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163 This Week in *Science*

Editorial

165 Advances in Instrumentation

Letters

167 Battle Over Error: W. W. STEWART AND N. FEDER; B. J. CULLITON ■ Revival of the Ethics Advisory Board: G. B. ELLIS ■ Research at USAMRIID: J. M. NOVAK ■ "La Niña" or "El Viejo"?: J. L. BUTLER

Policy Forum

173 Science Policy: George Bush; Michael S. Dukakis

News & Comment

183 The Drug of Champions
185 Academy Explores Use of Laboratory Animals
Much Work but Slow Going on Alternatives to Draize Test
186 CBO Cautions Congress on SSC
187 Bill Would Set Fraud Guidelines for Scientific Publications
Harvard's Blumenthal Advises Dukakis
188 AID Acts on Erickson Case
Health Problems of the Homeless
189 SDI Plan Endorsed
190 Strengthened Endangered Species Act Passes

Research News

191 Gene Transfer Is Coming Right on Target
192 Similar Experiments, Dissimilar Results
193 Joint Soviet-U.S. Attack on Heart Muscle Dogma
195 Slices of Continental Crust Coming into View
198 *Random Samples*: Cyclosporin Turns Five ■ I'll Have the Rehydratable Beef Patty, Please ■ Reason for Caution in Monsoon Season ■ The Way We Are

Articles

Advances in Instrumentation

209 Scanning Tunneling Microscopy and Atomic Force Microscopy: Application to Biology and Technology: P. K. HANSMA, V. B. ELINGS, O. MARTI, C. E. BRACKER
217 The Impact of High-Temperature Superconductivity on SQUID Magnetometers: J. CLARKE AND R. H. KOCH
224 Capillary Electrophoresis: M. J. GORDON, X. HUANG, S. L. PENTONEY, JR., R. N. ZARE
229 DNA Diagnostics—Molecular Techniques and Automation: U. LANDEGREN, R. KAISER, C. T. CASKEY, L. HOOD

Research Articles

240 Mutant Trp Repressors with New DNA-Binding Specificities: S. BASS, V. SORRELLS, P. YOUNDERIAN

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COVER The image of a single crystal of the amino acid DL-leucine reveals the individual methyl groups at the end of each amino acid molecule as white spots. It was taken with an atomic force microscope. See page 209. [Photograph by Scot Gould, Department of Physics, University of California, Santa Barbara, CA 93106]

Reports

- 249 Bulk Superconductivity up to 122 K in the Tl-Pb-Sr-Ca-Cu-O System: M. A. SUBRAMANIAN, C. C. TORARDI, J. GOPALAKRISHNAN, P. L. GAI, J. C. CALABRESE, T. R. ASKEW, R. B. FLIPPEN, A. W. SLEIGHT
- 252 The Paleomagnetic Field from Equatorial Deep-Sea Sediments: Axial Symmetry and Polarity Asymmetry: D. A. SCHNEIDER AND D. V. KENT
- 256 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin Kills Immature Thymocytes by Ca^{2+} -Mediated Endonuclease Activation: D. J. MCCONKEY, P. HARTZELL, S. K. DUDDY, H. HÅKANSSON, S. ORRENIUS
- 259 A *Mycobacterium leprae*-Specific Human T Cell Epitope Cross-Reactive with an HLA-DR2 Peptide: D. C. ANDERSON, W. C. A. VAN SCHOOTEN, M. E. BARRY, A. A. M. JANSON, T. M. BUCHANAN, R. R. P. DE VRIES
- 261 Unusual Immunoglobulin Gene Rearrangement Leads to Replacement of Recombinational Signal Sequences: E. MORZYCKA-WROBLEWSKA, F. E. H. LEE, S. V. DESIDERIO
- 263 Structural Rearrangement of the Retinoblastoma Gene in Human Breast Carcinoma: A. T'ANG, J. M. VARLEY, S. CHAKRABORTY, A. L. MURPHREE, Y.-K. T. FUNG
- 266 Recognition and Transport of Adenine Derivatives with Synthetic Receptors: T. BENZING, T. TJIVIKUA, J. WOLFE, J. REBEK, JR.
- 268 Sarafotoxin, a Novel Vasoconstrictor Peptide: Phosphoinositide Hydrolysis in Rat Heart and Brain: Y. KLOOG, I. AMBAR, M. SOKOLOVSKY, E. KOCHVA, Z. WOLLBERG, A. BDOLAH
- 270 Heterogeneity of Glycine Receptors and Their Messenger RNAs in Rat Brain and Spinal Cord: H. AKAGI AND R. MILEDI
- 273 Acetaldehyde Production and Transfer by the Perfused Human Placental Cotyledon: P. I. KARL, B. H. J. GORDON, C. S. LIEBER, S. E. FISHER
- 275 Antibodies to Asp-Asp-Glu-Asp Can Inhibit Transport of Nuclear Proteins into the Nucleus: Y. YONEDA, N. IMAMOTO-SONOBE, Y. MATSUOKA, R. IWAMOTO, Y. KIIHO, T. UCHIDA
- 278 Expression of a Calcium-Mobilizing Parathyroid Hormone-Like Peptide in Lactating Mammary Tissue: M. A. THIEDE AND G. A. RODAN

Book Reviews

- 305 First Births in America, reviewed by D. P. HOGAN ■ Ed School, M. LAZERSON ■ The Ocean Basins and Margins, D. S. COWAN ■ Some Other Books of Interest ■ Books Received

Products & Materials

- 311 True 3-D Graphic Display ■ Splitter for Dual-Detection SFC ■ Complement ■ Single-Well Gamma Counter ■ Bioreactor Control System ■ Fast Fourier Transform Software Library ■ Digital Imaging SEM ■ Literature

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This Week in SCIENCE

Presidential candidates discuss science

THE contenders for the presidency of the United States, Michael Dukakis and George Bush, face off on page 173—Bush on the left and Dukakis on the right (sides of the page). Each was asked questions about what his science policies would be if he is elected president in November. The candidates considered such issues as how priorities between big and little science will be decided, how priorities will be set for spending in biomedicine, space, and applied research and development, whether the current level of spending for science in this country is appropriate, what the role and status of the science adviser will be in the next administration, how technologic advances that affect the competitiveness of the United States in the world marketplace will be promoted, and how science and math education in the United States will be improved.

Normal and reversed fields

PALaeomagnetic data from deep-sea sediment cores taken close to the equator in the Indian, Atlantic, and Pacific oceans have provided new information on the nature of the dynamo in the earth's core, which produces the earth's magnetic field (page 252). Schneider and Kent analyzed 89 cores containing sediments deposited during the past 5 million years. Significant differences in the strength of the nondipole field component were evident during episodes of normal versus reversed magnetic fields: the axial quadrupole component was always greater during reversed-field epochs, and it may make a substantial contribution to the total field at reversals, when the main dipole field collapses. One explanation of the data is that the magnetic field has a nonreversing component as well as the well-documented reversing component that is associated with the main dipole field. The source of the nonreversing standing field is not known. The data support an important assumption in

many paleomagnetic studies that the time-averaged geomagnetic field remains symmetric about the spin axis of the earth.

Diverse vasoconstrictors

LETHAL snake venoms (sarafotoxins) and a naturally occurring heart peptide (endothelin) have similar biologic effects and strong sequence homology (page 268). Both cause constriction of heart blood vessels and both have 21 amino acids, 15 of which are identical. Kloog *et al.* found that sarafotoxins bind with high affinity to brain and heart membranes of rats. Binding leads to hydrolysis of phosphoinositides in the tissues, and a second messenger for the mobilization of intracellular calcium ions is produced; calcium mobilization is crucial to the vasoconstriction, transient hypertension, and other actions of the toxins. It remains to be seen whether the small differences in structure, concentration differences, or differences in how activities of these substances are regulated will account for the large biologic differences of these two peptides—the venoms can kill mice in minutes whereas endothelin appears to serve as a normal modulator of ion channels in the endothelium. An increase in the production of endothelin might be a factor in the development of hypertension and other diseases that involve aberrant vasoconstriction.

Acetaldehyde and fetal alcohol syndrome

I^N the Western world, fetal alcohol syndrome is a major cause of congenital anomalies, mental retardation, and delayed in utero growth. In humans, the extent of fetal injury may be related to the level of acetaldehyde in the maternal circulation; this substance is the most toxic metabolic product of ethyl alcohol (ethanol) for cells. Karl *et al.* show, using a perfusion model, that the human placenta transfers acetaldehyde from the maternal to the fetal circulation. Furthermore, the placenta

can oxidize ethanol to acetaldehyde; thus, when ethanol but not acetaldehyde is present in the maternal circulation, the fetus can still be exposed to acetaldehyde (page 273). Human placentas oxidized both high and moderate levels of ethanol, indicating that fetuses of both heavy and "social" drinkers are at risk. The liver of the fetus has a low capacity for eliminating acetaldehyde, and therefore this substance may persist and produce pathogenic effects.

Lactation-associated peptide

DURING lactation, normal mammary tissues produce a peptide that closely resembles a molecule found in tissues of patients with humoral hypercalcemia of malignancy called parathyroid hormone-like peptide (PTH-LP). Thiede and Rodan report that, shortly after the birth of a litter and in association with lactation, messenger RNA molecules for PTH-LP appear in rat mammary glands (page 278). PTH-LP expression was induced by nursing, and, if the litter was taken away from the mother, expression soon stopped. The mammary tissues of nonlactating females did not produce PTH-LP. PTH-LP is known to have potent effects on calcium metabolism; its newly identified association with lactation reinforces the notion that it may act as a hormone for mobilizing or transferring calcium from bones into milk.

Instrumentation

The feature articles and editorial this week report on four instruments that are being used in the biomedical, biochemical, and physical sciences. The authors discuss how each state-of-the-art instrument works, applications for which each is suited, and ways in which the new instruments surpass their precursors in design and performance (pages 165, 209, 217, 224, and 229).

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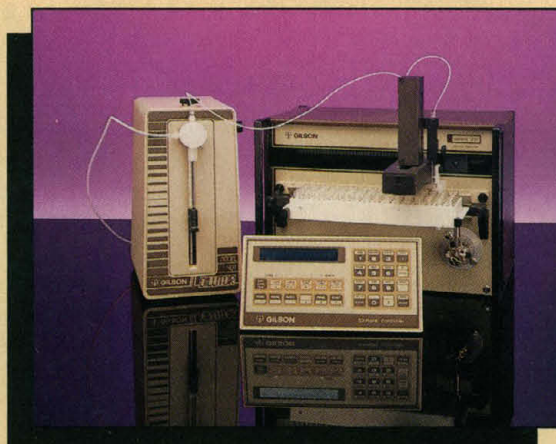
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Advances in Instrumentation

Scientific progress and instrumentation have become inextricably intertwined. The discovery of new phenomena can lead to new ways of characterizing or quantifying the systems scientists study, and advances in instrumentation can open up new ways for conducting scientific research.

Instrumentation affects research in a variety of ways. New measurements reveal previously unknown phenomena; quantities can be measured more precisely, accurately, and rapidly. Each of these aspects leads to increased productivity and in many cases to the ability to solve new problems. In addition to these traditional measures of value, however, are hidden or less quantifiable ones. An especially critical aspect of improved instrumentation is the ability to catch errors and wrong assumptions quickly. An incorrect assumption may lead to extended efforts that ultimately prove futile. Modern instrumentation often allows the recognition that one is on the wrong path and thus saves the experimenter from a long and unproductive journey. Also, more alternatives can be explored with less extensive effort. The consequent increase in productivity in some fields has been remarkable.

Instruments come in a variety of styles, shapes, and prices. Commercial instruments have costs that range from thousands to hundreds of thousands of dollars. For many scientists, commercially available instruments such as Fourier transform infrared, nuclear magnetic resonance, electron paramagnetic resonance, x-ray, and mass spectrometers, and the mutual coupling of these instruments with various separation technologies, have revolutionized the nature and complexities of the problems on which they work. One-of-a-kind instruments—accelerators, synchrotron light sources, neutron sources, free electron lasers—lie at the other end of the scale. These generally are used to make measurements that simply cannot be made in any other way.

Between these two extremes we have a most interesting area—instruments that are still in the process of laboratory development. Their impact derives in part from applications to immediate tasks in the laboratory of their developers. But there is also the possibility that these instruments will become widespread in their availability and usefulness, and join the ranks of commercially available instruments used routinely in many laboratories and in the field. The instruments described in this issue fall largely into this category. We present a selection, from many that might have been chosen, of state-of-the-art techniques that have the promise of being seen in many laboratories during the next few years.

Hansma, Elings, Marti, and Bracker describe scanning tunneling microscopy (STM) and atomic force microscopy (AFM). These techniques were recognized immediately for their ability to provide direct views of the atomic domain. Surface details at the atomic level of graphite, organic conductors, and adsorbed atoms are displayed. Thin conductive metal coatings allow viewing of biological materials. The AFM provides a nondestructive view of organic materials that are nonconducting. Possible future applications, including dynamic studies, are described.

Clarke and Koch describe progress in SQUID magnetometers, which are among the most widely used superconducting devices. This is probably the first application in which high-temperature superconductors are playing a role. In this article the advantages and disadvantages in the applications of this new technology are discussed.

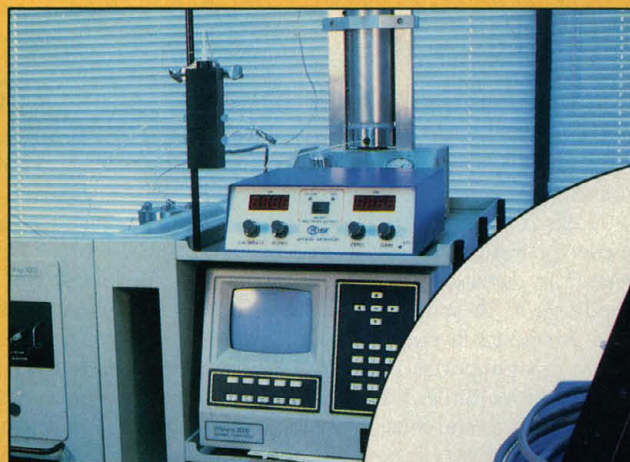
Gordon, Huang, Pentoney, and Zare describe capillary electrophoresis. The resolving power in separation and the great sensitivity of this new, relatively simple methodology make it almost certain that it will become a mainstay of the analytical community.

Finally, Landergren, Kaiser, Caskey, and Hood describe the area of DNA diagnostics. Molecular science and the ability to perform automated analyses are making it possible to undertake the solution of a very large number of important, disease-related problems.

Zare, quoting Joshua Lederberg, points out the often unacknowledged role which instrumentation plays in research. This issue of *Science* acknowledges that role and shows that the way in which we are able to carry out our science has a profound impact on the science that we are able to do. Advances in instrumentation continue to open new horizons.

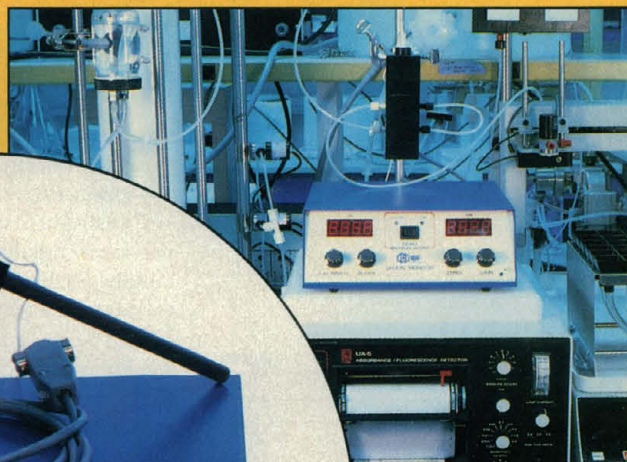
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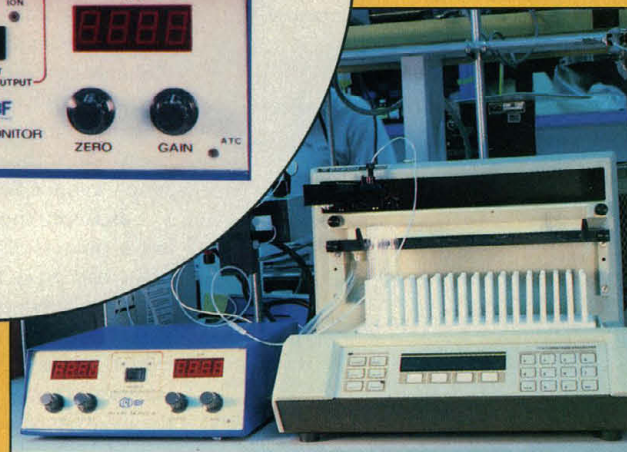
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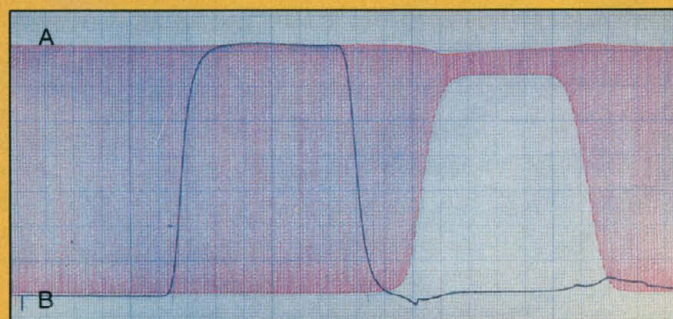
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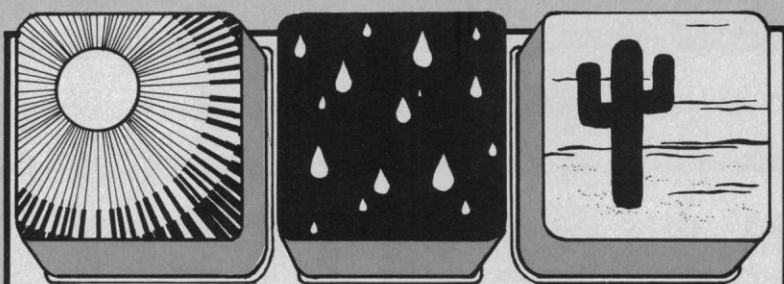
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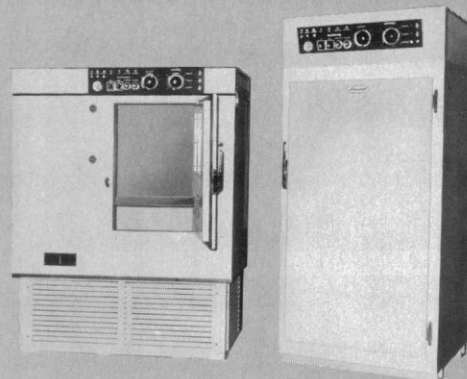
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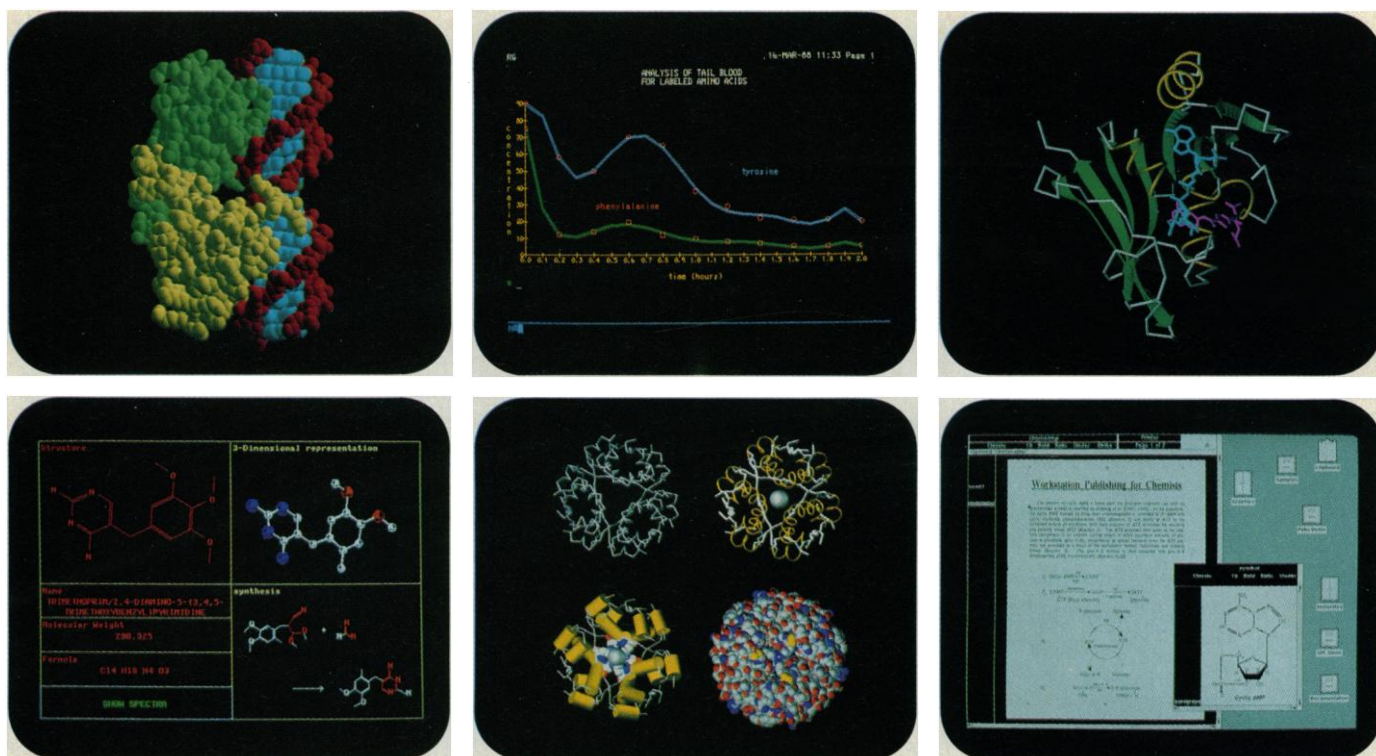


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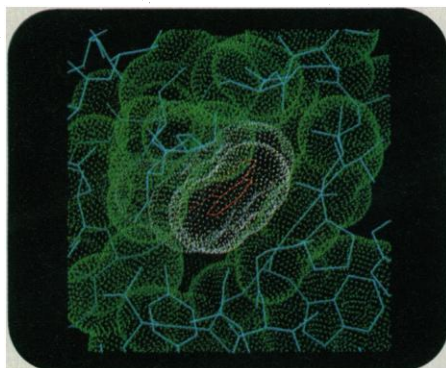
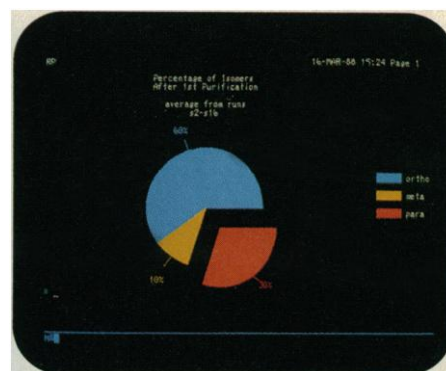
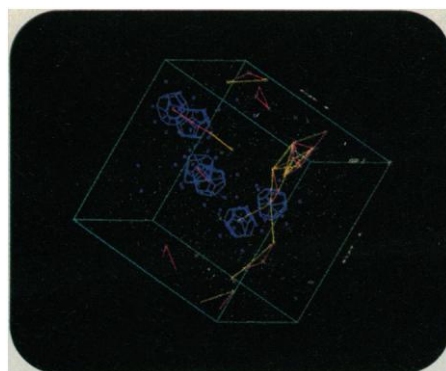
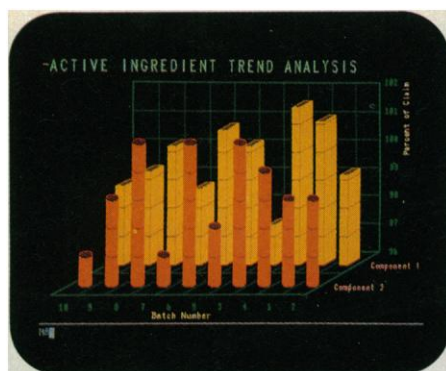


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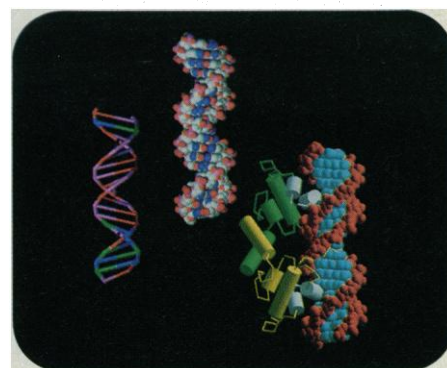
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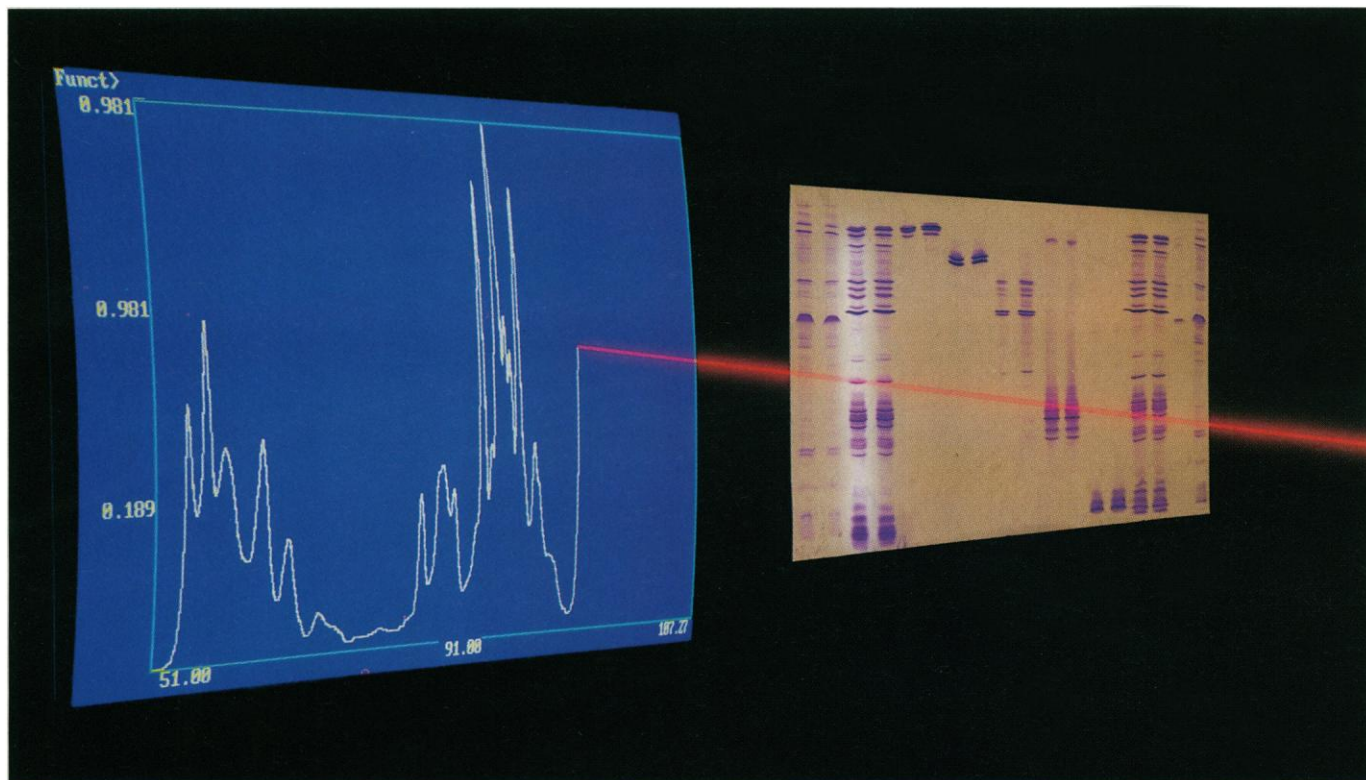
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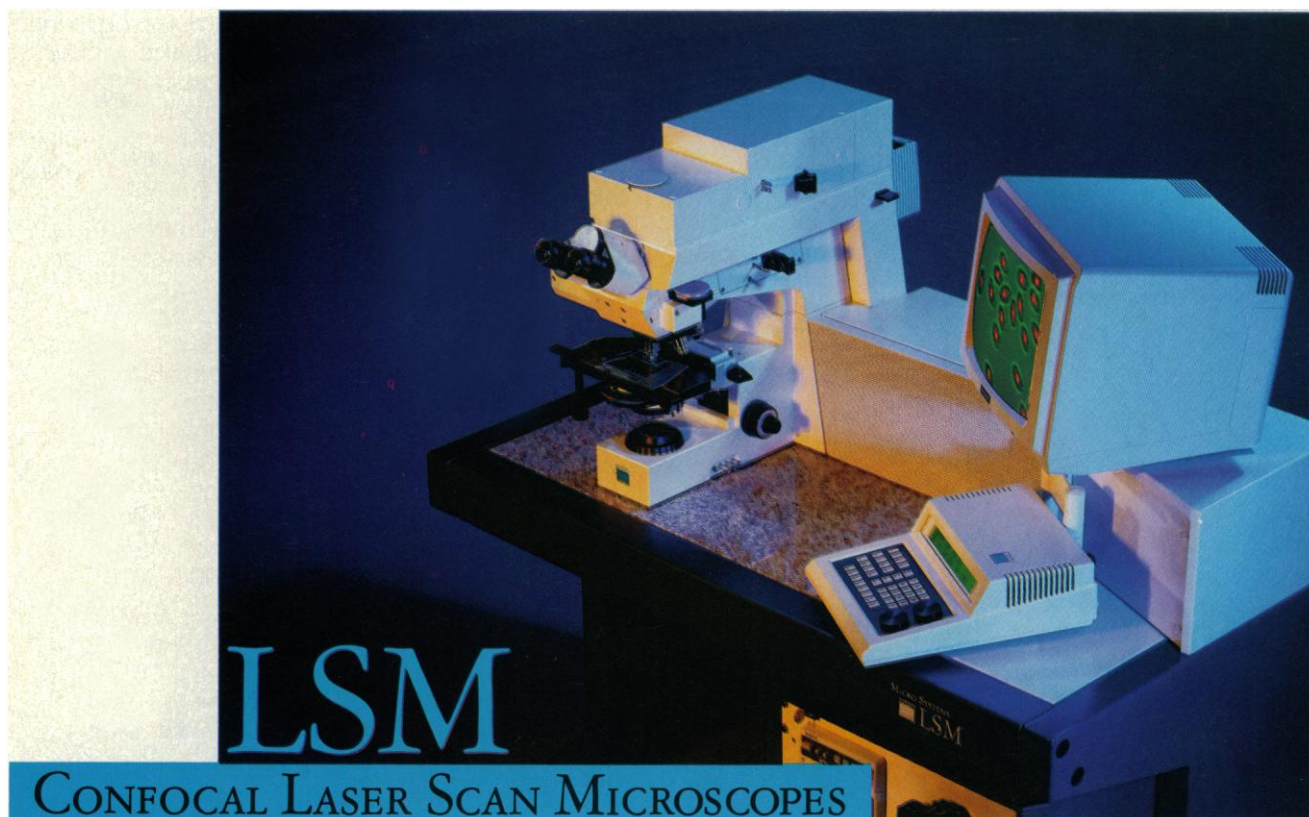
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FEATURES

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FEATURES

- Hinged lid
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- Removable rack insert

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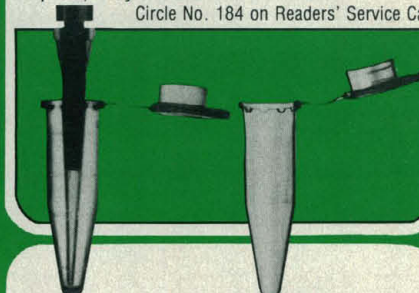
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FEATURES

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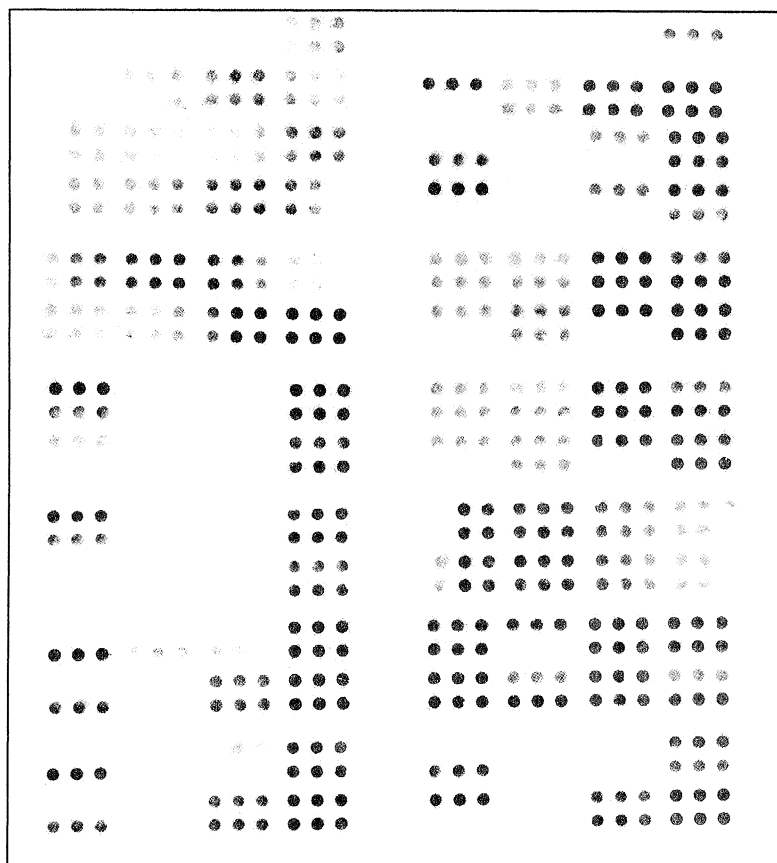
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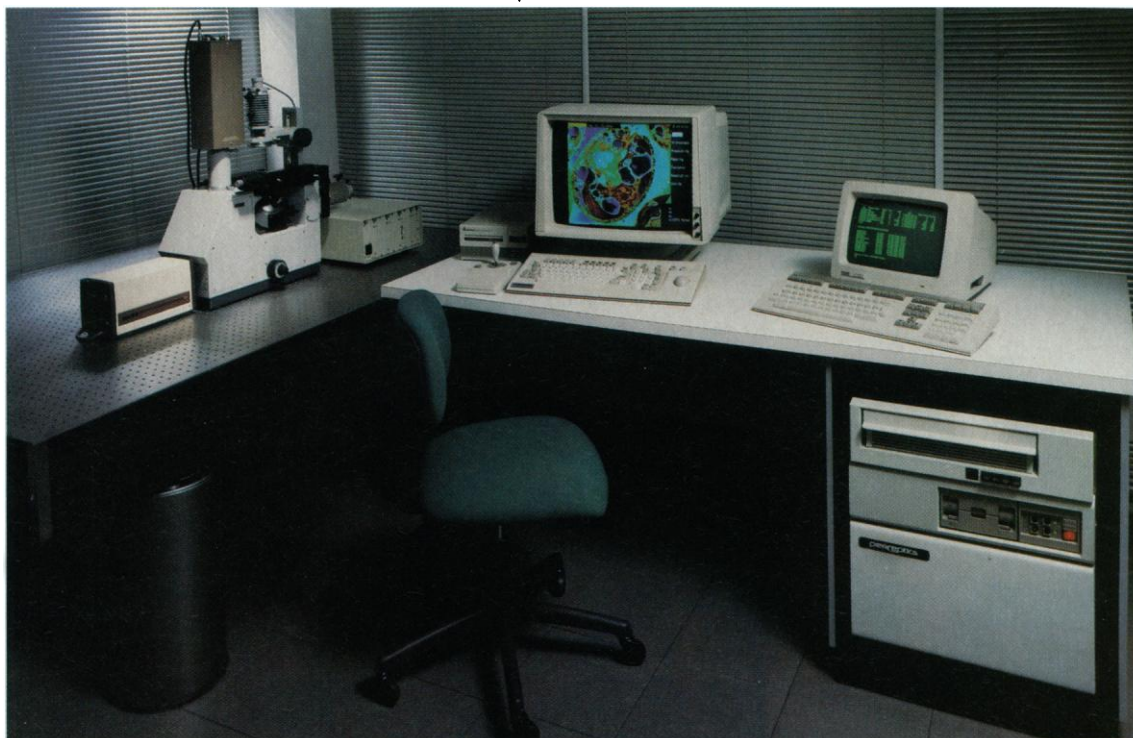
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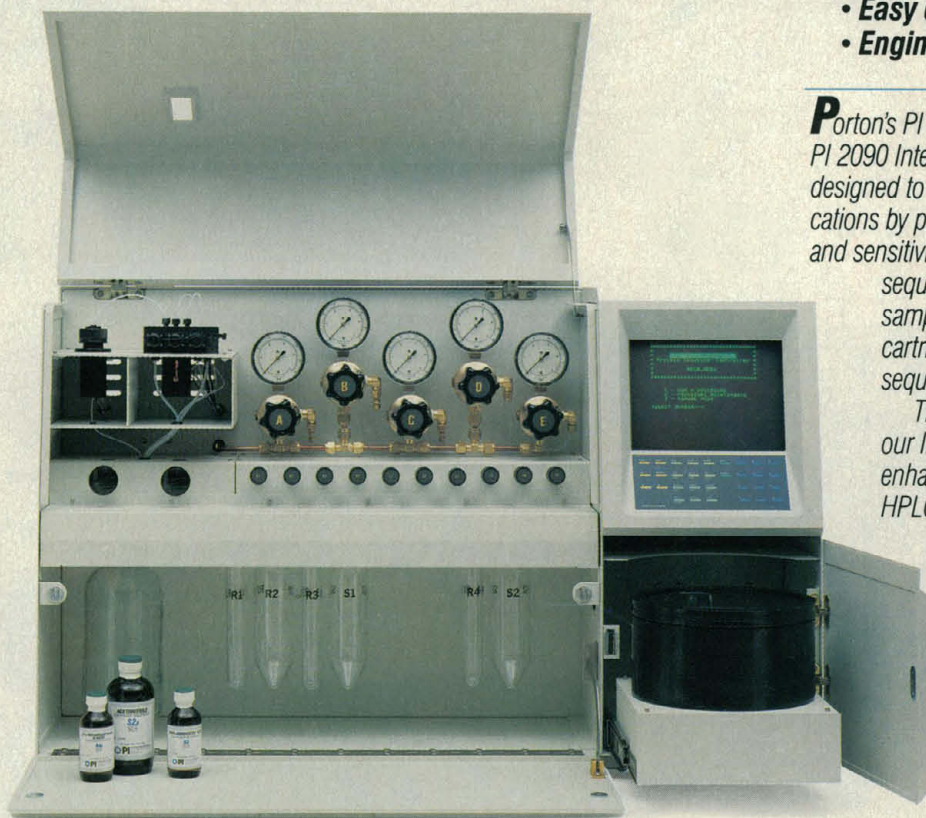
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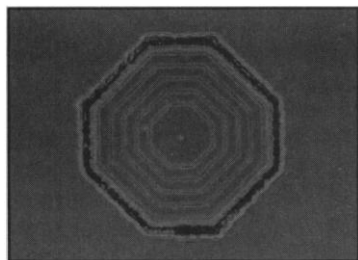
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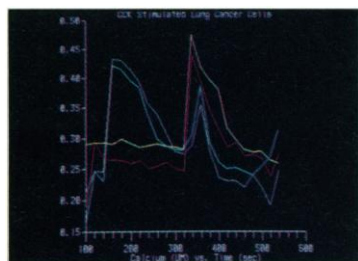
CHO cell isolated by "Cookie Cutter" technique. (Courtesy of Dr. Margaret Wade, Meridian Instruments)

Reason #2 Quantitative Fluorescence Measurements

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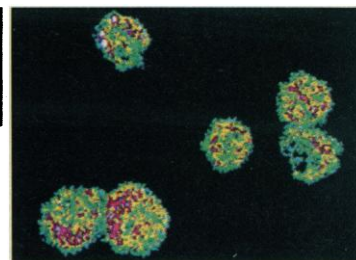


Cholecystokinin induced increase in intracellular calcium levels in human small cell lung cancer cells. Only 2 cells responded to cholecystokinin, whereas all 4 cells responded to carbachol as evidenced by the later peaks. (Courtesy of Dr. Ronald Barrett, Abbott Laboratories.)

Reason #3 Sensitive Fluorescence Measurements

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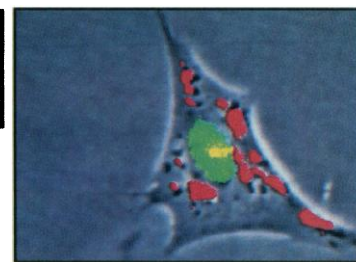


Detection of 30-60 copies of ABL mRNA by in situ hybridization in the leukemia cell line, K562. (Courtesy of Dr. Joel Bresser, M.D. Anderson Hospital.)

Reason #4 Versatile Integrated Instrumentation

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Overlay of phase contrast and two fluorescence images of a 3T3 cell labeled with acridine orange (Green: nucleus; Red: lysosomes). (Courtesy of Dr. Margaret Wade, Meridian Instruments.)

Reason #5 Exceptional Technical Support

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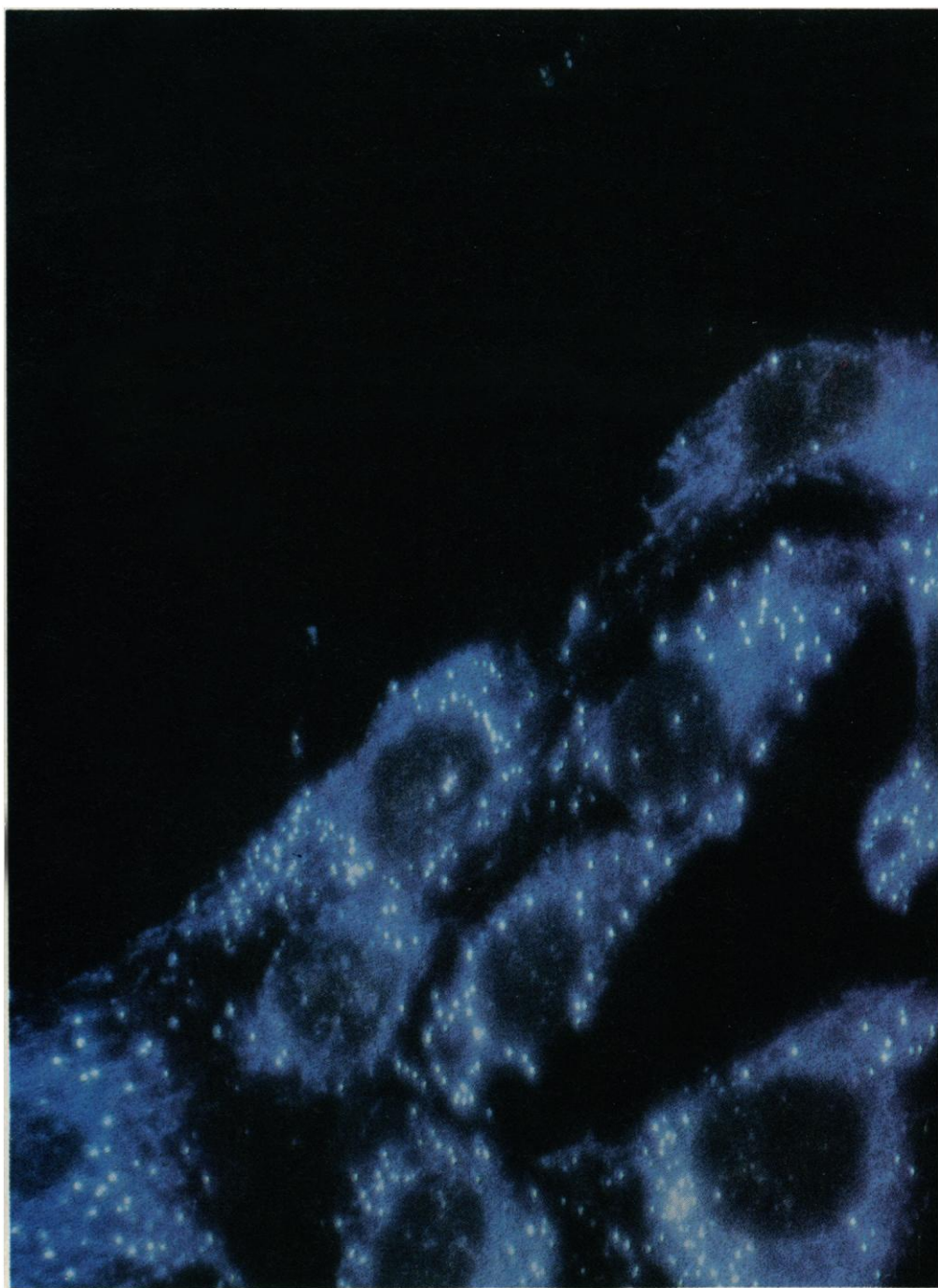
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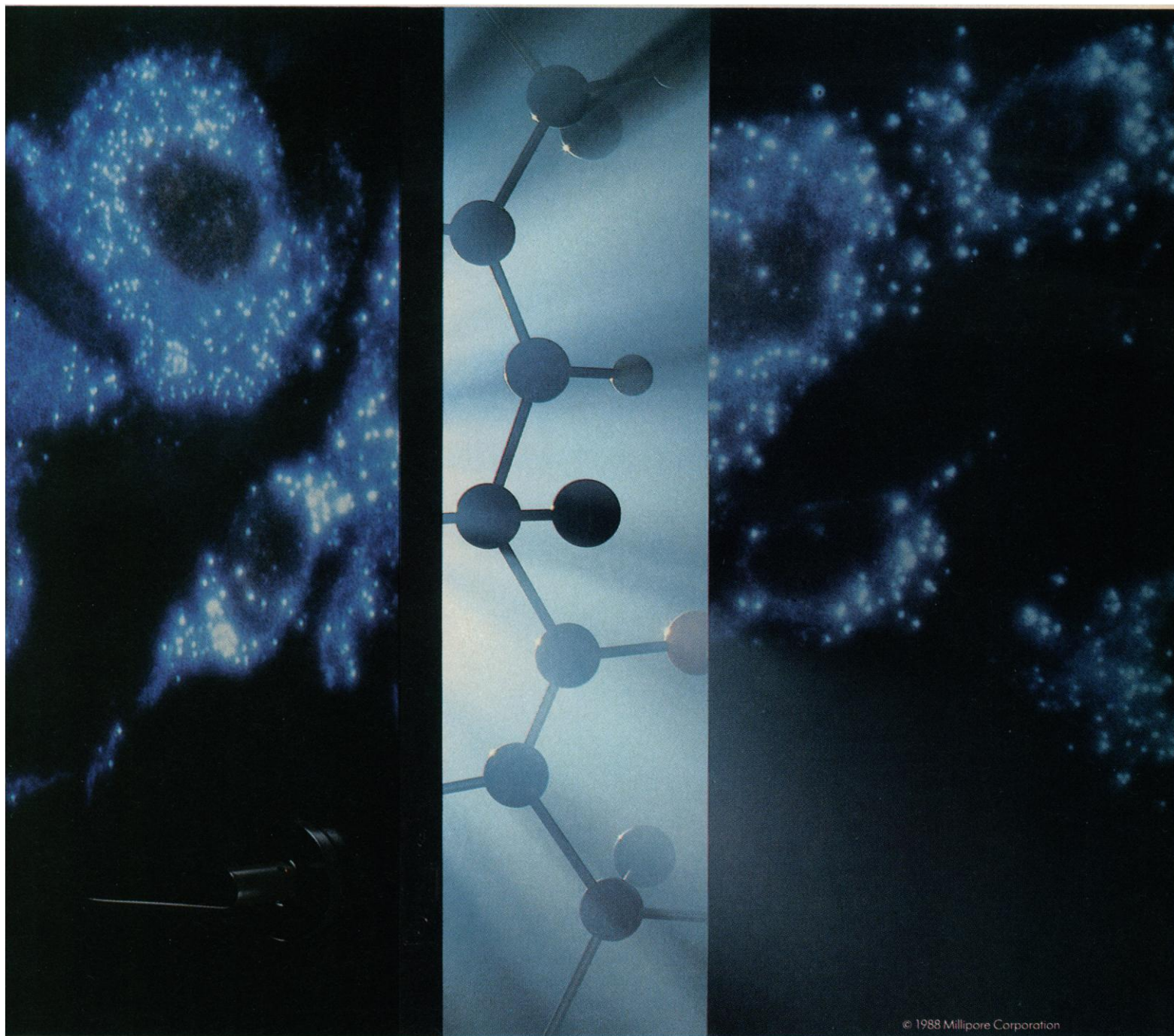


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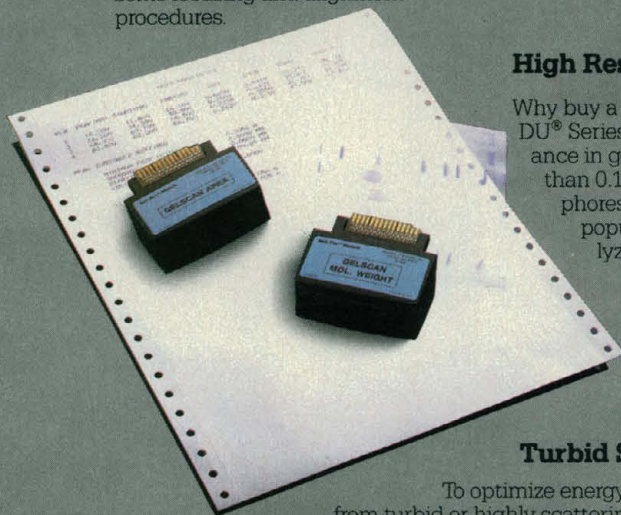
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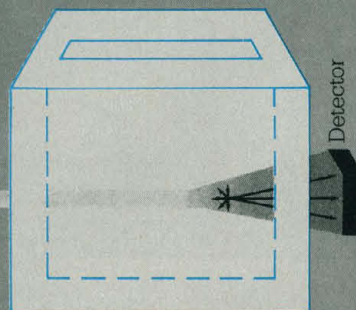


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2.0000	0.0460	0.4560	0.8760	0.4940	2.0244	7.7611	37.447
3.0000	0.0460	0.4620	0.8930	0.4912	2.0361	4.1989	38.300

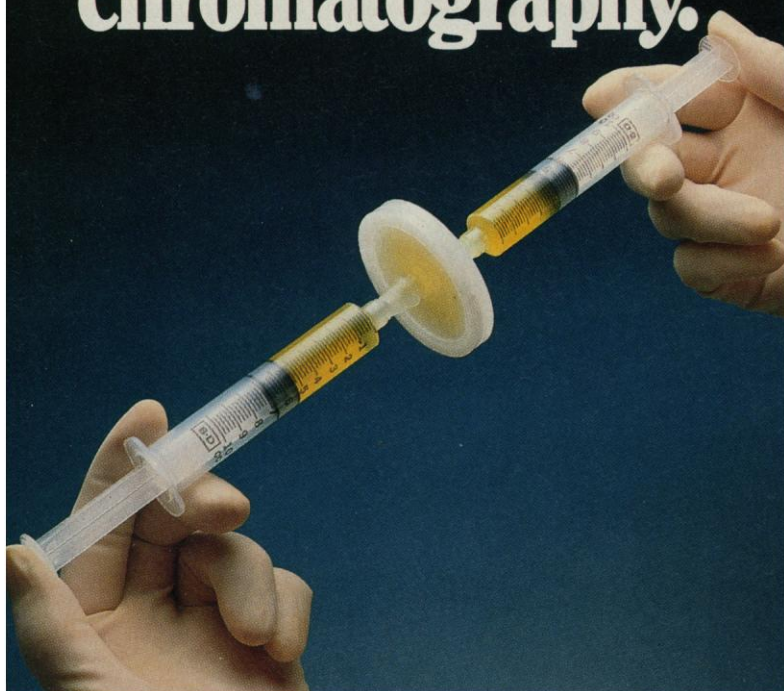
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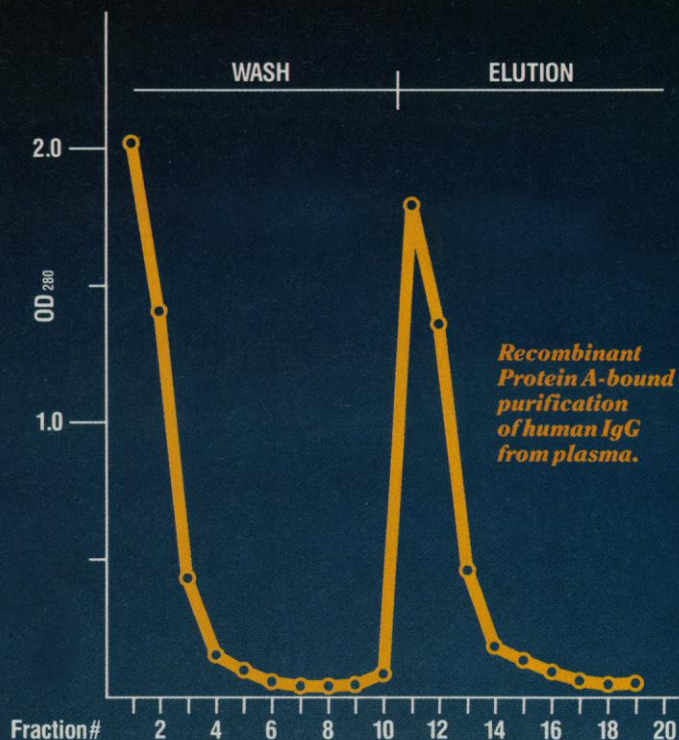
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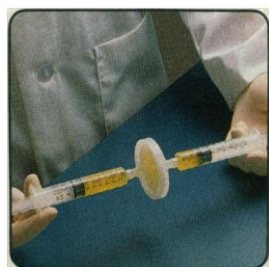
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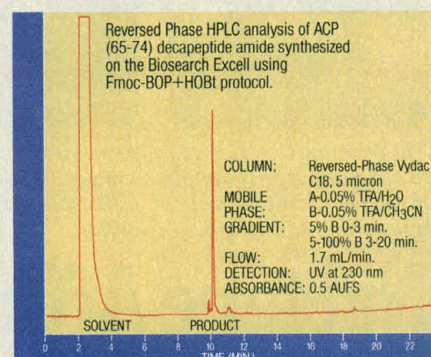
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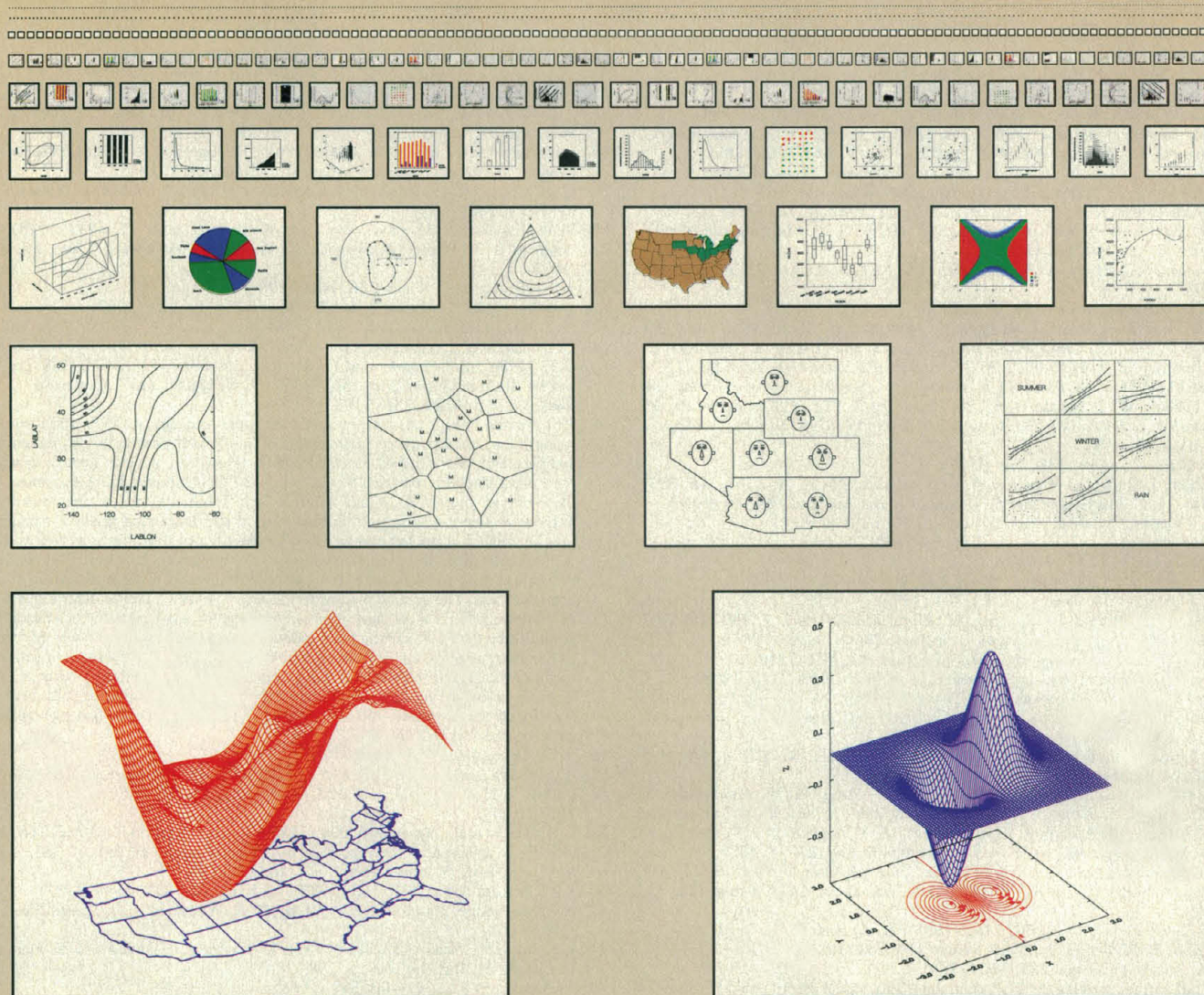
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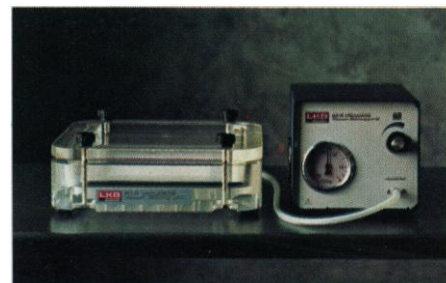
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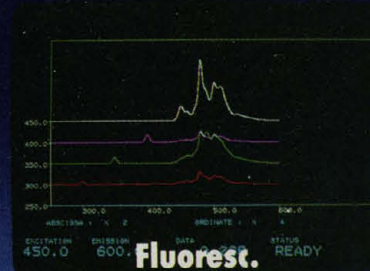
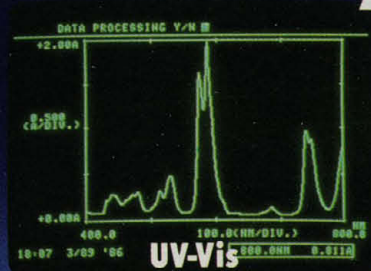
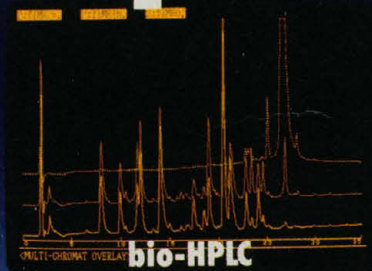
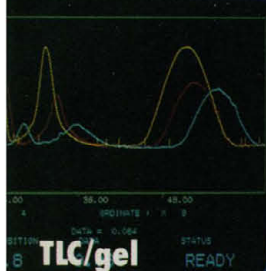
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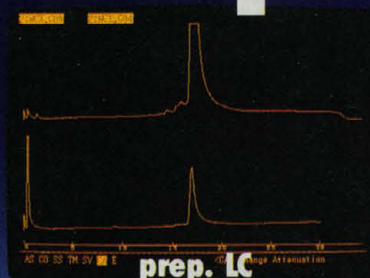
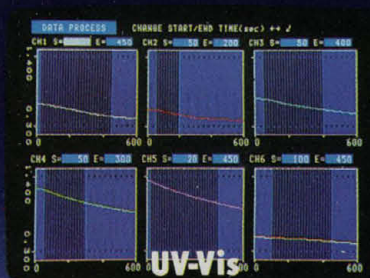
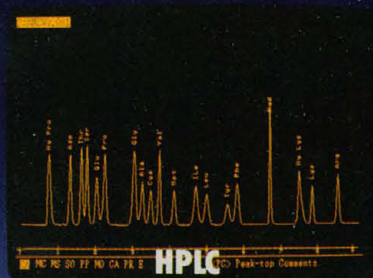
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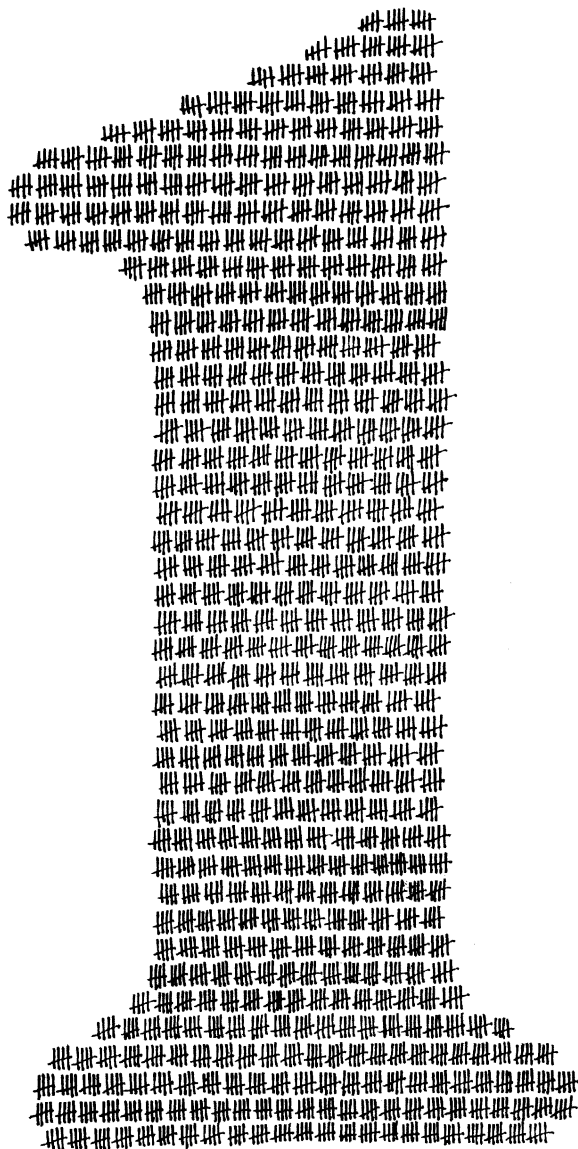
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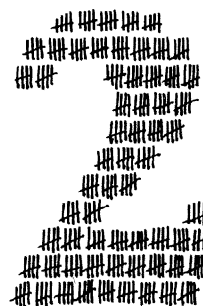
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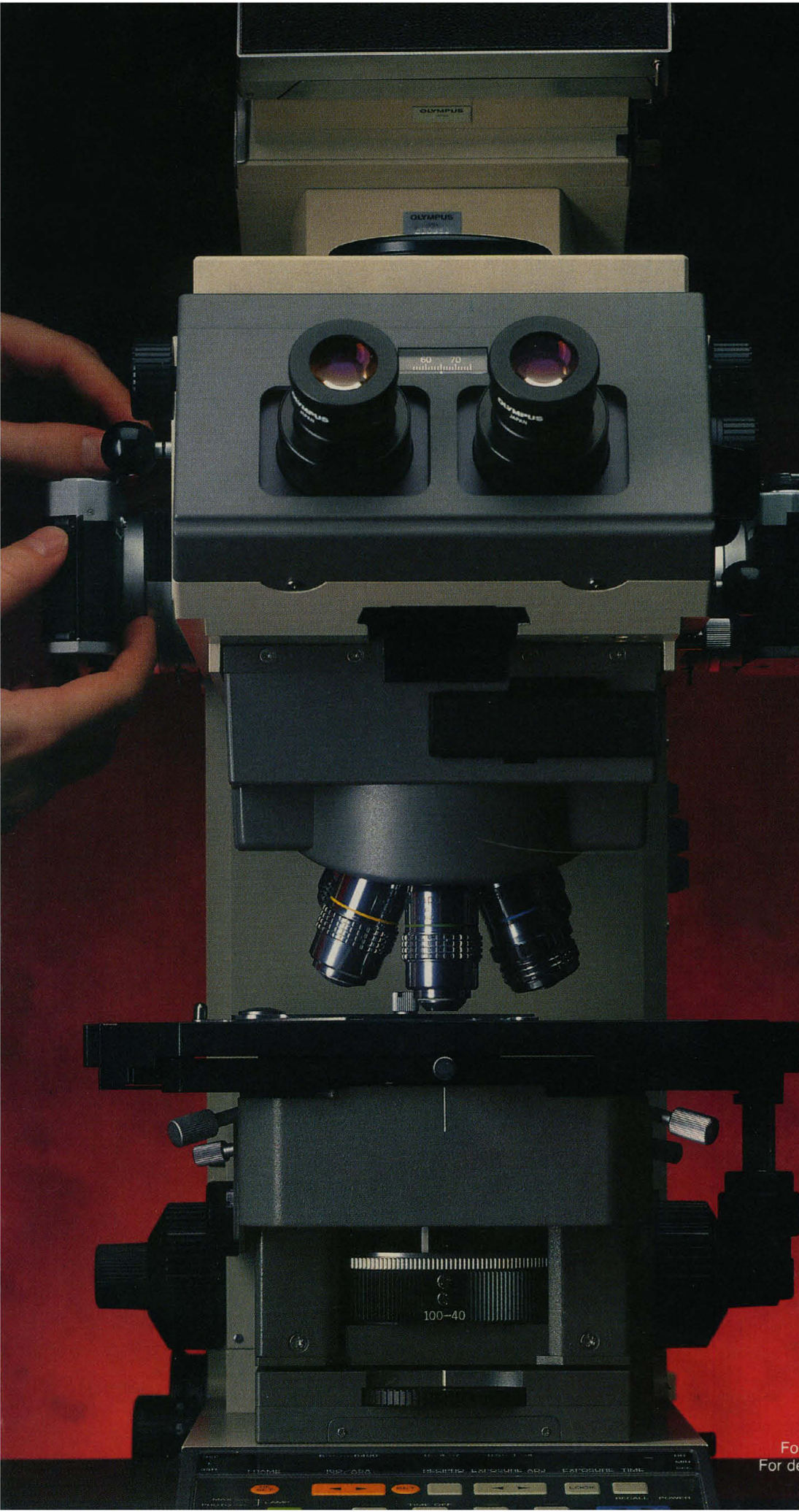
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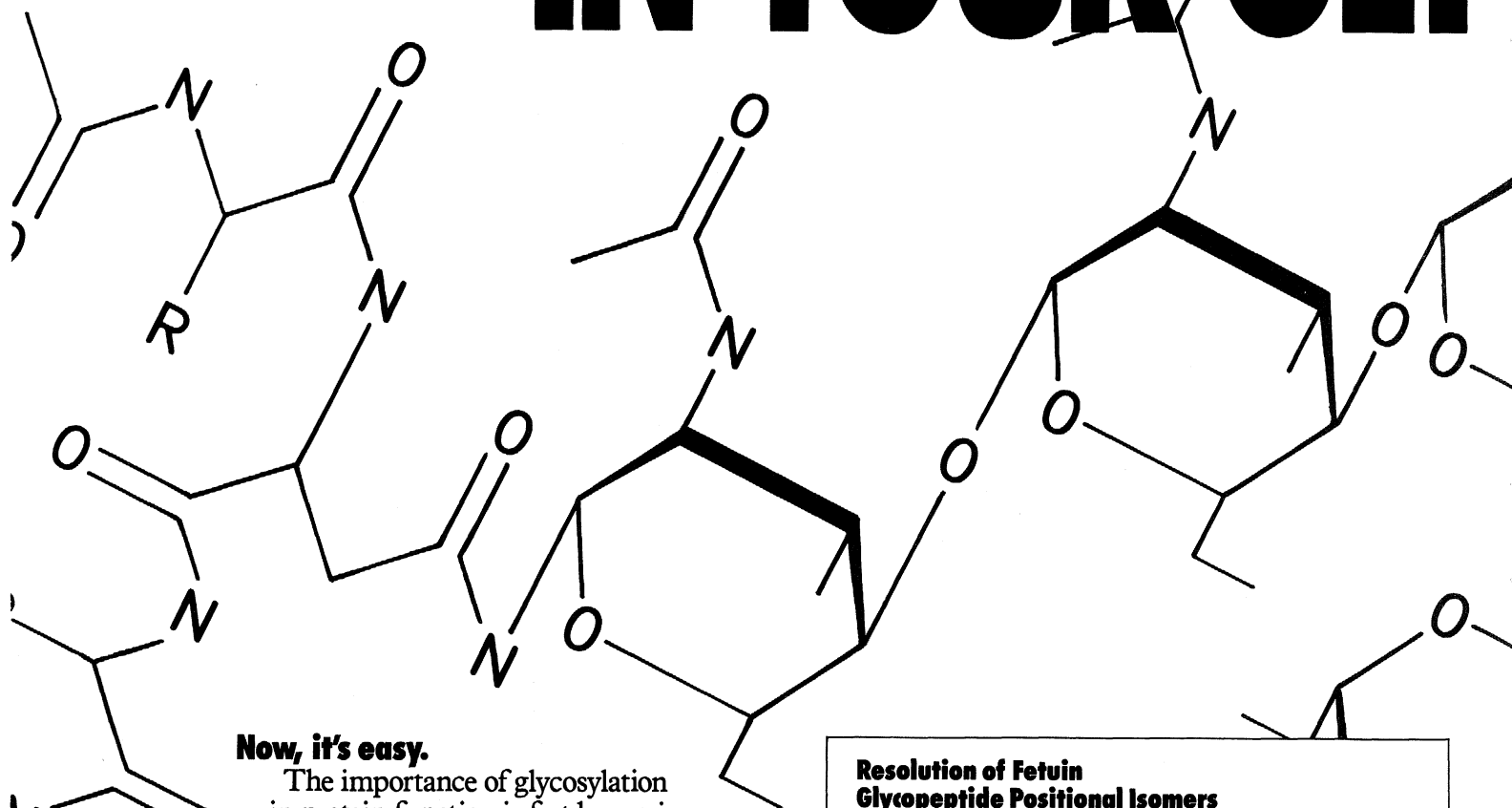
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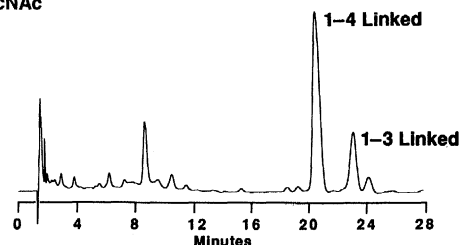
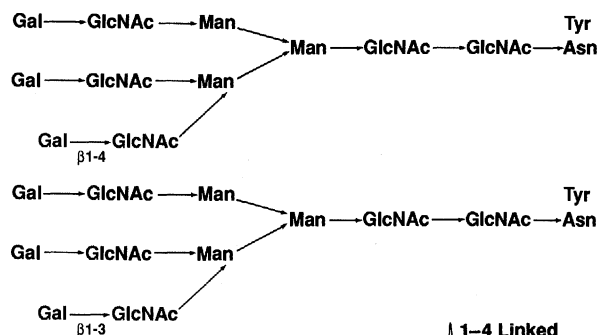
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Sample Courtesy of Dr. R. Townsend, Biology Dept.,
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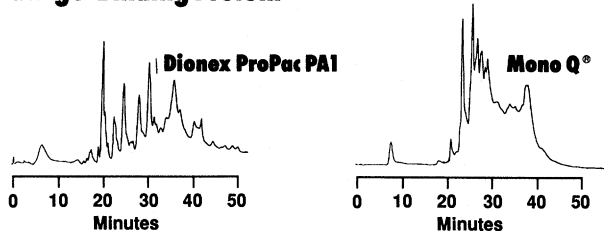
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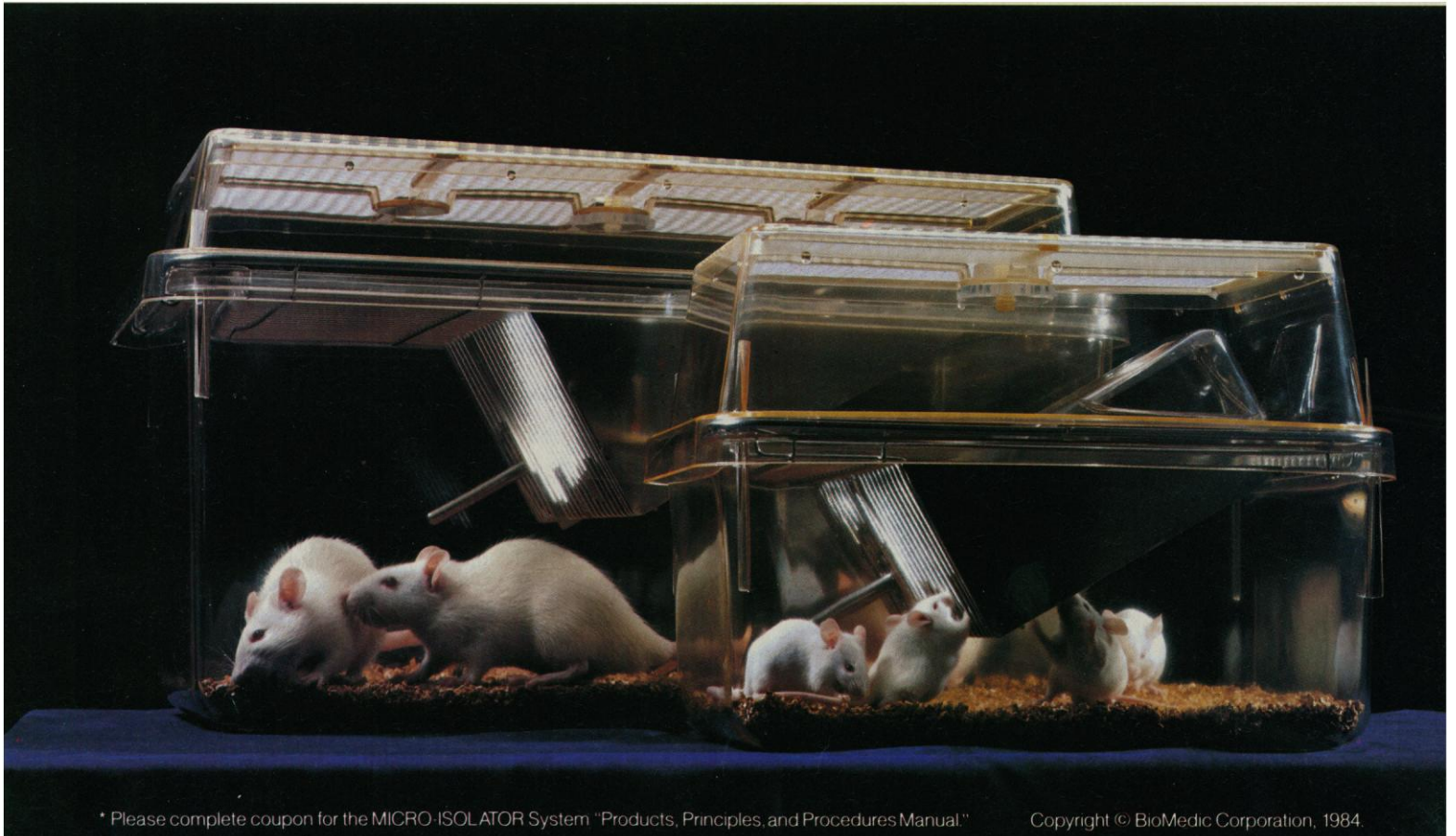
all manipulations are conducted in a Class 100 workbench, individuals allergic to animals are protected from dander and therefore are able to work in comfort.

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.

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Brain Structure, Learning, and Memory

Edited by Joel L. Davis and Robert W. Newburgh, *Office of Naval Research*, and Edward J. Wegman, *George Mason University*

This new book, based on a AAAS Annual Meeting symposium, explores the connections between cellular and computational approaches to understanding the neural basis of learning and memory. Incorporating such diverse ideas as invertebrate and computer-based models, cerebellar involvement in motor engrams, learning, and the sensory sciences; nonstationary point processes; and models closely tied to vertebrate neural nets, the contributors not only shed new light on important brain functions but also provide an example of how neuroscience research should be structured.

\$35.00; AAAS members \$28.00 (include membership number from *Science*). 301 pp., 1988. AAAS Selected Symposium 105.

Order from: Westview Press, Dept. AAAS, 5500 Central Avenue, Boulder, CO 80301. (Add \$2.50 postage and handling for the first copy, 75 cents for each additional copy; allow 4-6 weeks for delivery.)

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Work Experience and Psychological Development Through the Life Span

Edited by Jeylan T. Mortimer, *University of Minnesota*, and Kathryn M. Borman, *University of Cincinnati*

Only recently have researchers begun to explore the relationship between occupational conditions and psychological development during different phases of life. This book examines a wide range of related issues, including part-time work for adolescents; adjustment of young adults to new work roles; occupational self-direction among different age groups; job satisfaction, age, and gender; women's dual roles at home and at work; loss of "vitality" among midcareer and older workers; and self-concept and job-related disabilities.

\$29.95; AAAS members \$23.96 (include membership number from *Science*). 306 pp., 1987. AAAS Selected Symposium 107.

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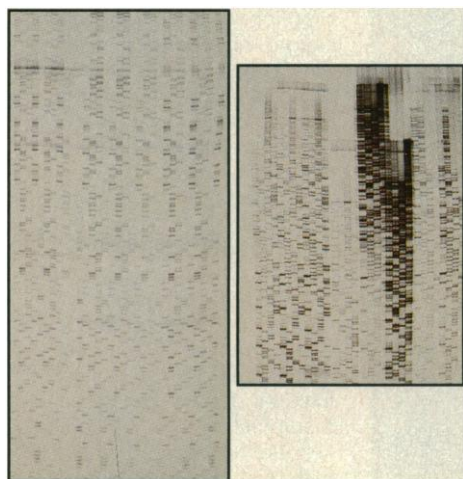
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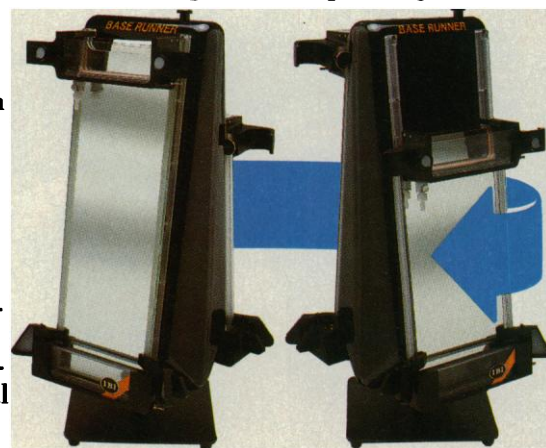
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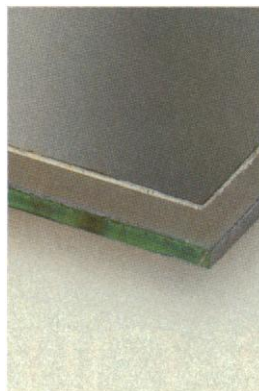
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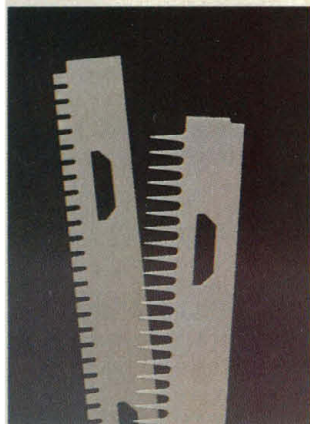
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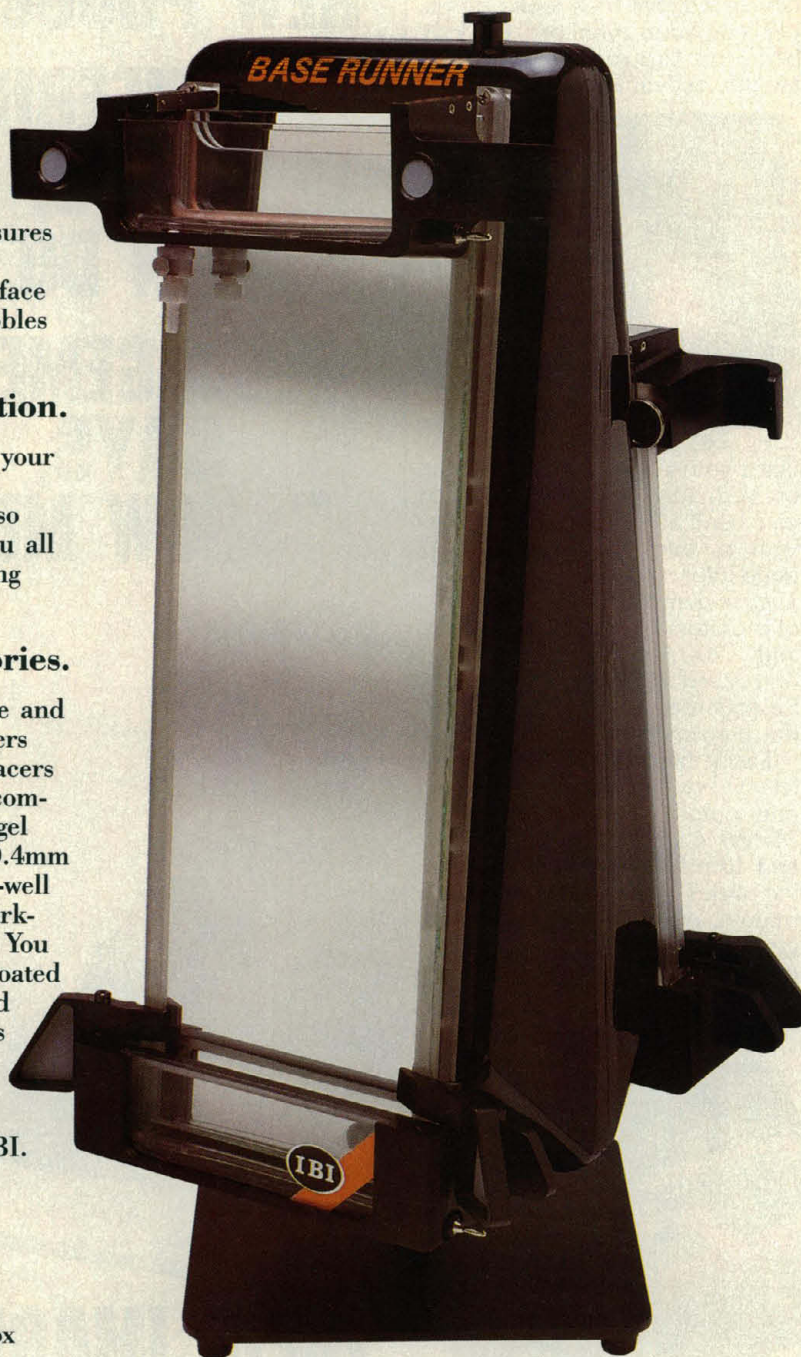
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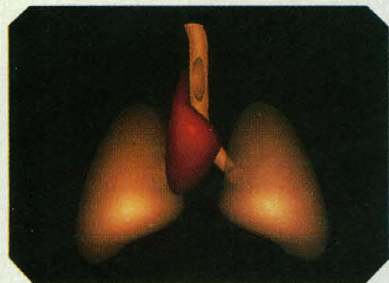


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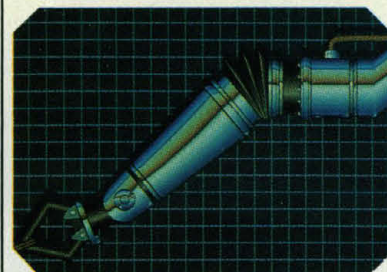
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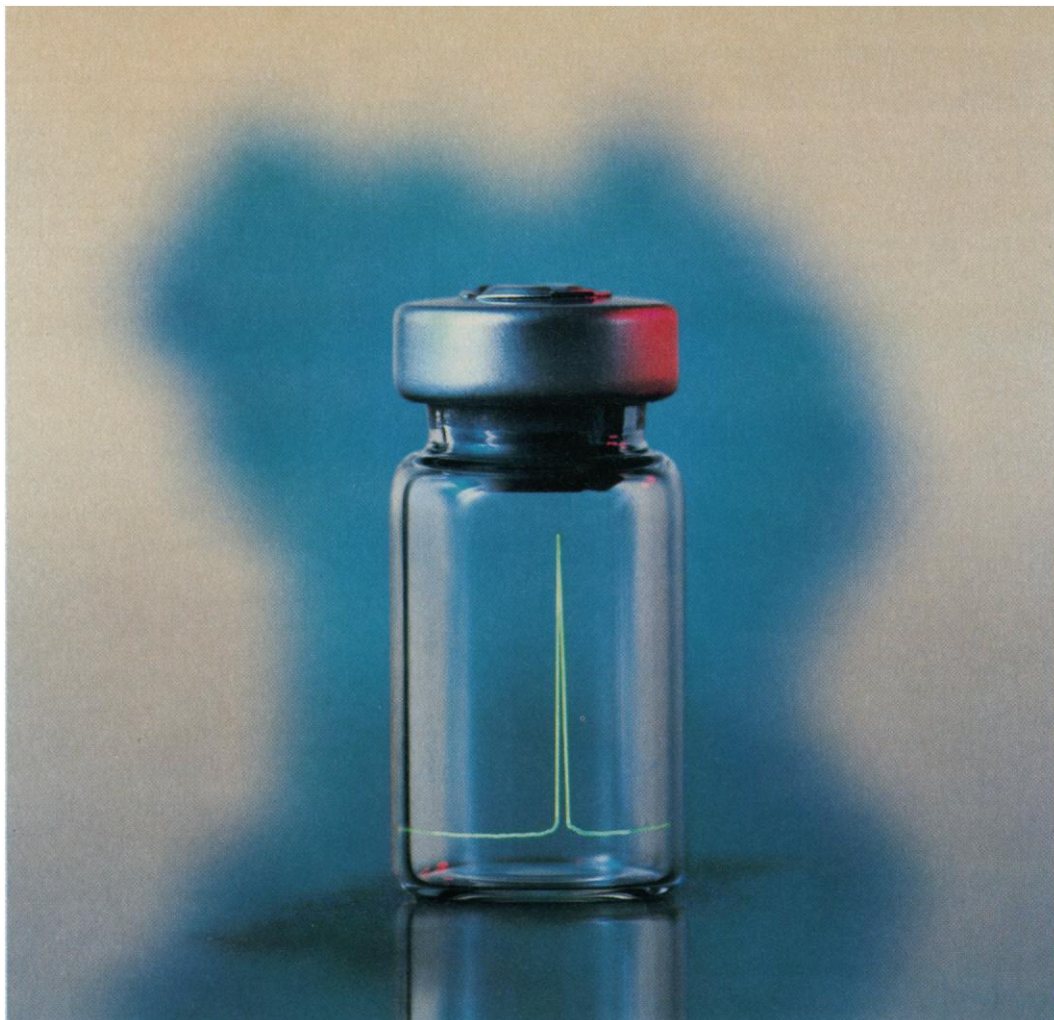
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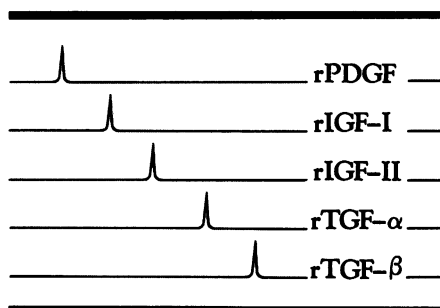
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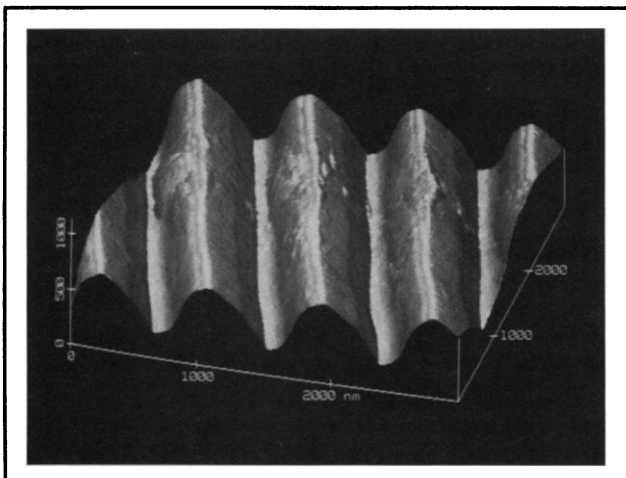
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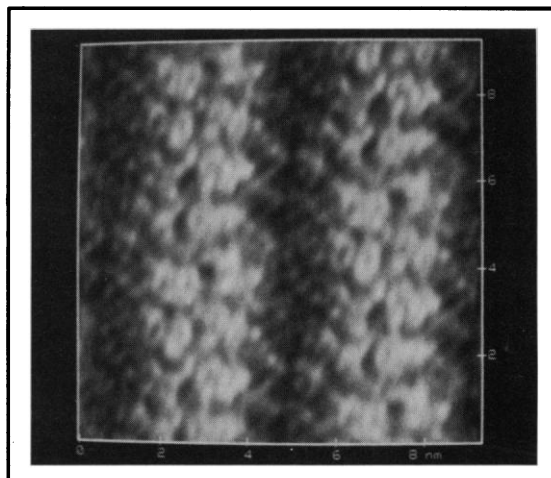
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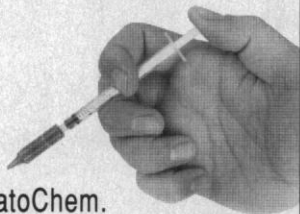
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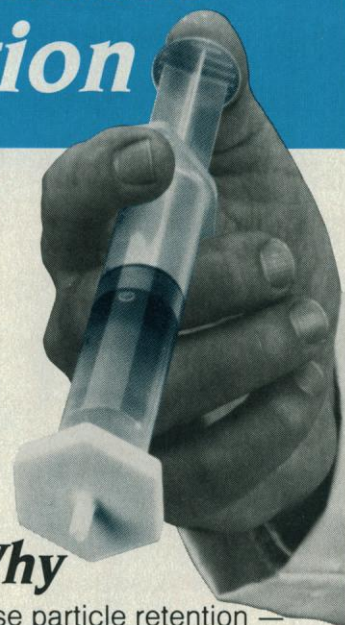
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Beijing, Republic of China/April 24-26

Scientific Organization: F. Aiuti (I), Z. Zonghan (PRC) and S. Guoxian (PRC)

8th Workshop on Development and Function of the Reproductive Organs

Touraine, France/May 23-25

Scientific Organization: N. Josso (F)

1st International Congress on G.I.F.T.: from Basics to Clinics

Rapallo, Italy/June 8-10

Scientific Organization: R.H. Asch (USA) and L. De Cecco (I)

Membrane Technology in Clinical Pathology, Biochemistry and Pharmacology

L'Aquila, Italy/June 19-23

Scientific Organization: R. Verna (I), R.P. Blumenthal (USA), J.A. Hannover (USA) and R.P. Garay (F)

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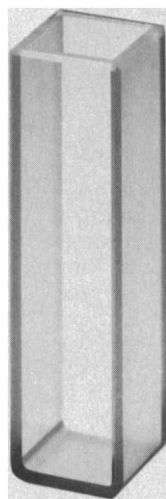
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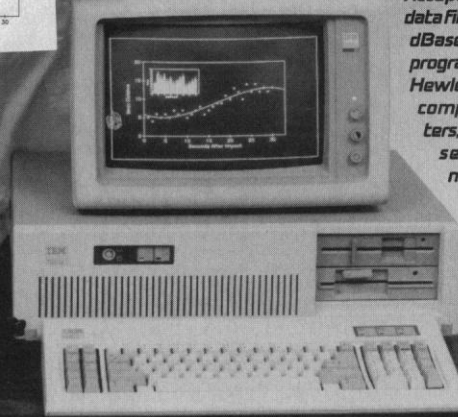
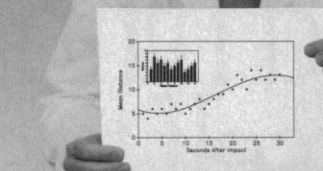
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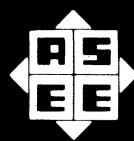
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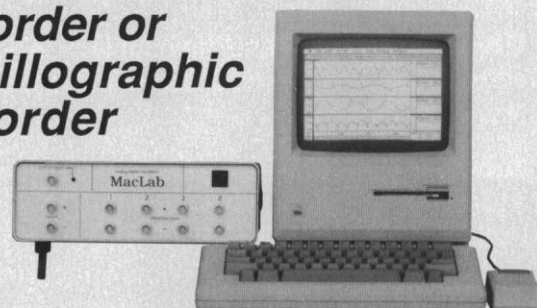
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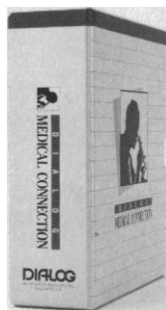
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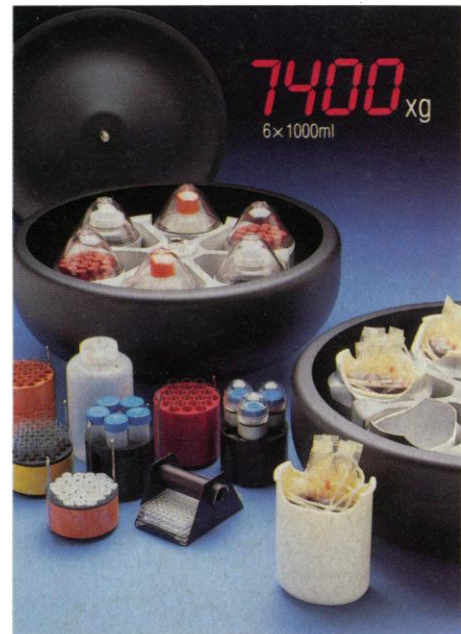
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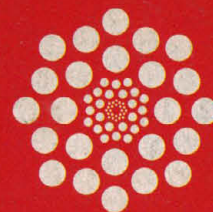
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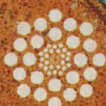
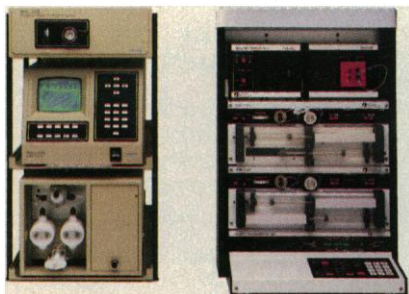


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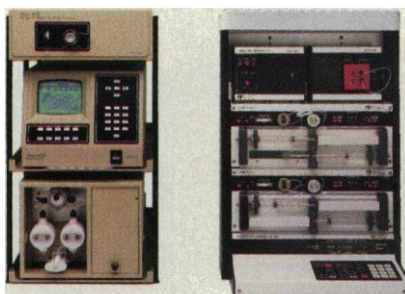
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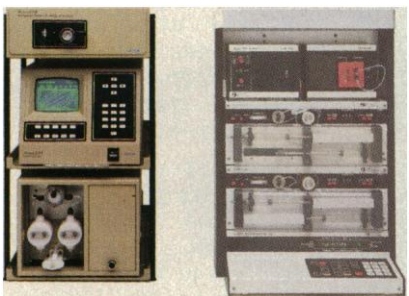
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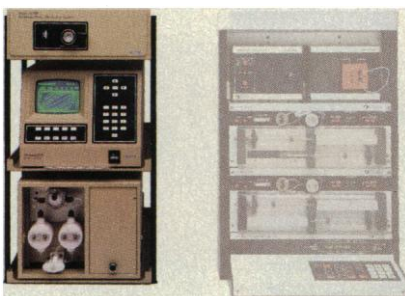
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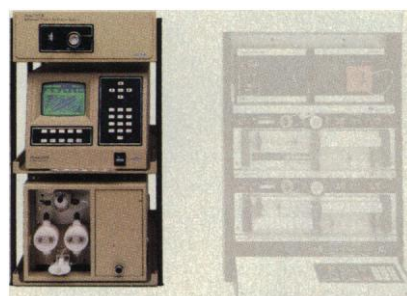
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homemakers are married (a possibility not specified in the models). Despite the repeated assertion of the salience of economic factors in the first-birth process, the same model includes no variable indicating husband's income or household income, preventing the authors from testing a major economic explanation of fertility. The instability of fertility intentions over time is analyzed without indication of whether marriage in the interim is associated with changing plans about parenthood.

Though the matter of the role of marriage in the timing of parenthood is troublesome, there is no doubt that this book provides a dramatic point of departure for future demographic studies of fertility. Its analytic framework will be widely adopted, and the authors' mastery of demographic data and methods provides a standard that other fertility researchers would do well to emulate.

DENNIS P. HOGAN

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Population Issues Research Center,
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Allegiances in Education

Ed School. A Brief for Professional Education. GERALDINE JONCHICH CLIFFORD and JAMES W. GUTHRIE. University of Chicago Press, Chicago, 1988. xii, 413 pp. \$24.95.

This provocative book by two professors of education at the University of California at Berkeley argues that "schools of education, particularly those located on the campuses of prestigious research universities, have become ensnared improvidently in the academic and political cultures of their institutions and have neglected their professional allegiances" (p. 3). By seeking status through the academic disciplines, schools of education in the research universities have lost a sense of purpose. They "have seldom succeeded in satisfying the scholarly norms of their campus letters and science colleagues, and they are simultaneously estranged from their practicing professional peers" (p. 3). The more scholarly such schools become, the more distant they are from the public schools; on those few occa-

sions where they have made systematic efforts to address the problems of the public schools, they have been placed at risk on their research-dominated campuses.

The authors make their case largely through integrated histories and case examples drawn from ten schools of education in elite, graduate-oriented research universities—including Harvard, Stanford, Yale, Michigan, Duke, Chicago, and Columbia—during the 20th century, showing how these schools became the model type toward which other institutions gravitated. Their affiliation with elite universities, the emphasis on the scientific principles of education to be discovered by researchers, and the prominence given to preparing educational leaders (defined primarily as administrators and professors of education) increased their status at the expense of normal schools and state teachers' colleges. Yet on their own campuses these same schools of education were second-class citizens.

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5. H. Omura, T.
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egies" (p. 332) of appeasement and accommodation, including the appointment of discipline-oriented scholars with little interest in the practical problems of schools, the exaltation of the Ph.D. degree over the more clinical and applied Ed.D. degree, and the emphasis on social science educational policy research rather than on the problems facing the predominantly female teaching force. Imitative rather than initiative, the accommodations served only to confirm the second-class status of schools of education, which were tolerated on their campuses only because they allowed universities to show concern for education and because their students brought tuition income.

Clifford and Guthrie believe that schools of education can improve themselves through a commitment to professional education rooted in the practical problems that confront teachers. In keeping with the thrust of recent reports on the teaching profession, they believe that the undergraduate education major should be eliminated and that national professional standards for entering teaching should be established. But their essential recommendation is more fundamental: "Schools of education must take the profession of education, not academia, as their main point of reference" (p. 349). One consequence of this is the recommendation that the Ph.D. degree in education be abandoned in favor of an Ed.D. degree that includes "knowledge of and appreciation for academic research" but is not "oriented primarily toward academic inquiry" (p. 358).

Ed School is a powerfully argued case against almost every major trend in education schools for more than 50 years. As such, it should be a center of discussion for those inside and outside education schools. But powerfully argued as it is, *Ed School* is deeply flawed. Clifford and Guthrie appear to have been much affected by the near closing of the school of education at Berkeley (in the saving of which they were active players). They imply that the arts and sciences disciplines were at the heart of the problem at Berkeley, that the education school tried to be too much like those disciplines and was treated contemptuously for the effort. That is only one reading of what occurred at Berkeley, and it distorts Clifford and Guthrie's reading of schools of education more broadly. Their call for a more extensive research agenda rooted in educational practice is right on target; their positing of academic research as the enemy is not. Schools of education need the tension of multiple points of view and the stimulus of scholarly dialogue, and it is essential that scholars in education schools partake in the research mission of their university colleagues. Clifford and Guthrie depreciate the

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