

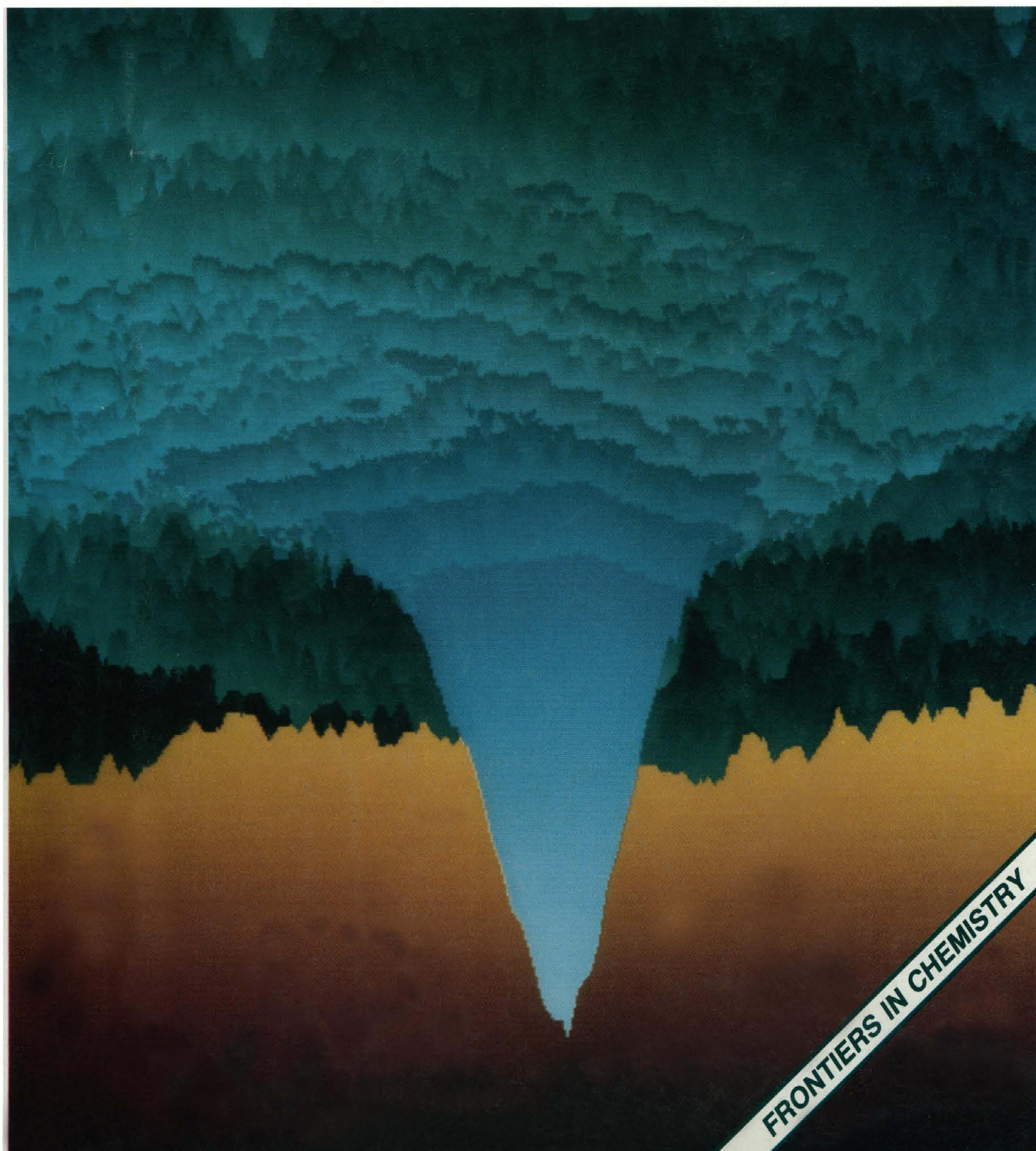
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COVER The singular properties of the core region and the rotation center of the spiral wave in the Belousov-Zhabotinsky reaction are shown in three-dimensional perspective. The image was obtained by an overlay of a large number of single snapshots of spiral rotation covering three full revolutions. It presents the upper envelope of the concentration variation, that is the maximum level of oxidation of the catalyst ferroin reached at each point in space. The envelope is shown in arbitrary pseudo colors. See page 460. [S. C. Müller, Th. Plesser, and B. Hess, Max-Planck-Institut für Ernährungsphysiologie, D-4600 Dortmund, Federal Republic of Germany]

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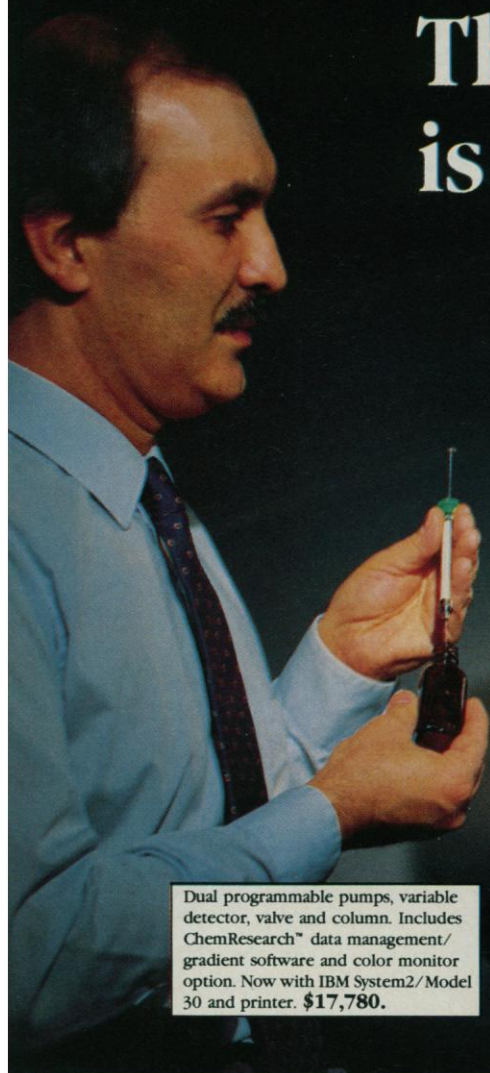
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This Week in SCIENCE

Making waves

THE “tornado” on the cover is a chemical wave. It is an example of one of the orderly structures, in this case a spiral, that can form in complex chemical reactions and then propagate through the chemical solution (page 460). The cover illustration is a composite time series of single snapshots made of a spiral wave that formed during the Belousov-Zhabotinsky reaction (bromination of an organic substrate). The range of chemical waves that have been observed is described by Ross *et al.* in one of eight articles in this special chemistry issue. [Brauman’s editorial summarizes some of the highlights and major developments in chemistry that are described in the articles (page 373)]. Three types of waves—kinematic waves, trigger waves, and phase diffusion waves—along with their properties and geometries are compared. The formation of such waves in chemical systems far from equilibrium conditions is especially relevant to natural phenomena, most of which are also far from equilibrium. Peristalsis, nerve conduction, pulses of pheromone emissions, and other biologic phenomena in a range of living organisms involve the propagation of electrochemical waves; thus analysis of the physical chemistry of waves is important in understanding not only chemical systems but also biologic and biochemical ones.

Nile delta subsidence

THE northeastern part of the Nile delta, where today at least a million people live, may be under water by the year 2100 (page 497). Stanley describes how the geologic configuration of the region has changed through the past 7500 years and explains why submergence of much of the northeastern part of the delta within 30 kilometers of the Mediterranean coast is possible. This part of the delta plain has been sinking at a rapid rate, on average between 40 to 50 centimeters per century for at least 75 centuries. Apparently, tectonic factors have contributed to

the more rapid subsidence of this part of the delta. In turn, subsidence has redirected some of the branches of the Nile to the area. One of the important factors in subsidence calculations is the changing sea level, and, worldwide, sea level is on the rise; currently much of the delta is only about a meter above sea level. Added to these factors is decreased deposition of Nile River sediments as a result of the construction of the Aswan High Dam in 1964; sediment deposition currently fails to keep up with coastal erosion as it had in the past. The region’s future thus comes into question in light of flooding and submergence under the sea.

Selfish DNA

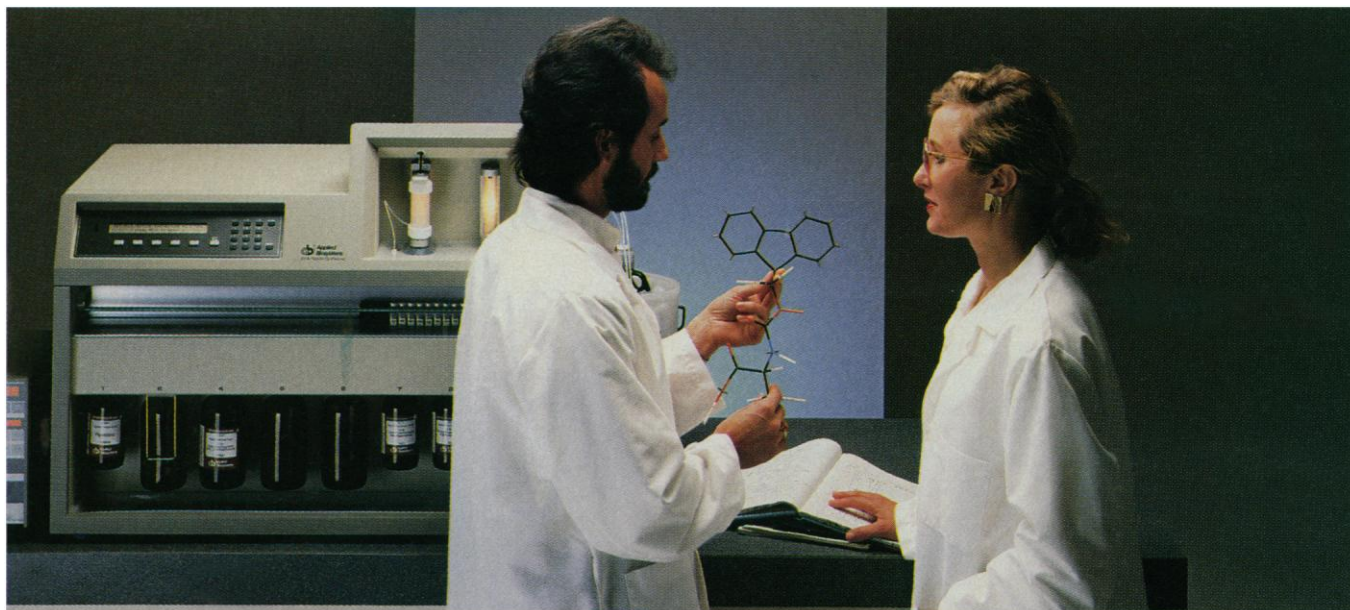
THE wasp *Nasonia vitripennis*, a parasite that lays its eggs in the pupae of flies, contains what might be, according to Nur *et al.*, the most “selfish” genetic element yet described—the *psr* (paternal sex ratio) element (page 512). Typically in this species, males develop from unfertilized eggs and thus have only one set of chromosomes, the ones from the egg-laying female; females develop from fertilized eggs and have chromosome sets from mother and father. Females generally exert major control over what the ratio of sexes within the population will be and usually bias the ratio toward females. Thus more eggs are fertilized than not. However, when, along with sperm, the *psr* element is transmitted to the egg, that sex ratio suddenly shifts: the *psr* element causes the paternal chromosomes to condense and disappear, fertilized eggs end up carrying only one set of chromosomes, and, instead of females, males are produced; these males then continue to transmit the *psr* element and push the population to greater and greater percentages of males. The work reported clarifies much about the structure of *psr* (a “supernumerary” chromosome) and its repeating subunit; with this information it may be possible to determine if any of the *psr* element’s gene products have functions other than ensuring self-perpetuation.

Advance in scanning tunneling microscopy

REFINEMENTS in scanning tunneling microscopy should make this technique of value for producing accurate three-dimensional images of biological materials that have been coated with conducting films (page 514). Amrein *et al.* used complexes of DNA and the recA protein (with which DNA interacts during recombination) for defining some conditions that permit faithful imaging. (The recA-DNA complex has been studied with other techniques and is known to have a long, filamentous helical structure; thus a check is provided on the new technology.) Films made of mixtures of platinum, iridium, and carbon permitted stable tunneling, produced little granularity, and yielded atomic images under atmospheric conditions. This technique should surpass transmission electron microscopy in depth resolution and allow more direct topographic analyses; unlike transmission electron microscopic images, the images from scanning tunneling microscopy are not generated from averaging the results of different projections.

Estrogen and breast cancers

IN the early stages of their growth, human breast cancers need estrogen; later, and in association with the initiation of a more aggressive phase of the disease, some cancers continue to grow whether or not estrogen is available (page 524). Sukumar *et al.* assessed the possibility that this escape to estrogen independence was associated with some change in *H-ras*, the oncogene that is responsible for the transformation of normal cells to breast cancer cells. Both the presence and the level of expression of *H-ras* were indistinguishable in estrogen-dependent and estrogen-independent tumors. Therefore, the switch to estrogen independence in breast cancer must be triggered by a mechanism separate from the activities of the *ras* oncogene.



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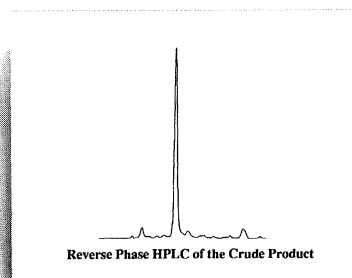
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Frontiers in Chemistry

Chemistry, the most central of scientific disciplines, continues to show the promise, excitement, and possibilities set out 2 years ago in *Opportunities in Chemistry*, the Pimentel Report. Much of this promise is already being realized: better understanding of chemical properties and reactions, improved instrumentation, increased computational ability, advances in theory, and novel experimental approaches to synthetic challenges are all having serious consequences for the field. Readers will recognize from individual articles in previous issues of *Science* that significant advances in this field are continually occurring—creating new intellectual opportunities as well as solidifying earlier ones.

In this issue are highlighted a few of the exciting developments in chemistry, chosen to expose some of the breadth and depth of the field. As is usually the case in these field-organized issues with only a limited number of papers, it is not possible to cover the entire area; readers will continue to see other important and interesting work in future issues.

Many of the advances in modern chemistry have come from superior methods of analysis, improved both in sensitivity and specificity. Wightman describes some extraordinary developments in microelectrodes that give microsecond time resolution and micrometer spatial resolution. Potential applications in many areas, including brain chemistry, are pointed out.

Synthetic chemistry lies at the heart of chemical science. New molecules and new ways of making them are critical. Evans describes new advances in stereoselective synthesis, which involves the rational construction of molecules whose complex structures involve the specific geometrical relations of ring connections and functional groups. Schultz describes the design and construction of efficient highly selective catalysts that are catalytic antibodies and hybrid enzymes. In this work we see major breakthroughs in the modification of naturally occurring molecules to perform new and different chemistries.

An understanding of naturally occurring complex chemical systems is crucial to understanding life itself as well as in designing new chemistry. Dawson describes structure and function in the bioinorganic chemistry of heme-containing oxidases and peroxidases. This important work depends significantly on synthetic models that are capable of doing much of the chemistry of the natural systems. Closs and Miller describe studies of long-distance intramolecular electron transfer, an extremely fundamental and key chemical process. Invention and synthesis of models and studies of their chemistry provide critical insight and tests of theories.

Some of the most interesting and important chemical interactions occur when molecules interact only very weakly. Sophisticated measurements and interpretation of spectra allow us to understand how molecules behave in this limit. Miller describes some of the insights obtained from near-infrared studies of van der Waals and hydrogen-bonded molecules.

Dunning and his coauthors describe theoretical studies of the dynamics of chemical reactions. These illustrate some of the important advances in computational chemistry and its applicability to solutions of real problems.

As our understanding progresses, it is becoming possible to deal with complex systems that contain many exciting possibilities for nonlinear behavior seen in living as well as in other real-world systems. Ross, Müller, and Vidal describe chemical waves, an example of spatial structures that can occur in nonlinear systems far from equilibrium.

The plate of chemistry is a full one; the menu is extremely rich and varied. We expect to see continuing insights, imaginative breakthroughs, and useful applications. The combination of understanding, insight, and technological power makes it clear that much is yet to come. The promise of the Pimentel Report is indeed being realized.—JOHN I. BRAUMAN, *Department of Chemistry, Stanford University, Stanford, CA 94305*

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hours in length instead of the 1½ hours provided by the contract. The NIMH invited me to submit a supplemental funds proposal, since I judged that about \$45,000 of the resulting cost overrun had been incurred in good faith and was justified in the interests of the study and the investment already made. Officials at Indiana University in charge of the contract with NORC feared issues of liability and consequently did not approve my proposal. This caused a year's delay in data acquisition from NORC.

Our priorities of subsequent years were to have several major analyses progressing in the preparation of a 15-chapter monograph. Much effort was required to develop indices and scales so that a wide range of latent variable structures could be examined. This was imperative before analyses could begin, since the survey produced an unprecedented wealth of raw data (about 600 items per person).

We presented a broad overview of the data in June 1973 at the annual meeting of the American Orthopsychiatric Association (2). As the book progressed, preliminary findings were also presented on public attitudes toward and perceptions of homosexuals (3), on sex education experience in the United States (4), and on sexual suppression of women (1-5). The project graduate re-

search assistant produced a doctoral dissertation (6).

Given this progress, Colin J. Williams stated in an early 1975 memo that so much work was done and in progress that I should not be replaced as project director and senior author; he volunteered to help, as third author. Williams did not simply write the book then. I explained our methods, interpreted results, outlined and sometimes dictated a chapter to him, or provided a draft so he could write while I continued other analyses. Later, he originated chapters himself. (As he says, in some ways we worked well together.)

There are many reasons why the "long, lost survey" is not yet published. I did not give up the fight early or easily, and with each new chance I continued to fight. Until Charles Turner of the National Academy of Sciences urged further effort to publish, I had found no further avenues to pursue; I greatly appreciate his assistance and the open-minded facilitation of ISR director June M. Reinisch in the resurrection of publication possibilities. I may not believe in miracles, but some of my friends think I do.

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2. E. E. Levitt and A. D. Klassen, paper presented at the annual meeting of the American Orthopsychiatric Association, New York, June 1973).
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4. A. D. Klassen, paper presented at the Public Forum on Sex Education, Sex Information, and Education Council of Indiana, Indianapolis, October 1976.
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Erratum: In line 7 of the second paragraph of William W. Darrow's letter "Behavioral research and AIDS prevention" (25 Mar., p. 1477), reference 2 was misnumbered as (1).

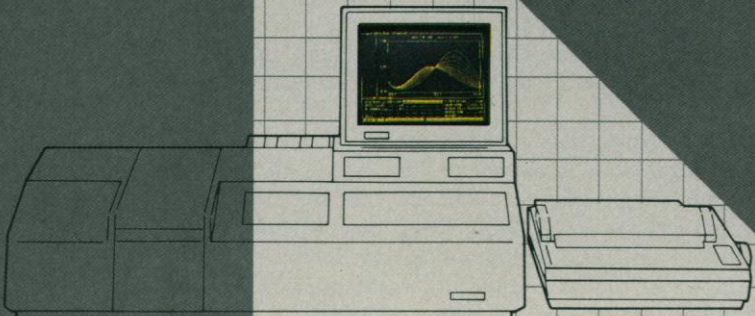
Erratum: In the third paragraph of the Research News article "Probing the authenticity of antiquities with high-tech attacks on a microscale" by Deborah M. Barnes (18 Mar., p. 1374), Sir Humphrey Davy's name was misspelled.

Erratum: At the end of his Research News article "New superconductors answer some questions" (8 Apr., p. 146), Robert Pool's name was misspelled.

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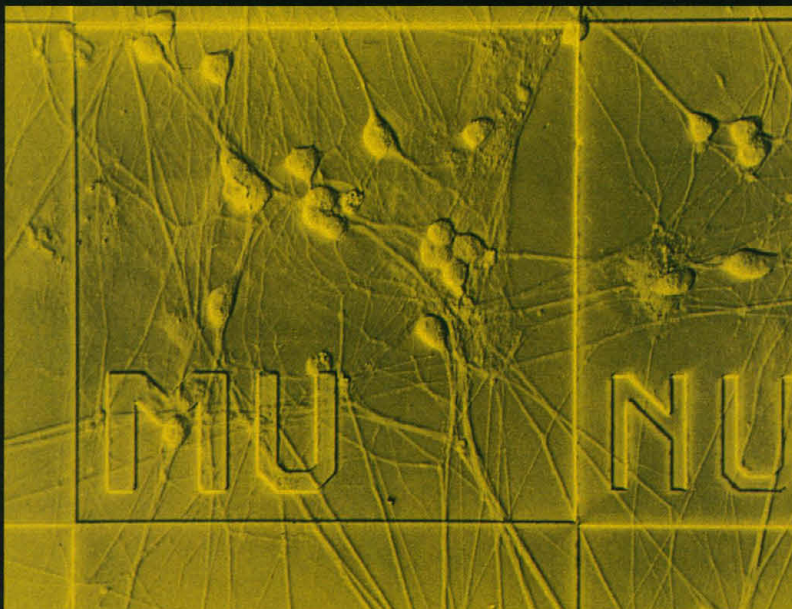
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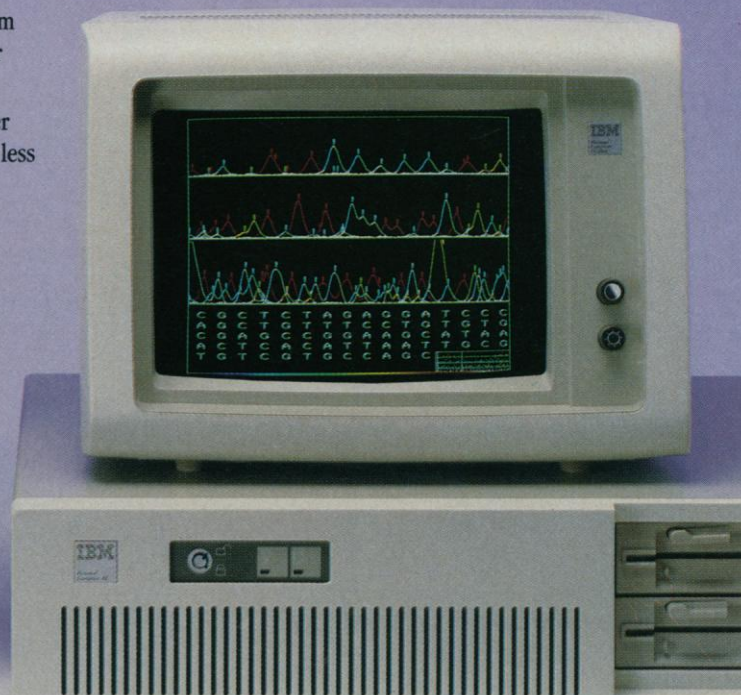
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1. Elder, J.K., Green, D.K., and Southern, E.M. (1986). *Nuc. Acids Res.* 14:417-424.

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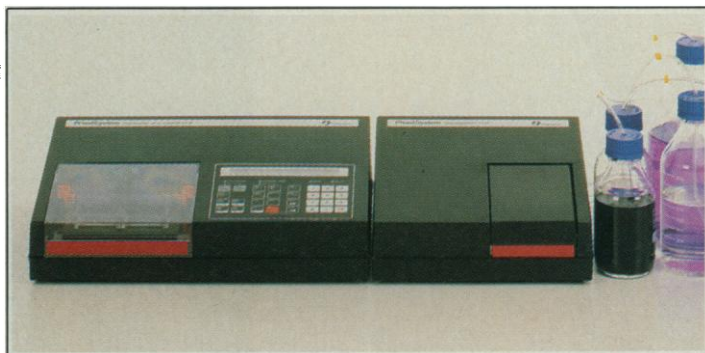
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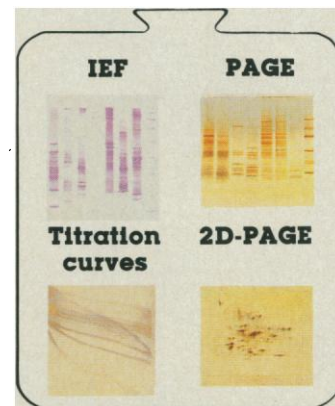
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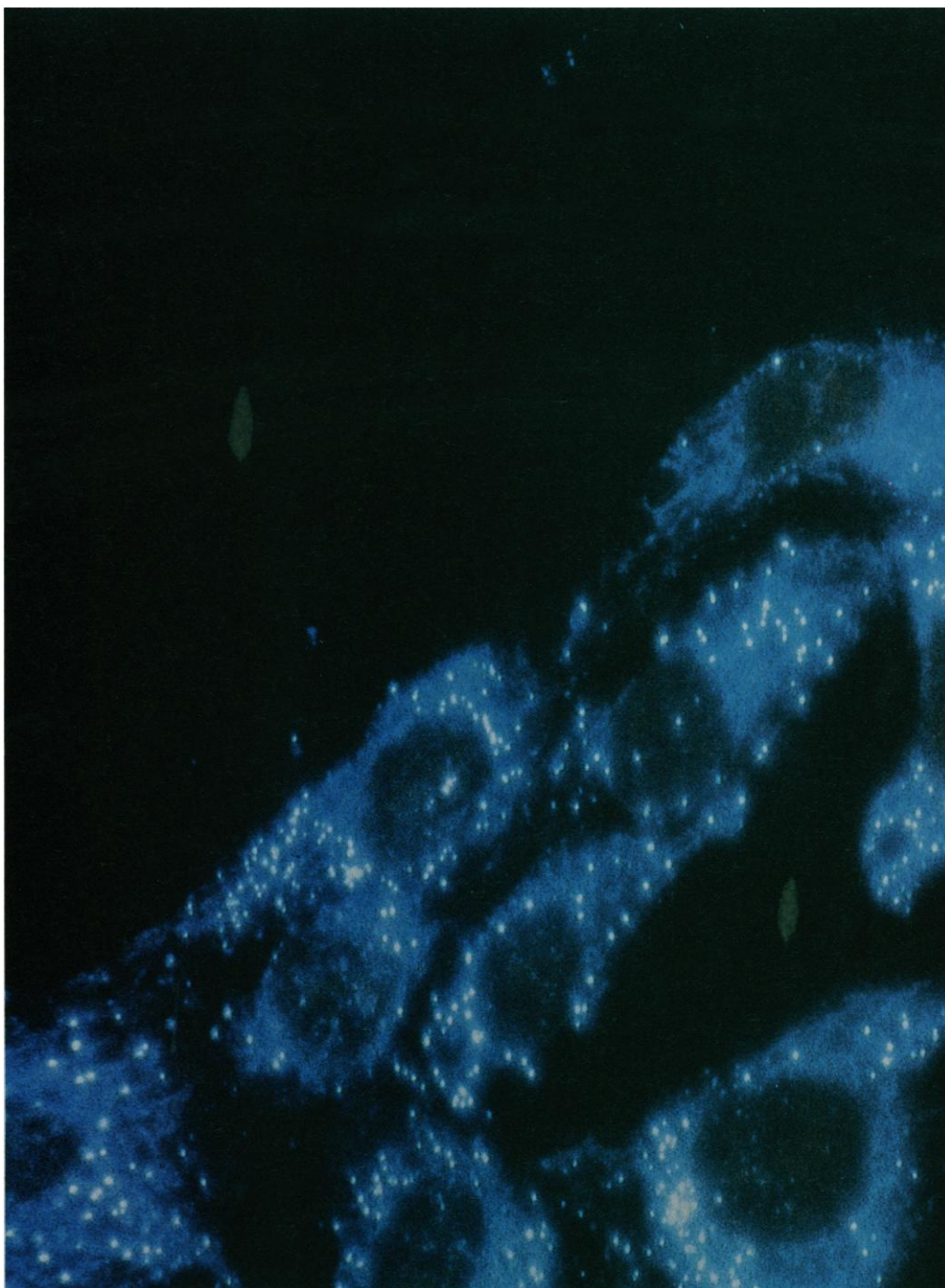
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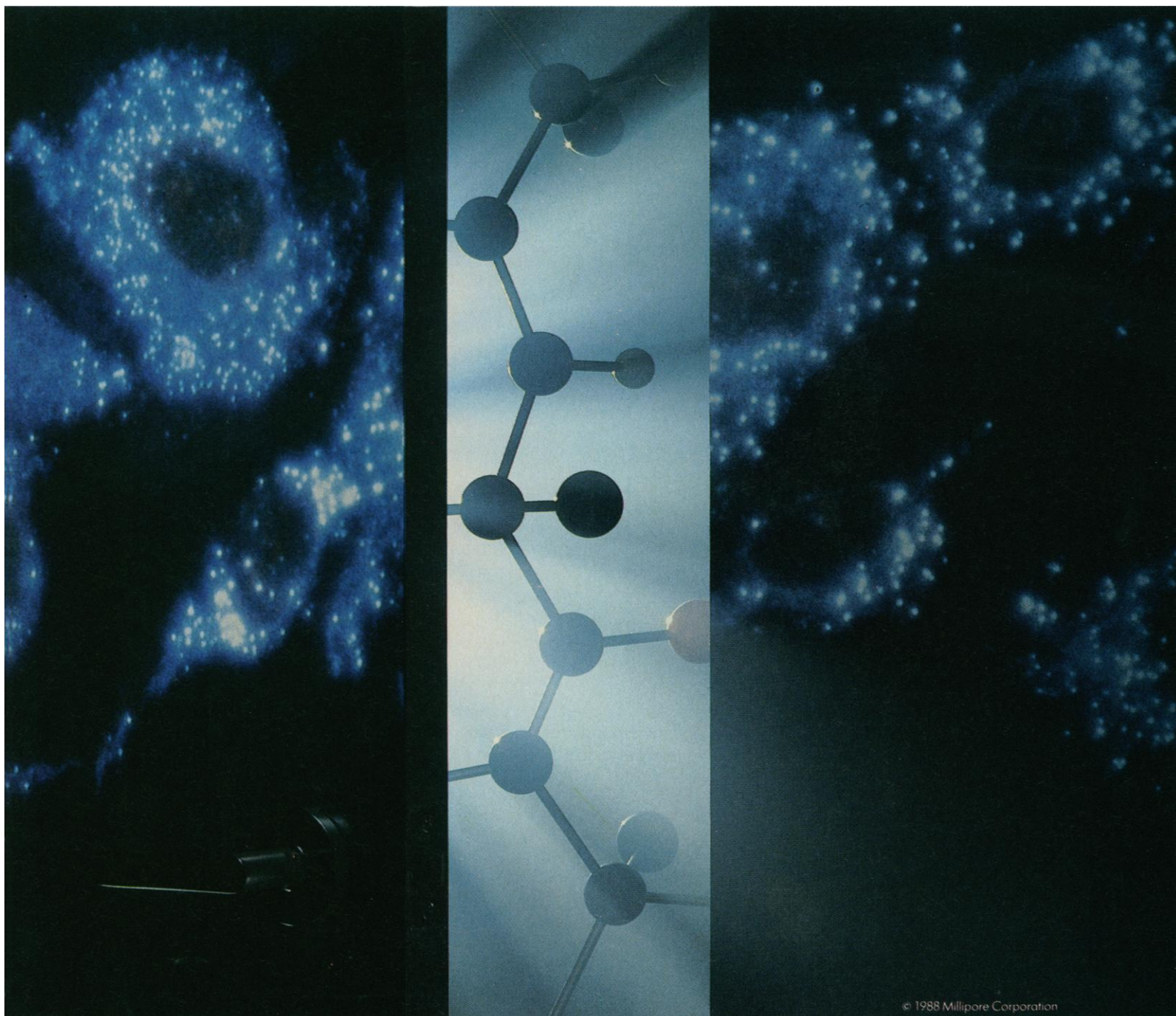
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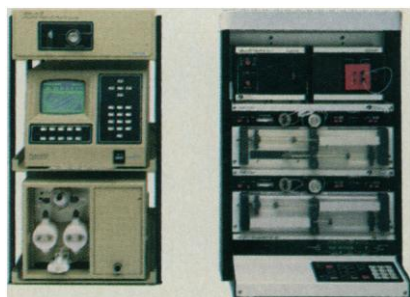
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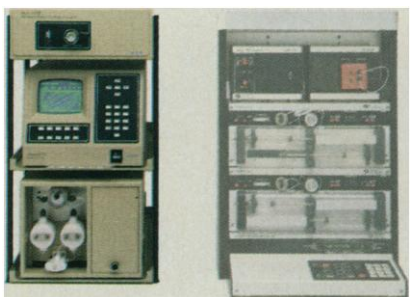
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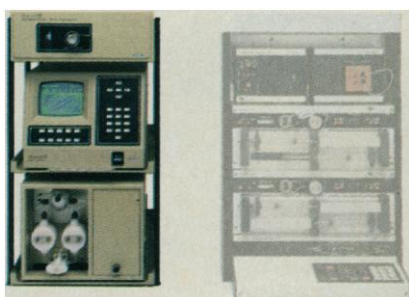
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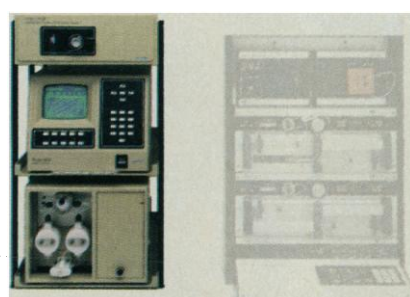
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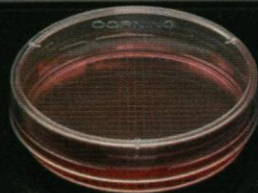
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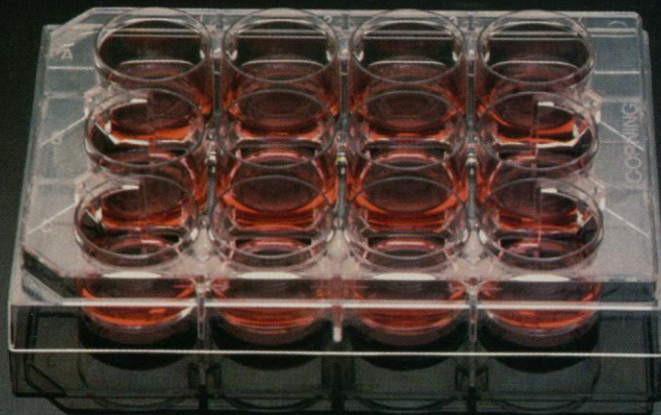
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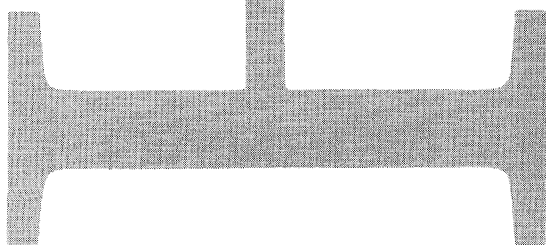
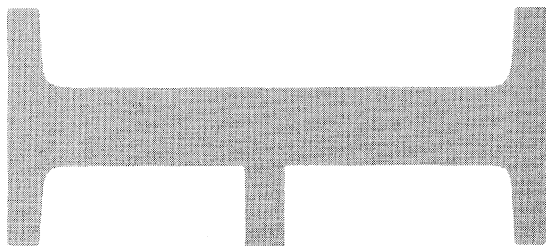
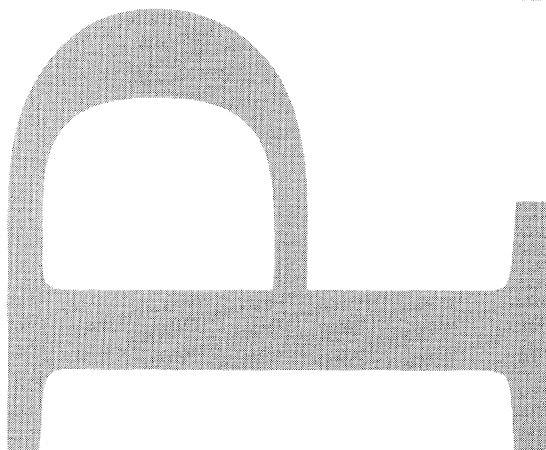
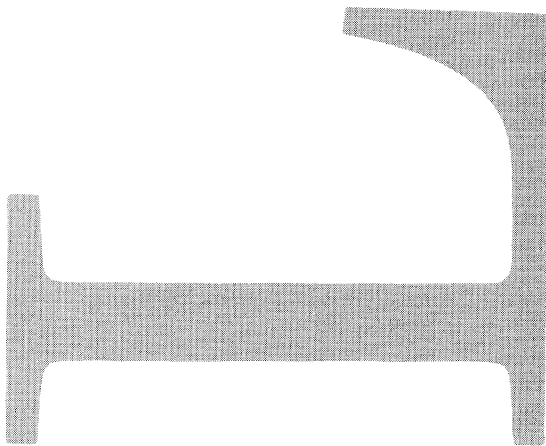
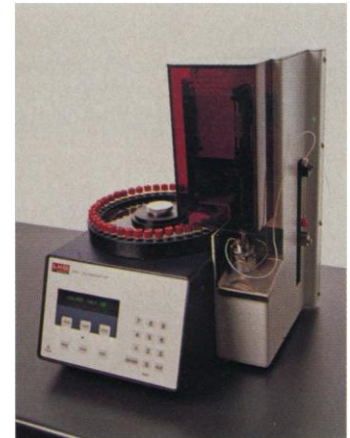
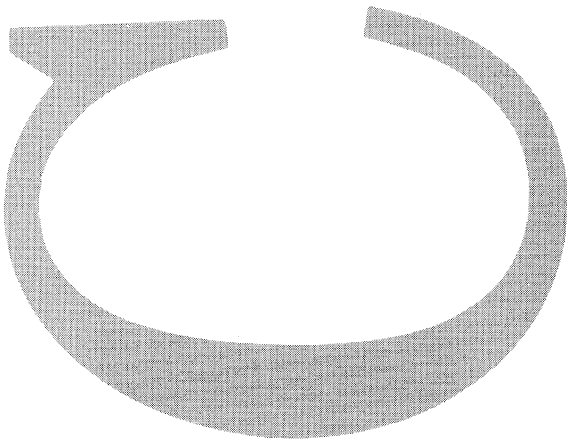
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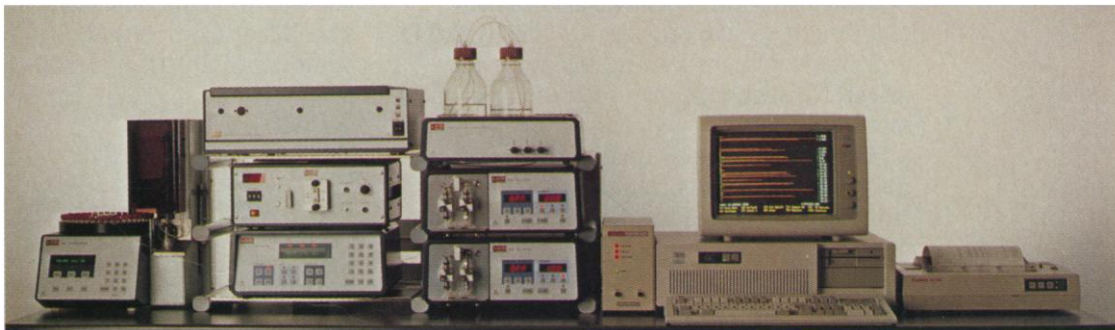
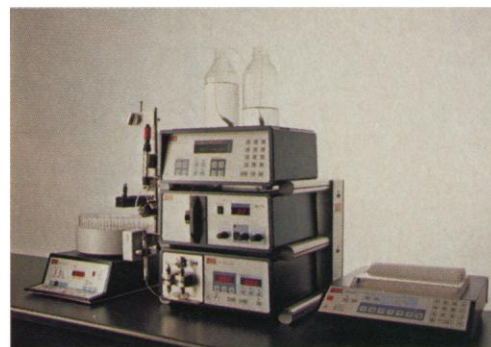
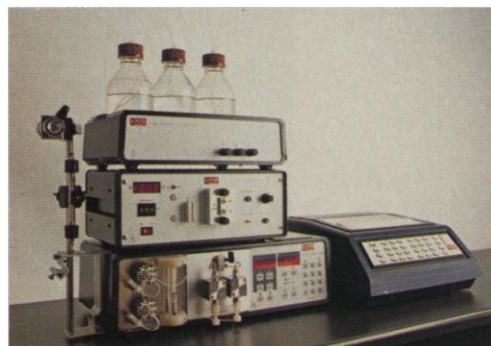
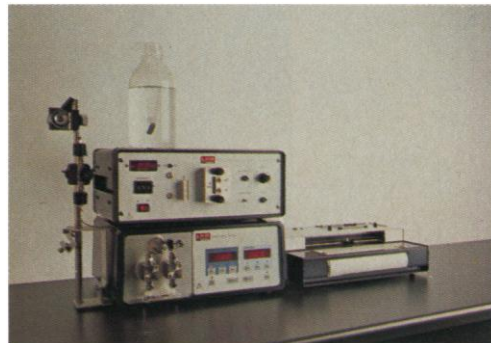
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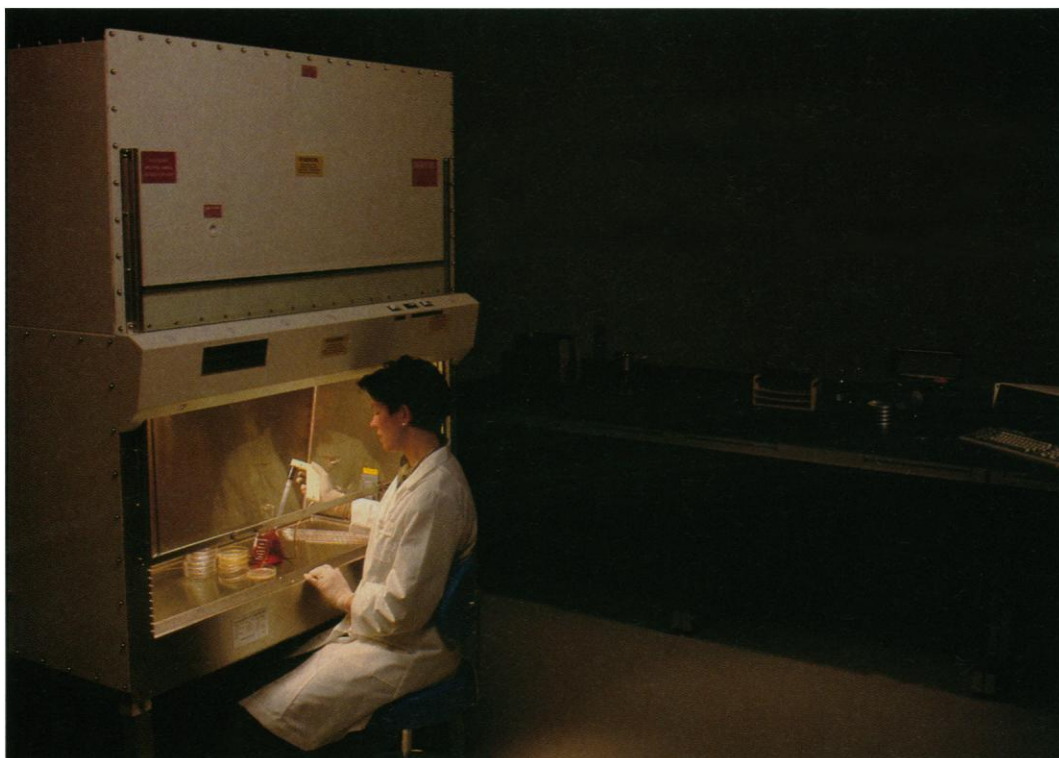
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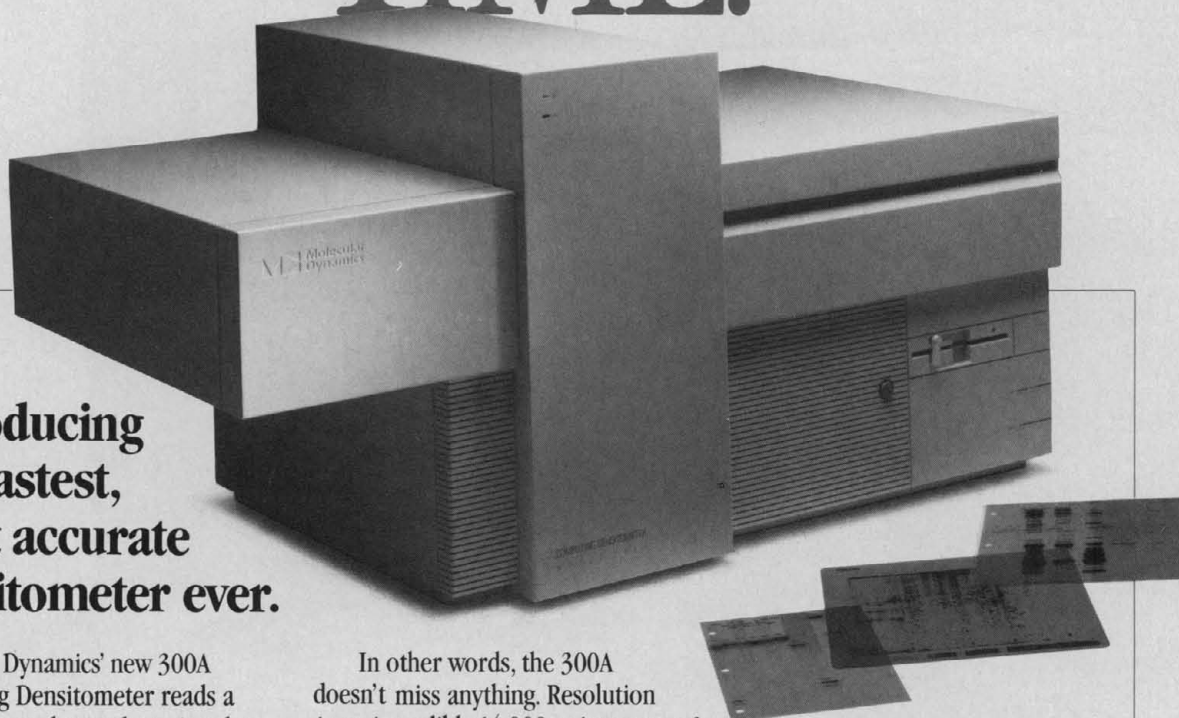
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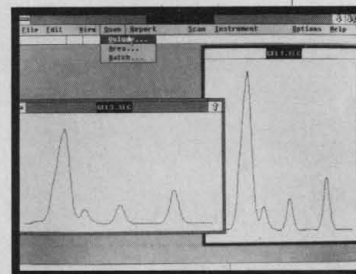
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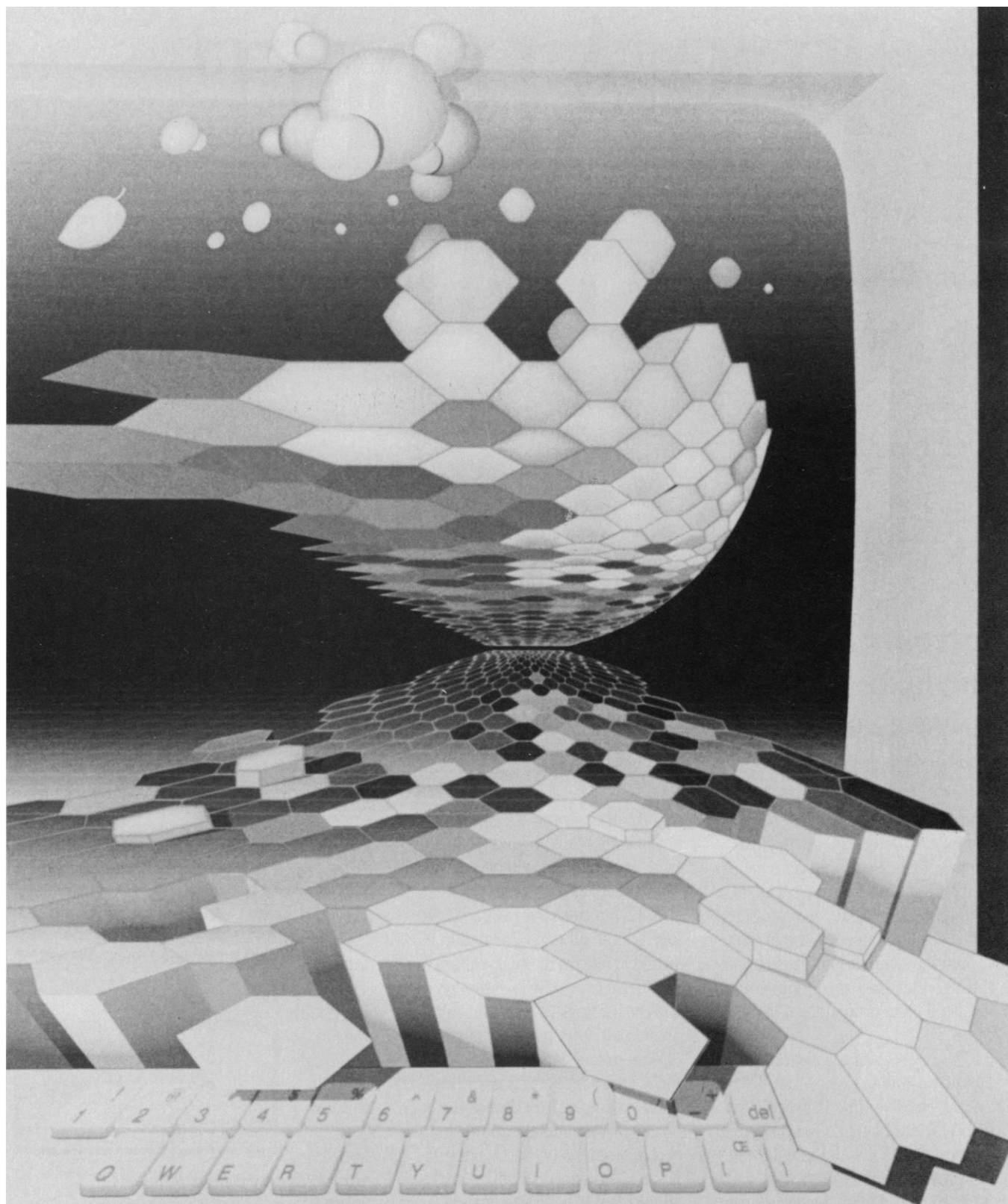
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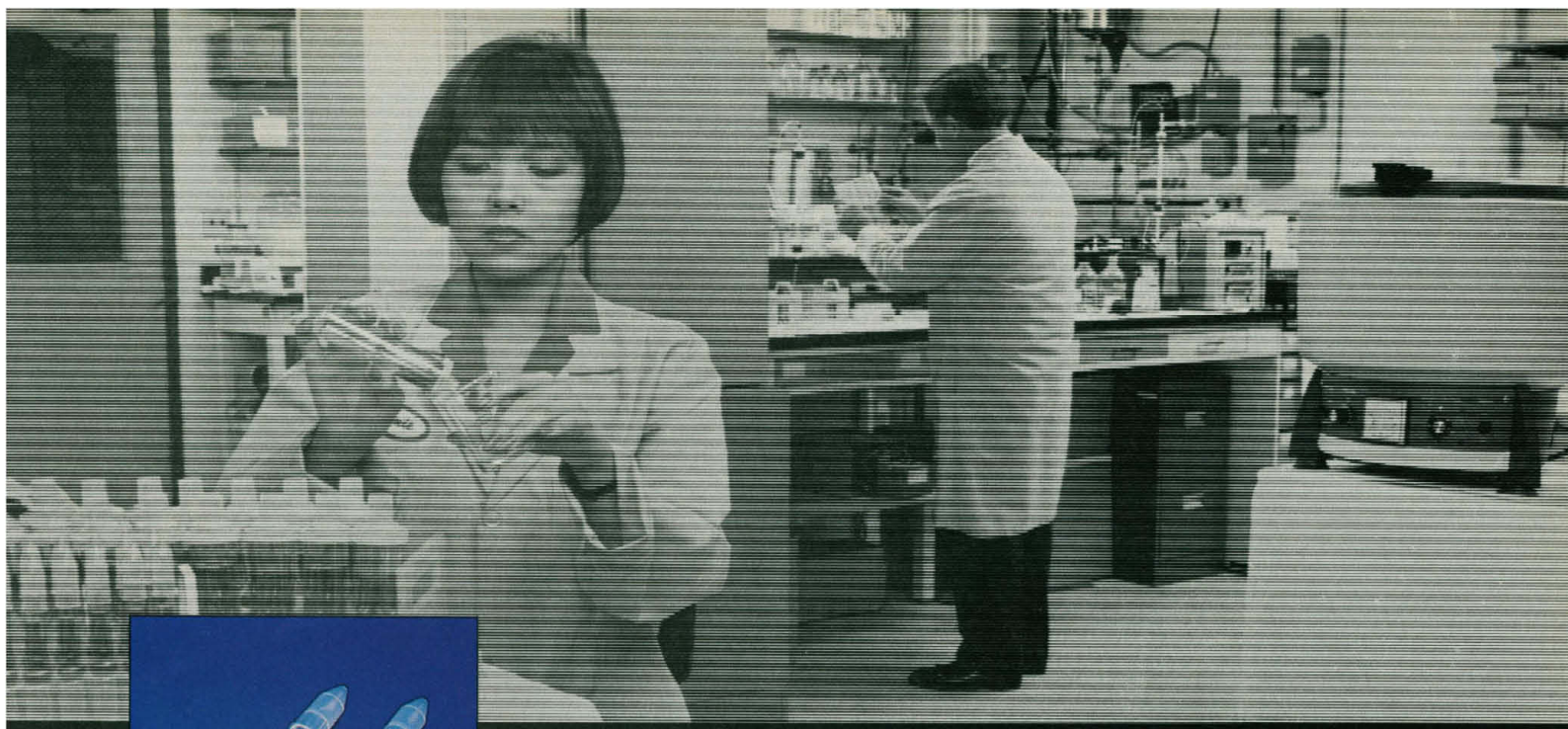
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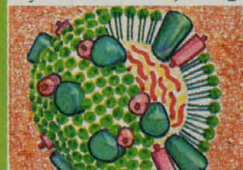
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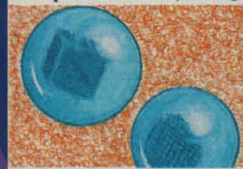
Lysosomes 30,000xg



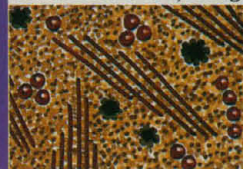
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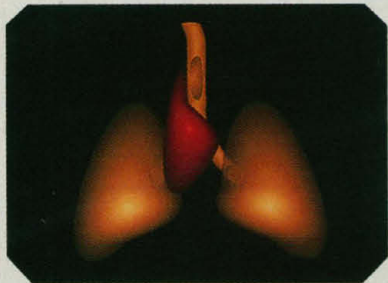


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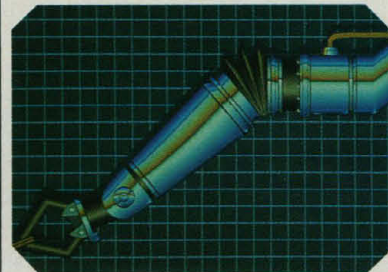
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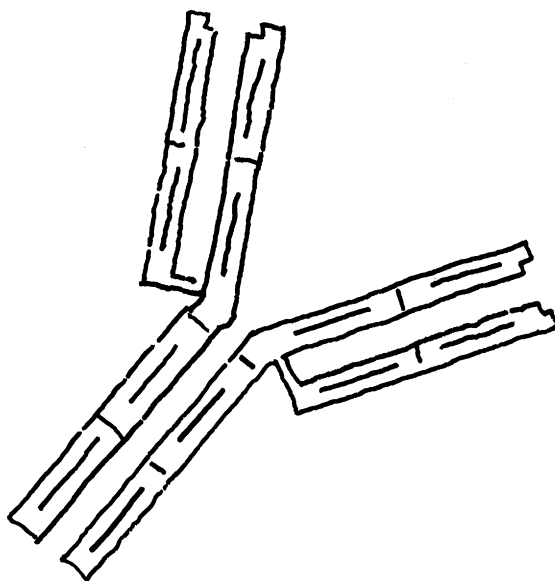
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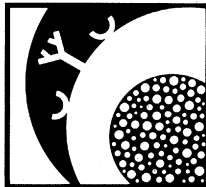
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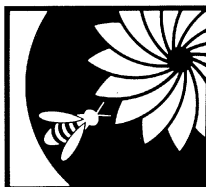
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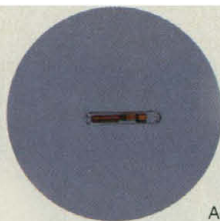
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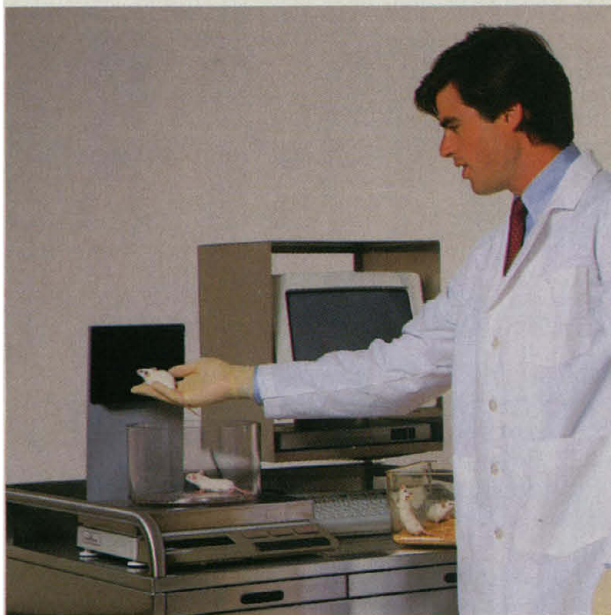
Cost—it's expensive to mark the animals initially and to read them subsequently

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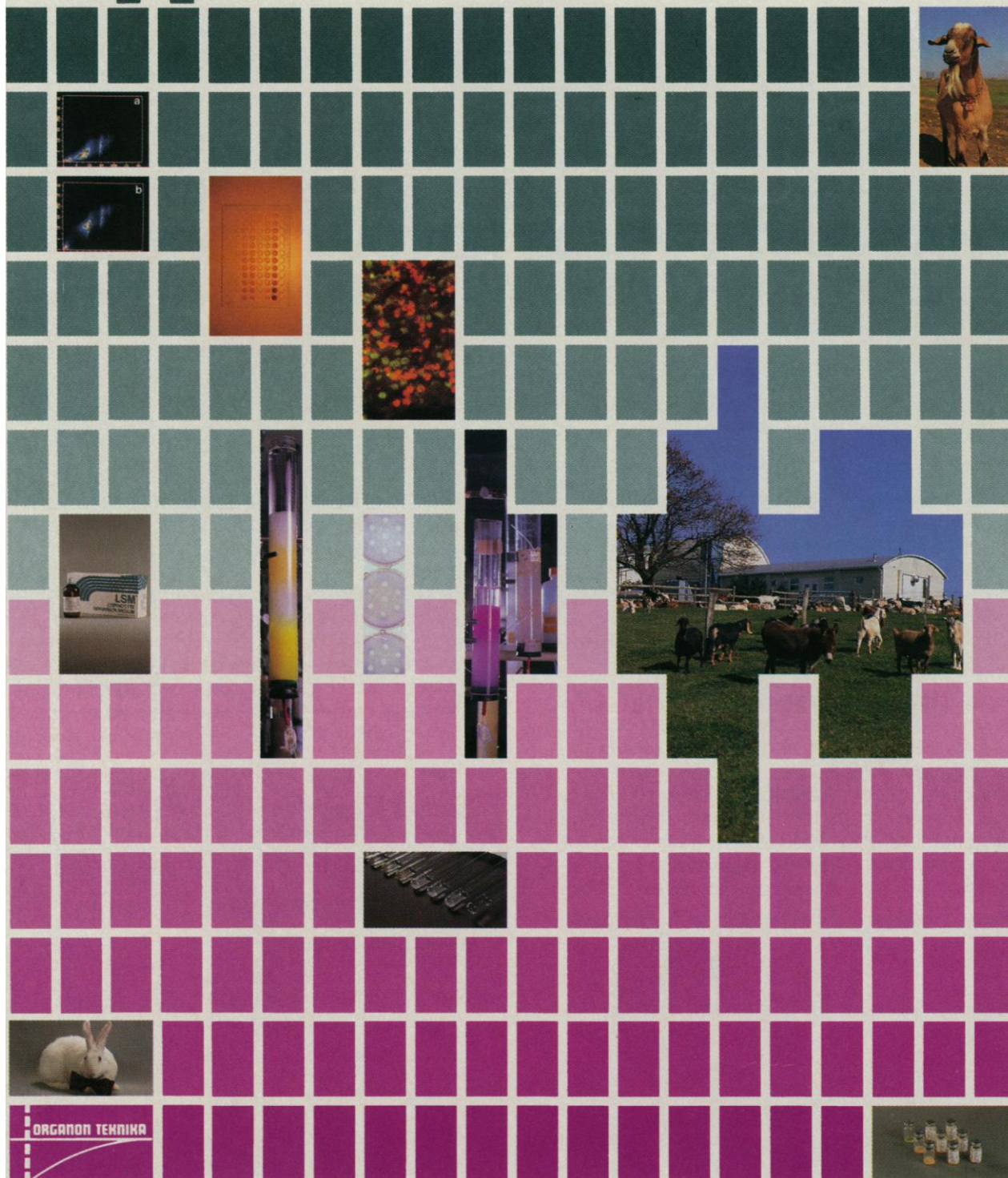
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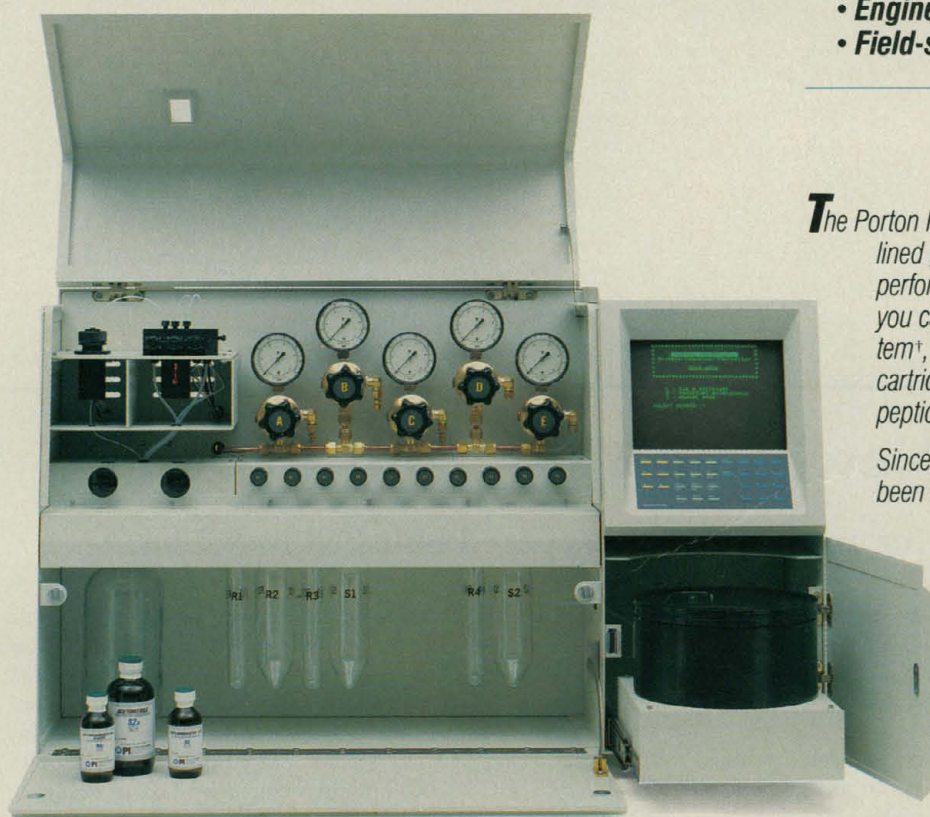
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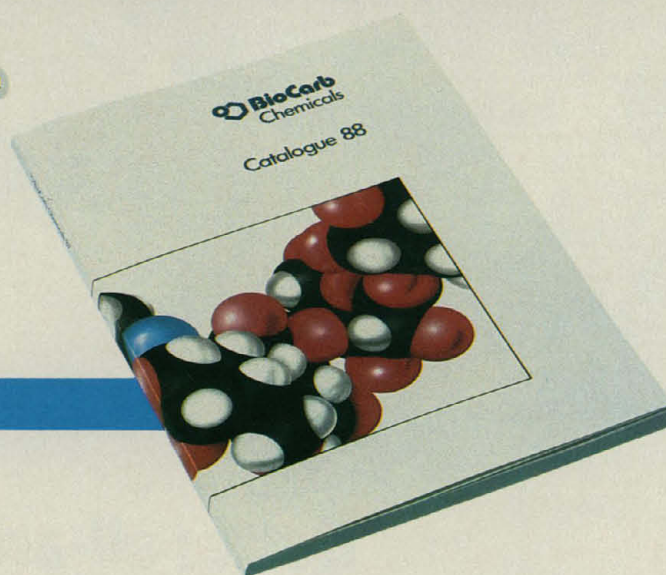
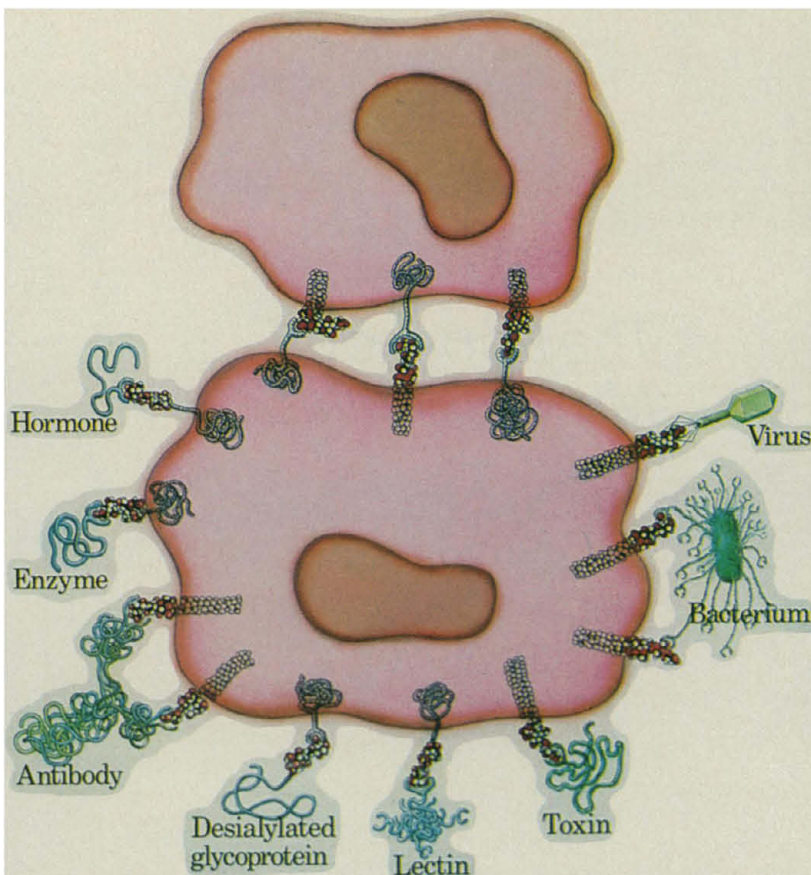


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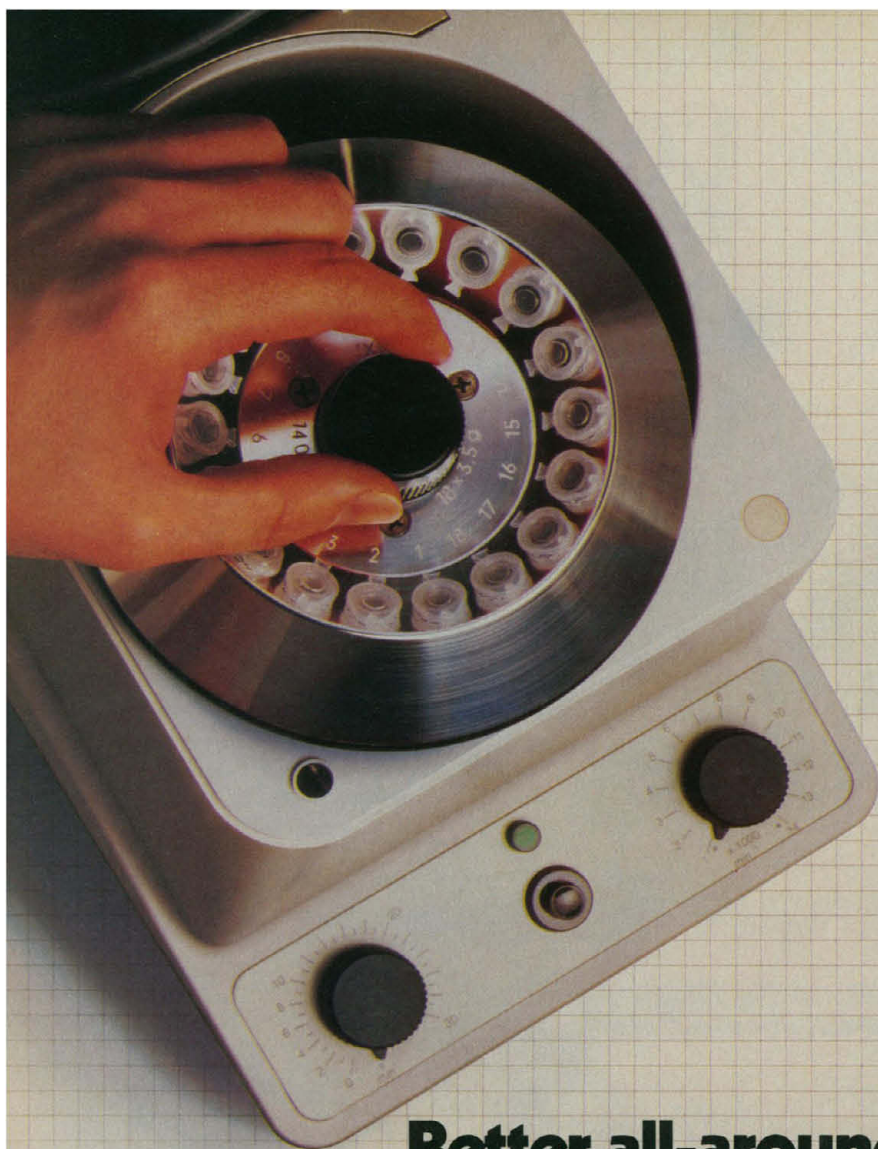
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Higher capacity...plus.

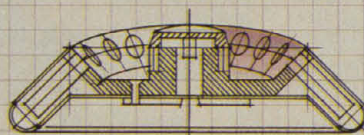
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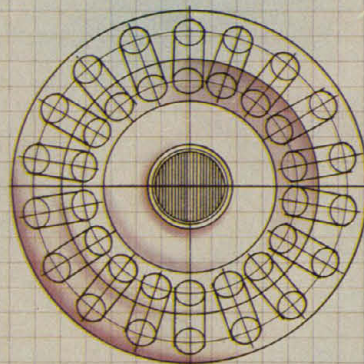
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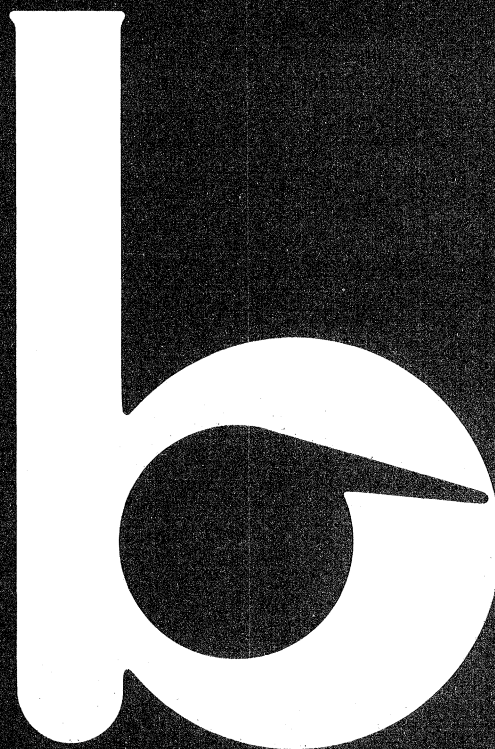
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If you thought there's nothing new in ion exchange, here's a pleasant surprise...

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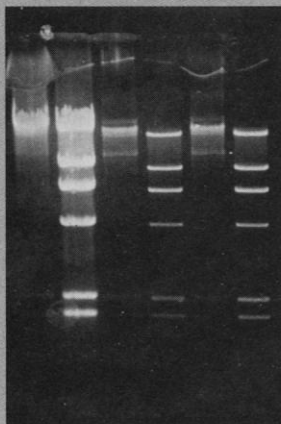
Rapid removal of ethidium bromide

Molecular biology grade ion exchange resins are *certified* nuclease-free and ligase inhibitor free. As such, they will maintain the integrity of your sample during the purification process. Further, you can achieve same day results when you use these resins for rapid removal of ethidium bromide from plasmids and deionization of PEG and formamide.

Fast, easy product purification

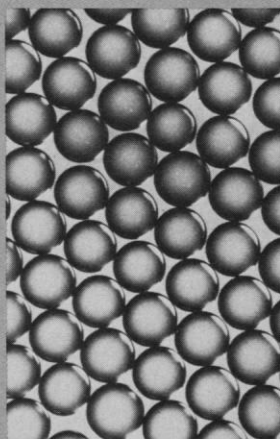
Biotechnology grade resins are of the highest quality and certified to have low microbial levels. Once again, the integrity of your samples is protected and you will save considerable time by using these resins for :

- Detergent removal, heavy metal removal, and deionization of nonionic products. We'll provide technical assistance for scale-up applications.



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So if you thought nothing much has happened to ion exchange resins, or just never thought they'd be useful for your work, get in touch. You're in for a pleasant surprise.

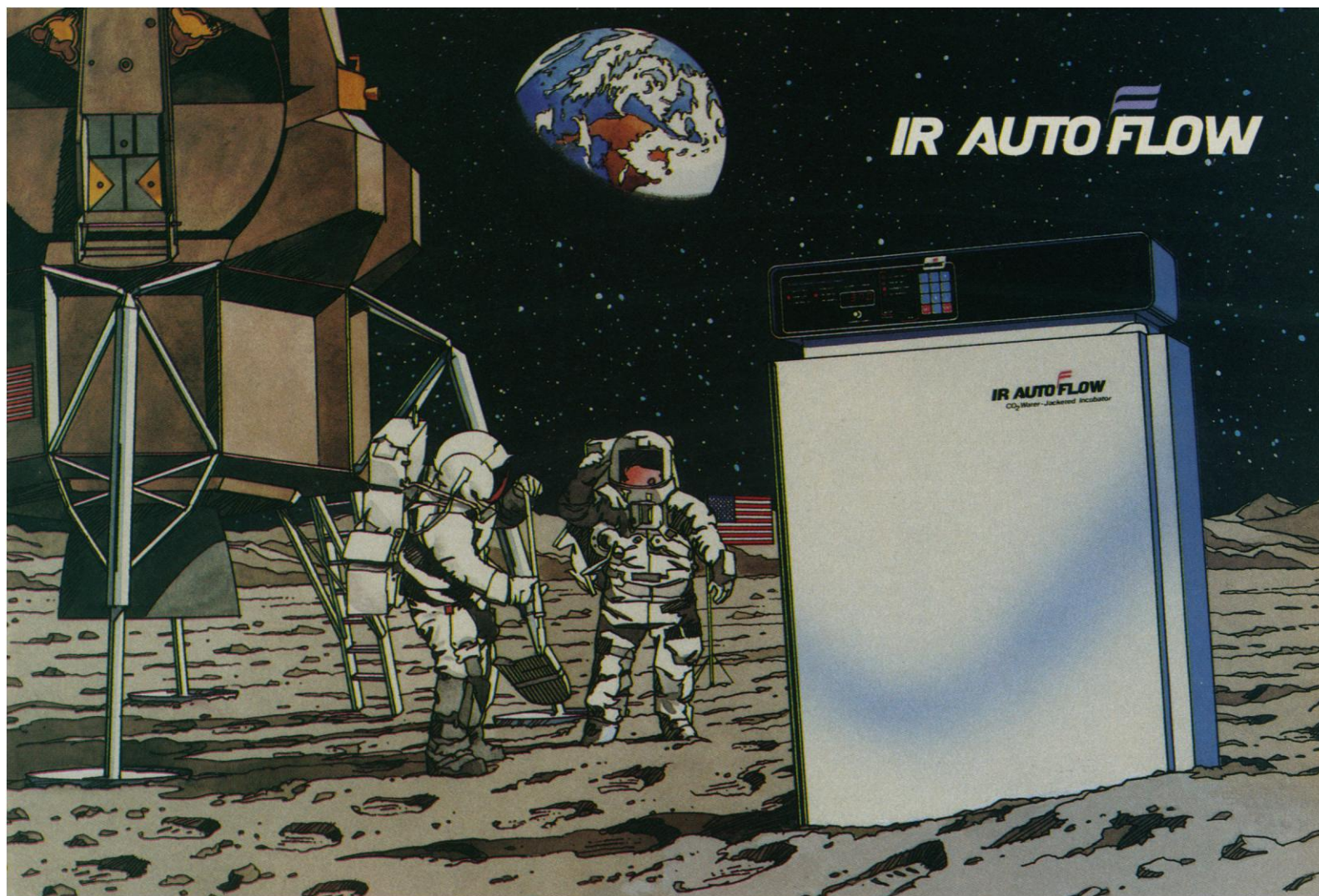
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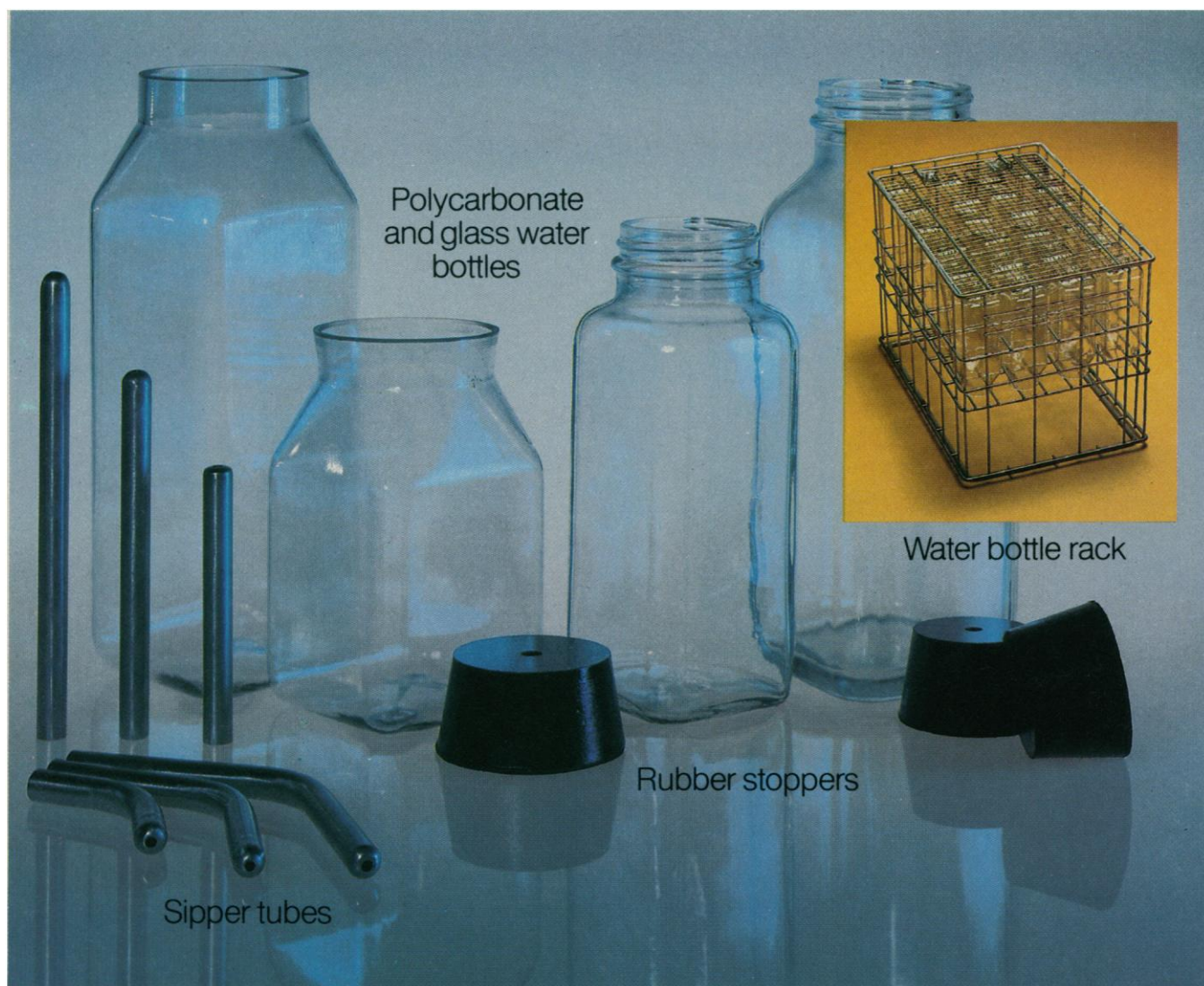
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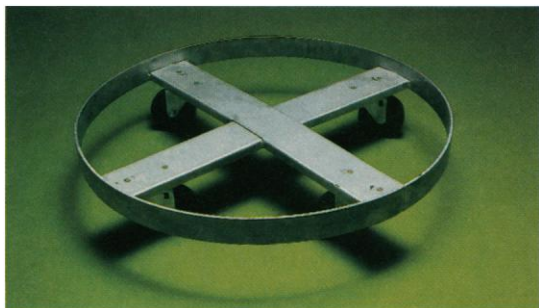
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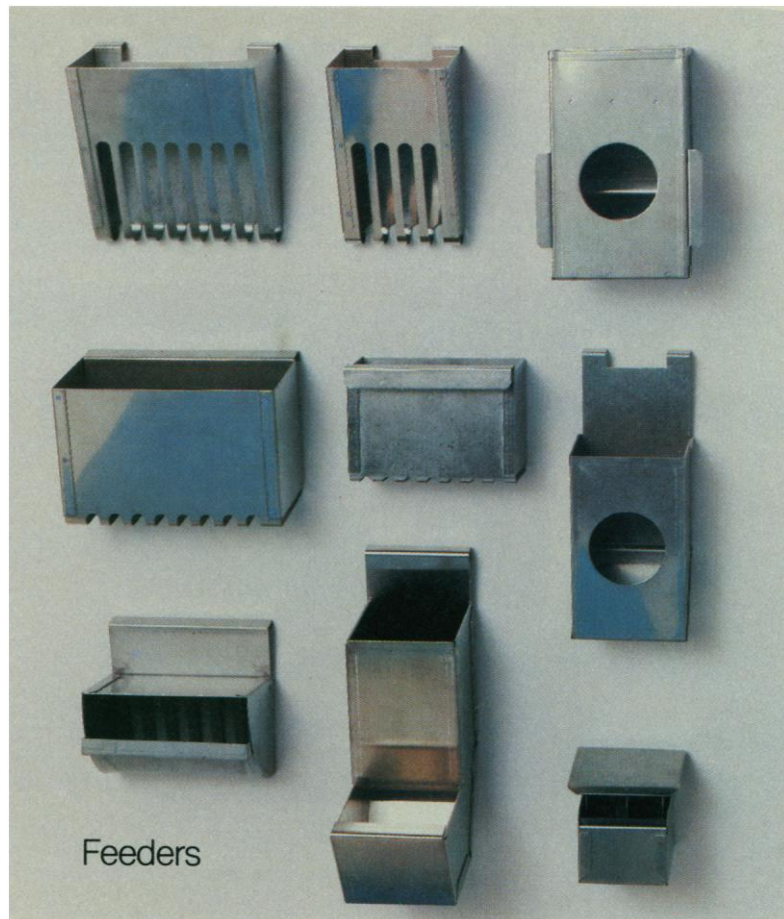
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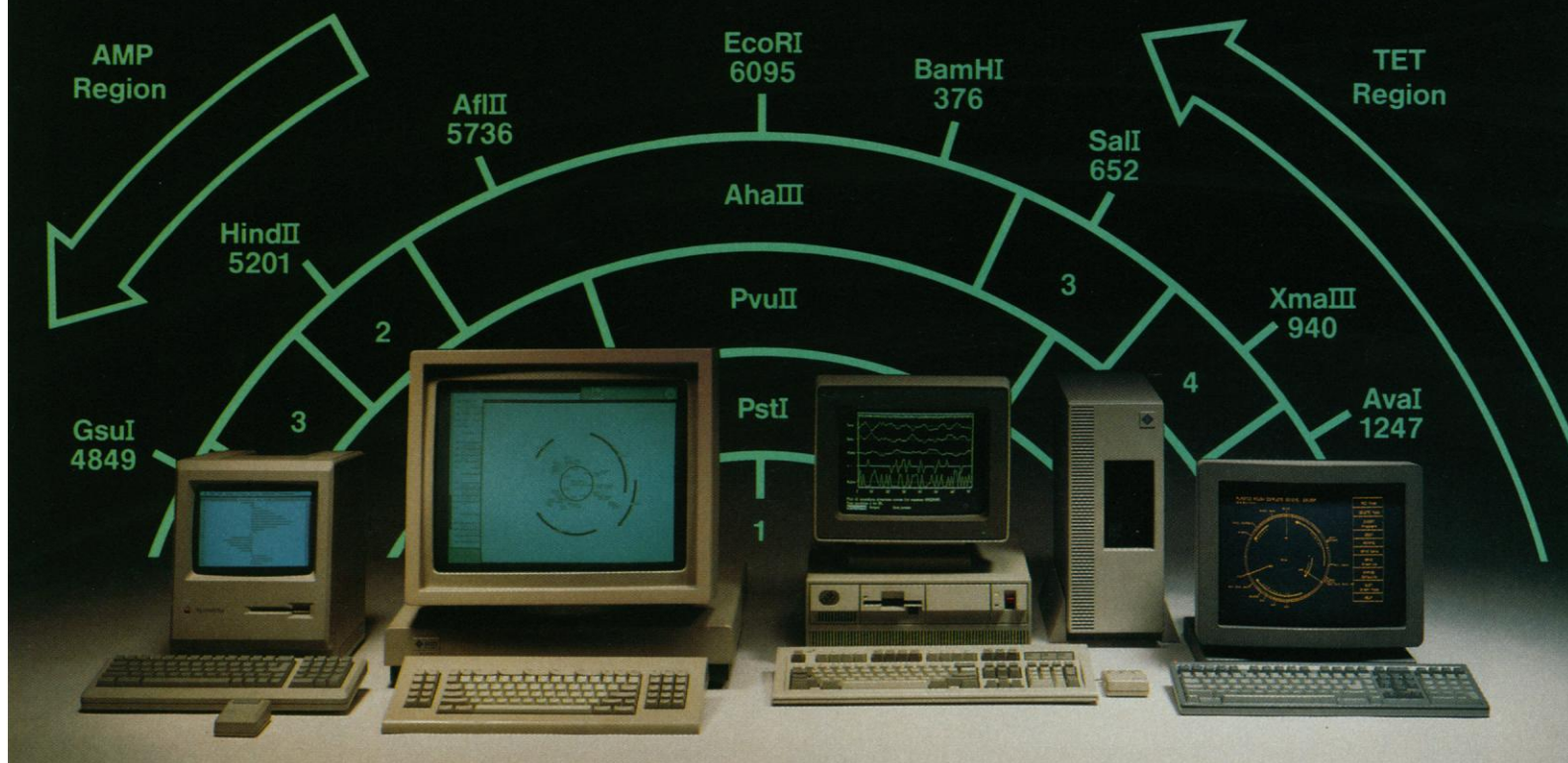
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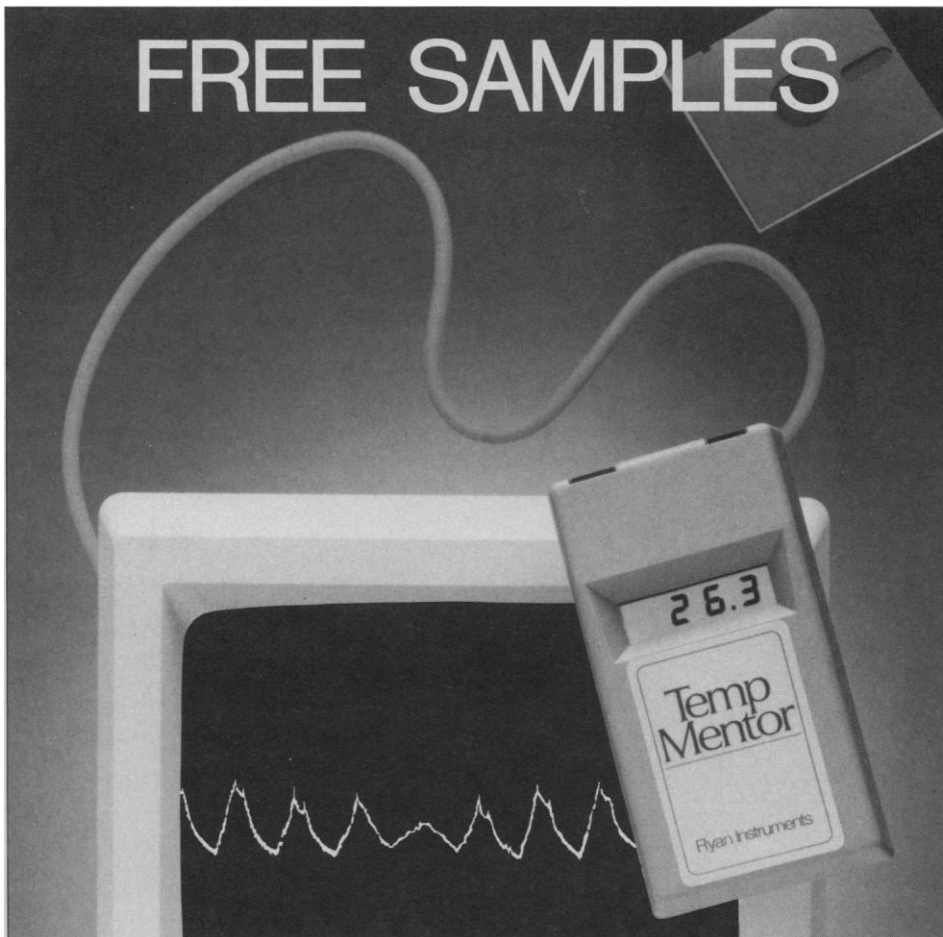
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Replaces Nylon Wool Columns and T-Cell Rosettes

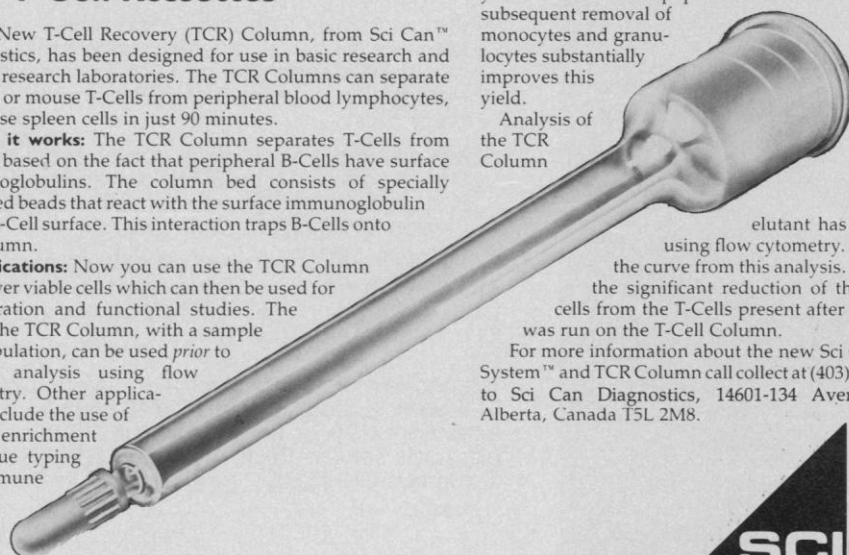
The New T-Cell Recovery (TCR) Column, from Sci Can™ Diagnostics, has been designed for use in basic research and clinical research laboratories. The TCR Columns can separate human or mouse T-Cells from peripheral blood lymphocytes, or mouse spleen cells in just 90 minutes.

How it works: The TCR Column separates T-Cells from B-Cells based on the fact that peripheral B-Cells have surface immunoglobulins. The column bed consists of specially prepared beads that react with the surface immunoglobulin of the B-Cell surface. This interaction traps B-Cells onto the column.

Applications: Now you can use the TCR Column to recover viable cells which can then be used for enumeration and functional studies. The use of the TCR Column, with a sample cell population, can be used *prior* to further analysis using flow cytometry. Other applications include the use of T-Cell enrichment for tissue typing and immune status monitoring.

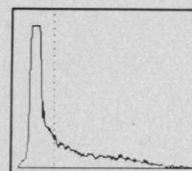
Proven Performance: Based on analysis, over 95% of the B-Cells are retained by the Sci Can TCR Column, with typical yields for the T-Cell population of 70% or greater. Prior or subsequent removal of monocytes and granulocytes substantially improves this yield.

Analysis of the TCR Column

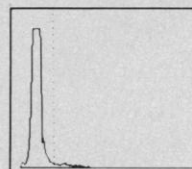


elutant has been performed using flow cytometry. Graph #1 shows the curve from this analysis. Graph #2 shows the significant reduction of the contaminating cells from the T-Cells present after the same sample was run on the T-Cell Column.

For more information about the new Sci Can Cell Passage System™ and TCR Column call collect at (403) 455-6079 or write to Sci Can Diagnostics, 14601-134 Avenue, Edmonton, Alberta, Canada T5L 2M8.



PBL's prior to separation. Treated with CD4 & CD8 monoclonal antibodies. Goat anti-mouse IgG and IgM FITC used to identify T-Cells.



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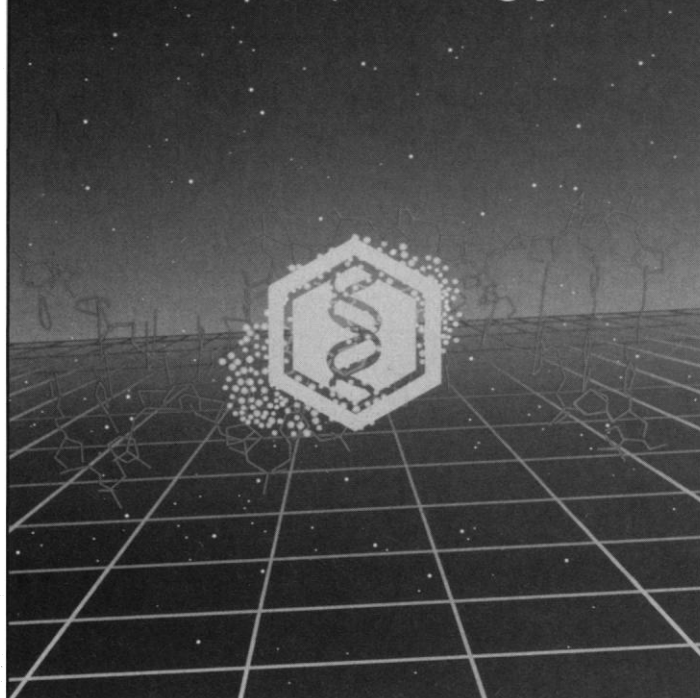
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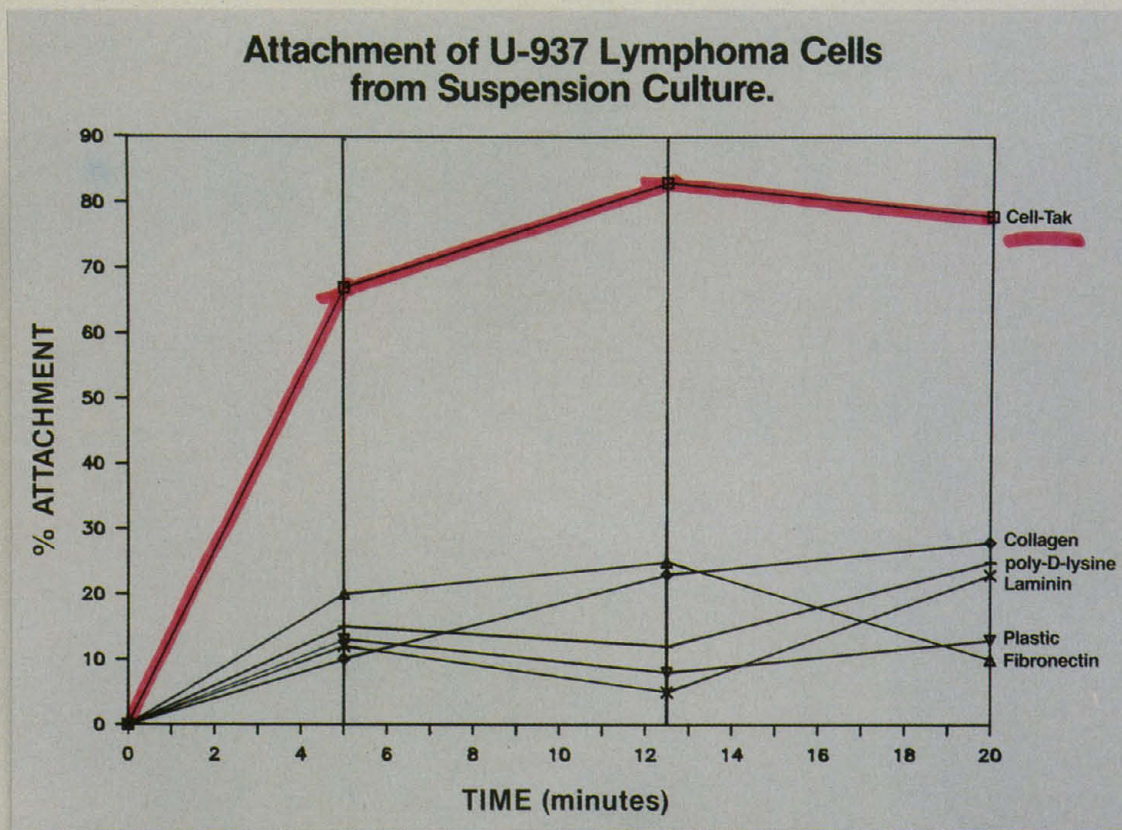
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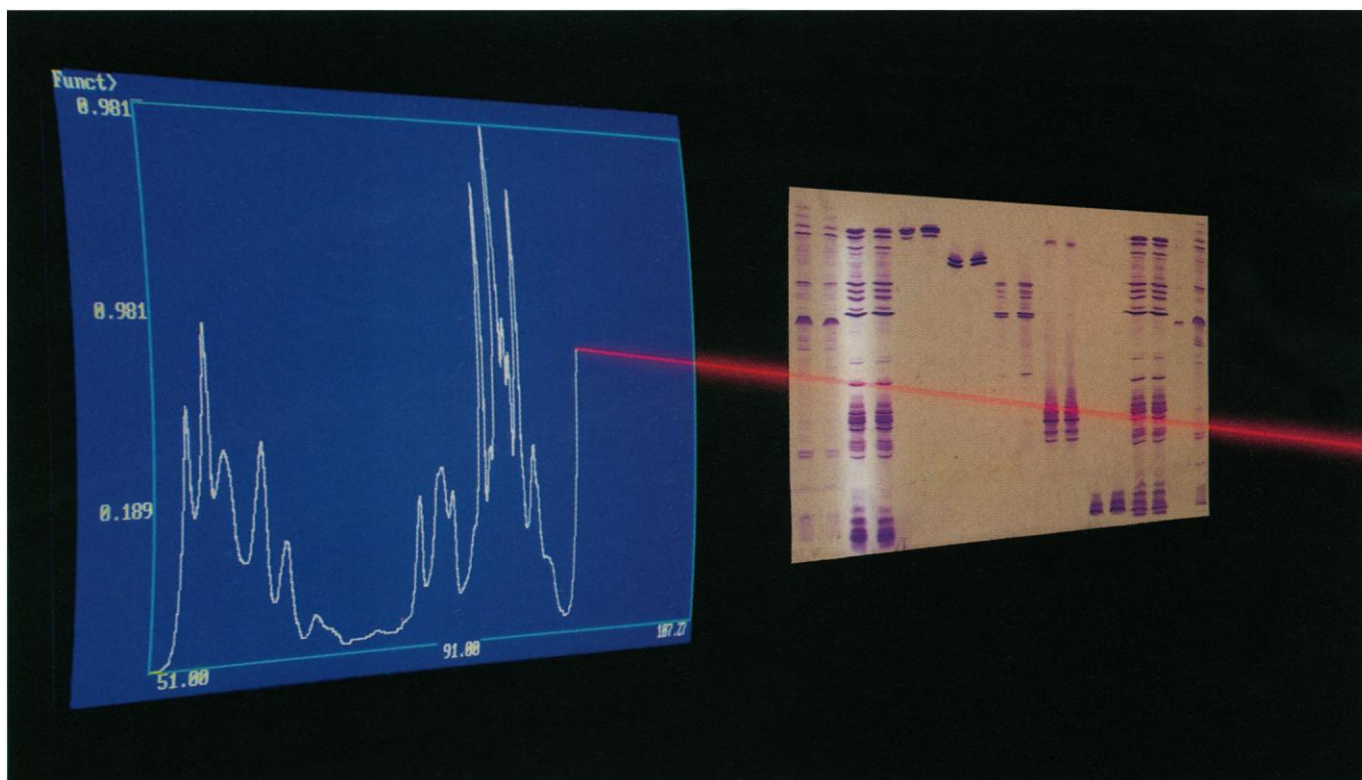
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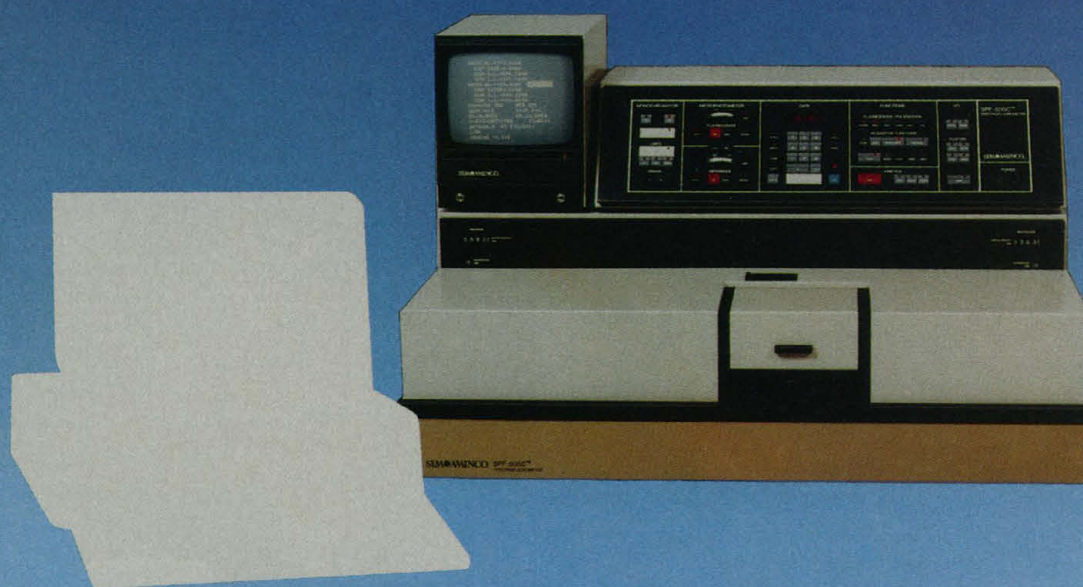
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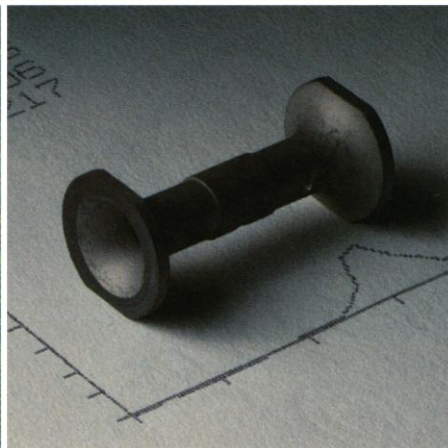
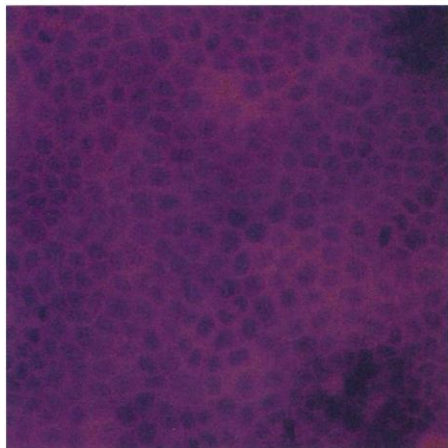
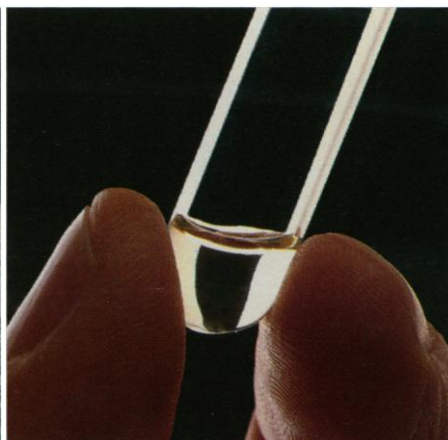
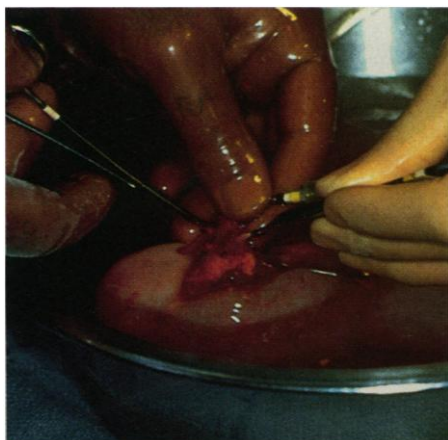
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(Above) Life science: organ transplantation. Unacceptably high levels of endotoxins were showing up in isolated organs after perfusion. Contaminants were linked to tetra-distilled rinse water where they fluctuated according to changes in feed water quality.

(Below) Life science: cell culture. Mammalian cells stopped growing in defined medium but not in serum-supplemented medium. After checking hormones, powdered media, HEPES and other medium components, problem was linked to double-distilled water. Problem did not occur when Milli-Q water was used.

(Above) In-vitro fertilization: gamete processing. Consistent and controlled conception was impossible. Dissolved contaminants (heavy metals and organics) in water used for rinsing and as basis for media incapacitated sperm. IVF became viable only after switching to a Milli-Q system.

(Below) Biotech: DNA research. Very high rate of DNA loss or degradation during storage. Analysis of distilled water showed fluctuating ion levels, especially magnesium, a cofactor for enzymes that degrade DNA. Switch to Milli-Q system water greatly increased DNA viability and saved valuable materials.

(Above) HPLC: routine protein purification. Couldn't account for protein contamination until they checked their double-distilled water. Trace levels of endotoxins were adhering to glassware.

(Below) Atomic Adsorption: routine analysis. Never had any problems with the quality of double-distilled water until a new graphite furnace was installed. When lab water was used to "zero" new device, trace elements were lost below base line. Water used to dissolve samples introduced spurious readings. Only Milli-Q system water kept contamination below base line levels.

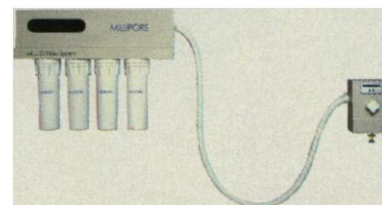
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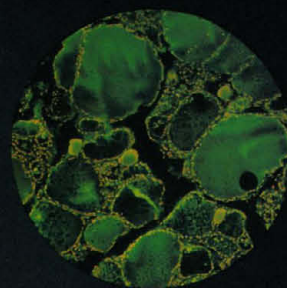
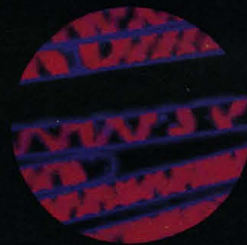
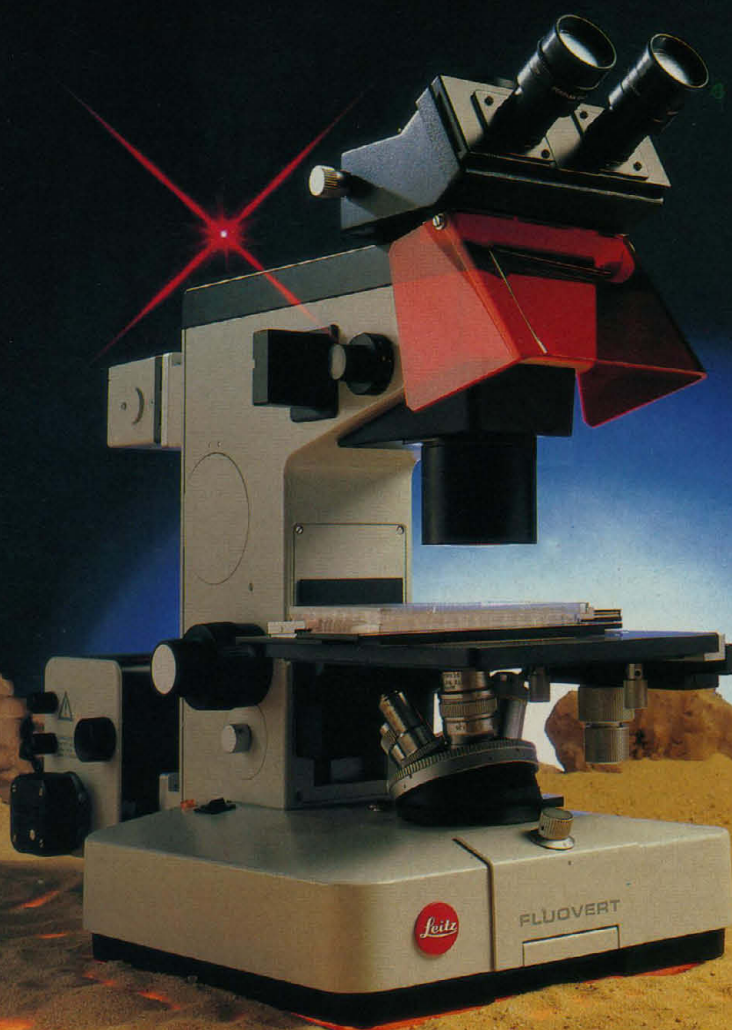


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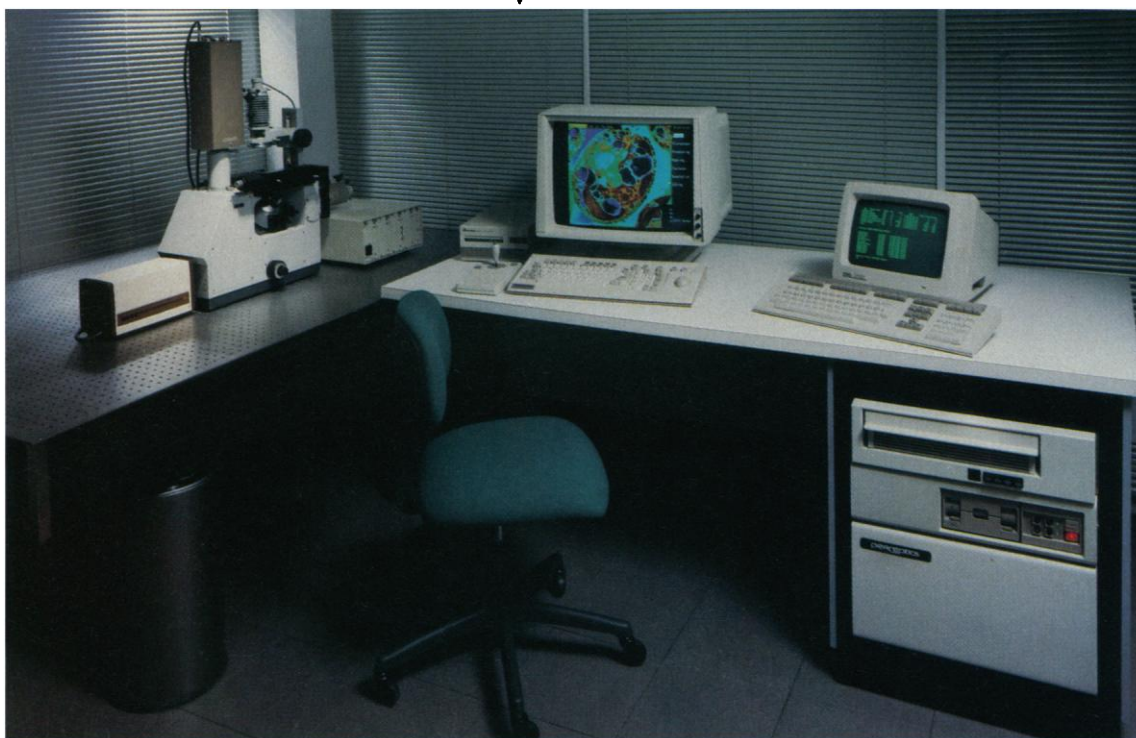
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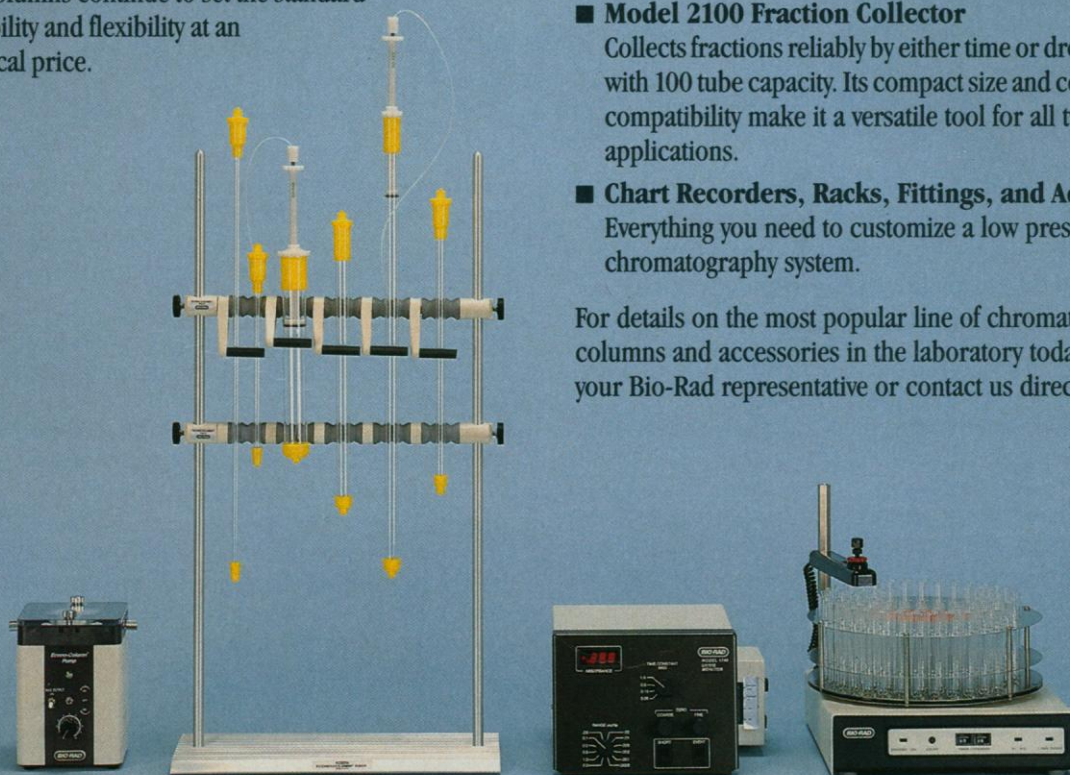
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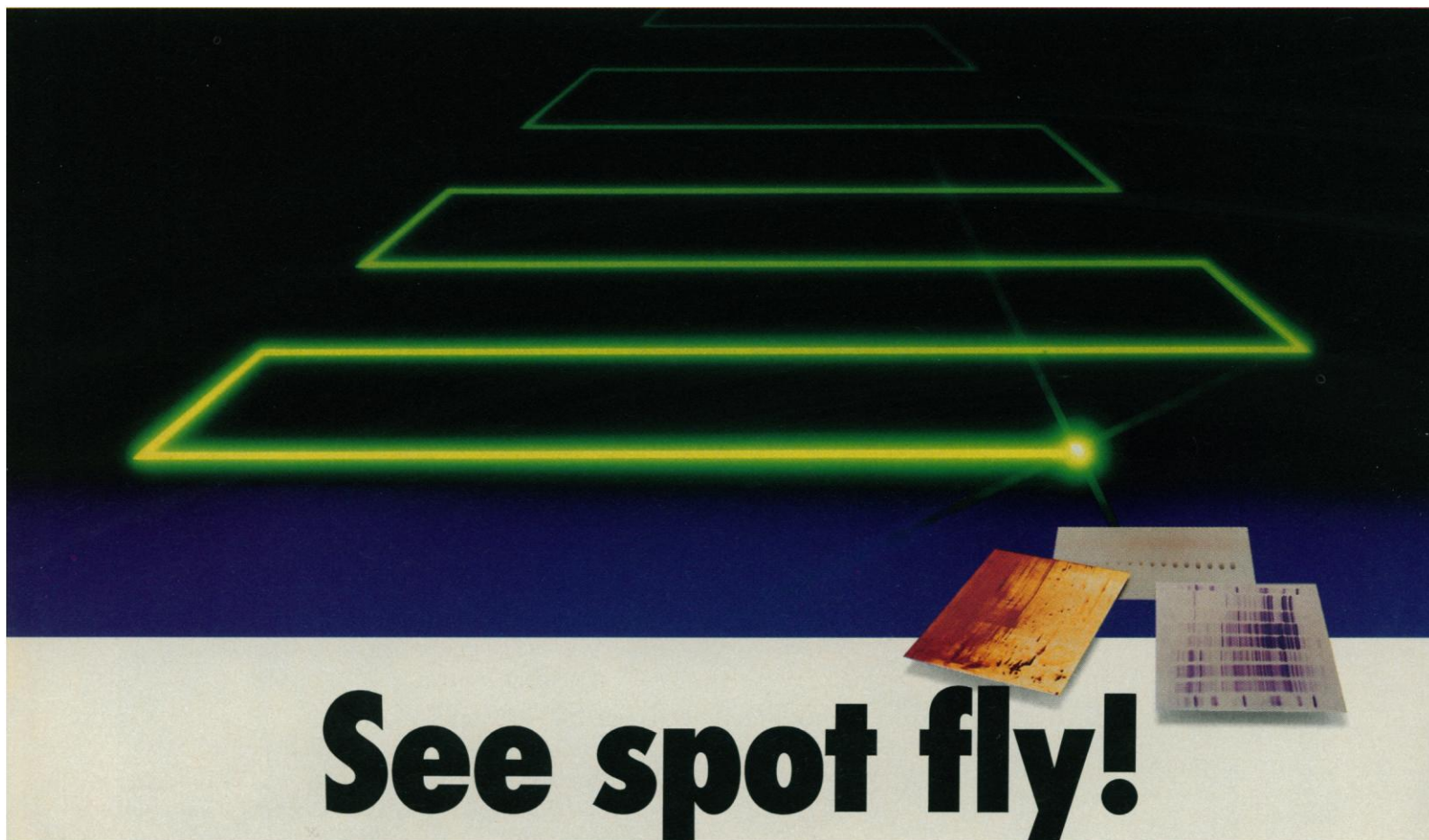
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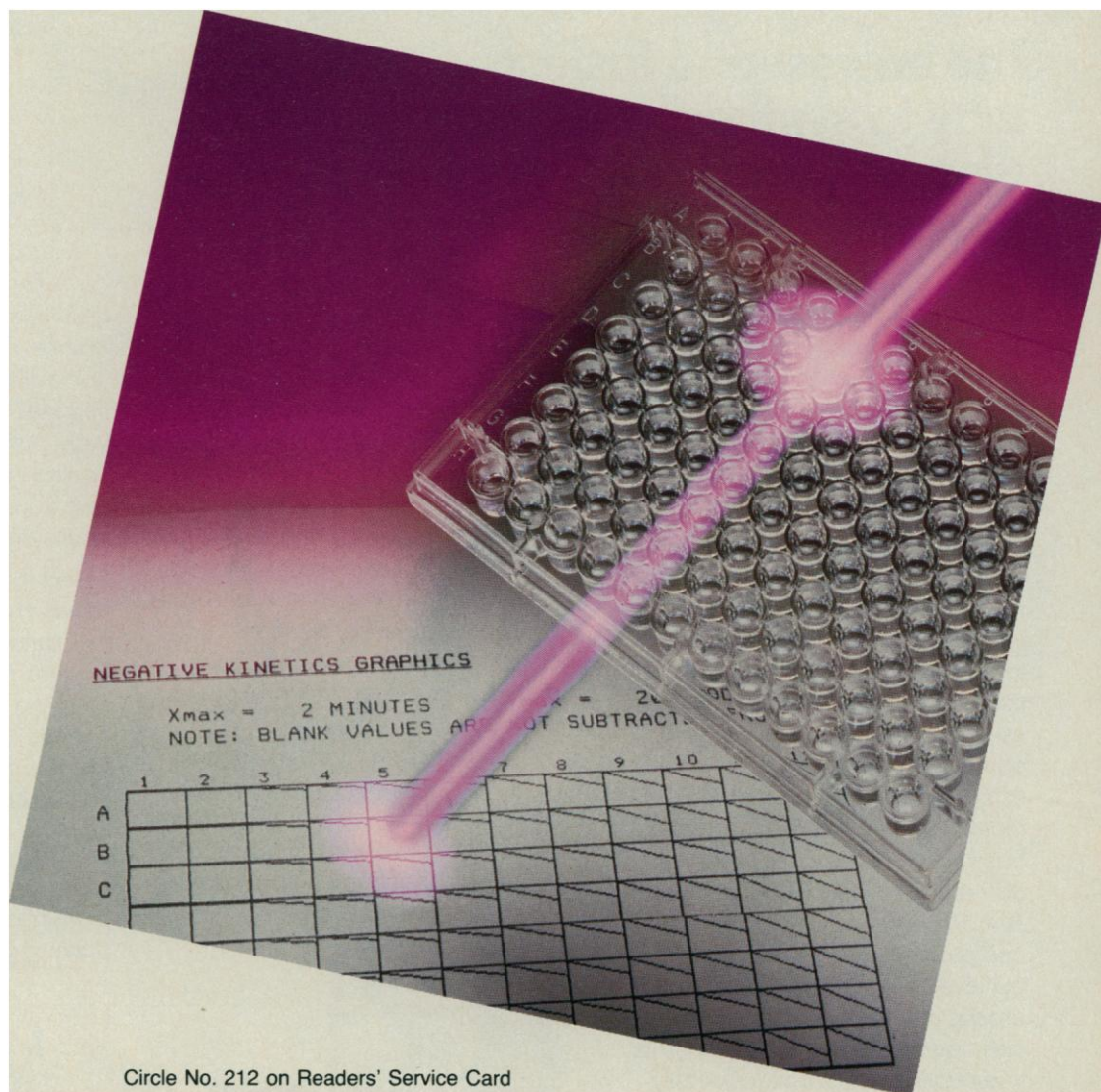
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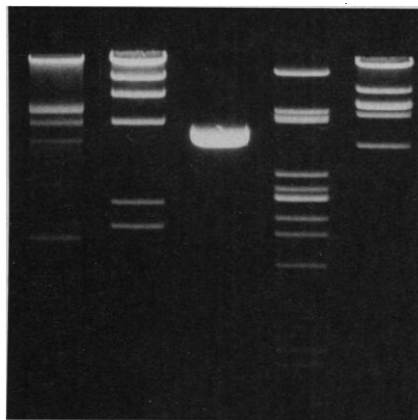
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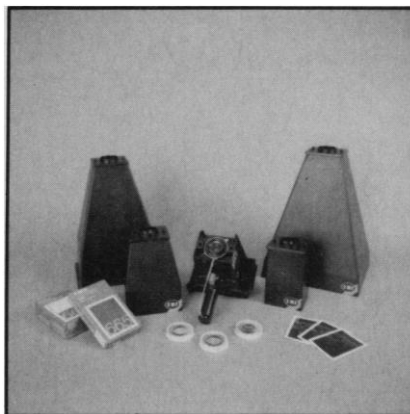
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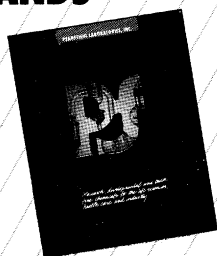
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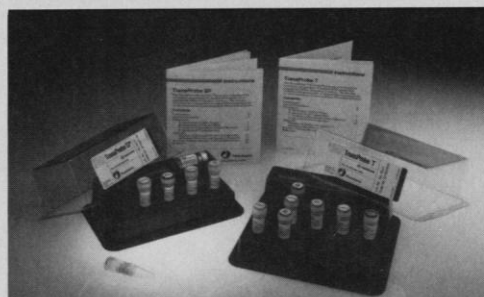
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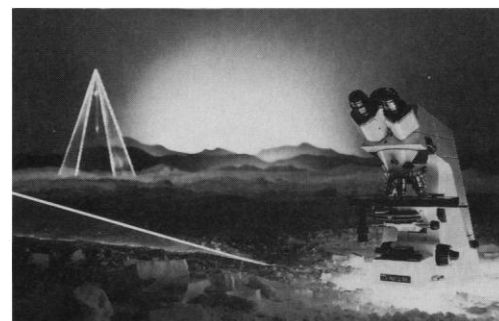
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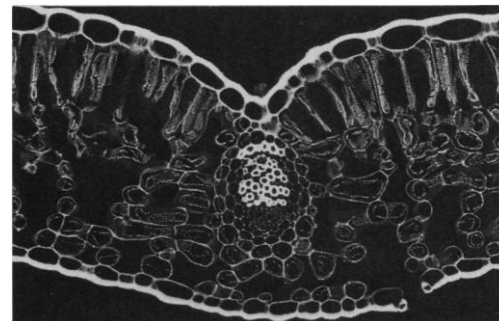
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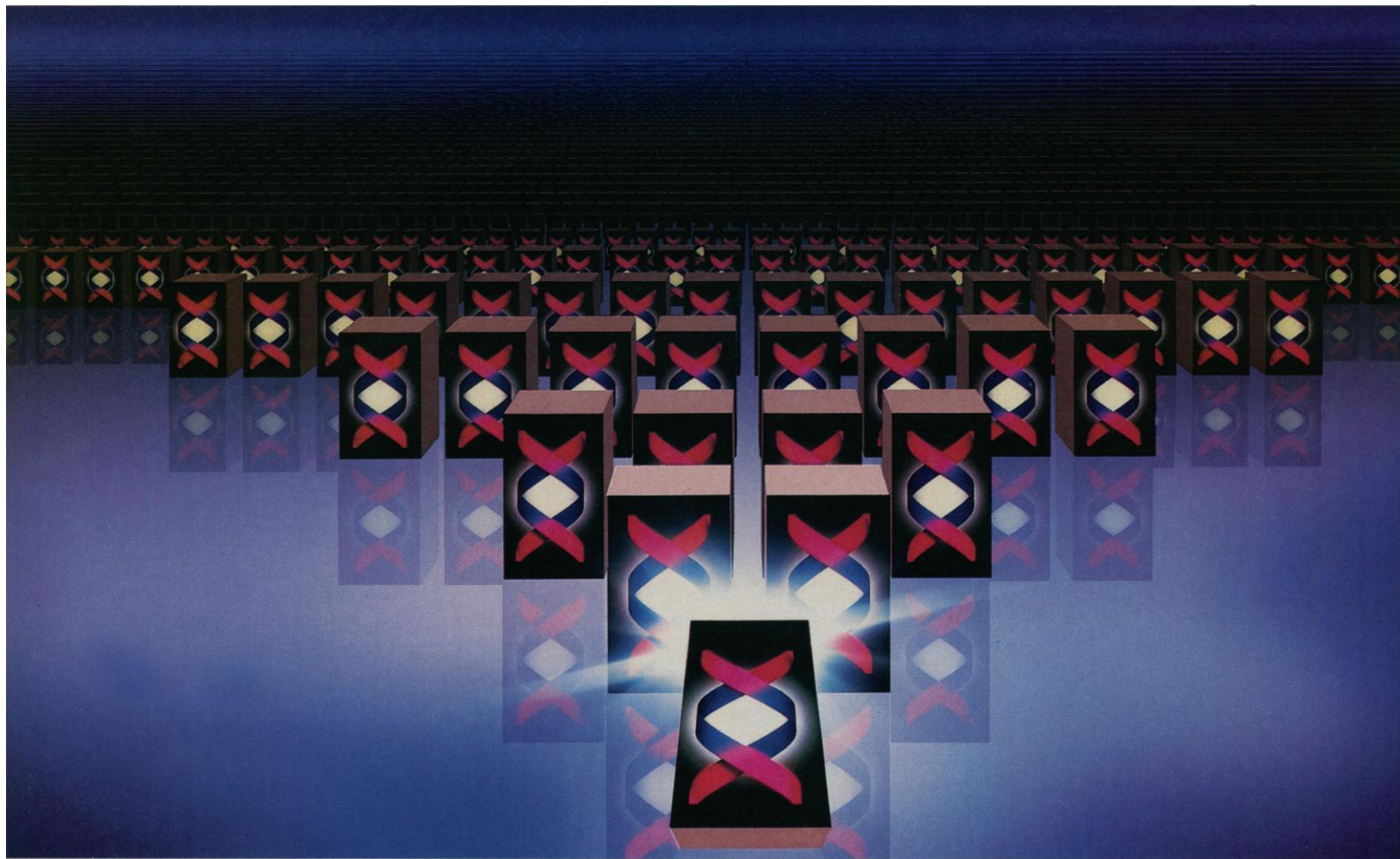
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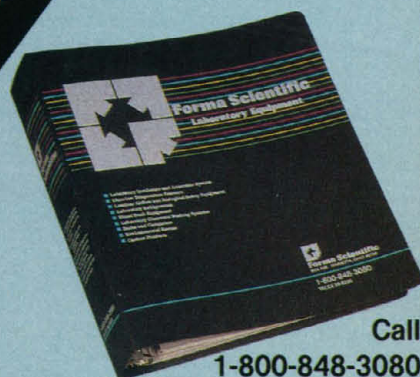
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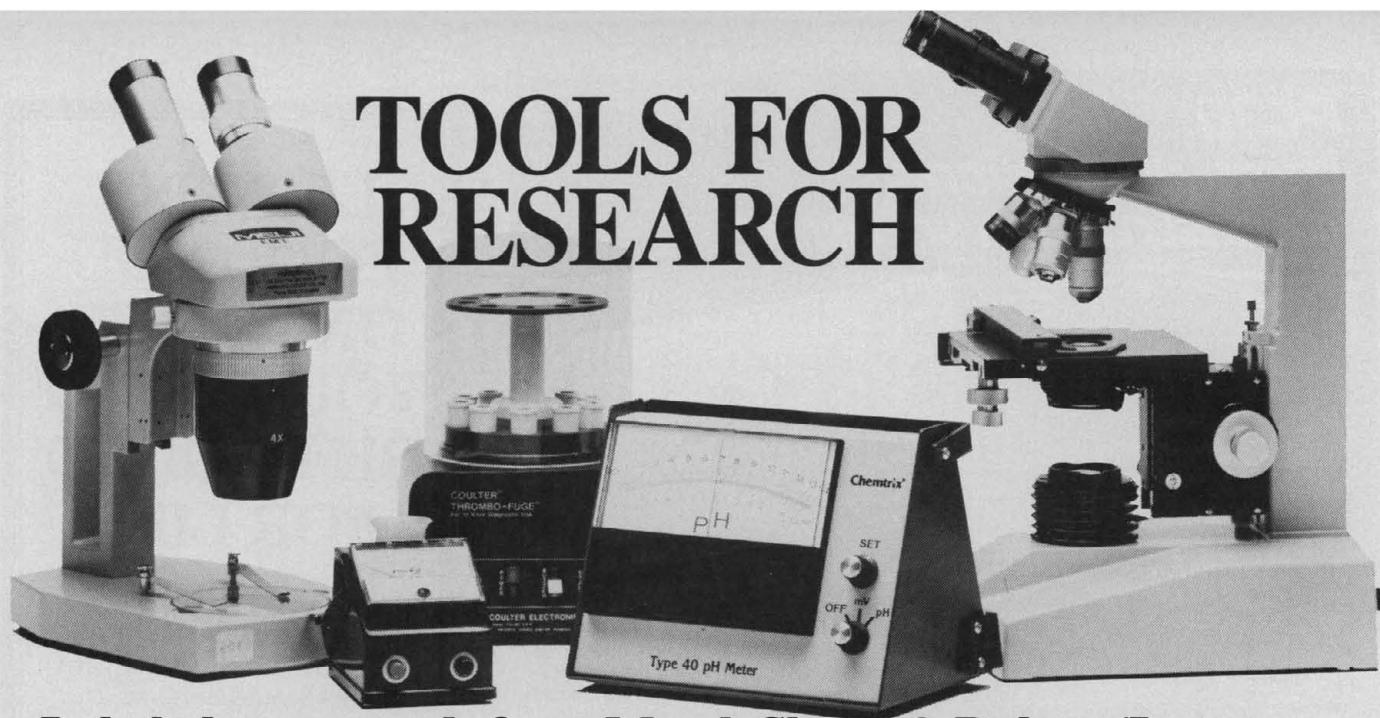
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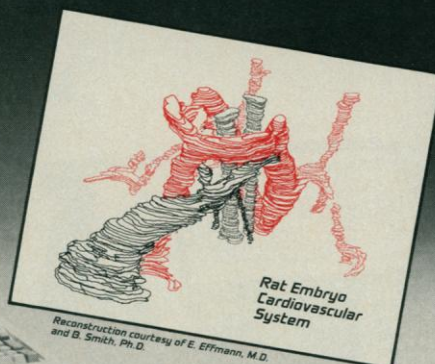
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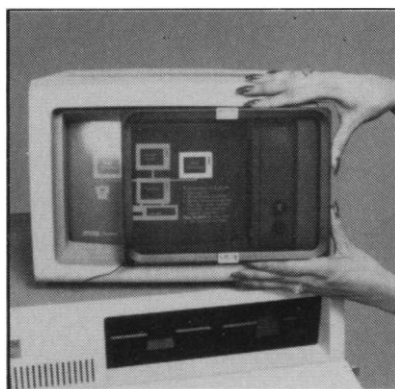
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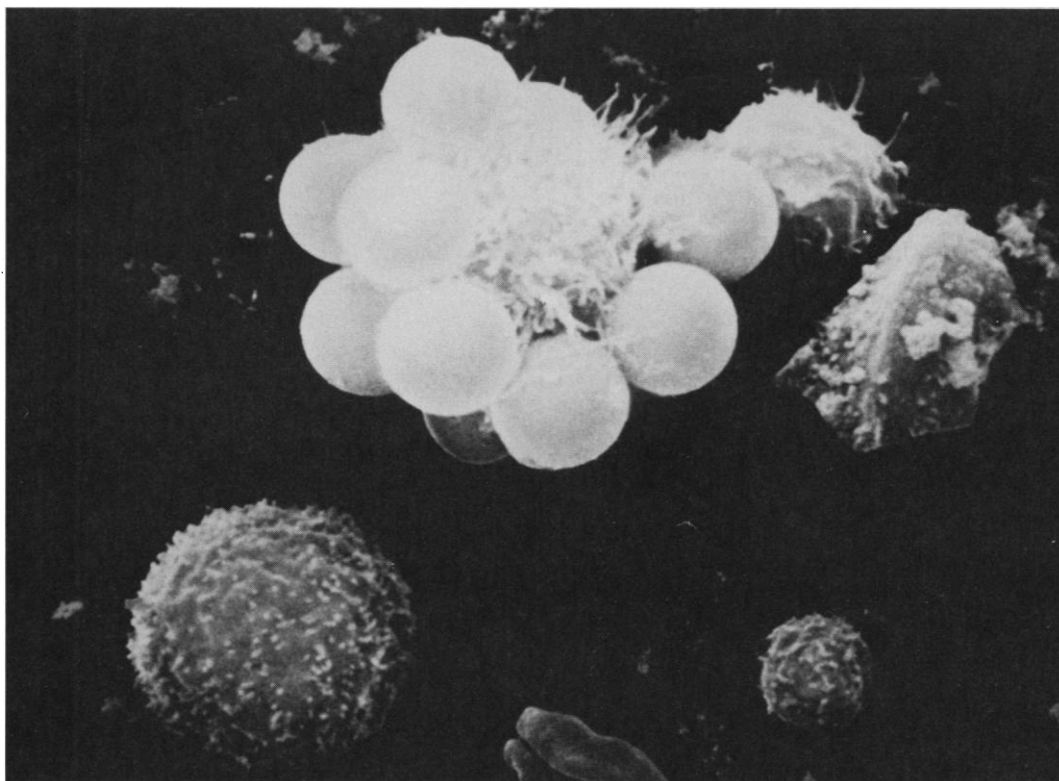
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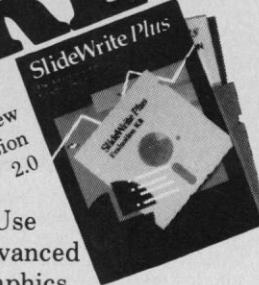
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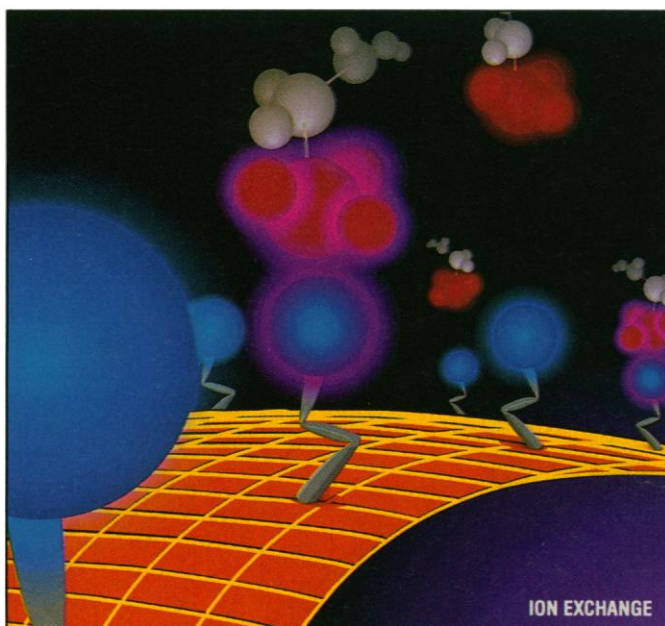
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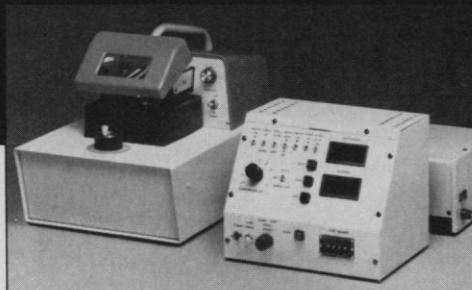
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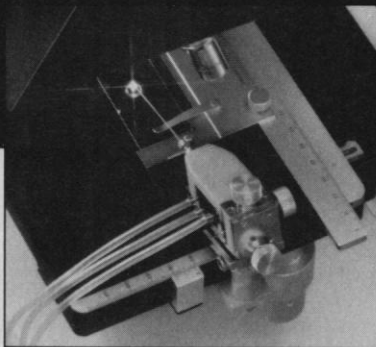
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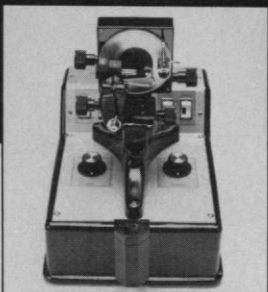


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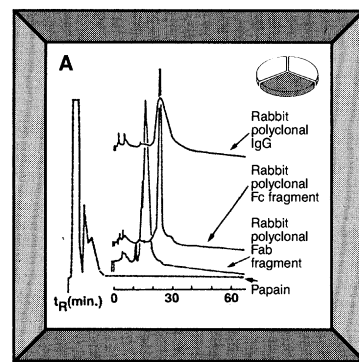
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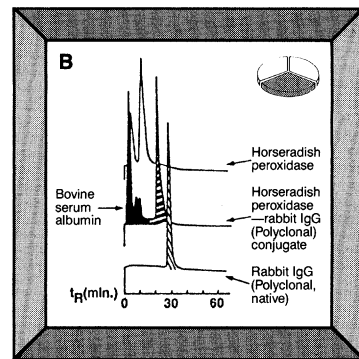
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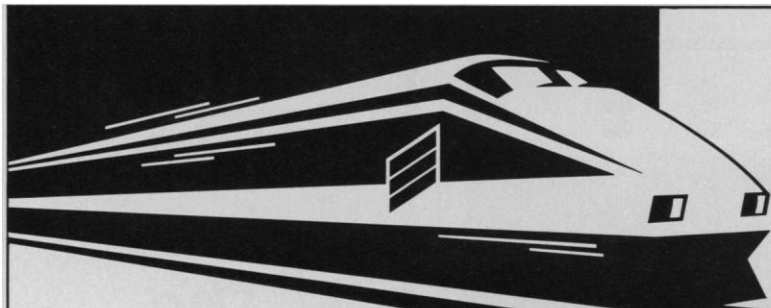


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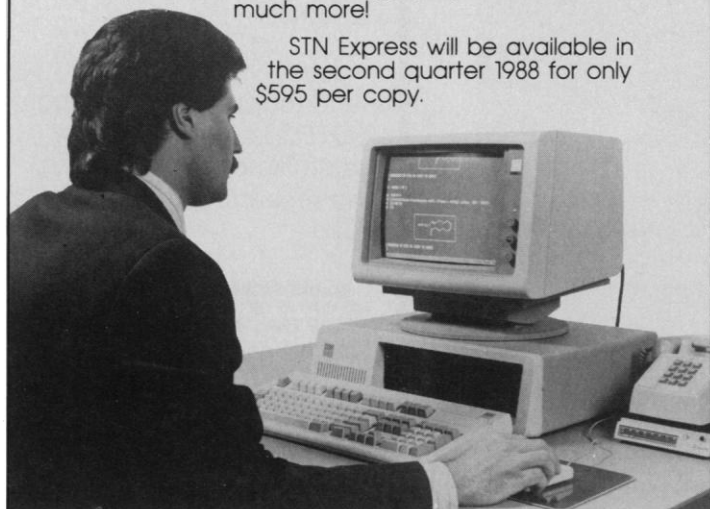
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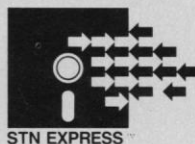
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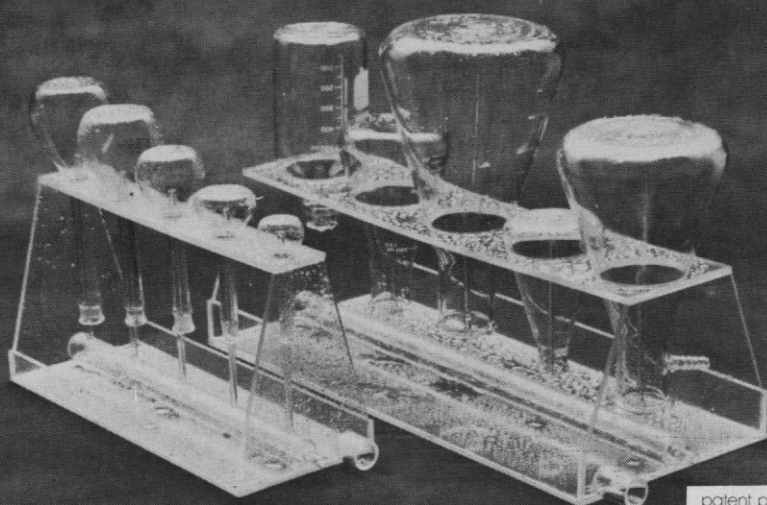


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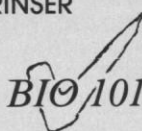
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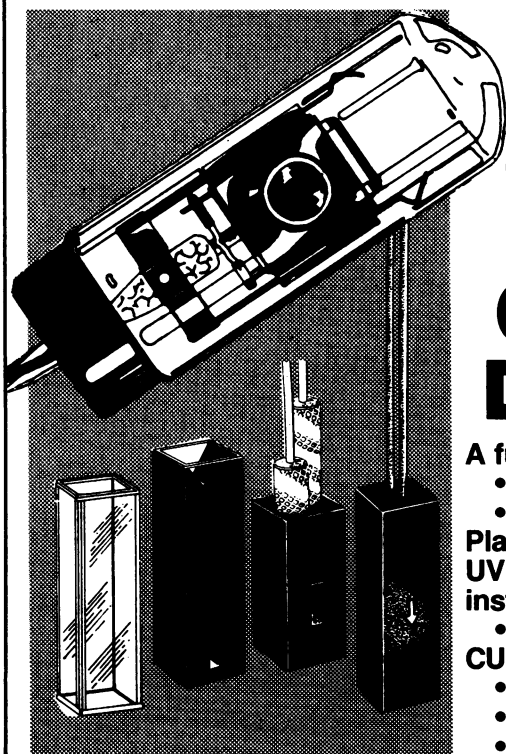
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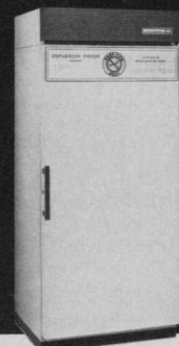
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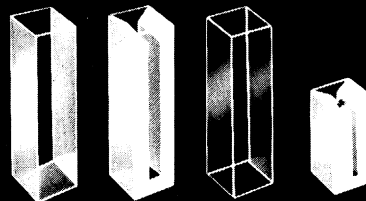
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Food Problems

Soviet Agriculture. ZHORES MEDVEDEV. Norton, New York, 1987. xiv, 464 pp. \$27.50.

Not far from the center of Moscow, a lovely Botanical Garden sprawls over many acres with a profligacy possible only where land is as haphazardly valued as it is in the Soviet Union. One of the most intriguing sections of the park is called the "Russian Historical Kitchen Garden." There, under the watchful patrol of a militiaman who enforces the "No Picking" injunction, strollers can observe broccoli, cauliflower, curly cabbage, kale, rosemary, sage, and other vegetables and herbs that have not been seen in Russian markets or kitchens for decades.

Zhores Medvedev has written an excellent and readable account of how a country with the agricultural potential of the Soviet Union has become a major food importer and still offers its citizenry a diet that, although adequate in calories, lacks variety and quality. Medvedev is a biologist who experienced at first hand the misfortunes that Trofim Lysenko inflicted on Soviet agricultural science. He expected his inquiry into the difficulties of Soviet agriculture to detail how Lysenko mortgaged the sector in pursuit of his harebrained schemes and turned over a much-depreciated asset when his account was called in. Midway into his project, however, Medvedev found that, appalling as the effects of Lysenko were, they were not all that was wrong with Soviet agriculture. The policy environment and institutional structure of agriculture in the Soviet Union have handicapped the sector at least as much as Lysenko.

Medvedev begins appropriately with the agrarian situation prior to the revolution and argues that the Stolypin Reforms in the decade following the Revolution of 1905 did not have time to accomplish for Russia what the Enclosures did for England. Much of Russia entered the Soviet period with a communal system of land tenure that retarded the transformation of the peasantry into modern farmers. Soviet policy dating from the day after the storming of the Winter Palace through Stalin's death (with perhaps a brief interlude during the New Economic Policy of the 1920s) emphasized appropriation of agricultural output rather than production. Medvedev shows the resulting poverty of much of the rural population and of the rest of the country as well. In extreme

years there was famine (1921, 1932–33, and 1946–47) and in better years a deterioration in diet and rural standards of living. The potato, which we think of as traditionally the basis of the Russian peasant's diet, became even more so as it replaced grain. Goats (the Stalin cow) were important for rural families because their heads were not taxed and their milk could not be processed by state dairies. Medvedev relates how the ravages of collectivization were compounded by the horrors of war. Women in rural areas replaced not only conscripted tractor drivers but also conscripted fuel and draft animals.

The early part of Medvedev's story is fascinating but less intellectually challenging than his later account of the dull Brezhnev years. There are few mysteries as to why Soviet agriculture performed poorly under Lenin's and Stalin's stewardship, but Brezhnev reversed the flow of resources and began pumping investment into the sector. Throughout much of his tenure, agriculture received about 30% of all investment in the economy. Output improved, but at very high cost, and in the mid-1970s even this expensive growth slowed down. Brezhnev passed to his heirs an agriculture very costly both in rubles and in dollars that still does not offer animal products in the quality and quantities that consumers demand.

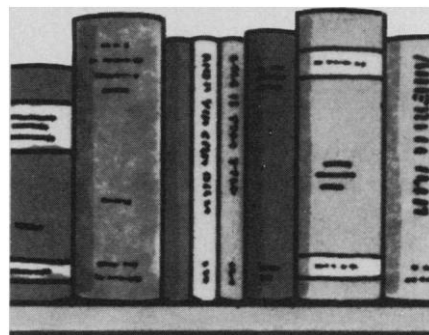
Medvedev shows us subsector by subsector how money was spent to relatively little effect. Distortions in input markets and poor incentives became extremely costly with Brezhnev's decision to invest in agriculture. Medvedev fears that some of the high costs are passed on to future generations through environmental degradation: erosion, gully-ing, and deterioration of soil and water quality.

Problems with agriculture now are acute both on the supply side and on the demand side. Costs of production are significantly higher than those of major world traders; the continued protection of Soviet producers is costly to their society. Severely distorted retail prices lead consumers to seek quantities of meat, dairy products, fruits, and vegetables that will not be available even if very optimistic production targets are met.

Medvedev outlines the choices Gorbachev has in agriculture. He wisely refrains from speculating much on how far the fragile reform effort will be pushed or how success-

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