sea surface temperatures that signal the onset of such events. This information is vital for seasonal forecasting, but the data for that period are lost and irreplaceable.

A new international program called TOGA (Tropical Oceans Global Atmosphere) gets under way in January 1985 for a decade and has as its objectives to describe, understand, and predict the

time-dependent behavior of the tropical oceans and the global atmosphere, including such phenomena as El Niño events. A crucial and central role is to be played by data from meteorological satellites. Continuous satellite coverage is regarded as an extremely high priority by the meteorological and oceanographic scientific community.

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### Lead and IQ Scores: A Reanalysis

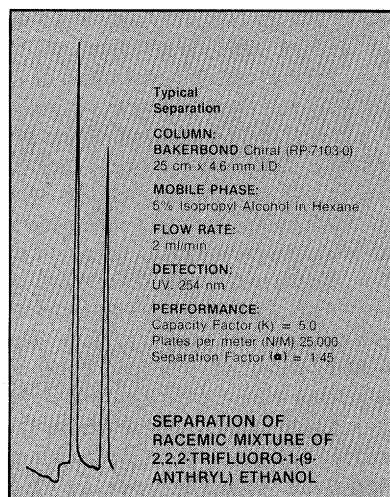
Although it is widely acknowledged that lead at high doses damages children's brains, the demonstration of neurotoxicity from lesser doses continues to be debated. In 1979, my colleagues and I evaluated neuropsychological performance in asymptomatic children whose past lead exposure had been measured and classified by the lead content of their teeth. Teeth were collected from each child, and dentine lead concentrations were measured for each subject. Those subjects whose dentine lead concentrations were not concordant by defined criteria were excluded from the analysis. Included subjects were classified dichotomously as those exposed to "high" lead concentrations (<20 parts per million) or "low" lead concentrations (<10 parts per million). After 39 socioeconomic covariates were controlled in the analysis, subjects exposed to high lead concentrations were found to have significantly lower Wechsler IQ scores than their low-exposure counterparts (1). When our study was reviewed by a panel of consultants to the Environmental Protection Agency, certain elements of the design were criticized, and the panel concluded that the study neither confirmed nor rejected the conclusion that lead was toxic at the doses observed (2). These criticisms were discussed in a News and Comment article by Eliot Marshall (25 Nov. 1983, p. 906).

The major criticisms of the panel report can be summarized as follows: (i) fathers' education should have been controlled instead of fathers' socioeconomic status (SES); (ii) raw IQ scores should have been entered into the analysis rather than age-adjusted scores, and age should then have been controlled as a separate covariate; (iii) the analysis of variance design we employed tended to maximize the difference between groups. The critics suggested using multiple re-





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Table 1. Analysis of covariance, dependent variable, verbal IQ. Covariates entered into the original model were parents' IQ, mother's age at subject's birth, mother's education, father's socioeconomic status, and number of live births.

Lead	Mean verbal IQ	F	P
	<i>Original model</i>		
High	99.20	4.58	0.03
Low	104.10		
	<i>Father's education substituted</i>		
High	99.30	4.13	0.04
Low	103.80		

gression analysis with backwards elimination to examine the data.

To respond to these criticisms, we first replaced fathers' SES by fathers' education and then repeated the analysis. This substitution had only minimal effect on the significance of the differences observed in the original model (Table 1).

Next, using multiple regression and entering dentine lead as a dummy variable, we compared results obtained by using raw IQ scores and entering age as a covariate with those obtained by using age-adjusted scores without age in the model. Entering age and raw IQ score reduced the coefficient for lead when verbal IQ was the outcome, but *P* values were not materially altered. In both cases *P* was <0.05 (Table 2).

We then calculated the mean dentine

lead concentration for each child from all specimens available and, using subjects' lead concentrations as a continuous variable, reanalyzed the data using a backward elimination multiple regression analysis. This brought back into the analysis those subjects previously dropped because of discordant lead concentrations and increased the sample size from 158 to 221. Mean dentine lead was entered with 10 nonlead covariates into the regression analysis. The criterion for excluding variables was set at *t* = 1.0. In the final model, the coefficient for lead was significant at *P* = 0.029 (Table 3). In the original publication, the significance of the observed difference in verbal IQ scores evaluated by analysis of covariance was 0.03.

We report here, for the sake of brevity, the effect of lead on one outcome, verbal intelligence. The reanalysis of performance IQ and of full-scale IQ showed effects similar to those shown in our original study. We conclude that the effects of lead on IQ are robust and are not biased by using SES instead of education as a covariate, or by using scaled IQ scores instead of raw scores. Nor were the results dependent on the form of the data analysis, whether analysis of covariance or multiple regression with ordinary least squares or backward elimination. The stability of the results, in the face of different covariate specifications and statistical procedures, is probably

Table 2. Multiple regression coefficients, dependent variable, and verbal IQ; *n* = 142.

Variable	Raw scores	<i>t</i>	Age adjusted scores	<i>t</i>
Age (months)	0.8581	7.25		
Parents' IQ	0.3422	4.41	0.3808	4.46
Mother's education	-1.2770	1.12	-1.5138	1.21
Father's SES	-0.2678	0.24	-0.0459	0.03
Mother's age at birth	-0.899	0.49	0.0114	0.05
Number of live births	-1.2161	1.85	-1.3589	1.91
Lead concentration	-4.0010	1.98*	-5.0452	2.31*
Constant	-48.5384		72.4527	
<i>F</i>	14.14		9.19	
<i>R</i> <sup>2</sup>	0.39		0.26	

\**P* < 0.025.

Table 3. Backward elimination multiple regression analysis, verbal IQ, and final model; *n* = 221.

Variable	<i>B</i>	<i>T</i>	<i>P</i>
Mean lead concentration	-0.1716	-2.202	0.029
Mother's education	0.14451	-2.815	0.006
Number of live births	-0.1314	-2.056	0.041
Parents' IQ	0.2551	4.226	0.000
Father's age	-0.4491	-1.975	0.050
Mother's age	0.6079	1.962	0.050
<i>R</i> <sup>2</sup> = 0.29			
<i>F</i> = 10.95			



# CHEMISTRY

Special Issue of *Science*, 22 February 1985

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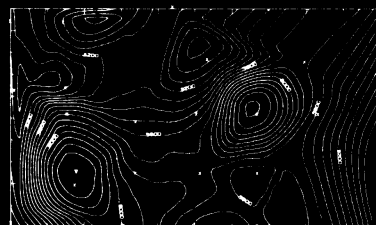
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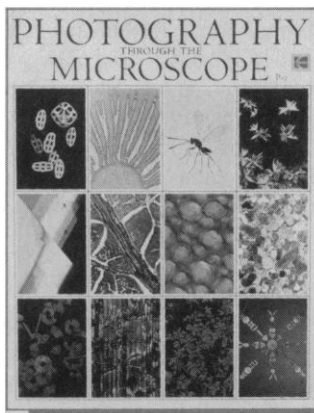
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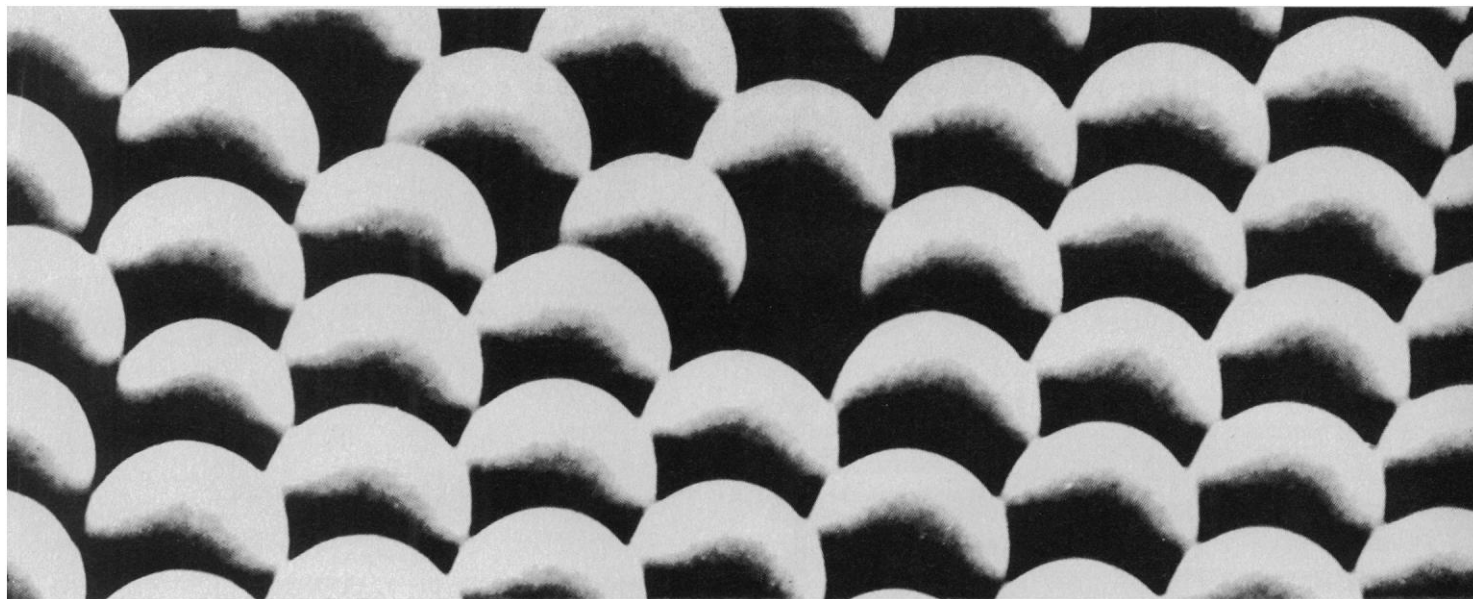
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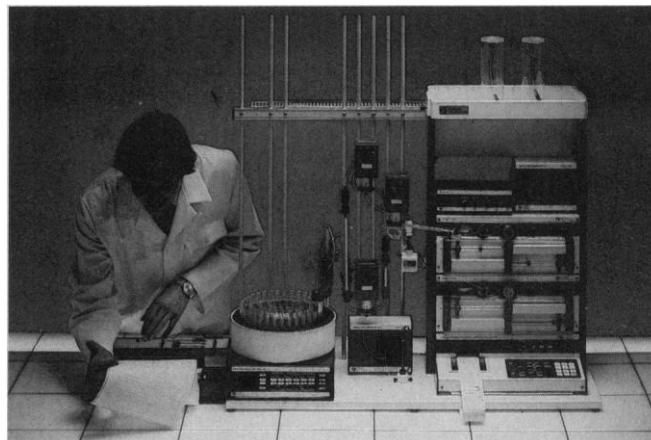
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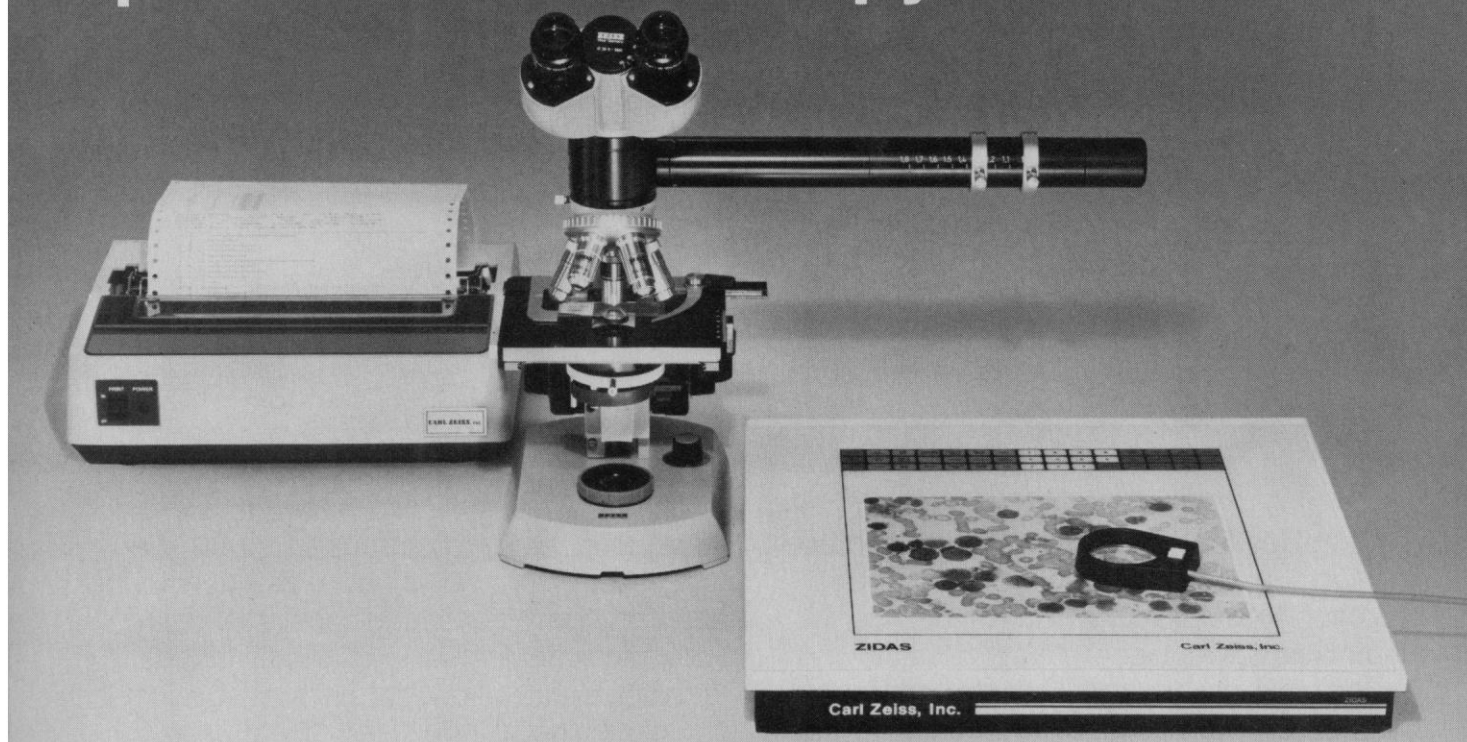
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## Preventing Famine

Every generation redefines what is intolerable in public health as science generates the knowledge needed for action. In this century the world has acquired the scientific basis and the technology to predict, mitigate, and eventually prevent famines. I am convinced, however, that little will happen without a concerted and continuing political effort on the part of the scientific and technological community.

The devastating famine that is striking African nations from Mauritania to Ethiopia is being treated as a sudden disaster. In fact, an early-warning system more comprehensive than the present Food and Agriculture Organization system could have been in place. It could have been connected with a mechanism that would trigger an immediate response to a developing crisis. This response should be based on meteorological data (collected daily by international airlines among others) coupled with satellite photography (which registers color changes in vegetation as droughts become more severe), economic data on prices and stores of basic foods in famine-prone regions, and health data on the rate of growth and appearance of poor children in vulnerable areas.

This information, transmitted to an international office under the FAO and the World Health Organization, could trigger the release of emergency reserves from storage in strategic locations in cold climates. Grain ships at sea could then be diverted to the threatened area so that the famine could be contained or even prevented.

In the long run, the African problem is solvable. Agricultural self-sufficiency is possible by the end of the century, but not without a major commitment by the African nations and the developed countries, the United States in particular.

Nutrition is one area where figures can be put on human needs. The techniques of the Green Revolution have enormously increased the potential to fulfill those needs. We know what should be done: improved road systems; better soil and water management; greater availability of nitrogen, potash, and phosphate fertilizers and of pesticides, insecticides, and rodenticides; a change from slash-and-burn agriculture to appropriate modern tillage methods; better herd health and genetic improvement of herds; more research in high-yielding crops suitable for African soils and climate (together with preservation of the germplasm of existing plants of economic importance); for farmers, primary education and agricultural extension; programs in rural health and birth control; a rural credit infrastructure; and development of agriculture-related industries like canning, repair of farming equipment, and fertilizers. Africa will also need steady, and for a time increasing, food aid, which must be very carefully managed so that it does not undermine local farmers' buying power.

This effort is far beyond the capacities of voluntary relief organizations and initially unsuited to private investment, at least in the first stages. It must be carried by governments in cooperation with foundations, universities, and international organizations experienced in such programs.

The burden must be shared by the world at large, but the United States has a particular role. We have the world's largest grain surpluses. We have the most efficient agriculture per farmer (although not the highest yield per acre). We developed agricultural research to its present effectiveness (although our research still concentrates too much on higher yields for U.S. crops already in surplus, rather than on tropical agriculture). We invented agricultural extension services, land-grant colleges, the rural banking system. And, if any science can be said to be peculiar to one nation, nutrition is surely the "American" science.

With greater knowledge comes greater responsibility. It is my hope that as scientists and technicians who have generated some of this knowledge we will make sure that it is used for peaceful development of the world, and I urge Congress to commit U.S. resources to that goal.—JEAN MAYER, President, Tufts University, Medford, Massachusetts 02155



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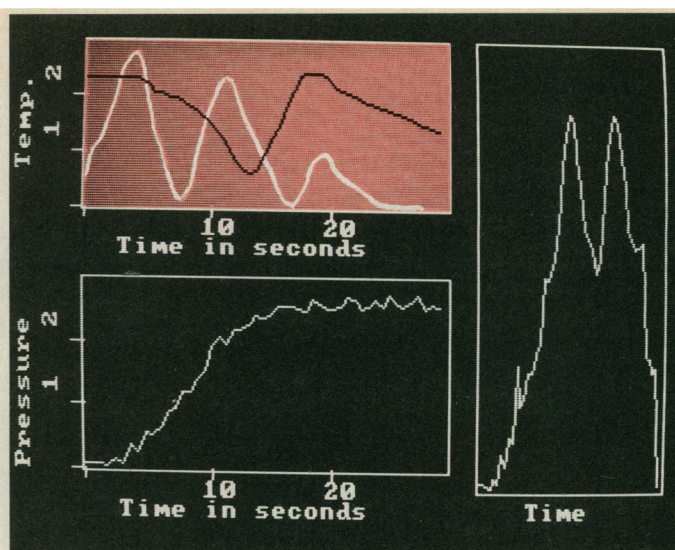
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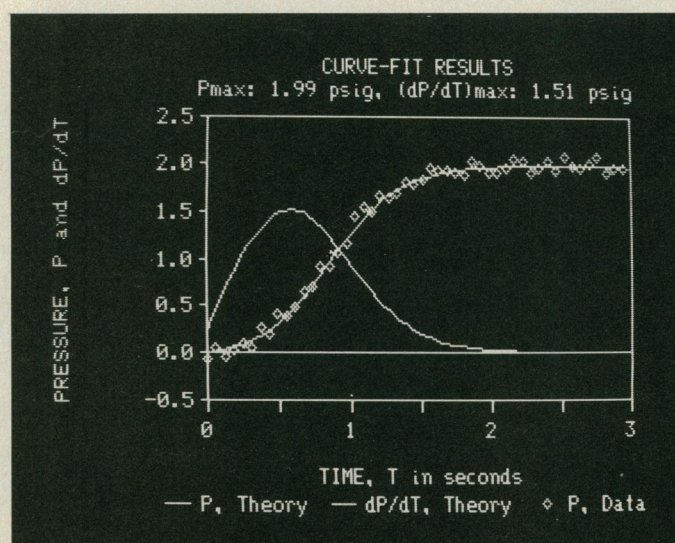


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Time Seconds	Pressure Atmospheres	Press. Derivative	Max P	Max dP
0.00000	-0.06132	-0.01040		
0.60000	0.06036	0.01011		
1.20000	-0.04797	-0.01439		
1.80000	0.02707	0.00912		
2.40000	0.10291	0.03007		
3.00000	0.05049	0.01735	Max P 2.09737	
3.60000	0.27654	0.06339	Max dP 1.56732	
4.20000	0.19450	0.00447		
4.80000	0.42390	0.10621		
5.40000	0.30765	0.12955		
6.00000	0.40747	0.16051		
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**10th AAAS R&D Colloquium  
Washington, D.C.  
3 & 4 April 1985**

**Advance  
Registration  
Form { \$2 }**

**Wednesday & Thursday, 3 & 4 April, The Capital Hilton, 16th & K Streets, 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:**

- ☐ \$150 Full Registration (sessions, three meals, three publications)  
☐ \$110 Partial Registration (sessions, three publications)  
☐ \$ 50 Student Registration (sessions, three publications; full-time graduate and undergraduate students only)

Separate Meal Tickets: ☐ Lunch, Wed. (\$20) ☐ Contl. Breakfast, Thu. (\$7) ☐ Lunch, Thu. (\$20)

Packets will be mailed to preregistrants on 18 March; registrations received after 18 March will be held at the AAAS Registration Desk in The Capital Hilton. **Refund policy:** Advance registration fees and meal tickets will be refunded for cancellations received by 1 April; no refunds will be made on cancellations received after this date.

All registrants will receive *AAAS Report X: Research and Development, FY 1986* before or at the Colloquium, published *Proceedings* following the meeting, and a supplementary report, *Congressional Action on R&D in the FY 1986 Budget*, in the fall.

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(Reservations received after 10 March cannot be guaranteed)

**Names and Address of All Occupants of Room:**

Name: \_\_\_\_\_ Name: \_\_\_\_\_

Address \_\_\_\_\_ Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

**Room:** \_\_\_\_\_ Single (\$105\*) \_\_\_\_\_ Double (\$115\*) \_\_\_\_\_ Twin (\$115\*)

**Arrival:** Date \_\_\_\_\_ Time \_\_\_\_\_

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