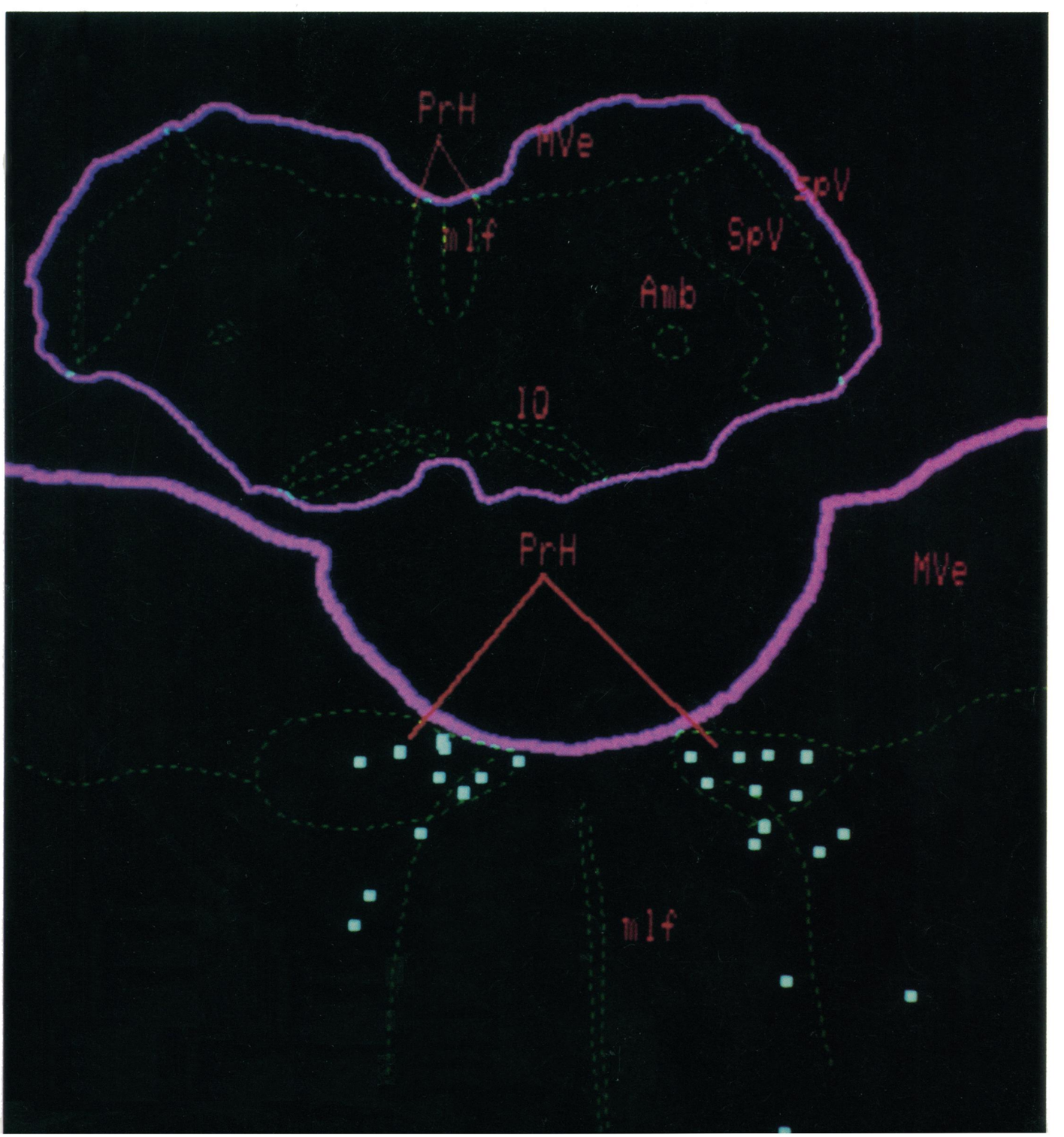
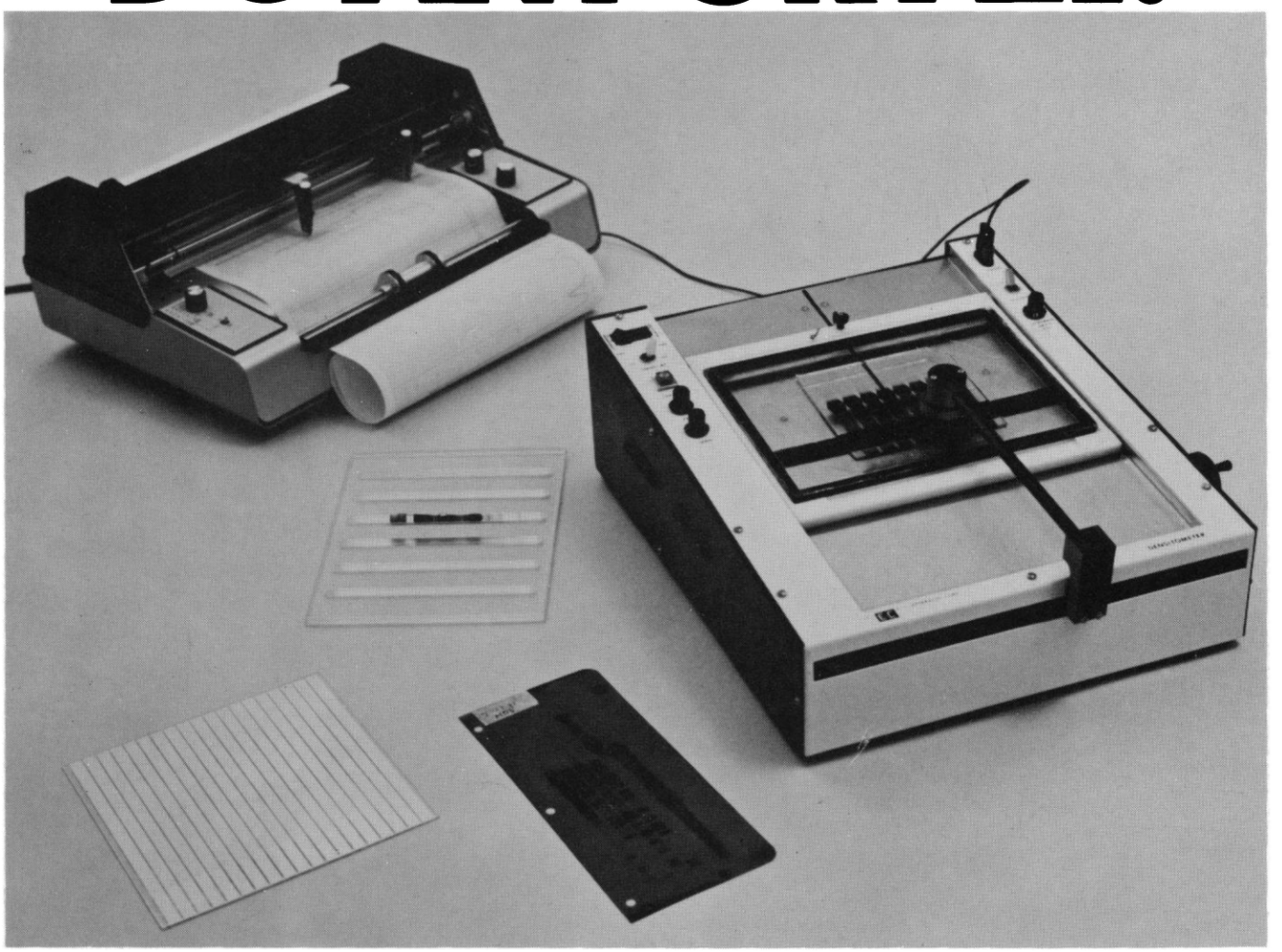
American Association for the Advancement of Science

SCIENCE

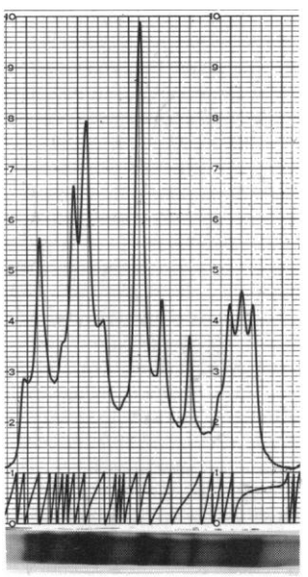
7 November 1986 $2.50
Vol. 234 ■ Pages 649–788



DO ANY OR ALL!



Autoradiograms, TLC plates, electrophoregrams. With one E-C Densitometer, do any or all!



Scan and integration of DNA sequence autoradiogram.

The EC 910 Transmission Densitometer offers the most versatility at the lowest cost of any densitometer scanning in the visible light range. Only $1695* complete with electronic integrator, dielectric filter, and the support medium template of your choice.

With it you can scan and integrate *intact* gel slabs and columns, X-ray film, cellulose acetate and chromatography strips, and other patterns on selected support media. Scanning area 18cm X 25cm eliminates need for cutting.

Interchangeable light slits and optical filters enable precise quantitation regardless of stain characteristics.

Compatible with all millivolt recorders, the EC 910 Densitometer is lightweight, compact, and takes little bench space. Reliability assured by solid state electronics.

Like more information? Call E-C Technical Service toll-free at 1-800-624-2232 (in Florida, 1-800-282-7932).

E-C Apparatus Corporation

3831 Tyrone Blvd. N., St. Petersburg, Florida, 33709
813-344-1644 Telex 51-4736 HALA

E-C

*Recorder additional but calibrated with Densitometer if ordered at the same time.

8E-9103R1

Circle No. 96 on Readers' Service Card

THEY'RE HERE! FREE! 1987 Handbooks & Encyclopedias

Get Yours Now!

OMEGA®
ENGINEERING, INC.

(203) 359-1660

One Omega Drive, Box 4047
Stamford, CT 06907

Circle No. 12 on Readers' Service Card

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE

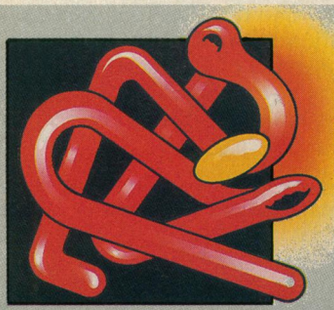
ISSN 0036-8075
7 NOVEMBER 1986
VOLUME 234
NUMBER 4777

■ **SCIENCE is published weekly on Friday, except the last week in December, and with an extra 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. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of $1 per copy plus $0.10 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 $1 + .10. **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.

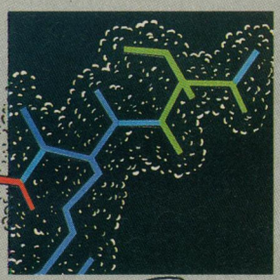
COVER A video computer-aided plot (Nikon/Joyce-Loebl Magiscan) made over an enhanced video image of a brain section containing retrogradely labeled neurons (white squares) in the rostral medulla after an injection of wheat germ agglutinin-conjugated horseradish peroxidase into the locus coeruleus. Low- (upper) and high-power (lower) views of the same section are given for orientation. See page 734. [M. Shipley, University of Cincinnati Medical College, Cincinnati, OH 45267; and G. Aston-Jones, Washington Square Center for Neural Science, New York University, New York, NY 10003]

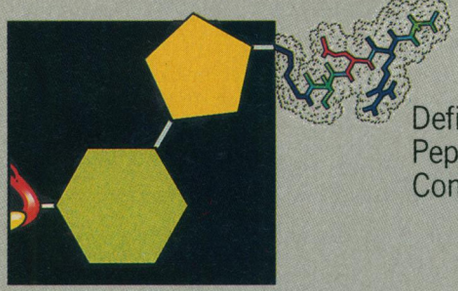
Custom Peptides and Antisera...



Antigenic Determinant Prediction

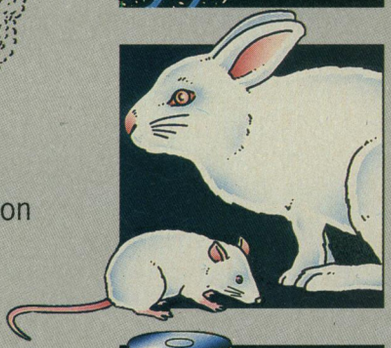
Optimised Peptide Synthesis

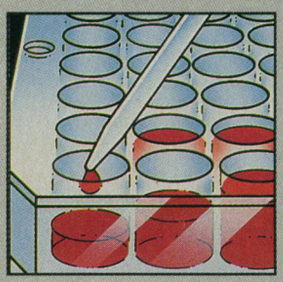




Defined Peptide-Carrier Conjugation

Efficient Antisera Production





Characterisation of Antisera

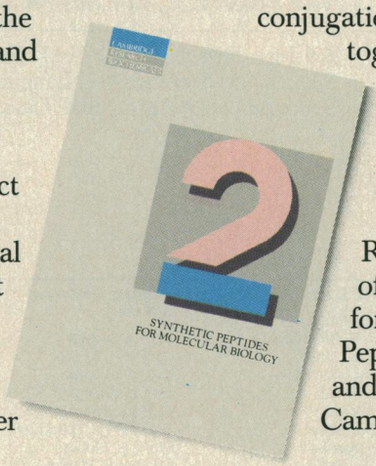
Custom Peptides and Antisera

...the Complete Service.

An expanded custom service for the rapid production of synthetic peptides and antipeptide antibodies is now available from the specialists in peptide research, Cambridge Research Biochemicals.

Developed to meet all your project needs, this confidential service includes hydropathic analysis to identify potential antigenic determinants and the efficient Fmoc-polyamide synthesis of selected peptides which are subsequently fully characterised.

Employing defined peptide-carrier conjugation and optimised immunisation protocols together with the assay of sera for anti*peptide* activity, the Cambridge Research Biochemicals custom service provides you with a unique product of the required pre-determined specificity.



Contact Dr Paul Sheppard, Contract Research Director, now for further details of this exciting new service or simply send for a free copy of the new 'Synthetic Peptides For Molecular Biology' brochure and discover how we produce the best at Cambridge.

CAMBRIDGE
RESEARCH
BIOCHEMICALS

UK. Cambridge Research Biochemicals Ltd., Button End, Harston, Cambridge, CB2 5NX, England. Tel: Cambridge (0223) 871674. Telex: 817694 CRB LTD G. Fax: 0223 872381
USA. Cambridge Research Biochemicals Inc., PO Box 58, 2005 Park Street, Atlantic Beach, New York 11509, USA. Toll free Tel: (800) 327 0125. Telex: 971398. Fax: 516 239 2782

Circle No. 45 on Readers' Service Card

This Week in
SCIENCE

Complex surface interactions

How can immune complexes (antibody plus antigen) bind to receptors on cell surfaces and trigger such wide-ranging responses as the release of soluble factors, the activation of cells, and the killing of pathogens (page 718)? Ravetch *et al.* studied the DNA from mouse lymphocytes that encodes receptors for immune complexes containing the IgG2b and IgG1 immunoglobulins; macrophages had the same gene and a second one encoding such receptors. Receptor molecules had an extracellular domain, a transmembrane domain, and a cytoplasmic domain. Extracellular domains encoded by the two genes were almost identical, but the other domains were different. When immune complexes bind to what appear to be identical receptors on diverse cells, different responses can be elicited because the signals sent along the transmembrane and cytoplasmic domains to the cell's interior would differ.

Quaking Pacific region

If the pattern of the past half century continues, sometime between mid-1993 and the end of 1996 a mainshock earthquake will occur in the sparsely populated Kaoiki region of the island of Hawaii; this region has had a mainshock earthquake of magnitude 5.5 to 6.6 roughly every 10.5 years since 1930 (page 726). The Kaoiki region is situated between two volcanic summits, Mauna Loa and Kilauea, in which crustal expansion occurs. As magma rises in narrow conduits under the volcanoes and intrudes into the rift zones, stress accumulates in the crust; both strike-slip and thrusting motions have characterized Kaoiki earthquakes. Wyss suggests that the predicted timing of the next mainshock may be further refined if precursory signs can be better defined; for example, the most recent active period (in 1983) was preceded by a 2.4-year quiescence period. The model developed from the Kaoiki pattern of earthquakes may be applicable for predicting earthquakes elsewhere in the world where similar tectonic features are found.

Porphyrin defect

A serious disease of infants called hepatoerythropoietic porphyria (HEP) can occur as a result of a change in a single base in the gene that encodes the enzyme uroporphyrinogen decarboxylase (UD); the change makes the enzyme extremely unstable (page 732). Symptoms of HEP include photosensitivity, blisters, tissue destruction, overgrowth of hair, and red-colored urine; it develops in homozygous infants whose parents each carry one defective gene for the enzyme. De Verneuil *et al.* cloned complementary DNA from a porphyria patient and compared the base sequence with that of the gene for normal enzyme. Only one substantive mutation distinguished the two; the mutation led to replacement of the amino acid glycine with glutamic acid at position 281 in the defective protein molecule. Both proteins were then made in vitro; the protein encoded in the patient's gene was extremely unstable in the presence of cell lysates, but the normal enzyme molecule showed no degradation. How widely this single base change occurs and whether it accounts for all cases of HEP and for other forms of porphyria in which UD is defective must still be evaluated.

Locus coeruleus revisited

The locus coeruleus (LC) of the brainstem, the major source of noradrenergic innervation for the brain, receives input mostly from two regions in the brain's rostral medulla, the prepositus hypoglossi and the paragigantocellularis (a region implicated in the processing of polysensory, painful, and autonomic stimuli) (page 734). Only minor input comes from two other areas, and no innervation comes from several regions previously thought to send LC signals. This significant redefinition of the LC's neurologic circuitry is described by Aston-Jones *et al.*, who used electrophysiology and sensitive anatomic tracing techniques. When retrograde labeling defined fewer afferent connections than expected, anterograde labeling was carried out from regions previously identified as providing input to the LC; some anterograde tracer was transported to structures near the LC but not into the LC. The LC has been implicated in a range of behavioral functions (vigilance, emotions) and in the etiology of depression, Alzheimer's dementia, and other mental disorders. Its output is widespread throughout the central nervous system. Definition of its roles in brain functioning and behavior depends on precise determinations of the circuitry regulating its activity.

Pertussis toxin, LPS, and G proteins

Bacteria and their hosts have uneasy combative relations (page 743). Bacterial substances can activate cells of the immune system, and these cells often can mount effective immune responses against the bacteria. One bacterial substance, lipopolysaccharide (LPS), readily activates both B cells and macrophages. Another bacterial product, pertussis toxin, secreted by the agent that causes whooping cough, is a potent toxin for the host; it may disarm the immune response elicited by LPS. Previous biochemical studies suggested that pertussis toxin and LPS each might interact with the G proteins that mediate transmembrane signals. Jakway and DeFranco demonstrate that pertussis toxin can inhibit activation of macrophage and B tumor cell lines by LPS and that modification (and presumably inactivation) of G proteins by pertussis toxin was complete. It is thus likely that LPS activation includes a crucial interaction with G proteins. The molecular steps in maturation and responsiveness of immunologically sensitive cells will become clearer as more signal substances participating in these processes are identified.

Introducing....
SEPRACELL-MN

The most advanced technology in mononuclear cell separation from whole blood.

You demand performance and quality in the products used in immunology today. Yet, density media products for lymphocyte separation provided few choices in performance and quality—until now.

Sepracell-MN is a colloidal silica based medium for the separation of mononuclear cells from whole blood by *continuous* density gradient centrifugation.

PERFORMANCE

80% lymphocyte recovery	75% lymphocyte purity
98% viability	20% monocytes

QUALITY

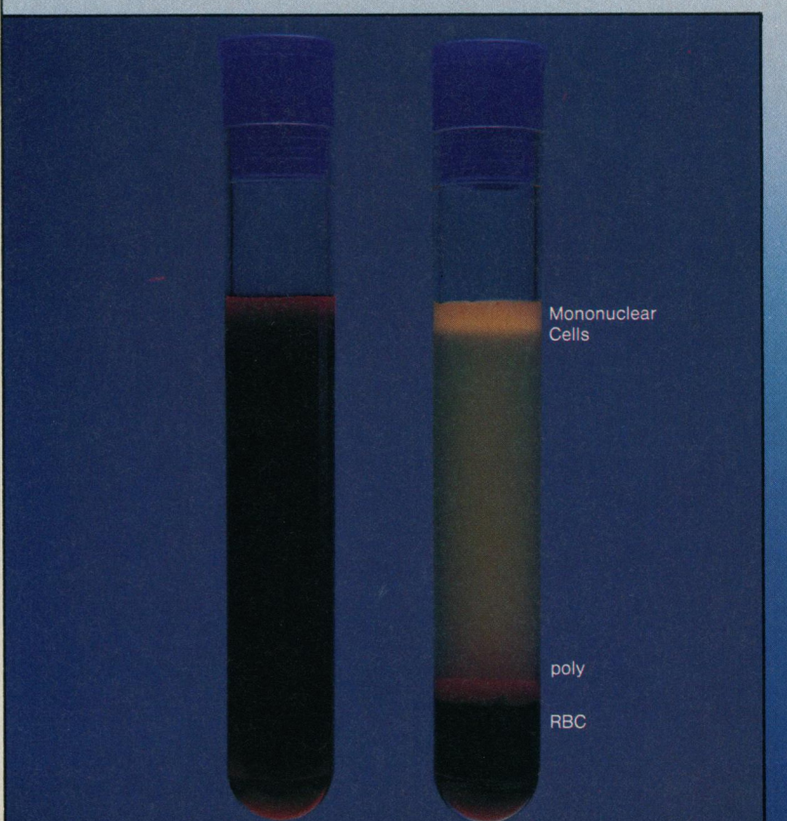
Sepracell-MN is sterile and non-toxic for functional studies. Results are included with each lot for lymphocyte recovery, purity, T and B cell ratios, and mitogen response.

CONVENIENT

Available in prepackaged racks of 50 sterile centrifuge tubes for whole blood separation.

ECONOMICAL

Prepackaged sterile tubes eliminate waste of separation media and use of expensive sterile centrifuge tubes. Quick separations and consistently greater lymphocyte recoveries reduces the time, blood, and supplies required for lymphocyte separations.



Sepracell-MN mixed with whole blood

Banding pattern after centrifugation (2,000 x G 10 min.)

Easy to use

No layering or dilution of blood. Just add whole blood (up to 6 mls.) to the prepackaged tube, mix and spin for 10 minutes.

CALL TOLL FREE
1-800-222-0924 for Free Samples (10 prepackaged tubes).
1-800-222-0924 for Ordering
1-800-222-0956 for Technical Assistance

Compare performance and quality.

SEPRATECH CORPORATION
Oklahoma City, Oklahoma, USA 73127

For in vitro diagnostic use. Patent Pending.

Circle No. 33 on Readers' Service Card

SCIENCE

7 NOVEMBER 1986
VOLUME 234
NUMBER 4777

The International Geosphere-Biosphere Program

Continuing and increasing concern about possible anthropogenic influences and other factors that determine habitability of the earth has led to initiation of a decades-long international program by the International Council of Scientific Unions (ICSU). Authorization of the International Geosphere-Biosphere Program (IGBP) occurred at ICSU's 21st General Assembly in Berne, Switzerland, 14 to 19 September 1986. The International Council of Scientific Unions is one of a number of organizations fostering this program,* and it has limited financial resources. However, when a global scientific effort is to be made, ICSU is the best today to coordinate the effort. It has the necessary convening power and prestige to elicit cooperation of leading scientists of countries of the East and the West, the North and the South. The objectives of IGBP are "to describe and understand the interactive physical, chemical and biological processes that regulate the total Earth system, the unique environment it provides for life, the changes that are occurring in that system, and the manner by which these changes are influenced by human actions." What makes these objectives approachable is the existence and potential existence of enormously powerful new instrumentation coupled with data-handling systems, computational power, and models to be tested.

Thomas Malone reminds us that "the emerging capabilities of remote sensing from satellites are making possible global synoptic measurement of . . . the surface temperature of the earth to an accuracy of 1°C; the global distribution of atmospheric clouds, ocean waves, currents, and eddies; the extent of ice on both sea and land; the mean chlorophyll density on land and in the ocean surfaces; and global patterns of agriculture and forests."*

Geophysicists have taken a leading role in the formulation of the program. However, they realize the importance of biological processes in determining global conditions. For example, enhanced production of methane by methanogenic organisms is influencing ozone content of the atmosphere. Careful measurements of production of gases at biomes will produce important information. Satellite measurements of vegetation and chlorophyll content of marine organisms require calibration and interpretation.

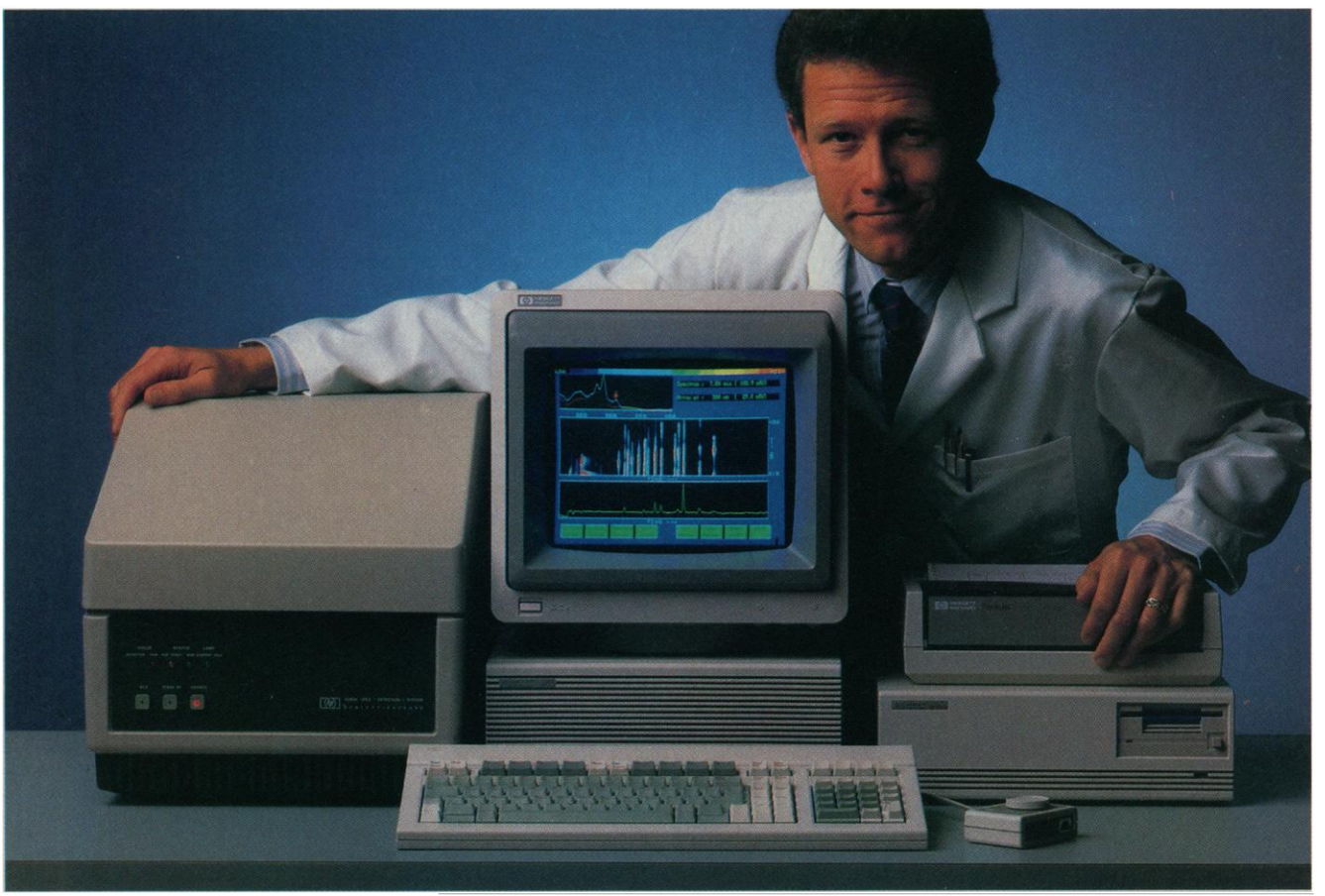
The program will include observations that extend from the sun to the interior of the earth. The study of the sun will include observations at many wavelengths. Variations in solar radiation striking the earth are thought to have had a key role in great climatic changes such as the ice ages. Thus one of the difficulties of detecting and measuring a greenhouse effect is uncertainty about variations or trends due to changing relationships between the sun and the earth.

It is accordingly particularly desirable to continue to examine evidence of prehistoric environmental changes. The global changes in the past half-million years were far larger than anything seen in historic times and may have been more rapid. Sea level fluctuated more than 100 meters during the transition from eras that were warm and wet to those that were cold and dry. The indicators of change or objects to be studied include global ice volume, tree-ring widths, ice cores, and isotope and chemical ratios in lake and ocean sediments.

The likelihood is that the International Geosphere-Biosphere Program will begin slowly during a continuing planning stage as various countries decide how they will participate. During the early phases the National Science Foundation will be a key supporter of U.S. activity related to the program. Eric Bloch, director of NSF, has announced an effort in Global Geosciences for fiscal year 1987 that includes global tropospheric chemistry, global ocean climate, global ocean flux, global ecosystem dynamics, oceanic ridge crest processes, and a global digital seismic network. Other U.S. agencies such as NASA and NOAA will participate and more intensively later. In any event, the United States is beginning fast. It cannot alone carry out a global program, but its commitment and example will not be lost on others.—PHILIP H. ABELSON

*T. F. Malone, *Environment* **28**, 6 (1986).

Resourceful.



The HPLC detection system for interactive problem-solving.

Maybe you're like Richard, who works in an analytical lab running samples for both R&D and manufacturing. Sometimes he has to be pretty resourceful.

Using equipment from a variety of manufacturers, Richard has configured each of his six HPLC systems for a special type of analysis.

For maximum confidence in his quantitative results, his HP 1040M diode-array detection system is an important part of his lab. And he can move it from one HPLC to another—wherever it's needed most.

This new detection system provides the sensitivity and qualitative information Richard requires for both his R&D and quality control work. It gives him the resources he needs to check suspicious peaks for purity and identity. Fast color graphics make it easy.

Interactive software allows him to store spectral data and evaluate it in a variety of ways without rerunning his samples—an invaluable feature, particularly when his time or sample is limited.

Whether your needs are similar to Richard's or very different, there's an HP system to match your requirements. Exactly.

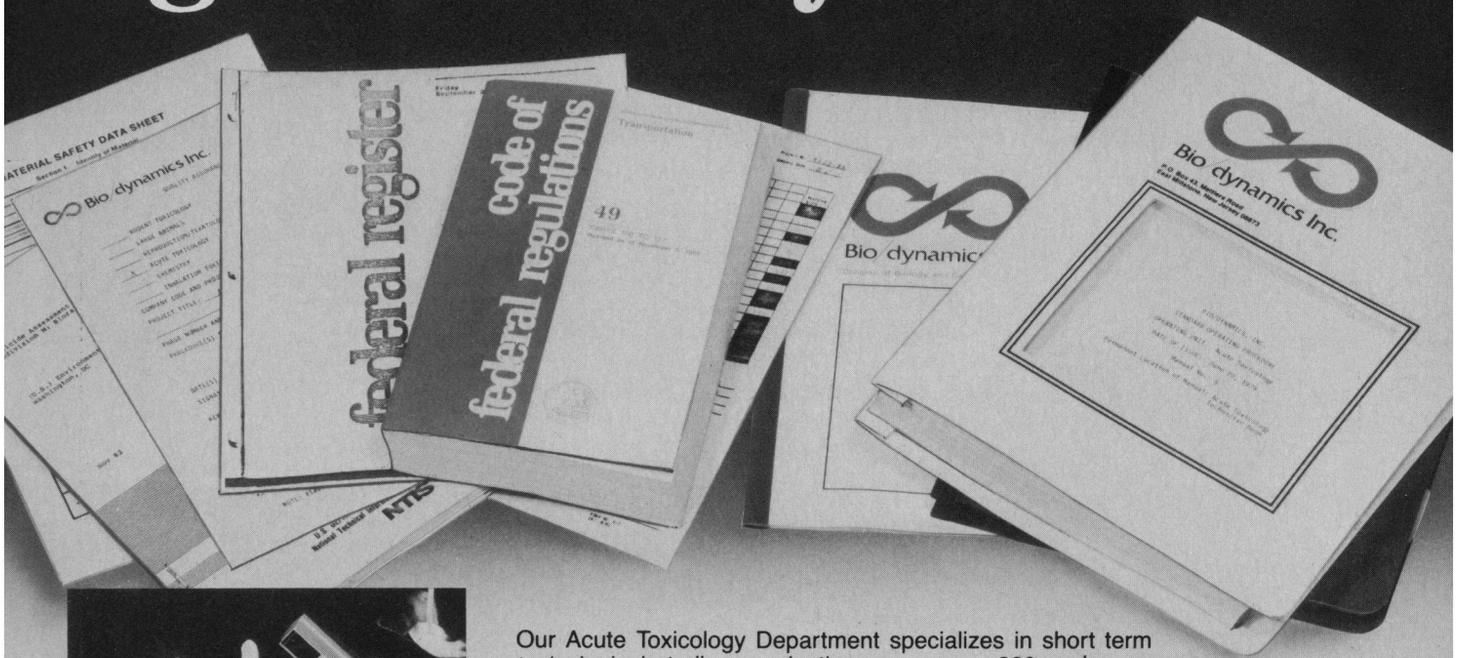
For more information, call the HP office listed in your white pages and ask for an analytical product representative. Or write Hewlett-Packard Analytical Group, 1820 Embarcadero Road, Palo Alto, CA 94303.

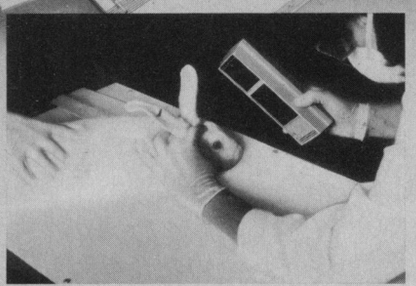
HEWLETT PACKARD

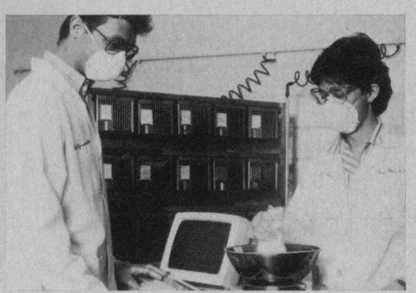
AGO4515

For literature circle reader service number 97
To have an HP Representative contact you circle reader service number 98

If safety evaluation is your responsibility, we're here to help you get the data you need.







Our Acute Toxicology Department specializes in short term toxicological studies, conducting as many as 800 each year.

We supply the data for such things as MSDS sheets, PMN's, FIFRA registration, product labeling, employee protection, OSHA compliance and DOT classifications. Our capabilities also include preliminary screening studies prior to initiation of comprehensive programs, and pre-market testing of a wide range of chemicals, pharmaceuticals and consumer products.

We routinely conduct acute toxicity, irritation and sensitization studies — and a full range of subchronic, neurotoxicity and phototoxicity studies.

And when it comes to people, we have more of the best. Credentials of our study directors, supervisory and technical staff include Society of Toxicology membership and certification by AALAS and the American Board of Toxicology.

So when a short term study is called for, contact us. We have the expertise to respond quickly, and provide accurate results on schedule.

Acute Toxicology Testing. We do it right the first time. On time.

Bio/dynamics, Inc.

Results you can trust.

DH-360

Mettlers Road, East Millstone, New Jersey 08873 • (201) 873-2550

TOXICOLOGY • INHALATION TOXICOLOGY • PATHOLOGY • METABOLIC AND ANALYTICAL CHEMISTRY • QUALITY ASSURANCE • FACILITIES MANAGEMENT

Circle No. 48 on Readers' Service Card

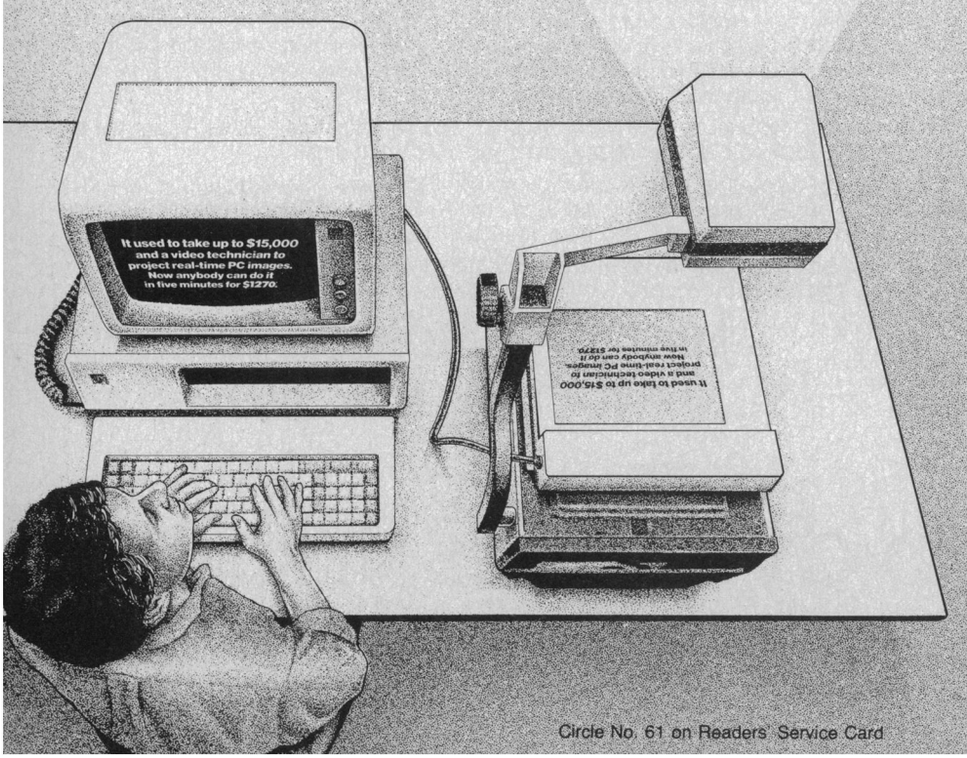
It used to take up to $15,000 and a video technician to project real-time PC images. Now anybody can do it in five minutes for $1270.*

1.
Plug the unit into your PC.
2.
Place it on your overhead projector.
3.
Begin your real-time presentation.

New KODAK DATASHOW System

Just think of all the applications.
Call for details:

1 800 44KODAK, Ext 865
(1 800 445-6325, Ext 865)



The DATASHOW System is used with an IBM PC or 100% compatible computer.
*Price shown is Kodak's suggested price only. Actual selling price is determined by dealer.

Eastman Kodak Company
Motion Picture and
Audiovisual Products Division

Circle No. 61 on Readers' Service Card

OPTICELL 5200R.
Start small, Think big.

Successful production of biomolecules is a matter of protocol. And OPTICELL™ is the culture system that lets you go from R&D to pilot to large scale production without having to change protocols at all.

The OPTICELL 5200R Research Model is the logical place to begin. It provides precise control over culture parameters, as well as documented, real-time feedback to eliminate guesswork—just the environment needed to establish protocols accurately and efficiently. It's the ideal development tool for producing biomolecules in research quantities from both attachment-dependent and suspension cells.

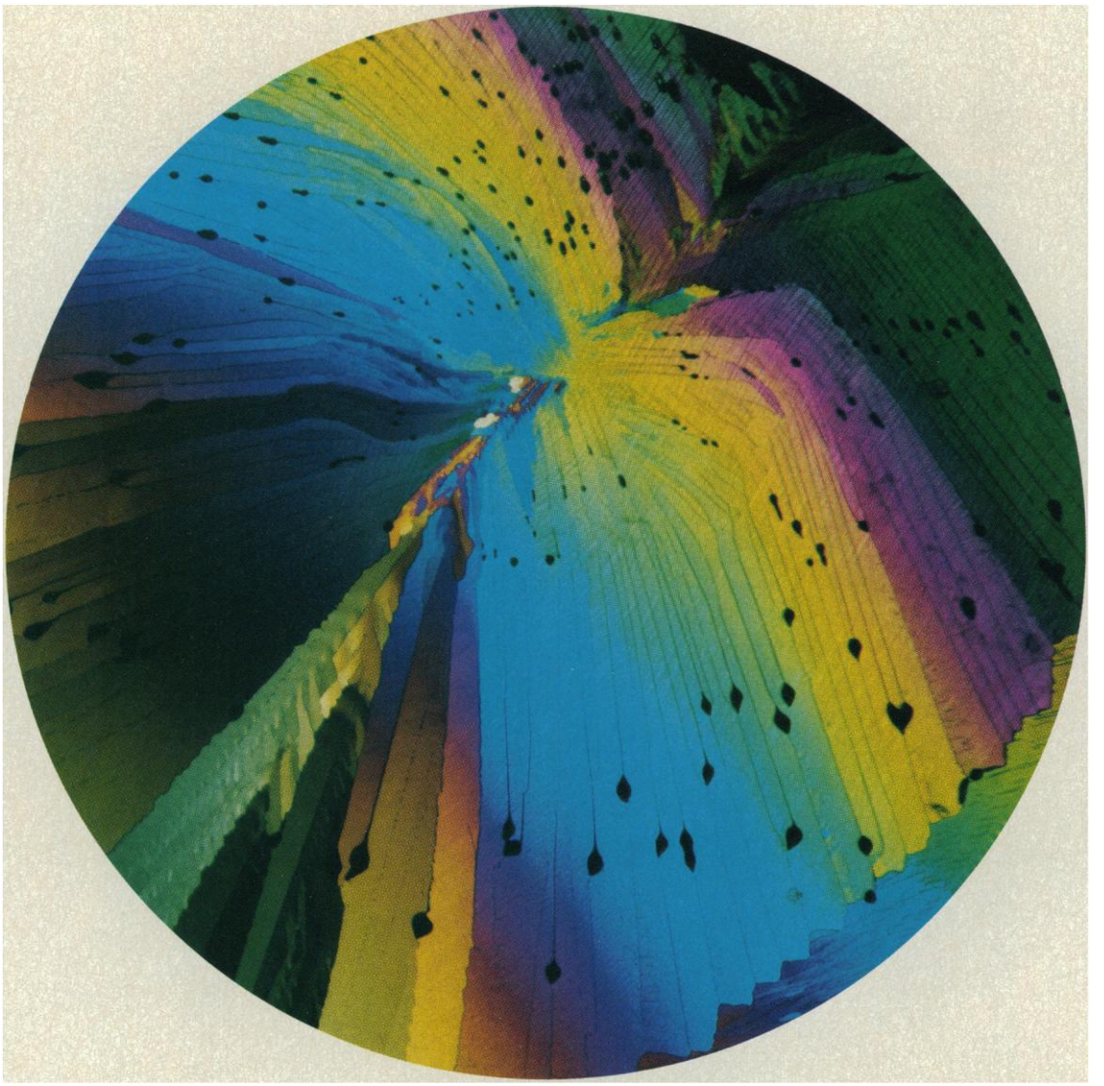
This culture system gives you the direct scalability you need to start small without having to think small. OPTICELL. Exclusively from CRBS, your partner in bioprocessing.

For complete information on the OPTICELL 5200R Research Model, contact CRBS now at 251 Ballardvale Street, Wilmington, MA 01887, (617) 657-6500. In Europe: Manston Road, Margate, Kent, England CT9 4LT, 843 89603.

And get ready to think big.

CRBS
CHARLES RIVER
BIOTECHNICAL SERVICES INC.

Circle No. 76 on Readers' Service Card



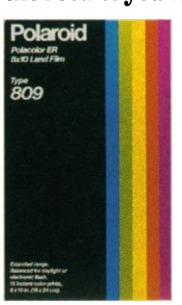
Research

Get the results you want instantly with Polaroid instant films and imaging systems.

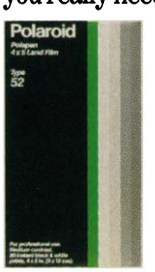
Research and development may be the place to experiment. But you shouldn't have to experiment with your means of documentation.

For that, you want the most effective and fastest method available right from the start. You want, in short, Polaroid instant imaging.

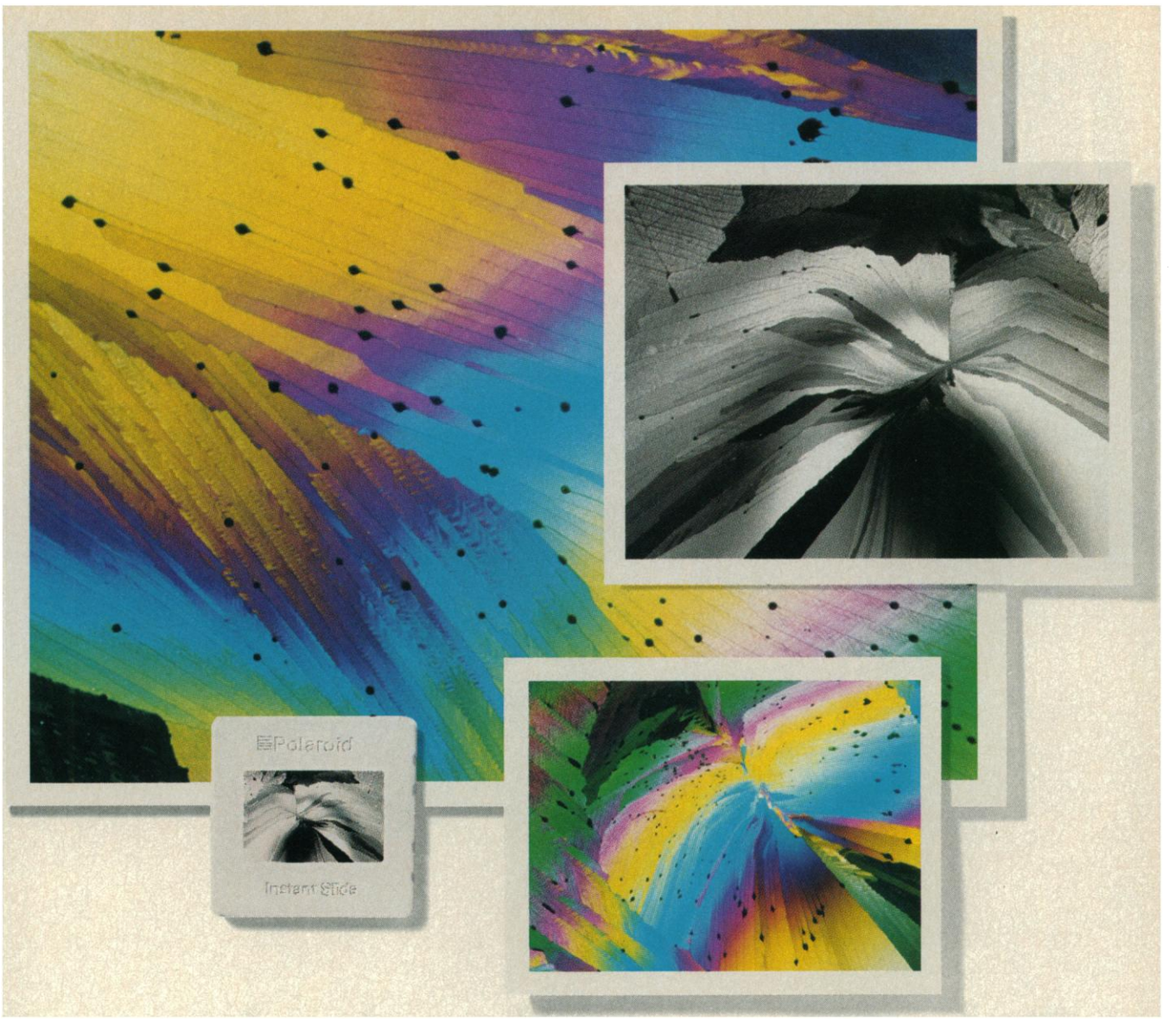
With our full line of over 40 different instant professional films, from 35 mm to 8 x 10", you can be sure of capturing the results you want, when you want them. Which means you can document, review, or present your findings without delays. With detailed accuracy.



Polaroid also lets you choose from a complete range of color or black and white emulsions that meet the imaging requirements of virtually any research condition. In the formats and film types you really need.



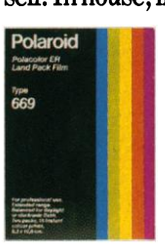
What's more, we offer you a comprehensive range of instant imaging systems. Cameras for photography of laboratory set-ups. Copy stands for recording flat art or small objects. Plus electronic imaging



and development.

systems for recording from most types of computers – PC's to mainframes – and from VCR's as well.

Better still, you can do it all yourself. In house, in complete confidentiality. Without the delays that outside services create.



In fact, no matter where your research takes you, you can look to Polaroid imaging systems for the means to handle any development.

Instantly.

For the Polaroid Professional Film Center nearest you, call toll-free **800-225-1618**, 9 a.m. to 6 p.m. Eastern Time.

Polaroid

There's an informative 35mm Photography Seminar coming to your area soon. To get your invitation call Polaroid toll free: 800-354-3535.

For more information, mail this coupon to Polaroid Corporation, Dept. 659, P.O. Box 5011, Clifton, NJ 07015.

Please send me information about:
☐ Polaroid Professional Films for Scientific Imaging
☐ Polaroid Instant Imaging Hardware

Name_____

Company_____

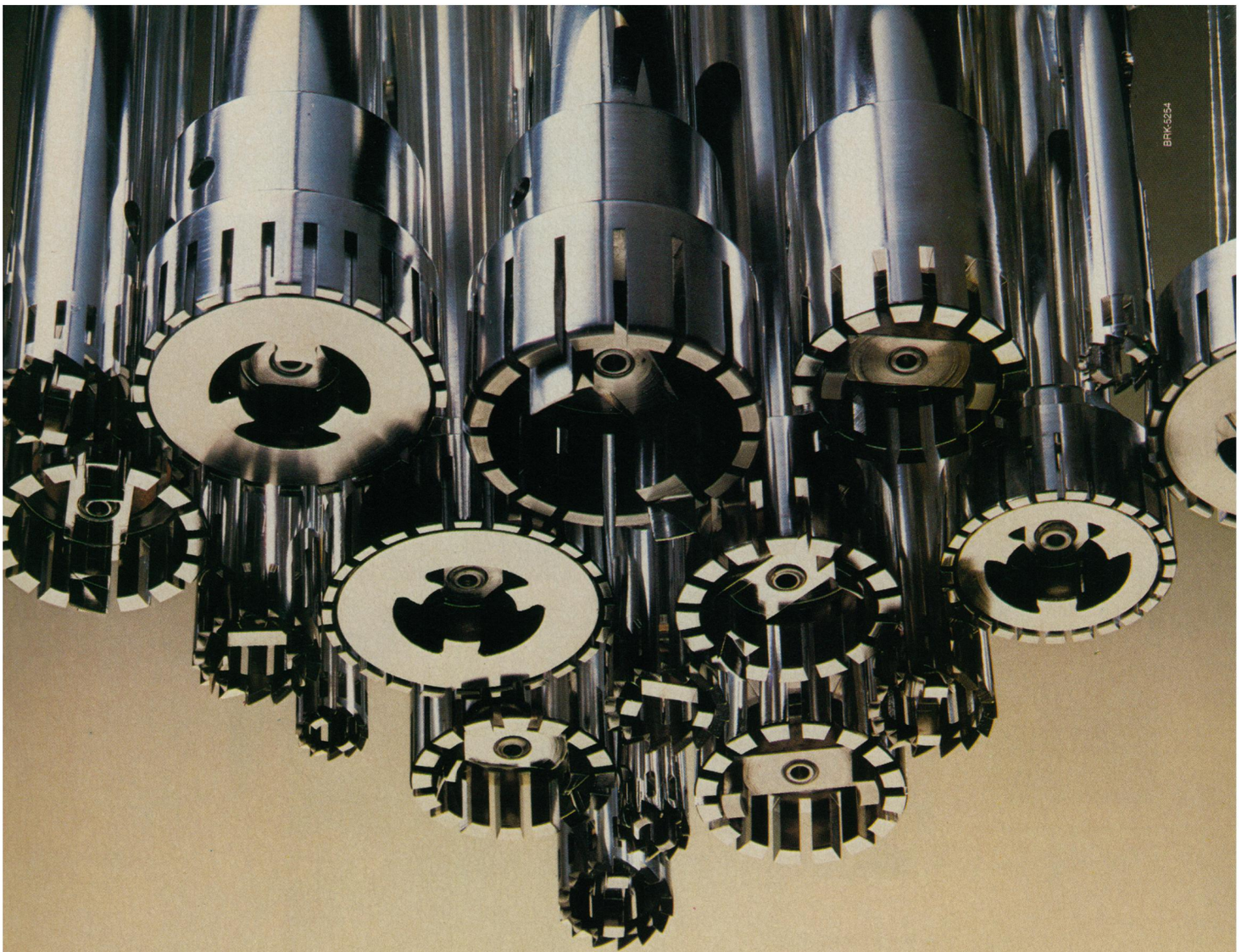
Address_____

City_____

State_____ Zip_____

Telephone_____ SC11/7

Circle No. 15 on Readers' Service Card



Only the sample breaks down.

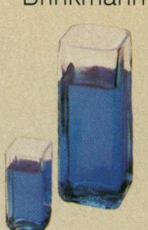
Brinkmann homogenizers make the difference —in 30 seconds.

Rapid action preserves biological integrity.
Brinkmann homogenizers take advantage of mechanical shearing and cavitation to assure you of uniform sample breakdown in only 30 to 60 seconds. This rapid action protects your samples from inactivation by heat generated during prolonged homogenization.

Powerful, durable motors work harder...longer.
Brinkmann homogenizers use heavy-duty, high-speed 700 W and 1600 W motors for high torque and long life. They reach speeds of up to 27,000 rpm to disintegrate samples efficiently and effortlessly.

One system meets all your homogenization needs.
Brinkmann homogenizers handle samples from 0.5 mL to 25 L with 21 generators, two motors, and a complete range of accessories.

For complete 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.



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

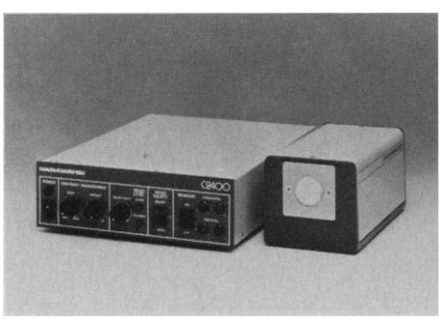
For literature circle reader service number 49
For a demonstration circle reader service number 50

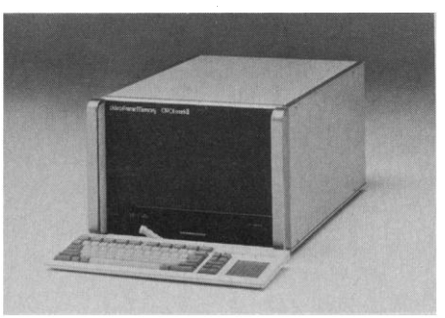
Four ways to improve your image.

PMI lets you choose from high performance cameras to advanced imaging systems designed specifically for videomicroscopy.

C2400 VIDEO CAMERA. Exceptional performance characteristics plus a variety of unique, user-oriented features enable the C2400 Video Camera to accurately detect details that are invisible with conventional video cameras. A modular control unit supports all available camera heads, and application-specific configurations are easily obtained through a wide choice of options and imaging tubes.

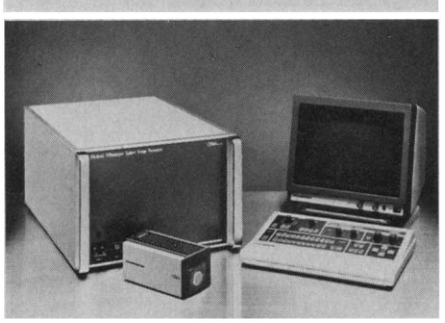
Circle No. 210 on Readers' Service Card





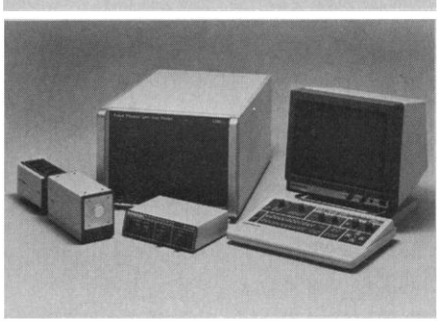
C1901 IMAGE PROCESSOR. This unique digital image processor employs two 16-bit video frame memories and executes a wide range of processing functions. Real-time features such as image integration, background subtraction and shading correction, as well as 3-D graphics and pseudocolor, make this system ideal for both image enhancement and low light level imaging.

Circle No. 212 on Readers' Service Card



C1966 AVEC SYSTEM. A totally integrated, turnkey imaging system with extensive enhancement and real-time digital processing capabilities. The C1966 AVEC system can dramatically improve image quality and detectability when visualizing low contrast, low intensity and dynamic specimens. A wide selection of video detectors is available, with characteristics ranging from high resolution to high sensitivity, from UV to IR. Highly flexible and easy to use.

Circle No. 211 on Readers' Service Card



C1966 VIM SYSTEM. Employing a unique ultra high sensitivity camera capable of photon-counting imaging, this system permits high quality quantitative imaging at light levels far below those attainable with conventional low light level cameras (10^{-1} lux to single photons). Spectral sensitivities ranging from 140 to 850nm and Peltier cooling allow the system to be configured for numerous applications. An integral processor provides advanced image processing and analysis functions.

Circle No. 213 on Readers' Service Card

Tell us about your application.

The Photonic Microscopy family of imaging products is engineered by Hamamatsu Photonics, a world leader in imaging detectors and systems. To learn how these products can be useful to you, contact us today.

PMI

Achieving the Ultimate Image.

PHOTONIC MICROSCOPY, INC.
2625 Butterfield Road/204 South/Oak Brook, Illinois 60521
Telephone: 312/571-1241/Facsimile: G3 312/571-1244
A Hamamatsu Company

Announcing a unique opportunity to hear from renowned leaders on the cutting edge of neuroscience research:

Frontiers of Neuroscience

a special three-day seminar at the Annual Meeting of The American Association for the Advancement of Science

14–18 February 1987 ✦ Chicago

Program:

Sunday 15 February:

9:00AM **Neurogenetics:** F. BLOOM (Scripps), J. MARTIN (Harvard), R. QUARLES (NIH)

1:15PM **Keynote Lecture:** S.H. SNYDER (Johns Hopkins) on Receptor Systems in the Brain

2:30PM **Ion Channels:** W. AGNEW (Yale), J.P. CHANGEUX (Pasteur Inst.), J. LINDSTROM (Salk Inst.), K. MAGELBY (U. Miami)

6:30PM **Cocktail Reception** (cash bar)

9:00PM **Poster Session** for all seminar registrants*

Monday, 16 February:

8:30AM **Ion Channels:** F. BEZANILLA (UCLA), R. LLINAS (NYU), R. TSIEN (Yale), K.W. YAU (Johns Hopkins)

1:15PM **Plenary Lecture:** D.L. ALKON (NIH) on Biophysical and Molecular Mechanisms of Associative Memory

2:30PM **Second Messengers:** R. DELORENZO (Med. Coll. of VA), L. KACZMAREK (Yale), I. WALAAS (Rockefeller)

10:00PM **Poster Session** for all seminar registrants*

Tuesday 17 February:

9:00AM **Axonal Transport:** J. GRIFFIN (Johns Hopkins), R. LASEK (Case Western Reserve), T. REESE (NIH)

2:30PM **Neural Systems:** E. BIZZI (MIT), C. GILBERT (Rockefeller), A. GRINVALD (Rockefeller), R. RAKIC (Yale)

* All registrants are encouraged to submit abstracts for poster sessions. (See 12 September 1986 issue of *Science*, page 1206, for appropriate format.)

Space is limited, so register now by completing and returning the form below.

Advance Registration Form
AAAS Annual Meeting

Name of registrant _____ (Last) _____ (First & initial)

Name of spouse registrant _____ (Last) _____ (First & initial)

Institution/Company _____ (Registrant)
(To be printed on badge)

_____ (Spouse registrant)

Mailing address _____ (Street)

_____ (City/State) _____ (Zip code) _____ (Telephone number)

Convention address _____ (Hotel and/or telephone number)
(Where you can be reached)

Check days on which you will attend meeting: Sat ☐ Sun ☐ Mon ☐ Tue ☐ Wed ☐

☐ Check here if you need special services due to a handicap. We will contact you before the meeting.

■ Your registration badge, receipt, and voucher for full Program and Abstracts will be mailed to you in early January. ■ Registrations received after 30 January will be held at the Advance Registrants' Desk at the Hyatt Regency Hotel. ■ Refund requests must be made by letter or telegram to the above address before 6 February 1987 and will be honored after the Meeting. No refunds are made on cancellations received after this date. ■ Student registration fees apply to full-time undergraduate or graduate students only.

Mail to: AAAS Meetings Office, Annual Meeting Registration, 1333 H Street, NW, Washington, DC 20005

Fees:

S3

	AAAS Member	Non-Member	
AAAS Annual Meeting			
Regular	☐ $65	☐ $90	$ ___
Student, Retired, Spouse, or HS Teacher	☐ $35	☐ $45	$ ___
Frontiers of Neuroscience — Special Seminar			
Regular	☐ $60*	☐ $85*	$ ___
Graduate Student ..	☐ $30*	☐ $45*	$ ___

***Note:** Registrants for this seminar must also register for the AAAS Annual Meeting (see above). If you have already registered for the Meeting, please check here ☐ .

Join AAAS — save with member rates

Regular Membership †	☐ $65		$ ___
Student or Retired Membership †	☐ $40		$ ___
Membership without *Science* (Spouse or Retired only) ..	☐ $17		$ ___

† includes 51 weekly issues of *Science*.

TOTAL AMOUNT $ ___

☐ Check enclosed ☐ **VISA** ☐ **MasterCard**
(no other cards accepted)

Card number _____ Expires _____

Signature _____

Discount Air Fares

to the AAAS Annual Meeting

14 – 18 February 1987 ✦ Chicago

AAAS has made special arrangements with United Airlines and with Delta Air Lines to obtain the following discounts for your travel to and from the AAAS Annual Meeting:

40% off any *regular* coach fare (no minimum stay or advance purchase required)

5% off any *discounted* or *promotional* fare (subject to availability or qualifying conditions)

These special savings are available for travel from 10–22 February 1987. To make reservations for these or any other promotional fares, call one of the toll-free numbers below and give the appropriate AAAS convention account number.

UNITED AIRLINES

AAAS Convention Account Number: 7018D
Call toll-free: 800-521-4041
(7 days a week, 8:00 a.m.-11:00 p.m. Eastern time)

DELTA

AAAS Convention Account Number: R0030
Call toll-free: 1-800-241-6760
(7 days a week, 8:30 a.m.-8:00 p.m. Eastern time)

Please note that the special AAAS discounts are only available through the airline convention desks at the numbers indicated above.

Hotel Reservation Form ✦ Hyatt Regency Chicago

AAAS Annual Meeting ✦ Chicago ✦ 14 – 18 February 1987

Mail to: Reservations, Hyatt Regency Chicago, 151 East Wacker Drive, Chicago, IL 60601

Send confirmation to:

Name _____ (Last) _____ (First & initial)

Mailing address _____ (Street)

_____ (City/State) _____ (Zip code) _____ (Telephone number)

Other occupant(s) of room: _____ (Name) _____ (Name)

Indicate special housing needs due to a handicap:
☐ wheelchair accessible room; other _____

Charge my major credit card (card type): _____

Card No. _____ Expires _____

Signature _____

Hyatt Regency Hotel Rates: Add 10.1% state and city sales tax. Check appropriate box for type of room desired.

Room Category	Single	Double or Twin	Parlor + 1 Bedrm.	Parlor + 2 Bedrms.
Standard	☐ $79	☐ $96	☐ $300 & up	☐ $379 & up
Club Level	☐ $102	☐ $118		

Arrival date _____

Time _____ ☐ a.m. ☐ p.m.

Departure date _____

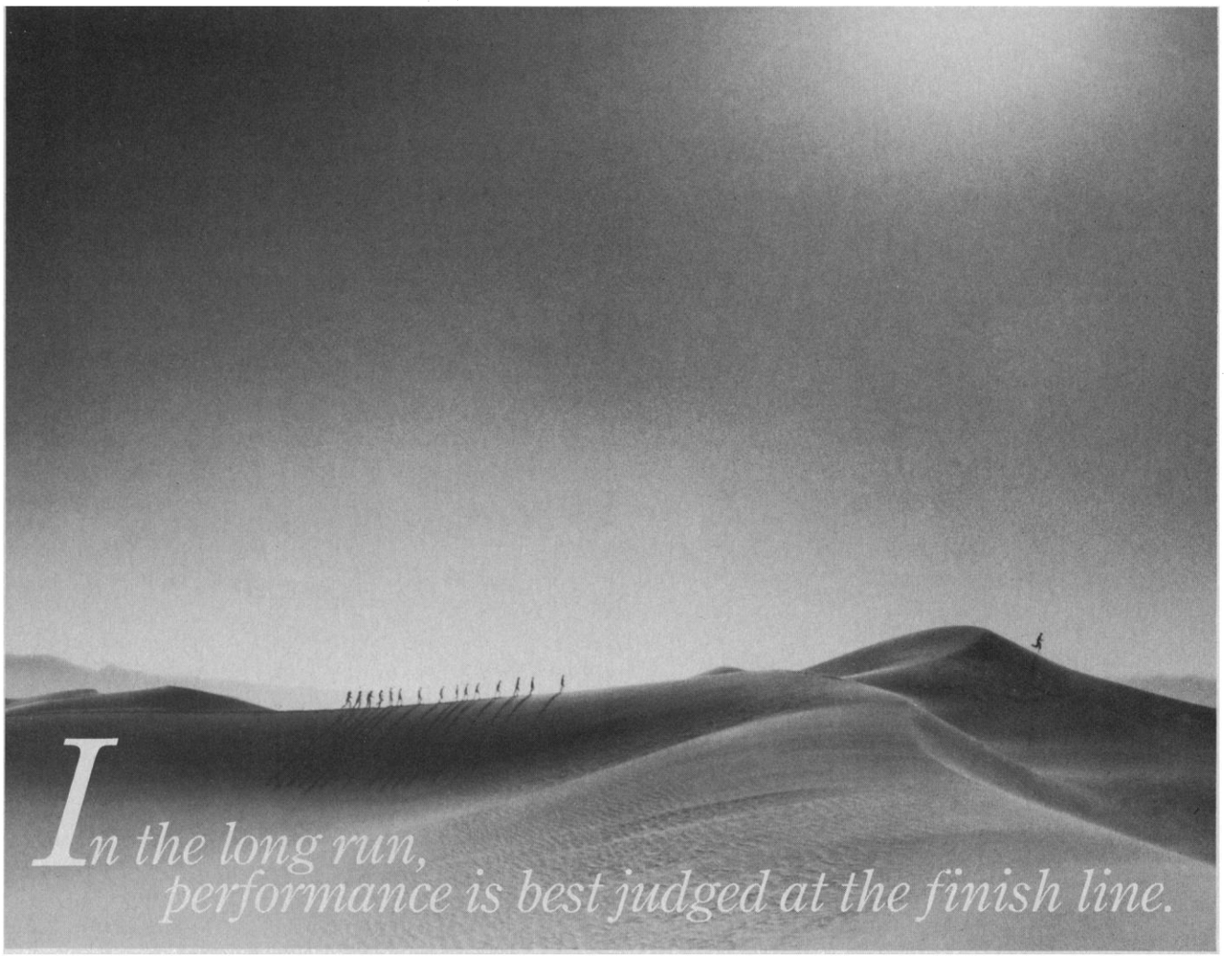
Time _____ ☐ a.m. ☐ p.m.

Be sure to list definite arrival and departure dates and times. reservations will be held only until 6 p.m. unless accompanied by 1 night's deposit or major credit card guarantee.

■ Reservations must be submitted to the Hyatt Regency (address above) on this official form by **23 January 1987.** Reservations received after this cut-off date are conditional on space availability. ■ Make any changes or cancellations directly with the hotel, which will also confirm your reservations.

■ Rollaway bed or extra person in room: $15.

■ Children to age 18 free of charge in same room with parents.



The strategy for running the marathon is vastly different than for the 100-yard dash.

A successful pension fund has a different investment strategy, too. Far different than the quick return, end-of-quarter performance goals of many investment funds.

While many financial service companies are racing to offer higher risk investments with the hope of higher returns, TIAA and CREF continue to achieve steady growth with broadly diversified portfolios of retirement-oriented investments.

This balanced, long-term investment philosophy is the foundation for building lifetime retirement incomes.

Maintaining the highest yields over 40 years would be comparable to maintaining the speed of the 100-yard dash over the 26-plus miles of the marathon. Highly unlikely.

The key to successful retirement funding is consistency over long time periods, because the investments must provide annuity payments throughout a staff member's entire retired life. A very real reason why over 150,000 retired educators enjoy the rewards of having participated in a TIAA-CREF retirement plan.

When the results are in at retirement, you will find that TIAA-CREF retirees are far ahead.

Send for a free copy of our recent survey among staff members retired from educational institutions. Simply write on your letterhead.

TIAA-CREF. You can count on us today... and for tomorrow.

TIAA CREF
Teachers Insurance and Annuity Association
College Retirement Equities Fund
730 Third Avenue, New York, NY 10017

NIKON REDEFINES STEREO MICROSCOPES.

Before you purchase a new zoom stereo microscope, compare the following Nikon advantages with the instrument you're currently using. See how Nikon's SMZ-1 has become the *definitive* stereo microscope.

RESOLUTION. The Nikon SMZ-1 Zoom Stereo microscope features *superior* resolution. Compare the resolution in lines per millimeter of your stereo microscope to the Nikon SMZ-1 using a resolution test plate and see the difference for yourself. This spectacular performance is the result of Nikon's advanced technologies in glass formulation and production, chromatic aberration-free (CF) optical design and precision manufacturing.

CONTRAST. Here you'll see a real black and white difference. The Nikon SMZ-1 has a visually preferred whiter image. Nikon's unique optical design eliminates internal flare and lens surface reflections for greatly improved image contrast.

BRIGHTNESS. The Nikon SMZ-1 image is perceptibly brighter than conventional instruments. That's because advanced lens coatings and fewer optical surfaces provide improved light transmission, unsurpassed color fidelity and edge-to-edge sharpness.

FATIGUE-FREE OPERATION. The 12° convergent angle design of the Nikon SMZ-1 produces sharp three dimensional images with greater eye comfort. Zoom control and focusing knobs are conveniently located on both sides of the instrument. Double diopter adjustments maintain a sharp image throughout the entire zoom range without the need to refocus. Now an operator can work more accurately and efficiently for prolonged periods without fatigue or eye strain.

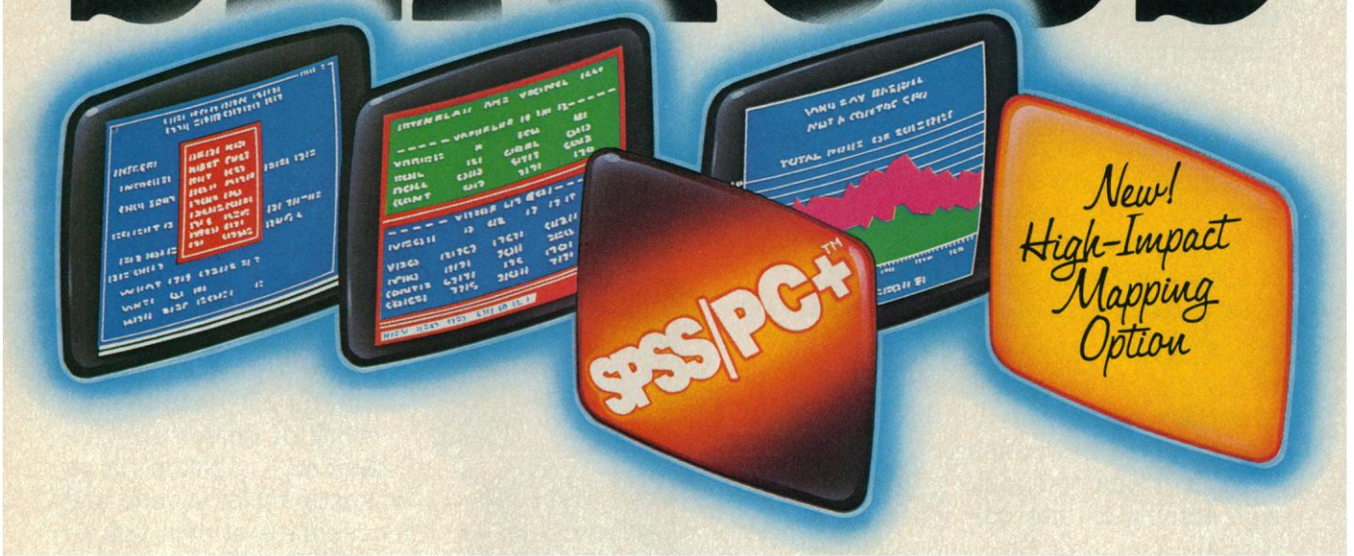
VALUE. These ruggedly constructed instruments are designed to provide years of trouble-free service. Each is backed by a five year full warranty and a nationwide network of dealer service centers. And Nikon's large assortment of stands and accessories allows you to precisely match any requirement or application.

Redefine your standard in stereo microscopy with a Nikon SMZ-1 Zoom Stereo microscope. For a demonstration or information on Nikon's full line of zoom stereo microscopes, contact Nikon Inc., Instrument Group, 623 Stewart Avenue, Garden City, NY 11530. (516) 222-0200.

Nikon

Extending Man's Vision

GET SERIOUS



...ABOUT ANALYZING YOUR DATA.

You might be spreading your spreadsheet a little too thin. Or maybe you're starting from scratch. But if you're serious about data analysis, you're ready for SPSS/PC+™ – a full software family that brings you six high-powered ways to complete any data analysis task.

Enter it. SPSS/PC+ Data Entry™ takes the effort out of entering and correcting data.

Analyze it. The SPSS/PC+ Base Package provides a powerful array of statistical and reporting procedures.

Examine it. SPSS/PC+ Advanced Statistics™ lets you get more serious with your data.

Table it. SPSS/PC+ Tables™ produces presentation-ready tables instantly.

Chart it. SPSS/PC+ Graphics™ featuring Microsoft® Chart creates show-stopping graphs and charts.

Map it. SPSS/PC+ Mapping™ featuring MAP-MASTER™ – our latest option – creates maps where vast amounts of data can be summarized and presented in one, simple picture.

SPSS/PC+ products are being put to productive use by serious fact finders in business, government and education. For countless purposes such as market research. Wage and salary studies. Survey analysis. And quality control. Plus each product is superbly documented and supported by SPSS Inc., a leader in statistical software for nearly 20 years.

So if you're serious about data analysis, step up to SPSS/PC+. For details, contact our Marketing Department. **CALL 1/312/329-3500**

SPSS inc.

SPSS Inc. • 444 North Michigan Avenue, Suite 3000 • Chicago, Illinois 60611
In Europe: SPSS Europe B.V. • P.O. Box 115 • 4200 AC Gorinchem, The Netherlands • Telephone: +31183036711 • TWX: 21019

SPSS/PC+ runs on IBM PC/XT/AT's with hard disk. Contact SPSS Inc. for compatible microcomputers. SPSS/PC+, SPSS/PC+ Data Entry, SPSS/PC+ Advanced Statistics, SPSS/PC+ Tables, SPSS/PC+ Graphics and SPSS/PC+ Mapping are trademarks of SPSS Inc. for its proprietary computer software. Chart and Microsoft are trademarks of Microsoft Corporation. MAP-MASTER is a trademark of Decision Resources.

Circle No. 113 on Readers' Service Card

FINE TUNE YOUR ATMOSPHERE WITH PRECISION

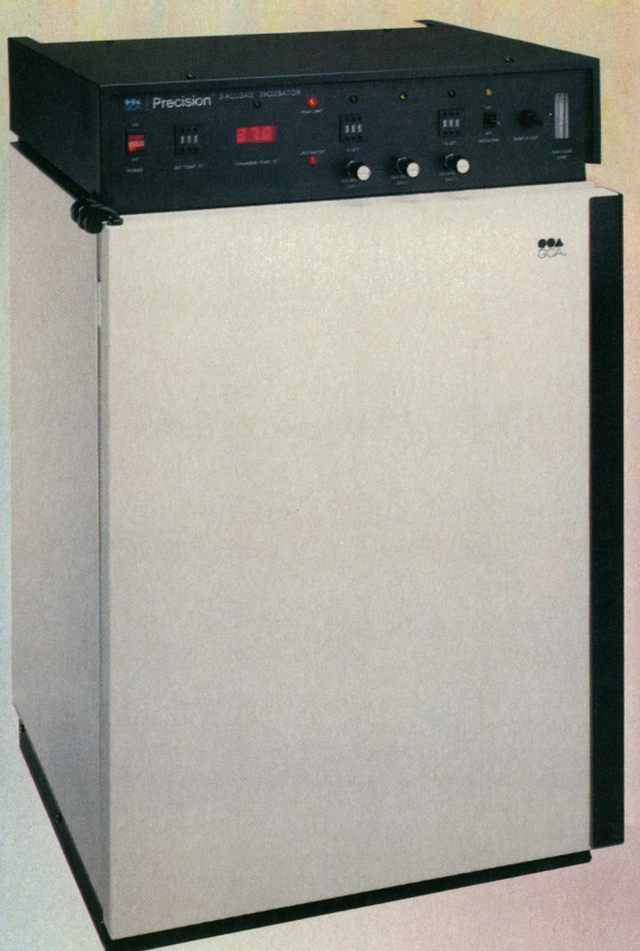
Gas densities impact flow rates in the time/flow incubators of today. That's why we put three sensitive needle valves on the new Precision Three Gas Incubator to let you fine tune each gas for optimum flow.

This exclusive fine tuning lets you be sure your cultures experience the atmosphere you select.

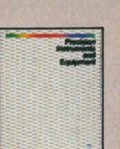
And the choice is yours. Set % O_2, CO_2, N_2, or whatever gas you need for an accurate in vitro modeling of your in vivo conditions.

You get precise °C control as well. Two heaters in the water jacket, above and below, hold 37°C ±0.1°C. No condensation on top. No chamber 'rain' to contaminate samples. Platinum probe right inside reacts to the same environment as your cells.

For distribution, pricing and ordering information, call **1-800-524-9482.** Or return coupon.



I'M HOT FOR MORE



- ☐ Send details on the new Precision Three Gas Incubator
- ☐ Have a sales representative call
- ☐ Send details on how to receive the new 1985 Precision constant temperature catalog.

Mail coupon on your letterhead with name, title, and address to Precision Scientific, 3737 West Cortland Street, Chicago, Illinois 60647.

Precision® Scientific

MEMBER
SAMA
SCIENTIFIC APPARATUS MAKERS ASSOCIATION

For literature circle reader service number 83
To have a Sales Representative call circle reader service number 84

The Superspeeds from SORVALL® – the practical RC-5B the advanced RC-5C

Let the complexity of your own work determine the SORVALL® model you need.

The advanced features of the SORVALL® RC-5C give you utmost flexibility. Enter your run and note that both "set" and "run" conditions are simultaneously visible. Instantly check g-force at any speed by touching the RCF Mode. Experience convenient duplication of any run, thanks to a built-in $\omega^2 dt$ integrator that calculates the total centrifugal effect. These features not only help you perform superior separations, but they make the RC-5C a pleasure to operate.

Are your procedures more routine? Then choose the practical RC-5B. This workhorse offers straightforward selection of run conditions in any sequence and allows you to change run parameters anytime during the run. No vacuum is required to achieve rotor speeds or maintain operating temperatures. You will find this time-tested instrument performing in laboratories worldwide.

Either way, whether you choose digital electronics to save you effort or opt for a simpler analog model and save money, you get outstanding SORVALL® reliability.

Find out more about both models—call (800) 527-2601, and ask Susan Boyd for our 12-page brochure. Or write Du Pont Company, BRML #16-2210, Wilmington, DE 19898. In Canada, call (416) 745-9870.

Circle No. 63 on Readers' Service Card

Sorvall® Centrifuges

We've got a centrifuge that's just your speed.

DU PONT
REG U.S. PAT. & TM. OFF.

E-82224

AAAS announces its first annual colloquium on science, arms control, and national security. . .

Science and Security: The Future of Arms Control

December 4 – 5, 1986
Omni Shoreham Hotel
Washington, D.C.

This new and exciting event will bring together more than 300 science, government, business, and citizen leaders to examine in depth the key issues relating science, technology, and national security. By providing a wide range of viewpoints on a variety of questions, the colloquium will offer a balanced and thorough examination of complex arms control and national security issues.

Program

Plenary sessions

- Overview of the role of science and technology in shaping national security policy
- Advances in weapons technologies and their impact on security
- SDI: An evaluation of its strategic and technical merits
- Congress and nuclear arms control
- Technology and the Five Continent Peace Initiative
- How can science and technology help us create a safer world?

In addition, smaller group sessions designed to encourage lively discussion and debate will focus on such critical issues as:

- verification and compliance
- weapons testing and nuclear proliferation
- Soviet technology and defense capabilities
- C3I and nuclear stability
- scientific community and defense research

For further information, please contact:
Richard Scribner
AAAS Committee on Science, Arms Control, and National Security
1333 H Street, N.W.
Washington, D.C. 20005
(202) 326-6494

American Association for the Advancement of Science

On-Site Registration Available

The Seventh Annual
DNA/HYBRIDOMA CONGRESSES

MARCH 1-4, 1987 • MOSCONE CENTER • SAN FRANCISCO

presented by Scherago Associates and Mary Ann Liebert, Inc., publishers

Co-chairmen DNA: Walter L. Miller, Peter Gruss
HYBRIDOMA: Zenon Steplewski, Hilary Koprowski, Joseph Davie

Sunday, March 1 Joint keynote addresses: Stephen Goff, Alexander Rich

Monday, March 2 Joint Session: **Aids Research and Therapy** Erling Norrby, *chairman*

Speakers Dani Bolognesi, Robert Gallo, Jay Levy, Bernard Moss, Robin Weiss, Myron Essex, William Haseltine, Luc Montagnier, Simon Wain Hobson, Flossie Wong-Staal

DNA Immunopathology of AIDS Erling Norrby, *chairman*
Chromatin Gary Felsenfeld, *chairman*

Tuesday, March 3

DNA Transcription George Khoury, *chairman*
Intracellular Protein Targeting Harvey Lodish, *chairman*

HYBRIDOMA Working Groups on Immunodiagnosis and Immunotherapy
Transgenic Mice as Tool in Immunology Davor Solter, *chairman*
Anti-idiotype Vaccines Donald Capra, *chairman*

Wednesday, March 4

DNA Neurobiology James L. Roberts, *chairman*
Developmental Biology Peter Gruss, *chairman*

HYBRIDOMA Use of Hybridomas in Determining Cytokine Structures and Functions Robert Schreiver, *chairman*
Anti-carbohydrate Mab's in Study of Glycolipid-Mediated Cellular Effects Jan Thurin, *chairman*

Registration $350 Advance Registration (received by November 15)
$400 Advance Registration (received by January 15)
$150 Student Registration

S-11-7

DNA HYBRIDOMA, c/o SCHERAGO ASSOCIATES
1515 Broadway, New York, NY 10036
(212) 730-1050

☐ Please reserve _____ space(s). Registration Fee of $_____ enclosed.
☐ Please send abstract form.

Name _____

Dept. _____ Organization _____

Street _____

City _____ State _____ Zip _____

Telephone: ( ) _____

Make checks payable to: Scherago Associates, Inc., DNA/HYBRIDOMA

THE TENDER TRAP.

Membrane 'trap' containing eluted Coomassie blue-stained sample.

The new Elutrap™ chamber— for the highest possible recovery of purified macromolecules.

Great advances often come in small packages—obviously the case with the new Elutrap chamber from S&S. This unique device represents a major step forward in the use of filtration for rapid elution, isolation and purification of nucleic acids and proteins from gels and for the concentration of biologicals from solutions.

Unique because, unlike other methods, it requires no membrane pre-treatment and minimal sample pre- and post-treatment.

Unique in its efficiency—because it delivers high concentrations of charged molecules, at high purity levels, with recovery rates greater than 90%.

Unique in its simplicity—operating in any standard horizontal electrophoresis chamber; no need to purchase a separate power supply.

Operation is simple. Sample molecules migrate through the device's elution chamber into a small "trap" formed by two inert exclusion membranes which allow current to pass through the device. Large particulates and contaminants are excluded by the first membrane: molecules larger than 5000 D are retained by the second one. Both membranes allow passage of buffer when an electric field is present, yet prevent buffer flow when there is no current. When elution or concentration is complete, the sample is simply removed from the trap with a standard pipet.

Call or write for more information on how to put the Elutrap chamber to work for your application.

Simultaneous use of multiple Elutrap chambers.

Sold under 'Biotrap' trademark outside the U.S. and Canada. Patent pending.

Schleicher & Schuell

Schleicher & Schuell, Inc., Keene, NH 03431 • 800-245-4024 • 603-352-3810

Schleicher & Schuell GmbH, D-3354 Dassel, West Germany • Schleicher & Schuell AG, CH-8714 Feldbach ZH, Switzerland • Schleicher & Schuell Nederland BV, 5201 AH 's-Hertogenbosch, The Netherlands

See us at ASCB Booth #311-313

Circle No. 26 on Readers' Service Card

Western gold...

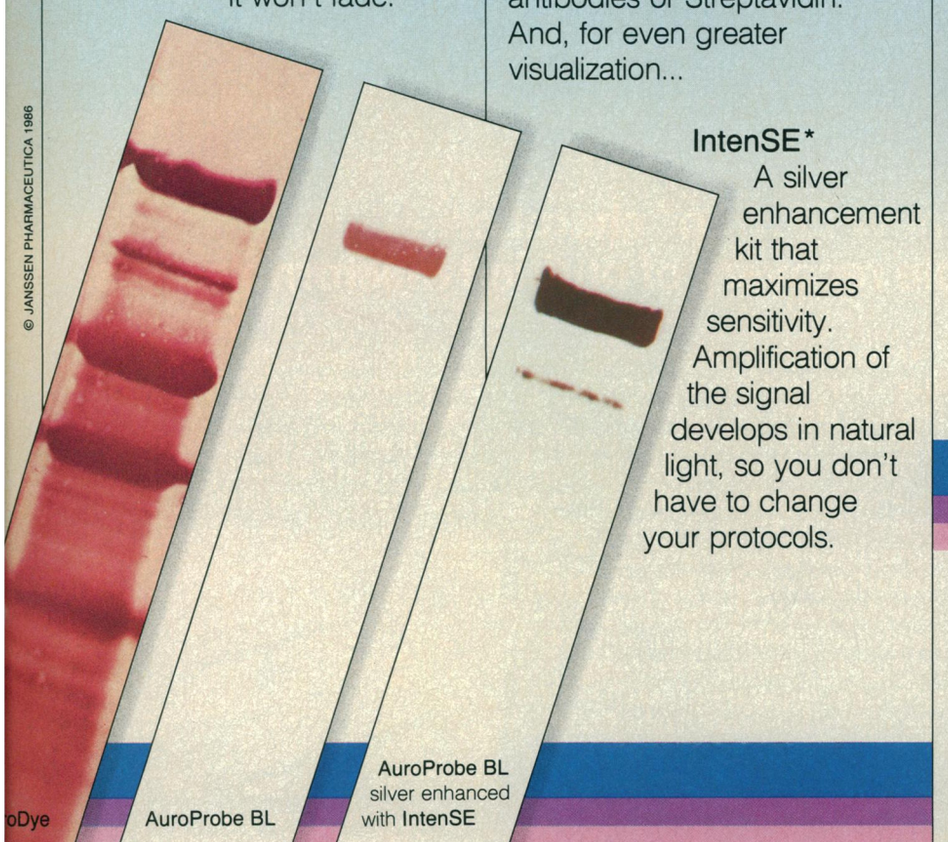
Immunogold blotting reagents to make your mark — permanent!

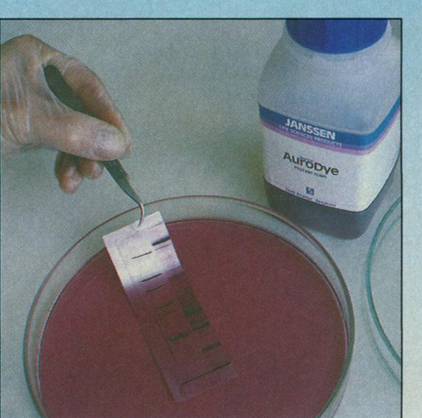
AuroDye*
An easy to use reagent to stain transferred proteins — Western or dot blots. Sensitivity is twenty times greater than conventional stains on nitrocellulose... and, it won't fade.

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

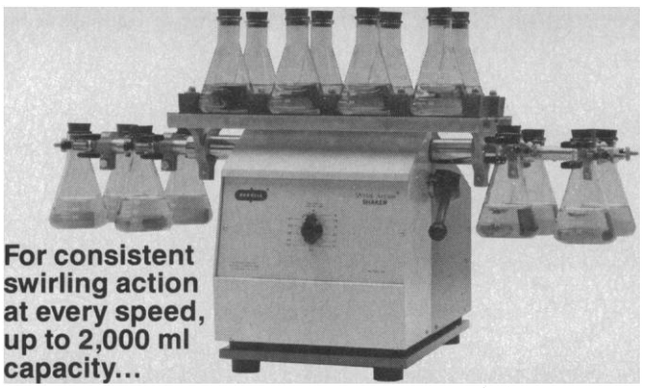
JANSSEN
LIFE SCIENCES PRODUCTS

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. 18 on Readers' Service Card

JANSSEN *pioneering in Life Sciences technology*



For consistent swirling action at every speed, up to 2,000 ml capacity...

BURRELL WRIST-ACTION® SHAKER

As long as you need, at the speed and angle you select, the Burrell Shaker duplicates hand mixing's swirling action. Consistent swirling at every speed allows you to accurately repeat all mixing operations.

With Burrell's Build-Up® System, you can add longer side-arms, platforms and clamps to accommodate various containers—from Erlenmeyer and 250 ml flasks to separatory funnels up to 2,000 ml!

Write or call for our brochure on the *only* Wrist-Action® Shaker on the market.

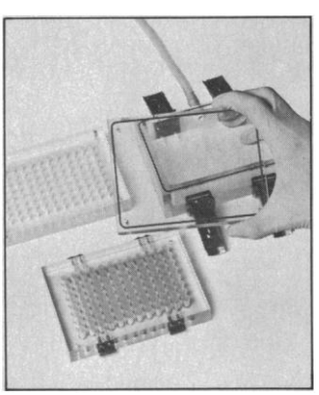
BURRELL

BURRELL CORPORATION
2223 Fifth Avenue, Pittsburgh, PA 15219
Telephone: (412) 471-2527

Circle No. 214 on Readers' Service Card

MINIFOLD® I Incubation Plate

Now...dot-blot filtration and incubation with one unit



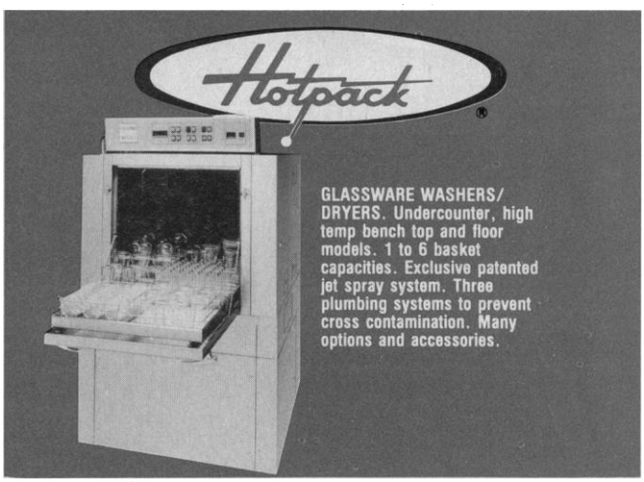
- Permits extended incubation periods
- No cross-lateral flow
- Precise, uniform spotting
- Screening of all dot-blot type assays
- Can be used with a variety of transfer media
- Compatible with isotopic/nonisotopic detection techniques

Now researchers can use the Minifold I filtration manifold for all membrane-based dot-blot assays requiring both filtration and incubation steps. The S&S incubation plate features O-ring construction which prevents cross-lateral flow—plus the standard 96-well format that permits a variety of dilutions or test conditions to be assayed on a single membrane. The incubation plate is available as an accessory for current Minifold I users or can be ordered as part of the Minifold I unit. Call or send for more information.

Schleicher & Schuell
Keene, New Hampshire 03431
(800) 245-4024 • (603) 352-3810

See us at ASCB Booth #311-313

Circle No. 209 on Readers' Service Card



When it's time to wash glassware, Hotpack shines

There's a Hotpack glassware washer configuration to fit your laboratory's capacity and space requirements. For productivity on the big job of getting the test tubes clean, Hotpack has the industry's winner. Ask about Heikol heavy duty detergents, too. Call Hotpack now for your *FREE* literature packet.

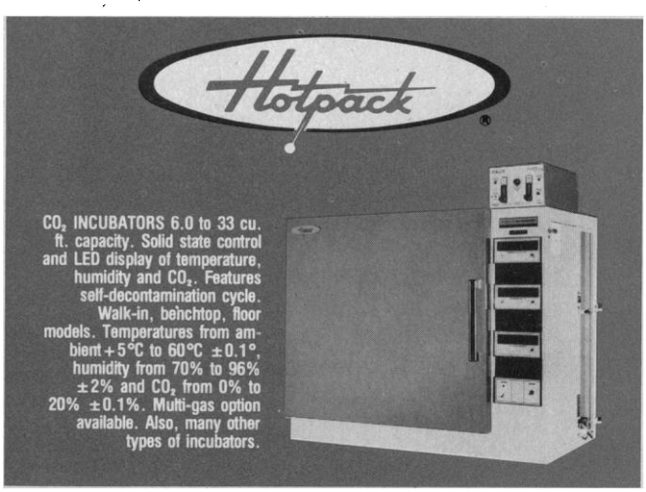
Hotpack *works*...with *you*...*direct*. Custom systems? Modifications? We'll engineer to *your* needs. Call us *toll free*

800-523-3608

or 215-824-1700 in Pennsylvania

Hotpack Corporation 10940 Dutton Rd. Philadelphia, PA 19154 • Telex 685-1197

For literature circle reader service number 57
To have a Representative call circle reader service number 58



Hotpack CO_2 incubators with self-decontamination save time and effort

Independent lab test prove Hotpack CO_2 incubators' decontamination cycle achieves 7 log reduction in B. Stearothermophilus spores, as required for FDA sterilization standards. Decon cycle does it automatically between test runs. Get this exclusive Hotpack feature plus more. Call Hotpack today for your *FREE* literature packet.

Hotpack *works*...with *you*...direct. Custom systems? Modifications? We'll engineer to *your* needs. Call us *toll free*

800-523-3608

or 215-824-1700 in Pennsylvania

Hotpack Corporation 10940 Dutton Rd. Philadelphia, PA 19154 • Telex 685-1197

For literature circle reader service number 59
To have a Representative call circle reader service number 60

THE FOURTH ANNUAL CONGRESS FOR
AUTOMATION, SCALE-UP and the ECONOMICS OF BIOLOGICAL PROCESS ENGINEERING

MARCH 4 - 5, 1987
MOSCONE CENTER, SAN FRANCISCO

A one and one half day meeting in conjunction with:
THE SEVENTH ANNUAL DNA/HYBRIDOMA CONGRESS EXPOSITION

ORGANIZED BY SCHERAGO ASSOCIATES, INC.
in conjunction with GENETIC ENGINEERING NEWS

CHAIRMAN: Gerald L. Hawk, PhD, Zymark Corporation

TOPICS:

Cell Propagation • Fermentation • Cell Optimization • Cell Characterization • Cell/Tissue Culture • Process Monitoring and Control • Automated Immunoassay • Purification • Biosensors • Human Genome Project • Drug Delivery Systems • Respect to GMP & GLP • Regulation Economic Issues • Automated DNA Sequencing • Automated Plasmid DNA Purification

Anyone wishing to submit an abstract for presentation may contact Congress Chairman Gerald L. Hawk, PhD, Zymark Corporation, Zymark Center, Hopkinton, MA 01748 (617) 435-9501. (Deadline December 1st).

S-11-7

Registration Fee: $300.00
Attendance will be limited. Make checks payable to: Scherago Associates, Inc., Automation, Scale-Up.

☐ Please reserve _____ space(s): Registration Fee must be included.
☐ Please send Registration Application.
Cancellations must be received by January 9, 1987.

Name _____

Dept. _____

Organization _____

Street _____

City _____ State _____ Zip _____

Telephone: ( )

Return to:
Automation, Scale-Up; c/o Scherago Associates, Inc.
1515 Broadway, Dept. S-11-7, New York, NY 10036 • (212) 730-1050

Circle No. 93 on Readers' Service Card