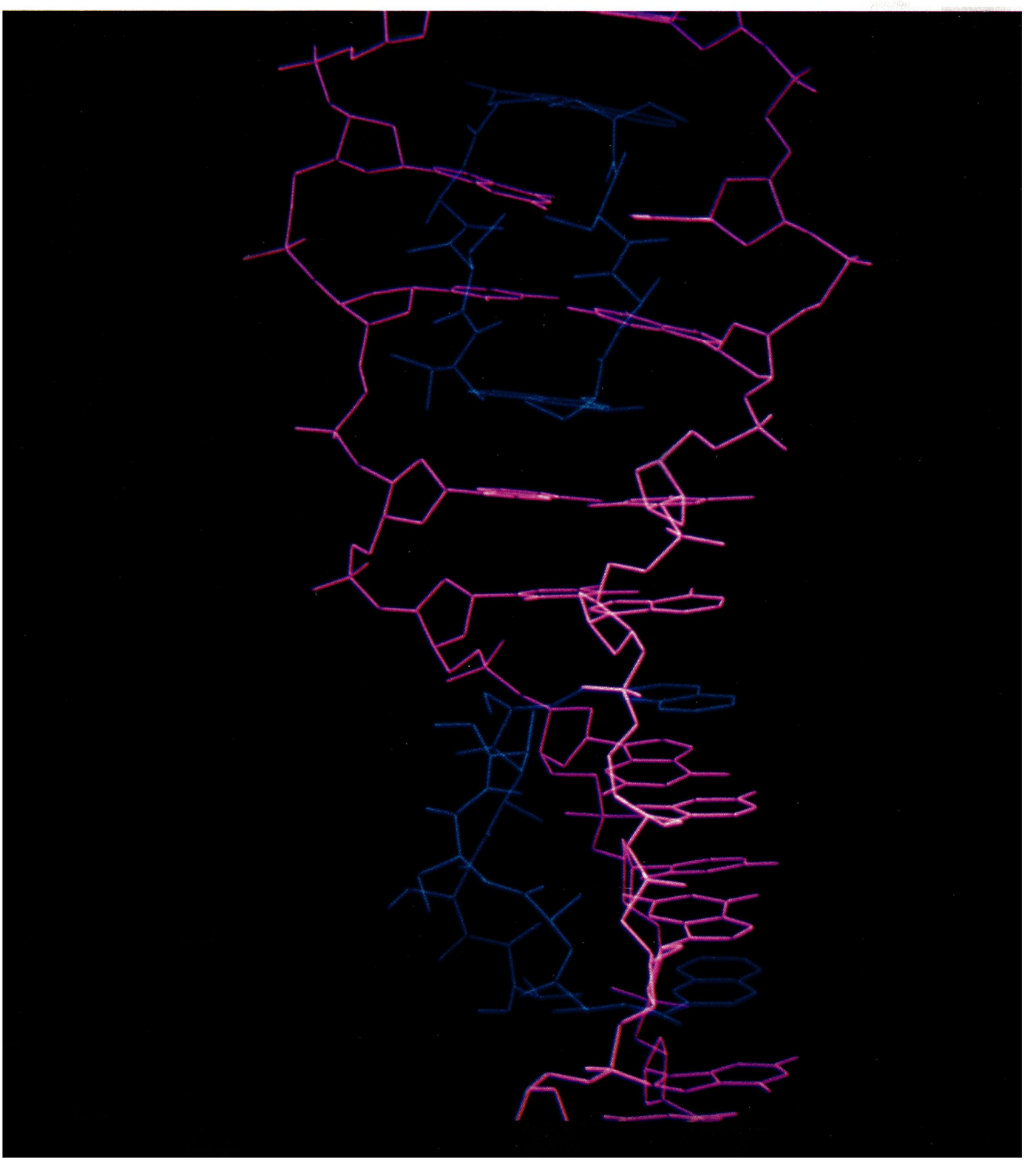
American Association for the Advancement of Science

SCIENCE

6 June 1986 $2.50
Vol. 232 ■ Pages 1173–1304



Monoclonal Antibodies and Beyond

The world's leading contract producer of MAb is now a full service bioprocessing company. With the addition of the OPTICELL™ system, Charles River Biotechnical Services has *in vitro* production capabilities for recombinant cellular products as well as MAb. The OPTICELL culture system is an established technology for the scale-up of biomolecules.

Whether you require contract production or an OPTICELL system, CRBS provides the option that best suits your needs. Our full service offerings include contract production in ascites fluid via MAXITAP® and in cell culture via OPTICELL, and sales of the OPTICELL culture system.

It's what you would expect from your bioprocessing partner.

CRBS, 251 Ballardvale Street, Wilmington, MA 01887. (617) 657-6500.

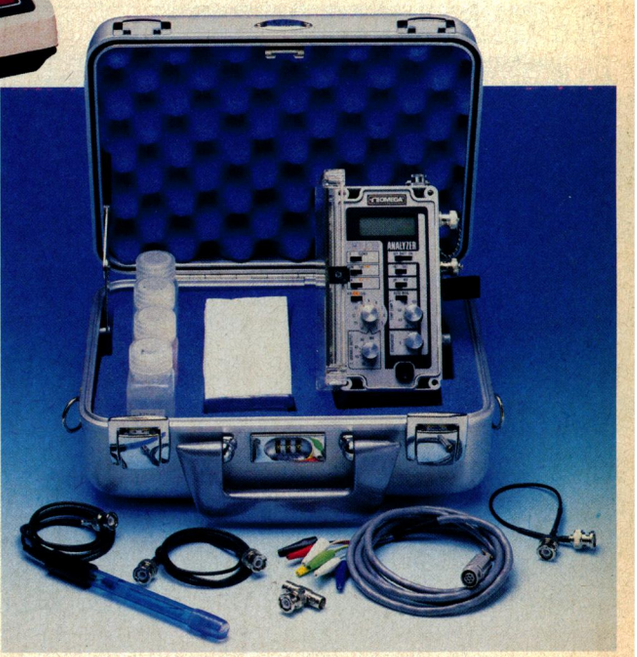
CRBS
CHARLES RIVER
BIOTECHNICAL SERVICES INC.

Circle No. 177 on Readers' Service Card

With OMEGA®

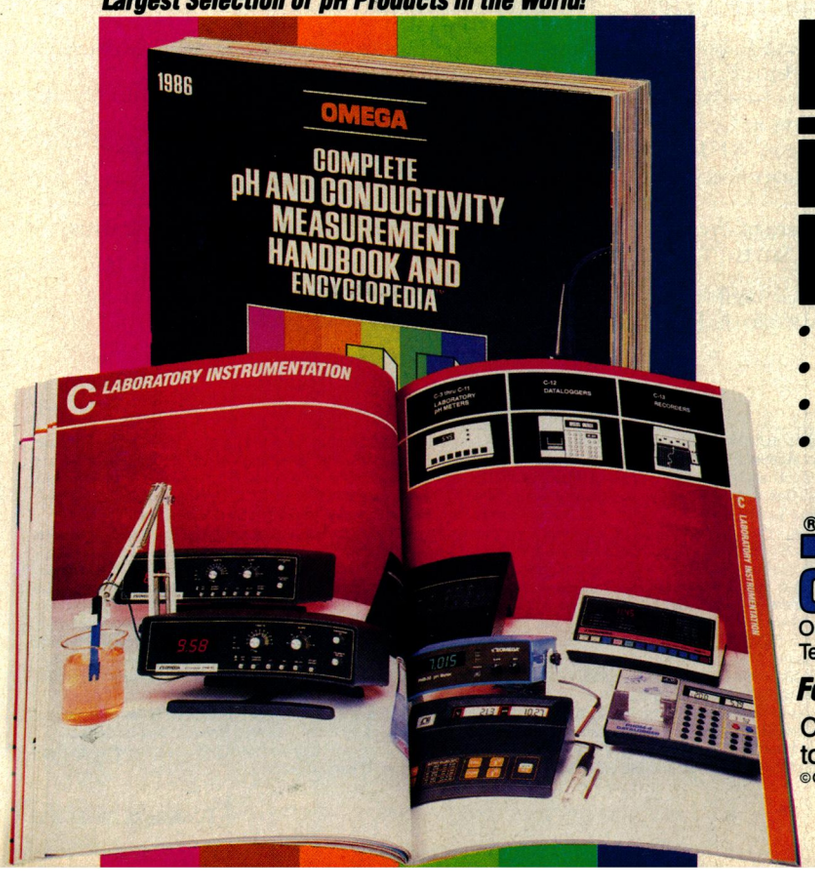
Microprocessor Based Laboratory Benchtop pH Meter

Laboratory Benchtop pH and Specific Ion Readout



Conductivity and pH Meter/Calibration Kits

Three of the Hundreds of pH Products in this Handbook! Largest Selection of pH Products in the World!



Nothing in pH is Beyond Measure

- ***ALL NEW! ALL FREE!***
- ***FULL COLOR!***
- ***PRICES INCLUDED!***
- ***OFF-THE-SHELF FOR IMMEDIATE DELIVERY!***

OMEGA® ENGINEERING, INC.

(203) 359-RUSH

One Omega Drive, Box 4047, Stamford, CT 06907
Telex 996404 Cable OMEGA FAX (203) 359-7700

For placing orders, dial (203) 359-1660!

Circle Reader Service Number
to Receive Your NEW! FREE! Handbooks.

Circle No. 37 on Readers' Service Card

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE

ISSN 0036-8075
6 JUNE 1986
VOLUME 232
NUMBER 4755

■ **SCIENCE is published weekly on Friday, except the last week in December, and with a plus issue in May by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005.** Second-class postage (publication No. 484460) paid at Washington, DC, and at an additional entry. Now combined with **The Scientific Monthly**® Domestic individual membership and subscription (51 issues): $65. Domestic institutional subscription (51 issues): $98. Foreign postage extra: Canada $24, other (surface mail) $27, air-surface via Amsterdam $65. First class, airmail, school-year, and student rates on request. Single copies $2.50 ($3 by mail); back issues $4 ($4.50 by mail); Biotechnology issue, $5.50 ($6 by mail); classroom rates on request; Guide to Biotechnology Products and Instruments $16 ($17 by mail). **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. **Postmaster:** Send Form 3579 to *Science*, 1333 H Street, NW, Washington, DC 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

■ The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

COVER Skeleton drawing of the bis-intercalator drug triostin A (blue) binding to the DNA duplex d(GCGTACGC) (magenta). Two molecules of the drug bind to each duplex. See page 1255. [Picture by Gary L. Quigley and Christin A. Frederick (Biology Department, Massachusetts Institute of Technology, Cambridge, MA 02139) with assistance of Rob Campbell (Chemistry Department, MIT) using the program FRODO by Alwynn Jones on an Evens and Sutherland PS300 graphics system]

Western gold...

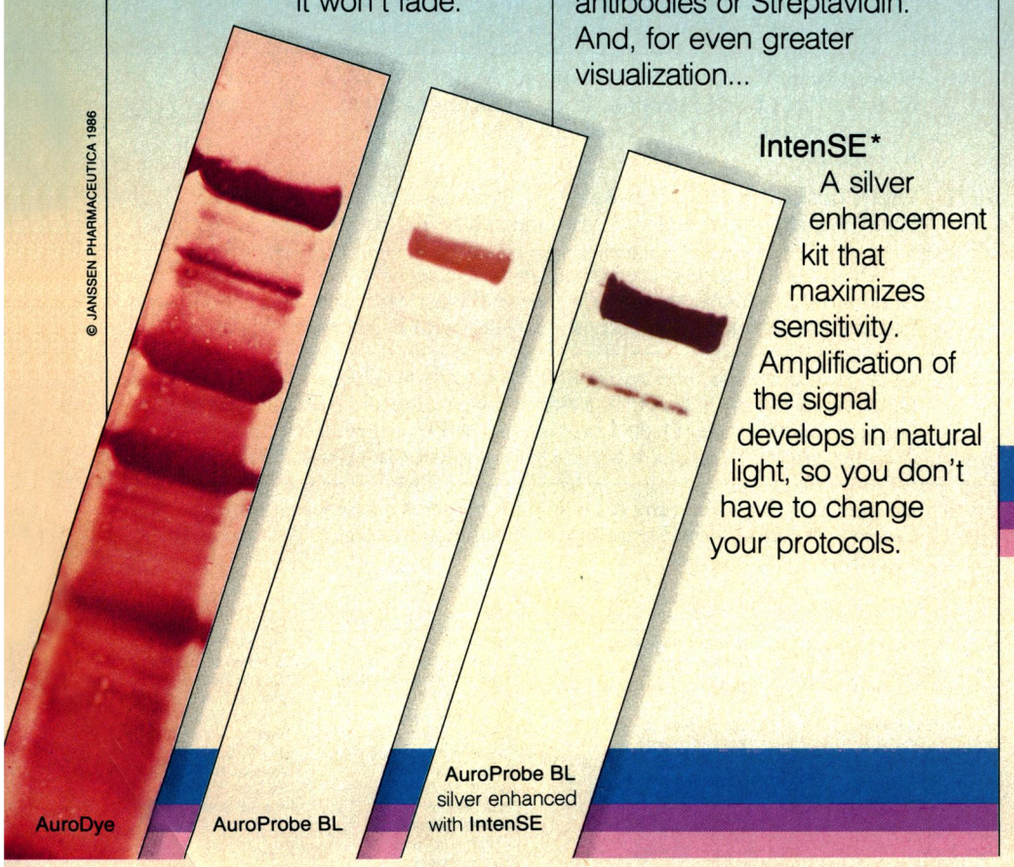
Immunogold blotting reagents to make your mark — permanent!

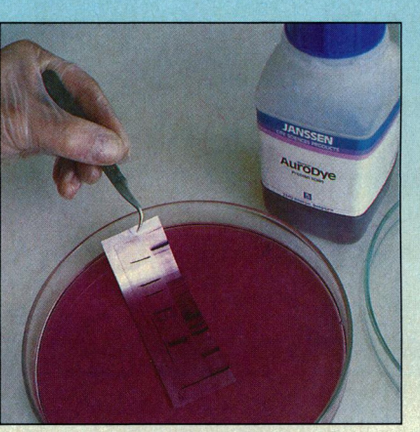
AuroDye*
An easy to use reagent to stain transferred proteins — Western or dot blots. Sensitivity is twenty times greater than conventional stains on nitrocellulose... and, it won't fade.

AuroProbe* BL
Superior reagent system for antigen detection — without enzyme development.

Choose from a menu of the most popular secondary antibodies or Streptavidin. And, for even greater visualization...

IntenSE*
A silver enhancement kit that maximizes sensitivity. Amplification of the signal develops in natural light, so you don't have to change your protocols.





For more information about our golden reagents, please call, toll free 1-800-624-0137.

* Trademark

JANSSEN
LIFE SCIENCES PRODUCTS

40 Kingsbridge Road
Piscataway, NJ 08854, USA
Tel.: 800-624-0137
Telex: 6853051

Turnhoutseweg 30
B-2340 Beerse, BELGIUM
Tel.: 014/60.33.85
Telex: 32.540

Circle No. 170 on Readers' Service Card

JANSSEN *pioneering in Life Sciences technology*

Caffeine stimulates the cell cycle

CAFFEINE induces cells that are arrested in the S phase of their cell cycle (a phase for replicating DNA) into a mitotic phase (page 1264). It causes premature chromosome condensation, the breakdown of the nuclear envelope, the "rounding up" of the cell, and synthesis of mitosis-specific phosphoproteins; these are all events associated with cell division that typically do not occur in cells until S phase is completed. Schlegel and Pardee found that caffeine effects occurred within a few hours. First, DNA synthesis had to be strongly suppressed. Then, upon exposure, mammalian cells in culture began synthesizing new proteins needed for mitotic events. (The RNA needed for mitosis had already accumulated in the cell during the S-phase arrest.) Caffeine either induces translation of this mitosis-related RNA into protein or stabilizes its protein products. Caffeine's effectiveness in uncoupling mitotic events of the cell cycle from the normal completion of DNA replication makes it a valuable reagent for studying biochemical events that stimulate mitosis in cells.

Pertussis vaccine

THE vaccine for whooping cough, while effective, can sometimes produce harmful side effects (page 1258). One component that apparently contributes to both the vaccine's protective and negative effects is the pertussis toxin. If, through genetic and molecular manipulations, the protective and toxic properties of the toxin could be separated, a safer vaccine might be developed. To this end, Locht and Keith have determined the complete nucleotide sequence of the pertussis toxin gene, have deduced from it the primary amino acid sequence of the toxin, and have defined other features of the molecular organization of gene and protein. Protective regions of the molecule can now be mapped and peptides resembling them synthesized; mutations can be made that might modify the toxin gene and its product so that toxic properties would be removed but protective ones would remain.

Distinctive K/T iridium anomaly

IN a long core of clay from a region of the Pacific ocean floor east of Hawaii where windblown dust from Asia and North America was deposited between 33 and 67 million years ago, only one peak of the element iridium stands out; that is the peak at the Cretaceous/Tertiary (K/T) boundary (page 1225). Detection of excess iridium several years ago in clay samples from the K/T boundary led to the theory that the mass extinction at the end of the Cretaceous period (that included the extinction of the dinosaurs) was caused by impact of a meteorite. Extraterrestrial dust and meteorites are considered to be sources of most of the iridium in deep sea cores (with minor terrestrial sources being weathering and volcanism). Kyte and Wasson measured iridium in 149 samples from the core by neutron-activation analysis. Iridium was 10 to 40 times higher at the K/T boundary than at other times, suggesting that a major accretionary event took place at the end of the Cretaceous. Apart from this anomaly, iridium entry to earth since the Cretaceous has been fairly stable. A calculation of the amount of iridium expected from periodic cometary showers yielded a much higher iridium value than was found at either the K/T or the Eocene/Oligocene boundary, making unlikely the possibility that such showers have been responsible for periodic extinctions.

Male-killing spiroplasmas cultivated

THE females of four species of fruit flies, when infected with spiroplasmas, produce only female progeny, because males are killed early in embryogenesis (page 1253). The spiroplasmas, called sex-ratio organisms (SRO's) because they alter the sex ratio of progeny fruit flies, are wall-less microorganisms that reside in the female's hemolymph. SRO's have been difficult to study because conditions for growing them outside their *Drosophila* hosts could not be found. Hackett *et al.* report the successful establishment of SRO's in tissue culture medium supplemented with an insect cell line; eventually the spiroplasmas could be cultivated in medium without added cells. When injected into female flies, cultivated spiroplasmas continued to be lethal for male progeny. Characteristics of the organisms can now be evaluated and their effects on the host and her progeny analyzed in more detail. In addition, similar cell-enriched systems may be adapted for growing other fastidious organisms.

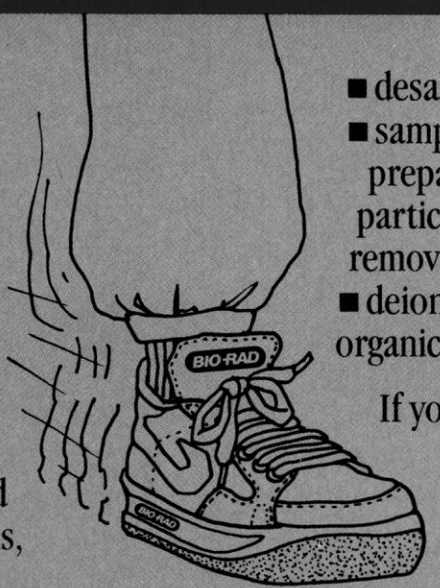
Gene deletion in familial hypercholesterolemia

A patient and model rabbits with the disease familial hypercholesterolemia (FH) (atherosclerosis and elevated serum cholesterol) have similar molecular defects in their genes for LDL (low density lipoprotein) receptors (page 1230). LDL receptors are responsible for transporting cholesterol-rich LDL into cells. In diseased rabbits and humans having a certain FH mutation, the receptors move at greatly reduced rates from their sites of synthesis in the cell to the surface, and most never reach the surface. Yamamoto *et al.* found that alleles (alternative genes) for the LDL receptor had a small deletion (12 bases in the rabbit, 21 to 36 bases in the patient). This gene region codes for a region of the protein that is rich in disulfide-bonded cysteines. Although cysteines were not among the amino acids deleted in the rabbit receptors, disulfide bonding would be impaired if the altered receptors folded improperly; cysteines would then be available to bond with cysteines of other proteins—perhaps a "gatekeeper" protein—along the route to the surface. Such a mechanism could prevent nonfunctional molecules from becoming positioned at the cell surface where they might elicit harmful immune responses.

Start your separations off on the right foot.

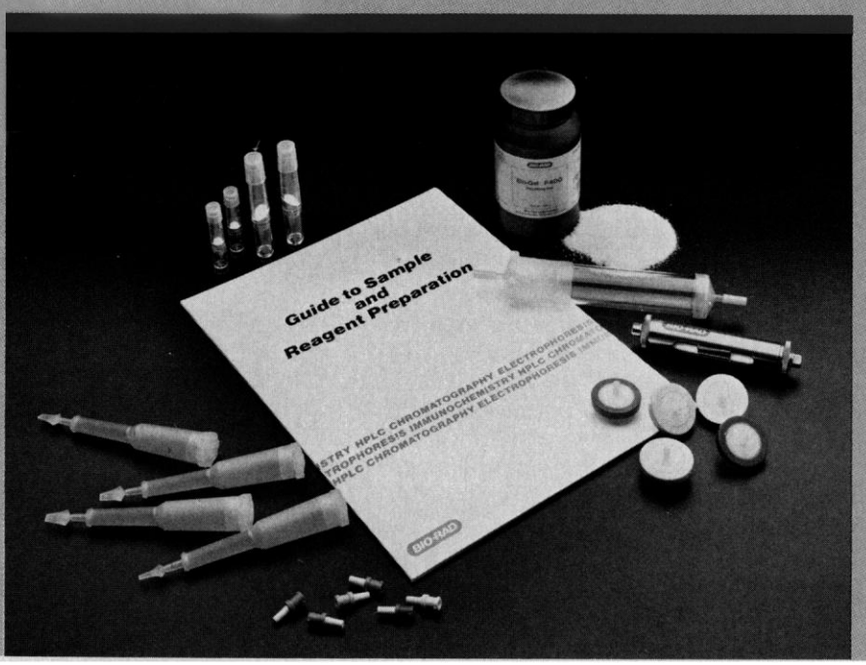
Start with Bio-Rad's sample preparation products.

Almost every separation or analysis requires treatment of the sample. Because of this, Bio-Rad offers a complete line of quality sample preparation products. These well-established tools include ion exchange resins, filtration products, disposable columns, and cartridges. Among the many sample prep applications that we satisfy are:



■ desalting ■ buffer exchange ■ sample concentration ■ buffer preparation ■ metal removal ■ particulate removal ■ detergent removal ■ deproteinization ■ deionization ■ adsorption of organics ■ HPLC deashing

If you're involved in chromatography, electrophoresis, immunochemistry, molecular biology, or HPLC, you'll find the "Guide to Sample and Reagent Preparation" invaluable. Contact us for your free copy.



BIO-RAD

1414 Harbour Way South
Richmond, CA 94804
(415) 232-7000
800-4-BIO-RAD

Also in Rockville Centre, NY; Hornsby, Australia; Vienna, Austria; Mississauga, Canada; Watford, England; Munich, Germany; Milan, Italy; Tokyo, Japan; Utrecht, The Netherlands; and Glattbrugg, Switzerland.

Answers.

Circle No. 206 on Readers' Service Card

SCIENCE

6 JUNE 1986
VOLUME 232
NUMBER 4755

Global Manufacturing Competition

The United States has been experiencing enormous trade deficits, largely due to inability to compete in the production of high-quality, low-cost durable goods. The situation will not be quickly remedied, but emerging new technology and better management practices hold the promise of better days. A crucial determinant in the outcome of global competition will be activities occurring in Michigan, the leading manufacturing state.

Until the late 1970's, a smug arrogance was the dominant mood in the automobile industry. To a major degree, the research laboratories of the big three automobile manufacturers were merely window dressing. In 1979, when a Japanese engineer described at a symposium his painstaking analysis of stresses in the shell of a Honda, he was an object of derision. The industry had little contact with universities except to hire some of the graduates. The state government's principal actions were to pile taxes and regulations on the industry while cutting back support for engineering at the universities.

The oil crisis, demand for high-quality small cars, and a recession that brought Michigan unemployment in 1981 to 17 percent had the effect of that of a two-by-four on a mule. The state government, industry, universities, and citizens in general recognized the need for change as well as to learn some lessons from the Japanese.

On a recent visit to Ann Arbor and Detroit, I noted evidence of changes that have occurred in the intervening years. The state government has provided $70 million for construction at the University of Michigan of new buildings for engineering. It has substantially increased its support for the engineering faculty and their research. The state is assisting in the financing of start-up companies such as those in robotics and machine vision.

The automobile industry is in the midst of change in the use of electronics, robots, machine vision, and new materials, as well as in supplier and employee relations. A new Buick-Oldsmobile-Cadillac plant at Hamtramck has 260 robots and many new computer-controlled features. To meet the needs for robots of various kinds and for machine vision, a large number of new small companies have become active in southeast Michigan. They bring an excitement reminiscent of that of an early Silicon Valley.

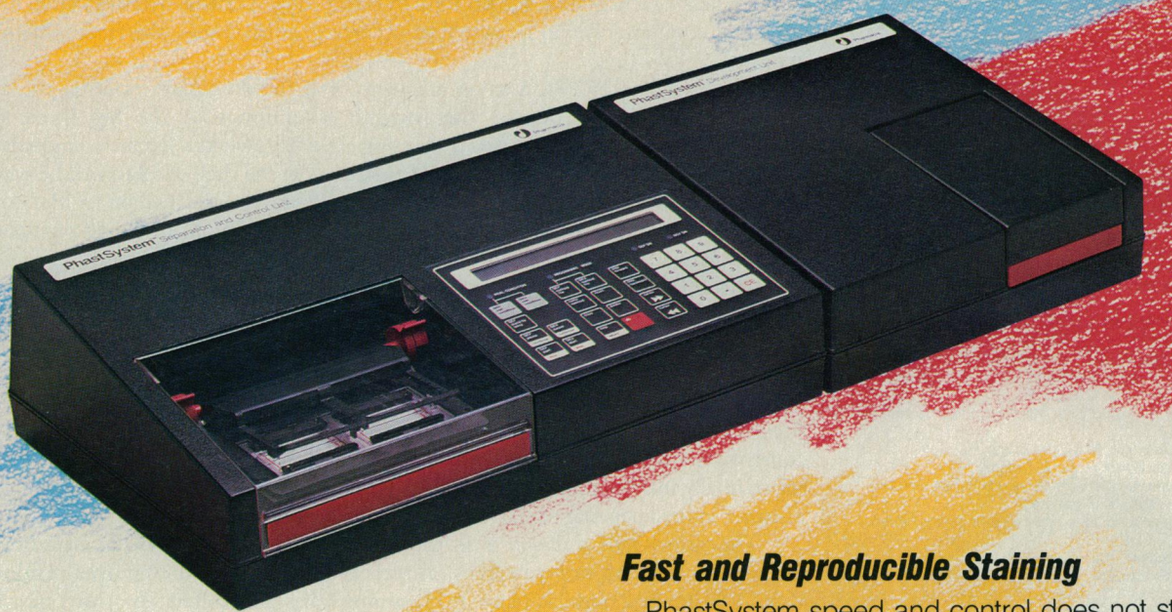
Two nonprofit institutes in Ann Arbor have impressive leadership and roles of increasing importance. The Environmental Research Institute of Michigan has some of the world's best experts in remote sensing. They have produced robots with good shape discrimination, devices for very accurate measurements of features of automobiles, and a device for inspecting the complete exterior of an automobile for proper trim, taillights, and other features. The machine vision is fast, cheap, and capable. They have also developed a computer with parallel processing especially suitable for processing the complex data related to machine vision.

The Industrial Technology Institute has activities that include a flexible machining group looking at machine tools, sensors, materials handling, and automated design for manufacturability. It is a robotic evaluation center. The institute is helping to write the specifications for a manufacturing automation protocol. This will provide a common computer and control language that will allow robots and other equipment to communicate no matter who makes them.

The University of Michigan has been positioning itself to interact with these institutes and with companies large and small. In turn, auto companies now welcome professors and their students and permit them to use assembly plants as laboratories. One of the aims at the university is to achieve interaction of experts in robotics, machine cognition, machine vision, and machine action with experts in computer-aided design of systems involving those technologies and new and superior materials. A goal is to develop highly adaptable robots with large-scale computing capability and expanded artificial intelligence.

One can encounter a great deal of enthusiasm and a climate of can-do in Ann Arbor. A new culture seems to be evolving there. If the rate of evolution continues, something will be created that will have impact beyond Michigan.—PHILIP H. ABELSON

Electrophoresis at the speed of biotechnology.



Technology moves fast. Biotechnology moves faster yet. Chromatographic separations that once took days are done in minutes. Now that same speed and accuracy is available for electrophoresis.

20 Minute Electrophoresis

PhastSystem uses a futuristic combination of preformed, ultra-thin, microelectrophoresis gels and computer-controlled instruments to effect absolutely unmatched speed and reproducibility in electrophoretic separations. Automated sample application creates a perfect volume and width of sample application zone. An internal power supply with volt-hour integration control assures "same-condition" reproducibility from one gel to the next. Preformed PhastGel™ Gradient runs SDS and native PAGE in less than 30 minutes. PhastGel™ IEF, in any of 3 popular pH ranges, runs in less than 20 minutes.

Fast and Reproducible Staining

PhastSystem speed and control does not stop at gel running. Staining, destaining and general gel development control is also commanded by PhastSystem. Done in a sealed "spin" compartment, automated temperature and solvent exchange programming takes detection to new levels of ease and reproducibility.

Now, with PhastSystem, your electrophoresis results come up to speed with the rest of your laboratory. Isn't it about time you found out more about PhastSystem?

PhastSystem™
IT'S ABOUT TIME

Pharmacia

Laboratory Separation Division
Piscataway, New Jersey 08854
Information: (800) 526-3618
In NJ: (201) 457-8000

553

Pharmacia products will be on display at ASBC - Booths E46, E48, E50, E52, F45, F47, F49, F51

Circle No. 195 on Readers' Service Card

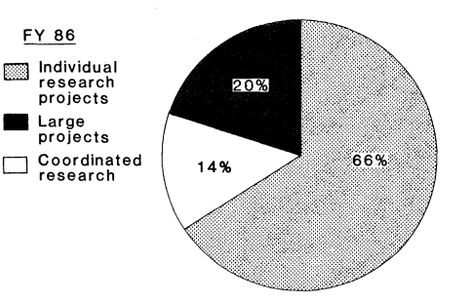
ric defending the SSC. If the AAU has drawn up such a list and compared it to the benefits of committing the same $1 billion per year to, say, 100 new university-government-industry centers, paying full overhead, revitalizing science education from first grade to graduate school, and so forth, it has surely kept it secret. If not, such rhetorical claims mislead both the public and the engineering and science community on the most important policy issue of our time—"science *or* engineering." The Department of Defense recently received some 900 proposals for a total of $7 billion in its University Research Initiative program. And by some unbelievable value structure, only $75 million is allocated to this program by the same nation that wants to put $1 billion into the SSC. Most incredible of all, the victims of this discrimination have not learned that they can stop it with a few hundred well-placed letters to Congress. An AAU spokesperson also is quoted indirectly as saying that the "nation will need more, not fewer, Ph.D.'s." Agreed. How will the SSC contribute to this need? By sidetracking even more Ph.D.'s into the societally irrelevant SSC. Are scientists not citizens, and have they no responsibility to help reduce the budget deficit in their own area? A minimal contribution must surely be to shelve the SSC until appropriate international arrangements can be made to advance the field collectively. Without such a policy posture, which I believe has the support not only of the vast majority of most other scientists but of the physics community itself (*1*), no American scientist can complain about any cuts in any of our programs which save less than the SSC cost.

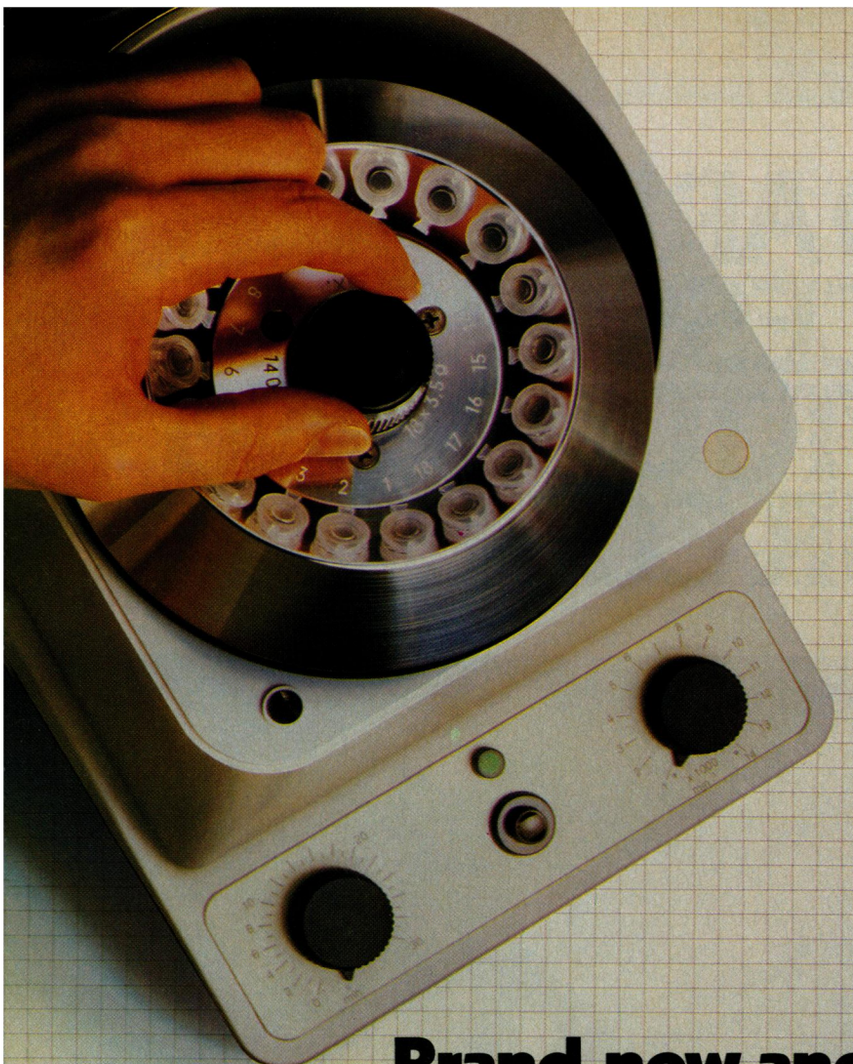
RUSTUM ROY
Materials Research Laboratory,
Pennsylvania State University,
University Park, PA 16802

REFERENCES

1. Letters, *Phys. Today* **39**, 11 (April 1986).

Erratum: In the article "Bloch prepares NSF for lean years" by John Walsh (News & Comment, 25 Apr., p. 440), the labels for "Coordinated research" and "Large projects" were inadvertently reversed in a chart depicting the breakdown of the fiscal year 1986 National Science Foundation budget. Coordinated research accounts for 14% of total research, and large projects account for 20%. A corrected chart is shown below.





The new Eppendorf Micro Centrifuge.

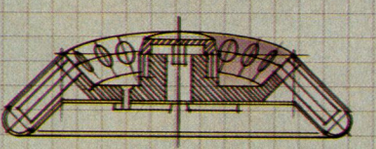
With 50% higher capacity, variable speed, quieter operation, and quick-release rotor.

Brand new and turning 18.

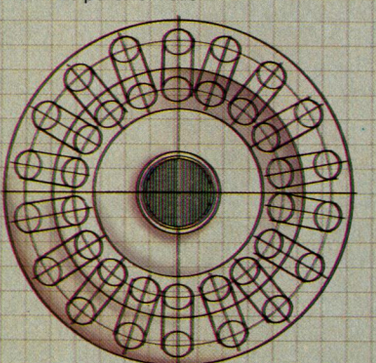
Higher capacity...plus.
The new *18-place* Model 5415 Micro Centrifuge gives you important operating advantages—with unique Eppendorf quality.

Versatile in use.
Model 5415 has a variable-speed motor that reaches a maximum of 14,000 rpm with an RCF of 16,000 x g; a 30-minute timer; and a momentary button for short spins. It accepts 1.5 mL, 500 µL, 400 µL, and 250 µL Eppendorf Microcentrifuge Tubes and blood collection microtubes, such as B-D Microtainer* Tubes.

New rotor design.
The enclosed rotor design reduces air turbulence for quieter operation. And the new quick-release feature lets you transport the rotor *with* tubes—especially convenient when the centrifuge is run in a cold room.



Enclosed rotor design reduces air turbulence and noise. Tubes are angled precisely at 45° to maximize pellet formation.



Quick-release feature allows the 18-position rotor to be easily transported even when loaded.

Microtainer Tubes is a registered trademark of Becton Dickinson and Company.

Safe and rugged.
The Eppendorf 5415 Micro Centrifuge is UL listed for safety. It's so rugged that an accidentally unbalanced load won't cause excessive vibration or motor damage. For more information or a demonstration, call or write: Brinkmann Instruments Co., Division of Sybron Corporation, Cantiague Road, Westbury, NY 11590, Tel: 800-645-3050; in New York, 516-334-7500. In Canada: 50 Galaxy Blvd., Rexdale, Ontario M9W 4Y5, Tel: 416-675-7911.

Specifications

Maximum speed	14,000 rpm
Maximum RCF	16,000 x g
Test-tube capacity	18
Time required for maximum speed	10 sec
Time required to stop	12 sec
Dimensions (L x W x H)	28 x 21 x 28.5 cm

eppendorf
Shaping the future. **Brinkmann** INSTRUMENTS CO.

BRK-5280

For literature circle reader service number 156
For a demonstration circle reader service number 157

THE FPS FAMILY OF

ADD ARRAY PROCESSORS WITHOUT TOUCHING YOUR CODE

FPS INTRODUCES THE MULTIPROCESSOR MP32

With the introduction of FPS MP32, array processor users can, for the first time, take advantage of expandable parallel processing without rewriting code to fit each new configuration.

The MP32 protects you against the two biggest risks in high-speed computation:

One, that your projects will outgrow your processing power.

Two, that you'll have to reprogram when you reinvest.

Once you're up and running on an MP32 with one computational processor, faster run times are just a plug-in away.

Each MP32 computational processor is a fully programmable array processor, designed around a 32-bit VLSI technology.

Each processor features an 18 MFLOPS architecture, selected for optimum price/performance. To help solve larger problems faster, each includes 24-bit direct addressing and up to 7MWords of shared memory.

Add processors and memory boards as you need them: the workload can be distributed automatically.

MP32 operation is straightforward, and is backed by extensive FPS libraries of multiprocessor microcode subroutines.

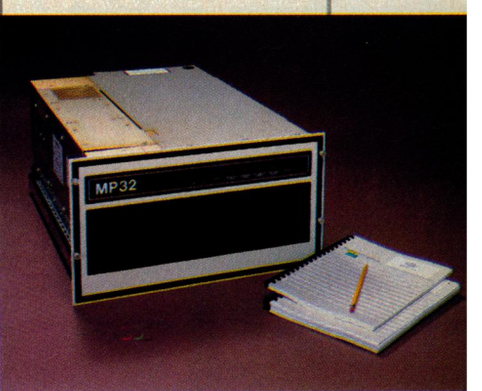
FPS development tools let you quickly build FORTRAN-callable programs from math and applications libraries. They make it easy to build optimized programs that you may never need to update again.

If you're already using the parallel processing power of the FPS-5000 Series, you can routinely port to the MP32: both machines use the same computational processors and MAXL compiler.

Learn more about the processing power and the staying power of the MP32—from the leader in accessible high-speed computation. See your local FPS sales representative, or contact Floating Point Systems, P.O. Box 23489, Portland, OR 97223. Telex 360470 FLOATPOIN BEAV. Sales offices worldwide. Call 1-800-635-0938.

MULTIPLE PROCESSORS MULTIPLY POWER

Benchmark	Data Set	Number of Computational Processors	Execution Time (Sec)	Effective MFLOPS
2D Complex FFT	256×256	1	0.355	12.5
		2	0.207	21.5
		3	0.161	27.6
	512×512	1	1.269	16.5
		2	0.646	32.4
		3	0.498	42.1
	1024×1024	1	5.304	16.8
		2	2.664	33.4
		3	1.880	47.3
2D Convolution (14×14-point operator)	512×512	1	8.449	12.1
		2	4.343	23.6
		3	2.925	35.1



FPS FLOATING POINT SYSTEMS

THE PROVEN POWER IN ACCESSIBLE HIGH-SPEED COMPUTATION.

Circle No. 162 on Readers' Service Card

Microconcentration made easy.

Centricon™

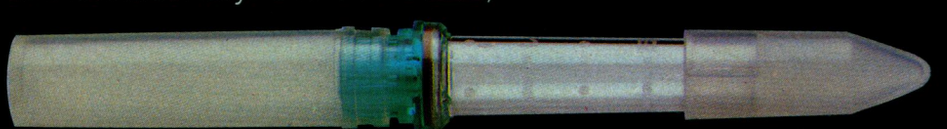
Are you concentrating or desalting samples containing plasmid DNA, restriction fragments, viruses, bacteria, proteins, or enzymes?

Are you purifying microvolumes of biological fluids, cell culture media, or fermentation broths?

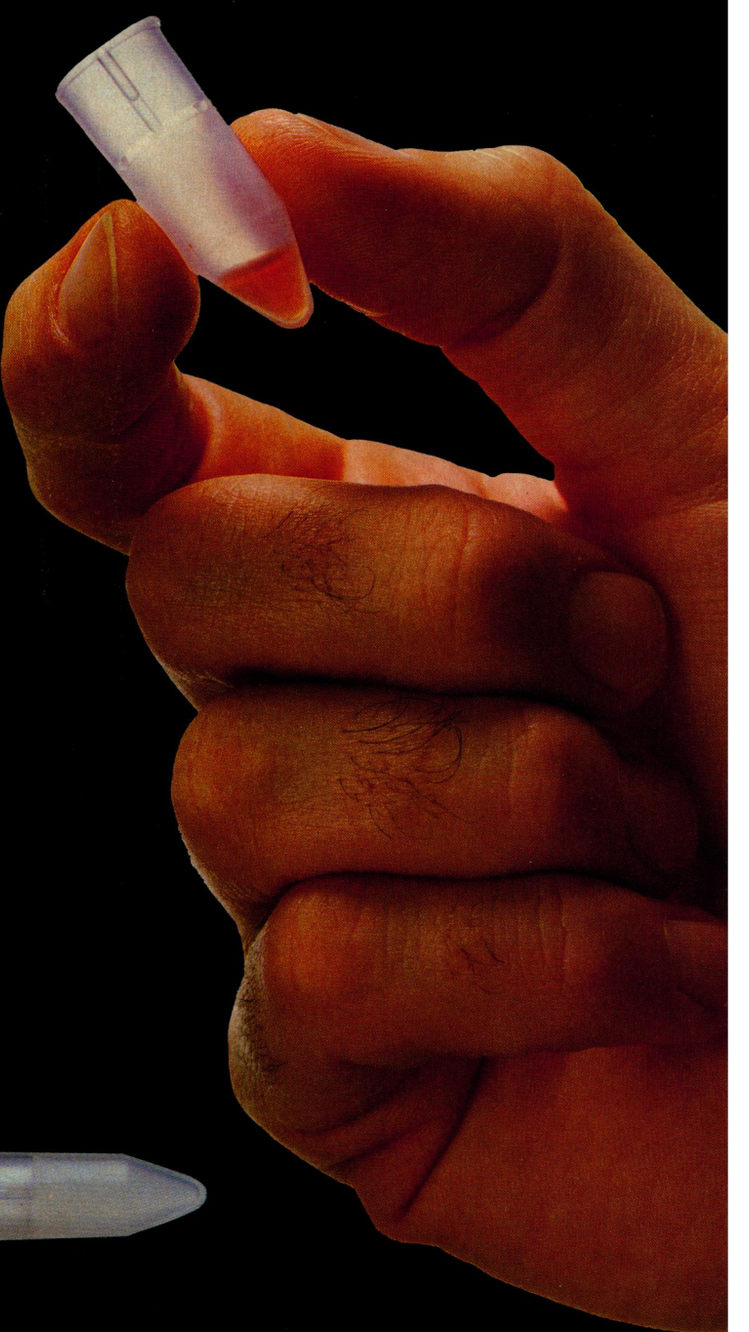
Now you can do it easier than ever before—with high recovery and low biological loss—using the Centricon Disposable Microconcentrator. There's nothing else like it.

Centricon yields 25–50μl concentrate from a 2ml sample by only a 30 to 60 minute spin in a fixed-angle centrifuge. That's all you need: no special equipment, no awkward procedures, no apparatus to clean up. Centricon is fast, simple, efficient.

Call the Toll-Free Hotline: 800-343-1397 Talk directly to our technical specialist about your application. Ask about our Applications Monographs, our Applications Source File, and our Microseparation Catalog. (In Massachusetts or internationally: 617-777-3622.)



ACTUAL SIZE



amicon
a GRACE company
17 Cherry Hill Drive, Danvers, MA 01923

Circle No. 202 on Readers' Service Card

At last, software that solves your mathematical problems symbolically.

In seconds.

If it is still taking you weeks or months to handle rudimentary algebraic problems and extremely complex analyses, then make it your business to find out about MACSYMA.™

MACSYMA is the most comprehensive approach to symbolic mathematics ever created. Originally designed at MIT through research in Artificial Intelligence, MACSYMA has been continuously developed and enhanced since 1969.

But for all its sophistication, you can put MACSYMA to work on computers ranging from workstations to mainframes. Without previous programming experience. In fact, you can interact with it in an almost conversational way while you use it to explore problems in basic or advanced mathematics that you couldn't begin to approach using a pencil, chalk or numerical software. This comprehensive program can then generate FORTRAN code from derived MACSYMA expressions and answers.

3 weeks vs. 10 seconds.

For example, an engineer working for a major aerospace company was stopped by an integral dealing with turbulence and boundary layers. Pencil and paper in hand, he had been looking at:

$$\int (k \log(x) - 2x^3 + 3x^2 + b)^4 \, dx$$

for more than three weeks. He always arrived at a different solution, never knowing which was the right one.

Less than 10 seconds after entering the problem into the computer, MACSYMA gave him the correct answer. Not just numerically, but in symbolic terms that gave him real insight into the physical nature of the problem.

How long would it take you or your staff to factor this expression?

$$3w^2z^6 + 2w^3z^4 - 10w^2y^2z^3 + 141xyz^3 + 45w^2x^3z^3 - 3w^2z^3 + 94wxyz - 2w^3z - 470xy^3 + 10w^2y^2 + 2115x^4y - 45w^2x^3$$

MACSYMA gives you the answer. In seconds.

$$(3z^3 + 2wz - 10y^2 + 45x^3)(w^2z^3 + 47xy - w^2)$$

What MACSYMA can do. For you.

MACSYMA arms you with hundreds of practical and real-world applications. It can:

- Do algebra, trigonometry and calculus
- Provide standard numerical techniques
- Generate FORTRAN output from MACSYMA expressions
- Simplify, factor or expand expressions
- Solve equations analytically or numerically
- Expand functions in Taylor or Laurent series
- Compute Fourier and Laplace transforms
- Manipulate matrices and tensors
- Plot functions in 2 or 3 dimensions
- Much, much more

Throughout the world, thousands of scientists, engineers and mathematicians are using MACSYMA in such diversified applications as electronics, structural engineering, CAD, acoustics, plasma physics, antenna theory, VLSI circuit design, control theory, numerical analysis, fluid mechanics, genetic studies, ship hull design, maximum likelihood estimation, ballistic missile defense systems design, underwater shock wave analysis, helicopter blade motion studies, and atomic scattering cross section analysis. And the range of use is expanding every day.

Easy computer algebra starts here.

MACSYMA is available right now from Symbolics,™ the leader in Symbolic processing. For a complete kit including a full capabilities brochure, just clip and mail the coupon or call **1-800-MACSYMA.** In Mass., Alaska & Hawaii only call **(617) 577-7500.**

MACSYMA™

The most comprehensive software approach to symbolic mathematical computations.

symbolics™

Your next step in computing.™

MACSYMA and SYMBOLICS are trademarks of Symbolics, Inc. Copyright 1986 Symbolics, Inc.

Symbolics, Inc. Dept. M-SI1
11 Cambridge Center
Cambridge, MA 02142

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone _____ Extension _____

MACSYMA is available to colleges and universities at special rates.

BIOSYSTEMS UPDATE

For People who make Peptides,

Here are five reasons why.

1 It's the Truly Efficient Way to Make Peptides

The Model 430A Peptide Synthesizer doesn't waste time, amino acids, or reagents. It consistently produces high yields of quality peptide which reduces post-synthesis purification and characterization significantly. You get more peptide for your effort *and* for your dollar.

2 It's More Flexible, Easier to Operate

The 430A meets the needs of every user whether new to peptide synthesis or very experienced. Software is written in plain English using familiar terminology. All control is implemented by simply touching the screen. Standard synthesis cycles and functions can be selected or new ones designed quickly and easily.

3 Its Chemistry is Proven and Unique

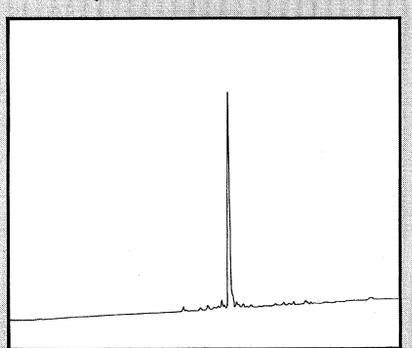
High stepwise yields, high purity and reproducibility are routine. Each step of the chemistry is specific to the requirements of the various amino acids. Coupling failures are eliminated or greatly reduced resulting in fewer double couplings. Both *t*-BOC and FMOC chemistries can be accommodated.

4 It Produces Superb Short Peptides

Step Yield (% Coupled) Standard ABI *t*-boc cycles, version 1.0

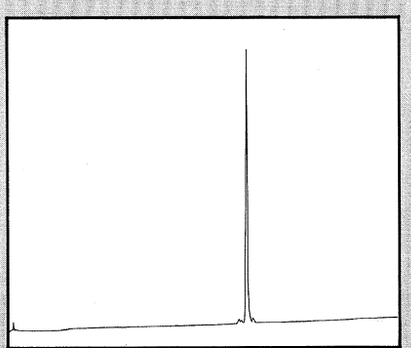
PEPTIDE SEQUENCE	LEU	HIS	PHE	PRO	HIS	ILE	TYR	VAL	ARG	ASP	AVG. STP. YIELD %
Ninhydrin Analysis	•	96.7	99.7	99.7	†99.6	98.9	99.5	98.3	99.5	99.4	**99.0**
Preview Sequence Analysis	•	•	•	99.5	99.2	94.9	96.6	96.5	97.1	97.9	**97.4**
RESIDUE NUMBER	10	9	8	7	6	5	4	3	2	1	

†Ninhydrin values for amino acids coupled to proline are not quantitative.



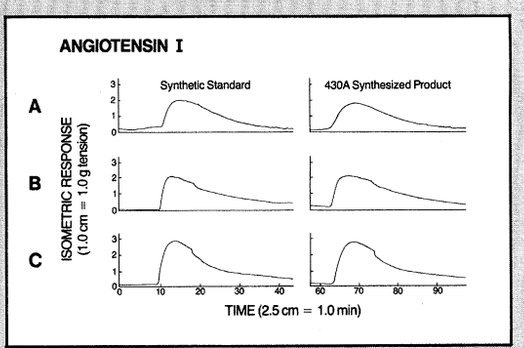
Angiotensin I, Crude

mobile phase	0.1% TFA/CH_3CN
gradient	0 to 60% in 60 minutes
flow rate	1.0 mL/min
detector	216 nm
column	Brownlee, C-8, 300Å, 10μm 4.6 mm x 250 mm



Angiotensin I, HPLC Purified

mobile phase	0.1% TFA/CH_3CN
gradient	0 to 60% in 60 minutes
flow rate	1.0 mL/min
detector	216 nm
column	Brownlee, C-8, 300Å, 10μm 4.6 mm x 250 mm



Panels A, B and C are isometric responses of two different Ile^5-Angiotensin I—a synthetic standard and the 430A-produced, purified peptide—on three separate rabbit aortic strips. The responses produced by the Applied Biosystems Ile^5-Angiotensin I were not significantly different than those of the standard. Sample concentrations were: in panel A, 564 ng/mL; in panels B and C, 500 ng/mL.

These response data were furnished by Drs. M. C. Khosla and A. Husein of the Cleveland Clinic Foundation.

the 430A is the No. 1 Choice.

5 It Produces Superb Long Peptides

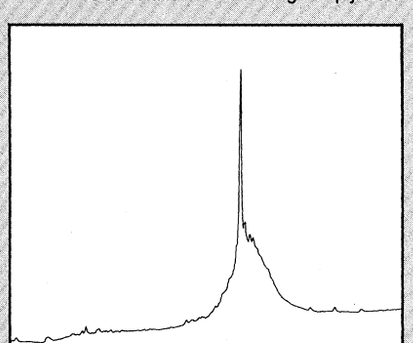
Step Yield (% Coupled) Standard ABI *t*-boc cycles, version 1.0

PEPTIDE SEQUENCE	GLY	GLY	LYS	GLU	SER	ARG	GLY	GLN	GLN	VAL	PRO	PRO	GLY	ASP	ARG	GLN	ALA	GLU	VAL	LEU
Ninhydrin Analysis	99.7	99.8	99.5	99.4	99.2	*99.6	99.4	*99.6	*99.2	98.0	97.0	†99.8	†99.1	98.9	99.0	99.1	98.7	98.6	98.5	98.5
Preview Sequence Analysis	•	•	99.6	99.6	99.5	99.6	99.5	•	•	99.1	•	1	98.9	99.0	99.0	98.6	98.7	98.6	98.5	98.4
RESIDUE NUMBER	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48

LYS	SER	TYR	ASP	PHE	SER	ASP	GLY	SER	GLU	GLU	TYR	GLU	ALA	ASN	LEU	GLU	ALA	ASP	LEU	THR	THR	GLN	ALA	LEU
95.8	97.4	97.2	97.8	98.3	98.3	97.9	96.9	98.5	98.3	98.0	97.1	97.2	98.2	*96.9	98.1	97.7	98.0	98.0	98.2	97.6	95.0	*82.7	96.0	96.1
98.5	98.5	98.5	98.5	98.8	97.9	98.0	97.8	97.0	•	•	98.8	•	99.3	99.3	99.3	98.9	99.1	98.9	93.9	•	•	98.4	99.0	98.1
47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23

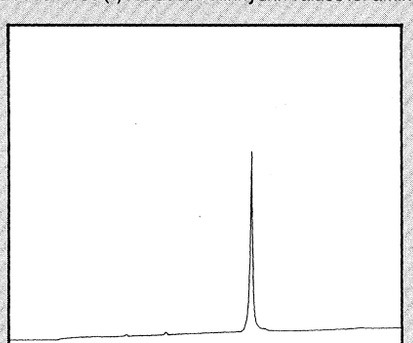
VAL	ARG	ALA	GLN	SER	SER	GLN	ARG	ASN	ARG	SER	SER	SER	SER	SER	ALA	PRO	ARG	SER	SER	SER	NET	AVG. STP. YIELD °o
96.1	*94.9	95.2	*94.6	95.5	95.5	*96.4	*92.5	*92.2	*91.7	93.9	95.0	96.7	96.2	94.5	94.8	94.4	†*95.0	97.2	•	95.9	96.5	***96.9**
98.3	98.5	98.0	96.8	•	•	•	•	97.9	•	•	•	•	•	•	95.2	95.1	97.2	•	•	•	•	**98.9**
22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	

*These are amino acid resin samples from the first coupling of the HOBT ester double couple cycles used for the Arg, Asn and Gln couplings. The calculation of the average step yield excludes these (*) residues. †Ninhydrin values for amino acids coupled to proline are not quantitative.



M-67-G ($CONH_2$), Crude

mobile phase	0.1% TFA/CH_3CN
gradient	0 to 60% in 60 minutes
flow rate	1.0 mL/min
detector	214 nm
column	Brownlee, C-8, 300Å, 10 µm 4.6 mm x 100 mm



M-67-G, ($CONH_2$), Purified

mobile phase	0.1% TFA/CH_3CN
gradient	0 to 60% in 60 minutes
flow rate	1.0 mL/min
detector	214 nm
column	Brownlee, C-8, 300Å, 10 µm 4.6 mm x 250 mm

Met-67-Gly ($CONH_2$) is a 69-residue peptide that is part of a 124k-dalton plant protein, Avena Phytochrome. This peptide is from an area of the Phytochrome protein that has been shown to be essential for complete biological activity. Although sequence analysis suggests the purified product contains minor peptide impurities, initial experiments have shown good peptide binding activity to antibodies made against the native protein. Work is continuing with efforts to map the exact reading frame of these antibodies by using deprotected, resin-bound peptides directly in the antibody binding assays.

This peptide was synthesized for collaborative research with Dr. Peter Quail, University of Wisconsin—Madison.

You Can Prove It for Yourself

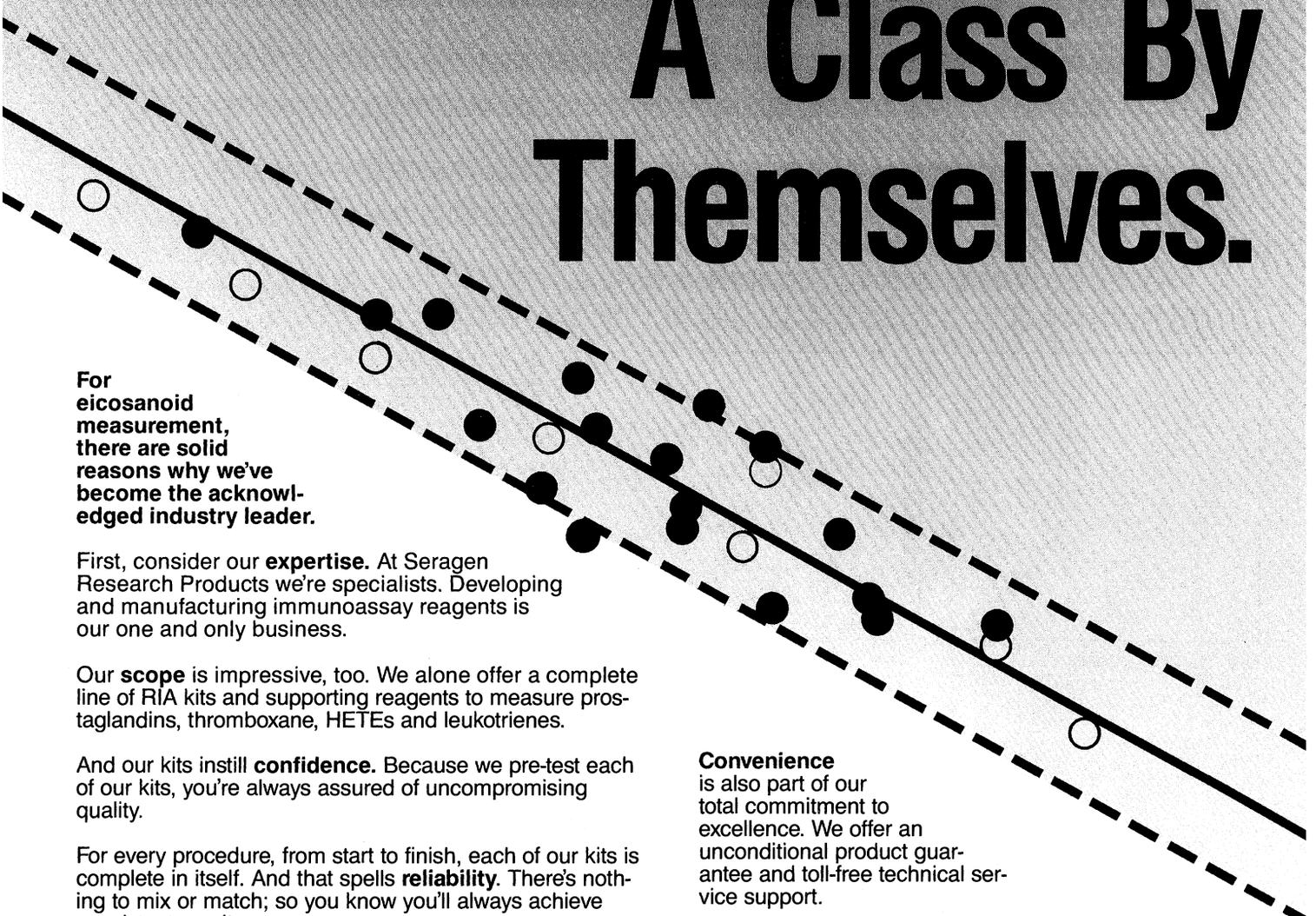
Compare a 430A-synthesized peptide made to *your* specifications (and at a very reasonable price) with what you've been getting so far. The quality will convince you that the 430A is the first choice of more people who make peptides.

For more information, contact Jan Bowen at our U.S.A. office, your local Applied Biosystems Representative, or indicate Reader Service Number 403.

Applied Biosystems

Sales and Service Worldwide: **U.S.A.** 850 Lincoln Centre Drive, Foster City, California 94404, U.S.A., Tel. (415) 570-6667, (800) 874-9868, in Calif. (800) 831-3582, Telex 470052
U.K. Birchwood Science Park, Warrington, Cheshire, U.K., Tel. 925-825650, Telex 629611 • **W.Germany** Bergstrasse 104, D6102 Pfungstadt, B.R.D., Tel. 6157-6036, Telex 4191746
Australia Suite 2, 1401 Burke Road KEW, Victoria, Australia 3101, Tel. (03) 859-9571

By Any Measure, Our RIA Kits Are In A Class By Themselves.



For eicosanoid measurement, there are solid reasons why we've become the acknowledged industry leader.

First, consider our **expertise.** At Seragen Research Products we're specialists. Developing and manufacturing immunoassay reagents is our one and only business.

Our **scope** is impressive, too. We alone offer a complete line of RIA kits and supporting reagents to measure prostaglandins, thromboxane, HETEs and leukotrienes.

And our kits instill **confidence.** Because we pre-test each of our kits, you're always assured of uncompromising quality.

For every procedure, from start to finish, each of our kits is complete in itself. And that spells **reliability.** There's nothing to mix or match; so you know you'll always achieve consistent results.

While other procedures require overnight incubation, ours takes as little as two hours to complete. For your lab, that's **efficiency.** With Seragen RIA kits, time is on your side.

Convenience is also part of our total commitment to excellence. We offer an unconditional product guarantee and toll-free technical service support.

If you feel your current procedures don't measure up, put Seragen RIA kits to the test.

Call today. **1-800-RIA-KITS.**

SERAGEN

Seragen, Inc.
54 Clayton Street
Boston, MA 02122

Circle No. 19 on Readers' Service Card

When there's only one chance there's only one choice: MASSCOMP

For the first time in 4.5 billion years, mankind is finally ready to tackle the mysteries of Halley's Comet.

Some of the most significant data, such as the actual chemical composition of the comet's tail, will lead to a better understanding of the origins of our solar system. MASSCOMP is providing computer technology to better equip scientists as they unlock these secrets.

An MC5500 Micro Supercomputer has been working since late 1985 as the heart of real-time analysis to examine the distribution of solar and cometary particles and how they mix to produce the tail.

Thanks to MASSCOMP's real-time version of the UNIX operating system (RTU)™ and real-time transparent multiprocessing technology, the Johnstone Plasma Analyzer experiment presented critical data to the entire scientific world. In real-time, data from the plasma analysis is separated by the first CPU from the stream of telemetry and stored on disk. The second CPU concurrently calculates plasma moments, yielding information about average particle size, temperature and three-dimensional velocity.

MAXIMUM CPU PERFORMANCE
- 10 MIPS
- 12,000K Whetstones/second
- 13 Mflops
- 4 CPUs

SUPERIOR DATA ACQUISITION CAPABILITIES
- One million samples per second
- Multiple fast busses
- High data throughput
- Real-time UNIX™ operating system

OUTSTANDING SYSTEM FEATURES
- Transparent multiprocessing
- 68020 performance
- Industry standards
- Graphics family
- High reliability
- Low cost: $15,000-$250,000

Write for your FREE copy of MASSCOMP's HALLEY'S COMET APPLICATION NOTES.

When there's only one chance for success, you need all the supercomputing power you can get. MASSCOMP.

MASSCOMP
The Micro Supercomputer Company

One Technology Park, Westford, MA 01886 (617)692-6200

800-451-1824

Circle No. 188 on Readers' Service Card

How to talk to a Mouse.™

The Queue Mouse integrated bioreactor system for fermentation and cell culture.

If you can type your name, you can operate the only system ever developed for both fermentation and cell culture. Control and monitor up to 21 individual variables. Even send the data to a printer or another computer.

Sensitive, precise and easy to use, the Mouse gives you the accurate control and constant monitoring to optimize product yield. And it's expandable with the addition of other parameter/monitor control options.

The user-friendly Mouse.
The Mouse's internal software is pre-programmed and ready to run. All commands are simple and direct – no computer language required. Its benchtop mainframe features a high-resolution video display that lets you scan complete bioreactor performance.

The Mouse™ is a benchtop mainframe with built-in computer, video display and keyboard. Computer printer also available.

From prokaryotic fermentation to eukaryotic cell culture. In batch, fed batch, or continuous culture applications. In hollow fiber, mechanically agitated or airlift bioreactors. If you grow cells or microorganisms to produce a product, the Queue Mouse will be at home in your lab.

For a literature portfolio, or to arrange a demonstration of the remarkable Mouse, call us toll-free at **1-800-334-7070.**

Queue®

Queue Systems, Inc. Box 1901 Parkersburg, WV 26102
1-800-334-7070 In WV 304-464-5400 Telex 869424

Circle No. 44 on Readers' Service Card

Now For DEC MicroVAX II, Prime, IBM OS/TSO.

Get very attractive figures

SPSS* Graphics gives you great looking numbers for a great little number: less than $9,999.

What do you call a menu-driven product that takes data, aggregates it, manipulates it, and turns it into presentation-quality charts, graphs and maps? We call it SPSS Graphics, the most powerful, affordable color graphics package of its kind.

Among its many features, SPSS Graphics gives you access to over 30 basic displays, including pie, bar, line and area charts. You can combine any number of images into a single display. Or change any element of a chart to create a custom display.

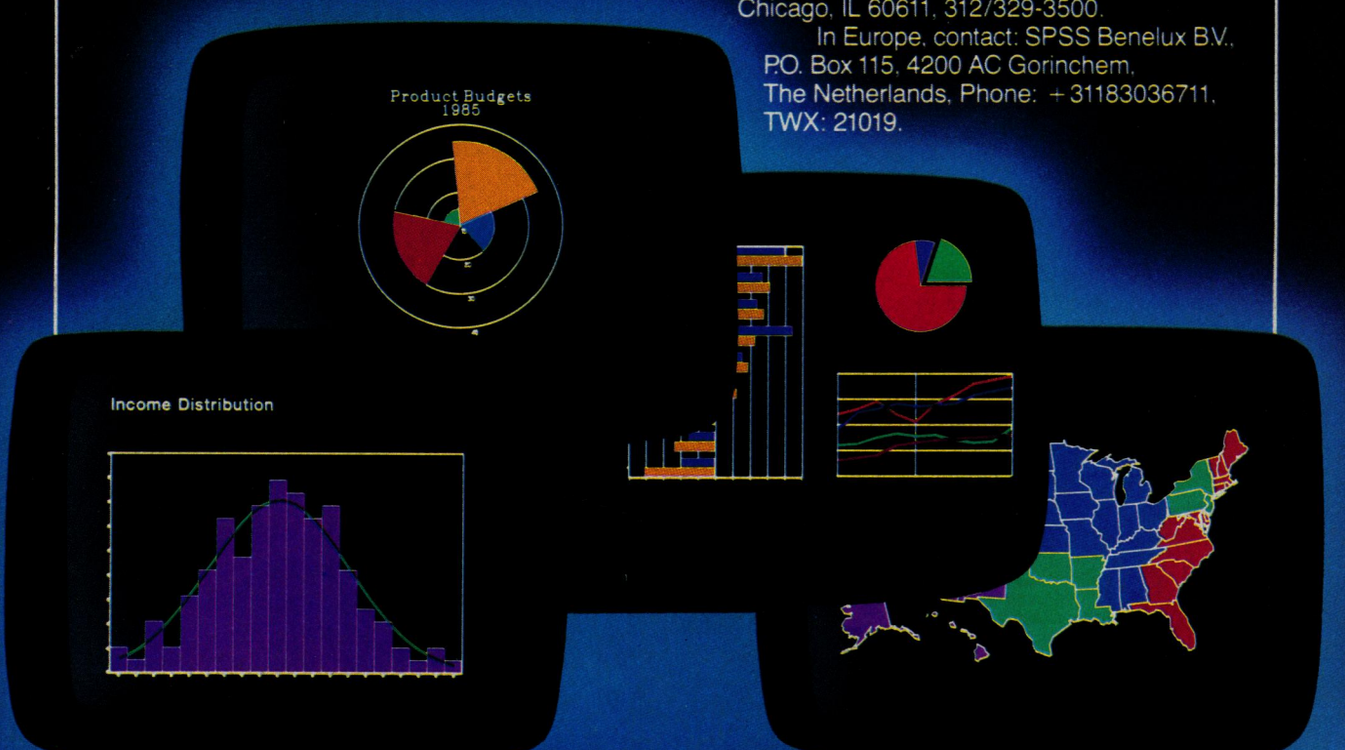
SPSS Graphics also provides two- and three-dimensional maps of all states, counties, Canadian provinces and countries. Lets you generate professional text-only displays. Enables you to enter files ranging from small tables to national survey data. And allows you to use forms and menus to restructure data without leaving the program. Or you can enter data directly from SPSS-X™—the Information Analysis System that's been serving thousands of researchers and analysts for nearly 20 years.

Currently available for IBM CMS and DEC VAX computers, SPSS Graphics is compatible with a wide variety of devices. Input can be entered from many popular terminals, including the IBM PC. And output can be directed to a host of plotters, CRT's, slide makers and PC's.

High impact graphics. Interactive. At an unprecedented price. If you'd like to see how attractive SPSS Graphics can be, call or write the SPSS Marketing Department today.

SPSS Inc., 444 N. Michigan Avenue, Chicago, IL 60611, 312/329-3500.

In Europe, contact: SPSS Benelux B.V., P.O. Box 115, 4200 AC Gorinchem, The Netherlands, Phone: +31183036711, TWX: 21019.



SPSS inc. PRODUCTIVITY RAISED TO THE HIGHEST POWER™

SCIENCE/SCOPE®

Twenty years ago on June 1, Surveyor 1 made the first soft landing on the moon, giving scientists their first close-up look of the lunar surface and blazing a trail for the manned Apollo missions three years later. The three-legged spacecraft, built by Hughes Aircraft Company, landed one second ahead of the originally predicted time and just nine miles from the predicted target point after traveling 240,000 miles. In the following eight months, Surveyor televised 11,150 pictures, photographed the solar corona of the setting sun, made a color composite photo of the lunar surface, and measured the hardness of the lunar surface. By January 1968, four other Surveyors had made soft landings on the moon. They provided detailed scientific information about the physical and chemical character of lunar materials and added immeasurably to the understanding of the physical processes that shape the moon's surface.

Building blocks for what will become an electronics factory of the future are being set in place at Hughes to cut costs in manufacturing airborne radars and other avionics programs. Lasers, fiber optics, remote fiber fluorometry, and advanced optics play a part in an Industrial Modernization Incentive Program (IMIP) contract awarded by the U.S. Navy with Air Force participation. IMIP is a share-the-savings concept to reduce costs of the F-14, F-15, and F/A-18 Hornet Strike Fighter radar programs by more than $10 million, while improving the quality and reliability of the systems. Three projects employing new manufacturing technology focus on solder joint inspection, metal fabrication inspection, and continuous chemical analysis of solutions used in electroplating printed wiring boards.

Military commanders at separate headquarters can share up-to-the-minute information, thanks to a new automated message processing system for Command and Control Information Systems (CCIS). The system, developed by Hughes, handles a wide range of formatted and unformatted messages as specified in the Joint US/NATO military reporting system. It will dramatically lessen the time needed to update planning, intelligence, and force status information in command and control systems. The system can receive messages over a variety of digital links. Messages can be drawn automatically from complex relational databases, or be used to update information automatically. Information can be displayed on screens in a variety of formats, and be modified by commanders.

An advanced binocular system turns night into day for military pilots flying nap-of-the-earth missions in helicopters. The Aviator's Night Vision Imaging System (ANVIS) is a helmet-mounted binocular that intensifies nighttime scenes illuminated only by faint moonlight or starlight. It uses advanced optics and molded mechanical components to offer high performance in a rugged, lightweight package. The optical system incorporates precision aspheric elements to provide high resolution and reduced complexity. Molded mechanical parts employ high-strength anti-friction plastics for smooth mechanical operation. Hughes Optical Products, a Hughes subsidiary, builds ANVIS for the U.S. Army.

An ultramodern facility spanning 1.75 million square feet is the showcase where outstanding Hughes engineering combines advanced manufacturing techniques and production processes. Our complex is complete, so we're looking for experienced and graduating engineers to work on such programs as infrared thermal imaging systems, laser rangefinders and designators, artificial intelligence, signal processing, VLSI, component qualification, hybrid microcircuitry, and focal planes. Send your resume to Hughes Electro-Optical and Data Systems Group, Professional Employment, P.O. Box 913, E8/G101, Dept. S2, El Segundo, CA 90245. Equal opportunity employer. U.S. citizenship required.

For more information write to: P.O. Box 45068, Los Angeles, CA 90045-0068

HUGHES
AIRCRAFT COMPANY

Subsidiary of GM Hughes Electronics

SCIENCE, ARMS CONTROL, AND NATIONAL SECURITY FELLOWSHIPS

AAAS Invites Applications

The American Association for the Advancement of Science invites applications for two Science, Arms Control, and National Security Fellowships. Fellows will select a term of either 8 months or 1 year to begin on January 1, 1987.

The Fellowship program will provide a unique opportunity for outstanding postdoctoral to mid-career scientists and engineers to participate directly in the policy-making process in the area of arms control and national security. Fellows will work in appropriate executive branch agencies of the federal government, congressional committees or support agencies, or nonprofit institutions in Washington, DC.

The AAAS will guide the placement process, provide an informative orientation program, and coordinate frequent seminars on a variety of topics related to arms control and national security.

The 1987 Science, Arms Control, and National Security Fellows will receive a stipend of up to $30,000 ($20,000 for an 8 month term) and a nominal relocation and travel allowance. Applications are invited from candidates in any area of the physical, biological, or behavioral sciences; science-related professions; or engineering. Minority and handicapped candidates are especially encouraged to apply.

For application requirements and additional information, contact:

Dr. W. Thomas Wander, Senior Program Associate
Science, Arms Control, and National Security Fellowships
American Association for the Advancement of Science
1333 H Street, NW, Washington, DC 20005

THE DEADLINE FOR THE RECEIPT OF ALL APPLICATION MATERIALS IS JUNE 30, 1986.

NIH PROGRAM FOR DEVELOPING TREATMENTS FOR ACQUIRED IMMUNODEFICIENCY SYNDROME

The National Cancer Institute and the National Institute of Allergy and Infectious Diseases of the National Institutes of Health, Bethesda, MD, have jointly organized an AIDS Drug Selection Committee to review and facilitate the development (testing) of possible treatments for AIDS. This committee is constituted to review suggestions submitted for treatment of AIDS patients and, in certain cases, to recommend appropriate pre-clinical and clinical research or further development. Interested parties who have synthetic or natural substances known to inhibit the growth of the retrovirus known to cause AIDS, or which may preserve or augment the immune status of infected persons, are encouraged to share this information. The committee will hold information of a proprietary nature in the strictest confidence. Detailed proposals should contain the following information:

1. The precise nature and composition of the substance or, if proprietary, a willingness to reveal that information to a closed session of the AIDS Drug Selection Committee.
2. Data regarding the substance's or substances' known biological, chemical, physical or physiological properties.
3. Data regarding the *in vitro* activity of the substance or substances such as to suggest that it might be active against the virus associated with AIDS, or function as an immunomodulator.
4. Data from animal studies, if any, indicating its safety, tolerance, and efficacy in conditions possessing some similarities to AIDS.
5. Data from human studies, if any, indicating its safety and tolerance.
6. A statement of willingness, if any, by an organization to supply material or to cooperate in the preparation of adequate amounts of material for study purposes.

Proposals should be submitted in writing to:

Eddie Reed, M.D.
Executive Secretary
AIDS Drug Selection Committee
Bldg. 31, Room 3A49
9000 Rockville Pike
National Institutes of Health
Bethesda, MD 20892

ACADEMIC RESEARCH ENHANCEMENT AWARD

Academic Research Enhancement Awards (AREAs) provide funding for feasibility studies, pilot studies and other small-scale research projects. Awards are made in amounts of up to $50,000 in direct costs (plus applicable indirect costs) for periods not to exceed 24 months.

Eligibility Requirements

1. Applicant Institutions
   (a) Must be a domestic institution offering baccalaureate or advanced degrees in the sciences related to health.
   (b) Have received an NIH Biomedical Research Grant (BRSG) in no more than three of the six fiscal years from FY 1981 through FY 1986.
2. Applicant Principal Investigators
   (a) Must not have active research grant support (including an AREA) from either NIH or the Alcohol, Drug Abuse and Mental Health Administration (ADAMHA) at the applicant institution at the time of award of an AREA grant.
   (b) May not submit a regular NIH or ADAMHA research grant application for essentially the same project as a pending AREA application.
   (c) Are expected to conduct the majority of their research at their own institution, although limited access to special facilities or equipment at another institution is permitted.
   (d) May not be awarded more than one AREA grant.

Award Criteria

Funding decisions are based on the research project's scientific merit and relevance to NIH programs, and the institution's contribution to the undergraduate preparation of doctoral-level health professionals. Among projects of essentially equivalent scientific merit and program relevance, preference will be given to those submitted by institutions that have granted baccalaureate degrees to 25 or more individuals who, during the period 1977–1986, obtained academic or professional doctoral degrees in the health related sciences.

APPLICATION RECEIPT DATE
September 22, 1986

Anticipated Number of Awards: Up to 75 grants

For information and application materials, contact:

Office of Grant Inquiries
Division of Research Grants
National Institutes of Health
Westwood Building, Room 449
Bethesda, Maryland 20892
(301) 496-7441

Eppendorf pipettes: filling every need.

Over 25 years ago, Eppendorf revolutionized liquid handling procedures by introducing the first mechanical-action pipette. Since then, we've developed a full line of high-quality instruments that include fixed-volume pipettes, continuously adjustable pipettes, and our new technologically advanced Ultra Micro series. From micro to macro samples, from routine quality control to pure research, there's an Eppendorf pipette for you.

New "Ultra Micro" Pipettes. Now, 0.5 µL is available as part of a series of newly designed, technologically advanced air-displacement pipettes that provide superior performance compared to conventional models. Easy-to-replace disposable tips eliminate carryover and are more convenient to use than positive-displacement systems. Five models available, including a continuously adjustable Digital Pipette, ranging from 0.5 to 10 µL.

Digital Pipettes™. Continuously adjustable, with direct digital display of the set volume to assure precise, reproducible results every time. The "click-set" ratchet mechanism locks your choice in place, practically eliminating accidental changes. Four models ranging from 0.5 to 1000 µL, with increments of 0.1 or 1.0 µL.

Maxipettor™. One pipette replaces conventional transfer and serological pipettes. Continuously adjustable setting lets you change volumes from 1 to 10 mL. Digital display of selected volume to 0.01 mL assures exact results; disposable tips maximize safety and accuracy by eliminating carryover. Two types of tips—air displacement (Maxitip "L") and positive displacement (Maxitip "P")—are available, in sterile and nonsterile packaging.

Fixed-Volume Pipettes. The laboratory standard for precise, accurate pipetting. Available with or without tip ejector, Fixed-Volume Pipettes cover a range of 1 to 1000 µL with a choice of 30 preset volumes.

Tri-Volume Pipettes. Tri-Volume Pipettes are adjustable to three different settings, so each is really three pipettes in one. Volume selection is simple and foolproof. Six models, with volume selection from 10 to 1000 µL, are available, all with built-in tip ejector and maintenance-free seals.

Disposable Tips. Eppendorf disposable tips are made of high-quality polypropylene and provide an airtight fit for the pipette to assure reliable delivery from first drop to last. Tips are available in bulk, tray-mounted, or sterile packaging: yellow Flex-Tips™* and clear, metal-free tips for volumes from 1 to 100 µL, blue tips for volumes from 101 to 1000 µL, and new Ultra Micro Tips for newly designed Ultra Micro Pipettes.

*U.S. Pat. No. 4072330

For literature, write: Brinkmann Instruments Co., Division of Sybron Corporation, Cantiague Road, Westbury, NY 11590, or call 800-645-3050; in New York, 516-334-7500. In Canada: 50 Galaxy Blvd., Rexdale, Ont. M9W 4Y5, or call 416-675-7911.

For literature circle reader service number 154
For a demonstration circle reader service number 155

eppendorf

BRK-5234

Brinkmann
DIVISION OF
SYBRON

NEW PRODUCT NEWS FROM HOEFER

Hoefer's new incubation units minimize reagent costs

To its line of vertical slab units and transfer units in both standard- and small-gel formats, Hoefer Scientific has added standard- and small-size incubation units for use with Western, Northern and Southern blots. These new units are designed to make membrane incubation as trouble-free as possible and to use minimal amounts of costly reagents.

• **Hoefer's PR 200 Deca-Probe™** is a ten-chamber microincubator for standard-size membranes (15 x 15 cm). Using the Deca-Probe it is possible to incubate 10 separate immunotransfers on a single transfer membrane—*without cutting the membrane into strips.* After incubation, the membrane will be intact, for easy, side-by-side comparison of sample lanes.

The precisely engineered Deca-Probe has a simple design. Two sturdy 19 x 19 cm acrylic plates fit together with a blotted membrane between them. Parallel troughs milled into one of the plates become individual incubation chambers when the plates are placed together and sealed. The 10 troughs match exactly the sample lanes of a special 10-well comb (PR 511) for use in Hoefer's standard-size vertical slab units. The Deca-Probe has double protection against leakage from one chamber to another: O-ring gaskets surround each chamber and a flat sheet of silicone rubber underlays the membrane. Another O-ring fits around the perimeter of the unit. Plastic Allen screws hold the unit's two plates together and seal all gaskets.

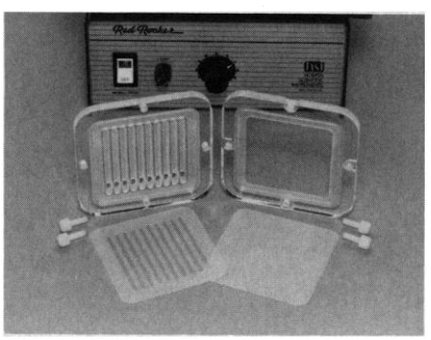
At the end of each of Deca-Probe's 10 chambers, a small oval port allows introduction and removal of reagents. All that's needed is just enough solution to wet the membrane and to allow for mixing when the unit is rocked—about 2-3 ml per chamber.

• **The PR 350 16-Well Incubation Tray** is an economical unit made of sturdy acrylic, for incubating strips from standard-size blotted membranes. To make the unit as convenient as possible to fill, empty and wash, wells in the PR 350 are spaced to accept 8-channel pipette and washing accessories.

The PR 350's wells are 16 cm long by 7 mm wide and require only about 5 ml of solution each. To keep wet membrane strips from sticking to the bottoms of wells, bottoms are slightly rounded. And to facilitate removal of strips after incubation, the end of each well is tapered so that forceps can slip right in under the end of a strip. A plastic tray lid is available as an option.

• **Hoefer's PR 300 Mighty Small Incubation Tray,** with 24 wells, is ideal for minimum-cost incubation of large numbers of short transfer strips. Wells in the PR 300 are 9 cm long and 7 mm wide. The amount of solution required in each well is only about 1.0 ml. Wells are spaced to accept 8-channel pipette and washing accessories.

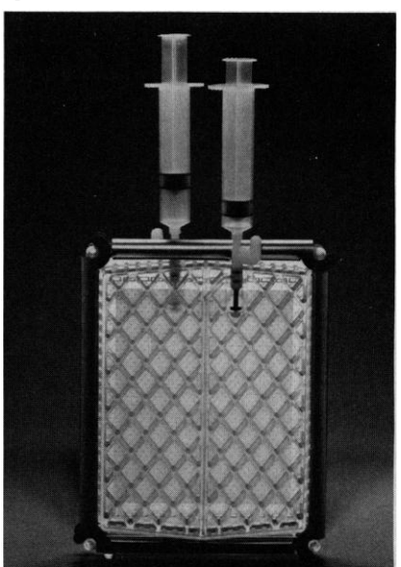
• **The PR 150 Mighty Small™ Deca-Probe** is an accessory in Hoefer's small-gel format line of products. Researchers running gels in the Hoefer Mighty Small I and II 7 x 8 cm vertical slab units and transferring to 8 x 8 cm membranes in the Mighty Small Transphor,® will find the Mighty Small Deca-Probe ideal for incubating those membranes intact. A slotted silicone rubber gasket seals the unit's inner chambers and a flat silicone rubber sheet seals the perimeter.



Solutions in the Mighty Small Deca-Probe are easy to introduce and withdraw through the oval port at the end of each chamber. Reagent requirements are extremely low—as little as 0.50 ml per chamber.

• **The PR 800 Hybrid-Ease™** hybridization chamber is Hoefer's new unit for high-resolution Northern and Southern blot analysis. Once a blotted membrane is in place in the Hybrid-Ease and the unit is closed, it is possible to perform all steps of the hybridization process — prehybridization, hybridization, stringency washing—without opening the unit again. Solutions wash evenly over all parts of a membrane, resulting in membranes that are free from artifacts.

Molded of polysulfone, the Hybrid-Ease is a safe, sturdy, leakproof unit that uses small amounts of solutions introduced and withdrawn through syringes, to cut down on radioactive waste and risk of spills. Syringes make possible nearly quantitative recovery of probe.



• **The PR 50 Red Rocker** rocking platform (shown above), the *PR 70 Red Rotor* orbital shaker, *pure nitrocellulose membranes,* three types of *nylon membranes* and *reagents* for immunodetection and protein staining are also available from Hoefer.

• **Hoefer Scientific Instruments,** P.O. Box 77387, San Francisco, CA 94107 USA. Phone: 800-227-4750; in California, 415-282-2307. Telefax: 415-821-1081. Telex: 470778.

For more information and literature Reader service card no. 122