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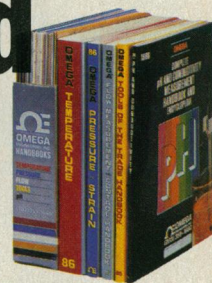
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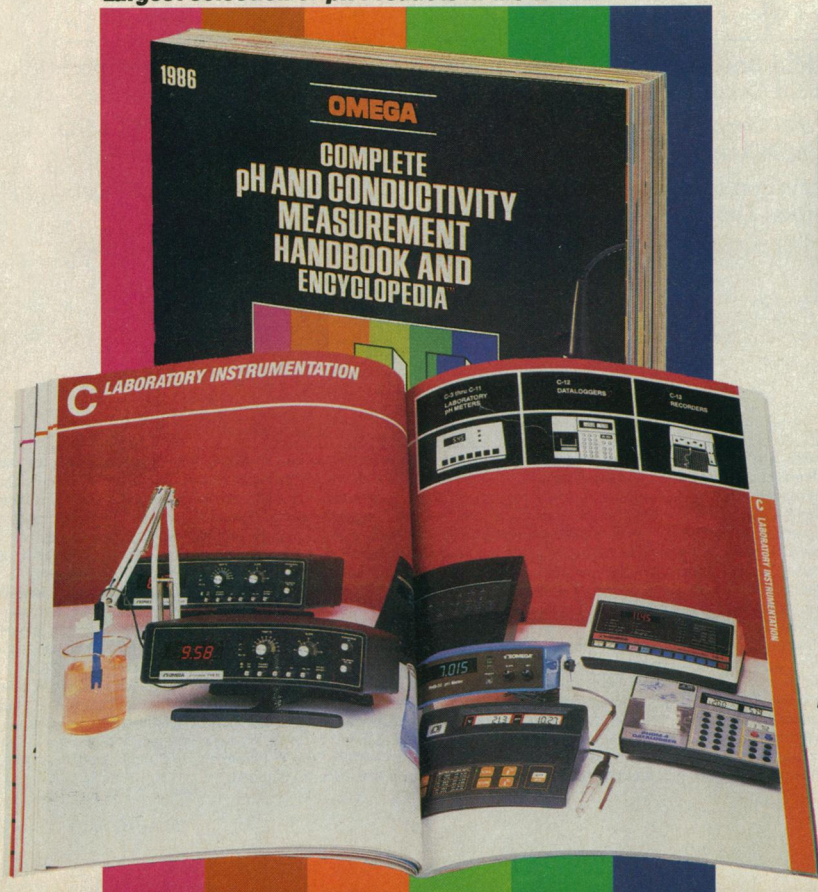
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**COVER** The open ocean is a potential source of cobalt, a strategic metal. Cobalt-rich ferromanganese crusts on the floor of the huge, new United States Exclusive Economic Zone are attracting interest as a potential mineral resource. See page 600. [Photograph courtesy of Dann S. Blackwood, U.S. Geological Survey, Woods Hole, Massachusetts 02543]

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## This Week in SCIENCE

### Muscles flexed by flexible hormone

OXYTOCIN, a peptide hormone, induces uterine contractions during childbirth and the release of milk in lactating mammals (page 633). The key to the hormone activity that activates receptors in the body so that smooth muscle contractions are promoted may lie in the flexibility of oxytocin's three-dimensional structure. Wood *et al.* studied crystals of synthetic derivatives of oxytocin; the partially hydrophobic conditions within the crystal were considered similar to the environment within the body in which oxytocin interacts with its receptors. Oxytocin's conformation, stabilized by hydrophobic interactions and hydrogen bonding, is flexible with regard to the handedness of the single disulfide bond between amino acids in the molecule; the receptor may be similarly flexible and able to respond by activation to strong agonists (those having a left-handed bond) and by inactivity to (right-handed) antagonists. The two forms of the hormone may be in equilibrium, with the favored conformation dependent on the local environment. From these structural data, potent synthetic derivatives of oxytocin, even more pharmacologically active than those already available, may be designed.

### Foot-and-mouth disease vaccine

A synthetic peptide vaccine that encompasses portions of the foot-and-mouth disease (FMD) virus elicits an immune response in cattle (page 639). DiMarchi *et al.* chemically synthesized a relatively small peptide having amino acid sequences found in the two most immunogenic regions of coat proteins of FMD virus. A two-amino acid spacer in the middle of the peptide bent the immunogenic regions toward each other; polymerization of the peptides into larger molecules was favored by positioning cysteines at both ends of the peptide so that disulfide

bonds could form between two molecules. The simple vaccine, uncomplicated with carrier molecules or other immunogenic structures, induced long-lasting antibodies in cattle, and even a single vaccination protected some cows against infections by direct viral challenge. Complete protection was achieved with a booster immunization. Because FMD can cause extensive morbidity in a herd and can be economically devastating, a highly immunogenic vaccine, not containing live virus or extraneous immunogens, is desirable for FMD control.

### Changing climates

CORE samples from two marine sites along the western coast of Africa indicate that major climate changes occurred on the earth 300,000 to 400,000 years ago (page 619). In the Northern Hemisphere, the climate shifted to more glacial conditions, and the earth became more arid as less moisture returned to the atmosphere by evaporation; in the Southern Hemisphere, an opposite trend brought a halt to the severe cold, and a humid interglacial period ensued. The changes in regional climate documented at these two sites are supported by changes in other marine and continental records—protozoa (foraminifera, radiolarians), algae (diatoms), pollen, rocks, sediments, carbonates, and lake salinity—from the period. Jansen *et al.* suggest that astronomically driven perturbations to the earth's orbit, periodic events that occur every  $4.13 \times 10^5$  years, may have induced the global climate changes.

### Gradual extinction of dinosaurs

EIGHT million years before the end of the Cretaceous Period, 30 species of dinosaurs lived in the northern Great Plains region; within 1 million years their extinction had begun, and by the end of the Cretaceous only 12 species remained (page 629).

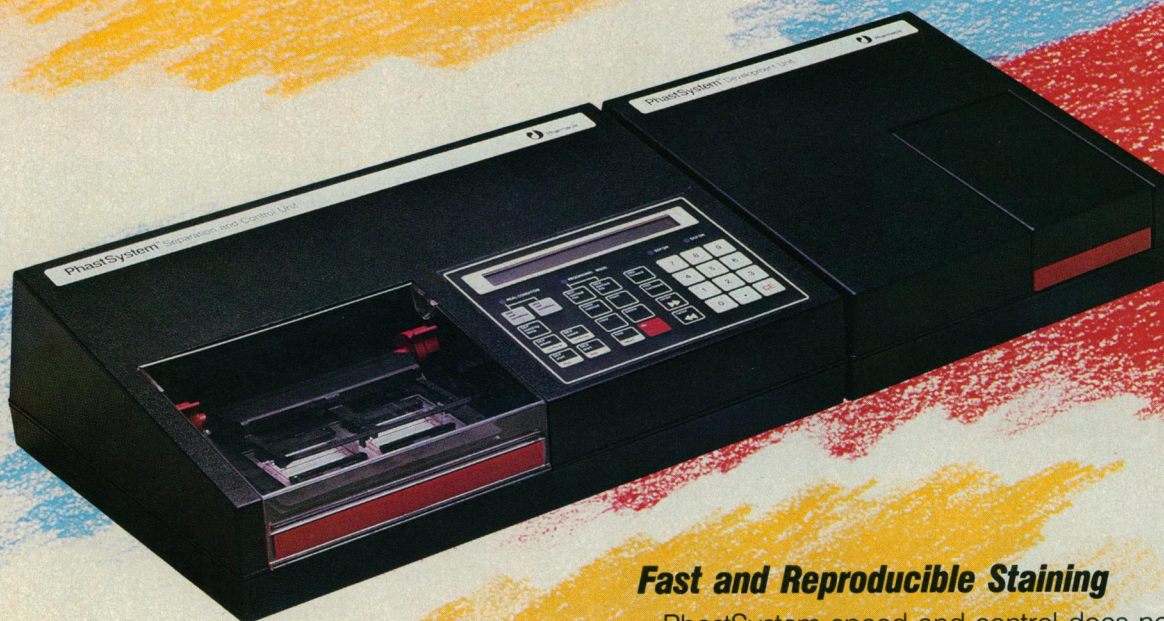
Between 7 and 11 species survived into the Tertiary Period, whose boundary with the Cretaceous is marked stratigraphically by an unusual abundance of the element iridium. Dinosaur teeth excavated together with pollen and teeth of the earliest Tertiary mammals in Montana, Wyoming, and Alberta date from some 40,000 years after the Cretaceous/Tertiary boundary. Thus the impact of an asteroid on the earth (to which the iridium anomaly has been attributed) seems to have been responsible for the extinction of only one to five species of dinosaurs. Sloan *et al.* attribute gradual extinction to a drop in global temperature during the final 15 million years of the Cretaceous, lowering of sea level and a concomitant increase in seasonality, major deterioration of flora as a result of climate changes, and competition between the dinosaurs and mammals for the flora that remained.

### Alzheimer's disease protein

NERVE cells in the brains of patients with Alzheimer's disease contain large amounts of a protein, Alz-50, that does not appear to be a component of normal brains (page 648). Through immunization of mice with a homogenate of forebrain tissue from people who had Alzheimer's disease, Wolozin *et al.* were able to generate monoclonal antibodies that were specific for Alz-50. The antibody to Alz-50 was then used for identifying the protein in brain slices from normal and diseased human brains. It reacted best with tissue from the diseased temporal cortex, a portion of the brain that develops lesions (tangles and plaques) as neuronal degeneration progresses and intellectual functions are lost in Alzheimer's disease. The antibodies to Alz-50 showed less reactivity with other brain regions that develop lesions and little reactivity with normal brains or with regions of the Alzheimer's brain not involved in the disease. The source and function (if any) of Alz-50 are not known.



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## A "One License—One Hearing" Policy

A landmark in the development of modern genetics was the "one gene—one enzyme" hypothesis. A "one license—one hearing" policy might provide a helpful impetus to the regulation of genetic engineering.

The development of a new biotechnology industry stands at a crossroad. The path traveled in developing new technologies has often been filled with recriminations between those who think we are going too slowly and those who think we are going too fast. Today, industrial advocates say that the new biotechnology industry is a fragile infant whose health is being impaired by the burden of bureaucratic red tape and unconscionable delays in litigation. Environmental groups say we are tampering with fundamental natural processes and that the hazards are too great to justify speed.

The vast majority of individuals on both sides are trying to do "the right thing." A good, safe destination is everyone's goal. However, different travelers use different premises and arguments on the most appropriate pathway. Science attracts adventurous souls who by nature are impatient with obstacles. Regulators are more cautious types, reasoning that change involves risk and that risk is more likely to lead to harm than to benefits.

An application for biotechnology experimentation can face interminable delays in multiple agencies in Washington, further delays in states and localities, and still be subject to lawsuits. Can scientists and environmentalists find a more direct and well-lighted path to safety and goodness? It seems possible that, with ingenuity and reasonableness, we can.

There are already a number of regulatory bodies in Washington with power to authorize genetic engineering applications and research. At the federal level each request for a license could be assigned to the agency most appropriate for that case, with notice given to all other regulatory bodies having overlapping interest or authority. The latter could appear as friends of the "court," posing questions to the primary regulatory agency and to the applicant; they might add words of wisdom, but they could not hold separate hearings.

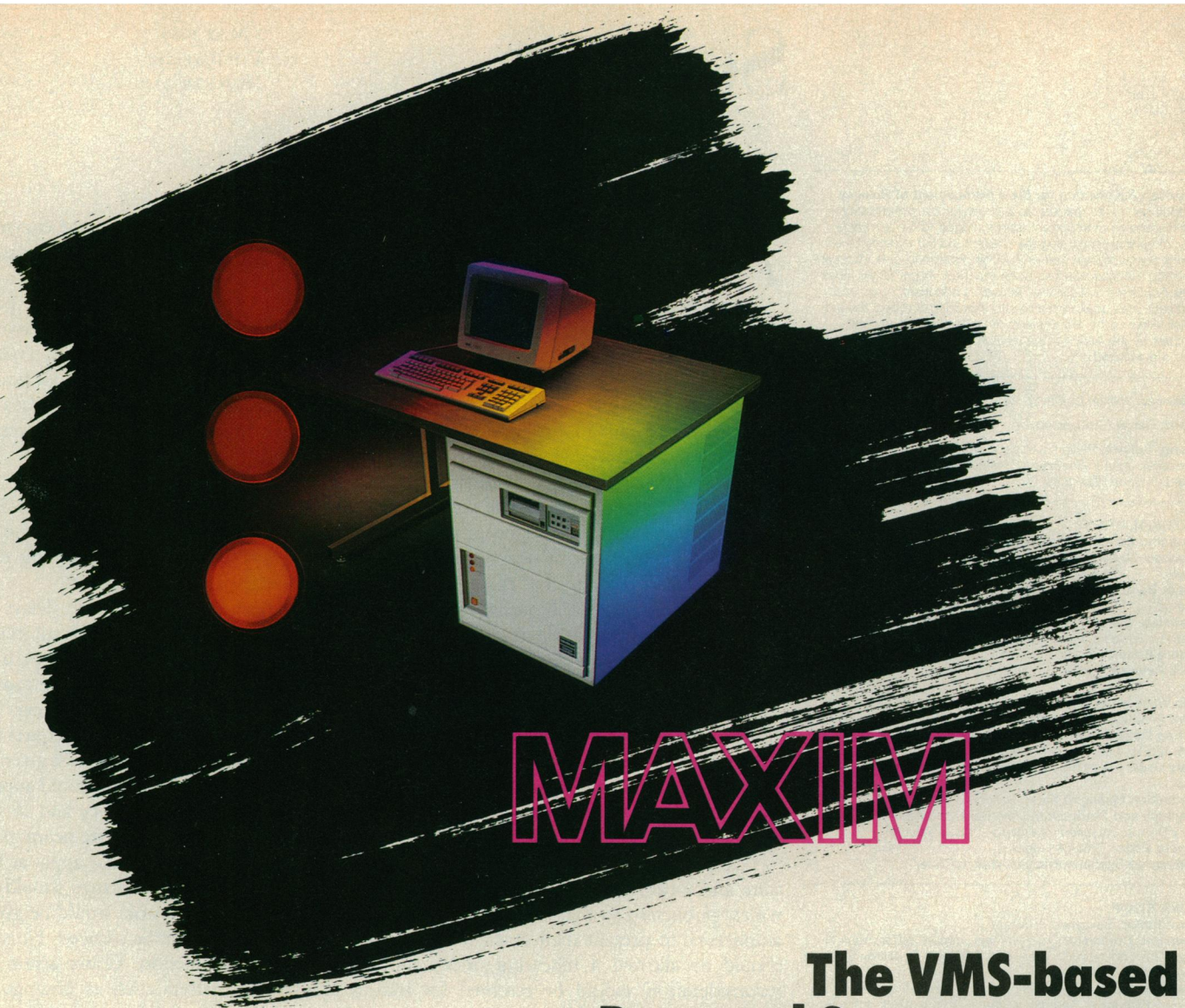
After the federal regulatory decision is reached, similar processes would apply at the state and local levels but with a "one state—one hearing" limit also. Hearings should be widely publicized so that all interested parties could have a say. Protestors would be given ample time to present their cases, but unreasonable delays would not be allowed. No side should be allowed a rehearing under another regulatory jurisdiction. Court action or reconsideration should be reserved for serious substantive matters such as findings of erroneous or concealed data; suing parties should be liable for financial damages when legal delays are frivolous or ill-considered.

Some will argue that this is not the American way, that we are entitled to litigious and chaotic behavior patterns. Nonetheless, the public appears fed up with excessive lawsuits that are closing playgrounds, preventing parades, and bankrupting city governments. More rational procedures will require good will and superior imagination on all sides. The public is apprehensive regarding this new technology and determined to be vocal in the decision-making; impatient scientists and industry have to listen. In turn, biotechnologists can expect laypersons to make their arguments in a timely manner. Furthermore, responsible industrialists should be willing to blow the whistle on colleagues who push experiments or field trials too rapidly just as environmentalists should blow the whistle on colleagues who use excessive delaying tactics. By having one well-organized hearing for a federal license and one hearing for a state license, both accountability and deliberate speed can be accommodated.

We are entering the era of a global economy. No country can afford to have the senseless procedures and unproductive delays that are the hallmarks of the present system. Since biotechnology regulatory machinery is just being developed, rational procedures can more readily be instituted now rather than later when staff and jurisdictions have become entrenched. It has been said that society will always come to the right conclusion after it has exhausted every other possible alternative. In the present case, we cannot afford to grope to conclusions by legal trial and bureaucratic error. By opting for a path not taken heretofore, we can protect both the environment and an infant industry, and possibly find that a genetic analogy may lead to the survival of the fittest regulatory procedure.

—DANIEL E. KOSHLAND, JR.





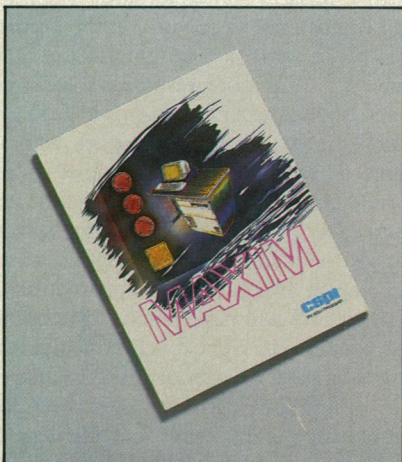
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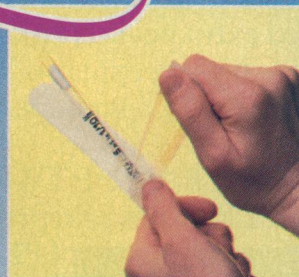
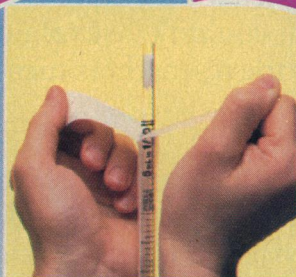
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This FPLC case history explains how the researchers turned their chromatography problem into a discovery.

**SEVEN PEAKS INSTEAD OF TWO.** During the early stages of the project, the group invited a Pharmacia representative to come and demonstrate the FPLC System. The system was quickly assembled. Knowing the approximate characteristics of the sample's proteins (pI, stability and size), the representative consulted Pharmacia's comprehensive library of FPLC methodology. Conditions for the separation, including column type, monitor wave length, and buffer system, were thereby determined.



Next a separation run on a column prepacked with Mono Q™, an anion exchanger, was programmed into the system's controller, the LCC-500. The sample

was then injected automatically by the MV-7 motorized valve. In the course of ten minutes, a totally unexpected chromatographic pattern had appeared on the controller's printout. The sample contained two specific proteins that should have given rise to two peaks. But here were seven peaks – casting some doubt upon the merit of this high performance liquid chromatography system.

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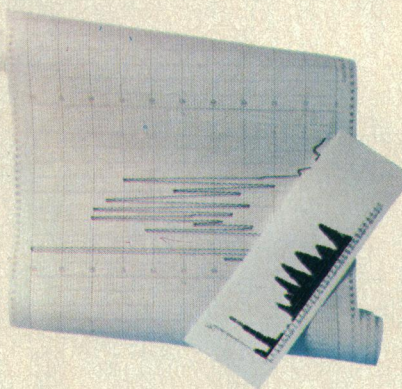


# THE FIVE EXTRA PEAKS

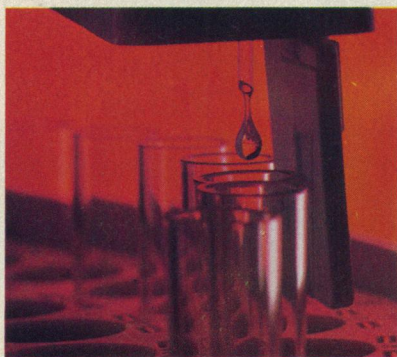


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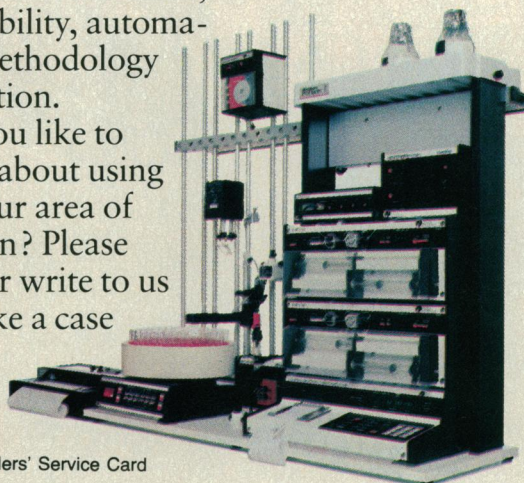


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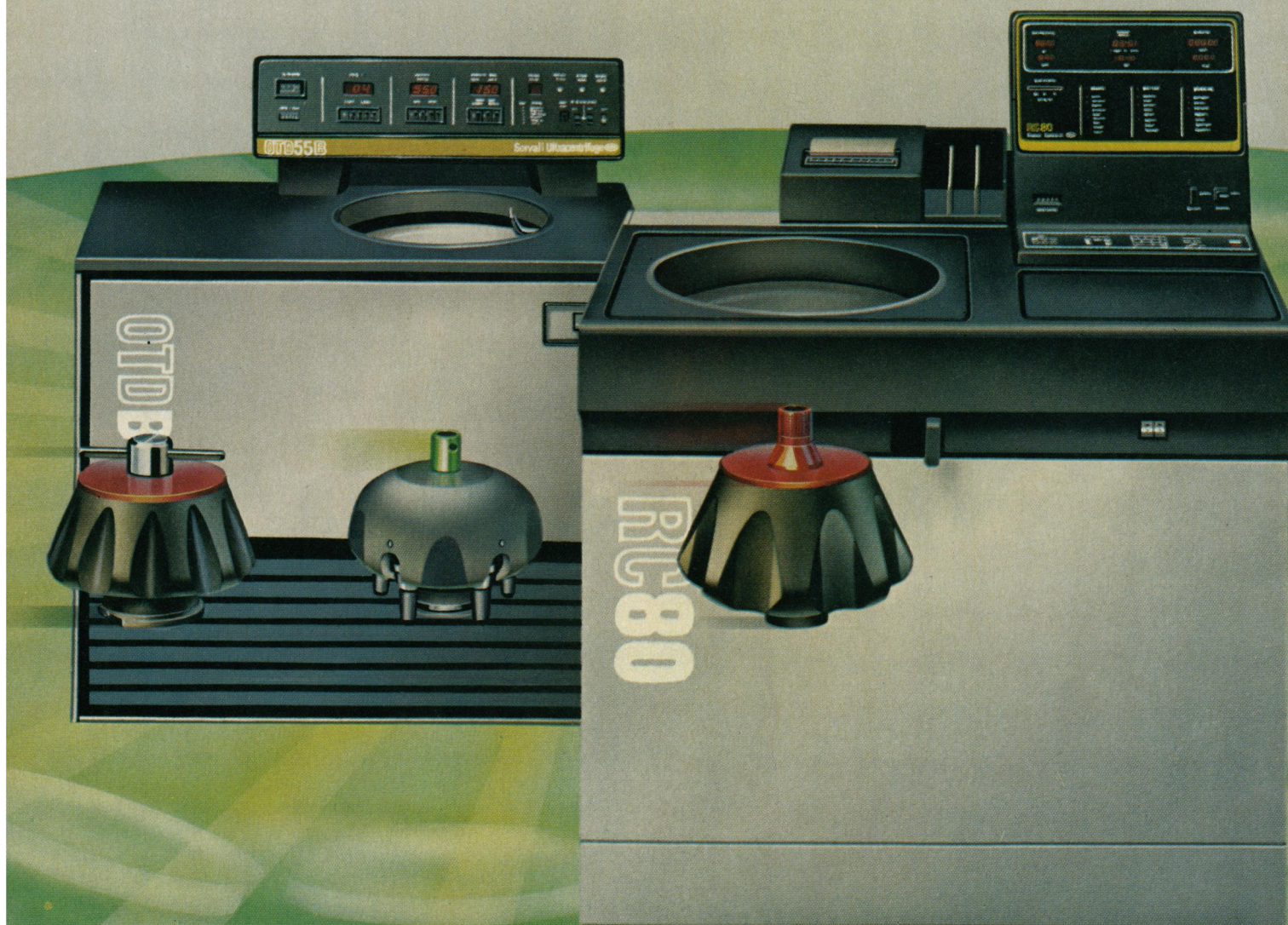




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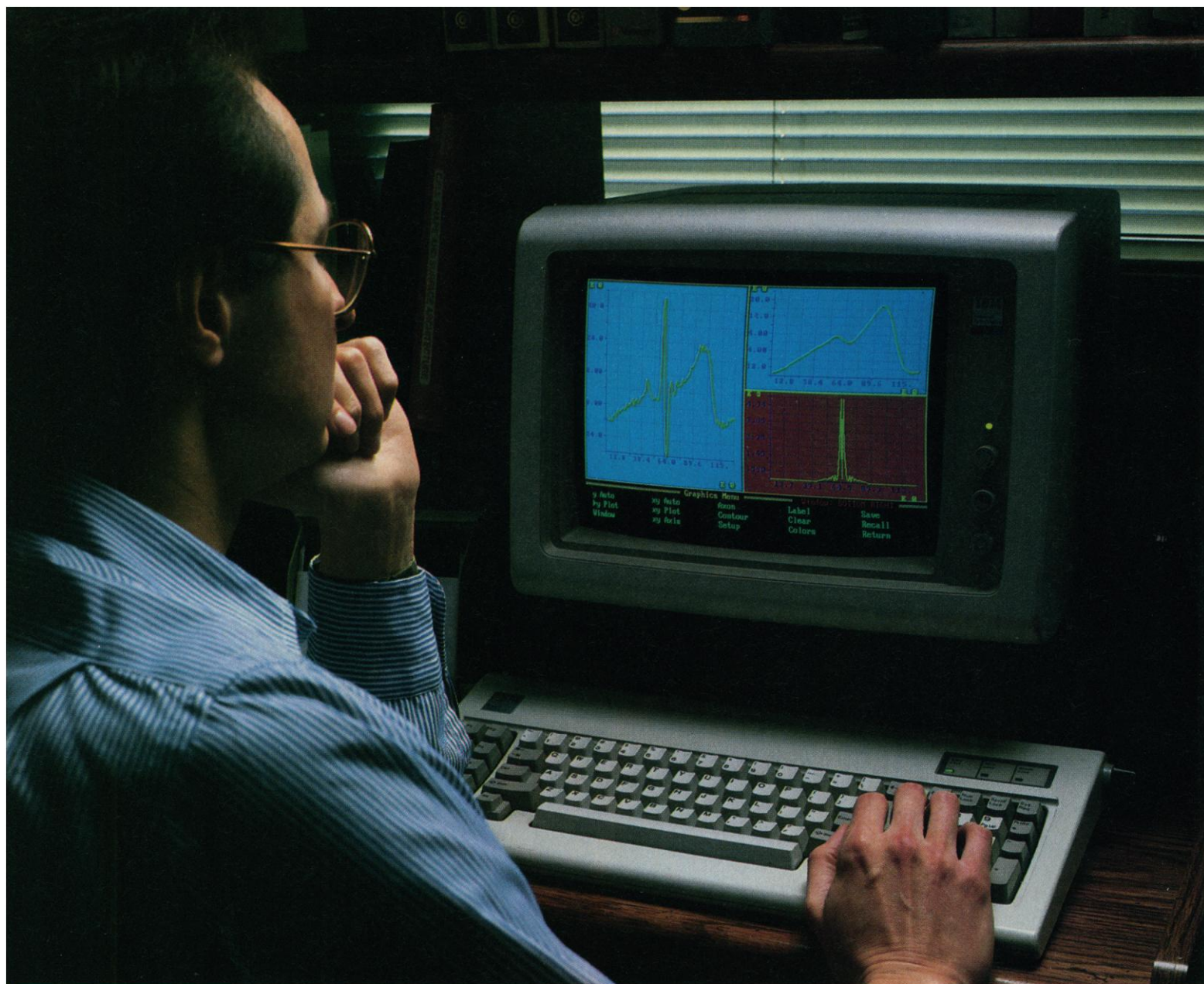


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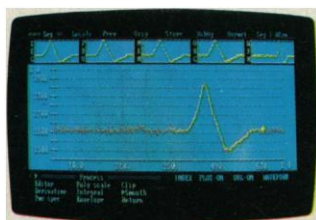
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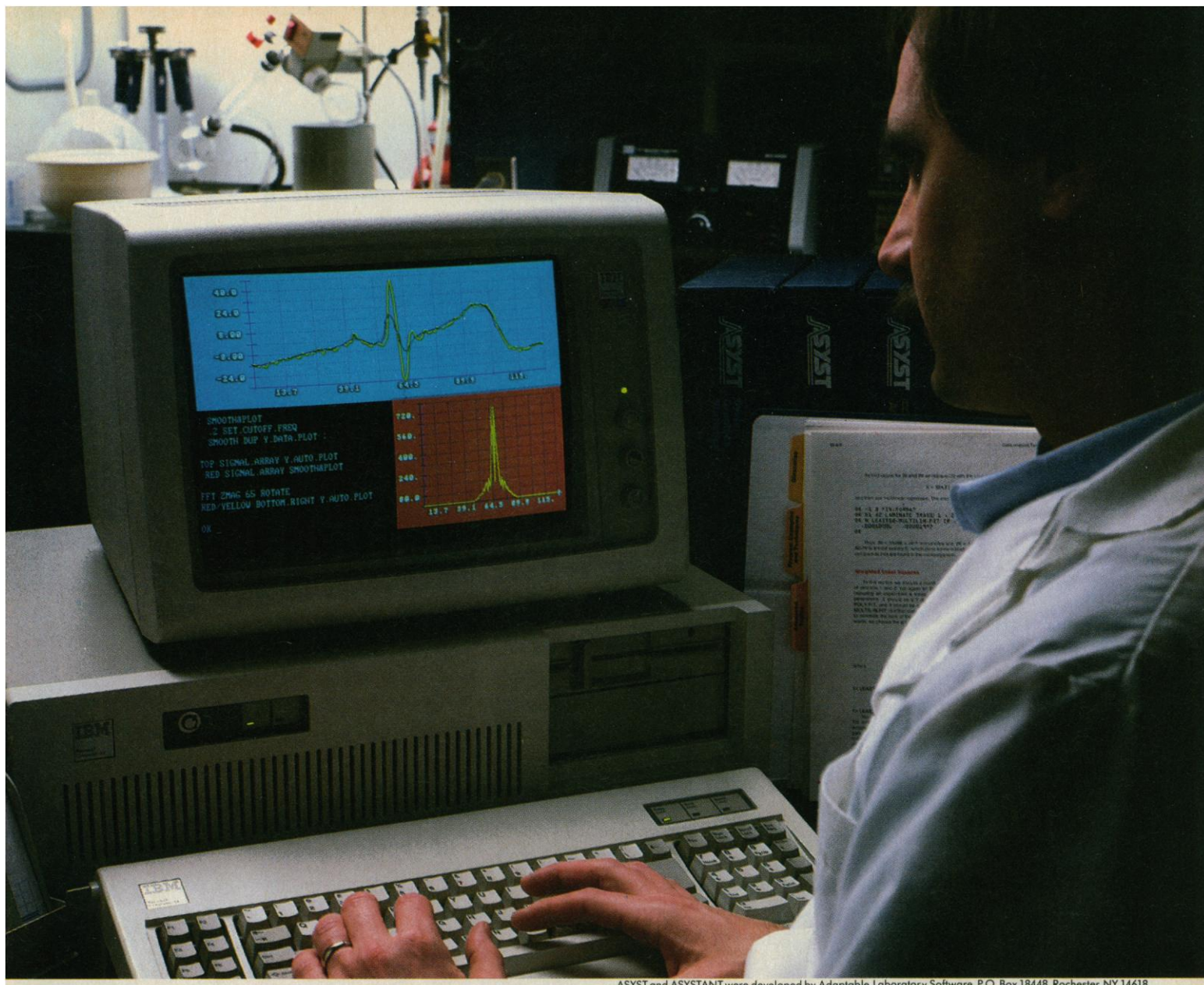
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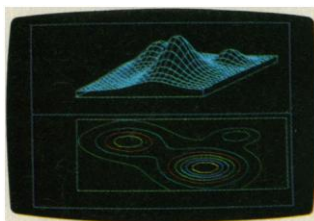
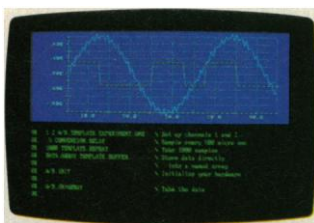
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Electronics engineers and doctors have created an implant to improve the hearing of profoundly deaf people. The device uses a microphone and pocket-sized signal processor to convert sound waves to electrical impulses. A transmitter behind the ear sends these electrical signals through the skin to a nickel-sized receiver/stimulator implanted in the mastoid cavity. From there, signals travel along an electrode array threaded to the snail-like cholea of the inner ear. Auditory nerve fibers receive these electronic signals and transmit them to the brain—tricking it into thinking the ear can hear normally. The electrode of the electronic ear is protected by a plastic coating material, which must provide electrical reliability and long life. Since most polymer insulations tend to lose adhesion in body fluids after a period of time, the National Institutes of Health has asked Hughes Aircraft Company to subject three coating materials to intensive testing. One plastic was created by Hughes, originally for high-temperature electronic and structural uses; the others were developed by Union Carbide and Dupont.

The last in a series of three spacecraft for AT&T is carrying telecommunications throughout the United States. Telstar 3B can handle 21,600 long-distance telephone calls simultaneously or a mix of voice, video, and high-speed data services. It carries 24 transponder channels, which can be switched by ground command to various combinations of regional coverage across the continental U.S. and Hawaii, Alaska, or Puerto Rico. The cylindrical satellite measures 7 feet 2 inches in diameter and 22 feet 5 inches high and is based on the Hughes HS 376 model. It is the world's most successful commercial communications satellite, with 30 spacecraft ordered to date.

A cryogenic refrigerator designed to cool infrared sensors has passed a test equivalent to operating three years in space. The Vuilleumier cycle cooler, set in operation at twice its normal speed in order to simulate a design life of five years, has passed the year-and-a-half point of flawless operation. The device will be used with infrared sensors in space for applications such as defense and geological surveys. The sensors must be chilled to near absolute zero to maintain adequate sensitivity to low-temperature thermal radiation. The VM cooler, developed by Hughes, is believed to be the only one of its type to have performed this long at such low temperatures.

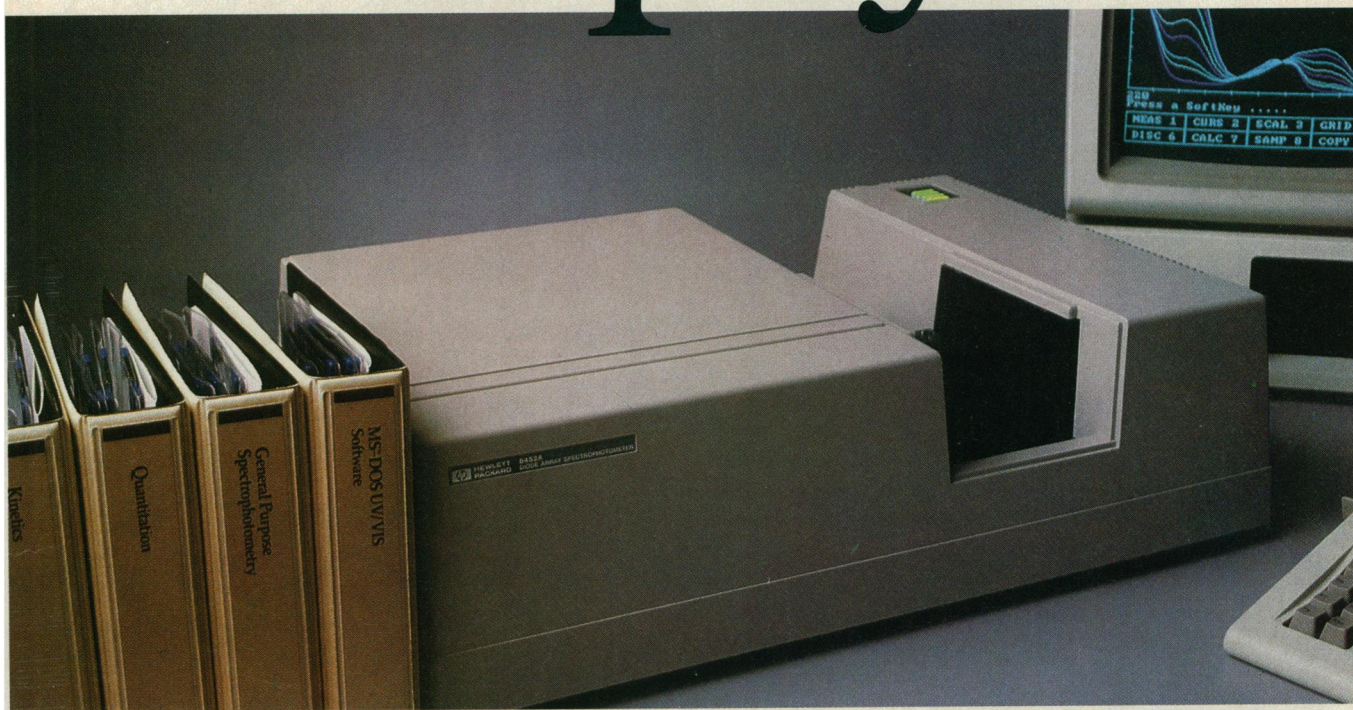
An experimental digital-to-analog converter chip is 10 times faster than the fastest conventional device. The chip, being developed at Hughes for advanced airborne radars, uses gallium arsenide as the substrate material. It has a settling time of 200 picoseconds, about an order of magnitude faster than a record-holding 6-bit Hughes silicon device. The new converter so far outdistances commercial devices that design engineers are developing special interfaces so that the device can be hooked up in data conversion systems for further testing and analysis.

Hughes Ground Systems Group is applying its airspace management experience to the exciting challenges of worldwide air traffic control. These systems will be designed to ensure service 24 hours a day, 7 days a week. They will support distribution of processing among multiple computers linked via local area networks. The many challenges include design and development of hardware and software to support advanced display and man-machine interface technology, and using satellite technologies for future ATC applications. To help design the next generation of air traffic control systems, send your resume to Hughes Ground Systems Group, Employment Dept. S2, P.O. Box 4275, Fullerton, CA 92634. Equal opportunity employer. U.S. citizenship required.

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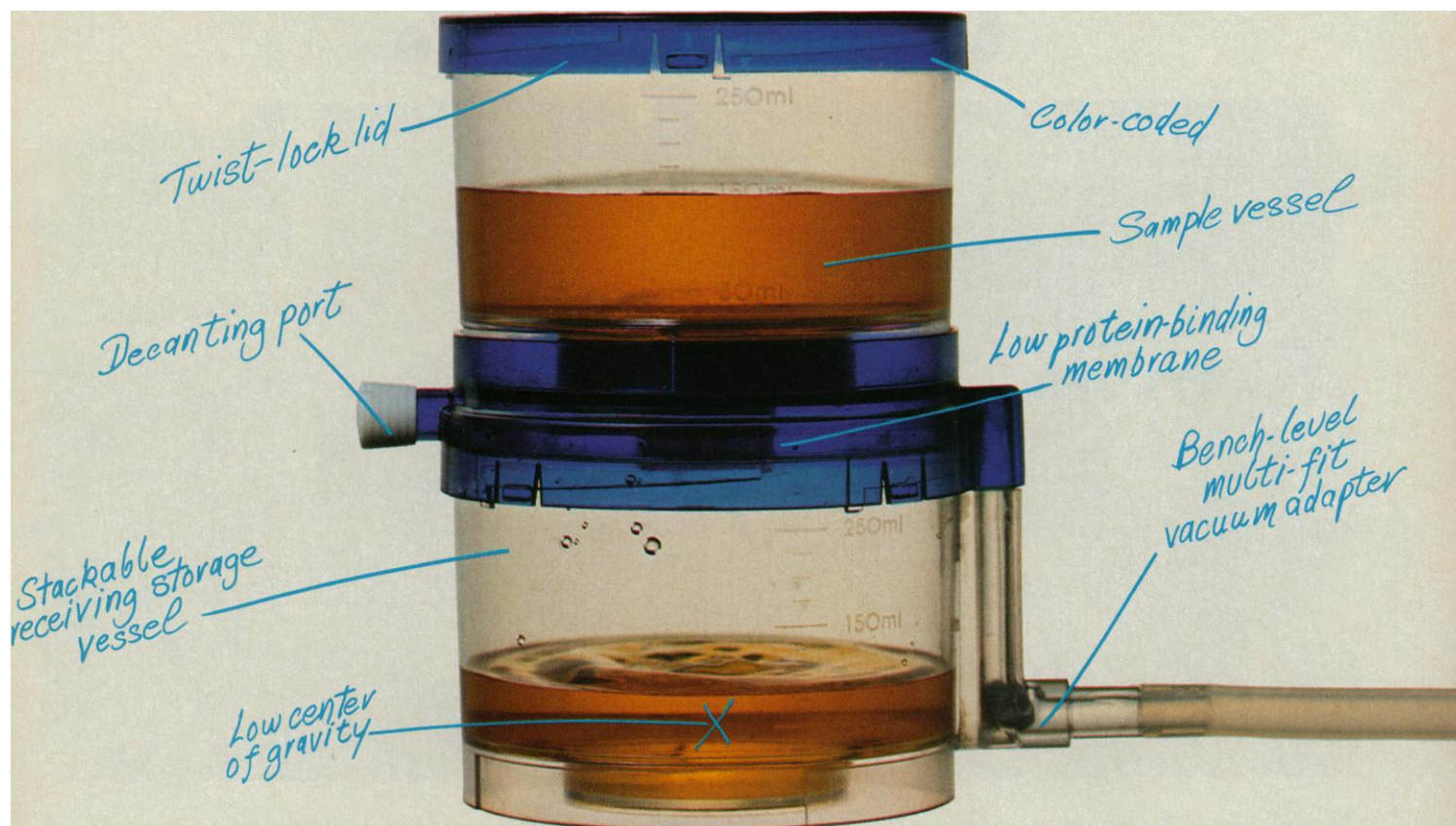
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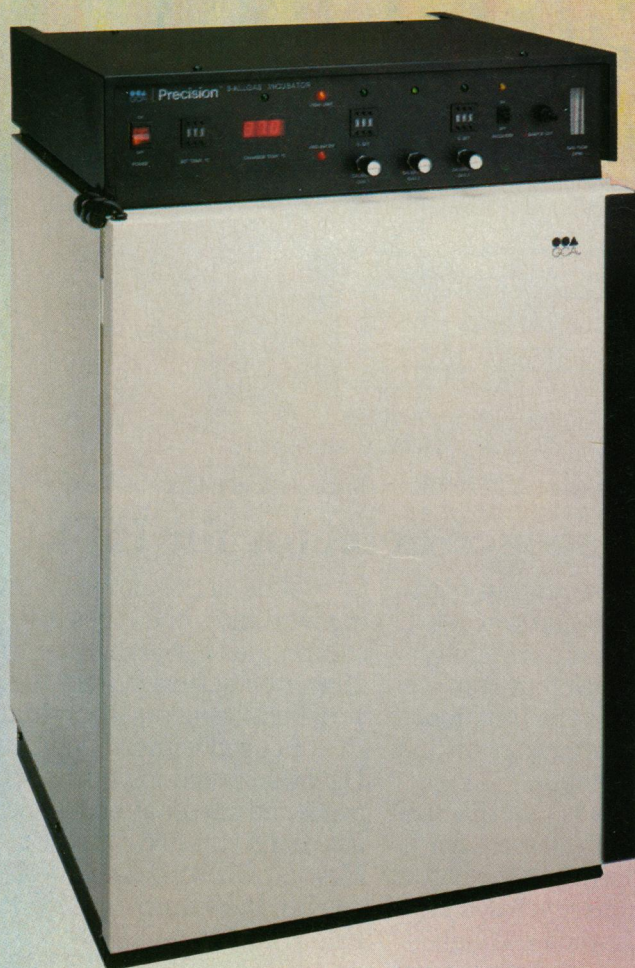
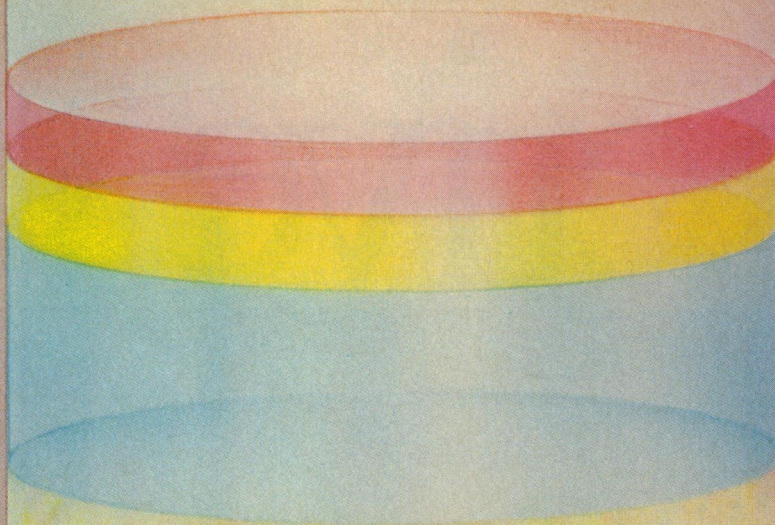
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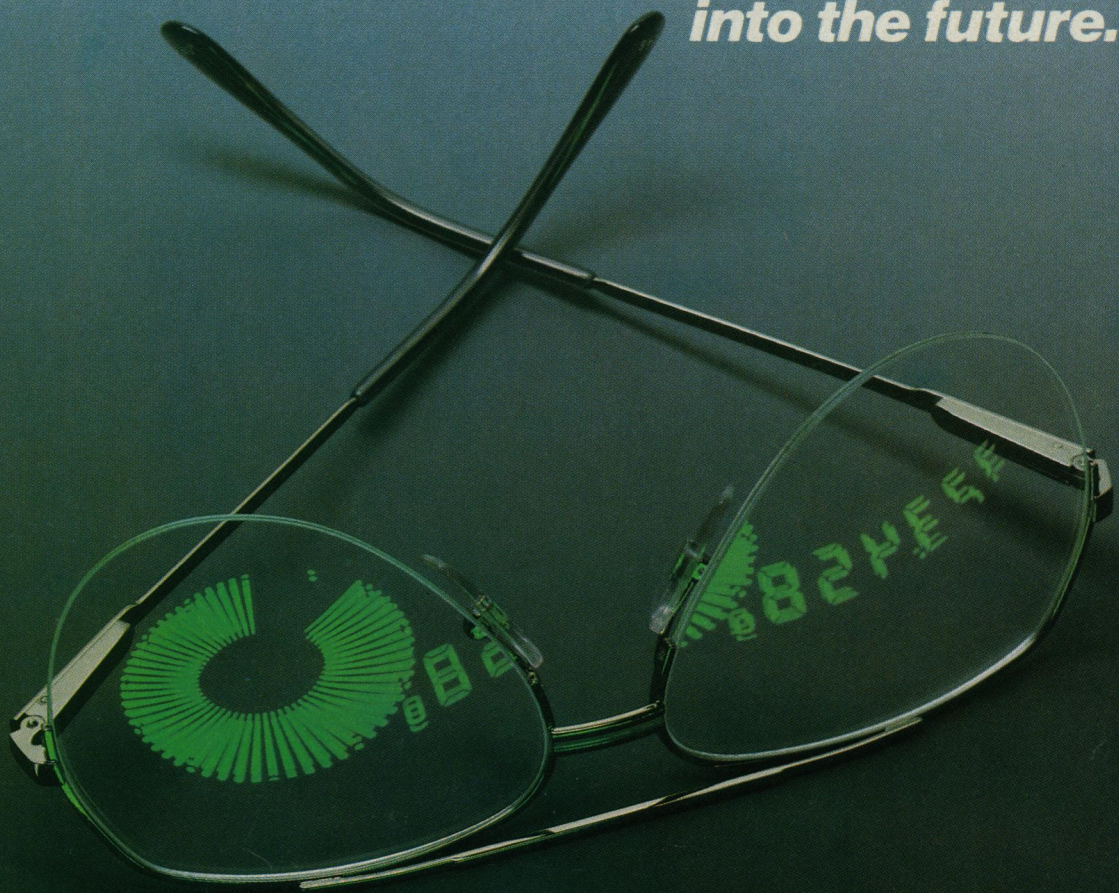
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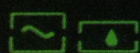
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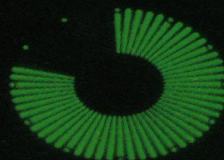
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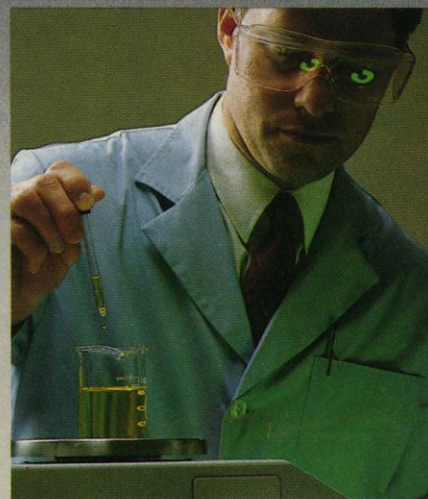
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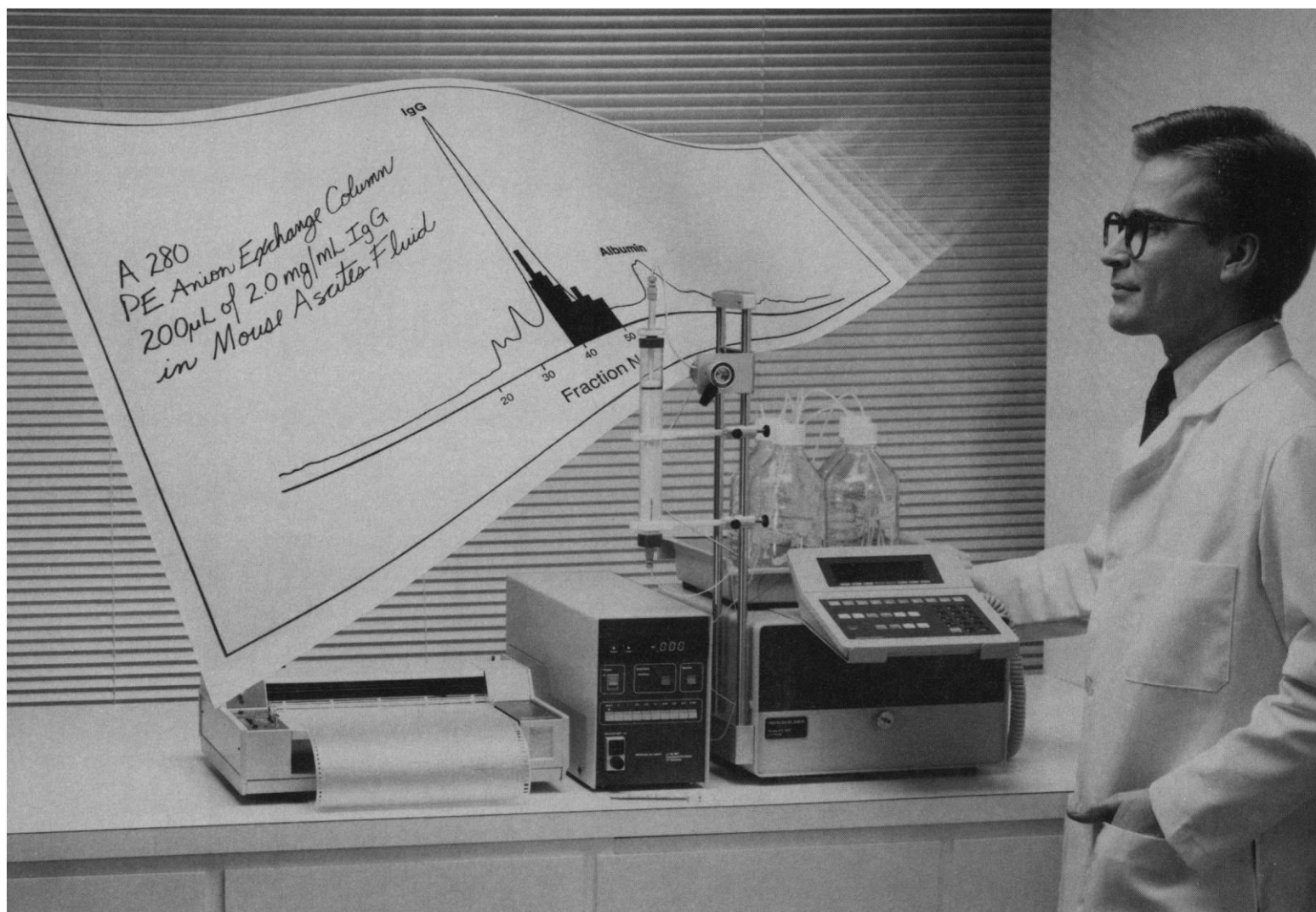


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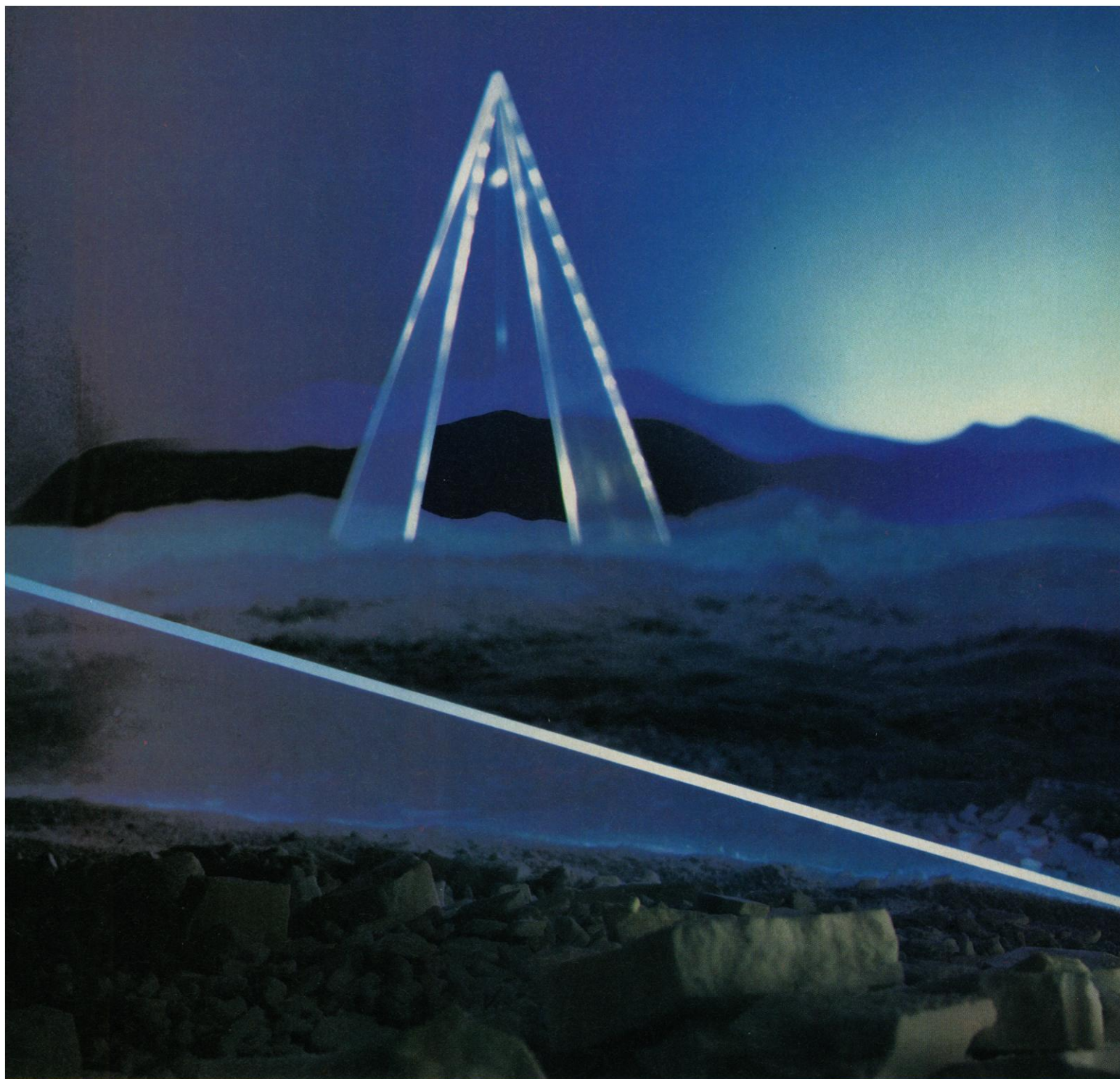
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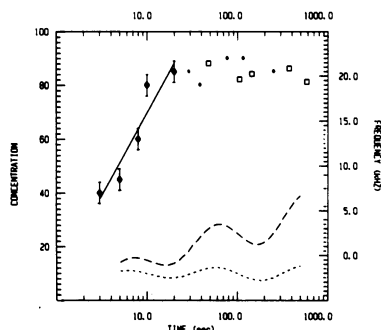
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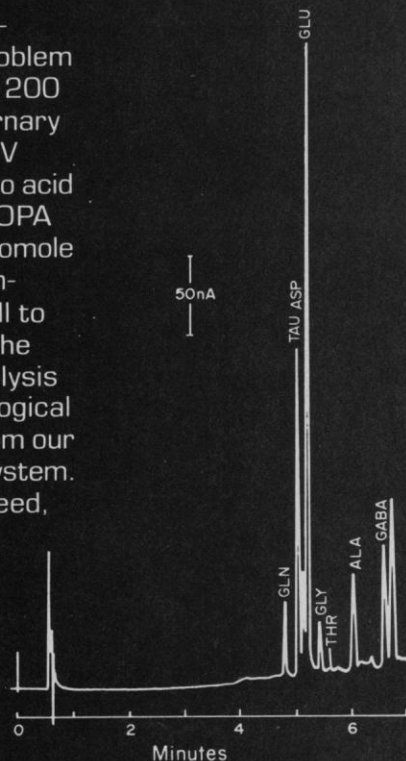
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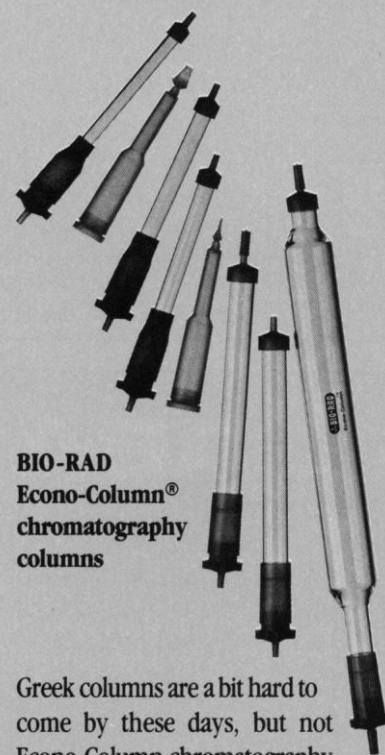


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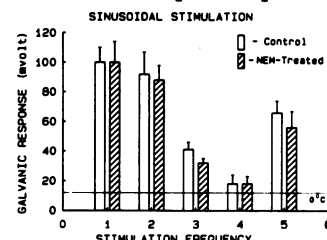
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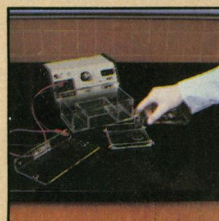
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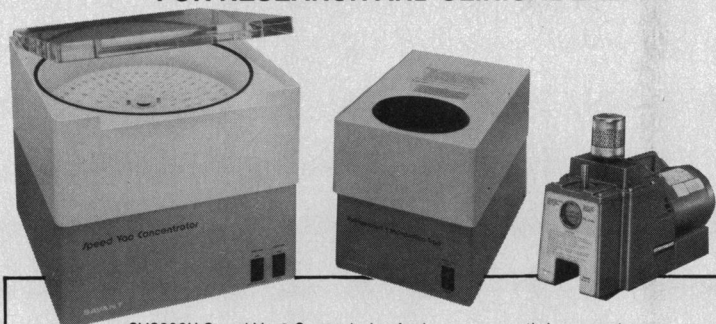
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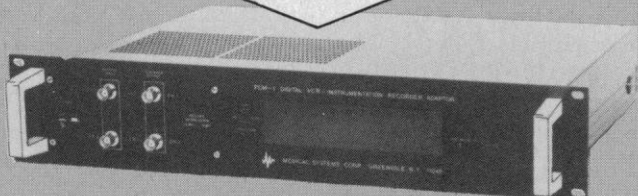
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- A. Computer Science
- B. Electrical Engineering
- C. Food Sufficiency for the Arab World
- D. Literary Translation
- E. Chemistry and Pharmacology in Arab Heritage

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