

15 August 1980 • Vol. 209 • No. 4458

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SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



"The TJ-6 is an excellent product. We're delighted we have one." "It's a very quiet-running centrifuge. Nothing ever seems to go wrong with it." "You folks have the TJ-6. We're very happy to have the colorful tube adapters. They're easy to change from previous types." "It's a remarkably quiet-running centrifuge. I can recommend a TJ-6 to any lab." "The lift-out bowl alone makes the TJ-6 an excellent product." "We have one." "It's a very quiet-running centrifuge. Nothing ever seems to go wrong with it." "You folks have the TJ-6. We're very happy to have the colorful tube adapters. They're easy to change from previous types."



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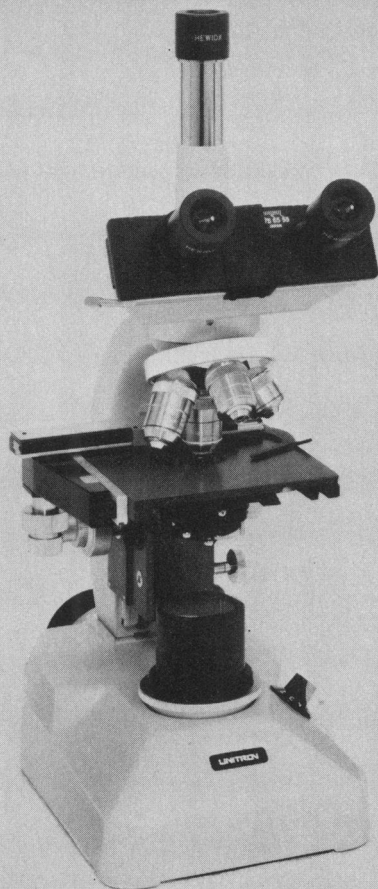


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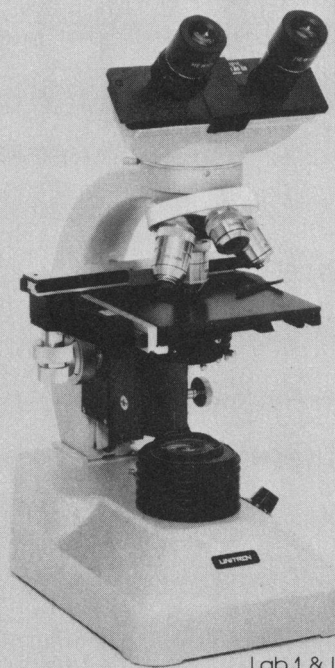
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LETTERS	Love Canal Chromosome Study: <i>M. W. Shaw; S. J. Gage; D. Picciano</i>	751
EDITORIAL	<i>The Global 2000 Report</i>	761
ARTICLES	Detecting Climate Change due to Increasing Carbon Dioxide: <i>R. A. Madden and V. Ramanathan</i>	763
	Teratocarcinomas and Mammalian Embryogenesis: <i>G. R. Martin</i>	768
	Geomorphic Reconstructions in the Environs of Ancient Troy: <i>J. C. Kraft, I. Kayan, O. Erol</i>	776
NEWS AND COMMENT	Looking Out for Science Policy	783
	Energy Standards for Buildings Face Delay	784
	House Reopens Nerve Gas Issue	786
	Ma Bell Losing Grip on Old Markets	787
	No Veto for States on Radwaste Sites.	788
	<i>Briefing: AMA's New Ethics Code Is Major Break from Past; House Votes Metric Board An Extension After Debate; Science Teachers to Ban Testing Harmful to Animals</i>	790
RESEARCH NEWS	Dilemma in Cancer Treatment	792
	Tapping Sun-Warmed Ocean Water for Power	794
	Irrigation Threatens Egyptian Temples	796
BOOK REVIEWS	A Cold Look at Warm-Blooded Dinosaurs, <i>reviewed by B. K. McNab</i> ; The Origin of the Gulf of Mexico and the Early Opening of the Central North Atlantic Ocean, <i>E. Uchupi</i> ; Human Genetics, <i>E. A. Murphy</i> ; The Ecological Approach to Visual Perception, <i>R. N. Haber</i> ; Books Received.	797
REPORTS	Sediment Trap Experiment on the Galápagos Spreading Center, Equatorial Pacific: <i>R. Cobler and J. Dymond</i>	801
	Stable Isotopes in Benthic Foraminifera: Seasonal Variation in Large Tropical Species: <i>G. Wefer and W. H. Berger</i>	803

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The Meteorite-Asteroid Connection: The Infrared Spectra of Eucrites, Shergottites, and Vesta: <i>M. A. Feierberg and M. J. Drake</i>	805
Human Taste: Response and Taste Bud Number in Fungiform Papillae: <i>K. Arvidson and U. Friberg</i>	807
Trophic Interactions Between Astroglial Cells and Hippocampal Neurons in Culture: <i>G. A. Banker</i>	809
Thyroid Hormone Receptor-Containing Fragment Released from Chromatin by Deoxyribonuclease I and Micrococcal Nuclease: <i>D. B. Jump and J. H. Oppenheimer</i>	811
Evidence for L-Glutamate as the Neurotransmitter of Baroreceptor Afferent Nerve Fibers: <i>W. T. Talman, M. H. Perrone, D. J. Reis</i>	813
Histamine-Mediated Delayed Permeability Response After Scald Burn Inhibited by Cimetidine or Cold-Water Treatment: <i>J. V. Boykin Jr., et al.</i>	815
Liver Tumors Induced in Rats by Oral Administration of the Antihistaminic Methapyrilene Hydrochloride: <i>W. Lijinsky, M. D. Reuber, B.-N. Blackwell</i>	817
Induction of Follicle Separation in the Mosquito by Physiological Amounts of Ecdysterone: <i>E. F. Beckemeyer and A. O. Lea</i>	819
Puberty Delay by a Urinary Cue from Female House Mice in Feral Populations: <i>A. Massey and J. G. Vandenberg</i>	821
Vitamin D Deficiency Inhibits Pancreatic Secretion of Insulin: <i>A. W. Norman et al.</i>	823
Factors Influencing the Inhibitory Effect of Selenium on Mice Inoculated with Ehrlich Ascites Tumor Cells: <i>G. A. Greeder and J. A. Milner</i>	825
Dexamethasone Fails to Suppress β -Endorphin Plasma Concentrations in Humans and Rhesus Monkeys: <i>N. H. Kalin et al.</i>	827
Phase-Sensitive Midbrain Neurons in <i>Eigenmannia</i> : Neural Correlates of the Jamming Avoidance Response: <i>J. Bastian and W. Heiligenberg</i>	828
Recall (Versus Recognition) of Taste and Immunization Against Aversive Taste Anticipations Based on Illness: <i>J.-S. Chen and A. Amsel</i>	831
<i>Technical Comments: Asymmetry in Facial Expression: P. Ekman; C. A. Nelson and F. D. Horowitz; S. I. Spinrad; H. A. Sackeim and R. C. Gur; Neurobiology of Amnesia: L. R. Squire, H. P. Davis, C. W. Spanis; P. E. Gold and D. B. Sternberg</i>	833

PRODUCTS AND MATERIALS

Powder Diffraction File; Trace Metals Analyzer; Plates for Ion-Exchange TLC; X-ray Spectrometer; Printing Counter; Monoclonal Antibodies to Detect Human Antigens; Transfer Pipettor; Literature	838
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COVER

The Dardanelles and Sea of Marmara as seen by a German cartographer in 1694. Scholars at that time believed the city of Troy to be either mythical or located at an unidentified site to the south (right). Greek and Roman historians such as Strabo offered specific information as to the strategic location of Troy near the Dardanelles (Hellespont), but were generally ignored until the time of Schliemann (1870's). See page 776. [From an original print in the collection of John C. Kraft, University of Delaware, Newark]

The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve 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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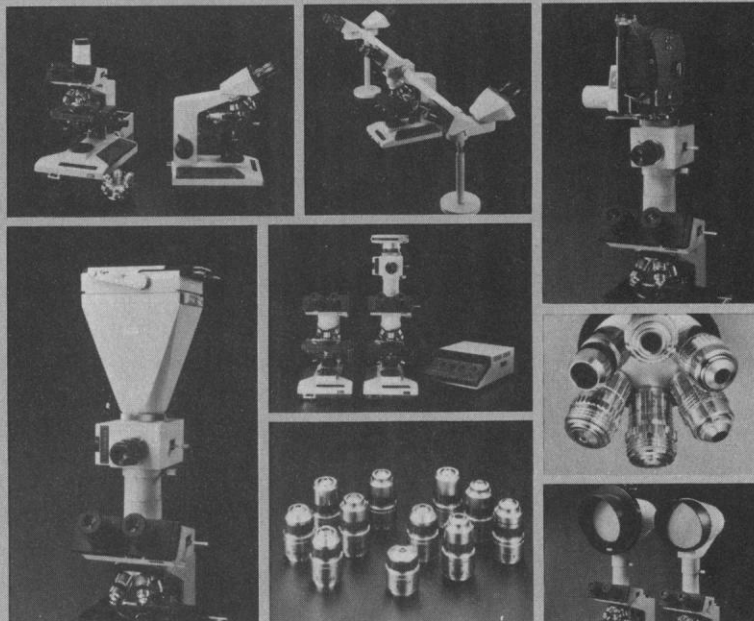
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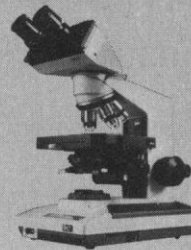
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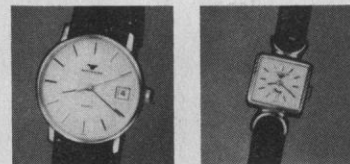
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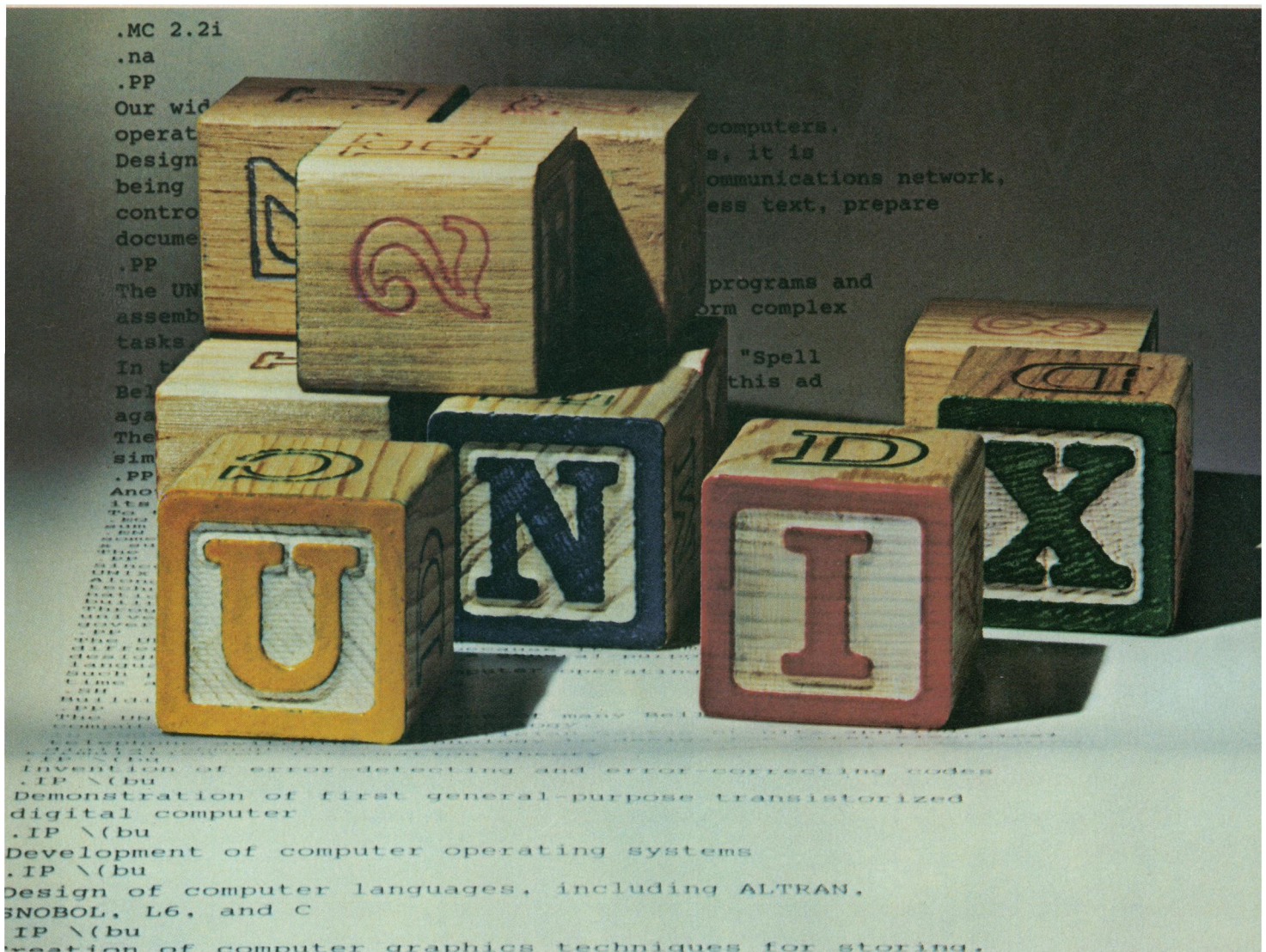
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Our widely accepted *UNIX*[™] operating system is simplifying the use of computers. Designed to handle a variety of applications, it is being used to manage and maintain the telecommunications network, control experiments, develop software, process text, prepare documents, and teach computer science.

The *UNIX* system allows users to take small programs and assemble them like building blocks to perform complex tasks. In text processing, for example, the command "Spell Bell Labs Ad" tells a computer to proofread this ad against a dictionary filed in its memory. The program that performs the task was created by simply combining several smaller *UNIX* programs.

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Since 1969 the Bell System has installed more than 1100 *UNIX* systems. Along with other Bell Labs innovations in computing technology, these systems are enhancing the way the nation's telecommunications network is planned, designed, built, and operated. Through licensing agreements with Western Electric, universities have installed over 800 *UNIX* systems, and government and

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The *UNIX* operating system can be used with computers of different manufacturers because it is small, cleanly designed, and written in a general-purpose programming language. Such portability in a computer operating system saves time and money.

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- First demonstration of remote computer terminal and data link
- Conception of electronic analog computer
- First design of AND and OR gates for diode circuitry
- Formulation of Information Theory
- Invention of error-detecting and error-correcting codes
- Demonstration of first general-purpose transistorized digital computer
- Development of computer operating systems
- Design of computer languages, including ALTRAN, SNOBOL, L6, and C
- Creation of computer graphics techniques for storing,

manipulating, and presenting information

- Development of Fast Fourier Transform
- Design of central processors for switching systems having virtually no downtime

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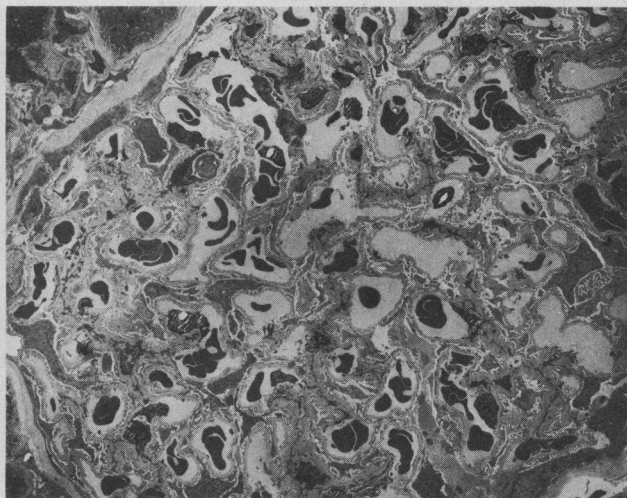
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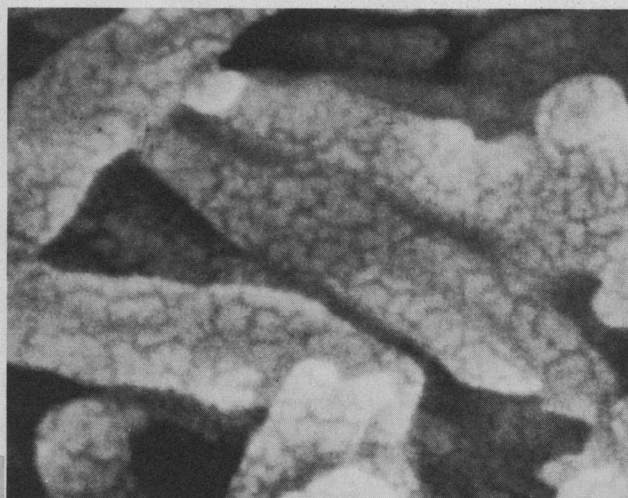
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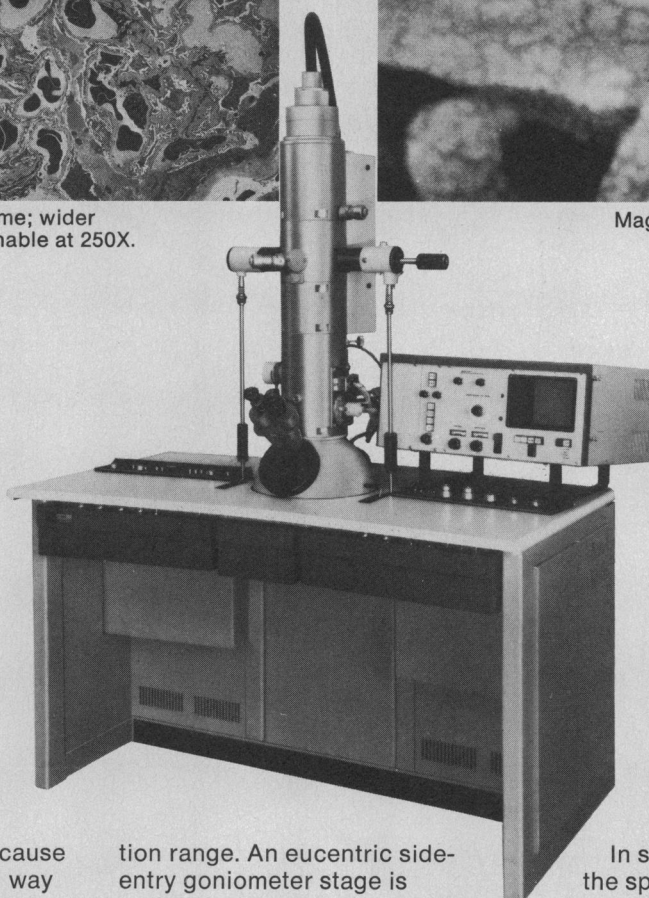
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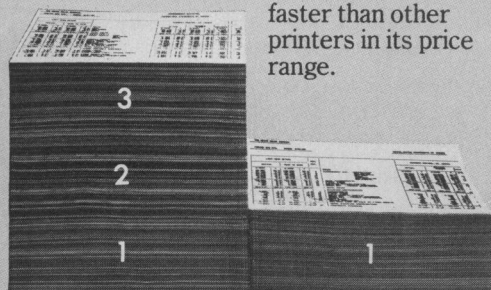


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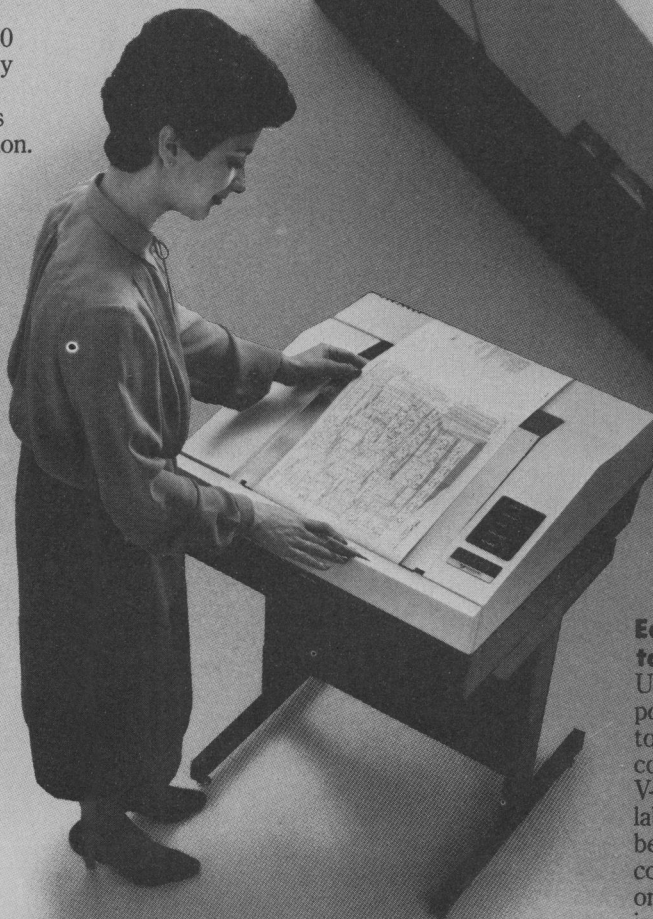
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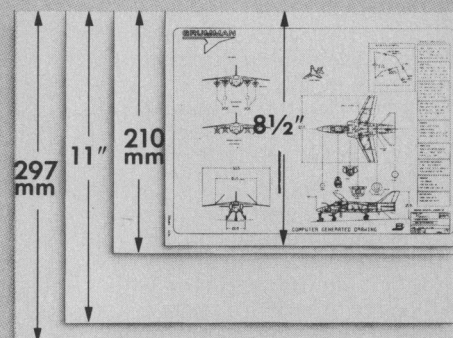
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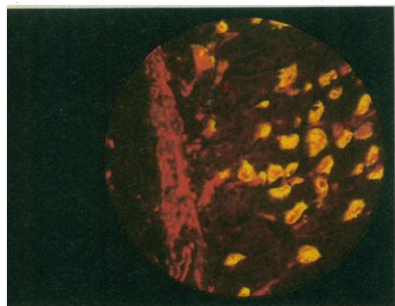
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ed in the future by government, industry, exposed populations, special interest groups, and others. Expert advice from statisticians and epidemiologists would be necessary for developing an acceptable research design.

Biological significance. It is difficult for the lay person to understand uncertainties in science, yet it is imperative that scientists attempt to educate the nonscientist concerning the problems which arise when extrapolating from laboratory data to an assessment of risk in human populations. Stochastic events that occur after exposure to mutagens, clastogens, carcinogens, and teratogens are not easy to explain. Chromosome damage is only one indicator in a series of poorly understood biological events that occur randomly in cells (and therefore in individuals) as a result of an external environmental insult. We cannot equate a ring chromosome in a lymphocyte with a cleft palate in an offspring. We should recognize our ignorance and uncertainties and try to help the regulators as well as the human subjects to appreciate the concept of probabilities rather than certainties. In our democratic society, perhaps we will decide that 500,000 deaths per year is an acceptable price for toxic chemicals in our environment, just as we have decided that 50,000 traffic deaths per year is an acceptable price for automobile travel. On the other hand we may decide that 5000 deaths per year is an unacceptable price for toxic chemicals. The scientists should provide the data and interpret the results; the public should decide.

MARGERY W. SHAW
*Medical Genetics Center, University of
Texas Health Science Center, Post
Office Box 20334, Houston 77025*

References

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3. J. German, *Science* 144, 298 (1964).

Kolata's article about the pilot cytogenetic study of Love Canal residents raises some important issues. I would like to comment on some related issues and their broader significance.

I would like to confirm that the study conducted by the Biogenics Corporation did not serve as the basis of the President's decision to provide federal funding for the temporary relocation of Love Canal residents and for health and environmental studies in that area. Those actions, widely supported by most scien-

tific administrators, were taken because of the cumulative evidence of exposure to toxic wastes and because of mounting evidence of resulting health effects.

Our primary concern in releasing the study was fairness and forthrightness in explaining the results to the 36 participants and to the other Love Canal residents. Unfortunately, the data were leaked to several newspapers before we could initiate peer review of the study. Because of the many caveats that needed to be placed on the conclusions, we went ahead with personal explanations to the participants on 15 May. That action, of course, constituted public release of the data, so we complied with news media requests for a formal briefing later in the day. In the press briefing, we carefully pointed out that scientific review had not yet been performed (a caveat largely ignored by most of the press accounts) and that such a review of the study was planned for 18 May. After that initial review was subsequently frustrated, I asked Roy Albert of New York University to assemble a panel of experts to review the pilot study and materials released to the Environmental Protection Agency (EPA) by Biogenics. The Albert review, forwarded to me on 12 June and released to the public, concluded that the study "should be regarded as indeterminate." The panel said that the "results are not positive in terms of the norms for the occurrence of chromosomal abnormalities, but the study cannot be called negative because of technical inadequacies and the lack of a control group." The panel also indicated that the "purported occurrence of a rare abnormality, 'supernumerary acentric fragment,' was not substantiated." I have accepted the findings of the Albert review and feel that little of scientific value can be gained from further rehashing of the pilot study, because of its shortcomings. For the future, EPA is working with the Center for Disease Control to undertake a comprehensive cytogenetic study of Love Canal residents.

There are well-established norms for the conduct of scientific investigations. Among these are peer review of research protocols and of research results, including full disclosure of techniques and data. EPA adheres to those norms; indeed, we have been continually strengthening our peer review mechanisms. We extensively use the agency's science advisory board to review research programs and health and environmental criteria documents. We widely use peer review mechanisms for intramural research and for extramural grants and cooperative agreement awards. Recent-

The longest line

α -Adrenergic

Clonidine hydrochloride, [4-³H]-
Desmethylinipramine hydrochloride,
[2,4,6,8-³H]-
Dihydro- α -ergocryptine, 9,10-[9,10-³H(N)]-
WB-4101 (2,6-Dimethoxyphenoxyethyl)
aminomethyl-1, 4-benzodioxane,
2-[*phenoxy*-3-³H(N)]-
Epinephrine, *levo*-[*methy*-³H]-
Norepinephrine, *levo*-[7,8-³H(N)]-

β -Adrenergic

Carazolol, DL-[3,6-³H(N)]-
Dihydroalprenolol hydrochloride, *levo*-
[*propyl*-2,3-³H]-
Epinephrine, *levo*-[*N-methyl*-³H]-
Hydroxybenzylisoproterenol, *p*-[7-³H]-
Iodohydroxybenzylpindolol, [1²⁵]-
Isoproterenol, DL-[7-³H(N)]-
Norepinephrine, *levo*-[7,8-³H(N)]-
Propranolol, L-[4-³H]-

Aspartate

Aspartic acid, D-[2,3-³H]-
Aspartic acid, L-[2,3-³H]-
Methyl-D-aspartic acid, *N*-[*methyl*-³H]-

Benzodiazepine

Diazepam, [methyl-³H]-
Flunitrazepam, [methyl-³H]-

Cholinergic

Muscarinic

Acetylcholine chloride, [*N-methyl*-³H]-
Choline chloride, [methyl-³H]-
Pilocarpine, [³H(G)]-
Scopolamine methyl chloride,
[*N-methyl*-³H]-

Nicotinic

Acetylcholine chloride, [*N-methyl*-³H]-
 α -Bungarotoxin, [1²⁵]-
Choline chloride, [methyl-³H]-
Tubocurarine chloride, *dextro*-[13'-³H(N)]-

Dopaminergic

ADTN Amino-6,7-dihydroxy-
1,2,3,4-tetrahydronaphthalene,
2-[5,8-³H]-
Amphetamine sulfate, D-[³H(G)]-
Apomorphine, [8,9-³H]-
Chlorpromazine, [³H]-
Dihydroxyphenylethylamine,
3,4-[ethyl-1-³H(N)]- or [ethyl-2-³H(N)]-
Haloperidol, [³H(G)]-
Propylorapomorphine, *N*-[*propyl*-³H(N)]-
Spiroperidol, [1-*phényl*-4-³H]-

GABA

Alanine, β -[3-³H(N)]-
Aminobutyric acid, γ -[2,3-³H(N)]-
Dihydropicrotoxinin, α -[8,10-³H]-
Isoguvacine hydrochloride, [³H]-
Muscimol, [methylene-³H(N)]- or [4-³H]-
Nipecotic acid, [ring-³H]-

Glutamate

Glutamic acid, L-[3,4-³H]-

Glycine

Glycine, [2-³H]-

of labeled ligands

Histamine

H₁

Histamine, [³H(G)]-
Pyrimidine, [pyridinyl-5-³H]- (Mepyramine)

H₂

Histamine, [³H(G)]-

Opiate

Dihydromorphine, [7,8-³H(N)]-
Enkephalin (5-L-leucine), [tyrosyl-3,5-³H(N)]-
Enkephalin (5-L-methionine),
[tyrosyl-3,5-³H(N)]-
Enkephalinamide
(2-D-alanine-5-L-methionine),
[tyrosyl-ring-2,6-³H]-
Ethylketocyclazocine, [9-³H]-
Morphine, [6-³H(N)]-

Serotonin

Hydroxytryptamine binosalate, 5-[1,2-³H(N)]-
Hydroxytryptamine creatinine sulfate,
5-[1,2-³H(N)]-

Steroid

Androgen

Dihydrotestosterone,
[1,2,4,5,6,7,16,17-³H(N)]-
Methyltrienolone, [17 α -methyl-³H]- (R1881)*
Testosterone, [1,2,6,7,16,17-³H(N)]-

Estrogen

Estradiol, [2,4,6,7,16,17-³H(N)]-
Iodo-3, 17 β -estradiol, 16 α -[1²⁵]-
Moxestrol, [11 β -methoxy-³H]- (R2858)*

Glucocorticoid

Dexamethasone, [6,7-³H(N)]-
Prednisolone, [6,7-³H(N)]-
Triamcinolone acetonide, [6,7-³H(N)]-

Mineralocorticoid

Aldosterone, D-[1,2,6,7-³H(N)]-

Progesterone

Dihydroprogesterone, [1,2-³H(N)]-
Nor-17 α -ethynyltestosterone, 19-[6,7-³H(N)]-
Progesterone, [1,2,6,7-³H(N)]-
Promegestone, [17 α -methyl-³H]- (R5020)*

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Miscellaneous

Dihydroxyvitamin D₃, 1 α , 25-[26,27-³H]-
Hydroxyvitamin D₃, 25-[26,27-³H]-
Imipramine hydrochloride, [2,4,6,8-³H]-
Phencyclidine, [piperidyl-3,4-³H(N)]-
Reserpine, [benzoyl-³H(G)]-

is longer yet:

New labeled ligands

Aminoclonidine, *p*-[3, 5-³H]-
Dioxolane, L (+)-cis-[2-methyl-³H]-
Domperidone, [benzene-ring-³H]-
Doxepin, [methyl-³H]-
Lysergic acid diethylamide,
[*N-methyl*-³H]-
Melanotropin Release Inhibiting
Hormone, [L-proline-2, 3, 4, 5-³H]- (MRIH)
Naloxone, [N-allyl-2, 3-³H]-
Oxotremorine-M, [methyl-³H]-
Oxymorphone hydrochloride,
[*N-methyl*-³H]-
Pargyline, [³H(G)]-
Prazosin, [furoyl-5-³H]-
Quinuclidinyl benzilate,
L-[benzyl-4,4'-³H(N)]-
SKF 10,047, [N-allyl-2, 3-³H]-
Yohimbine, [methyl-³H]-

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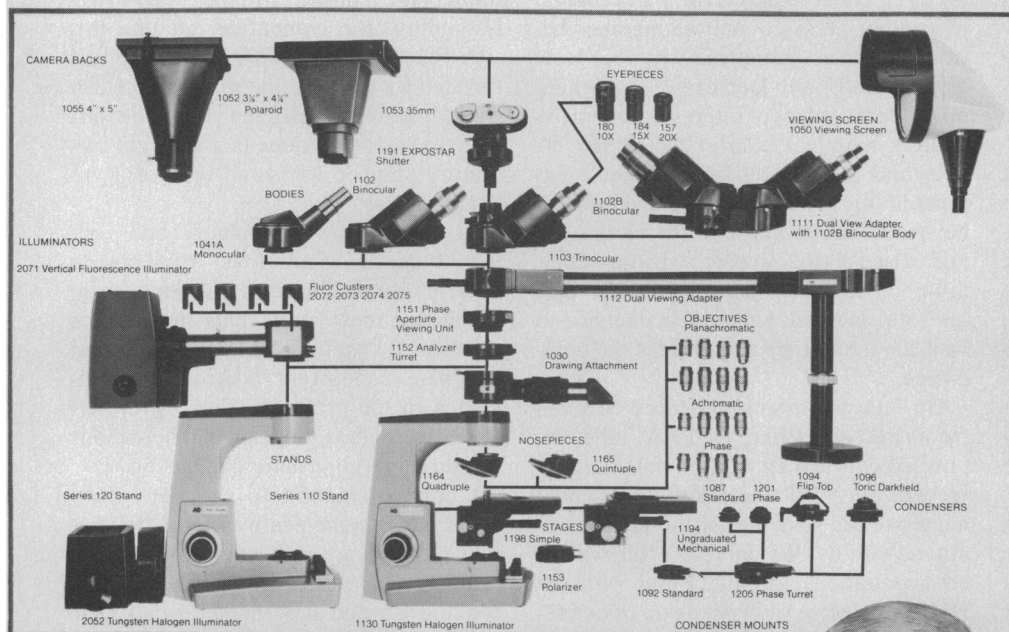
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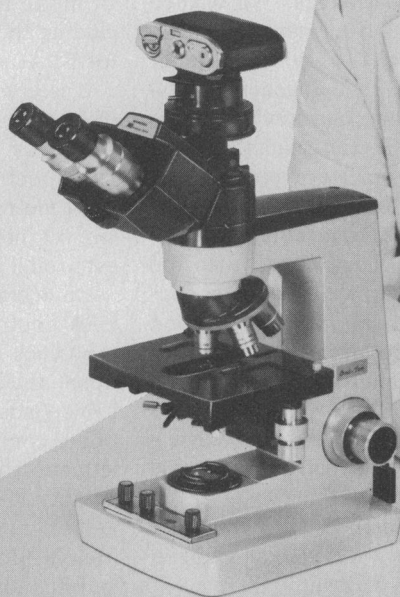


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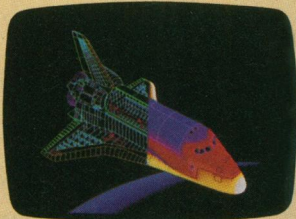
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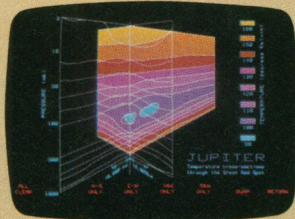
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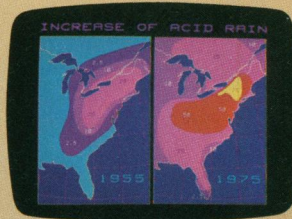
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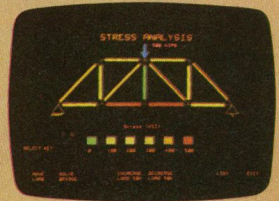
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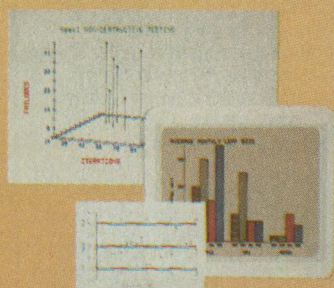
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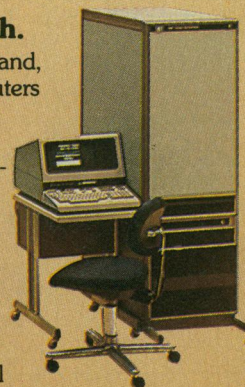
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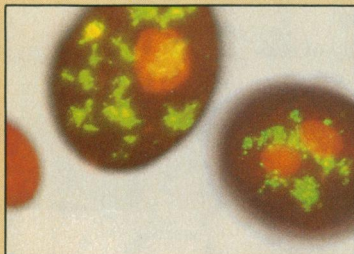
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Live/Dead Cell Enumeration

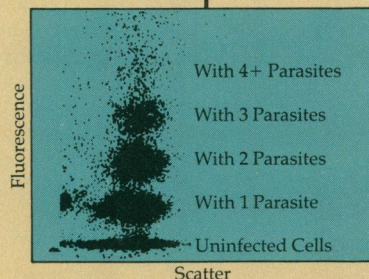
The forward-angle light-scattering measurement of FACS can be used to discriminate viable and nonviable cells in homogeneous populations, such as lymphocytes. FACS analysis during a lymphocytotoxicity

test of mouse spleen cells reacted with varying dilutions of rabbit anti-mouse T-cell antiserum plus complement has shown that as antiserum concentration increases, the percentage of cells in the dead subpopulation also increases.

Sorting of Erythrocytes Containing Malaria Parasites

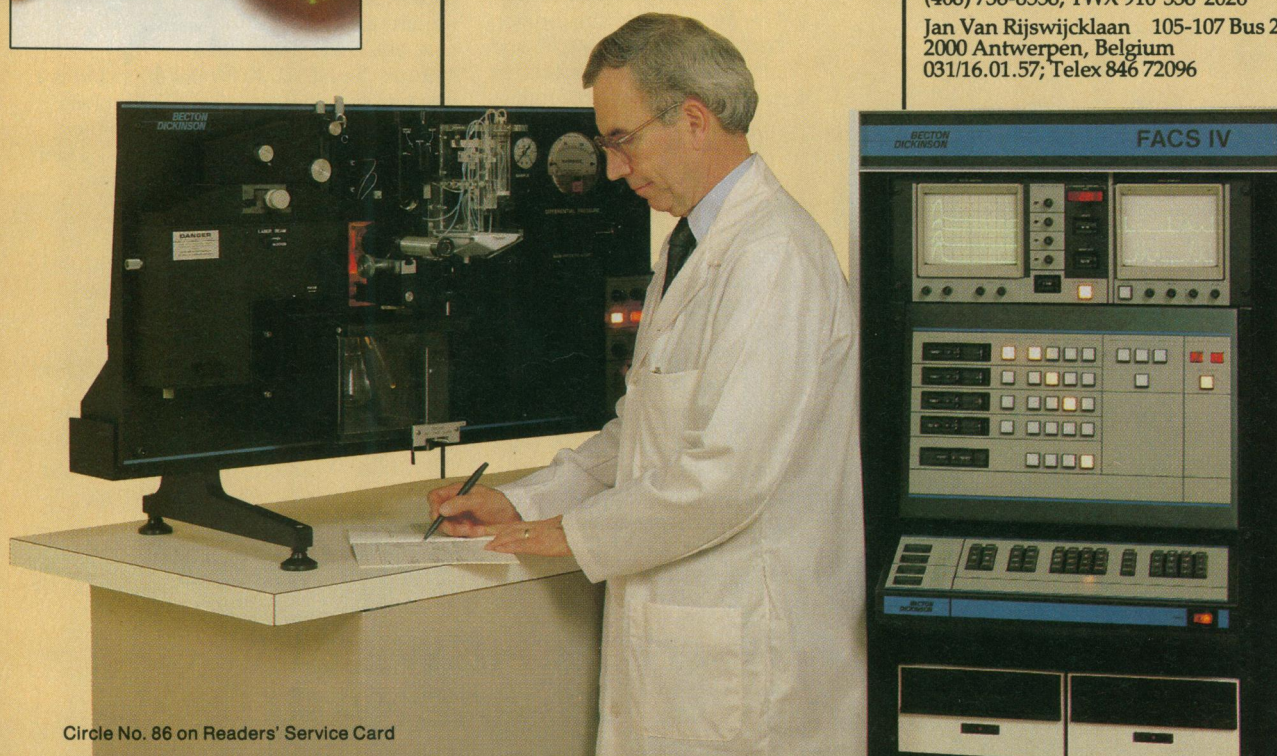
Plasmodium berghei-infected mouse erythrocytes can be analyzed and sorted on the basis of parasite DNA content. Infected cells, treated with a vital DNA-binding dye, fluoresce with intensity corresponding to the number of parasites contained. Uninfected cells are nonfluorescent. Measurements of light scatter and fluorescence intensity from each cell are displayed as a correlated dot plot, as shown. Sorting of uninfected from infected cells enables subsequent studies.

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The Global 2000 Report

Some parts of the world will probably reach limits to growth in the next decade or two. The reasons are well known—a 3 percent annual increase in population leads to a doubling in about 24 years. Such a rate of increase in food production cannot be sustained indefinitely. The problem has been treated many times, including studies by the Club of Rome. On 24 July the federal government got into the act with a report of about 800 pages entitled *The Global 2000 Report to the President*.

On 23 May 1977 President Carter called for "a one year study of the probable changes in the world's population, natural resources and environment through the end of the century." The Council on Environmental Quality and the Department of State were designated as lead agencies and were authorized to call on other appropriate federal agencies for assistance. A reading of portions of the report produced after 3 years reveals more about the functioning of the federal government than it conveys new reliable information about the future of the world.

Some of the agencies responded quickly while others were slow. Thus, part of the material is outdated. The energy projections were made in the spring of 1978 before the Iran crisis. At that time oil prices seemed stable at about \$13 a barrel. Accordingly, the Department of Energy (DOE) made projections of energy use on the basis that, in constant dollars, the price would remain \$13 a barrel until 1990. The drastic change that occurred in 1979 goes largely unrecognized, as does the current sharp decline in U.S. consumption of oil. In 1978 the common view was that oil production would continue to increase until it peaked in about 1990. But experts are now saying that the peak probably occurred in 1978. The material also contains at least two other significant errors. The oil in place at Athabasca and other formations in the region is now estimated at 1300 to 2400 billion barrels (the older DOE figure was 895 billion barrels). That in Venezuela is placed at 700 billion to 3000 billion barrels (the DOE estimate was 200 billion barrels).

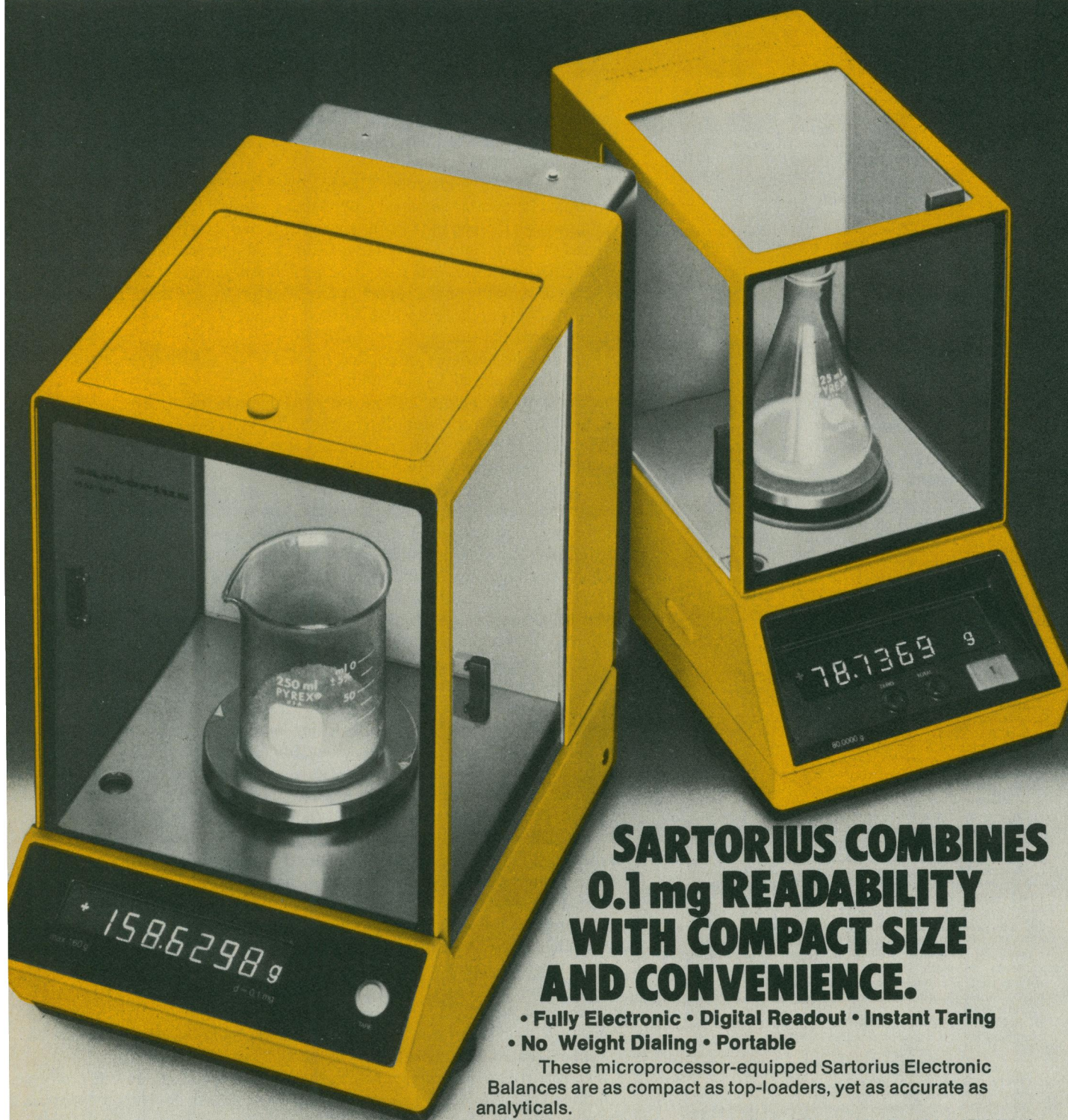
A chapter on environmental projections has a section on "The use of chemicals in the development of societies" in which one of the State Department employees provided this gem: "It was not until the end of the 19th century that the use of chemicals in society began to become widespread. . . . This development coincided with the discovery that crude oil . . . could also be used as a new source of supply of chemicals. A new scientific discipline emerged, to expand the utility of crude oil: organic chemistry." In point of fact, organic chemistry began in 1828 with Wöhler. By the 1880's the German chemical industry was a billion-dollar-a-year enterprise (in 1880 dollars). It was producing a great variety of organic chemicals, including dyestuffs from coal tar. Use of petroleum as a feedstock became important only in the 1930's.

Deforestation is very serious in parts of the world. However, the author of the chapter on forestry has made questionable statements about the Amazon Valley. He quotes an estimate that the area is being deforested at the rate of 4 percent a year, with half the forest to be removed by 2000. My informant at the Brazilian Embassy scoffed, "Has the man flown over the Amazon?" He went on to state that road-building there has almost stopped—the energy crisis has caused a shift in priorities.

The report has other deficiencies of analysis and consistency. It projects continued fast growth in gross national product in less-developed countries (LDC's) without adequate discussion of the impact of sharp increases in the price of oil. It projects virtually unchecked population growth in LDC's and corresponding increases in food production while emphasizing losses in cropland due to desertification, deforestation, water logging, urbanization, and soil erosion.

The report is correct in emphasizing that the world faces decades of difficulties and some of its sections are well done. But outdated material and inaccuracies detract from its value.—PHILIP H. ABELSON

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Model 1602MP (left) weighs 160g to 0.1mg; Model 1207MP (right) weighs 80g to 0.1mg. Operation is completely automatic; there are no weights to 'dial in' and no suspended 'swinging' pan. Far smaller and lighter than comparable analytical balances, these models may easily be moved to any weighing location as needed.

Sartorius . . . those remarkable yellow balances. For literature, write: Sartorius Division, Brinkmann Instruments, Inc., Subsidiary of Sybron Corp., Cantiague Road, Westbury, NY 11590, or call 516/334-7500.

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