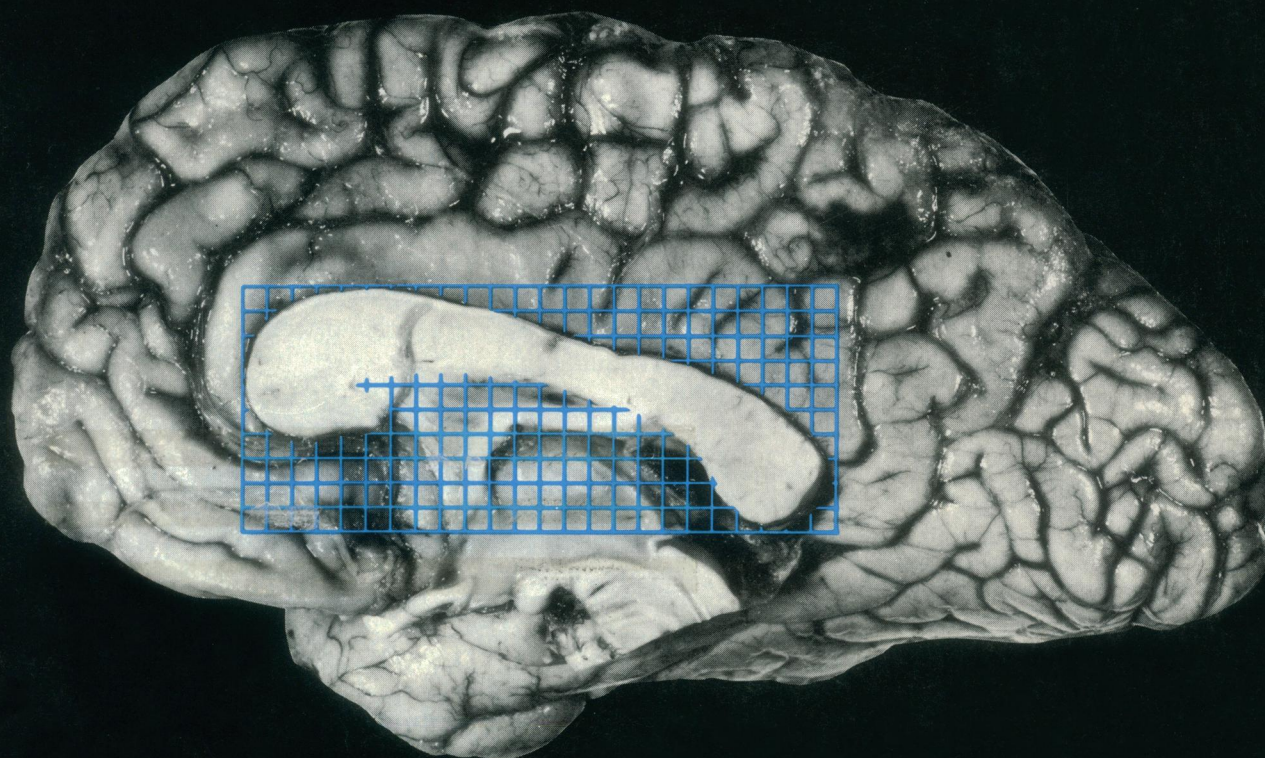
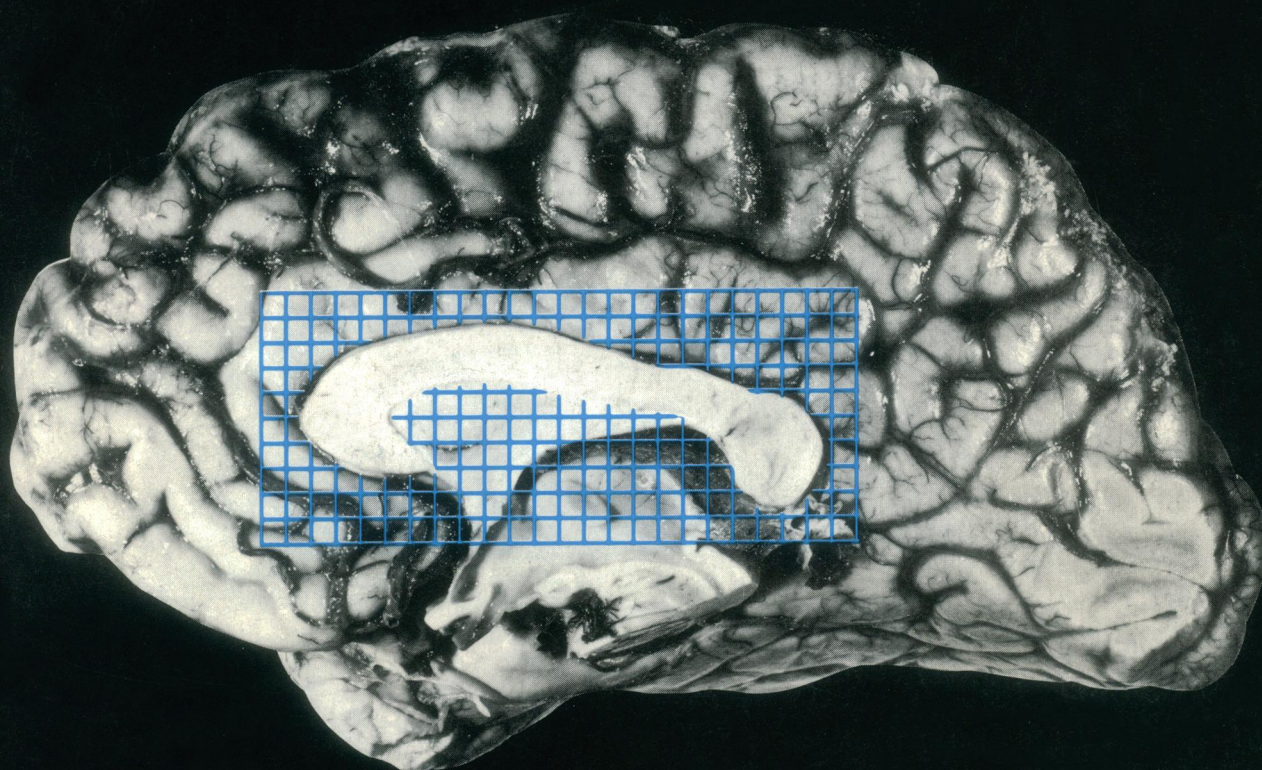


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MicroGenie produces the optimal alignment between two protein sequences. Similarities are indicated on the screen by vertical lines between the sequences.

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```

1  AlaSerPheAspAlaHisGluArgLysPheIleValAspLeuIrpAlaLysValAspVal
1  AlaSerPheAspProHisGluLysGlnLeuIleGlyAspLeuIrpHisLysValAspVal
21  AlaGlnCysGlyAlaAspAlaLeuSerArgMetLeuIleValTyrProTyrLysArgArg
21  AlaHisCysGlyGlyGluAlaLeuSerArgMetLeuIleValTyrProTyrLysArgArg
41  TyrPheGluHisPheGlyLysMetCysAsnAlaHisAspIleLeuHisAsnSerLysVal
41  TyrPheGluAsnPheGlyAspIleSerAsnAlaGlnAlaIleMetHisAsnGluLysVal
61  GlnGluHisGlyLysLysValLeuAlaSerPheGlyGluAlaValLysHisLeuAspAsn
61  GlnAlaHisGlyLysLysValLeuAlaSerPheGlyGluAlaValCysHisLeuAspGly

Matches = 60  Mismatches = 20  Unmatched = 0
Length = 80  Matches/length = 75.0 percent

Please enter the page to be shown: _ PAGE ANALYSIS: Examine

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contig 1  610  620  630  640  650  660
          TAGTTGCTCAGC GCTTGGCTAAGCTTC TTATGTT TACAACTTACATACATCAGC
CEL 008  < TAGT
CEL 014  < TAGTTGCTCAGC TCTTGC
CEL 007  < TAGTTGCTCAGCTGCTTGGCTAAGCTTC TTATGTT TACAACTTACATACAC
CEL 002  < TAGTTGCTCAGC GCTTGGCTAAGCTTC TTATGTT TACAACTTACAT
CEL 016  < TAGTTGCTCAGC GCTTGGCTAAGCTTC TTATGTT TACAACTTACATACAT
CEL 005  < TAGTTGCTCAGC GCTTGGCTAAGCTTC TTATGTT TACAACTTACATACAT
CEL 004  < TAGTTGCTCAGC GCTTGGCTAAGCTTC TTATGTT TACAACTTACATACAT
CEL 001  < TAGTTGCTCAGC GCTTGGCTAAGCTTC TTATGTT TACAACTTACATACATCAGC

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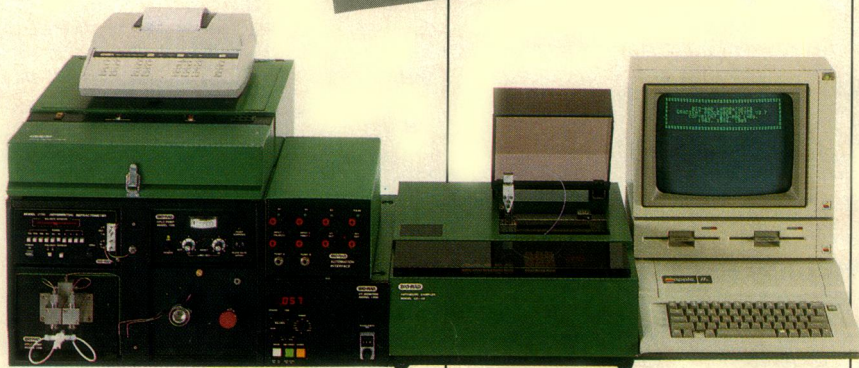
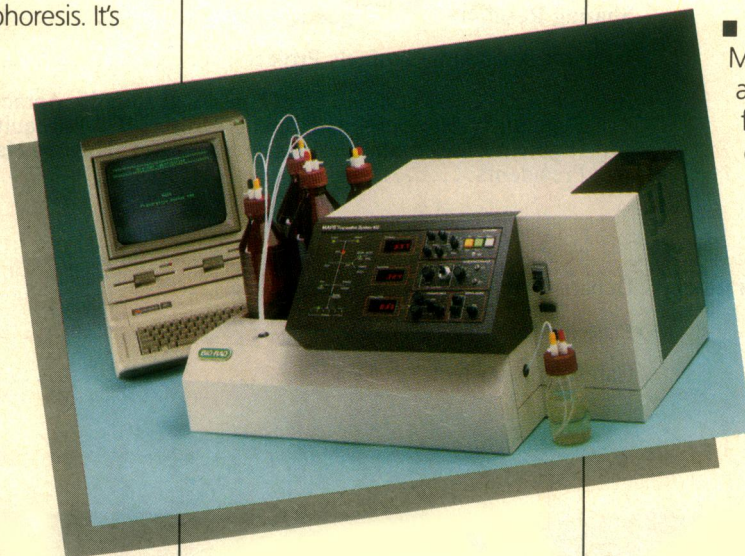
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COVER

Southern Inyo Crater near Mammoth Lakes in Long Valley Caldera, California. This phreatic explosion crater apparently formed late in a sequence of eruptions which ended 550 years ago. The caldera has, since 1978, been experiencing renewed magmatic resurgence accompanied by uplift and an increase in seismicity and fumarolic activity. See page 551. [Stanley N. Williams, Department of Geology, Louisiana State University, Baton Rouge 70803]

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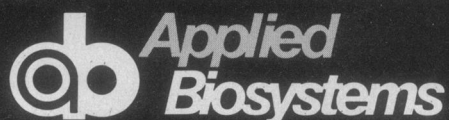
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Earthquake expected

Roughly every 22 years, an earthquake has occurred along the San Andreas Fault near Parkfield, California, and the next one is expected in 1988 (page 619). This site has had five so-called characteristic earthquakes within the past 130 years, and only the fourth was out of phase. Between earthquakes, strain builds up in the crustal material adjacent to the fault; at the time of the earthquake, the strain energy is suddenly released by slip on the fault. Where measurements have been available, the earthquakes have had similar intensities and the same epicenter, involved the same faulting mechanism, and ruptured at the same place for similar distances. Two were preceded by identical foreshocks exactly 17 minutes before the main shock. Bakun and Lindh describe the measurements being made to predict the next Parkfield event. If successful, their method could be applied to earthquake prediction elsewhere.

Good offense not the best defense

Willow trees in the Sierra Nevada mountains can produce a defensive chemical, salicin, for protecting leaves from various pests; one pest, the leaf beetle, has adapted salicin for use against ants that prey on its larvae (page 649). Beetles and larvae metabolize salicin to salicylaldehyde, store it in glands, and later secrete the compound as a defensive spray. Smiley *et al.* analyzed the exploitation of willows by beetles and found that leaf damage by beetles was greatest for those willows producing the most salicin. Experimentally, larvae survived better and secreted more salicylaldehyde when attached to trees producing larger amounts of salicin. At another location in the mountains, salicin production was found to be quite low, as was the number of beetles; a beetle onslaught in the past may have caused tree adaptation that diminished their attractiveness for the pests. Ultimately, in response to beetle infestation, the willows may stop producing salicin.

Mercury's atmosphere

Mercury, the planet nearest the sun, has an atmosphere closely resembling the coma of a comet—the region of diffuse gas that surrounds the nucleus of a comet (page 651). Using a ground-based telescope and spectrometer, Potter and Morgan found that sodium vapor is a major constituent of Mercury's thin atmosphere. Helium and hydrogen previously had been detected in its atmosphere by Mariner 10. Sodium on Mercury's surface—perhaps deposited there as dust from meteors—may be sputtered into the atmosphere as the solar wind hits the planet's surface; the atmosphere may be continuously swept away by the solar wind, but a steady-state balance is maintained to produce the comet-like atmosphere.

Biological processes in coastal seas

Growth of phytoplankton and primary production—the generation of new organic matter through photosynthesis—are limited in coastal seas and estuaries by the availability of nitrogen (page 653). In contrast, these biological processes in lakes are limited by the availability of phosphorus. In seas, nitrogen fixation relies on the chemical element molybdenum, a component of the nitrogen-fixing enzyme. Howarth and Cole found that uptake of molybdate was inhibited by sulfate. Molybdate and sulfate are structurally similar, and sulfate is abundant in seawater. In laboratory tests with Baltic Sea water, the sulfate-molybdate ratio affected the rate of nitrogen fixation and the rate of phytoplankton and bacterial growth. Nitrogen fixation proceeds rapidly and extensively in freshwater lakes (where sulfate is 100 times less concentrated than it is in coastal seas). Thus, how these processes in seas and lakes differ may be explained by competition for cellular uptake between sulfate and molybdate.

Brain size and handedness

The corpus callosum—the band of nerve tissue connecting the right and left hemispheres of the brain (cover)—is about 11 percent larger among the ambidextrous and people with a preference for the left hand than in people with a preference for the right hand (page 665). The corpus callosum forms early in fetal life, grows during early development, then loses fibers, and is smaller at maturity. Right-handers may have a congenitally smaller corpus callosum or may eliminate more cells and axons from the band. If the number of nerve fibers determines the size of the corpus callosum, structure and function may be simply correlated. In brains of left-handers and the ambidextrous, cognitive tasks and extensive connections made through the corpus callosum may link the hemispheres. In the brains of right-handers, such tasks usually are localized to one hemisphere so that such extensive connections may not be needed.

Brain and body size

A developmental model has been proposed to explain evolutionary relationships between brain and body size in mammals (page 668). As distantly related species are compared over time, brain size appears to have changed more rapidly than body size. In studies with rodents, Riska and Atchley found that a positive correlation between brain and body sizes is maintained only during early growth—a time when genetic factors more strongly influence growth of both brain and body. Body size evolution is a mixture of change in early and later growth, but only change in early growth is accompanied by corresponding change in brain size.

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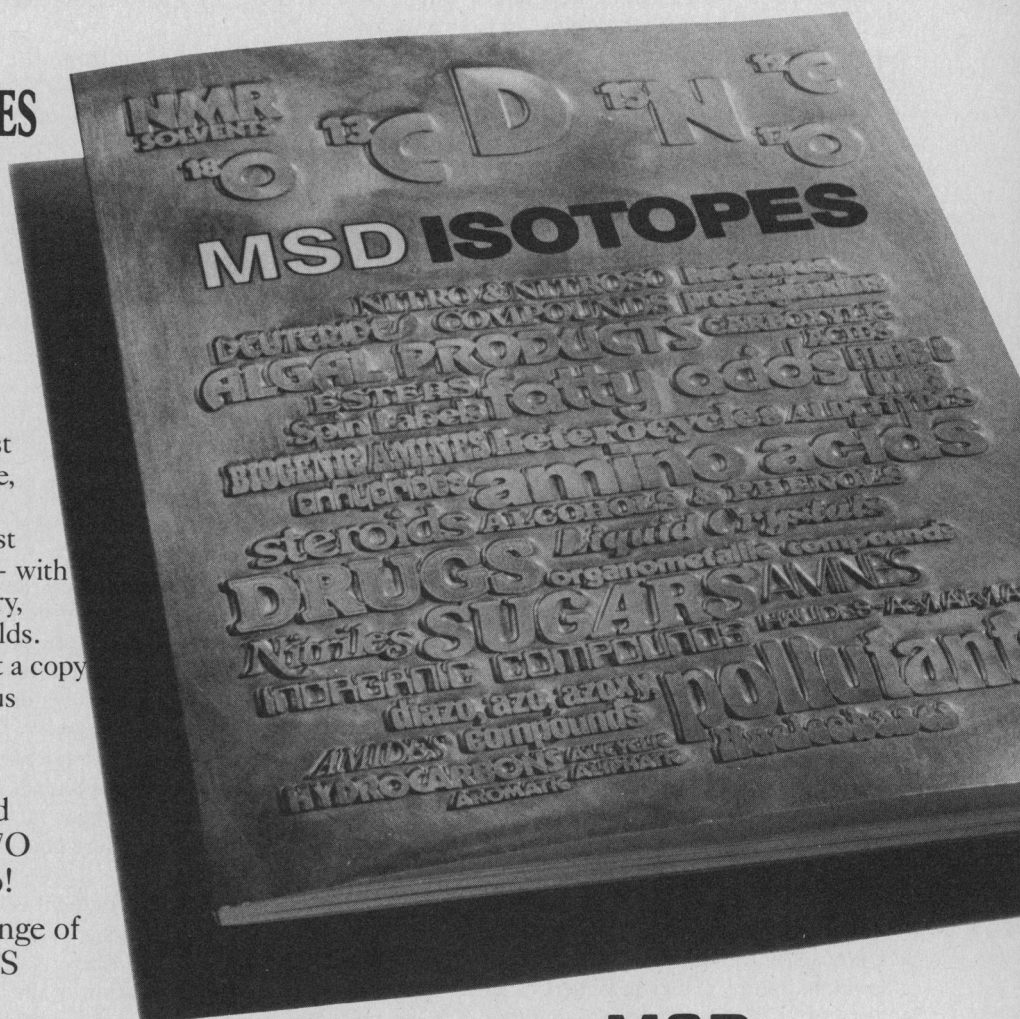
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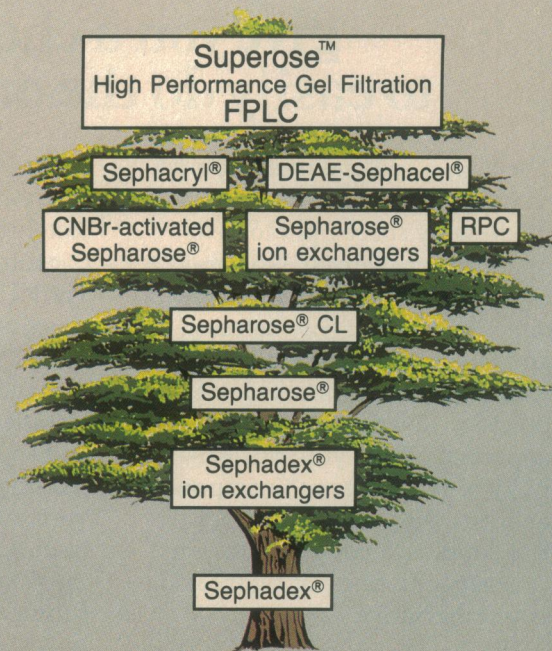
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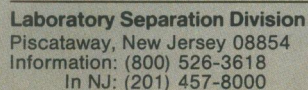
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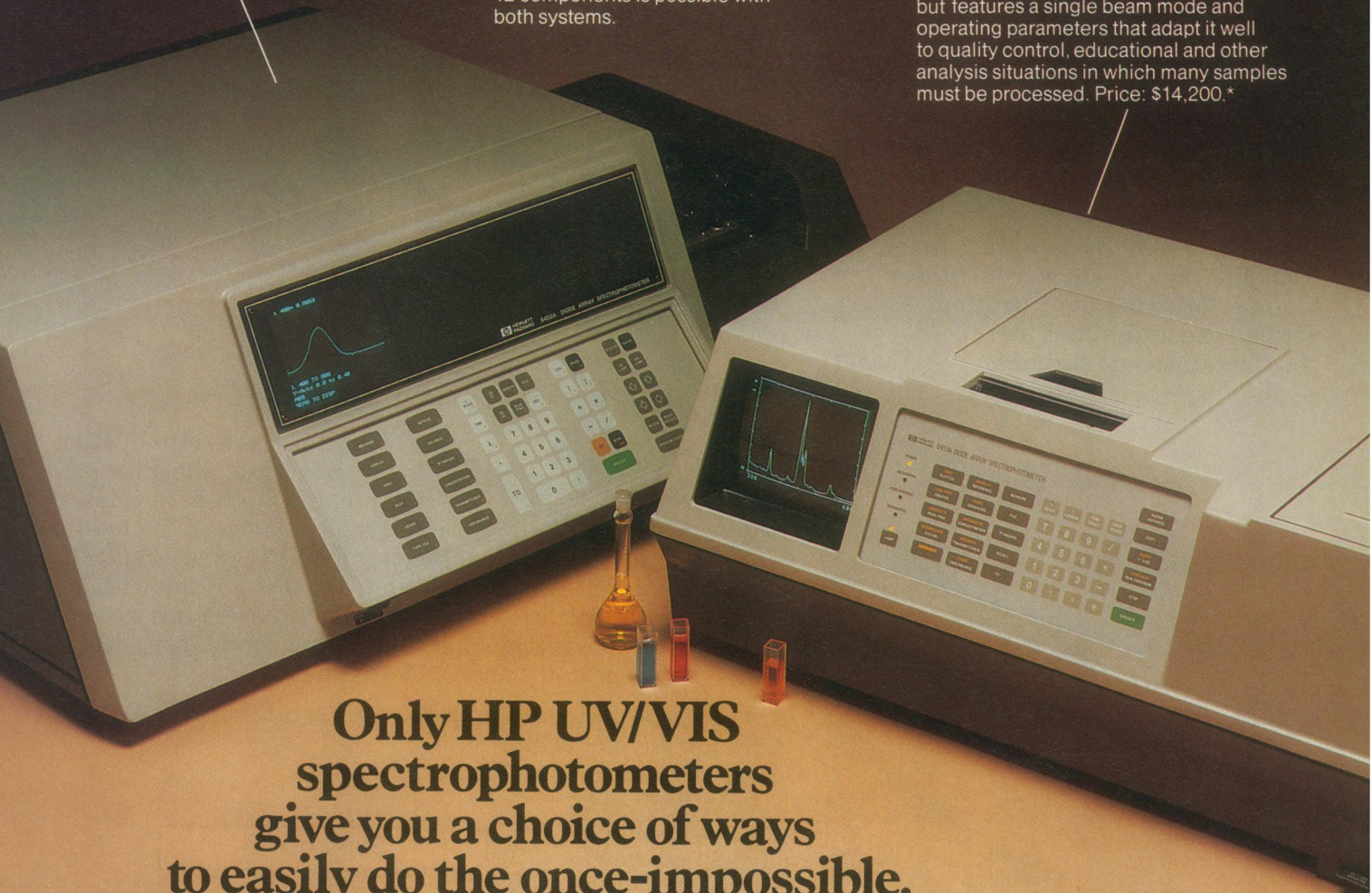
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Pilots of future aircraft may rely on artificial intelligence systems to help them assess combat situations and take appropriate offensive or defensive actions. Hughes engineers are conducting studies for the U.S. Air Force on potential uses of artificial intelligence for fire control and battle management. One focus is how to identify targets automatically and present this information for a pilot's use. Another aspect involves tactical analysis, including decision-making that advises a pilot whether to attack, flee, apply electronic countermeasures, or fly low-altitude routes. New automation techniques may be necessary for pilots to cope with the fire control systems that now are being designed for the next generation of military aircraft.

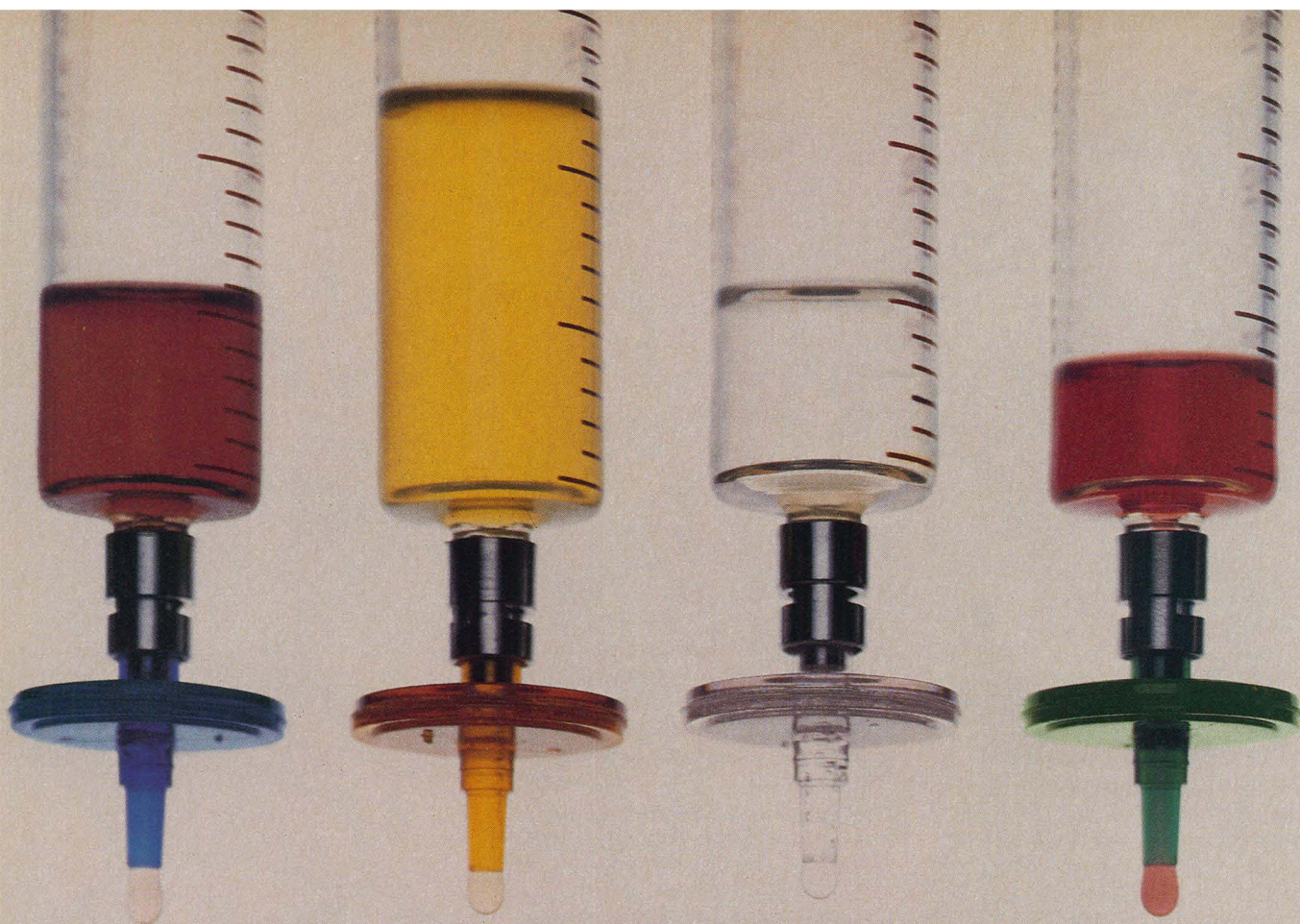
The first attempt to sample the atmosphere of an outer planet, NASA's Project Galileo will journey 750 million miles to Jupiter this decade. The mission will consist of two spacecraft, an orbiter and a Hughes-built probe. Six instruments inside the probe's descent module will assess the structure and composition of the atmosphere, determine the location and structure of clouds, calibrate a precise ratio of hydrogen and helium, and measure lightning, radio emission, and energy absorption. The probe will transmit data to the orbiter for relay to Earth. Project Galileo will be the first interplanetary vehicle launched from the space shuttle. The launch is set for May 1986 and arrival for August 1988. Four Hughes-built probes explored the atmosphere of Venus in 1978.

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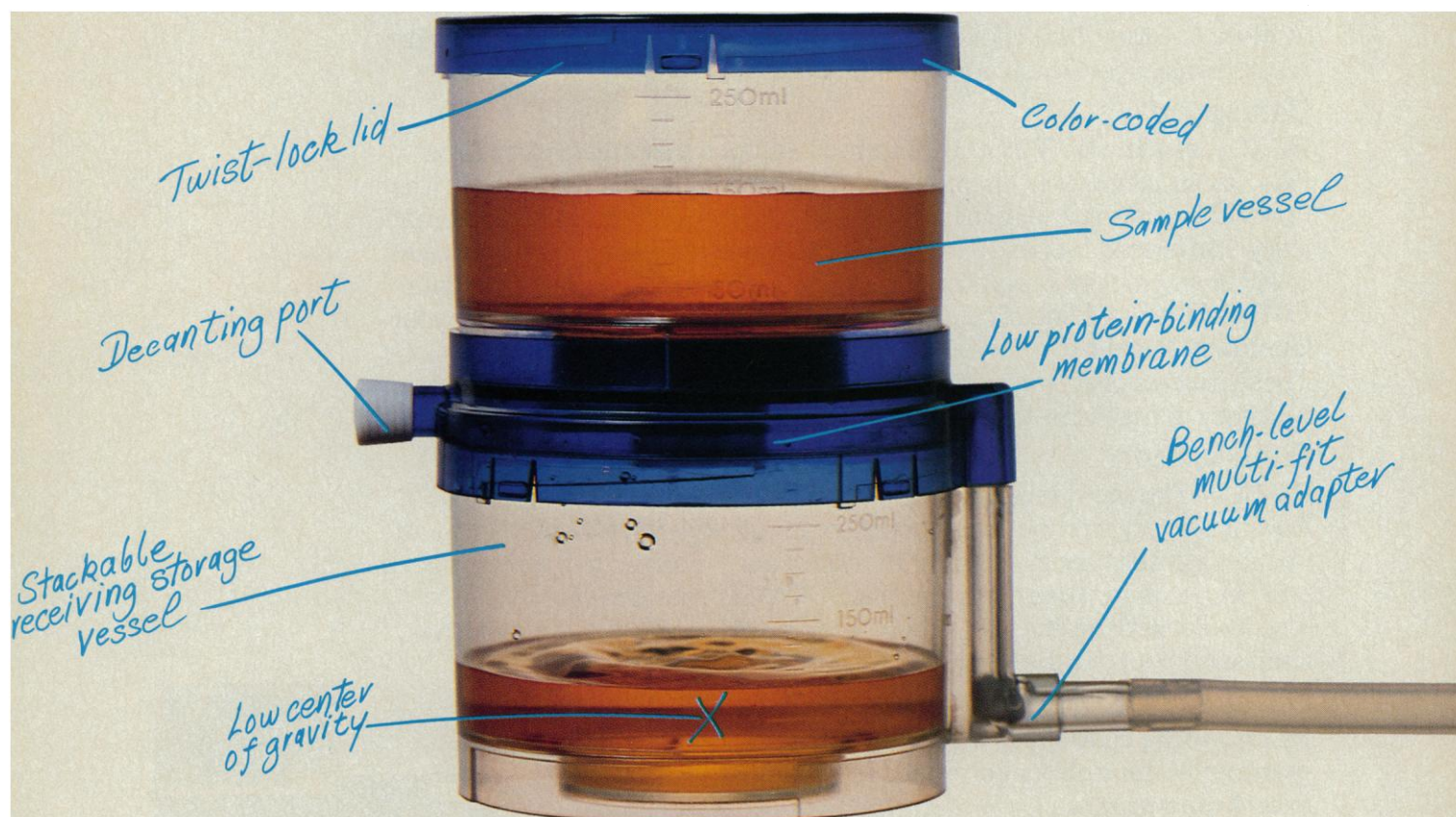
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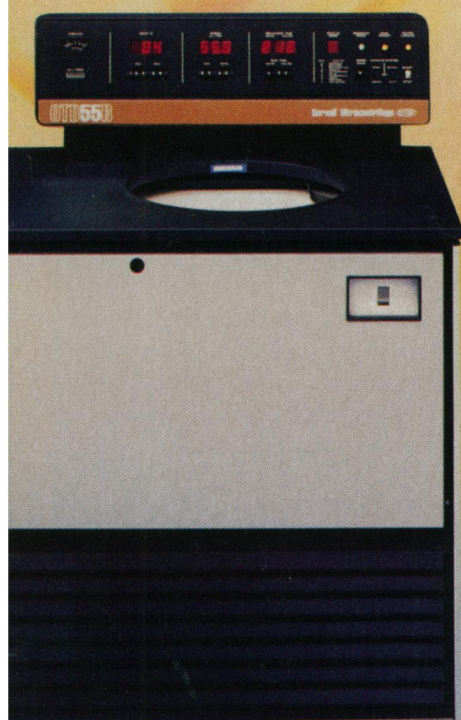


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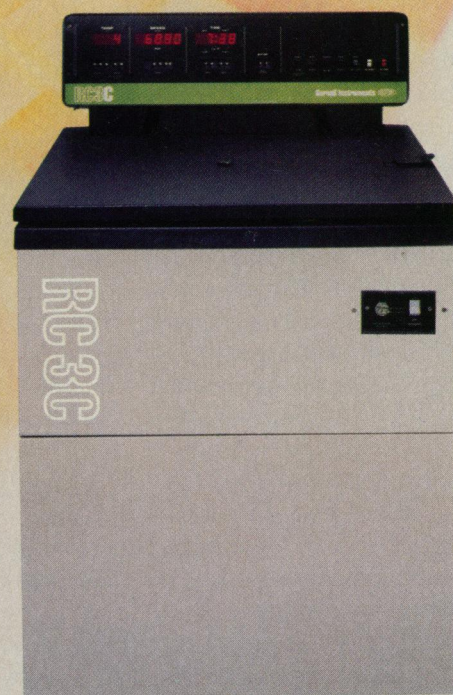
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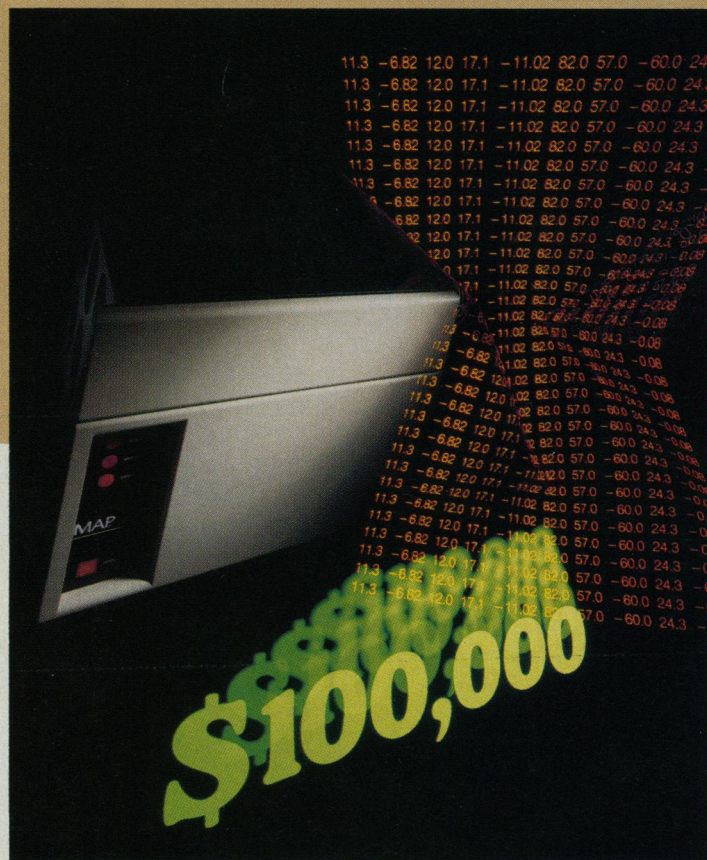
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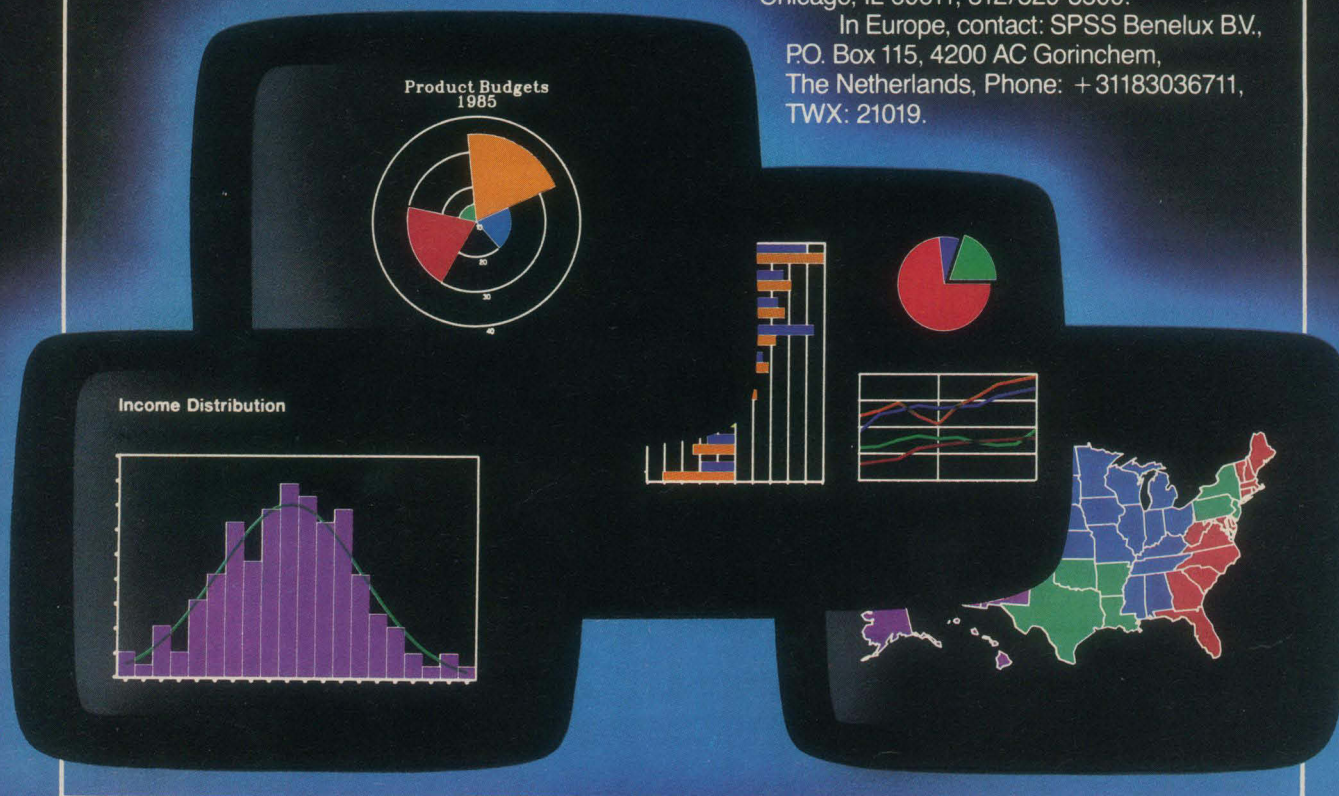
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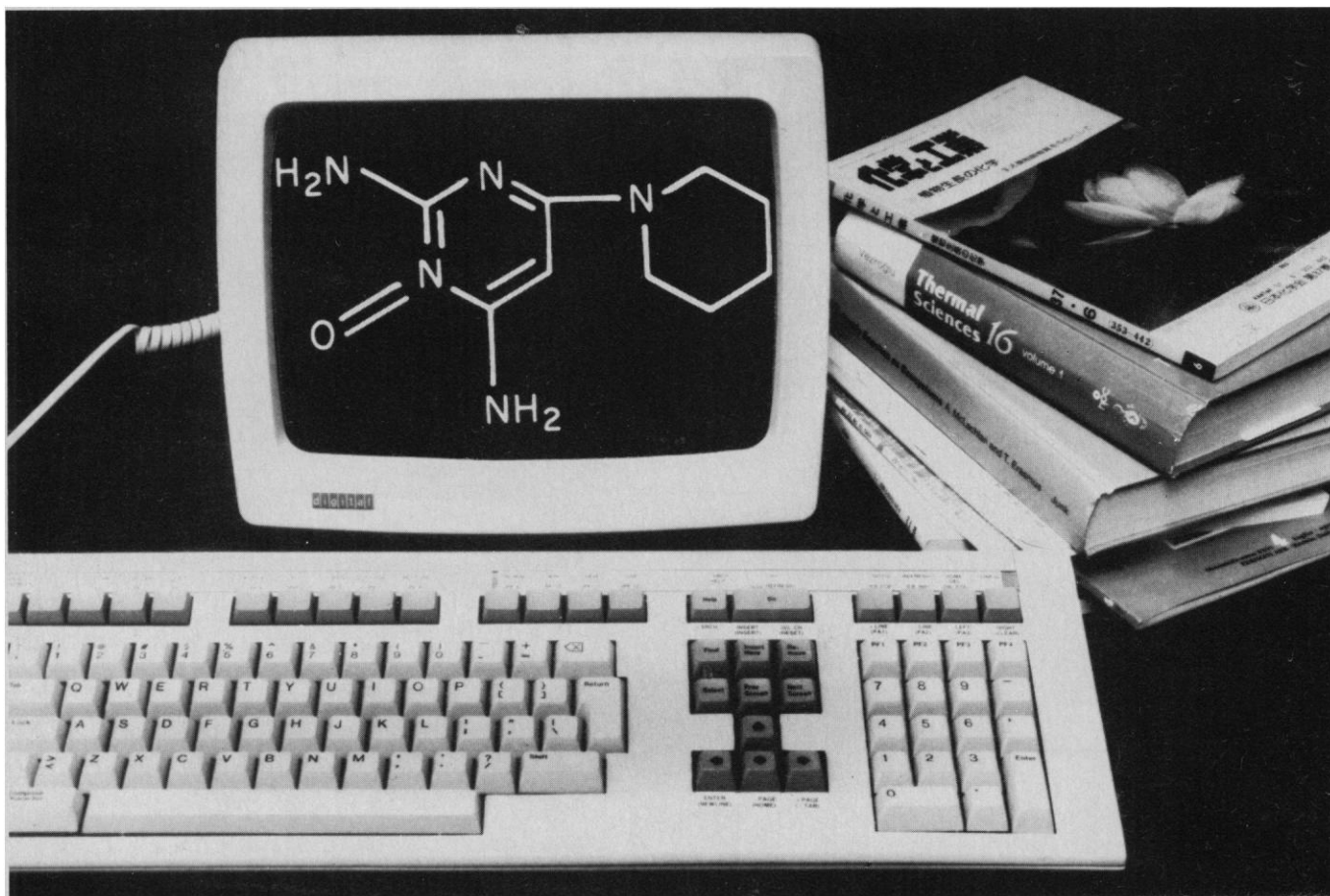


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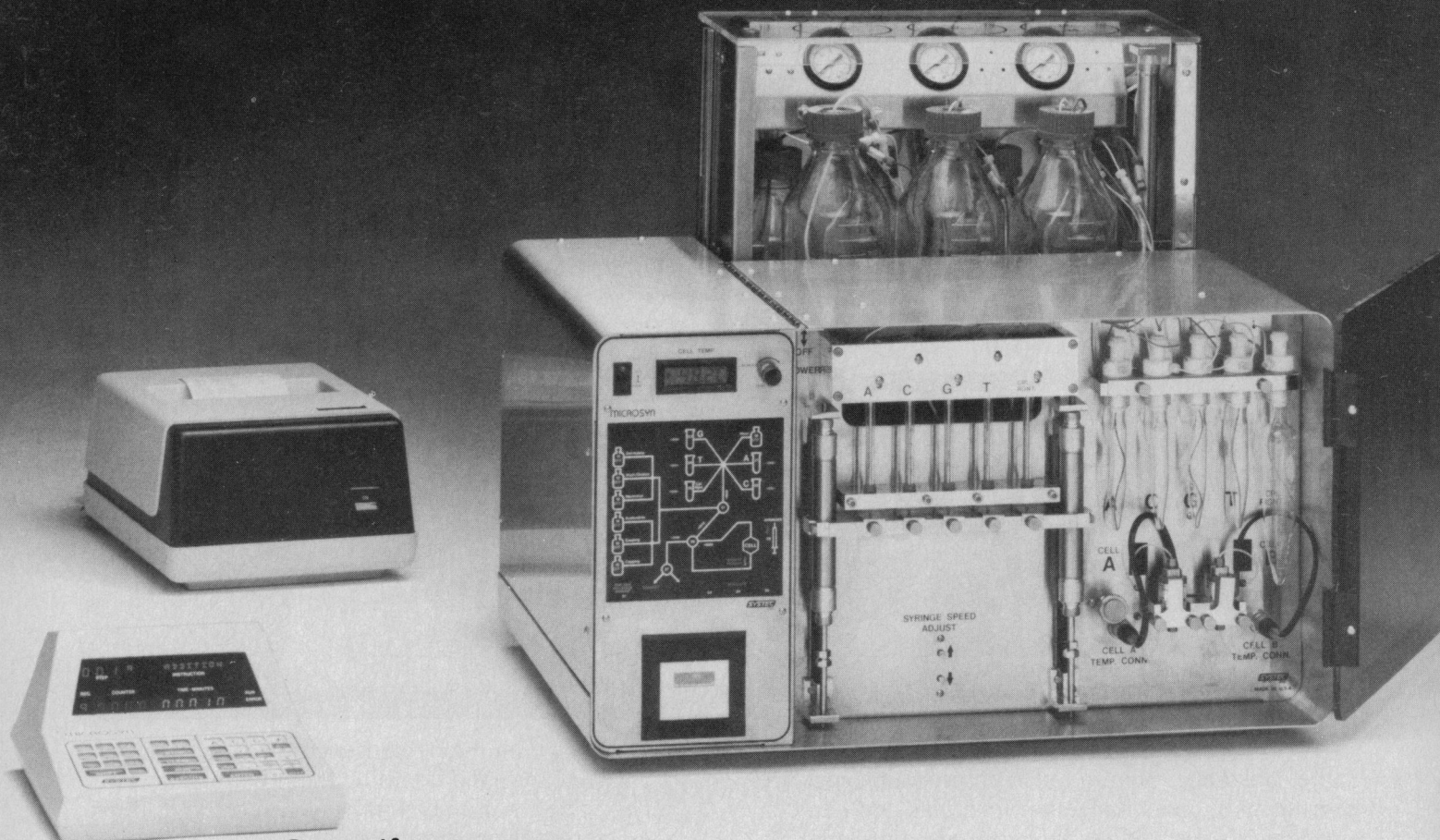
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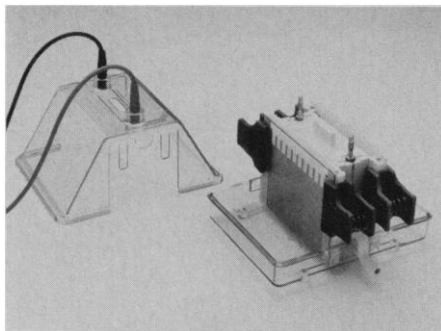
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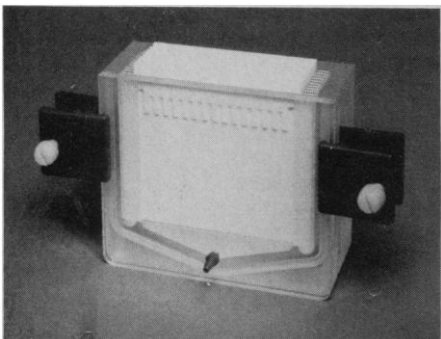
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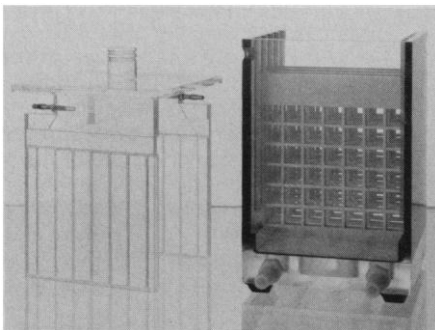
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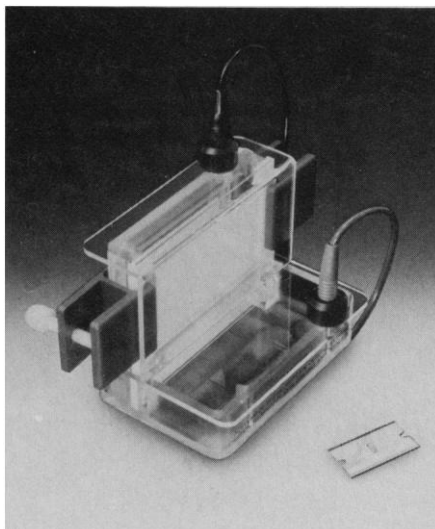
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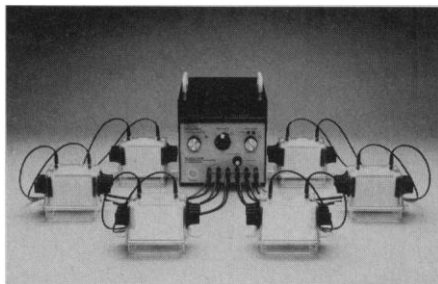
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The PS 500X is portable (only 8 lbs.) and compact (4" x 8" x 12").

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- **Hoefer Scientific Instruments, P.O. Box 77387, San Francisco, CA 94107 USA.** In California: 415-282-2307. Outside California: 800-227-4750. Outside USA: Telex 470778.

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Plant-Fungal Symbiosis

The current era of deforestation and consequent soil erosion in many countries must ultimately be followed by reforestation. In much of the tropics, the growth of food crops or forests is limited by low availability of phosphate in lateritic soils. The growth of vegetation can be substantially increased by the presence of symbiotic fungi. The benefits of the relation can include enhanced efficiency of uptake of phosphate, drought tolerance, broader pH tolerance, and resistance to certain pathogens. The fungi attach to roots and send out hyphae that increase the volume of soil tapped by the tree or plant. The value of the symbiotic relation has been shown on strip-mine sites: seedlings with symbionts prospered while control seedlings languished or died.

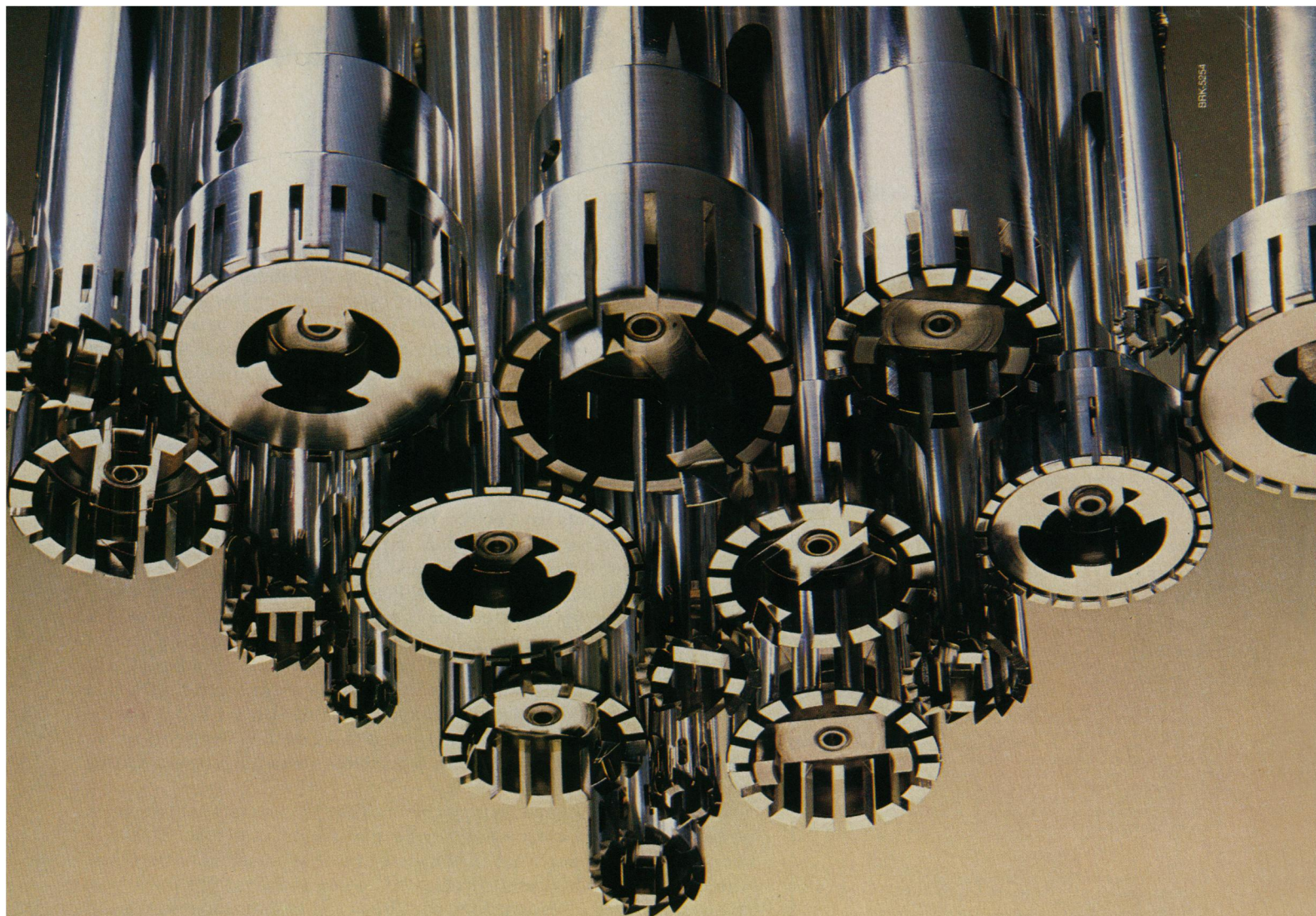
Many woody plants have ectomycorrhizal fungi as their symbionts. This group of fungi forms myceliums that surround the roots. Techniques are available to grow the myceliums of these fungi in pure culture. A commercial venture, Sylvan Spawn, of Butler, Pennsylvania, now is able to supply large amounts of fungi prepared from a customer's isolate. Millions of pine seedlings are already being treated, and the cost per seedling is only about one cent. Benefits include better performance of the seedling in the nursery and better survival and growth in the field. Ultimately a substantial fraction of the 2 billion tree seedlings set out annually in the United States may be treated. The seedlings are obtained from seeds planted in fumigated soil to which the inoculum is added. These procedures are in the process of being mechanized.

When the seedlings and their symbionts leave the favorable environment of the nursery, they enter what may be a hostile circumstance. Thus it is necessary to determine what combination of tree and fungus can best cope with each new environment. Fortunately, some species of the fungi have broad capabilities of associations with trees and of flourishing in a broad spectrum of environments. An example is a culture of *Pisolithus tinctorius* that was selected and is maintained by D. H. Marx of the Department of Agriculture Forest Service Laboratory in Athens, Georgia.

The symbionts of most food crops and some trees invade the roots, resulting in combinations called vesicular-arbuscular mycorrhizae (VAM). They also act to extend the volume tapped by the plants. About 80 percent of all the plants and trees have VAM symbionts. In the United States VAM has been tested with vegetable and fruit crops. Benefits have been demonstrated with many plants and trees including citrus, sweet gum, and black walnut. Legumes with VAM tend to be better nodulated than those without VAM in soils low in available phosphorus. Considerable research has been devoted to tests of VAM with grain crops. However, application of large amounts of fertilizers produces yields more inexpensively than does the application of VAM. One factor limiting the practical use of VAM is that it has not been possible to grow VAM in pure culture. Another limitation is the poor response of the plant-symbiont relation to substantial levels of available phosphorus. In these circumstances the mycorrhizal fungi do not benefit the plant or may be absent.

Half the land in the tropics has soil poor in available phosphorus, and is thus unfit for agriculture without application of large amounts of phosphate. The use of VAM could reduce the need. Additional cropland could be made available by the use of VAM to increase the salt tolerance and drought resistance of plants.

Further improvement of relation between trees, symbionts, and their environments is likely to take two forms. The potentials for improvement through conventional selection procedures have not been exhausted. In addition, strenuous efforts are being made to improve plants through genetic engineering techniques. These efforts will surely come to include a broad approach to plants and trees that treats them and their symbionts as a system to be optimized.—PHILIP H. ABELSON



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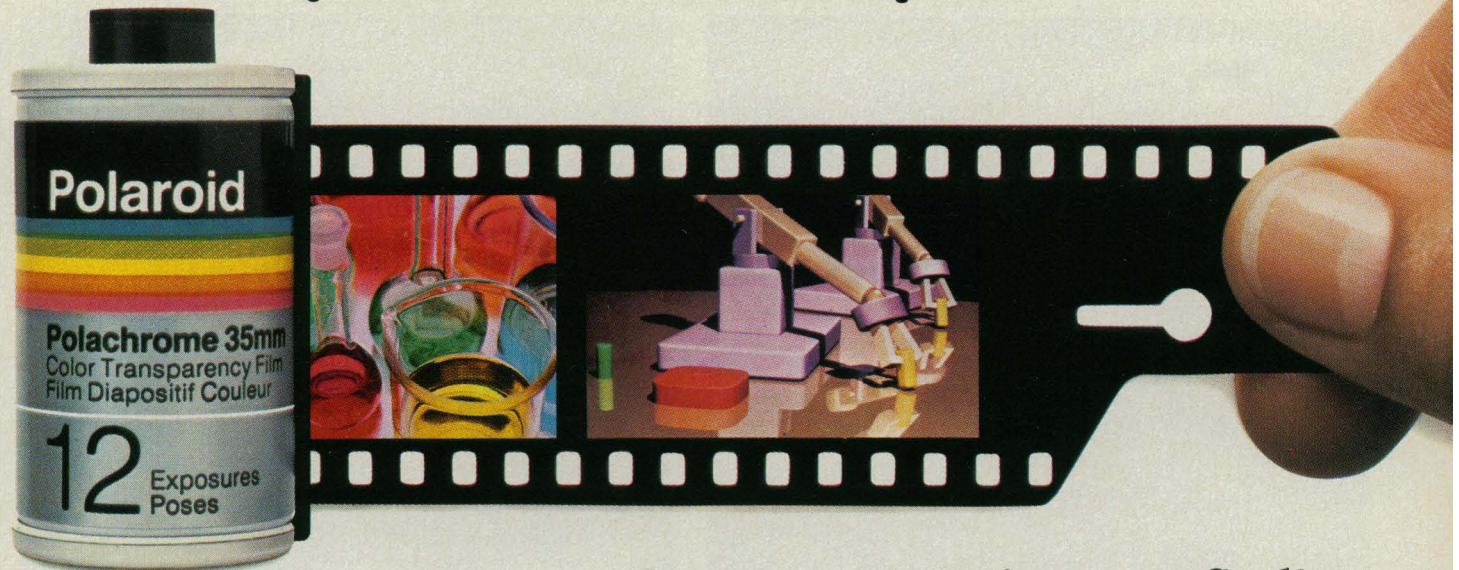


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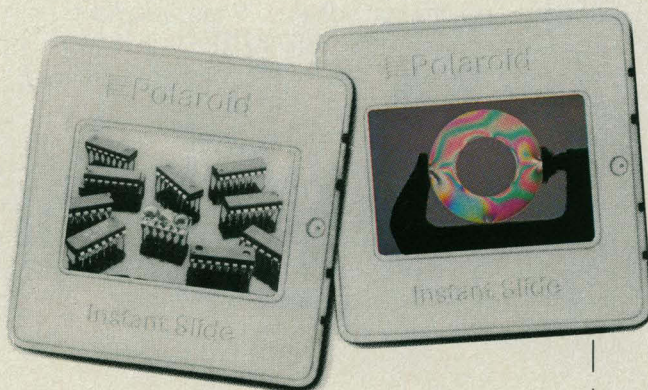
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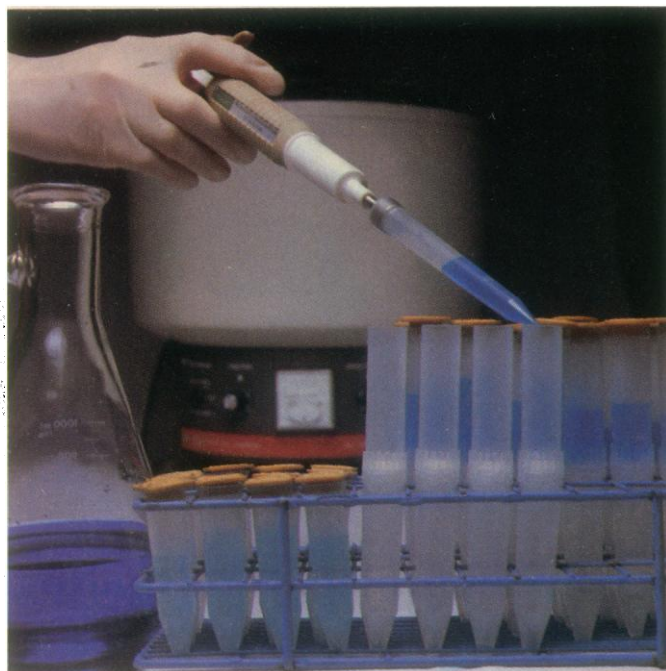
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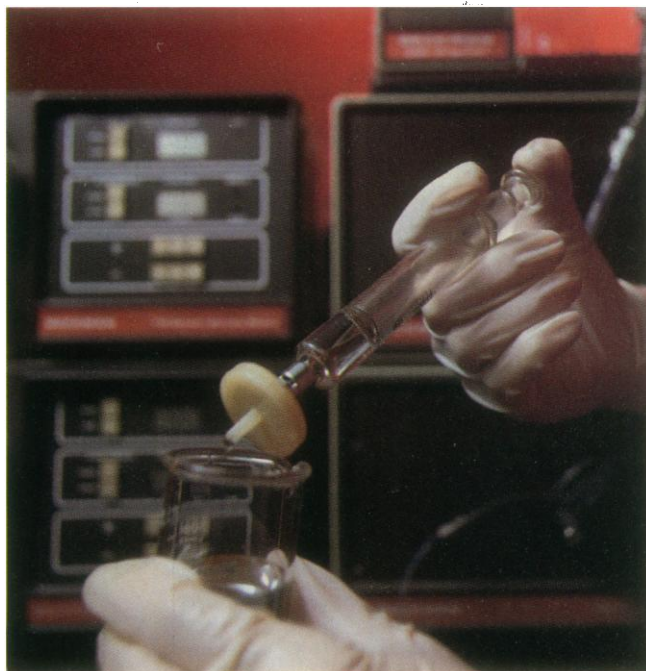
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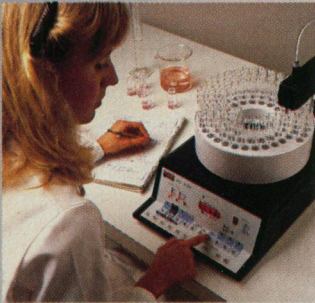
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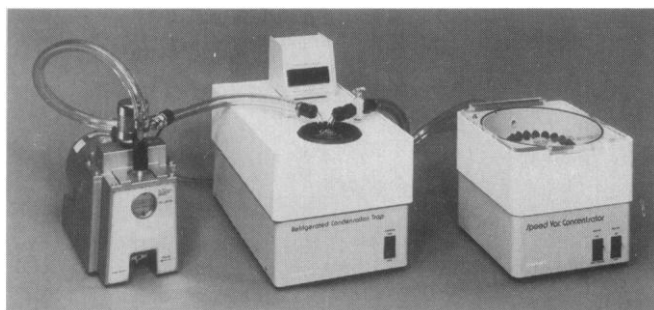
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