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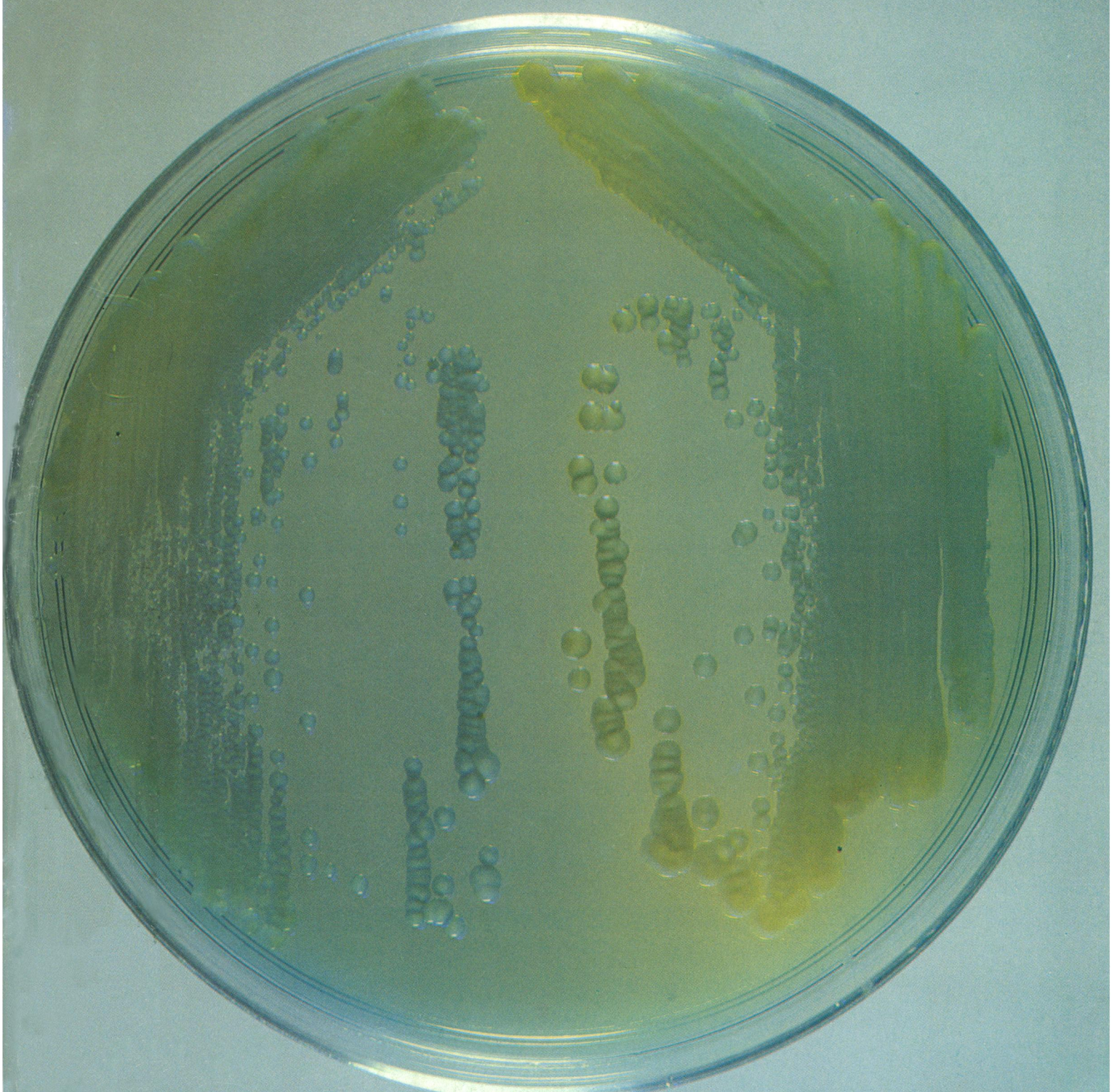

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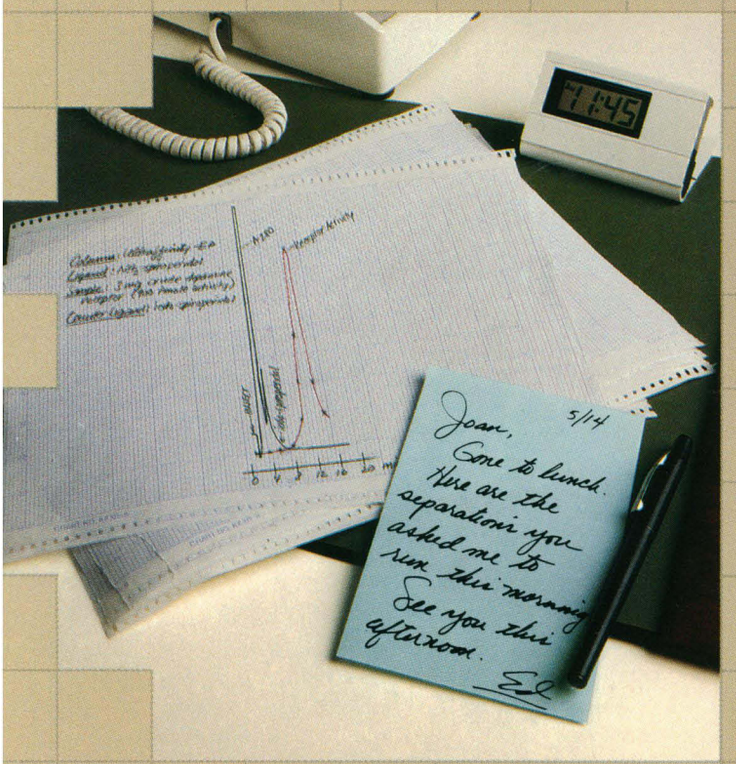

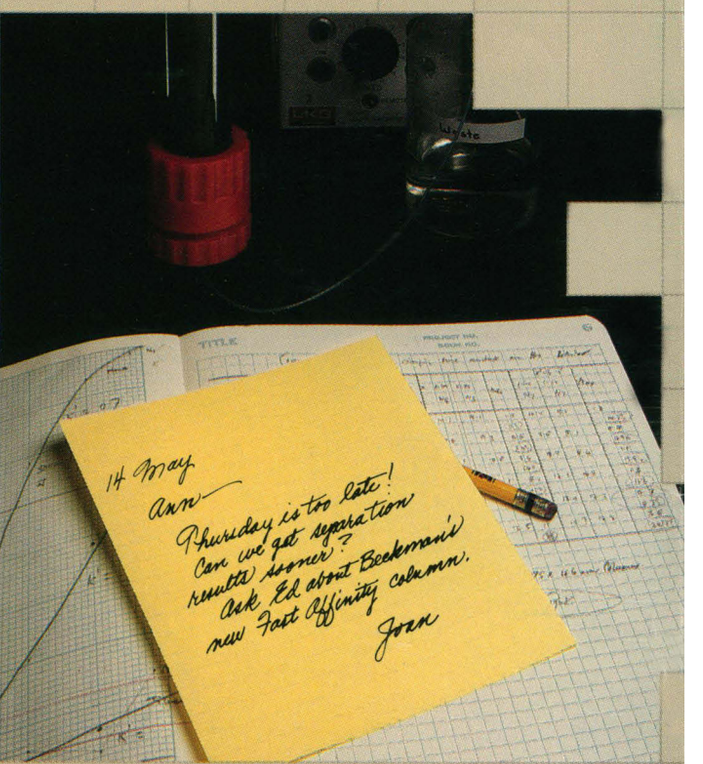

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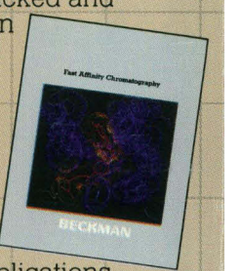

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COVER

Autoregulation of yeast copperthionein gene. Yeast cells were grown on a bromthymol blue galactose indicator plate on which positive cells are yellow and negative cells are white. Both strains contain an episomal fusion gene in which yeast copperthionein regulatory sequences drive the expression of bacterial galactokinase. The cells to the left contain multiple copies of the chromosomal structural gene for copperthionein and are galactose-negative. The cells to the right lack an intact copperthionein gene and are galactose-positive due to increased basal transcription of the fusion gene. See page 685. [Dean H. Hamer, National Institutes of Health, Bethesda, Maryland 20205]

Assembling the immunoglobulin genes

Genes for immunoglobulins are constructed from pieces of DNA scattered on the chromosome. Genetic mechanisms that might contribute to the assembly of the gene for one region of the immunoglobulin molecule (the V-J portion responsible for binding to antigens) have been analyzed in a model system (page 677). The genes for the V and J regions are made contiguous by a site-specific recombination process, and secondary genetic mechanisms may have a role in the nature of the final gene product. The genetic processes for V-J assembly may prove to be generally applicable for other antigen receptors and for other portions of the immunoglobulin molecule.

Fossil record of soft-bodied organisms

The fossil remains of a group of soft-bodied organisms that lived 400 million years ago have been discovered at a site near Milwaukee, Wisconsin (page 715). Scientists rarely get a chance to see such a collection, and it is thought that some unusual features of the local environment contributed to the preservation of these soft structures. The range of organisms represented in the collection gives an indication of the diversity of biologic forms that lived in Paleozoic times. Compound eyes were found in wormlike and arthropod specimens, and several kinds of appendages were seen on arthropods. One unusual limb suggests an adaptation for seizing prey. Such structures had previously been reported only on organisms that lived 40 million years later. A toothlike formation, probably from a conodont organism, may be only the second such specimen ever described. Although some organisms cannot yet be classified, after further analysis they may help explain gaps in the taxonomic record of Paleozoic organisms. This discovery provides new data for a 100-million-year period from which little information has been available.

Herpes simplex vaccine

Herpes simplex viruses (HSV) cause tremendous suffering. They initially infect the eyes, the lips, or, in the most well-publicized example, the genitalia; they then can travel along nerves and remain latent in the nervous system. Intermittently, they may be reactivated to cause new herpes lesions. A genetically engineered vaccine has now been prepared which successfully protects mice from lethal HSV infections and also seems to be effective in preventing the establishment of latent infections (page 737). The vaccine uses a modified vaccinia virus into which herpes DNA, coding for a herpes glycoprotein, was inserted. Under the control of a strong promoter gene of vaccinia, the HSV glycoprotein was produced and displayed on the vaccinial surface, where it proved to be immunogenic. Vaccinia was chosen for the vaccine because it is known to be a stable virus for immunization. It was the agent used for vaccination against smallpox, a disease that has now been eradicated worldwide. Because vaccinia can accommodate large amounts of foreign DNA, it may be used in the future as the carrier in a polyvalent vaccine containing immunogenic materials from many pathogens.

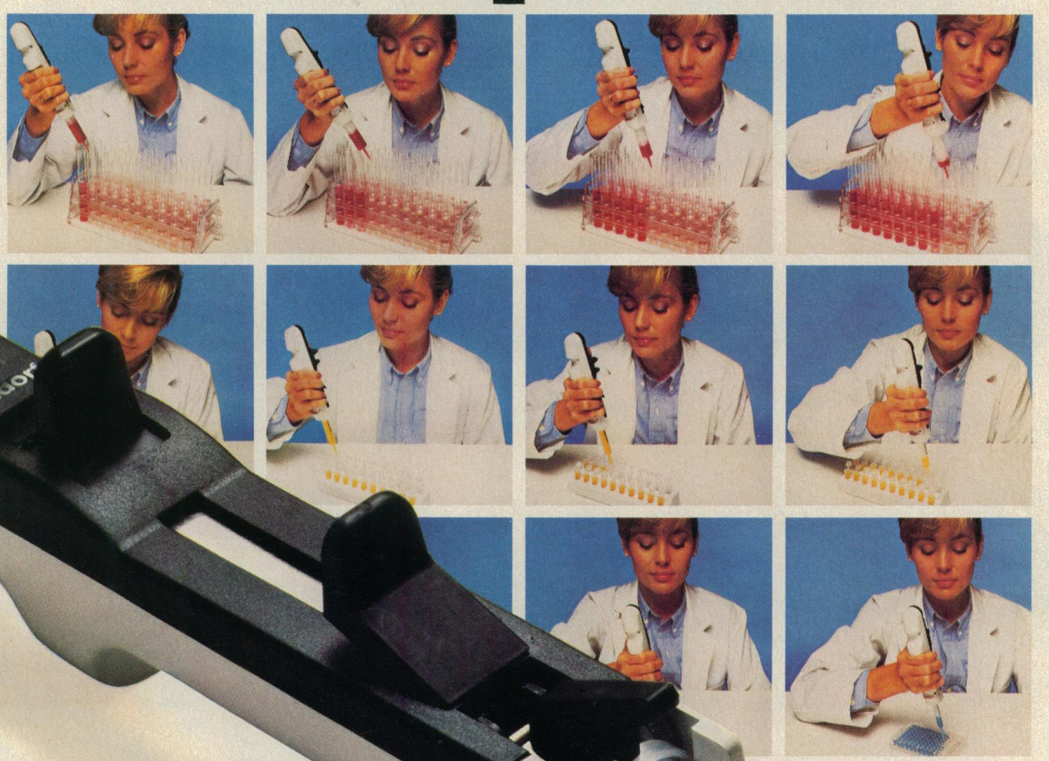
Golgi apparatus in live cells

A new technique has been developed for labeling the Golgi apparatus, permitting, at last, a study of its dynamics in the live cell (page 745). The Golgi apparatus, a netlike, membranous structure, was first seen inside cells that had been fixed and stained for light microscopic study almost 100 years ago and was later studied in detail in dried cells in the electron microscope. Since similar structures were never detectable in living cells, a slim possibility lingered that the Golgi apparatus was only an artifact. The label, a fluorescent lipid complex, tags membranous components of the cell as its lipid component is metabolized. The experimental conditions were adjusted for preferential accumulation of the label in the Golgi apparatus. With the fluorescent label, structural changes of the Golgi previously seen in cells that had been prepared for microscopy during successive stages of cell division were shown to be the same in live cells. The functions of the Golgi apparatus in assembling and transporting different kinds of molecules in the cell have been known for some time. With the fluorescent label, it may now be possible to correlate these functions with structural changes in this important cellular apparatus.

Borna virus and psychiatric disorders

Borna disease has been killing horses and sheep in Germany and Switzerland for 150 years. It is a form of encephalitis in which spasms, paralysis, and either excitability or apathy develop; sometimes it is called "crazy disease." The Borna virus from the brains of sick animals can, when injected into many kinds of experimental animals, cause neurologic and behavioral changes. Could this virus account for behavioral abnormalities in humans? Serum samples from almost 1000 psychiatric patients in the United States and Germany and from appropriate controls were tested for antibody to the Borna virus; evidence of exposure to Borna or a related virus was found in 16 patients (page 755). The clinical diagnosis common to those 16 patients was depression, and usually the depression was cyclical. The possible association of the Borna virus with human psychiatric disorders will undoubtedly stimulate research on the characterization of the virus, the identification of antibodies that can react with it, and the morphologic effects of the virus on the brain and on other parts of the nervous system.

The repeater.



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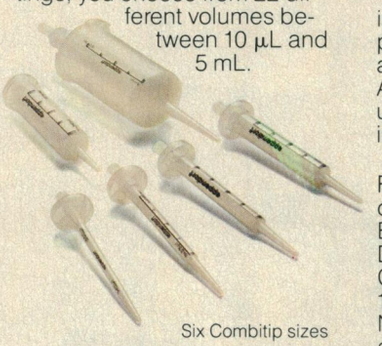

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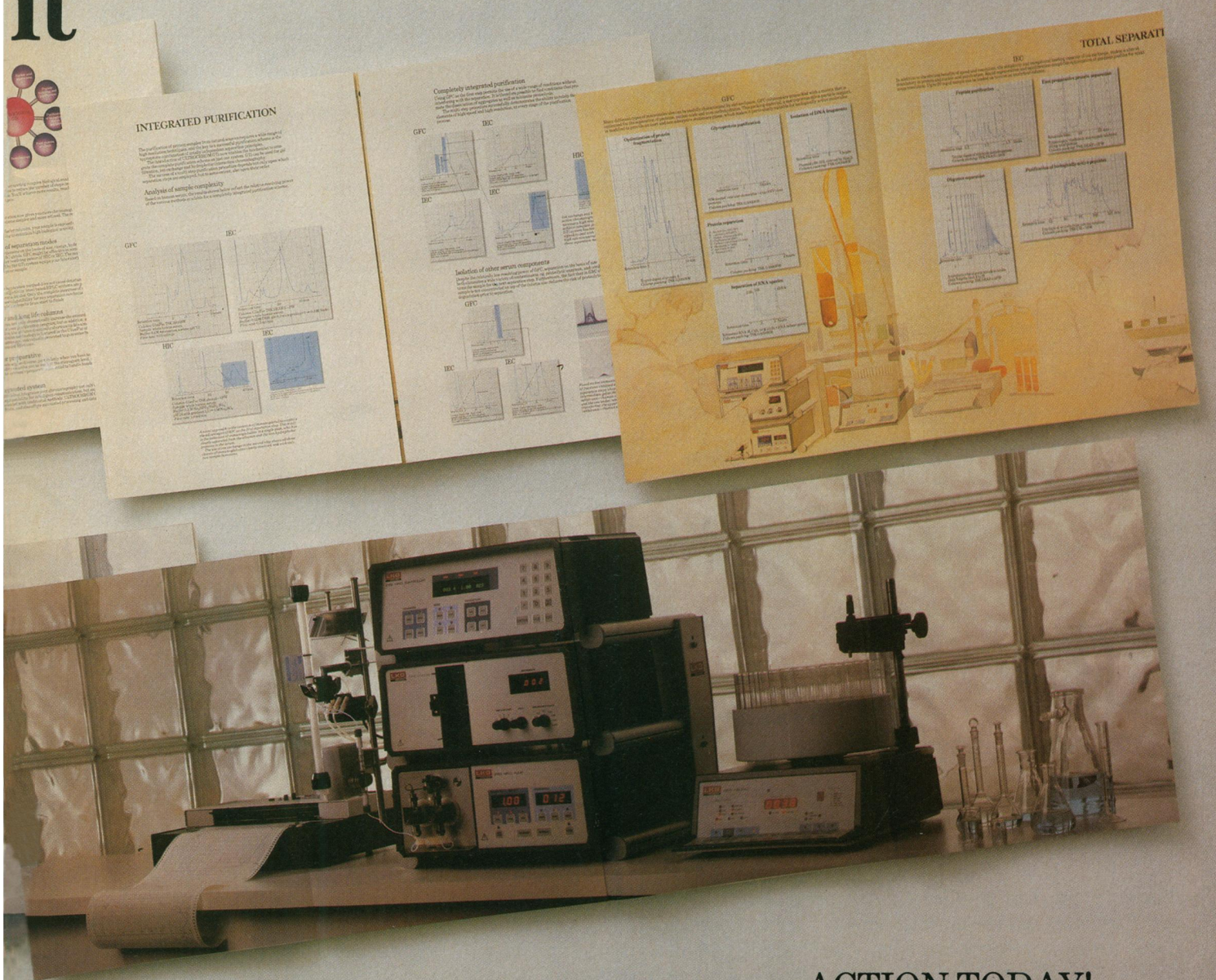

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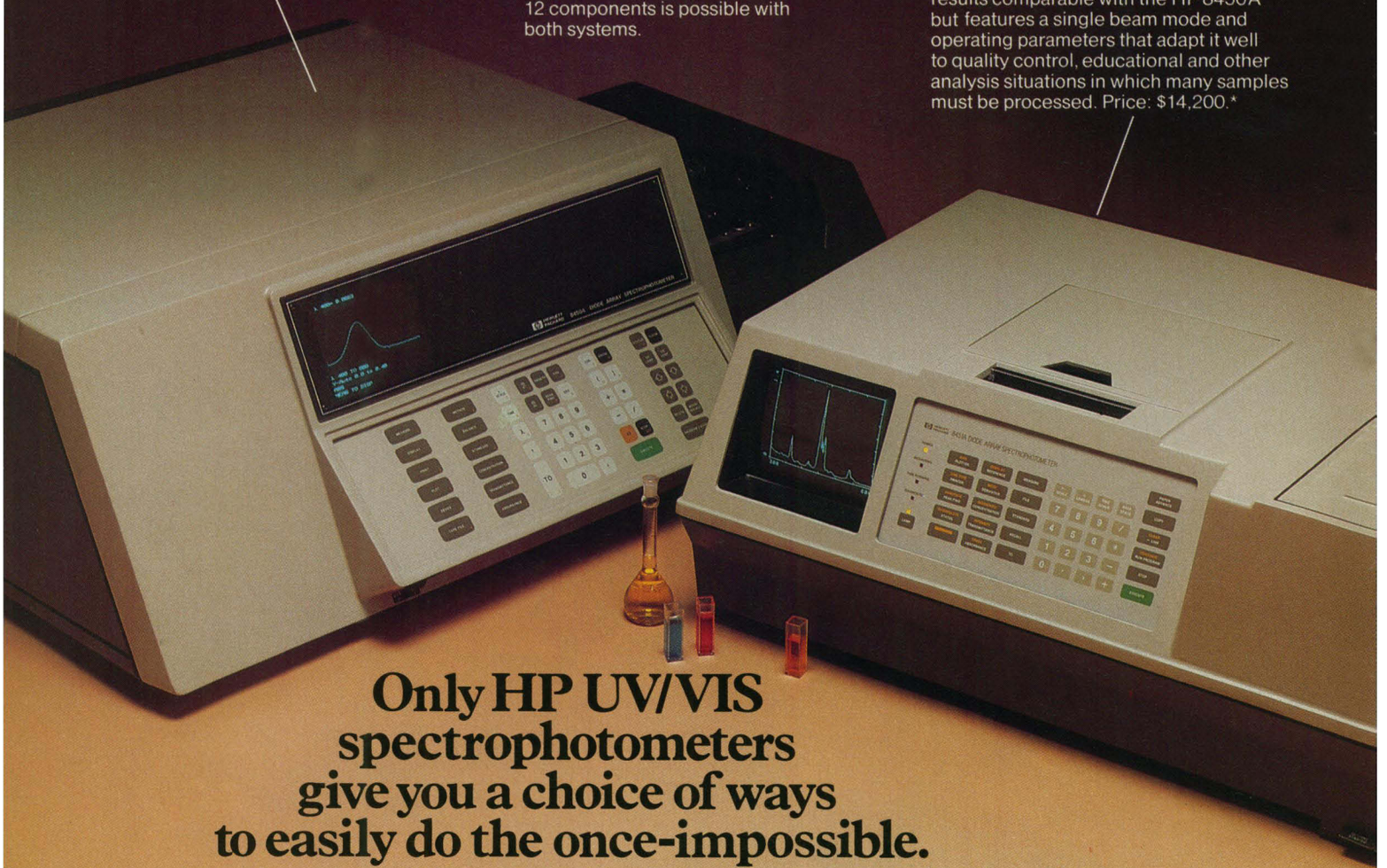

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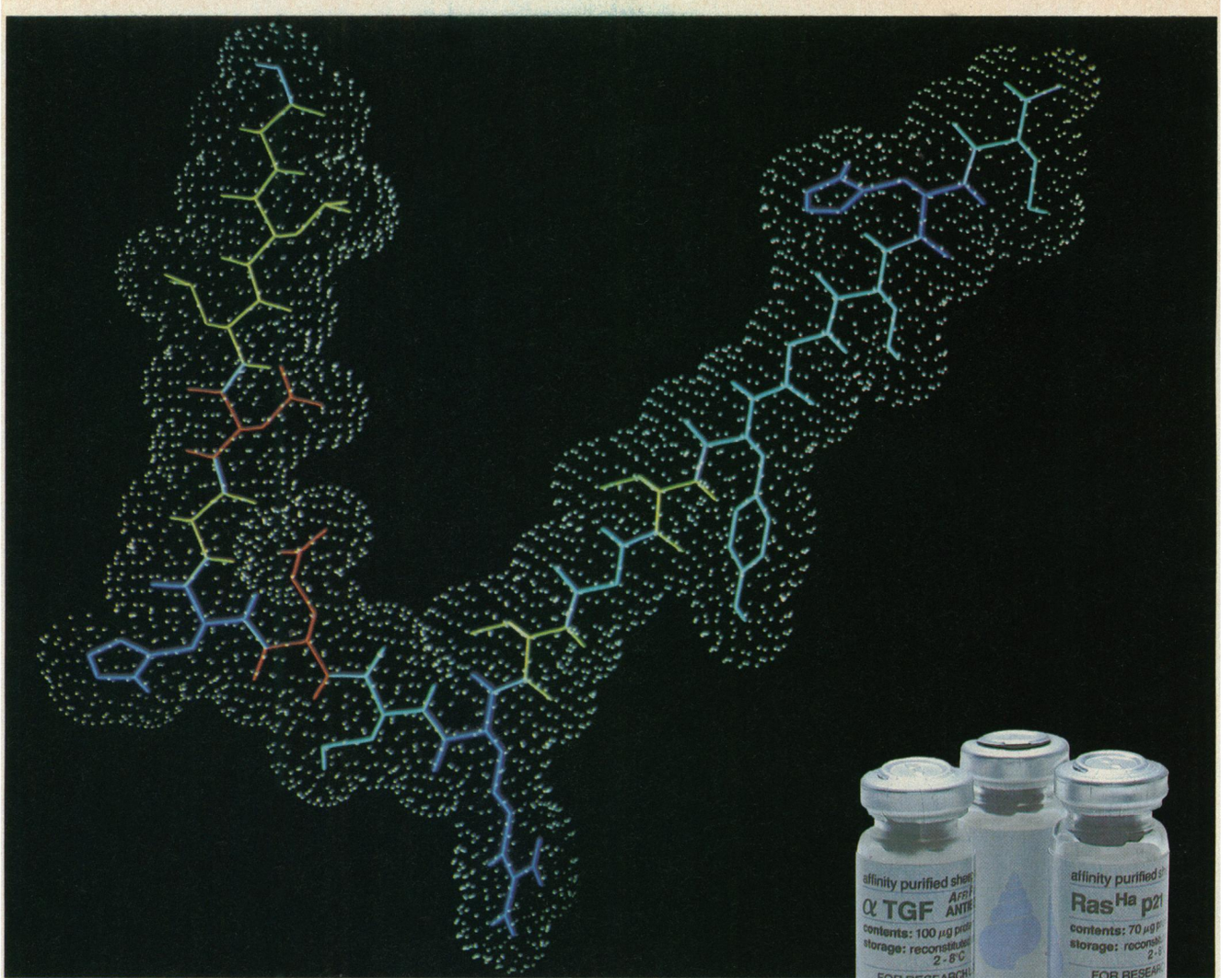

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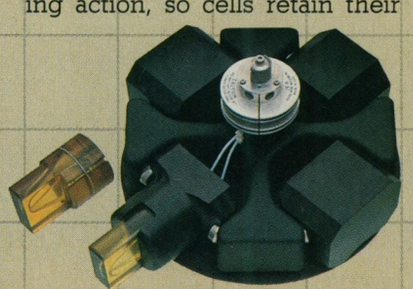

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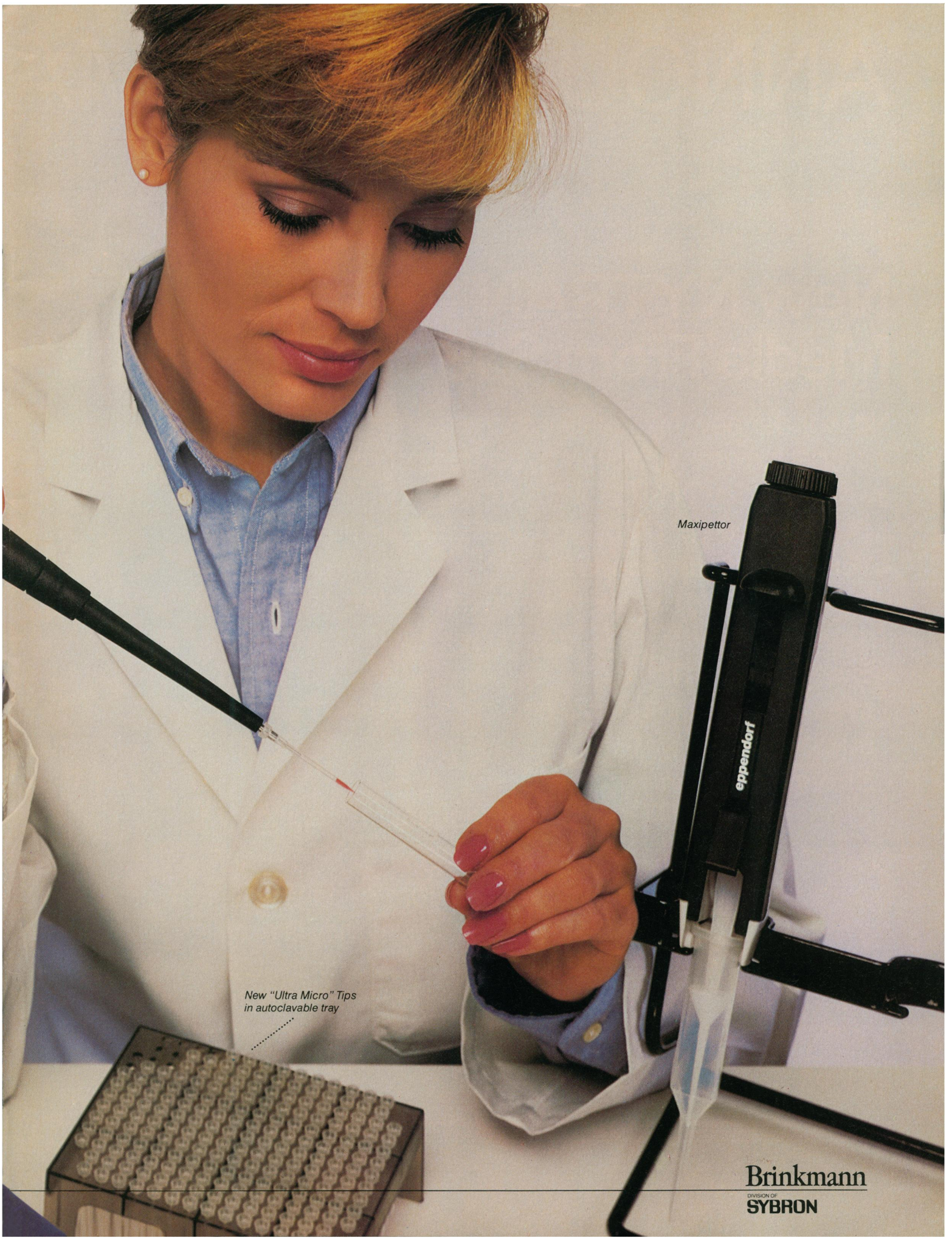

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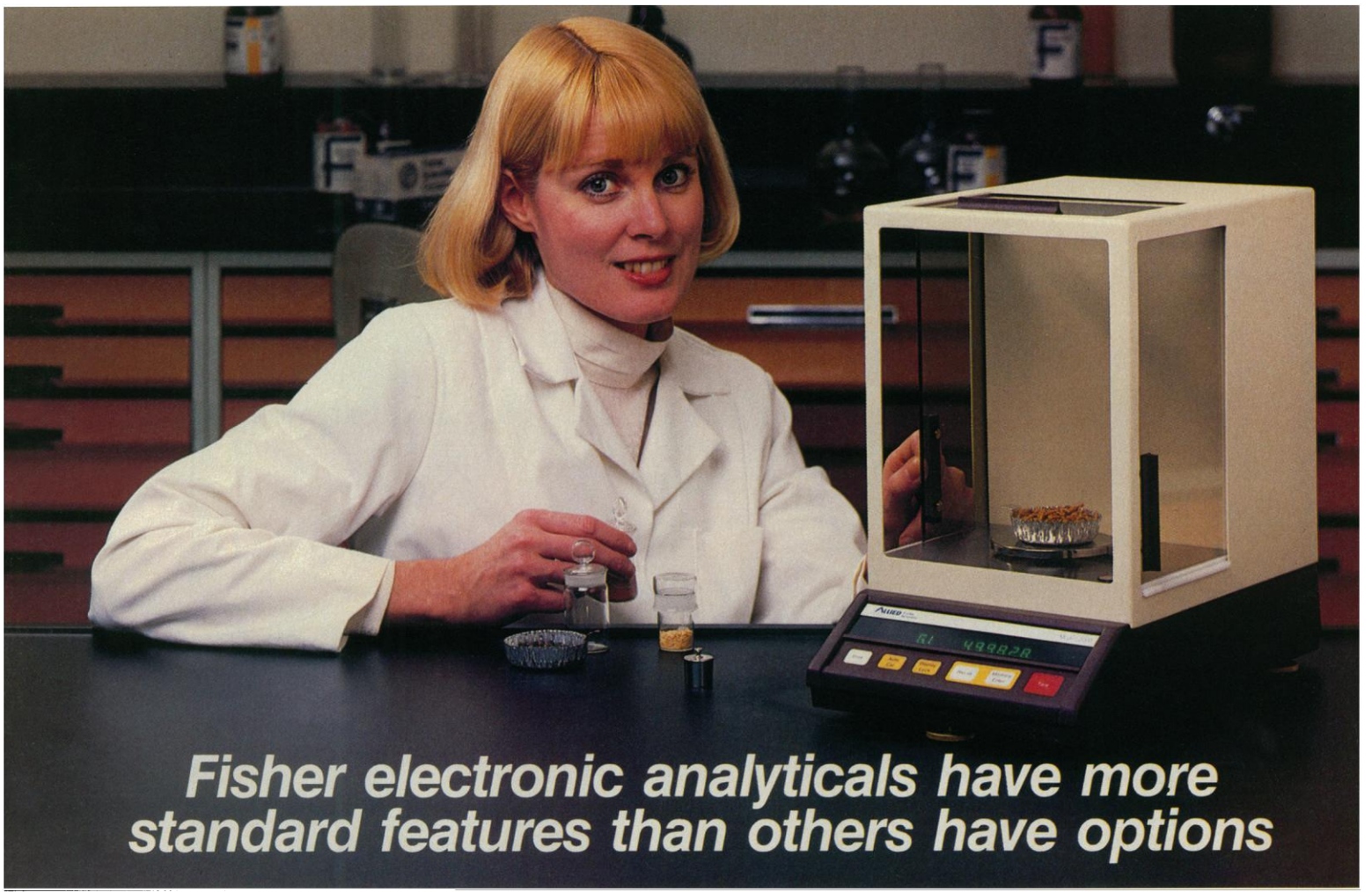

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LETTERS

"Nuclear Winter" Calculations

The description by Turco *et al.* of the possible global consequences of multiple nuclear explosions" (23 Dec 1983, p. 1283), represents an important attempt to quantify the effects of a nuclear war on global climate. In common with other preliminary studies (*1*), the numerical model simulations of Turco *et al.* suggest that heating of the earth's surface by solar radiation might be drastically reduced by the dust raised in high-yield nuclear blasts and by smoke from city and forest fires ignited by the blasts. However, in view of uncertainties in important inputs to the models and in many of the physical processes involved, as well as inadequacies in the models themselves, the predictions of a nuclear winter must be viewed as a possible, rather than the definite, outcome of a nuclear war. While this caveat has generally been made in scientific articles on the subject, and has been reemphasized in an excellent report by the National Academy of Sciences (*2*), it is often neglected in communications with the general public.

To further underscore the tentative nature of the nuclear winter predictions, I list below some of the scientific uncertainties associated with the numerical model calculations (*3*).

1) The amounts of material that would burn are not well quantified (for example, How widespread will forest fires be in winter?).

2) There are large uncertainties about the quantities of smoke particles that would be emitted into the atmosphere from various types of fires. On the basis of limited field data available (*4*), it appears that Turco *et al.* may have overestimated these emissions.

3) Clouds generally form above large fires, and these clouds often produce rain. This provides a mechanism for the prompt removal of some of the smoke particles, which would further reduce the effective (widespread) emissions of smoke.

4) The radiative properties of smoke particles are not well known. In view of the complex nature of smokes, these properties need to be established by field studies of the plumes from large fires.

5) Widespread smoke will change the radiative properties of clouds. Possible effects include enhanced absorption of terrestrial (long-wave) radiation by smoke particles when they are covered with water, decreases in the average size of cloud droplets (*5*), and decreases in the ice content of clouds (*6*). In view of the profound effects that clouds have on the radiative balance of the earth, these effects should be included in numerical simulations of the effects of smoke particles on atmospheric temperatures.

While some of these effects would tend to diminish the predicted decreases in temperature at the earth's surface, others would tend to enhance the lowering in surface temperatures. Clearly, at this juncture, there are too many uncertainties and simplifications in the numerical simulations of the effects on climate of a nuclear war to place much reliance on their predictions. Reduction of these uncertainties will require dedicated research efforts to better quantify the amounts and nature of the smoke particles from various types of fires, the rates of removal of smoke particles from the atmosphere (particularly prompt removal), and the radiative properties of smokes and clouds affected by smoke, as well as to improve numerical models of global climate. The importance and urgency of the problem dictates that these research tasks be given top priority.

PETER V. HOBBS
Cloud and Aerosol Research Group, Department of Atmospheric Sciences, University of Washington, Seattle 98195

References and Notes

1. P. J. Crutzen and J. W. Birks, *Ambio* **11**, 114 (1982); C. Covey, S. H. Schneider, S. L. Thompson, *Nature (London)* **308**, 21 (1984); V. V. Aleksandrov and G. L. Stenchikov, *U.S.S.R. J. Compt. Phys.* **14**, 140 (1984).
2. *The Effects on the Atmosphere of a Major Nuclear Exchange* (National Academy Press, Washington, D.C., 1984).
3. A more detailed discussion of the scientific uncertainties is given in P. V. Hobbs, L. F. Radke, D. A. Hegg, *ICSU-SCOPE Workshop on the Nuclear Winter Scenario, Proc. 9th Intern. Cloud Physics Conf. (1984)*, Tallinn, Estonia, in press.
4. L. F. Radke, J. H. Lyons, D. A. Hegg, P. V. Hobbs, *Final Report from the Cloud and Aerosol Research Group, University of Washington, to Lockheed-EMSCO for Project Nos. AM526 and AM680* (1984); D. E. Ward, in preparation.
5. R. C. Eagan, P. V. Hobbs, L. F. Radke, *J. Appl. Meteor.* **13**, 553 (1974).
6. P. V. Hobbs and A. Rangno, in prepration.
7. I thank L. F. Radke, D. A. Hegg, C. Leovy, and S. Warren for helpful discussions.

Diagnostic Ultrasound

Our initial report on increased frequency of sister chromatid exchanges (SCE's) after in vitro exposure of human lymphocytes to pulsed diagnostic level ultrasound (*1*) has been confirmed and extended in publications from five laboratories in the United States and elsewhere (*2–4*). The increase has now been detected after continuous wave insonation and after in vivo exposure (*4*). The

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frequency of SCE's increased with acoustic power in a critical range (*3*).

Free radicals are generated in aqueous solutions by pulsed ultrasound (*5*); their products have also been identified in the DNA thymidine of animal cells exposed to continuous wave insonation (*6*). The bioeffects of ultrasound responsible for the increased SCE frequency and some of the other findings described in more than 700 publications since 1950 (*7*) may well be the result of free radical release.

The failure of Ciaravino *et al.* to confirm our results (15 Mar., p. 1349) might be accounted for by many factors. Among these are the high degree of interobserver variation in their SCE scoring, their high SCE baseline values, and the fact that their critical acoustical power range was not verified and was not systematically varied. These and other variables may account for the failure of some laboratories to reproduce results of others, leading to the confusion in this field.

ROBERT BASES

Department of Radiology, Albert Einstein College of Medicine, Yeshiva University, Bronx, New York 10461

References

1. D. Liebeskind *et al.*, *Science* **205**, 1273 (1979).
2. M. Haupt *et al.*, *Hum. Genet.* **59**, 221 (1981); A. O. Martin *et al.*, *Am. J. Obstet. Gynecol.* **148**, 991 (1984).
3. N. Ozawa *et al.*, *Tohoku J. Exp. Med.* **143**, 473 (1984).
4. M. Stella *et al.*, *Mutat. Res.* **138**, 75 (1984).
5. K. Makino, M. M. Mossoba, P. Riesz, *J. Am. Chem. Soc.* **104**, 3537 (1982).
6. D. Dooley, P. G. Sacks, M. W. Miller, *Rad. Res.* **97**, 71 (1984).
7. H. Stewart and R. M. Moore, *J. Clin. Ultrasound* **12**, 493 (1984).

The following points are pertinent to Bases' letter.

1) Interobserver variation in SCE scores is expected and is the reason why controls were included. The SCE rate in our experiments did not increase above control values for any of the three independent scorers.

2) SCE baseline values vary considerably from laboratory to laboratory; for example, they were 3.28 for Kakati *et al.* (*1*), 16.3 for Lambert *et al.* (*2*), and 27.33 for Dutrillaux *et al.* (*3*). Our SCE baseline values were well within this range.

3) The dosimetry for our experiments was accomplished by Paul Goodwin, staff physicist at Albert Einstein College of Medicine, who also was involved in making dosimetric determinations for Liebeskind *et al.* (*4*). The intent of our experiments (*5*) was to duplicate exactly the experimental conditions of the Liebeskind *et al.* study (*4*) with a well-defined, nonvarying field from a specific diagnostic ultrasound device. Our earlier attempts to verify their results with our equipment had been unsuccessful (*6*).

4) The Albert Einstein group declined to score the slides that we made on their premises with their equipment.

5) Bases suggested that we undertake "independent double-blind scoring by recognized experts . . ." of our slides (*7*). The coded slides were sent to William Morgan (at the University of California Medical Center, San Francisco); his evaluation agreed with ours.

6) Bases then suggested (*8*) that we send the slides to David Jacobson-Kram (George Washington University) for evaluation. His scoring agreed with ours.

7) The results of Martin *et al.* (*9*) are negative ["χ^2 tests . . . were not significant. . . ." (*9*, p. 993)], as are the results of most of the studies in this area (*10*).

8) Makino *et al.* (*11*) used a Bransonic 12 cell disrupter that produces a continuous sound wave at a frequency of 20 kilohertz; their study thus has little relevance to diagnostic ultrasound.

MORTON W. MILLER
VICTOR CIARAVINO

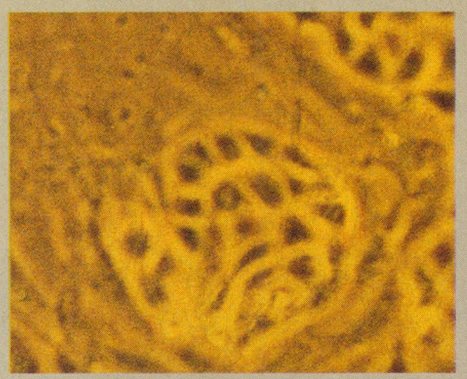
Department of Radiation Biology and Biophysics, School of Medicine and Dentistry, University of Rochester, Rochester, New York 14642

References

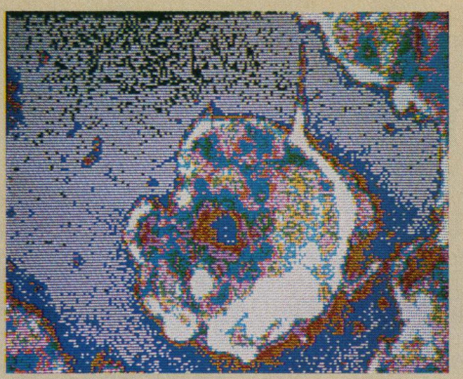
1. S. Kakati *et al.*, *Cancer Res.* **38**, 2918 (1978).
2. B. Lambert *et al.*, *Mutat. Res.* **67**, 281 (1979).
3. B. Dutrillaux *et al. Chromosoma* **48**, 327 (1974).
4. D. Liebeskind *et al.*, *Science* **205**, 1273 (1979).
5. V. Ciaravino *et al.*, *ibid.* **227**, 1349 (1985).
6. M. Miller *et al.*, *Mutat. Res.* **120**, 261 (1983); A. Brulfert *et al.*, *Ultrasound Med. Biol.* **10**, 309 (1984).
7. R. Bases, personal communication, 10 January 1984.
8. R. Bases, personal communication, 31 January 1984.
9. A. Martin *et al.*, *Am. J. Obstet. Gynecol.* **148**, 991 (1984).
10. S. Goss, *J. Ultrasound Med.* **3**, 4673 (1984); M. W. Miller. *Ultrasound Med. Biol.*, in press.
11. K. Makino *et al.*, *J. Am. Chem. Soc.* **104**, 3537 (1982).

Murine Retroviral Vectors and Human Gene Therapy

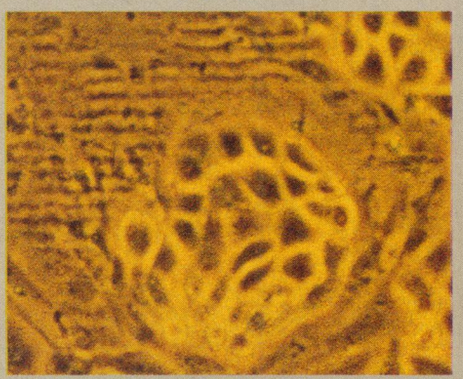
In his excellent and timely article, "Prospects for human gene therapy" (26 Oct. 1984, p. 401), W. F. Anderson discusses some of the possible difficulties surrounding the envisaged future use of retroviral vectors in attempts to correct human genetic defects. Such vectors unfortunately appear to have a strong propensity for deleting or rearranging their own sequences. One way in which such structural alterations might arise is through recombination events with homologous endogenous viruses already present in the cellular genome. In addition to the possible loss of vector-born



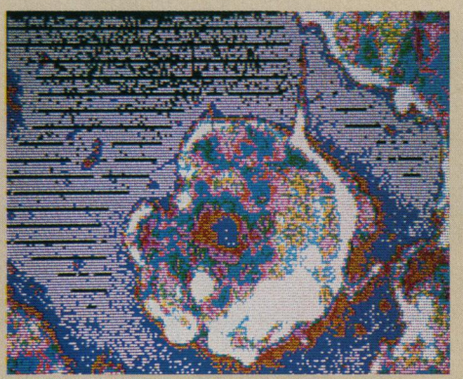
1. Co-culture of human diploid fibroblasts and Madin Darby Canine Kidney (MDCK) cells treated with fluorescein labelled monoclonal antibodies to MDCK cells[1]



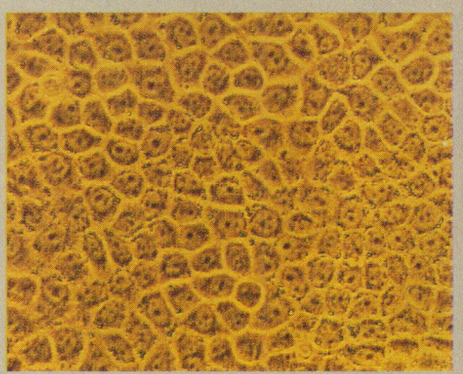
2. Computer-generated pseudo-color fluorescent image of labelled cells.



3. Same as Figure 1. Selective irradiation of non-fluorescently labelled cells with a high intensity laser beam.



4. Same as Figure 2. Lines indicate the path of the laser beam, selectively leaving the MDCK cells untouched.



5. Growth of MDCK cells several days after exposing fibroblasts to laser irradiation.

6. Same as Figure 5. Fluorescent image of MDCK cells after retreatment with monoclonal antibody.

[1]Courtesy of Dr. William Smith, Michigan State University.

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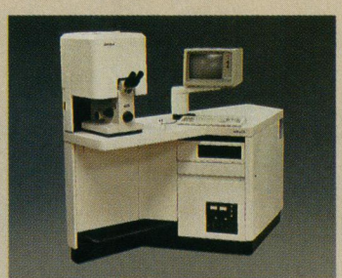

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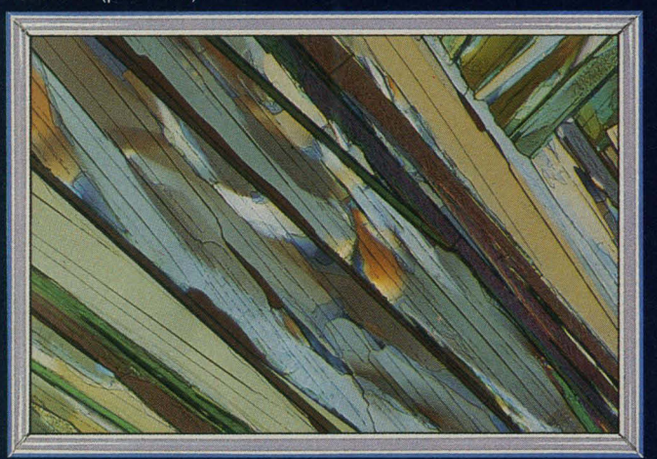

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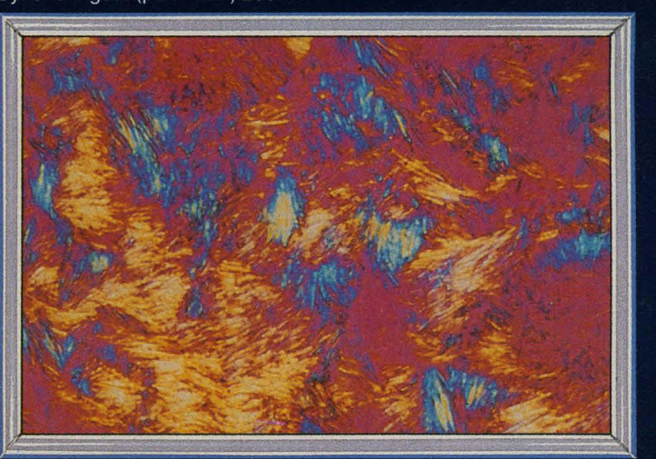

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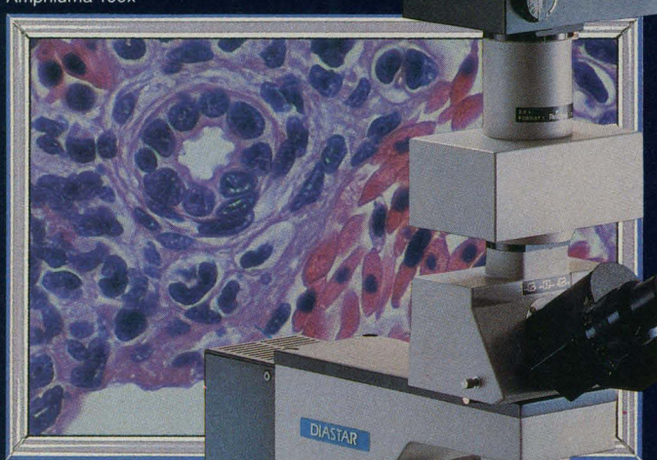

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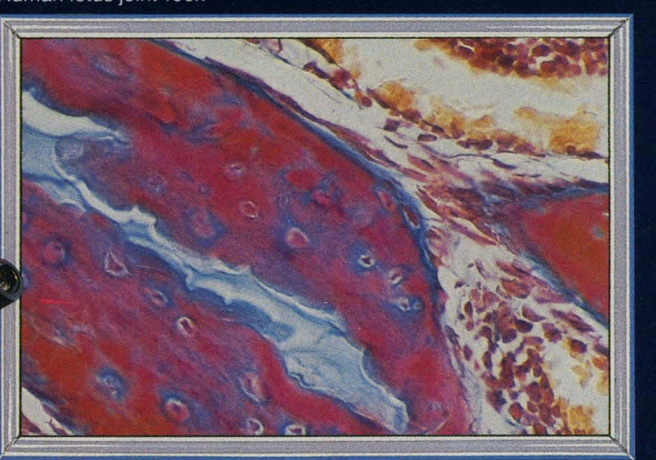

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sequences, such events could lead to the potentially harmful production of packageable infectious recombinant virus. Since avoidance of any homology with endogenous retroviruses is thus desirable, Anderson suggests using mouse retroviral vectors as a delivery system. However, quite apart from the putative inherent instability of recombinant retroviruses, this proposal is probably insufficient to overcome the recombination problem. This is because sequences with homology to mouse mammary tumor virus (*1*), Moloney murine sarcoma virus (*2*), Abelson murine leukemia virus (*3*), and Moloney murine leukemia virus (*4*) have recently been found in the human genome. Indeed, sequences containing murine retrovirus long terminal repeats (LTR's) have been employed in the screening of human genomic libraries (*5*).

There would appear to be two alternative means of circumventing this problem which would eventually enable murine vectors to be used in human gene therapy. Every such attempt would have to be preceded by a search for vector-homologous sequences in the patient's genome by Southern blotting. If sequences homologous to murine retroviral vectors currently in use are indeed found to be common in human genomes, as suggested by the work of Repaske *et al.* (*4*), alternative vectors derived from more distantly related species would have to be considered. Clearly, considerable attention will have to be directed toward the construction and experimental trial of appropriate retroviral vectors in order to optimize any future gene delivery system for use in humans.

DAVID N. COOPER
Institut de Biologie Animale,
Université de Lausanne,
CH-1015 Lausanne, Switzerland

References

1. R. Callahan *et al.*, *Proc. Natl. Acad. Sci. U.S.A.* **79**, 5503 (1982).
2. R. Watson, M. Oskarsson, G. F. Vande Woude, *ibid.*, p. 4078.
3. N. Heisterkamp *et al.*, *Nature (London)* **306**, 239 (1983).
4. R. Repaske *et al.*, *Proc. Natl. Acad. Sci. U.S.A.* **80**, 678 (1983).
5. M. A. Martin *et al.*, *ibid.* **78**, 4892 (1981).

David Cooper raises a legitimate concern regarding possible recombination between murine leukemia virus (MuLV)–based viral vectors and endogenous retroviral sequences present in the human genome. In fact, recombination between a deletion mutant of Moloney MuLV and homologous sequences in mouse DNA involving a 400-base-pair segment that was 78 percent homologous has recently been demonstrated (*1*). To evaluate possible recombination between MuLV's and human endogenous retroviral sequences, mouse cells have been cotransfected with defined *gag* and *pol* deletion mutants of Moloney MuLV (*2*) and cloned *gag* and *pol* segments of endogenous human retroviral DNA's. In no case could recombination be demonstrated. Although the deduced amino acid sequences comprising the *gag* and *pol* regions of endogenous human retroviral sequences are evolutionarily related to comparable segments of MuLV's (*3*), the extent of polynucleotide sequence identity may be too low for homologous recombination. For example, the *gag* and *pol* regions of human endogenous MuLV sequences are only 35 percent and 44 percent, respectively, related to analogous segments of MuLV. Furthermore, nucleotide sequencing of several different human endogenous retroviral clones (*4*) has indicated the presence of point mutations, inappropriate terminator codons, and deletions of various sizes, any one of which could render recombinants that might be generated replication defective.

MALCOLM A. MARTIN
Laboratory of Molecular Microbiology, National Institute of Allergy and Infectious Diseases, National Institutes of Health, Bethesda, Maryland 20205
STEPHEN P. GOFF
Department of Biochemistry and Institute for Cancer Research, Columbia University, College of Physicians and Surgeons, New York 10032
W. FRENCH ANDERSON
Laboratory of Molecular Hematology, National Heart, Lung and Blood Institute, National Institutes of Health, Bethesda, Maryland 20205

References

1. P. Schwartzberg, J. Colicelli, S. P. Goff, *J. Virol.* **53**, 719 (1985).
2. ———, *ibid.* **49**, 918 (1984); *Cell* **37**, 1043 (1984).
3. R. Repaske *et al.*, *Proc. Natl. Acad. Sci. U.S.A.* **80**, 678 (1983).
4. R. Repaske *et al.*, *J. Virol.*, in press.

Erratum: The name of M. Wallroth was omitted as the fourth author of the report "A simple and general method for transferring genes into plants" by R. B. Horsch *et al.* (8 Mar., p. 1229).

Erratum: In the legend for figure 2 of the report "*Plasmodium falciparum* malaria: Band 3 as a possible receptor during invasion of human erythrocytes" by V. C. N. Okoye and V. Bennett (11 Jan., p. 169), a reference for the use of metrizamide to purify schizonts was inadvertently omitted after the fifth sentence. It should have read, "Following the method of C. S. Pavia *et al.* [*Am. J. Trop. Med. Hyg.* **32**, 675 (1983)], as modified by Lyons."

Erratum: In figure 1 of the report "How bees remember flower shapes" by J. L. Gould (22 Mar., p. 1492), the results shown for the 24-element patterns (K_1 and K_2) should have been $P > 0.05$.

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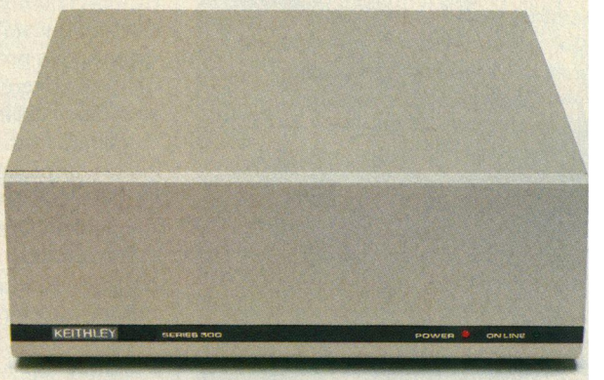
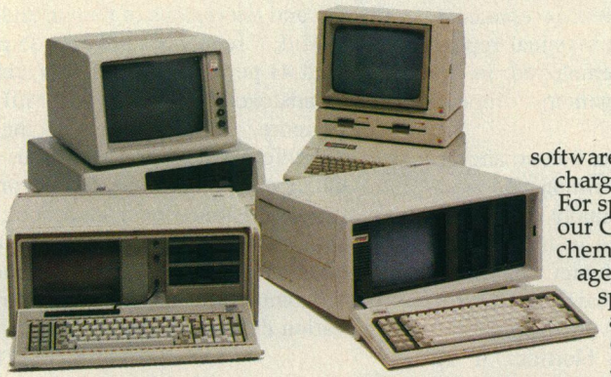


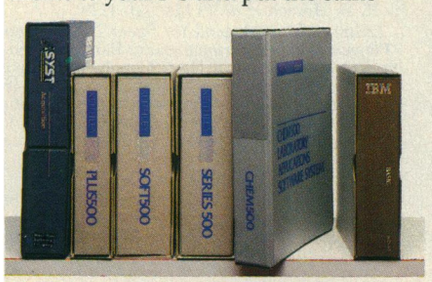


A. A CHOICE OF PCs.

First of all, the Series 500 supports the PCs most commonly used in lab and R&D work: the IBM PC, PC-XT and Portable PC; the Apple II+ and IIe; and the Compaq Portable. We even support the 8087 coprocessor.

A. A CHOICE OF SOFTWARE.

Our Soft500 package was written to give beginners the accessibility and ease of use they need to get results, yet it also offers more experienced users the depth and extra facilities necessary for more complex applications. Facilities like high-speed sampling, data storage, graphics, statistical analyses and memory-mapped I/O for high-speed data transfer. Our unique interrupt-driven architecture allows data acquisition in the background and simultaneous real-time analysis, control and display in the foreground. What's more, with our new Plus500 interface, you can also connect IEEE-488 instruments to your PC and put the same software environment in charge of both interfaces. For special needs, there's our Chem500 analytical chemistry software package for chromatography, spectroscopy, thermal analysis and colorimetry. And the Series 500 is also supported by the Macmillan ASYST™ and Lab Notebook™ software packages.



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A. ALL THIS, BACKED BY KEITHLEY QUALITY.

Behind the Series 500 is Keithley's 40-year reputation for engineering excellence and low-level measurement expertise. We designed it to provide the least noise, the highest accuracy and the greatest thermal stability of any PC-based data acquisition system.

A. BACKED BY KEITHLEY SUPPORT, TOO.

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For a demonstration or more information, call us toll-free at 1-800-552-1115. In Massachusetts call 617-423-7780. Or write us at Keithley Data Acquisition and Control, Inc., 210 Lincoln Street, Boston, MA 02111. For literature on the Series 500, circle Reader Service Number 000.

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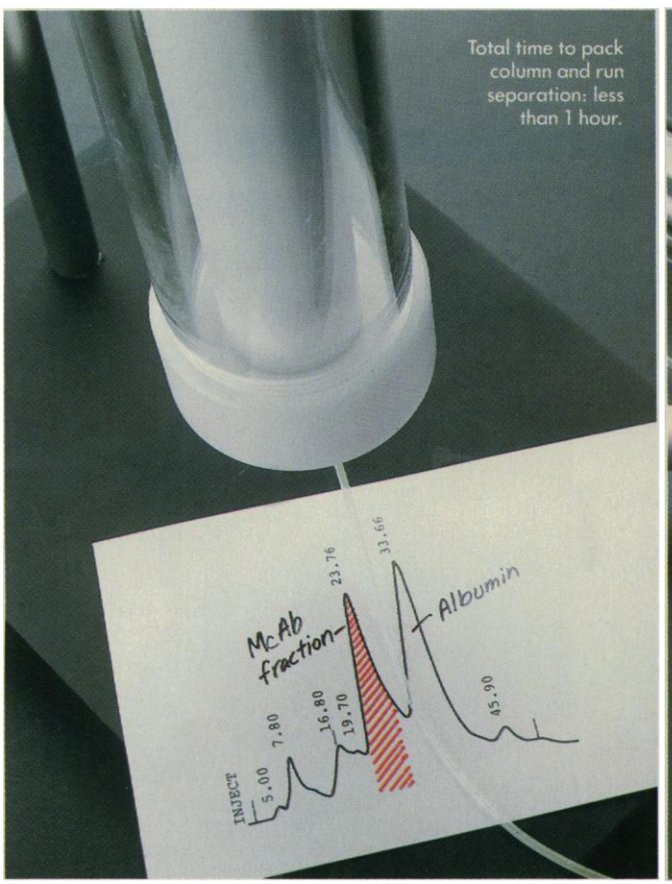

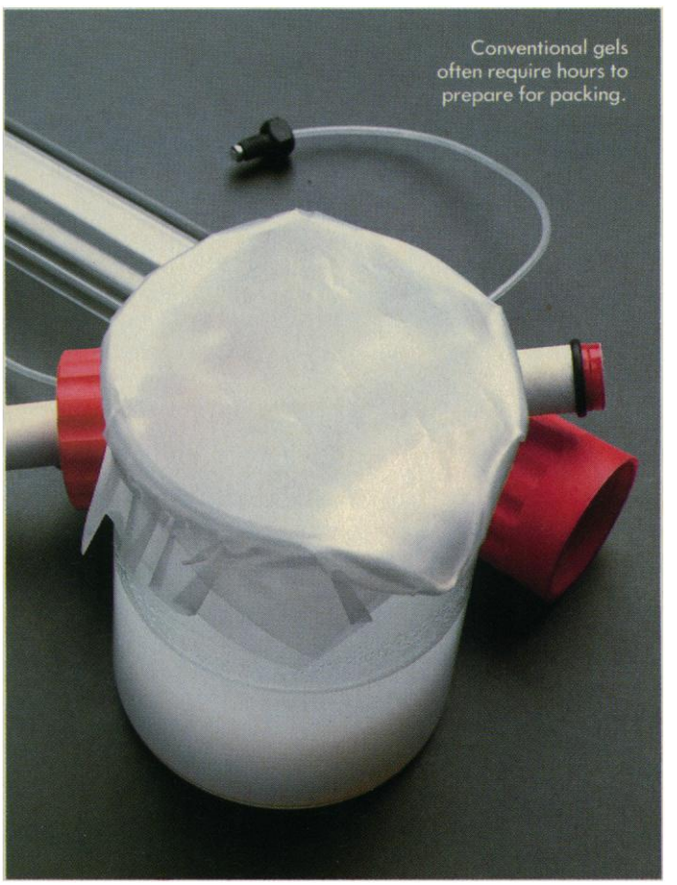

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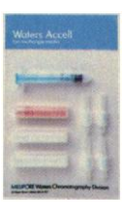

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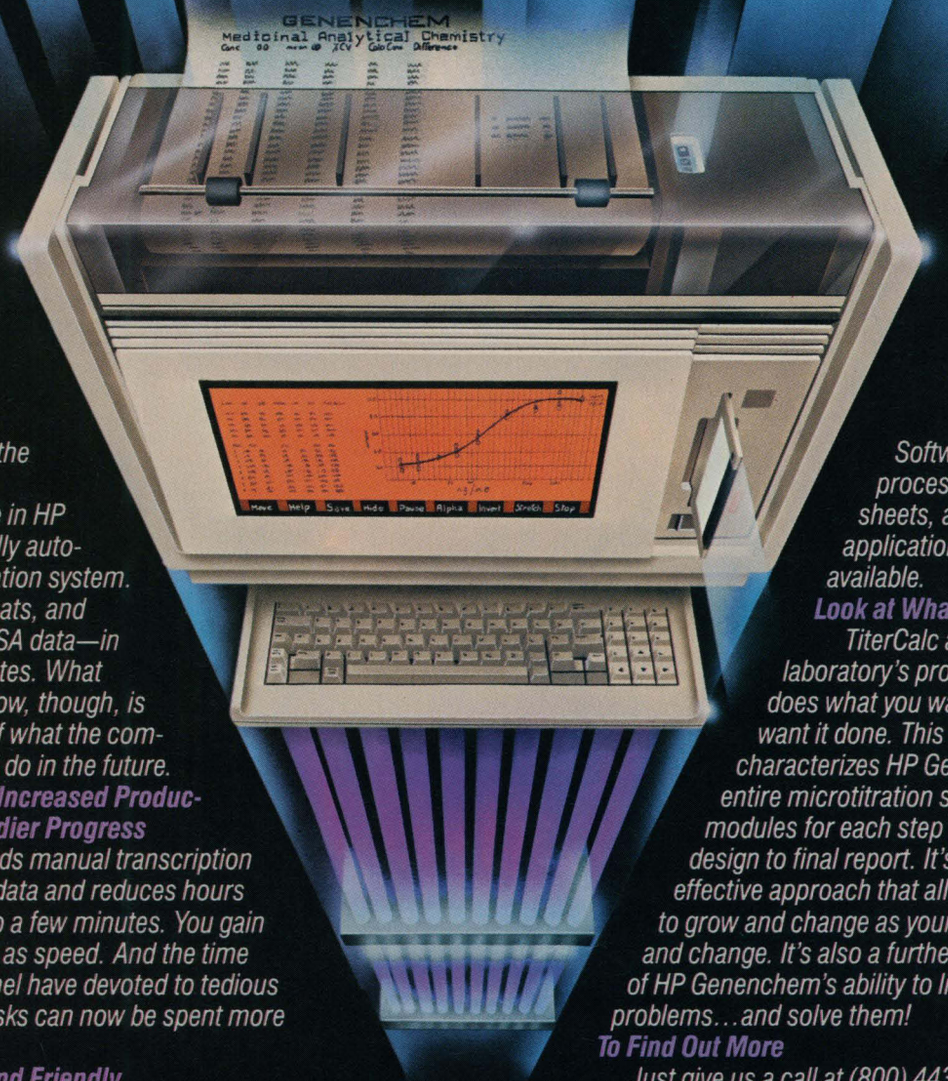

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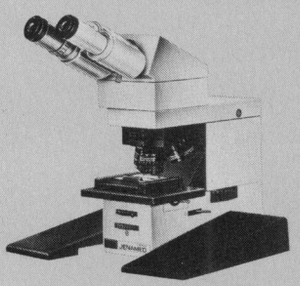
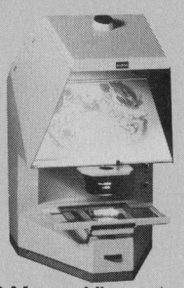
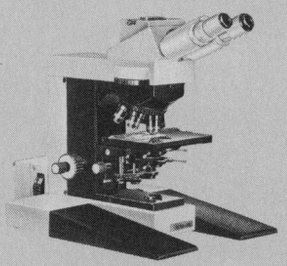


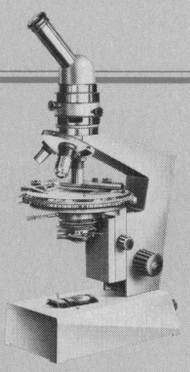
Jenamed Laboratory Microscope with CF infinity 250mm optics.



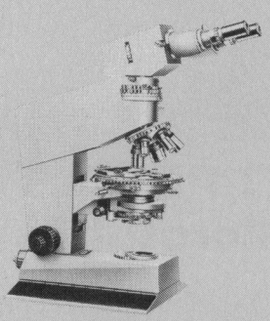
DL-2 Macro Viewer/ Projector with 6X, 9X, 13X, 17X magnification.



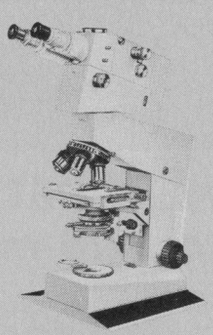
Jenaval Research Microscope with CF infinity 250 mm optics.



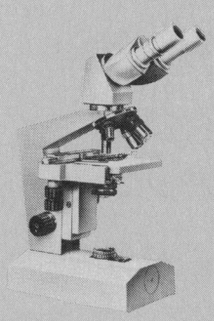
Laboval Polarizing Laboratory Microscope.



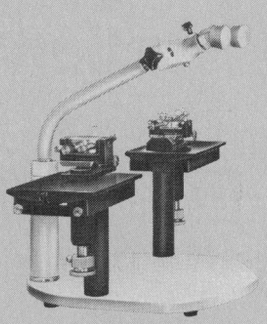
Amplival Research Polarizing Microscope with infinity optics.



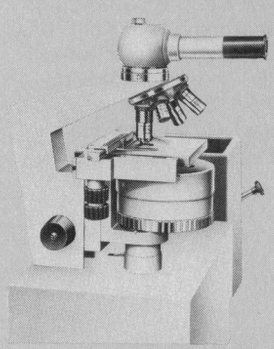
Peraval Interference Measuring Microscope with infinity optics.



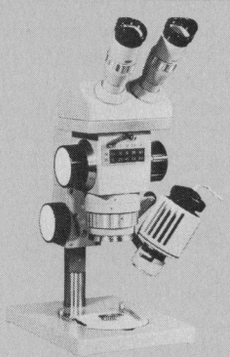
Laboval 3 Laboratory Microscope with Halogen illumination.



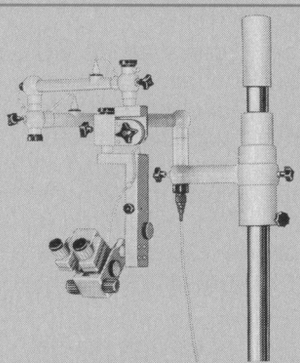
Micromanipulator complete with left and right side movements.



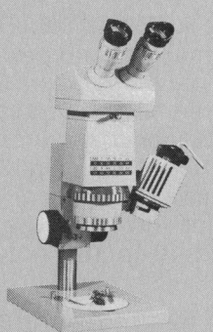
Pictoval Projector with Tin Halide illumination and matching optic settings.



Technival 2 Stereomicroscope with Halogen illumination— Apo lens —Dual View on turret magnification changes.



Surgery 212 Microscope with Halogen lens. Choice of working distance and infinity optics.



Citoval 2 Research Stereomicroscope with infinity zoom optics, and all features of Technivals.

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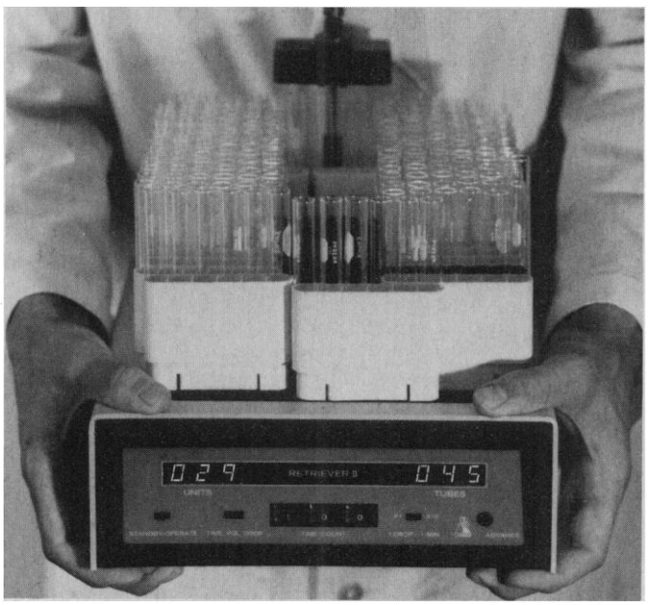

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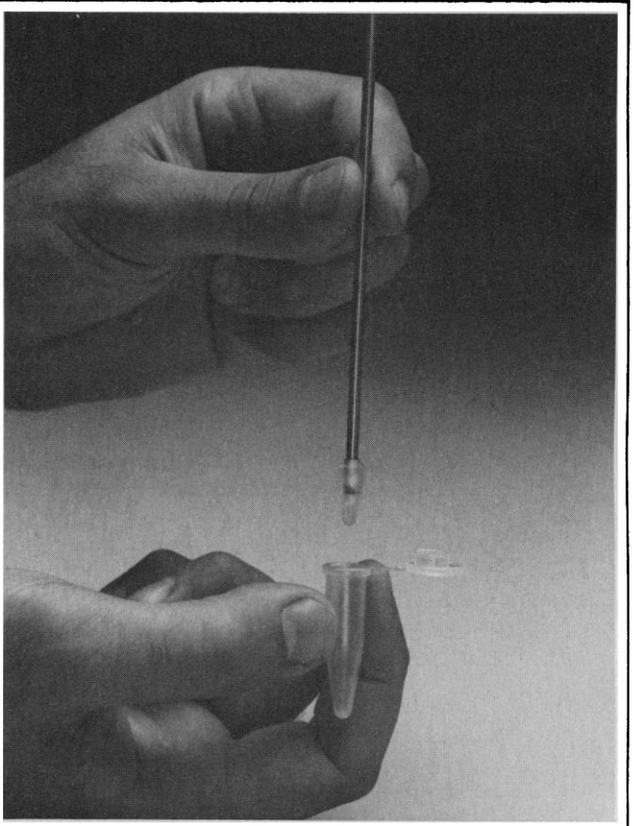

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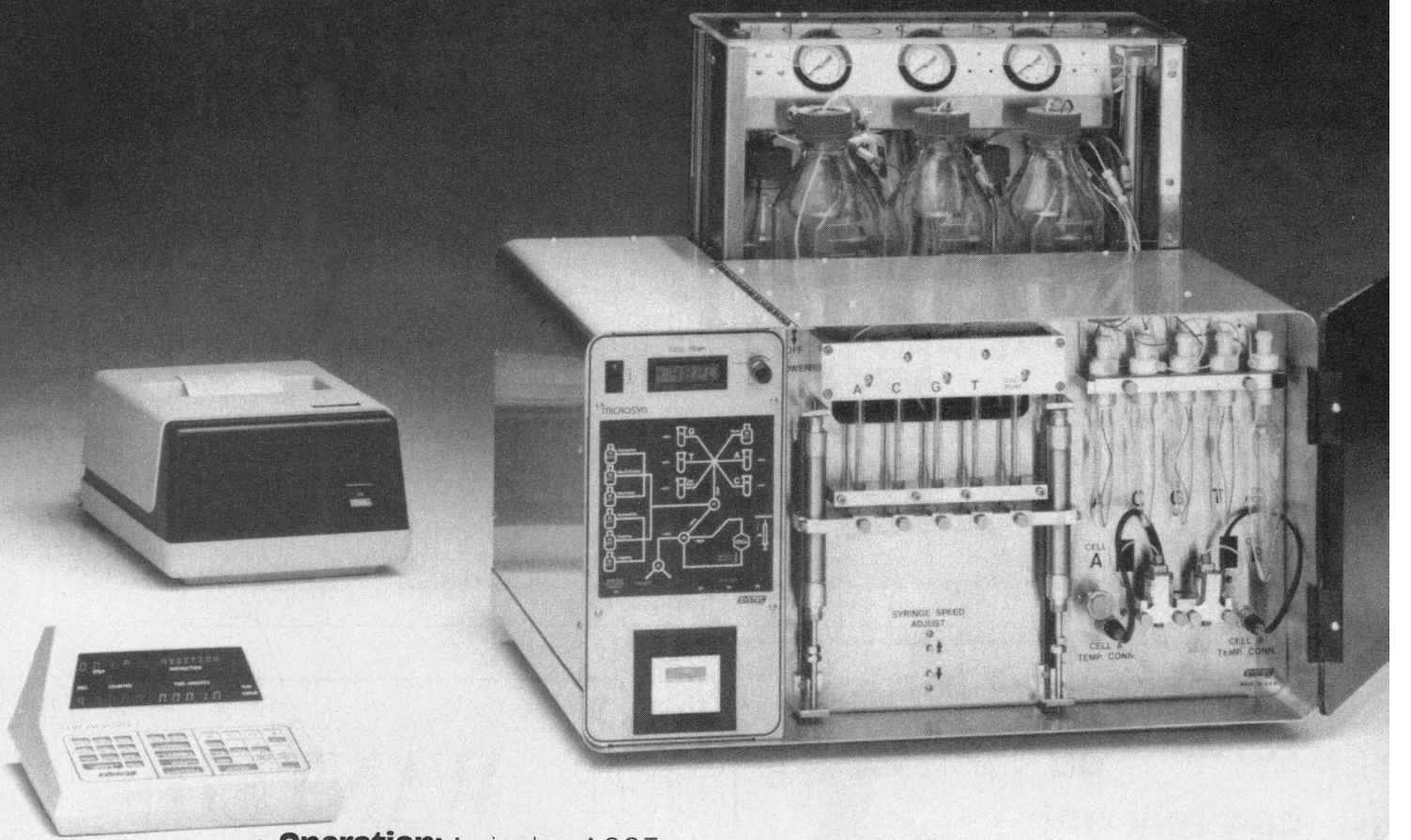

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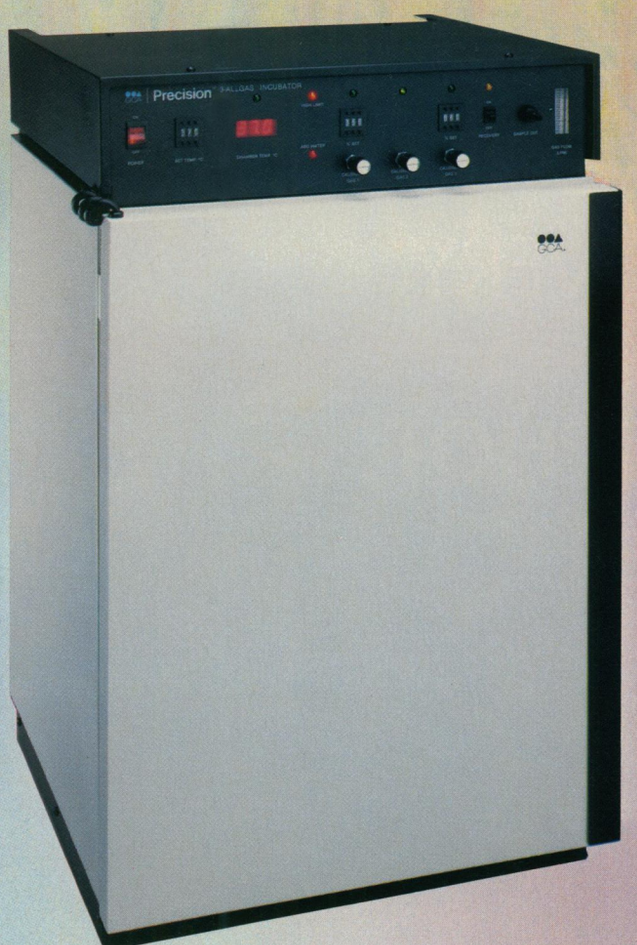

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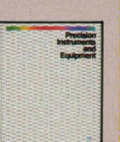

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10 May 1985, Volume 228, Number 4700 **SCIENCE**

A New Feature in *Science*

Modern scientists are accused of being specialists. This is a bum rap; it is also true. It is a bum rap when it implies that Newton knew all of science in his day whereas modern scientists are merely nuclear physicists, steroid chemists, or oil economists. The truth is that each of these specialties alone encompasses far more knowledge than did all of science in Newton's day. The range of facts, theories, and technologies that modern scientists must know is usually very broad, even within what outsiders might consider a specialty. Individual scientists may appear to be narrow because of the ever increasing accumulation of knowledge. Actually they know more, but it is a smaller fraction of total knowledge.

Scientists become increasingly isolated because of the jargon used in each specialty. New terms are introduced to describe concepts unknown in Newton's day. The replicons, cistrons, and liposomes of the biologist are foreign phrases to the physicist. The quarks, bosons, and GUT of the physicists are an undeciphered code to the economist. Yet there is both a desire and a need for different disciplines to understand each other. One institution that can contribute to a translating service is a multidisciplinary journal like *Science*. The question is how. We already publish important findings from many disciplines in the same journal. But just as we see that a giraffe tends to fall in love with another giraffe, we suspect that chemists love to read chemistry, archeologists archeology, and so forth. Moreover, adventurous readers who venture outside their areas of expertise soon run into the language barrier. The arcane terminology of a different field is denounced, whereas the jargon in one's own field is defended as the only way to express complicated concepts succinctly.

We have therefore decided to contribute to interdisciplinary communication by starting a new feature, "This Week in *Science*." On this new page, Ruth Guyer will summarize four to eight papers that appear in the current issue of the magazine. The purpose of these brief summaries is to allow the mathematician to understand the purpose and basic content of an article in medicine or a sociologist to understand an article in solid-state physics. We are deliberately picking papers to illustrate diverse developments, not to confer honors on a select few. Any scientist knows that what is immediately trendy may turn out in the light of history to be less important than some unheralded work that was far ahead of its time. In addition, a magazine like *Science* operates in loco parentis—all its authors are valued and cherished. Any article or report that survives our reviewing process is deemed to be of widespread interest. However, it would be physically impossible to give a special accounting of every paper in our weekly issue. We will select only a few so that the page can be read quickly. Over the long run, the subjects will cover a wide spectrum of disciplines even though the selections from one issue will be limited. Thus, over time, the reader of this page should get a good sense of the trends and accomplishments in other fields. This service complements the role played by our Research News and News and Comment writers in reporting the developments in various fields of research. The difference is that the new summaries will be briefer and even less specialist-oriented. An advantage is that those whose curiosity for more is aroused can read the original paper in the same magazine.

Wisdom is sometimes characterized as the ability to learn a little bit about a lot of subjects and a lot about one. We hope that the Renaissance women and men who read our journal will enjoy this new feature.

—DANIEL E. KOSHLAND, JR.

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The Pharmacia FPLC System and the Automatic Injector ACT-100 bring the full benefits of the latest technology to your standard methods. Together, they form the perfect biocompatible, high performance liquid chromatography system for the separation of labile biomolecules.

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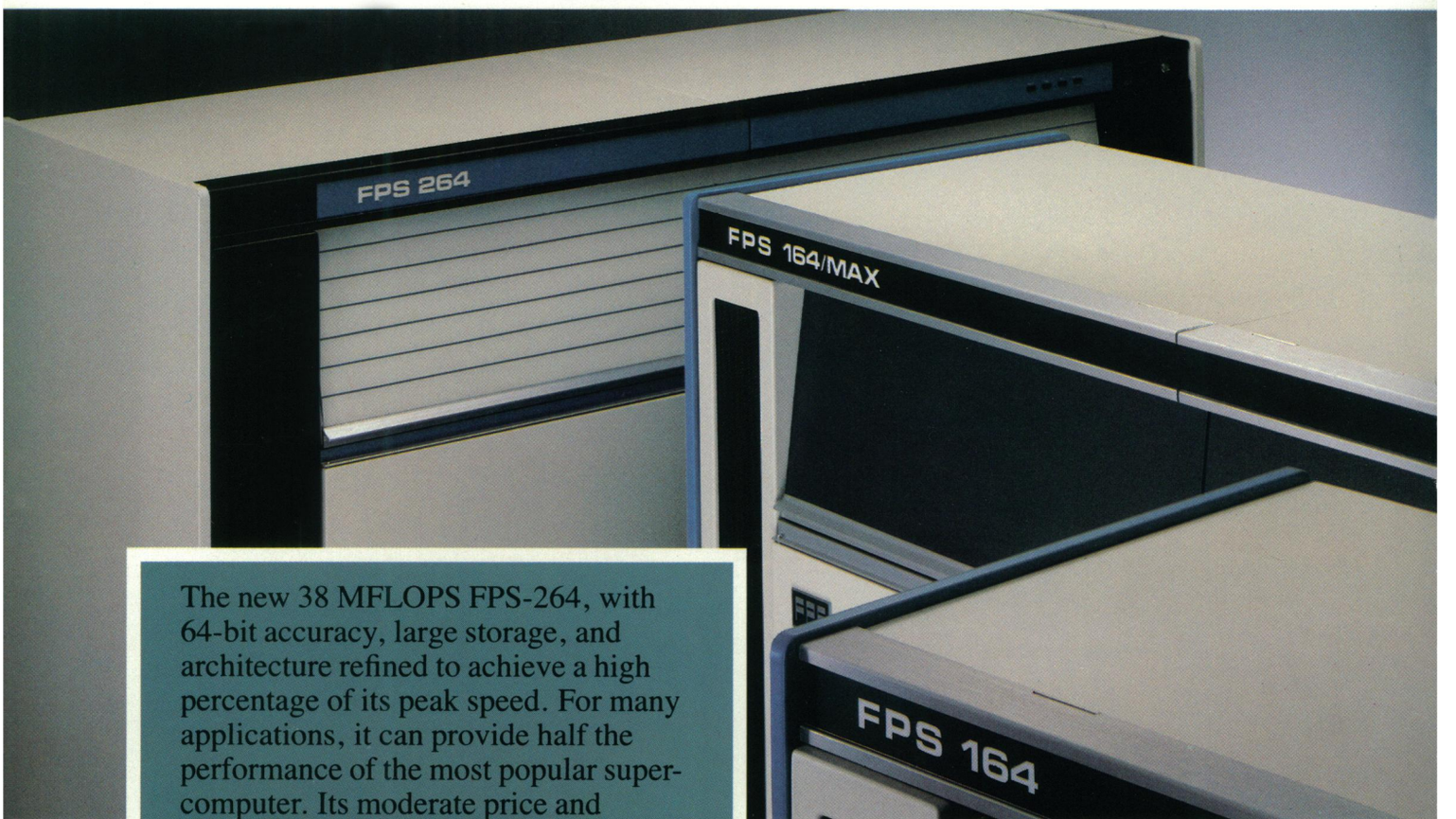
SUPERCOMPUTING

A STRATEGIC APPROACH TO SCIENTIFIC AND ENGINEERING SUPERCOMPUTING.

THE FPS 64-BIT FAMILY: CONSIDER WHY THE MOST ACCESSIBLE SUPERCOMPUTERS MAY BE THE FASTEST WAY TO DO YOUR JOB.



The new 38 MFLOPS FPS-264, with 64-bit accuracy, large storage, and architecture refined to achieve a high percentage of its peak speed. For many applications, it can provide half the performance of the most popular supercomputer. Its moderate price and exceptional support liberates supercomputing from the realm of major corporate investment and puts it within practical reach of departments and teams.

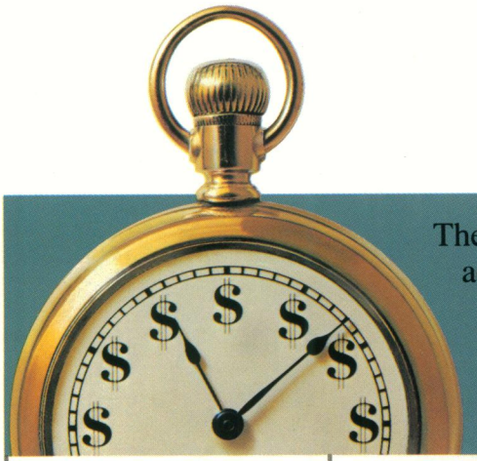
Any chess player can appreciate the value of protecting existing resources. Of looking ahead. Of knowing what to sacrifice when. Of strategic planning. In other words, a balanced attack.

The FPS 64-bit family is precisely that kind of balanced attack on compute-intensive analysis and simulation problems:

It protects and works with your existing hardware and software resources.

It is highly expandable. Proven dependable. Well-serviced. In other words, it is a safe, farsighted investment.

And most telling of all, it makes supercomputing speeds affordable at the department level . . . so even those teams with remote access to multimillion dollar Crays® and Cybers™ are likely to find that the advantage of immediate, local access is well worth the sacrifice of standing in line for the "fastest" machines.



The FPS optimizing FORTRAN-77 Compiler lets you easily adapt code to FPS' pipelined architecture in a form that is nearly as efficient as hand-coded assembly language. With extensions for asynchronous I/O and for enhancing compatibility with other compilers, it is one of most comprehensive tools of its kind.

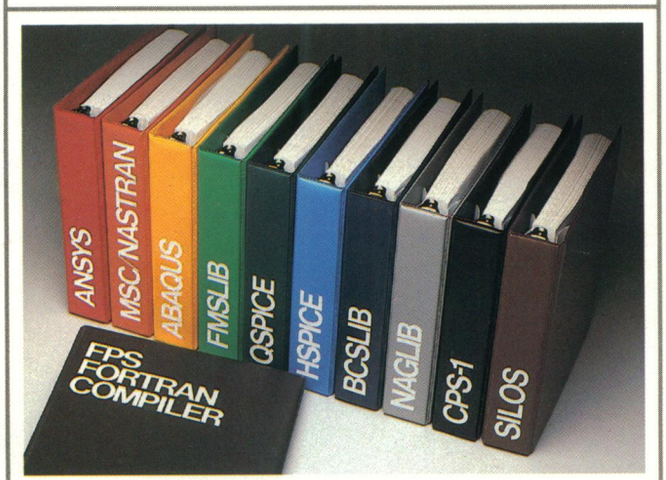
There's more to performance than hardware specification. FPS provides you with an exceptional software tool set, compatible across the entire 64-bit family.

These include the System Job Executive (SJE) operating system, which supports interactive, multi-user, and batch sessions; our robust Compiler; the Overlay Linker for memory-intensive applications; plus Assembler, Object Librarian, Interactive Debugger, and extensive libraries of FORTRAN-callable matrix, simulation and mathematical subroutines.

If your investment in FORTRAN software is typical, you'll find the compiler alone to be a most compelling advantage of the FPS supercomputing family.

Family Specifications

	FPS-264	FPS-164/MAX	FPS-164
Peak speed, MFLOPS	38	33-341	11
Dynamic range	2.8 x 10^{-309} to 9.0 x 10^{+307}	2.8 x 10^{-309} to 9.0 x 10^{+307}	2.8 x 10^{-309} to 9.0 x 10^{+307}
Logic format	64 bits	64 bits	64 bits
Main memory capacity	4.5 MWords	15 MWords	7.25 MWords
Maximum disk storage capacity	16 Gbytes	3 Gbytes	3 Gbytes
Precision	15 decimal digits	15 decimal digits	15 decimal digits
Vector registers	4 x 2K	124 x 2K (max.)	4 x 2K
Scalar registers	64	184 (max.)	64
Host interfaces	IBM, DEC	IBM, DEC, Sperry, Apollo	
Program Development Software	FORTRAN Compiler, Overlay Linker, Assembler, Object Librarian, Interactive Debugger.		



More applications software than for any comparable computer. Compare quantity and quality of compatible third-party software packages—for structural analysis, circuit design, reservoir simulation, fluid flow analysis, chemistry and much more—and the FPS advantage widens.

How fast you get a supercomputer up and running is as important as how fast it runs. In the real world, efficient operation is a function not only of speed, but of software, proven dependability, compatibility and established service capabilities—factors that for Floating Point aren't just promises or expectations, but *facts*.

THE FPS FAMILY

Where does the FPS 64-bit family fit in? Anywhere scientific computations have become increasingly cumbersome and costly to general-purpose computing. By offloading numerically-intensive operations to the FPS pipelined architecture, you can complete mathematical models and simulations many times faster. You can do it for a fraction of the cost of multi-million dollar scientific mainframes. And you can free your other computers for the jobs they are best equipped to perform.

Now three complementary performance ranges give you more value for the dollar and more room for growth.

With system prices starting at $300,000 (U.S.), for the 11 MFLOPS FPS-164, Floating Point Systems can give you the number-crunching capability of several general-purpose computers, for less than the cost of one.

The new 38 MFLOPS FPS-264 achieves 4-5 times the speed of the FPS-164 on many applications programs. It is the best choice for conventionally-written FORTRAN programs (in contrast to optimized code tailored specifically for the FPS-164/MAX). Systems start at $640,000.

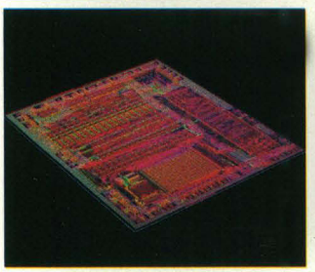
The FPS-164/MAX adds another dimension to the family. With its multiple special parallel processing units and peak 341 MFLOPS performance, it can run many common matrix computations as fast or faster than supercomputer mainframes costing 10 times as much to purchase and operate. System prices start at $400,000.

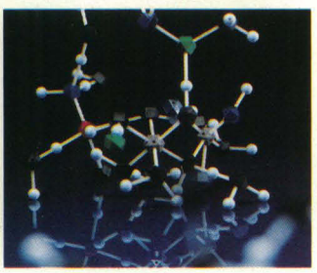
All three FPS Scientific Computers are highly expandable in memory and mass storage capacity. They are totally compatible with each other in terms of program development and applications software. Error-correcting memories and advanced internal diagnostics are among the components of a reliability program that extends from exhaustive manufacturing testing to our 21 field office service facilities worldwide.

Compare the specifications, benchmarks and price ranges listed here with all the alternatives—from superminis to Class 7 supercomputers. Then ask your local Floating Point sales representative to help you develop your own strategy for accessible supercomputing. Contact Floating Point Systems, Box 23489, Portland, OR 97223. Telex 360470 FLOATPOIN BEAV. Sales offices worldwide. Call collect (503) 627-9667.

Family Performance Measures

	FPS-264	FPS-164/MAX		FPS-164
		15 accelerators	1 accelerator	
Peak MFLOPS	38	341	33	11
Peak MOPS	190	1705	165	55
Peak MIPS (Multi-instruction partcels)	19	5.5	5.5	5.5
Typical MFLOPS, LINPACK Benchmark	9.9	20.0	6.0	2.6
Whetstones (64-bit)	20,100	5800	5800	5800
1000x1000 matrix multiply, seconds	53	10	66	189
$K/MFLOPS (system price/peak speed)	$16.8K	$2.5K	$12.3K	$27.1K





The new FPS-264 will be of particular benefit to the problems of structural analysis, reservoir simulation, electronic circuit design and computational chemistry and physics.

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Call for Symposium Proposals
Philadelphia Meeting • 25–30 May 1986

AAAS members are invited to submit symposium proposals for the next Annual Meeting in Philadelphia, 25 – 30 May 1986. Please complete the form below, attach a "Synopsis of Objectives" (about 200 words), and send it to us **not later than 1 August 1985.**

We are particularly interested in symposia dealing with the latest developments in science and technology, and the implications of these developments for society.

All symposium proposals are subject to review. If the information submitted is inadequate for reviewing, the proposal will be returned. Endorsement (sponsorship) by a AAAS Section Committee expedites the review process. It is therefore in the interest of the proposer to send a *copy* of the proposal to the appropriate Section Secretary (see table of contents page of *Science* for names) for endorsement at the same time the *original* is sent to the AAAS Meetings Office.

Speakers should *not* be confirmed at this time; however, sufficient information about probable speakers and their topics should be provided to allow for evaluation of the proposal. Please note that AAAS does not pay honoraria to speakers.

Some Deadlines

October: You will be notified about acceptance, conditional acceptance, or non-acceptance of your proposal. Further information will be provided at that time.

November: Preliminary programs with confirmed speakers are due.

January: Final program copy, suitable for publication, is due.

1986 AAAS ANNUAL MEETING **Philadelphia, 25–30 May**	**PROPOSED SYMPOSIUM** Submit not later than 1 August 1985	**Return this form to:** AAAS Meetings Office 1101 Vermont Ave., N.W. Washington, D.C. 20005 Telephone: (202) 842-9530

PRINCIPAL ORGANIZER (who will receive correspondence): TELEPHONE _____ (Area Code) (Number)

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TITLE OF SYMPOSIUM _____

SPONSORSHIP (AAAS Section, Office, or Affiliate **only**) _____ No. of 3-hr. Sessions _____

1. Speaker _____
Affiliation _____
Topic _____

2. Speaker _____
Affiliation _____
Topic _____

3. Speaker _____
Affiliation _____
Topic _____

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Topic _____

PLEASE ATTACH SYNOPSIS OF OBJECTIVES OF PROPOSED SYMPOSIUM (APPROXIMATELY 200 WORDS).