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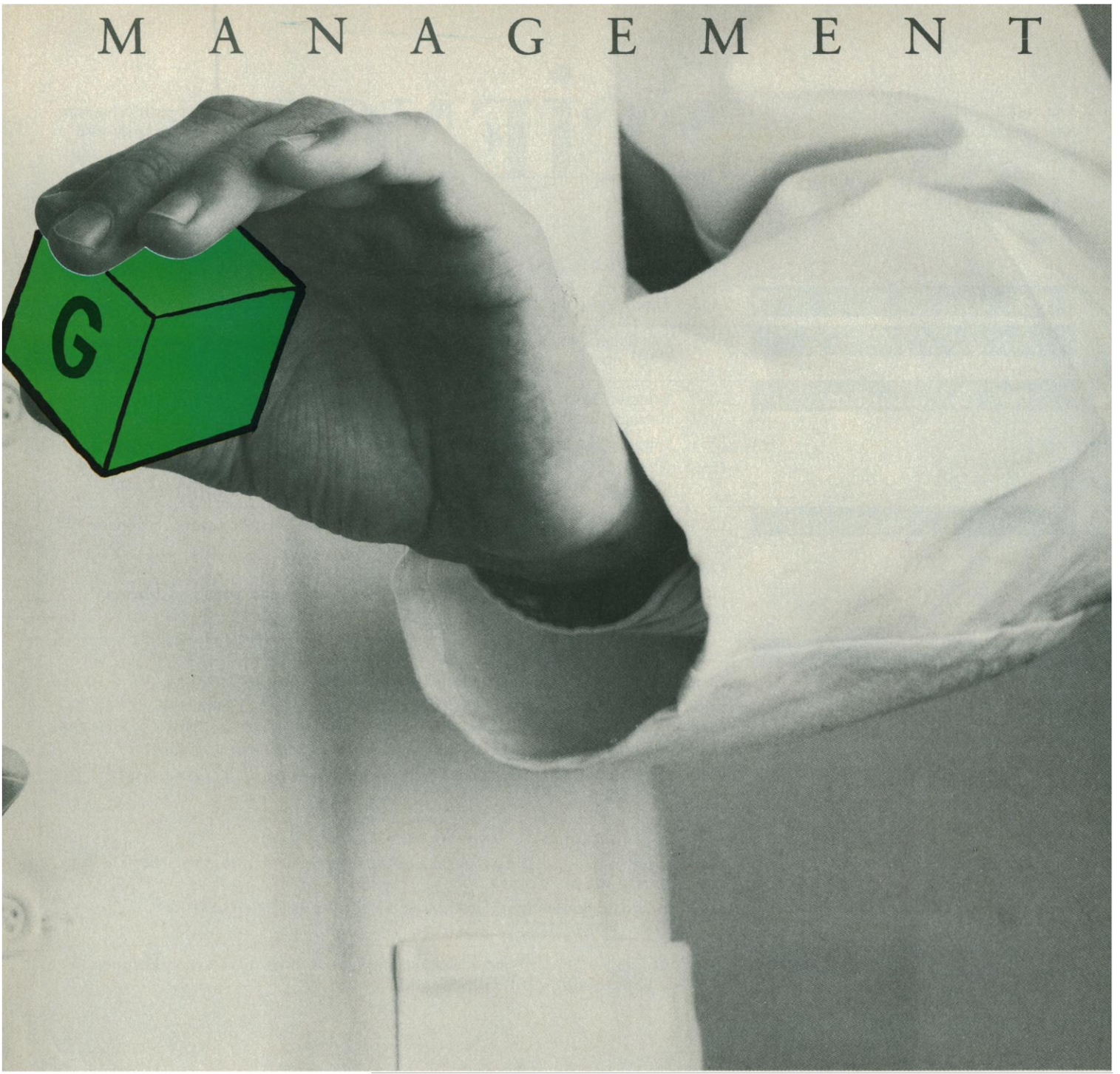

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COVER Advances in genetic engineering are bringing new variations of naturally occurring species to the research laboratory and into the field for testing and marketing. This issue of *Science* focuses on the applications of this technology that are already available and the prospects for the future. See page 1275. [Illustration by Donna Williams]

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Human gene therapy

ACCEPTANCE of gene therapy as a reasonable method for treating various human diseases and conditions has been growing. Unlike other therapies that treat symptoms, gene therapy would get at the root cause of a disease. Gene therapy includes the repair of aberrant genes or their replacement with genes that have normal structures or that function properly; in theory, it could be used for correcting genetic defects, for treating malignancies (diseases in which gene expression appears to be pathologic), and even for altering the genes of infectious agents so as to reduce their pathogenicity. Friedmann describes a number of technical advances that have been made in gene therapy, some immediate goals of gene therapy, and some ethical issues that are surfacing and must be addressed as the vision of gene therapy gets closer to becoming a reality (see pages 1233 and 1275 to 1317).

Fuels for fertility

FERTILITY problems have been noted among lean female athletes and dancers, women with eating disorders, and food-deprived animals. The problems were thought to be caused simply by individuals' low body weights. However, experiments in hamsters suggest that it is the availability of metabolic fuels—derived from sugars or fatty acids in the diet or from fatty acids stored in adipose tissues—that determines whether sexual cycling will occur (page 1326). Three measures of sexual readiness were followed—ovulation, vaginal discharge, and lordosis (arching of the back that indicates receptivity). Female hamsters were sexually receptive whenever at least one fuel source was available and were not receptive when inhibitors blocked metabolism of both sugars and fatty acids; a prerequisite to sexual cycling is therefore fuel availability, not some critical body weight or ratio of fat to lean. Schneider and Wade note that reproduction in many mammals can be put on hold when energy is needed for survival, for example, for enduring cold winters. Similarly, monthly cycling may cease in thin women whose limited fuel supplies are being expended for other (for example, athletic) purposes.

Resetting human clocks

IN just 2 to 3 days, it is possible, with bright lights, to reset the human internal circadian pacemaker to a new, desired daily pattern (page 1328). Manipulation and adjustment of the pacemaker could be a great help to travelers who experience jet lag, to shift workers, to people suffering from certain sleep-wake disorders, and to individuals who perhaps experience "seasonal depression." In experiments with healthy subjects, Czeisler *et al.* show that the timing of exposure to bright light, indoor light, and darkness is key to determining how quickly the phase of the rhythm will be shifted and which direction—forward or backward—it will move. Body temperature, which drops to its daily low 2 to 3 hours before normal wake time, was used as a proxy for the internal pacemaker's rhythm; the daily rhythms of two other markers—urine output and plasma cortisol levels—shifted coordinately with shifts in body temperature, indicating that all three parameters are driven by the same pacemaker. The extreme light-sensitivity shown by the human pacemaker, a sensitivity that only insects and plants were thought to possess, indicates that the pacemaker is quite flexible and has great potential for change under the right inducing conditions. (See also page 1256.)

Troublesome antibodies

NOT all antibodies that are produced during viral infections help curb infections; some actually enhance the ability of viruses to enter cells (and then to proliferate and spread). The immune phenomenon of enhancement poses difficult problems for vaccine development because a safe vaccine must elicit only protective antibodies; it is necessary to identify viral antigens that elicit enhancing antibodies and exclude them from vaccine preparations. A case in point is a vaccine for AIDS. Blood from patients with AIDS and from animals infected with the AIDS virus often contains enhancing antibodies. Homsy *et al.* found that complexes of enhancing antibodies and viruses attach to FcRIII receptors on the surfaces of macrophages (page 1357); other cells in the immune system also have FcRIII receptors (including lymphocytes, which play several key roles in AIDS). The experiments suggest that it may be necessary to block two kinds of receptors in order to prevent the AIDS virus from spreading in an infected individual—the FcRIII receptors to which viruses complexed with antibodies bind and a second receptor to which viruses bind when they enter cells on their own.

Damage from PCP and MK-801

A drug that has been under consideration for use in the treatment of neurodegenerative diseases may be too dangerous to use; although MK-801 provides protection to the nervous system—it interferes with excitatory and toxic actions of certain amino acids—it also produces major (though reversible) morphologic changes in certain brain cells (page 1360). MK-801 binds to the receptor in the brain used by PCP, which is a potent street drug that can induce psychotic behavior. Studies by Olney *et al.* indicate that MK-801, PCP, and two other compounds that have affinity for the "PCP receptor" are all toxic for nerve cells in restricted regions of the rat brain—the posterior cingulate and the retrosplenial cortices. Cells fill with large vacuoles and lose mitochondria (structures that contain metabolic machinery). Because the psychotic behaviors induced by PCP-type drugs resemble behaviors characteristic of schizophrenics, it is conceivable that endogenous substances like PCP induce psychoses in schizophrenics by acting on the same cells in the same regions of the brain affected by PCP.

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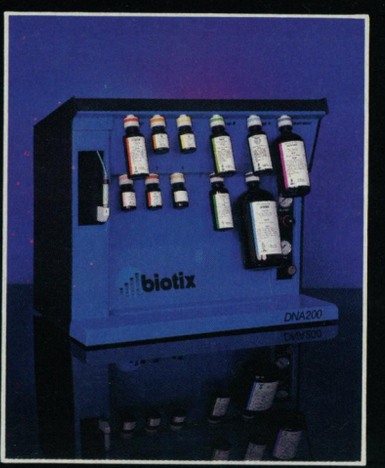

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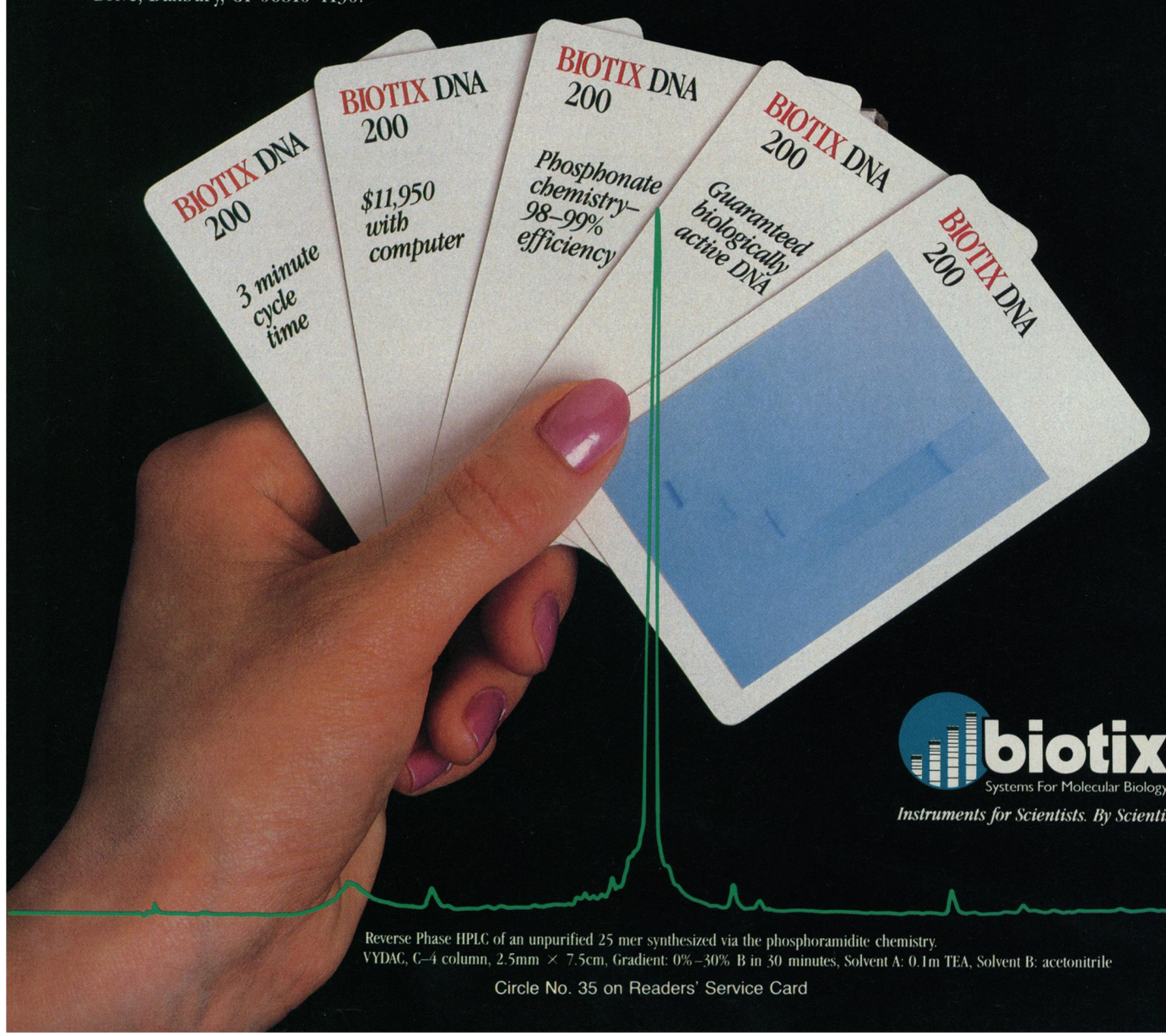

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The Engineering of Species

Somewhere in the vast pantheon of science a molecular biologist is saying, "I'd like to engineer a wolf into a dog." Somewhere else, the sepulchral voice of a geneticist will reply, "It's been done." For in fact, over evolutionary time, the friendliest of wolves (and possibly the most intelligent) learned that wagging their tails and delivering slippers was an easier way to earn a living than hunting caribou in the wilds. In modern times, scientists have accelerated evolution for the benefit of humans by deliberate selection techniques to improve livestock, crops, and other life forms. The difference between these techniques and the use of recombinant DNA is that direct gene alteration removes some chanciness and accelerates the pace at which new variants can be produced. This issue of *Science*, assembled with the insight and editing skills of Barbara Jasny, shows how various species are being genetically engineered.

The most controversial genetic engineering involves humans and Friedmann covers the latest exciting advances in the development of gene therapies. Gene transfer techniques that produce somatic mutations, such as by the introduction of viral vectors into bone marrow, have great potential for curing patients without affecting succeeding generations. Homologous recombination, as described in the article by Capecchi, allows the surgical removal of a single deficient gene and its replacement by a normal gene, the crucial step needed for efficient alteration of a germ line. It can reverse history in ending the progress of a deficient gene into new generations.

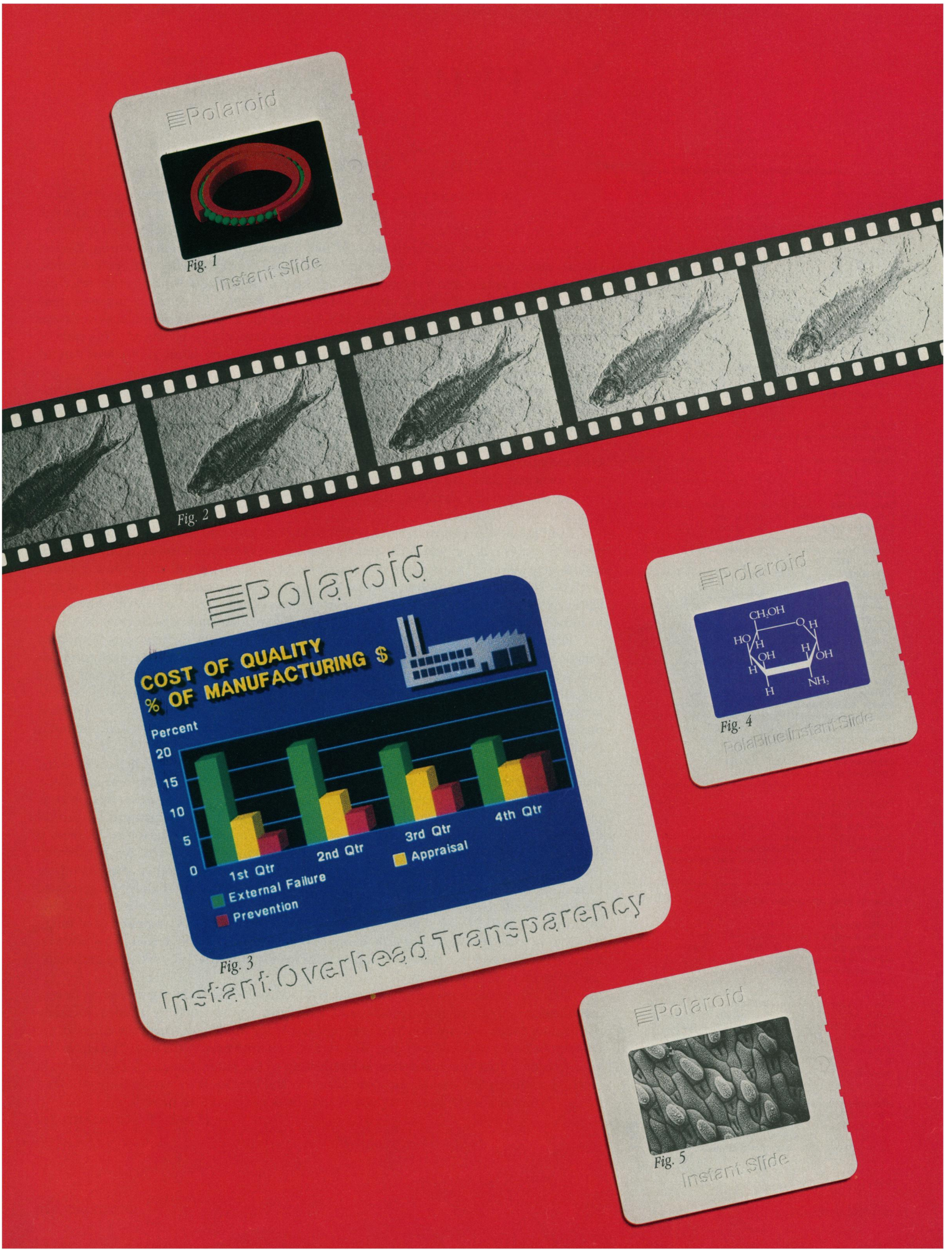
Even the best intentioned genetic engineering can have bad effects as illustrated in the article by Pursel *et al.*, in which the genetic engineering of livestock has been carried on for several generations. Two successive generations of pigs engineered to produce elevated levels of bovine growth hormone showed significant improvements in weight gain and feed efficiency and marked reduction in fat. However, these beneficial effects were offset by a high incidence of gastric ulcers, arthritis, cardiomegaly, dermatitis, and renal disease.

Plant research, as discussed by Gasser and Fraley, is one of the triumphs of modern genetic engineering; plants are being produced that are resistant to infectious agents or weed-control agents and can produce more and better food. As pesticides come under continual attack, the development of plants that naturally resist predators will become increasingly useful. An ironic feature is that some plant defenses involve synthesis of natural carcinogens. It is thus conceivable to get a plant that can be grown without pesticides but is deadly poisonous.

One alternative to pesticides is the use of biocontrol, a subject that is illustrated in the article by Lindow, Panopoulos, and McFarland. The famous "Ice$^-$" bacterium is a classic case in which genetic engineering of a bacterial species results in an organism that protects plants against damage from freezing. The importance of microorganisms is further illustrated by the genetic engineering of *Rhizobium* to improve nitrogen fixation, a development that could increase plant yields and diminish the need for agricultural chemicals. Additionally, engineered bacteria are being used to improve the cleanup of hazardous waste sites. Techniques described by O'Connor, Peifer, and Bender can accelerate the ease and efficiency of genetic engineering, not only on bacteria, but possibly on other organisms as well. Finally, Timberlake and Marshall discuss genetic engineering of fungi, which have great relevance, not only because they are serious pathogens in many diseases, but also because they have potential applications for the industrial production of antibiotics and other important chemicals.

This issue reminds us that we must proceed cautiously in introducing new genes or new combinations of genes into species, and long-term experiments are needed to study detrimental effects. We are nowhere near the knowledge needed to genetically engineer the complex behavior of a wolf or a dog. An original wolf might say to the dog, "You have lost your freedom. Your obsequiousness is humiliating to the family Canidae." The dog could reply, "I am much less warlike, far more altruistic, and besides, it's a wonderful standard of living." Whether society prefers to have wolves or dogs remains to be seen.

—DANIEL E. KOSHLAND, JR.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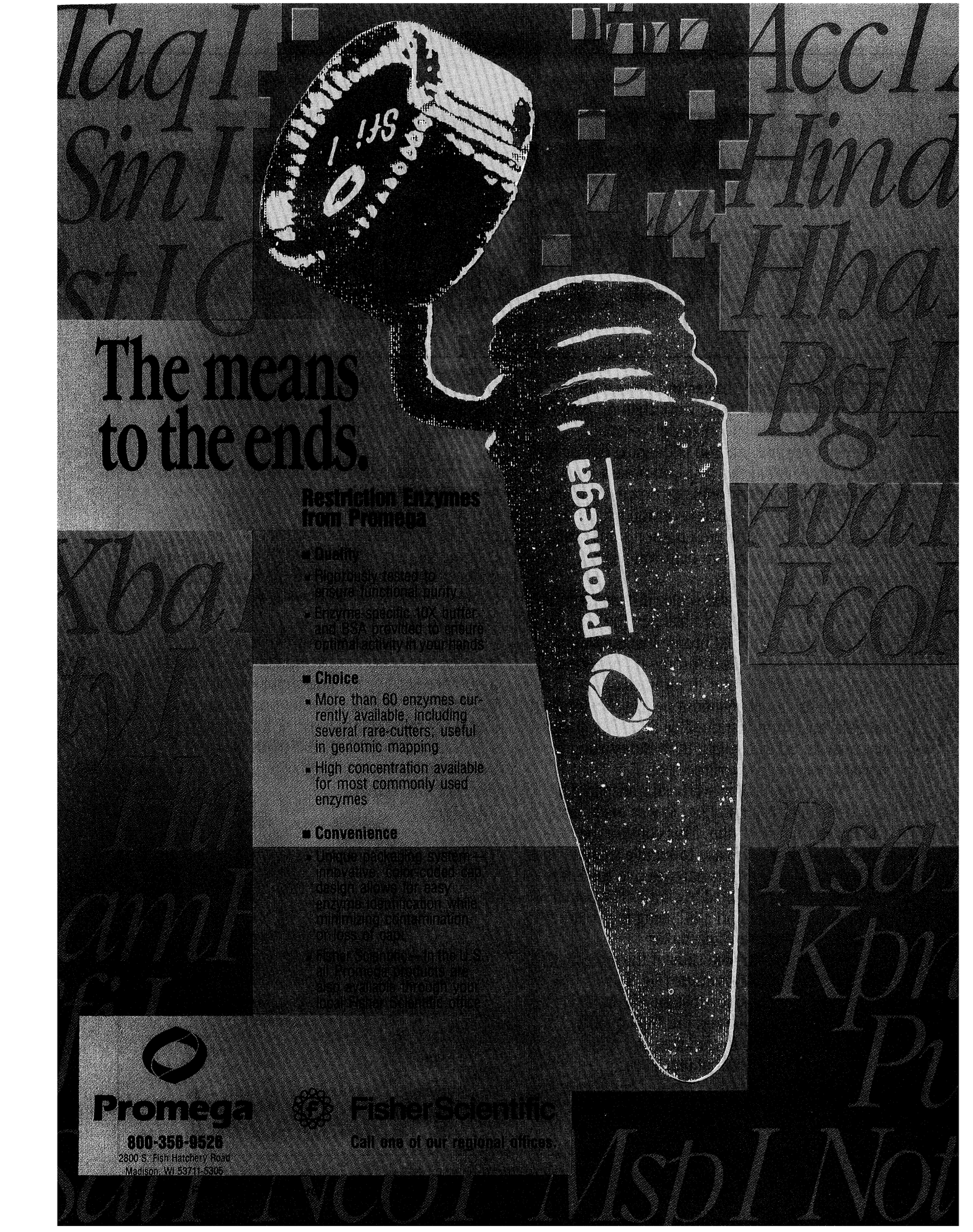

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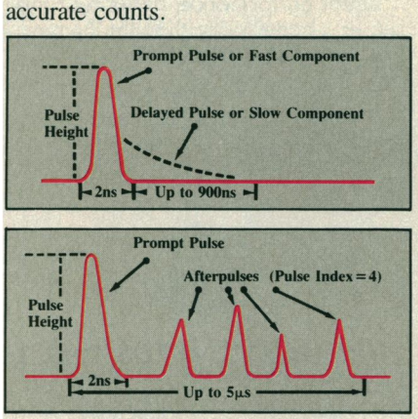
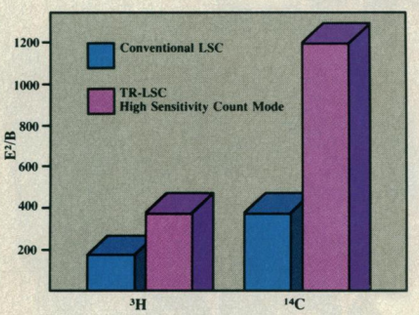


The typical beta scintillation pulse (top) is very fast and may be followed by a delayed component. The typical background pulse is followed by a series of afterpulses. Patented TR-LSC distinguishes between the two.



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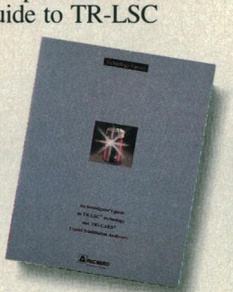

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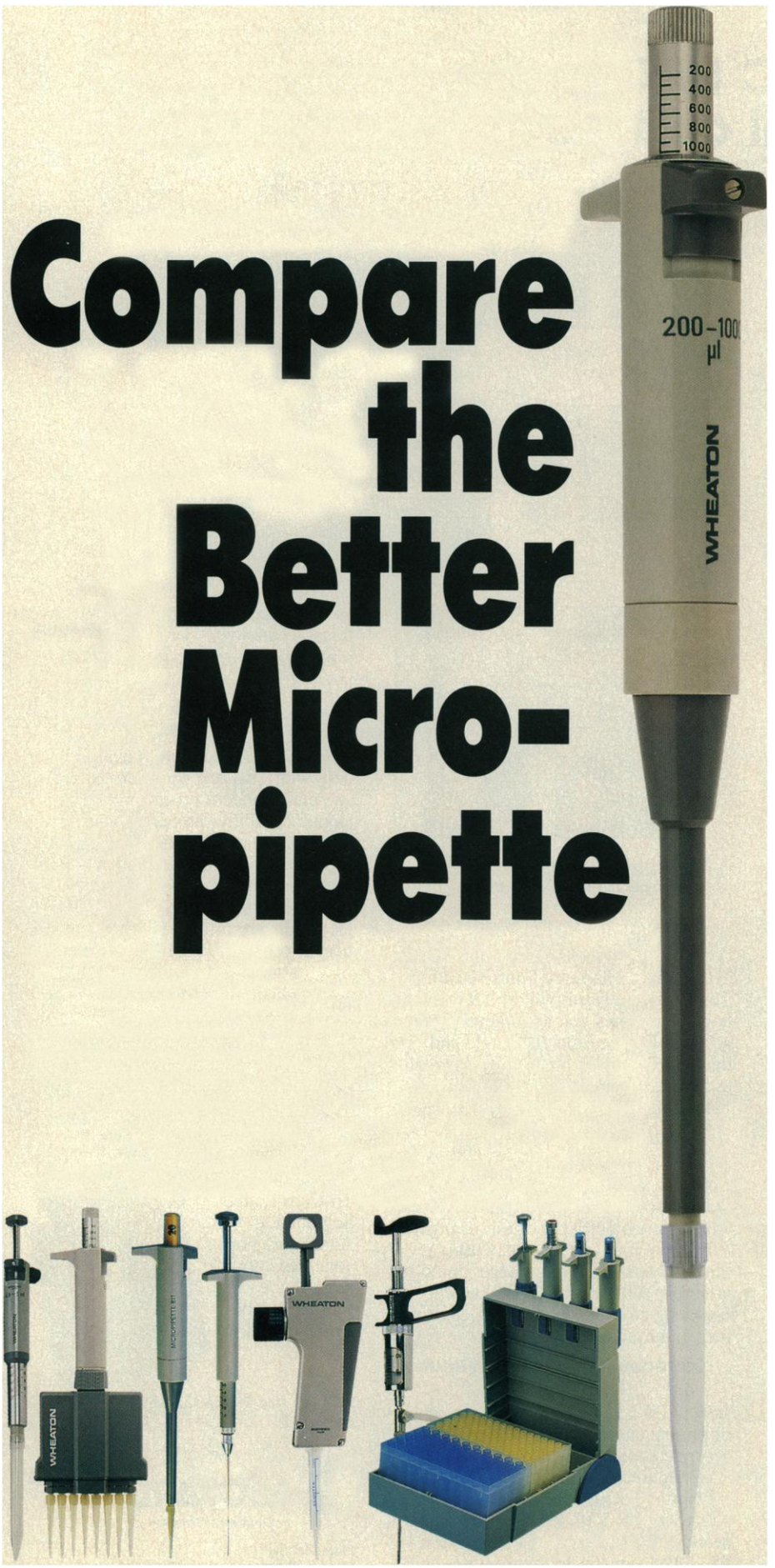

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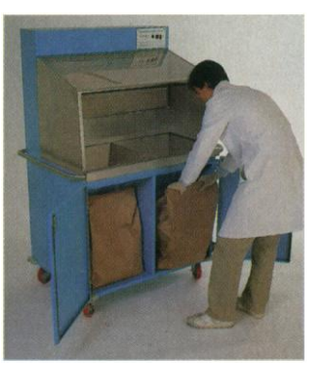

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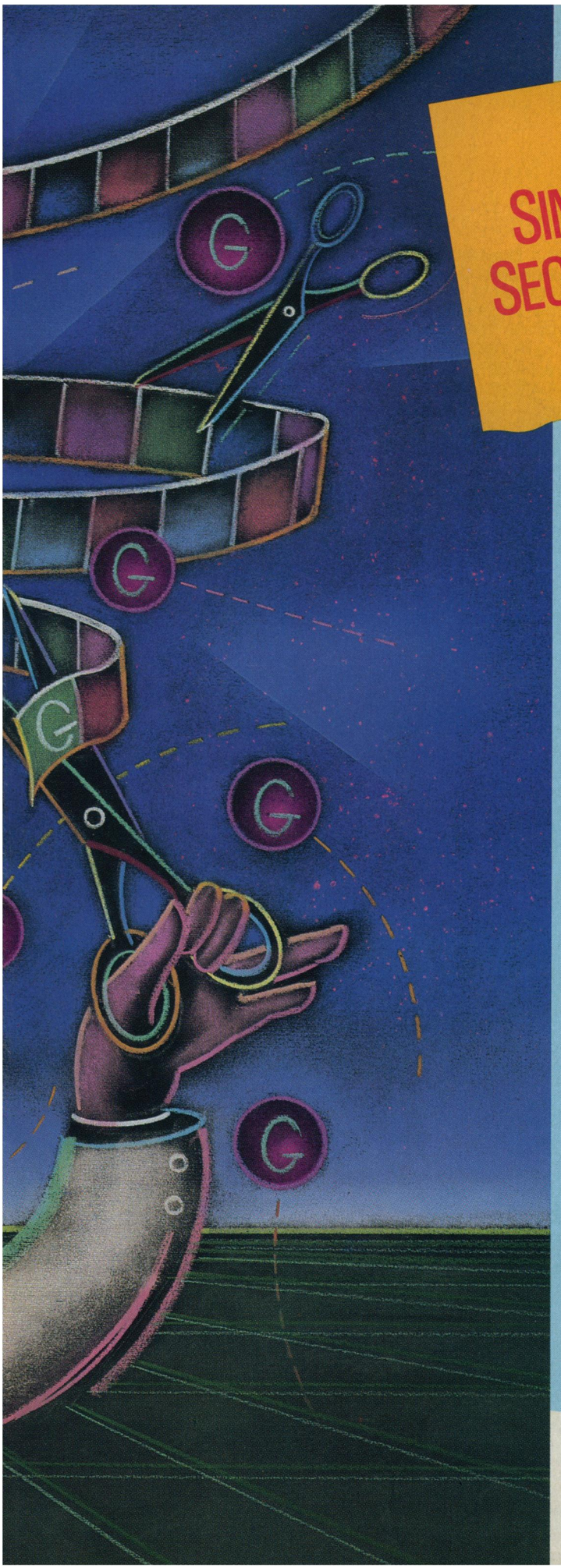

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One primary application will, of course, be in the physical mapping of related RNA species. In addition, consider RNA sequencing, secondary structure analysis and *in vitro* RNA metabolic studies.

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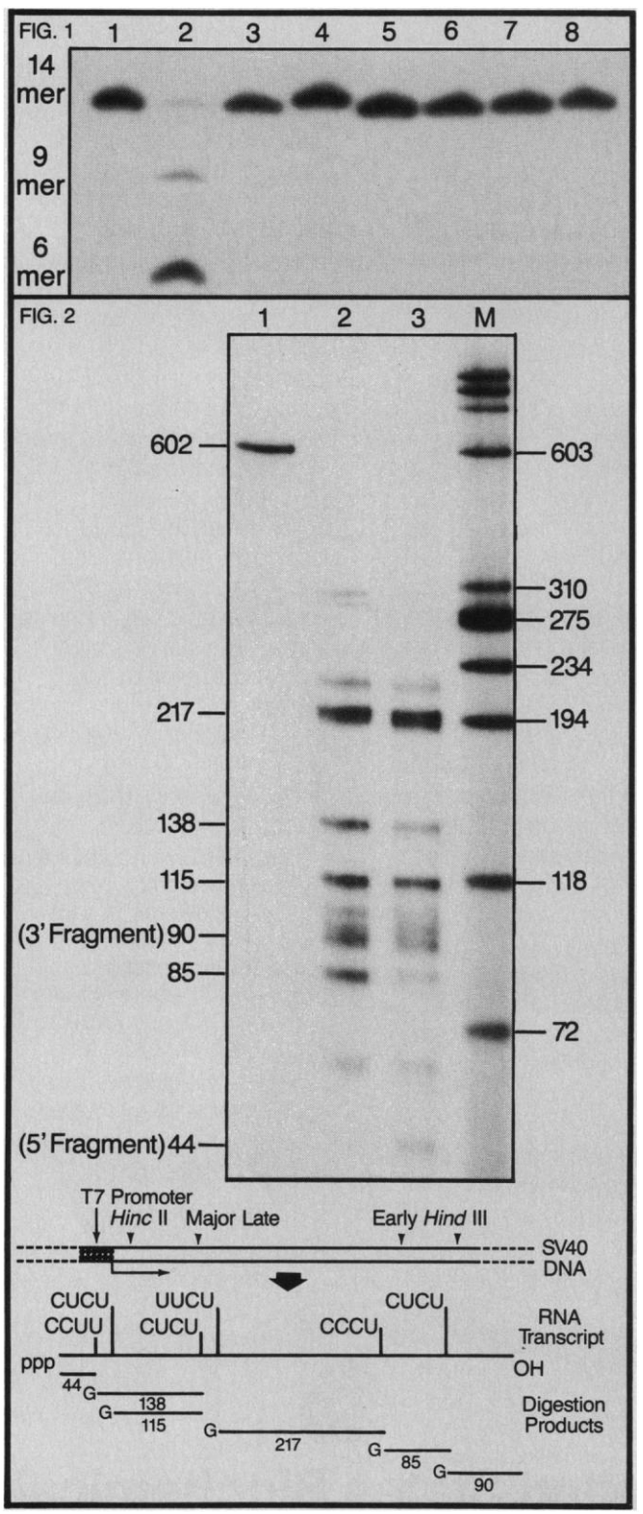

FIG. 1 Demonstration of the Specificity of Cleavage.
RNAzyme™ Tet 1.0 was incubated with seven different oligomeric RNA substrates: lanes 1 and 2, 5'GGGAC**CUC**UAAAAA3'; lane 3, 5'GGGAC**AUU**UAAAAA3'; lane 4, 5'GGGAC**GGC**UAAAAA3'; lane 5, 5'GGGAC**ACC**UAAAAA3'; lane 6, 5'GGGAC**ACA**UAAAAA3'; lane 7, 5'GGGAC**UAA**UAAAAA3'; lane 8, 5'GGGAC**GAA**UAAAAA3'. Lane 1 is a no ribozyme control. The reaction contained 0.10μM substrate ([α-32P] ATP labeled), 0.01μM RNAzyme™ Tet 1.0, 2.5M urea, 0.5mM GTP, 20mM $MgCl_2$, 50mM Tris-HCl (pH 7.5). Incubation was for 1 hour at 50°C. Samples from each reaction were electrophoresed on a high percentage acrylamide denaturing gel and the bands of substrate and digestion products were identified by autoradiography. Only the matched substrate in lane 2 was cleaved.

FIG. 2 RNA Fragments of SV40 and Physical Map.
SV40 RNA (610-nt) was glyoxalated and then cleaved with RNAzyme™ Tet 1.0 at 50°C in a reaction containing 1.5M urea. The RNA fragments were detected by two different labeling schemes which together identify the 5'-terminal fragment. The lanes are as follows: lane 1, 32P-labeled RNA transcript uncut; lane 2, unlabeled RNA cut with ribozyme in the presence of [32P]GTP; lane 3, body-labeled RNA cut in the presence of unlabeled GTP: M, glyoxalated *Hae*III fragments of φX DNA. The fragments were separated by electrophoresis in a 4% acrylamide gel containing 8M urea and the bands were visualized by autoradiography. The physical map shows the locations and sequences of the RNAzyme™ Tet 1.0 cleavage sites in SV40.

*RNAzyme™ Tet 1.0 (Ribozyme Tet 1.0) cucu specific RNAzyme™ is USB's brand of Ribozyme. Ribozymes — Patents pending.

The results shown illustrate the site-specific cleavage activity of RNAzyme™ Tet 1.0 on both oligomeric and larger RNA. They confirm the results originally reported for the *Tetrahymena* group I intron derived ribozymes (1,2). This work provides the basis for the experimenter to generate digestion patterns of larger RNA and to attempt studies involving the detection of different forms of RNA (e.g., alternatively spliced RNA) in complex populations. Studies involving *in vitro* transformation of purified RNA fragments could also be possible. The development of RNAzyme™ Tet 1.0 to its full potential as a biological tool will depend upon further characterization of its enzymatic activity as well as the development of specific protocols.

The RNAzyme™ Tet 1.0 kit includes sufficient ribozyme and reagents to allow a variety of investigations. The Control Substrate in the kit is provided to allow calibration of the RNAzyme™ Tet 1.0 activity since activity is dependent upon the concentration of GTP, urea, and cleavage sites as well as the ribozyme concentration. Selection of various conditions for cleavage depends upon the fraction of sites needed to be cleaved; the amount of radiolabel needed to be incorporated into the fragments and the degree of sequence specificity desired.

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References:
1. Zaug, A.J., Grosshans, C.A., and Cech, T.R., *Biochemistry* **27,** 8924-8931 (1988).
2. Zaug, A.J., Been, M.D., and Cech, T.R., *Nature* **324,** 429-433 (1986).

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and order of authorship vary in institutions and countries, the current practice is too vague to allow identification of any but the most eminent authors.

Publicly funded scientific research has so far been a matter of trust. Some members of our government are now concerned that this trust has been abused. It seems incumbent on the scientific community to demonstrate an open, constructive attitude to this criticism and to seek to mitigate its cause.

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Corrections

The Perspective "Gamma-ray observations of orbiting nuclear reactors" by Joel R. Primack (28 Apr., p. 407) incorrectly identified the Gamma-Ray Spectrometer on the Solar Maximum Mission satellite as having been blinded by radiation from Soviet satellites. The seventh paragraph should have read, in part, "Gamma-ray detectors are surrounded by charged-particle detectors, so that events initiated by gamma rays can be distinguished from background events initiated by electrons. But positrons can annihilate on other parts of the gamma-ray detector spacecraft such as the SMM shield, and the resulting 511-keV gamma rays can appear to be astronomical gamma-ray signals. The SMM-GRS picked up such signals an average of eight times per day for much of 1987 and early 1988, each time causing brief interference with astronomical observations. The data storage capacity of the Gamma-ray Burst Detector (GBD) on the Japanese Ginga satellite was sometimes saturated by such events, so that it could take no more data until the next pass over its ground station (which could be on the same orbit or as many as 14 orbits later); this effectively blinded the GBD about 20% of the time. The sensitive detectors aboard Gamma Ray Observatory . . . ." [The remainder of this paragraph is as published.]

In the report "Geomagnetic origin for transient particle events from nuclear reactor-powered satellites" by G. H. Share *et al.* (28 Apr., p. 444), the following corrections should be noted. The last sentence of the second full paragraph on page 445 should have read, "Their report provides detailed confirmation of the origin of the SMM events." On page 446, the last sentence of the caption of figure 3 should have read, "Rate is in counts per 0.5 s." On page 447, text references to figures 2 and 3 were interchanged. The sixth sentence of the fifth full paragraph should have read, "The concentration of particles on this L shell explains the peak observed by the GRS." The fourth sentence of the sixth paragraph should have read, "The spike near 12 min coincides with the time when SMM reached L shells on which positrons had been deposited about a minute earlier." Reference 12 should have read, "*Solar Geophysical Data Prompt Reports, No. 535 (Pt. 1)*, H. E. Coffey, Ed. (National Geophysical Data Center, Boulder, CO, 1989)."

In the report "Distribution and detection of positrons from an orbiting nuclear reactor" by E. W. Hones and P. R. Higbie (28 Apr., p. 448), the following corrections should be noted. The first sentence of the caption for figure 1 should have read, "Locations of SMM (dots) and Cosmos 1176 (triangles) at the times of 21 of the most intense 511-keV gamma events recorded by SMM during the 29 April to 2 September 1980 operating period." The first sentence of the caption for figure 3 should have read, "Estimated differential energy spectrum of positrons escaping from Cosmos 1176 per joule of fission energy." On page 450, the second sentence of the first full paragraph should have referred to event 5, not event 59.

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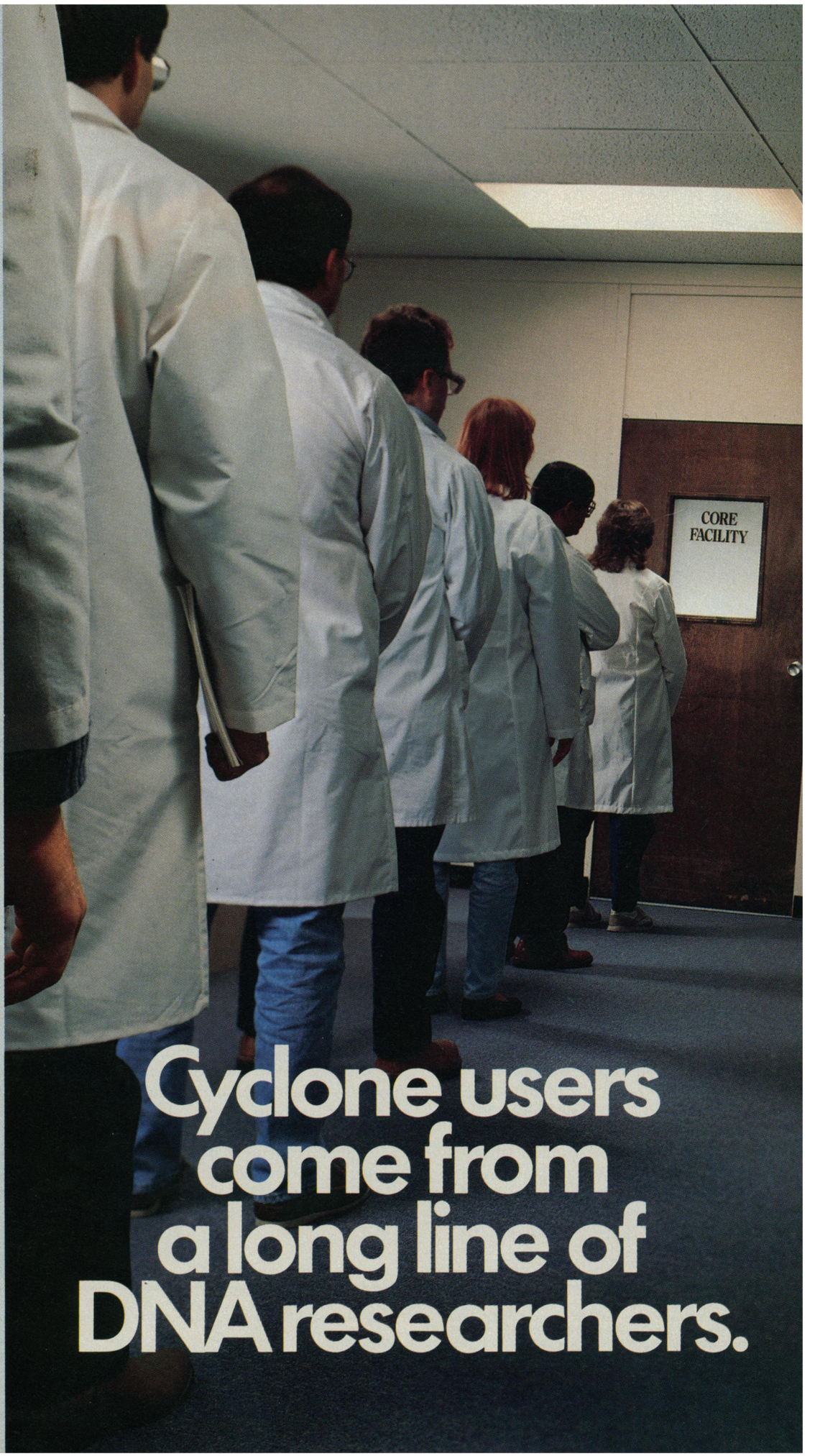

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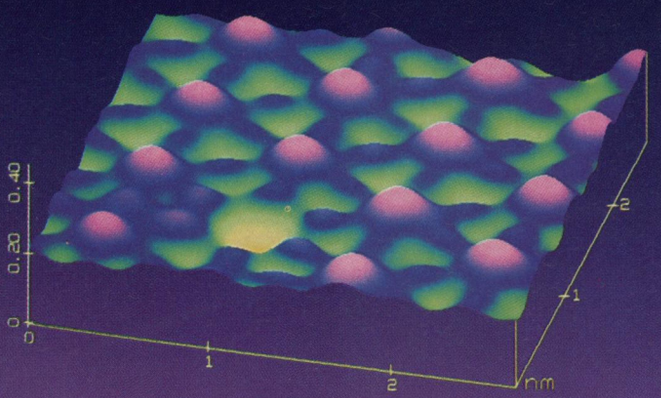

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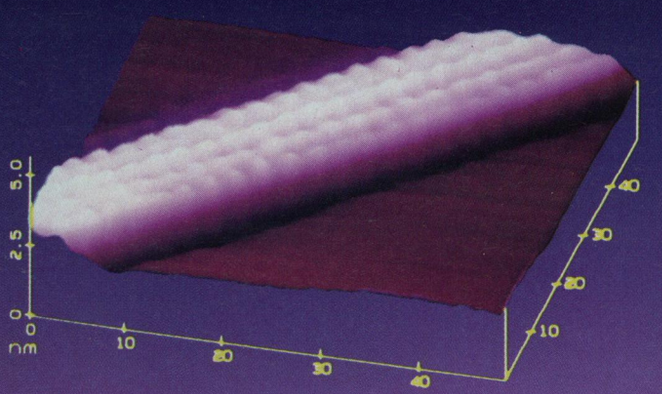
Schardt *et al.*, Purdue Univ. (Science, 24 Feb 89)



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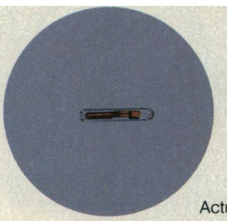

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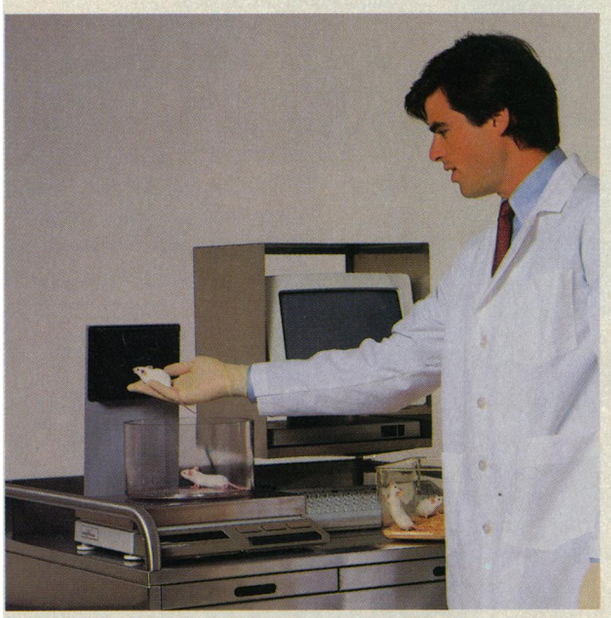

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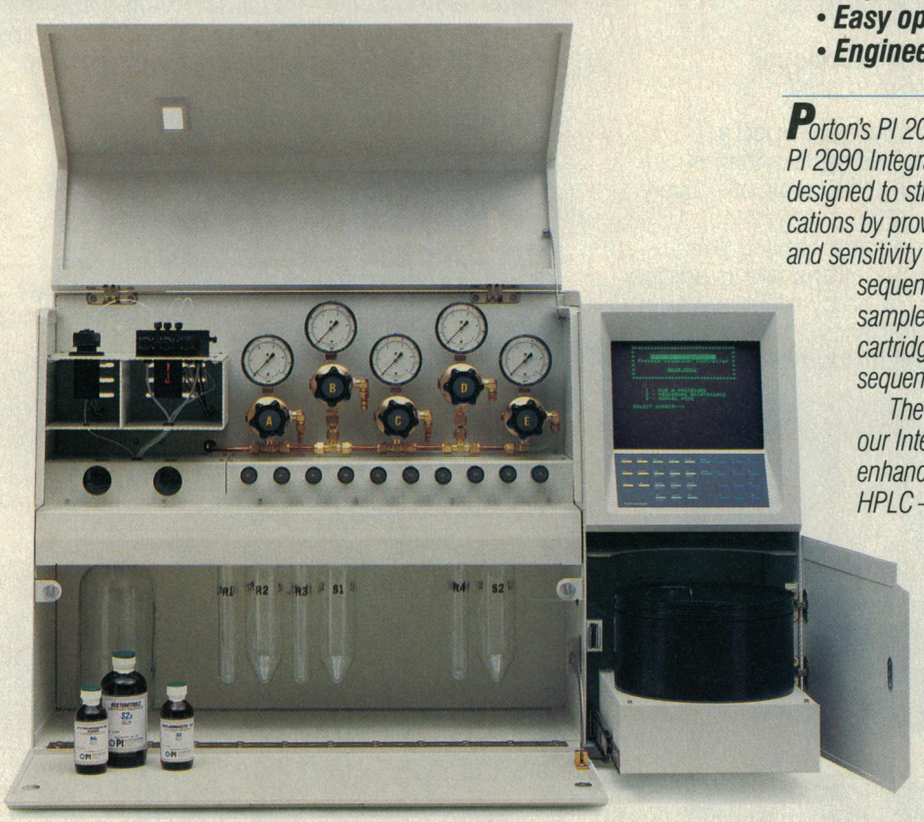

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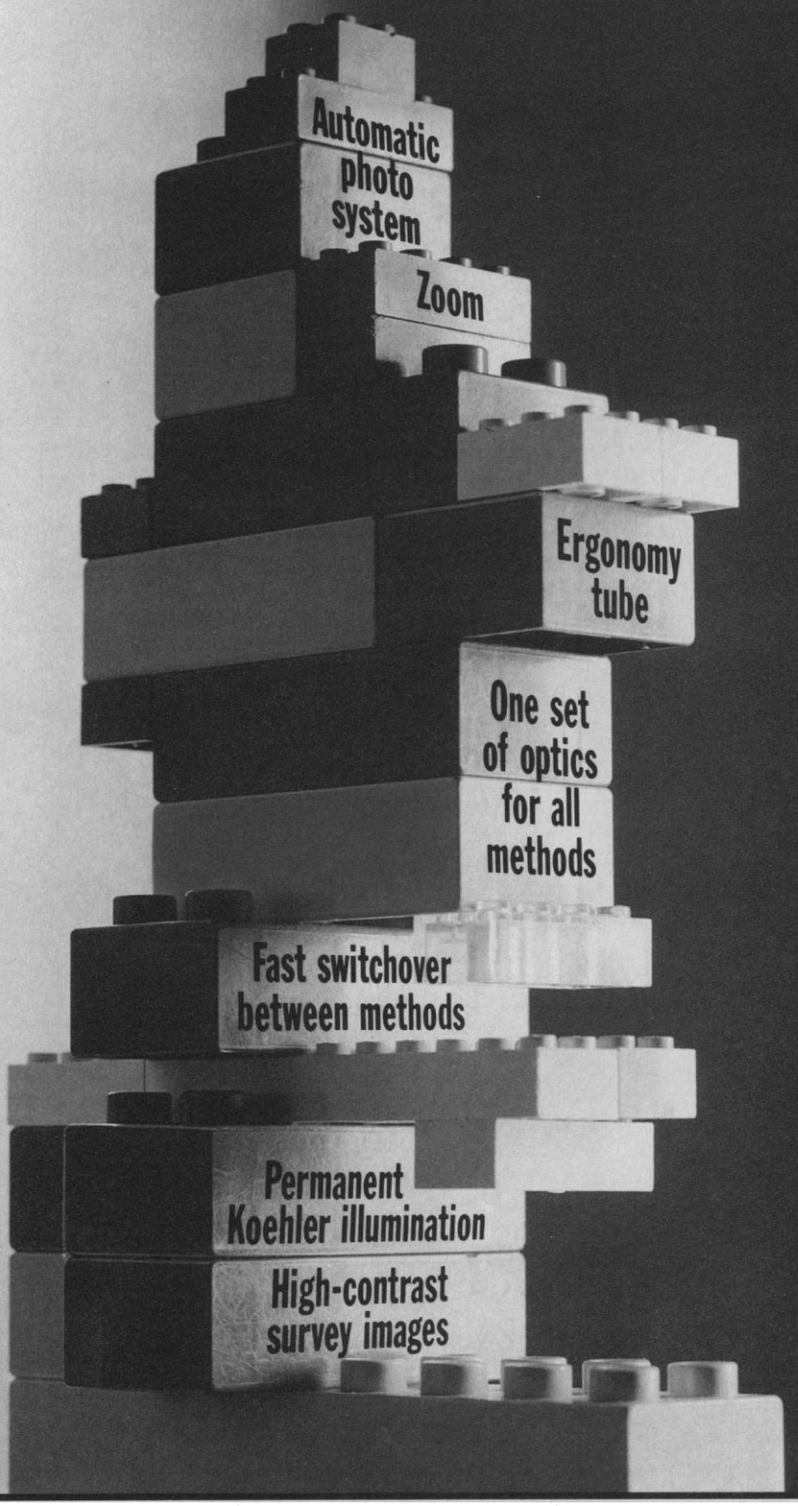

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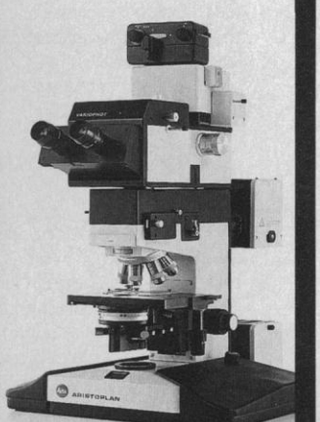

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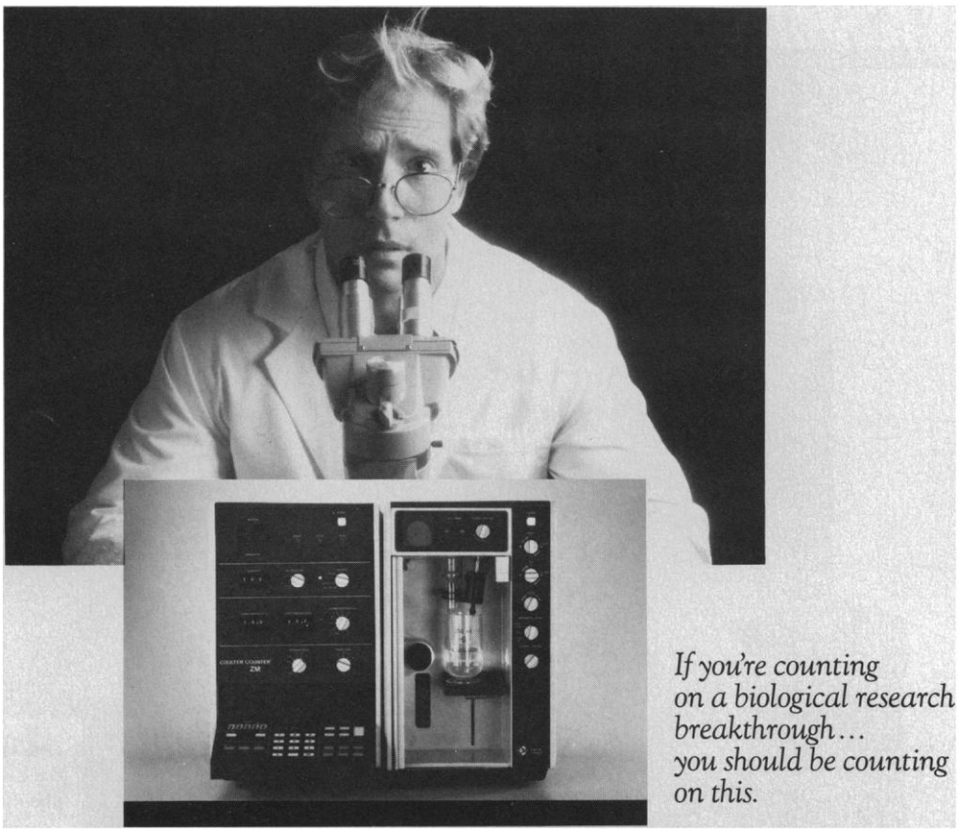

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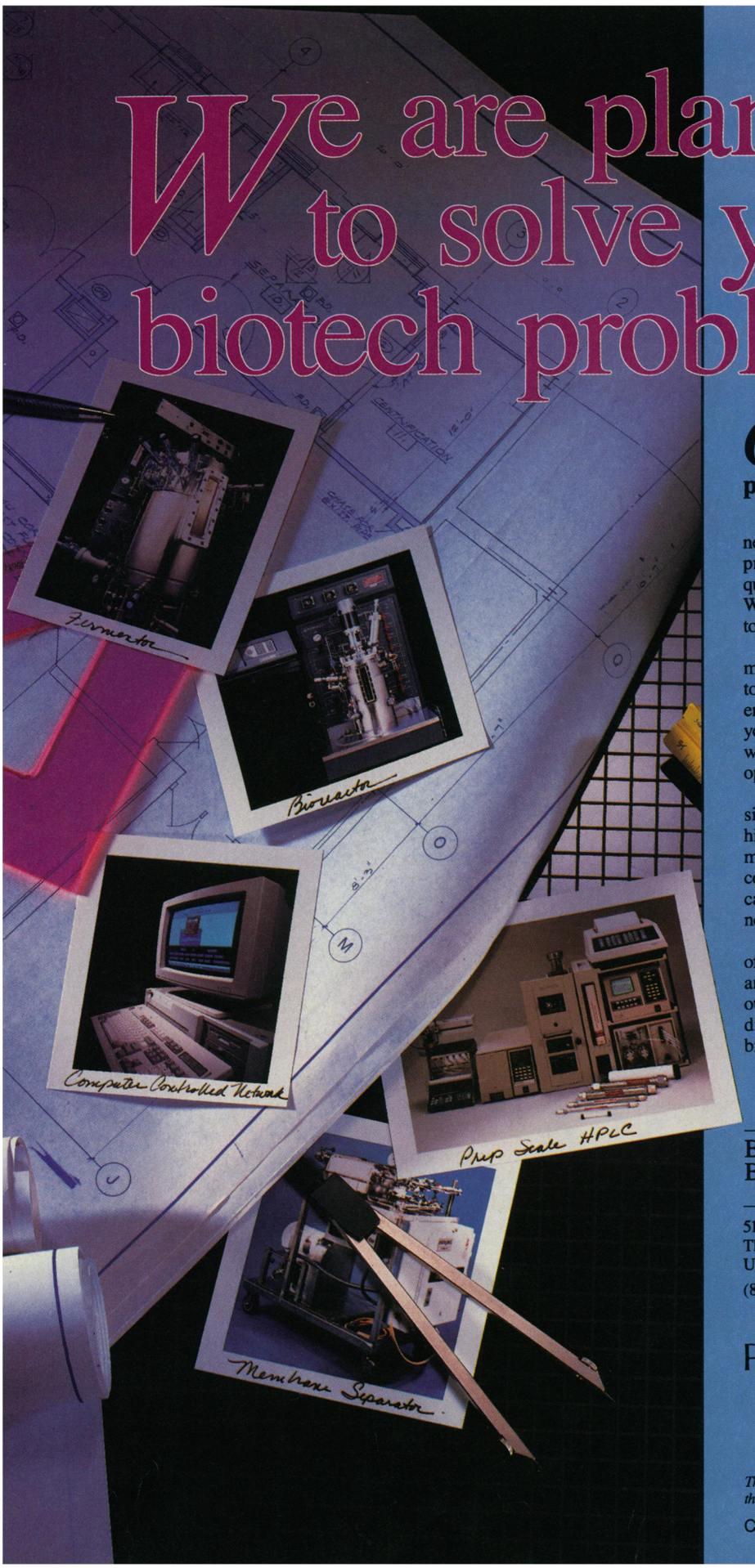

Our new pilot plant is designed to solve your process and scale-up problems.

We've invested in your future. You may need to scale up microbial or animal cell products, develop bioseparations, or quality control methods. Let us help. We have the equipment and the expertise to do the job.

Our personnel, procedures and commitment reflect our professional approach to your problems. Our industry experienced pilot plant manager will insure that your projects are managed efficiently. We will open our pilot plant in October and operate with Good Manufacturing Practices.

Penn State is a diverse research university, with an impressive biotechnology history. Eighty-three Penn State faculty members from many disciplines are conducting biotechnology research, and can be your partners for solving biotechnology problems.

Our Bioprocessing Resource Center offers pilot plant services, training, protein and DNA chemistry, biocomputing, and other bioprocessing services. Call to discuss how we can help solve your biotech problems: 1-800-833-5533.

Biotechnology Institute and Bioprocessing Resource Center

519 Wartik Laboratory,
The Pennsylvania State University,
University Park, PA 16802
(814) 863-3650 FAX (814) 863-1357

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The Pennsylvania Department of Commerce Sponsors the Penn State Bioprocessing Resource Center.

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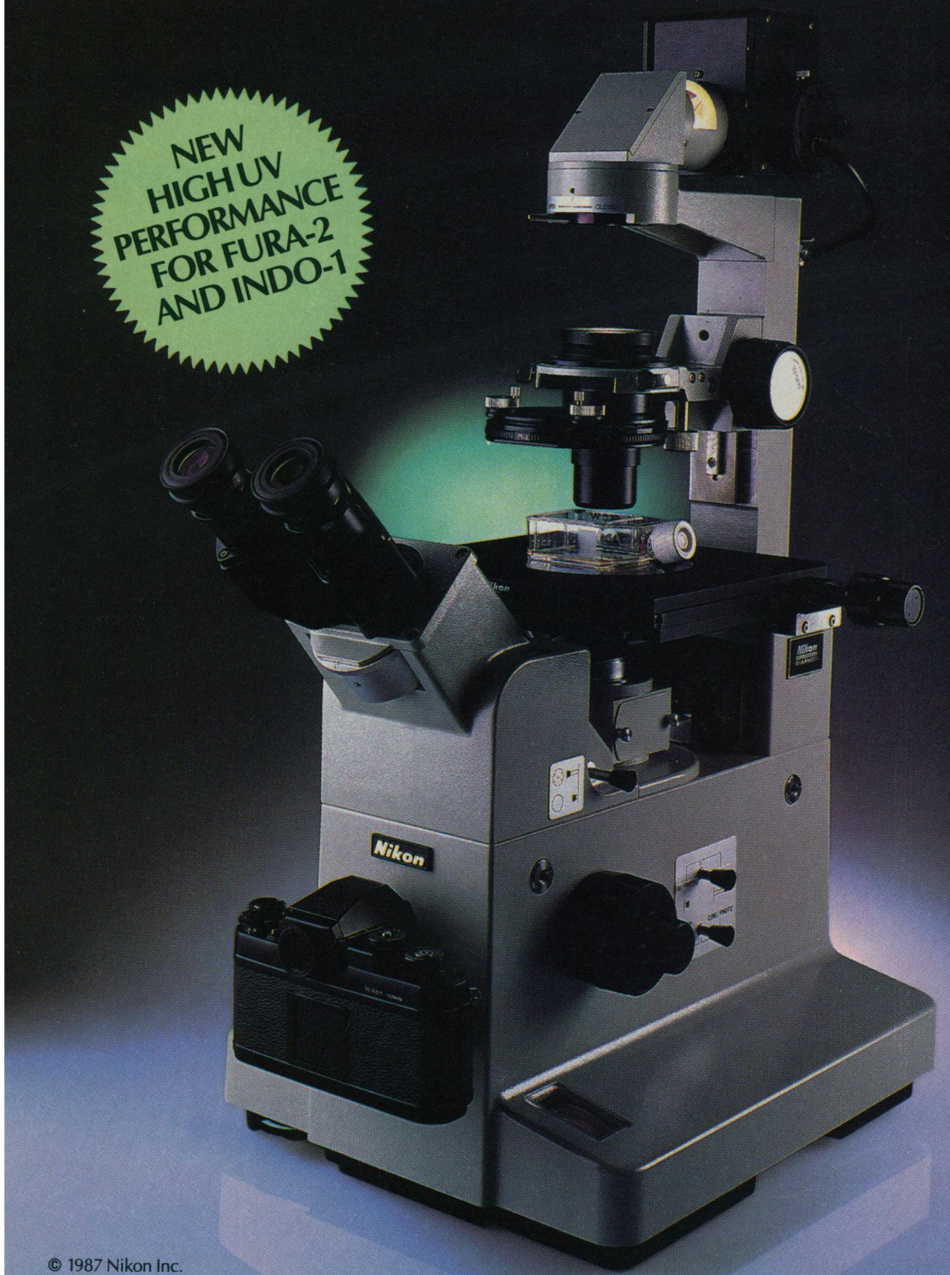
Everything you've heard is true.



The astonishingly bright, high-contrast image. The wide selection of quality accessories. The large stationary stage for maximum stability. The very modest price.

The renowned Diaphot.

It's the inverted microscope from Nikon that's designed to meet *all* the requirements of your research laboratory.

The Diaphot utilizes Nikon's exclusive CF optics, famous for their crisp, clear images. These optics deliver the extra edge that's needed in today's research and clinical laboratories.

A wide selection of accessories allow you to meet *all* the documentation requirements of your laboratory—from 35mm to large format and Polaroid®, CCTV and cinemicrography. With special CF objectives ranging from 4X through 100X, the Diaphot has complete capability in phase contrast, fluorescence and Nomarski DIC.

The Nikon Diaphot is engineered for functional performance and reliability. For maximum stability, its solid die-cast body has a very low center of gravity and the fixed stage makes Diaphot ideal for micro-manipulation. And in addition to everything you heard, the Diaphot's striking superiority is available at a very modest price.

To learn even more about the renowned Diaphot, contact: Nikon Inc., Instrument Group, 623 Stewart Avenue, Garden City, NY 11530. (516) 222-0200.

NIKON DIAPHOT

INVERTED MICROSCOPE

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Nikon

Extending Man's Vision

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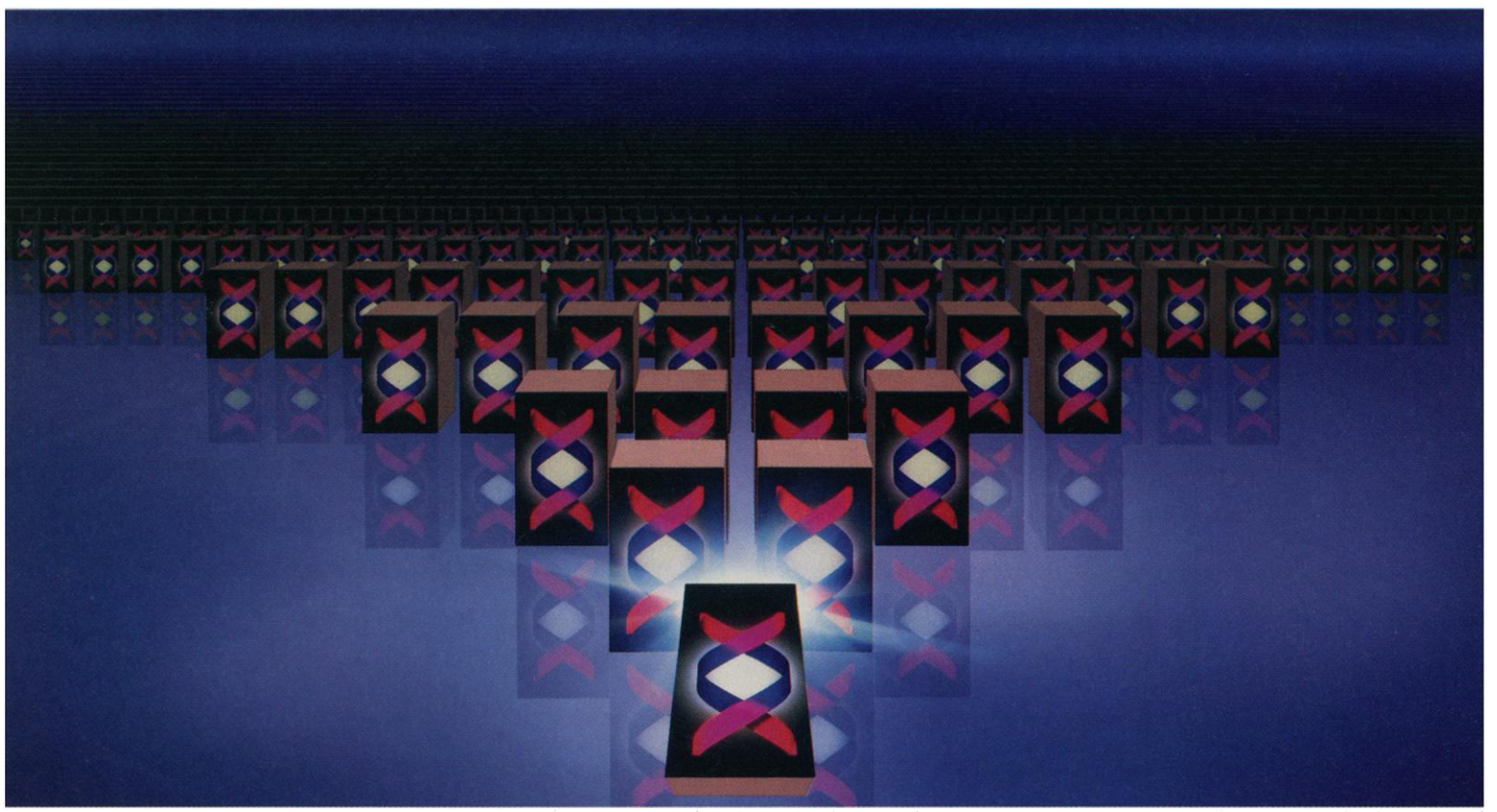

Don't settle for products that try to imitate the revolutionary DNA Amplification System. Ours is the *only* licensed and approved system designed expressly for the patented GeneAmp™ PCR process, pioneered and developed by Cetus scientists.

PROVEN PCR PERFORMANCE

Our DNA Amplification System provides you with performance you can depend on. You'll perform the PCR process quickly and efficiently using our GeneAmp Reagent Kit with recombinant AmpliTaq™ DNA Polymerase. And for easy-to-use, dependable automation, our DNA Thermal Cycler has no peer. Superior technology and proven performance make it the system-of-choice worldwide.

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Count on outstanding support for your DNA Amplification System. Like a free instructional video with your DNA Thermal Cycler purchase. Or the toll-free technical support number you can call to get expert answers from our PCR staff. And we'll keep you up to date with PCR protocol developments, applications information, PCR Bibliographies and a subscription to our newsletter, *Amplifications*.

FAST DELIVERY OF TAQ DNA POLYMERASE

Ordering is easy. For overnight delivery of the GeneAmp Kit and AmpliTaq DNA Polymerase, call PE XPRESS at 1-800-762-4002. And we're fully stocked and ready for prompt delivery of DNA Thermal Cyclers.

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Only from Perkin-Elmer Cetus— the PCR Technology Leader.

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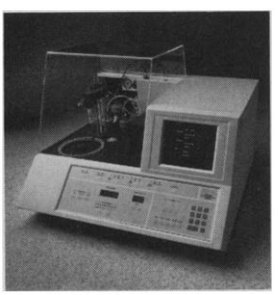
Circle No. 235 on Readers' Service Card

BIO-SOLUTIONS *Number I*

An Update on the State of the Art in Separations Technology

New capillary electrophoresis system provides unprecedented flexibility.

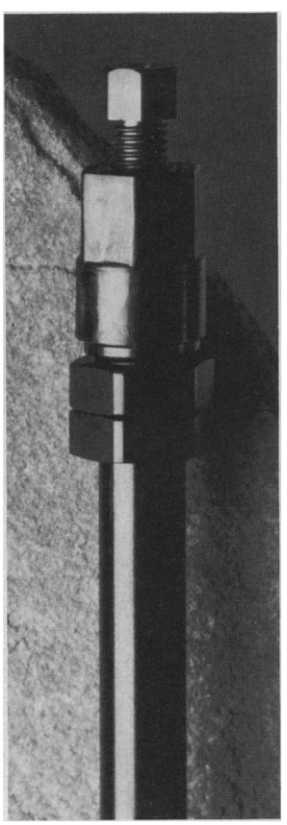


Capillary electrophoresis is drawing a great deal of attention for its ability to separate a wide range of molecules rapidly and with high resolution. With a potentially wide variety of applications, CE serves such disparate needs as basic research, methods development, and automated QA analysis.

The Dionex Capillary Electrophoresis System I rises to this challenge. The CES I features fully programmable, dual-polarity power supplies with 3 control modes and gradients. It offers 3 automatic sample-injection modes: electromigration, gravity, and pneumatic.

An intelligent, 40-position autosampler runs samples in any order, and the system automatically rinses and refills vials and capillaries at each run. Two detection modes are standard—UV/Vis with fiber optic-based remote cell and fluorescence with photo multiplier tube. The CES I uses forced-air cooling which assures reproducible analytical conditions.

The CES I breaks new ground in flexibility, ease of use, and value—regardless of application.



Unique OmniPac™ columns—a major advance over bonded silica.

These remarkable polymeric, multi-dimensional columns combine 2 separation modes—ion exchange and reversed phase. 100% solvent- and buffer-compatible, the OmniPac columns can work small miracles, such as combining sample preparation and analysis in one column, or separating ionic impurities from peptides and proteins. The columns are unique in their use of solvents and buffers to control selectivity for peptide mapping.

OmniPac columns combine a pH stability of 0–14 with the speed and efficiency of bonded silica, providing the ideal solution for bio separations.

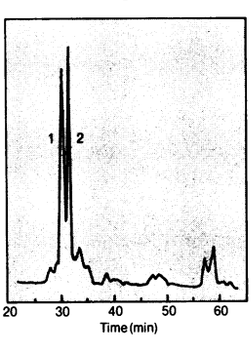
Now you can map the oligosaccharide components of glycoproteins.

Until now, glycoproteins have presented serious analytical obstacles to the researcher. While peptide mapping is relatively routine, oligosaccharides have always been notoriously resistant to mapping and sequencing.

With the growing awareness of the importance of oligosaccharides in numerous biological processes, the need to perform oligosaccharide mapping and profiling has also grown. Now Dionex makes all aspects of glycoprotein analysis not only possible but, for the first time, practical as well.

Dionex OligoStandards™ are the latest addition to what is fast becoming a total system for analyzing glycoproteins from initial purification to final analysis. They allow comparison of oligosaccharides under investigation to known standards for fast and easy recognition. What in the past required months and years of work can now be accomplished in minutes on the Dionex BioLC™ system.

Oligosaccharide map of bovine fetuin



System: BioLC
Column: CarboPac PA1
Detector: Pulsed Amperometric Detection

Peaks 1 and 2 can be identified with OligoStandards™

For complete information or to discuss your application, contact your local Dionex representative or (in U.S.A.) call 1-800-227-1817, ext. 42.

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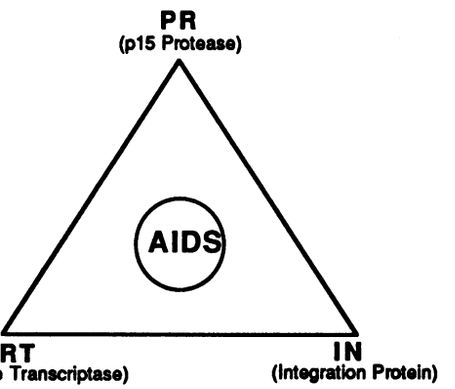
AIDS
Drug Research Tools from MGR



Critical reagents for the design and screening of drugs for AIDS therapy are available from MGR. Currently the best source for these reagents is avian myeloblastosis virus (AMV) and MGR has years of experience working with AMV.

Focus your AIDS research with dependable products from MGR. For more information, call or write:

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Tampa, FL 33634

800-255-8142 813-886-5338 (Florida Residents call collect)

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FOTO/PREP I is the first innovative transilluminator to offer the sensitivity of 300nm midrange UV, with the kind of protection previously provided only by 366nm UV sources.

The key? A unique sensitivity control device. In the analytical mode it provides the nanogram level sensitivity distinguishing all FOTODYNE 300nm DNA transilluminators. Switching to the preparative mode, the gel can be exposed as long as 20 minutes with little or no detectable photonicking damage. Yet, a 2000bp band containing less than 10 nanograms of DNA can be visualized for cutting.

FOTO/PREP I comes with a replaceable UV transparent protective sheet, so gels can be cut directly on its surface without damaging the UV glass. The molded, UV blocking cover can be raised from 0° to 90° to allow easy access to the gel.

For more information call or write.

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New Berlin, WIsconsin 53151-4131 USA
☎ 414-785-7000
Telex 260127
FAX 414-785-7013

FOTODYNE INCORPORATED

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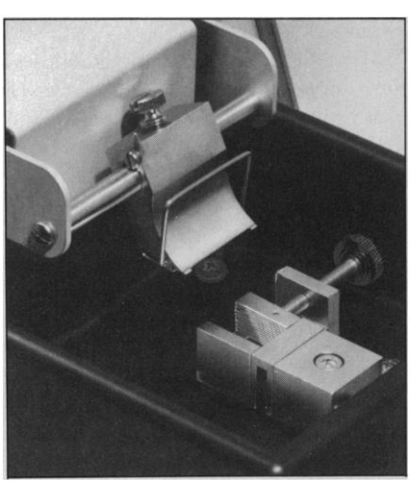
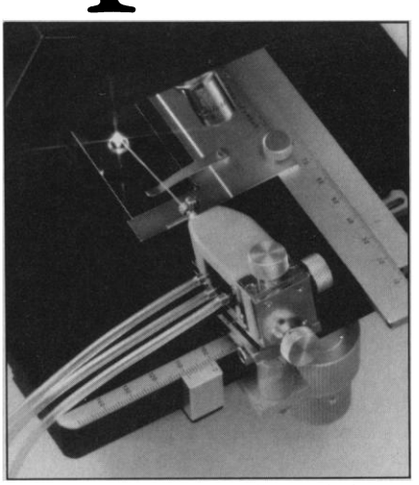
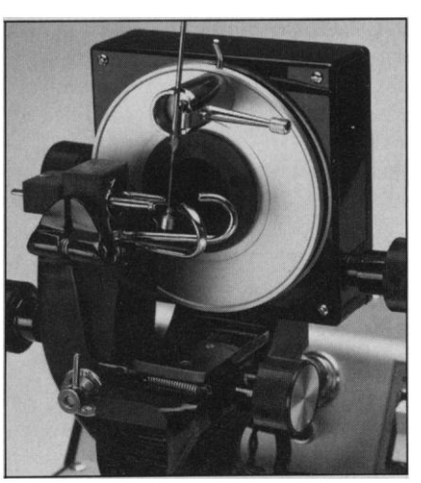
Thin Slices. Tight Spots. Tiny Tools.



Vibratome



de Fonbrune Stage-Mounted Micromanipulator



de Fonbrune Microforge

Whether it's fresh sectioning, micromanipulating or forging, turn to TPI for instruments as precise as your procedure.

Vibratome.® If your research demands fresh tissue sectioning with no freezing or embedding, turn to the Vibratome, the superior tissue sectioning system, Series 1000 or Series 2000. Vibratome Series 2000 gives you specimen bath refrigeration, automatic sectioning repetition, and motorized digital control of section thickness and specimen height.

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Micromanipulator. Precision control is in your hands with the TPI de Fonbrune Micromanipulators, free-standing and stage-mounted. Experience smooth, positive movement, virtually zero drift and no backlash, with easy to use single joystick control for either right or left-handed operator.

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Service. As the only U.S. manufacturer of de Fonbrune Micromanipulators and Forges, and *the* maker of Vibratome, TPI provides you assured delivery, on-demand technical service and complete repair and replacement should you need it. When your research demands thin slices, finds you in tight spots, or needing tiny tools, call TPI.

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The new MICRO-ISOLATOR™ System: A revolutionary breakthrough in animal housing.

A simple and versatile animal housing system that offers greater microbiological control than complex barrier rooms... but without the inconvenience and inefficiency that barrier rooms impose by limiting the movement of people and animals.

The Principle

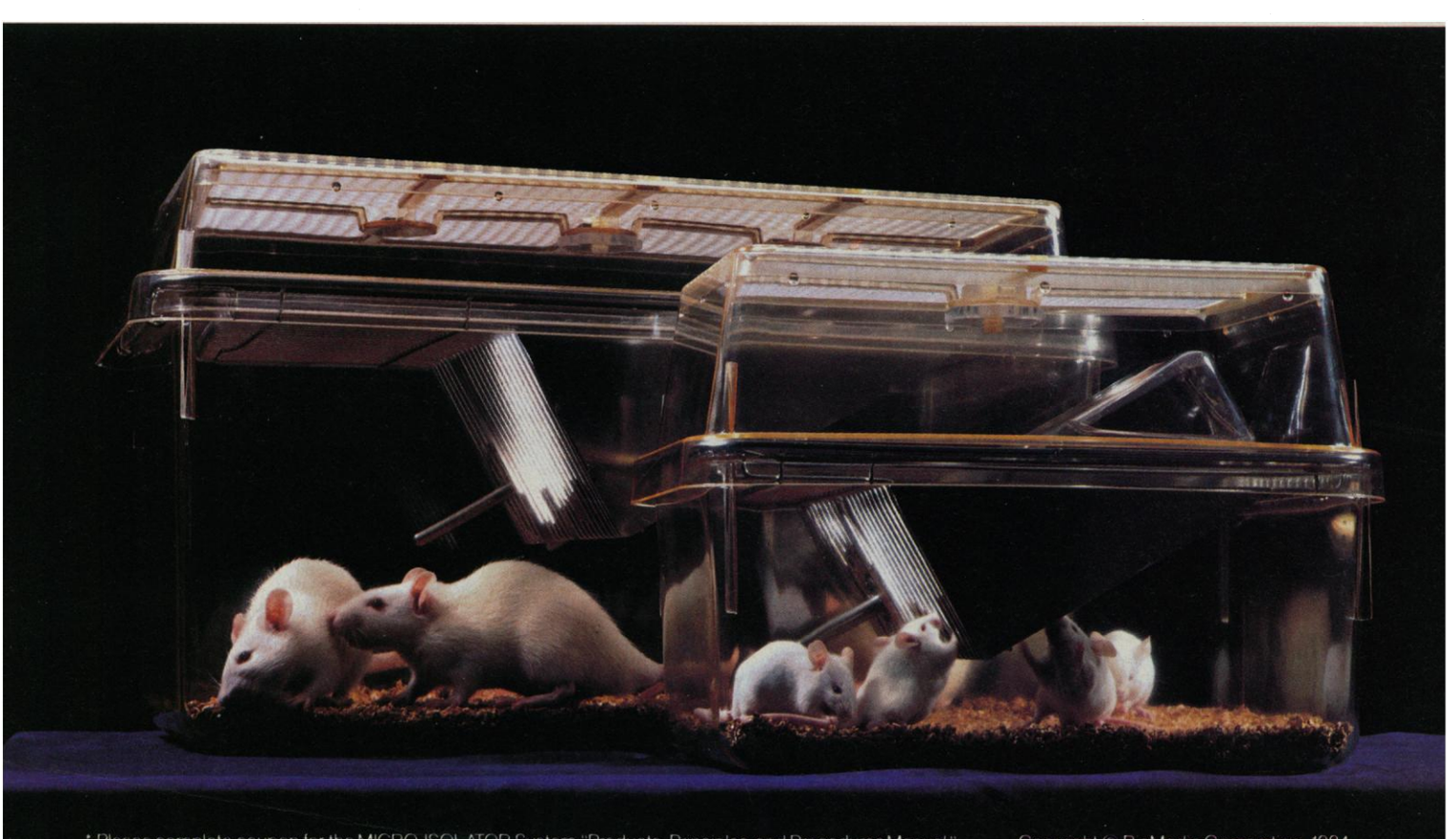
In effect, the MICRO-ISOLATOR System involves the use of durable filter-topped cages that function as "giant Petri dishes," which are only opened within a Class 100 workbench by personnel who observe aseptic technique at all times.* There are many benefits to this unique miniaturization strategy. For example, animals from multiple sources with different microbiological profiles have been housed in the same room without cross contamination. Likewise, investigators can experimentally infect animals in different MICRO-ISOLATORS within the same room without interfering with one another's research... and all of this can be accomplished without the inconvenience of requiring personnel to shower into or out of the room. Also, since all manipulations are conducted in a Class 100 workbench, individuals allergic to animals are protected from dander and therefore are able to work in comfort.

The complete MICRO-ISOLATOR System consists of the individual MICRO-ISOLATOR housing units, the STAY-CLEAN™ Laminar Flow Workbench, and the service cart.

The MICRO-ISOLATOR Units

This system consists of an autoclavable plastic cage and plastic filter frame with a static filter (now designed for rapid replacement of the filter material), plus the usual cage accessories. The plastic filter frame overlaps the bottom portion of the cage and effectively forms a giant Petri dish-like structure. Result: there is an effective protection against microbial contamination while still allowing for substantial gaseous interchange. The MICRO-ISOLATOR is, in other words, a protected microenvironment within any insect-controlled macroenvironment.

MICRO-ISOLATOR units, fabricated of autoclavable plastic material, are now available for mice, rats, hamsters, and guinea pigs.



* Please complete coupon for the MICRO-ISOLATOR System "Products, Principles, and Procedures Manual."

The Service Cart

The service cart completes the MICRO-ISOLATOR System by simplifying the movement of all necessary supplies to the laminar flow workbench for servicing the MICRO-ISOLATOR units.

For More Information

Write or call Lab Products, Inc., 255 West Spring Valley Avenue, P.O. Box 808, Maywood, New Jersey 07607 or complete the coupon. Phone 201/843-4600 or 800/526-0469.

lab products inc

a BioMedic company

The STAY-CLEAN Laminar Flow Workbench

Whenever a MICRO-ISOLATOR unit is being serviced (that is, when animals or the contents of the unit are being manipulated), these activities must take place within a Class 100 environment. The STAY-CLEAN Laminar Flow Workbench is a specialized unit developed for such cage and animal manipulation. It has been designed to achieve two goals: (1) to prevent ambient contagion from entering the workbench and any of the components, and (2) to limit the escape of animal dander and other particulate matter from the work area.

The STAY-CLEAN Laminar Flow Workbench is compact, moveable, and includes state-of-the-art monitoring instrumentation to assure proper operation.

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Patents applied for on the MICRO-ISOLATOR units and other elements of the complete system.

MICRO-ISOLATOR and STAY-CLEAN are trademarks of Lab Products, Inc.

Lab Products, Inc.
255 West Spring Valley Avenue
P.O. Box 808
Maywood, New Jersey 07607

I would appreciate:

- ☐ Your new MICRO-ISOLATOR System "Products, Principles, and Procedures Manual."
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- ☐ Your comprehensive catalog of animal housing and care systems and accessories.
- ☐ Seeing your local representative. Please call and set up an appointment.

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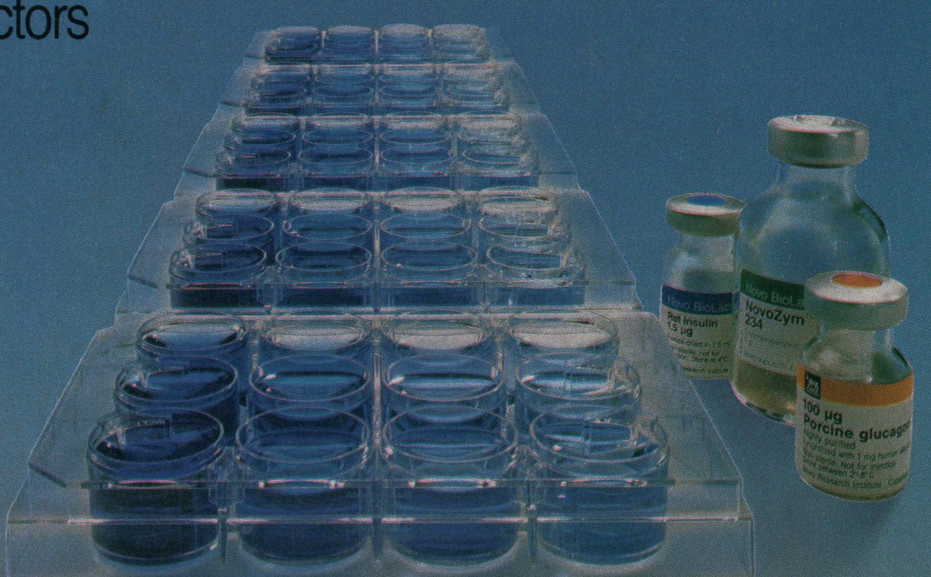

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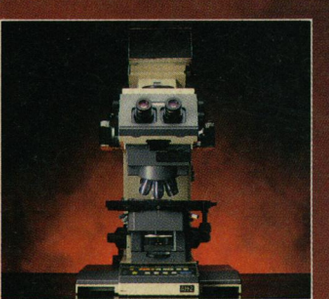

OLYMPUS
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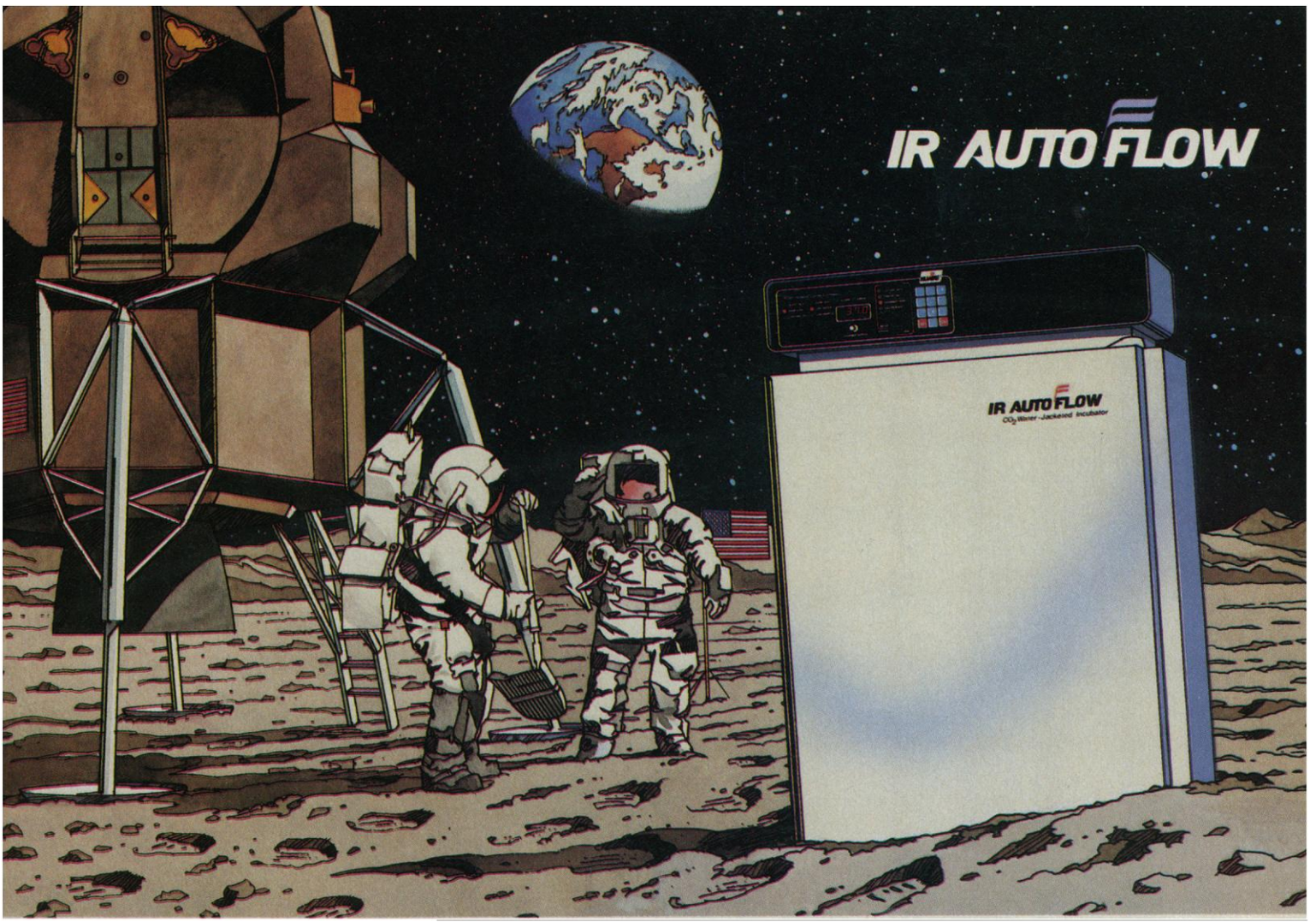
For information circle reader service number 173
For demonstration circle reader service number 174



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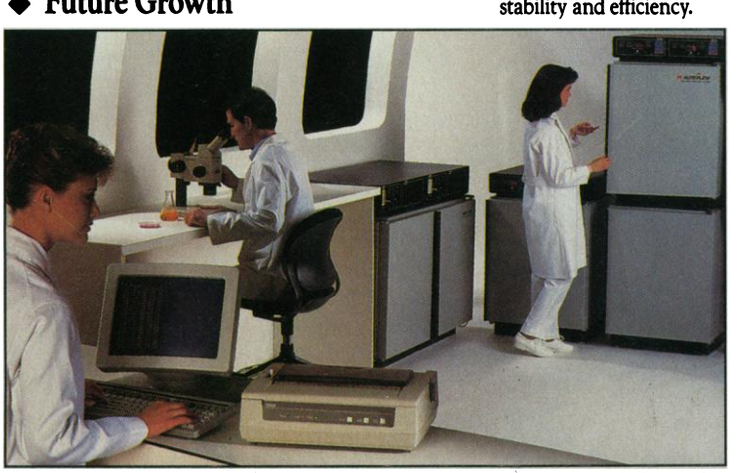
The new IR AutoFlow has a **Micro-Computer Based Control System** that is programmable for precise control of chamber temperature, CO_2, and humidity+. The result is an optimum growth environment.

A **New InfraRed CO_2 Sensor** senses CO_2 exclusively, offering significantly better CO_2 stability and efficiency.



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Automated Backup Systems of triple redundant temperature sensors, power fault tolerance, self diagnostics, and fail-safe gas shut-off—unique to the IR AutoFlow—provide increased assurance of long term reliability.

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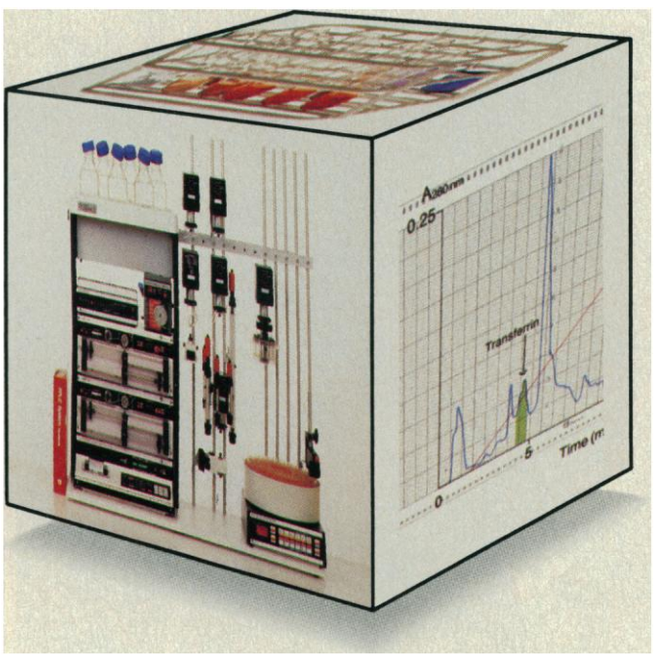

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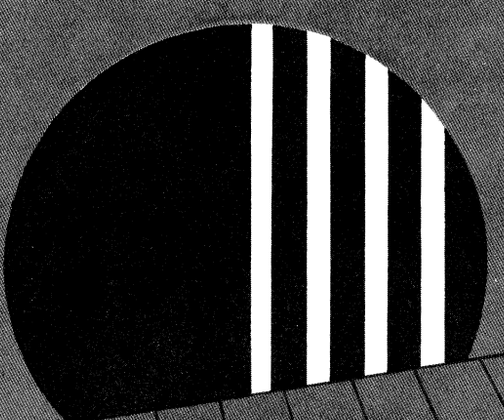

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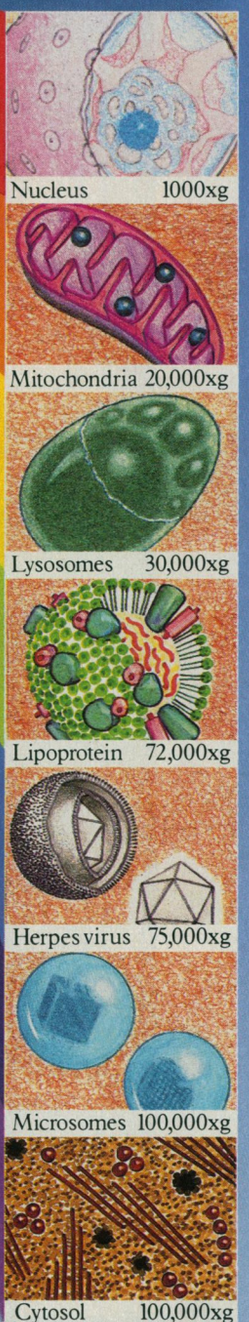

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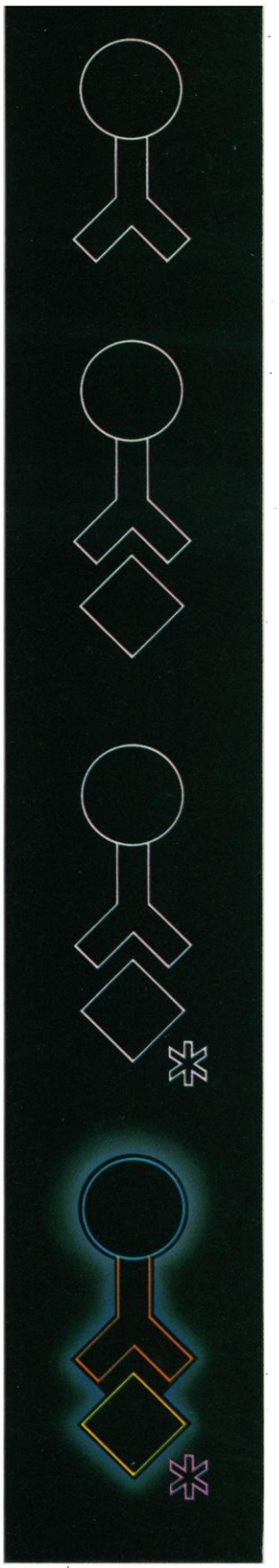

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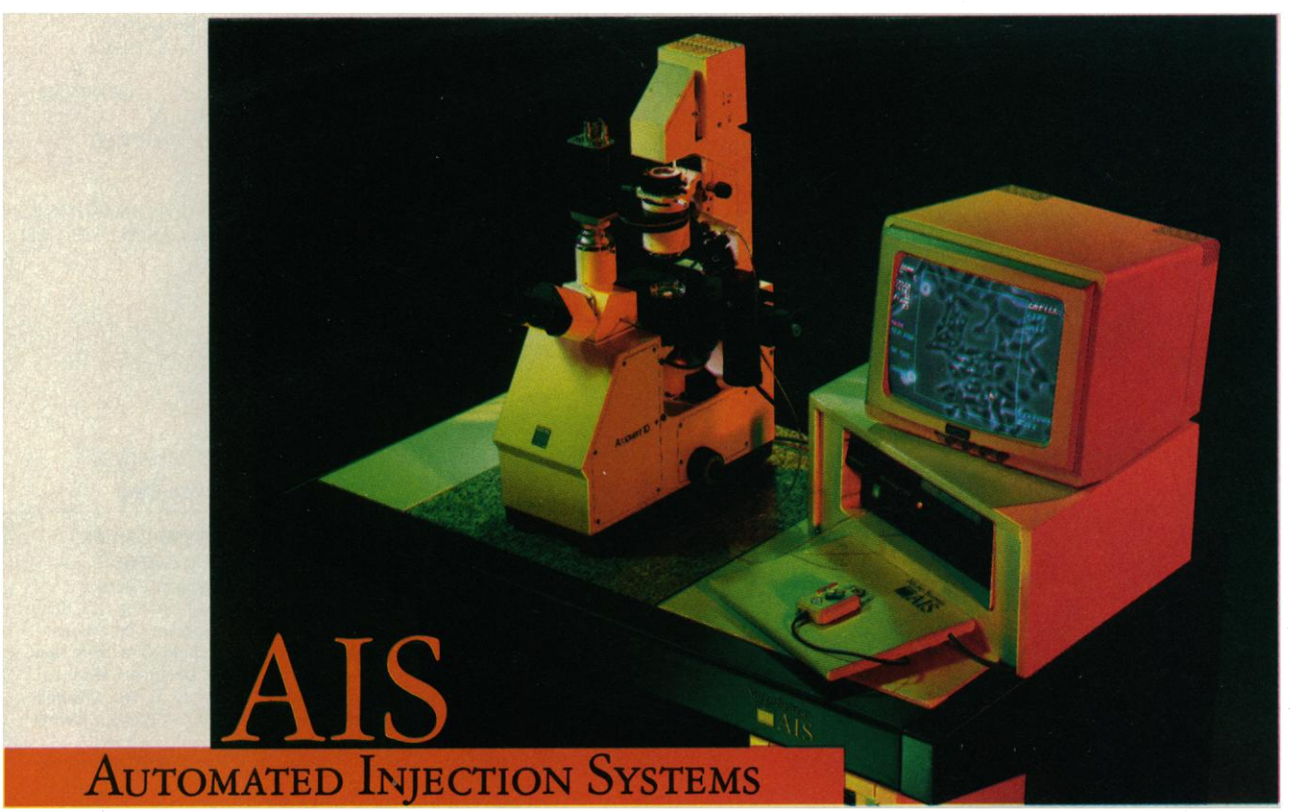

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September 10-14, 1989, Bao-Long Hotel, Shanghai, China. Organizing Committee - C.C. Tan (Honorary Chairman), S.D. Kung (Chairman), C.H.Y. Chu, (Vice Chairman). Program Committees: Recent Advances in Drosophila Genetics: B. Judd, Chairman; New Approaches to Human Genetics, E.H.Y. Chu, Chairman; Impact of Genetics and Genetic Engineering on Agriculture: R. Wu, Chairman; Microbial Genetics and Molecular Evolution: J.T.F. Wong, Chairman; Local Arrangements: J.L. Xue, Chairman
Program: Mon., Sept. 11: Opening Ceremony & Keynote address: Howard M. Temin; Plenary Session: Seymour Benzer, Lawrence Bogorad, Yuet Wai Kan; Session I - Drosophila Genetics: Spyros Artavanis-Tsakonas, Yuh Nung Jan, Elliot M. Meyerowitz, Ruth Lehman, Michael Young; Session II - Human Genetics: Savio Woo, David A. Williams, Y. T. Zeng, C. C. Liew, Dean Hamer, Zai-Ping Li, Barbara Hamkalo; Session III - Plant Genetics: Ray Wu, Marc Van Montagu, Roger Beachy, Y. T. Qian, Ning-Sung Yang, Zhang-Liang Chen; Session IV - Microbial Genetics & Molecular Evolution: J. Tze-Fei Wong, Jeffrey Miller, Alastair Matheson, Robert Cedergren, Ke-zhong Tong, Haruo Ozeki;Tues., Sept. 12: Plenary Session: Gerald Fink, Nam Hai Chua, C. Thomas Caskey, Charles Langley;Poster Session;Banquet: C.C. Tan Birthday Celebration; Keynote Address: Joshua Lederberg; Wed., Sept. 13: Plenary Session: David Hogness, Gurdev Khush, James Neel, Rita Colwell;Session I - Drosophila Genetics: L.Y. Jan, Bruce Baker, Michael Ashburner, William Engels, Chung-I Wu, Hampton Carson;Session II - Human Genetics: Ernest H.Y. Chu, Robert Moyzis, Elbert Branscomb, Lap-Chee Tsui, L.C. Sze, Larry Deaven, John J. Wasmuth; Session III -Plant Genetics: Thomas Hodges, A. Hirai, John C. Gray, Shain-dow Kung, Shyam Dube, Alan Teramura, C.C. Chen; Session IV - Microbial Genetics & Molecular Evolution: Edmund C.C. Lin, Frank Maley, Paul E. Sadowski, Paul O.P. Ts'o, Pei-Xuan Guo, Temple F. Smith;Thurs., Sept. 14: Plenary Session & Closing Ceremony: Eric Davidson, Thomas C. Kaufman, Michael Smith, Zu-Jia Sheng. For further information & registration contact: Helen Phillips, Ctr. for Agricultural Biotechnology, University of Maryland, College Park, Maryland 20742, USA, Telephone: (301) 454-6056 or 8312; FAX: (301) 454-8143. Registration Fee: $200; Bao-long Hotel - $35 per night

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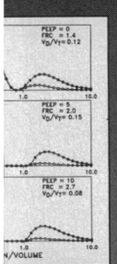

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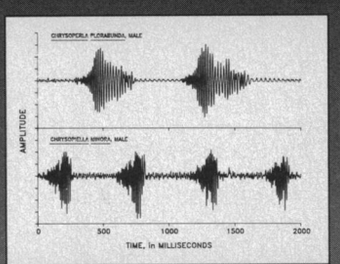

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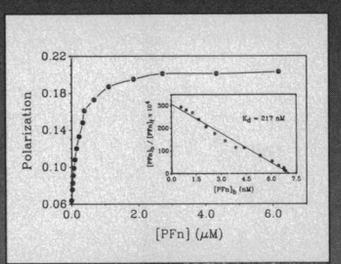
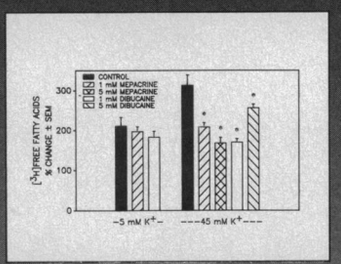
Univ. of Connecticut



Michael Benecky, Ph.D.
Mt. Sinai Medical Center[1]



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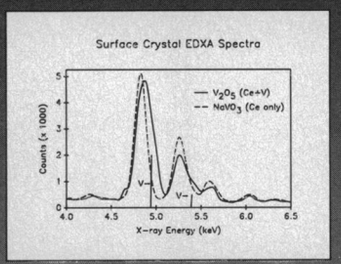

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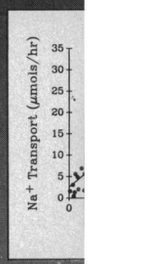

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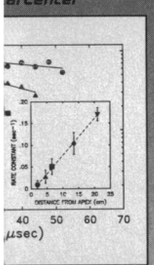

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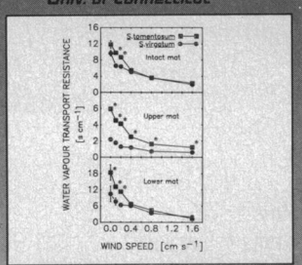

Darwyn Coxson
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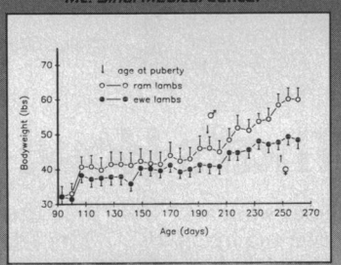

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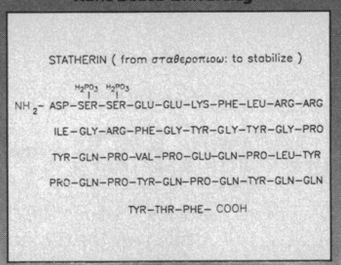

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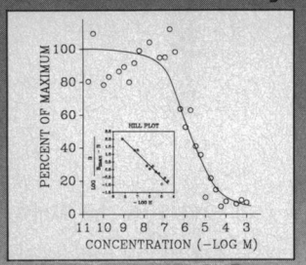
Forsyth Dental Center



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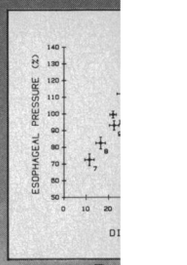

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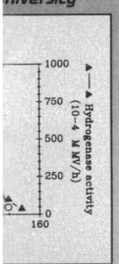

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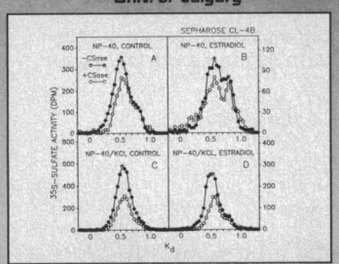

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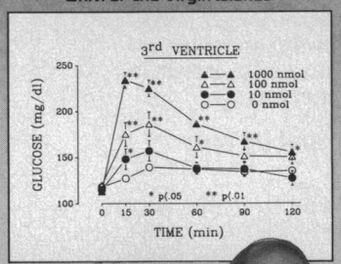

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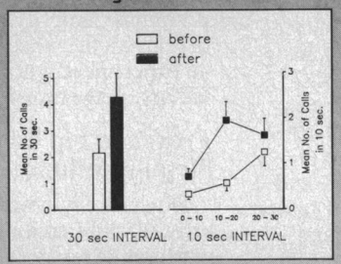

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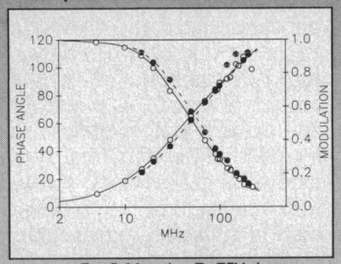

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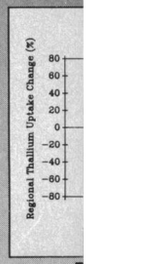
Univ. of Mississippi[5]



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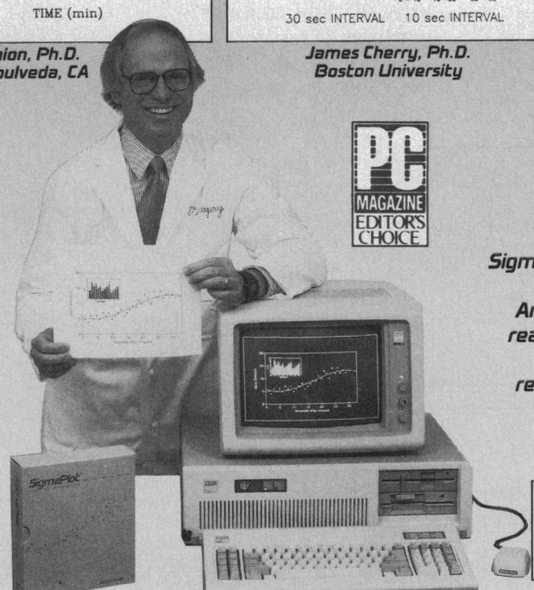

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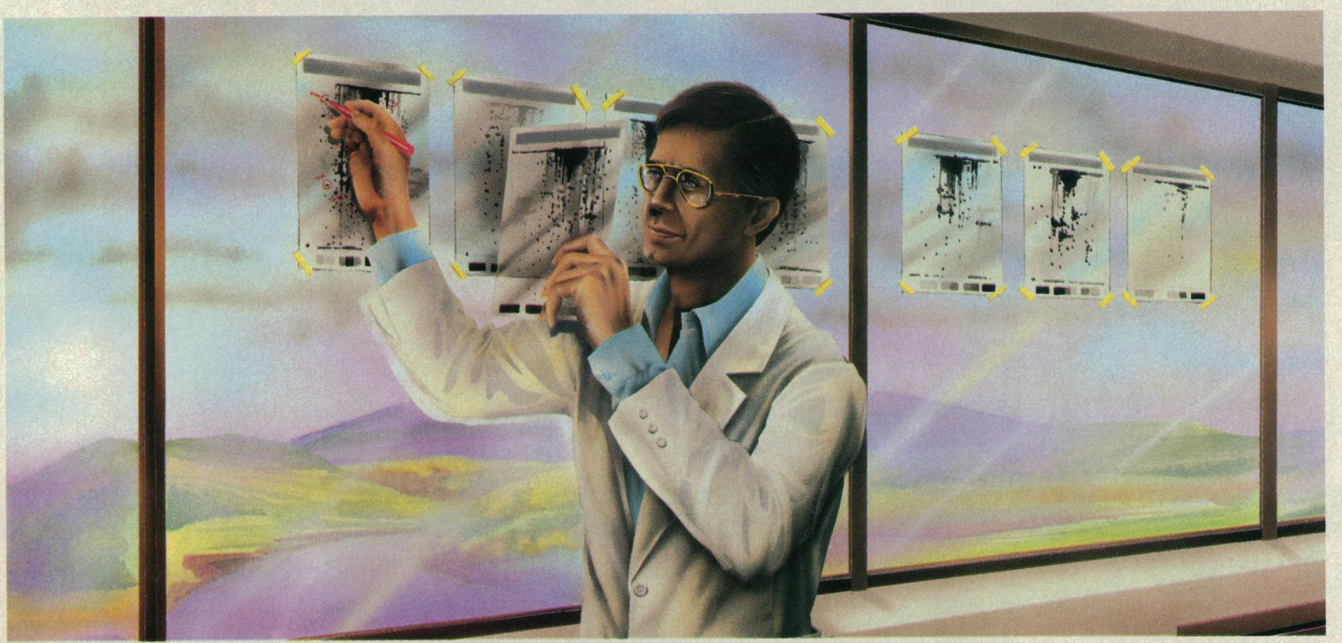

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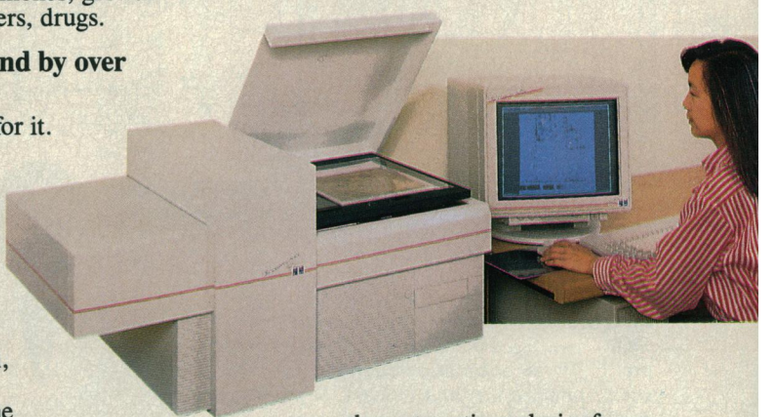

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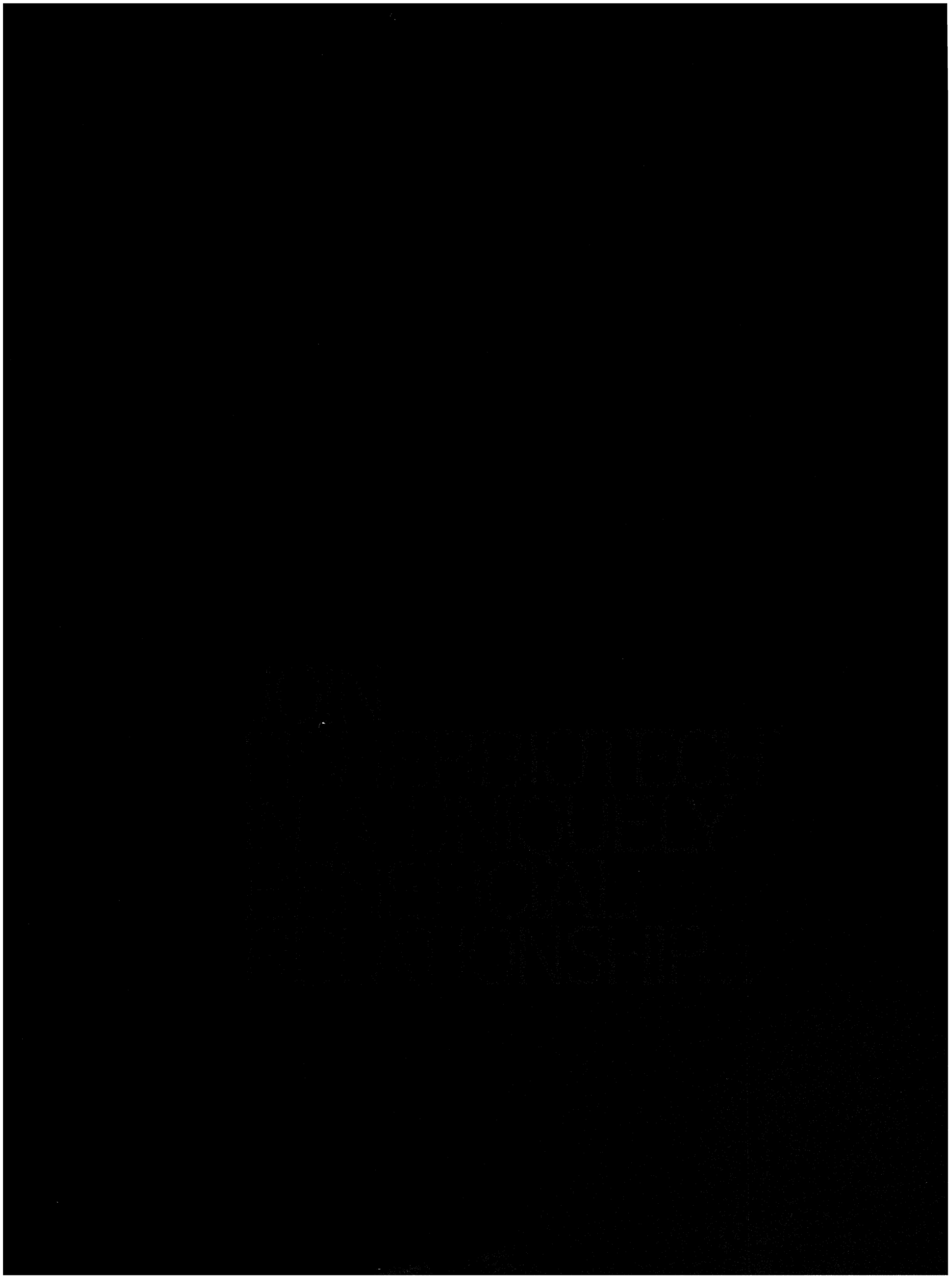

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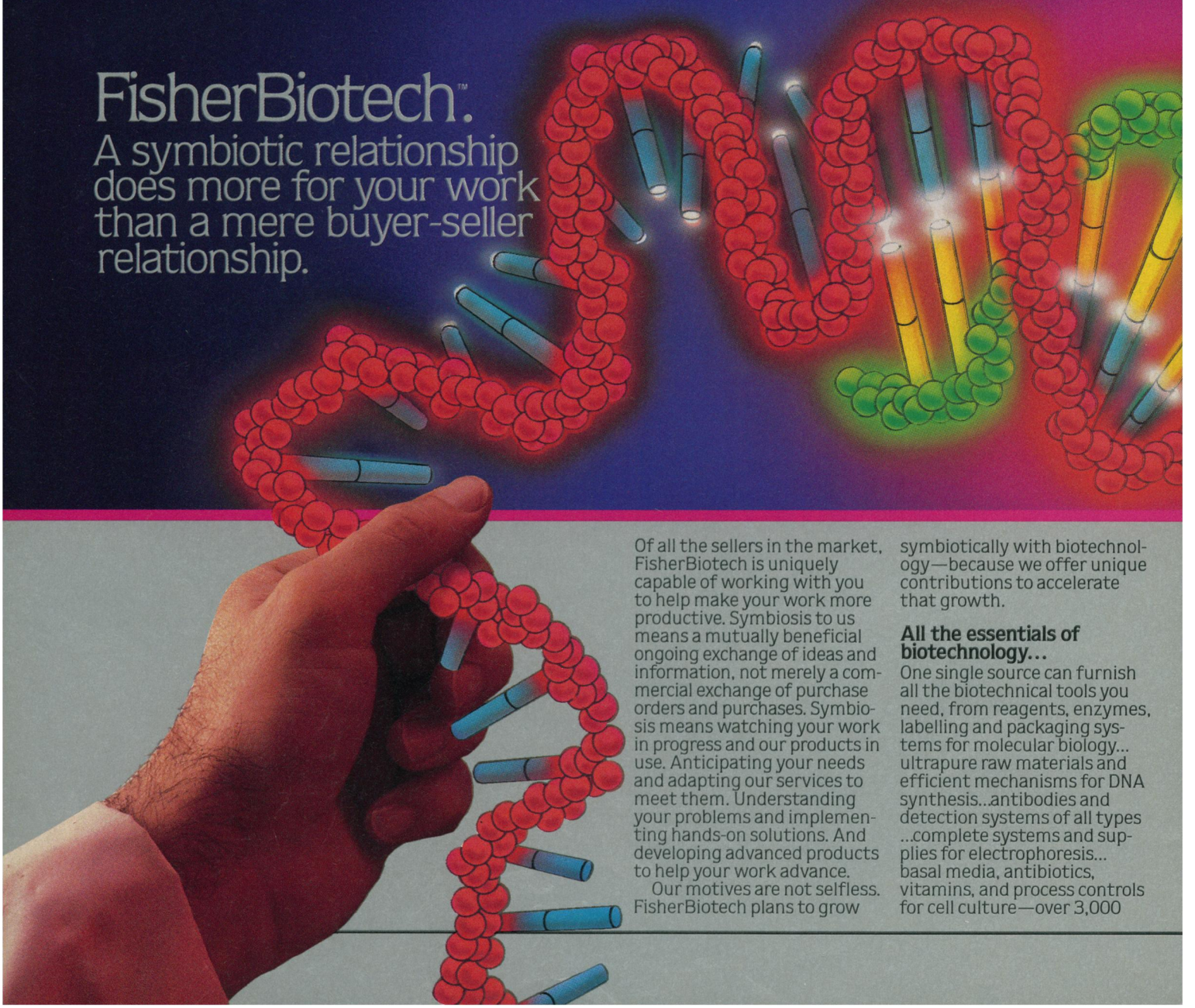
FisherBiotech™.

A symbiotic relationship does more for your work than a mere buyer-seller relationship.



Of all the sellers in the market, FisherBiotech is uniquely capable of working with you to help make your work more productive. Symbiosis to us means a mutually beneficial ongoing exchange of ideas and information, not merely a commercial exchange of purchase orders and purchases. Symbiosis means watching your work in progress and our products in use. Anticipating your needs and adapting our services to meet them. Understanding your problems and implementing hands-on solutions. And developing advanced products to help your work advance.

Our motives are not selfless. FisherBiotech plans to grow symbiotically with biotechnology—because we offer unique contributions to accelerate that growth.

All the essentials of biotechnology...

One single source can furnish all the biotechnical tools you need, from reagents, enzymes, labelling and packaging systems for molecular biology... ultrapure raw materials and efficient mechanisms for DNA synthesis...antibodies and detection systems of all types ...complete systems and supplies for electrophoresis... basal media, antibiotics, vitamins, and process controls for cell culture—over 3,000

products in all, with more added every week.

...and the skills essential to applying them

FisherBiotech sends our biotechnologists to work with your biotechnologists. Our Biotechnology Specialists, the largest dedicated force in the field, carry the best credentials and speak your language fluently. That promotes symbiosis, not just sales.

Quality is as critical to our results as it is to yours.

Biotechnology imposes unforgiving standards. So all FisherBiotech suppliers undergo stringent product evaluations, and must meet or exceed our Quality Assurance standards before we distribute their products. With nearly a century of manufacturing high quality reagents, FisherBiotech knows how to assure consistent purity. Our product assays—and our customers' results—speak for themselves.

The new products of symbiosis

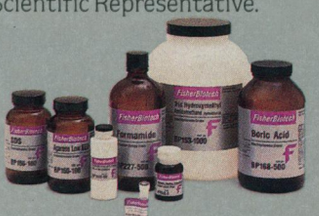
FisherBiotech introduces what you need by understanding firsthand what you need to know. Your problems stimulate our product development—for instance: in non-radioactive probes... new peptides...more efficient electrophoresis systems... new scintillation cocktails... and higher yield cell cultures, among others.

Delivery systems that help you deliver results

Instantaneous computerized ordering. Express shipments from massive inventories. Expert answers with one toll-free call. The convenience and economy of Fisher Scientific as the source for everything your lab needs. Fisher service lets you spend less time obtaining products, and more time using them productively.

Choose a supply house—or a symbiotic relationship.

Supply houses sell to you. FisherBiotech works with you. The benefits will be as unique and mutual as the relationship. For additional information, contact your Fisher Biotechnology Specialist or local Fisher Scientific Representative.



FisherBiotech

Symbiosis with Molecular Biology...Immunology...Electrophoresis... Cell Culture...Biochemicals

Fisher Scientific

Excellence in Serving Science...Since 1902