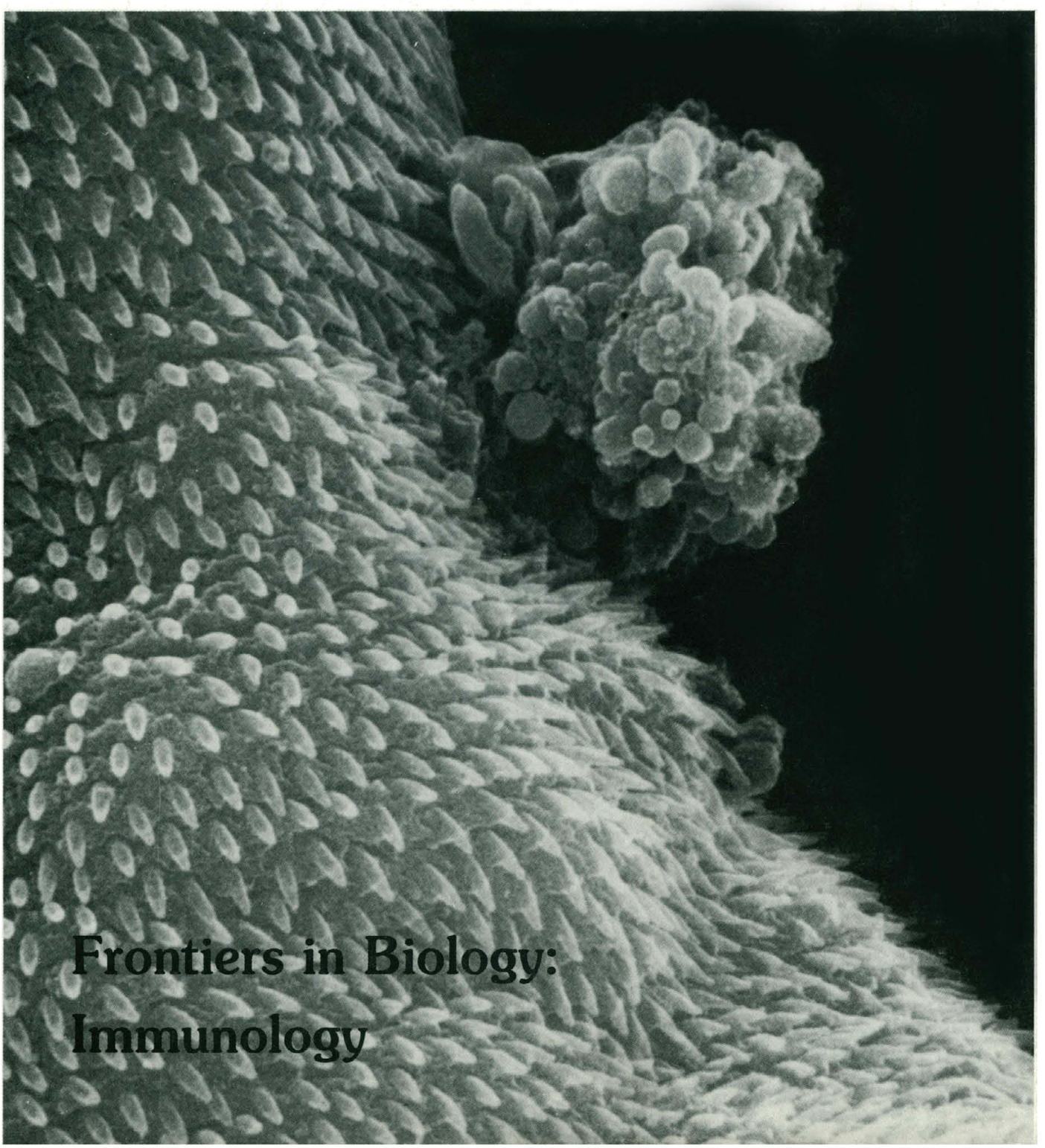
American Association for the Advancement of Science

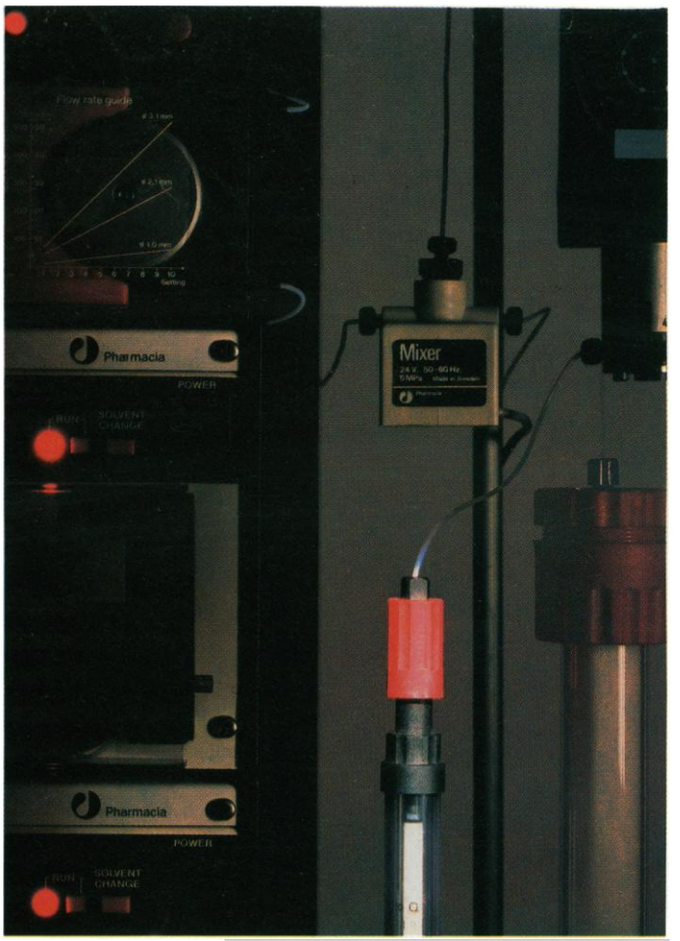
SCIENCE

20 November 1987 $2.50
Vol. 238 ■ Pages 1015–1202



Frontiers in Biology: Immunology

FPLC – DISCOVERING THE POWER OF LC.



AN FPLC SYSTEM GIVES YOU THE UNIQUE OPPORTUNITY TO COMBINE STANDARD WITH HIGH PERFORMANCE CHROMATOGRAPHY.

Why do so many researchers choose FPLC® to separate biomolecules?

The answer lies in a unique opportunity; FPLC enables them to use the full power of chromatography.

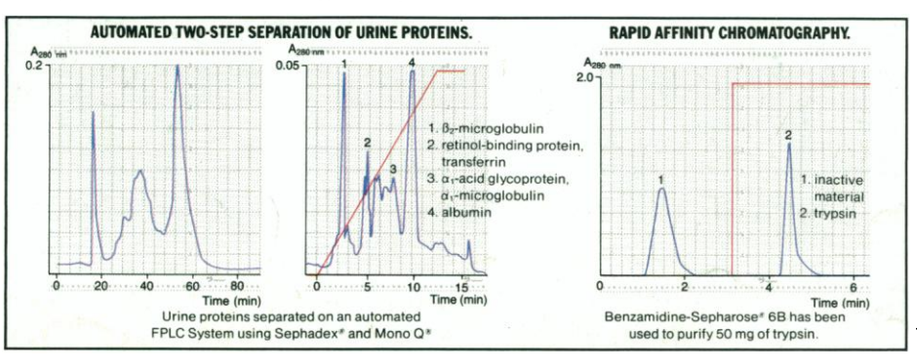
The diversity of biomolecules challenges any researcher who is trying to purify a specific molecule from a complex mixture. With FPLC, you never have to settle for a sub-optimal method. You can choose between six key, high performance techniques, and through rapid separations and system automation, you can combine these techniques to full effect.

But FPLC is not just a powerful combination of high performance separation techniques. Many separations actually require steps using both standard and high performance media. Why not combine these steps into one integrated scheme? With FPLC, you can combine the range and simplicity of standard chromatography, and the resolving power and speed of high performance chromatography, into one system. Well proven media based on Sephadex® Sepharose® or Sephacryl® are especially useful in the early stages of purification and can be linked directly to high performance schemes.

By combining the best of high performance and standard chromatography techniques together with full biocompatibility and genuine automation, FPLC is unique in the world of high performance chromatography. FPLC is the ideal system for optimal and efficient biomolecule separation.

Contact us today and let us prove how FPLC gives you the full power of chromatography.

WHERE ALL SCIENCE BEGINS · LIFE



Urine proteins separated on an automated FPLC System using Sephadex* and Mono Q*

Benzamidine-Sepharose* 6B has been used to purify 50 mg of trypsin.

Circle No. 107 on Readers' Service Card

Pharmacia

Pharmacia LKB Biotechnology Inc.
800 Centennial Avenue
Piscataway, NJ 08854
Information: (800) 526-3618
NJ: (201) 457-8000

World's Highest Capacity Cell Culture Facility Now In Production

Invitron's new, million-liter cell culture manufacturing facility is dedicated to the fully integrated production of cell culture derived products. State-of-the-art environmental control systems, computer automation, and advanced facility design unite with our patented perfusion technologies to create a new standard for biopharmaceutical production.

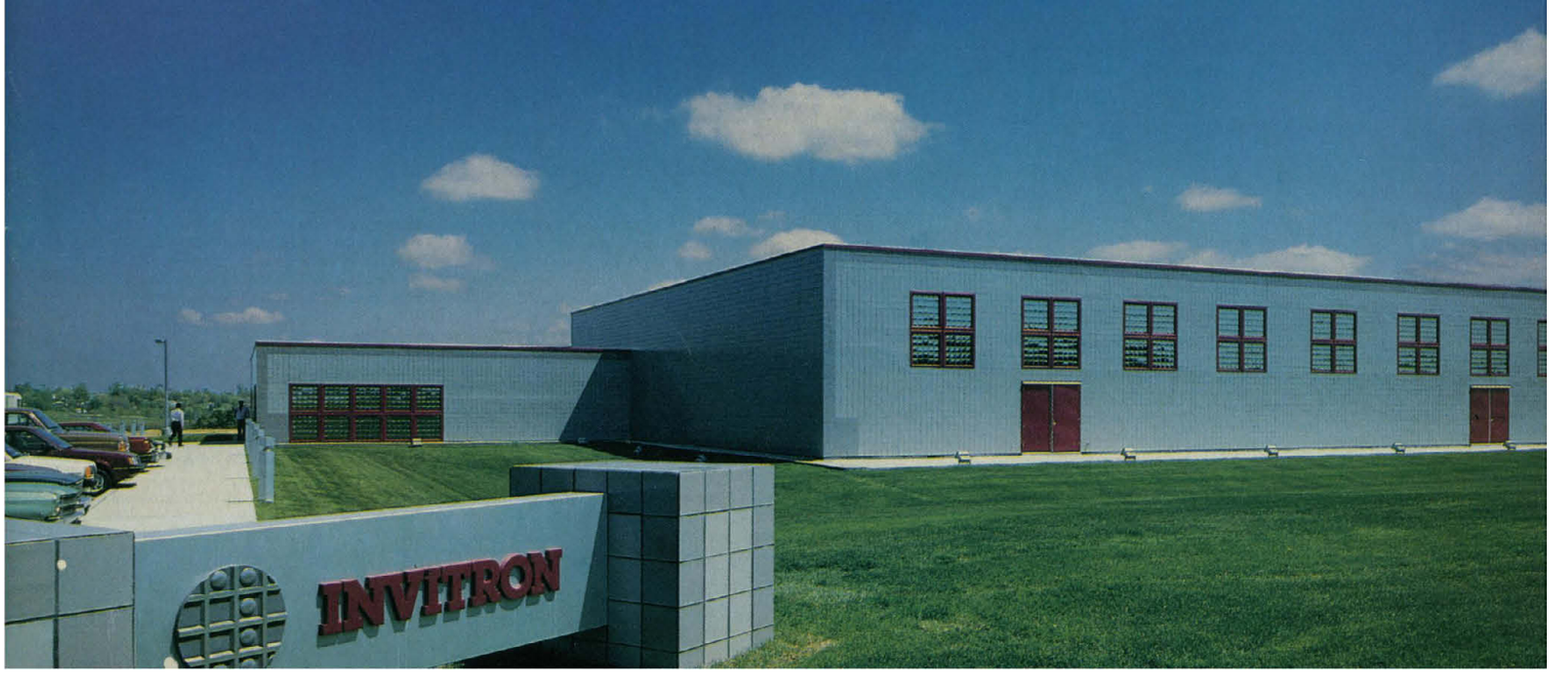
Our experienced staff of scientific and regulatory experts complements Invitron's unique technologies and facilities to provide the highest quality in comprehensive contract cell culture. Invitron offers integrated services customized to the dynamics and individual challenges of specific product development – supported by cell culture expertise, proprietary purification techniques, regulatory guidance, and the capacity to produce commercial supplies under cGMPs.

Join us: *Together we will bring your biopharmaceuticals to the marketplace.*

INVITRON

4649 Le Bourget Drive • St. Louis, MO 63134
314 426-5000 • 800 325-1792

Circle No. 33 on Readers' Service Card



AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE

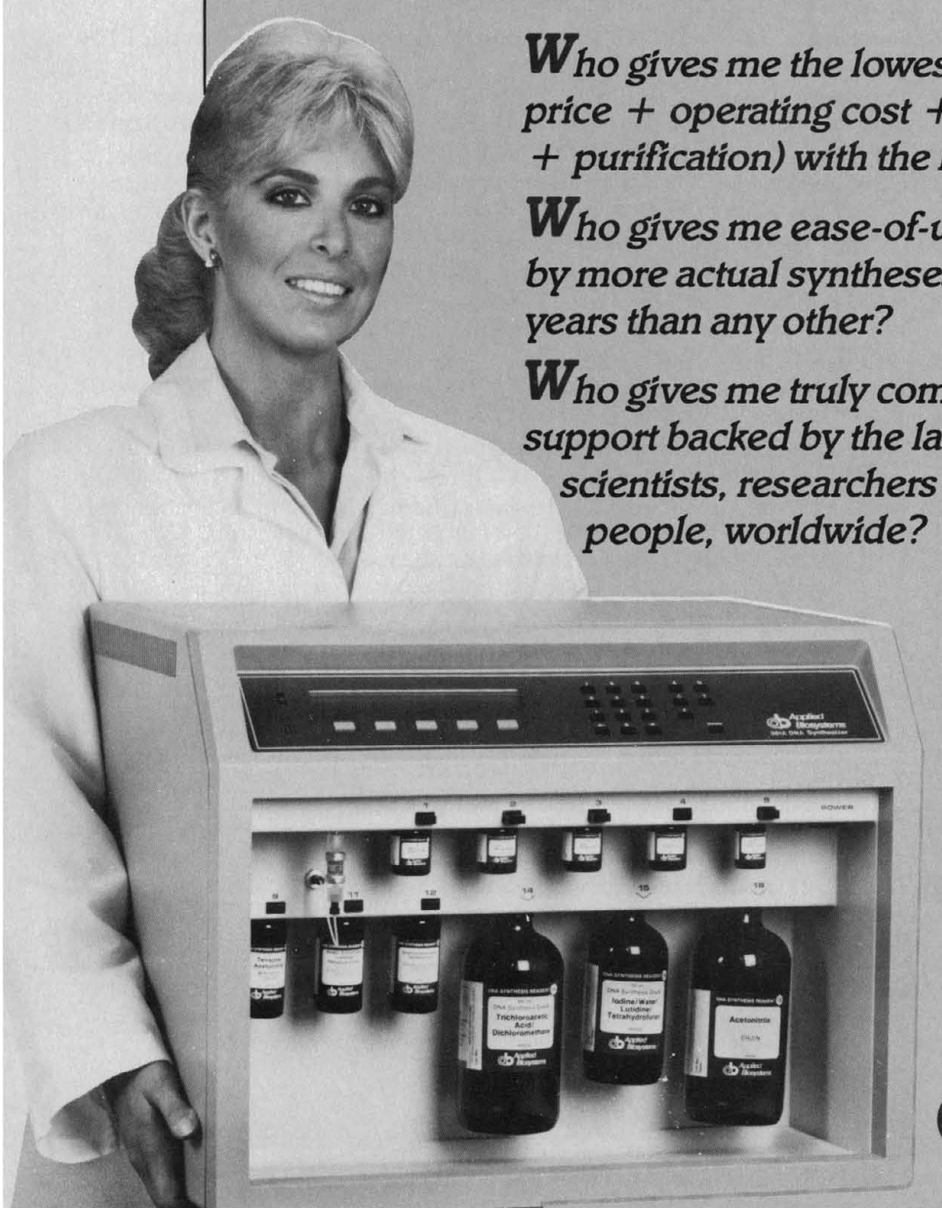
ISSN 0036-8075
20 NOVEMBER 1987
VOLUME 238
NUMBER 4830

■ **SCIENCE is published weekly on Friday, except the last week in December, and with an extra issue in February 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®** The title SCIENCE is a registered trademark of the AAAS. Domestic individual membership and subscription (51 issues): $65. Domestic institutional subscription (51 issues): $98. Foreign postage extra: Canada $32, 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 human eosinophil (upper right) is adhering to the surface of a larval schistosome that was coated with antibodies from patients suffering from schistosomiasis. The cell membrane is broken and granules are spilling from the cell (×11,000). See page 1065. [Courtesy of John P. Caulfield, Brigham and Women's Hospital, Harvard Medical School, Boston, MA 02115]

Before you buy any DNA synthesizer, you'll need the answers to these questions:



Who gives me the lowest overall cost (purchase price + operating cost + reagents + maintenance + purification) with the highest synthesis quality?

Who gives me ease-of-use and reliability proven by more actual syntheses, by more users, for more years than any other?

Who gives me truly comprehensive after-sales support backed by the largest number of working scientists, researchers and customer service people, worldwide?

Applied Biosystems is the answer to these and other important questions you'll want to consider. For the facts, contact one of our offices below.

Applied Biosystems
Foster City Biosystems Division

The Model 381A *fully programmable* DNA synthesizer.

Sales and Service Worldwide: **U.S.A.** 777 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 North, Warrington, Cheshire, U.K., WA3 7PB, Tel. 0925-825650, Telex 629611 • **Japan** 5-13-9, Nakakasai, Edogawa-Ku, Tokyo, Japan 134, Tel. (03) 877-0071 • **W. Germany** Robert Koch Strasse 16, 6108 Weiterstadt, B.R.D., Tel. 06151-87940, Telex 4197318 • **Australia** Suite 2, 1401 Burke Road, Kew East, Victoria, Australia 3102, Tel. (03) 859-9571 • **France** B.P. 50086, 13 Rue de la Perdrix, Z.A.C. Paris Nord II, 95948 Roissy, Charles de Gaulle, Cedex, R.F., Tel. (1) 48 63 24 44, Telex (1) 230 458 ABIF.

For Information Circle No. 401 For Sales Call Circle No. 402

Schistosomiasis

SCHISTOSOMIASIS kills 800,000 people each year; it is a chronic disease that currently affects about 200 million people around the world (page 1065). In recent decades, model systems for the disease have been developed and much has been learned about host defenses and the parasite's biology, physiology, and life cycles. Because of this diverse research, schistosomiasis may become one of the first parasitic diseases for which a vaccine will be developed. Capron *et al.* review what is known about the organisms and about host immune responses in humans, rats, and mice. Distinctions between responses in rats, which are nonpermissive hosts, and mice, which are permissive hosts, have been especially helpful in identification of components of the immune system that bring about successful as opposed to failed protection. A number of so-called "minor" immune components, such as eosinophilic cells and immunoglobin E antibodies, have proved to be major contributors to the anti-parasite response. Other advances and developments in the field of immunology are featured in this issue of *Science* (see page 1023 and pages 1065 to 1104).

San Andreas fault

THE San Andreas fault, which marks the conjunction of the Pacific and the North American plates, causes Californians a great deal of stress, but the plates themselves appear to be slipping by each other at extremely low shear stress levels (page 1105). The fault has been an enigma in terms of frictional faulting theory: the heat flow from it is too low, and the folds and reverse faults associated with it are nearly parallel to the fault instead of being at the hypothesized 30° to 45° angle. These paradoxes are becoming clear because the earth's crust along much of the fault has been found to be compressed approximately perpendicular to the fault's orientation. Preliminary data from a deep drilling experiment (now around 2 kilometers down but programmed to extend 5 kilometers into the crust) adjacent to the fault support the low-stress interpretation. Zoback *et al.* discuss the implications of these findings for understanding plate tectonics, faulting and deformations in the crust, the uplift of the Coast Ranges, and other fault-related phenomena.

Exciting events in the brain

BRAIN receptors for the excitatory amino acid *N*-methyl-D-aspartate (NMDA) are important in both the development and the normal and pathologic functioning of the central nervous system (page 1114). These receptors, like excitatory amino acid receptors for quisqualate and kainate, were first identified pharmacologically, but they are now being characterized at the molecular level. Using messenger RNA isolated from adult rat brains and from primary cultures that had been established from fetal rat brains, Verdoorn *et al.* show that an NMDA-like product can be produced in a *Xenopus* oocyte expression system. The receptors had properties similar to those of the NMDA receptors in the brain: the current-voltage relations were similar, receptor activation was blocked by magnesium in a voltage-dependent fashion, activation was also blocked by an NMDA antagonist, and the voltage was potentiated by the amino acid glycine. The *Xenopus* system should facilitate studies of how this and the other central nervous system synaptic receptors are activated and function.

Signals for assembling variable regions

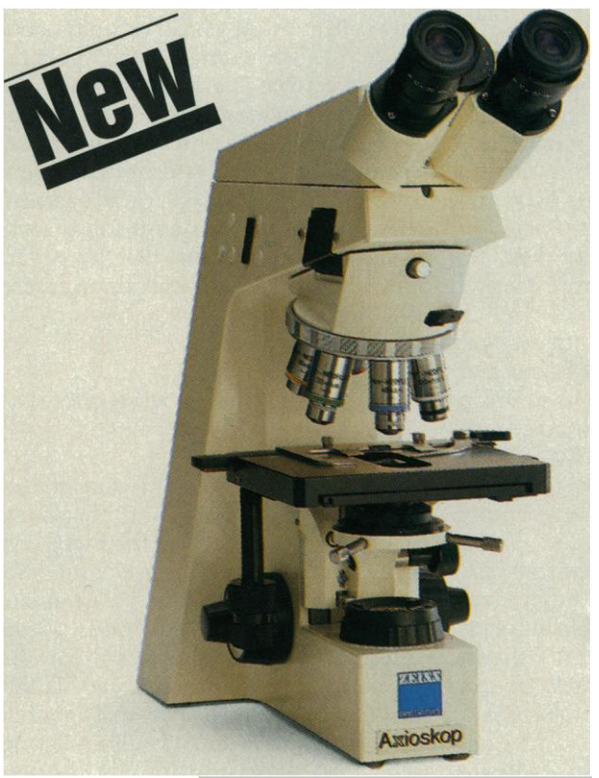
ASSEMBLY of the variable regions of immunoglobulin genes and genes for T cell receptors requires recombination events that bring together segments of DNA (called variable, diversity, and joining segments) from different parts of the chromosome (page 1134). Two short sequences of DNA—one a heptamer and the other a nonamer—are necessary signals for these recombination events; they exist in pairs and are effective only when one of the heptamer-nonamer pairs has a 12-base-pair spacer and the other a 23-base-pair spacer. In both the immunoglobulin variable region genes and in the T cell receptor variable genes, these heptamer-nonamer pairs are always positioned next to the segments that are to be joined. Akira *et al.* describe the construction of synthetic recombination-signal sequences and their introduction into cell lines in which recombination can occur. The signals flanked portions of a selectable marker, the neomycin phosphotransferase gene. With a range of artificial DNA constructs, heptamer-nonamer pairs with appropriate spacers were shown to be not only necessary but also sufficient for ensuring that the type of recombination that joins variable, diversity, and joining segments together will occur.

Fuel supply for seep communities

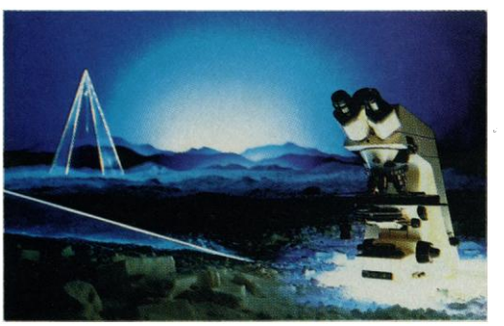
OIL and gas seeping onto the sea floor in the Gulf of Mexico provide much of the fuel that is used by seep-dwelling clams, tube worms, and mussels on the Louisiana continental slope (page 1138). Organisms collected in trawls near hydrocarbon seeps at depths from 400 to 920 meters were evaluated for their content of carbon, nitrogen, and sulfur isotopes (which are indicators of the types of food webs in which the organisms participate) and for several enzymes and bacteria that participate in the processing of these elements. The carbon in the organisms was mostly "dead"—originating in oil and gas—and was not derived from biogenic sources. The organisms contained a variety of symbionts and enzymes that provide clues to their food web relations in the sea. Brooks *et al.* describe a complex ecosystem that exists along the Louisiana continental slope and compare features of the seep communities with features of other communities that have been observed elsewhere around the world at deep-sea vents and cold seeps.

THE MORE-THAN-ROUTINE MICROSCOPE: AXIOSKOP

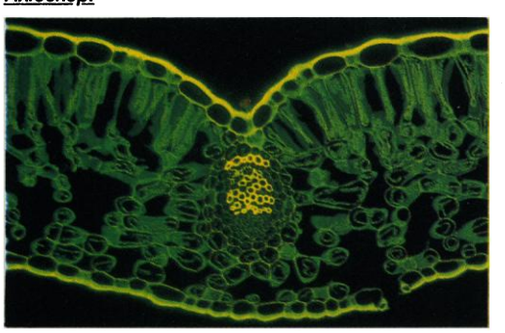
THE NEW ZEISS AGE IN MICROSCOPY CONTINUES.



Zeiss *Axioskop* with innovations to make microscopy more efficient: ICS-optics for high-contrast, bright color-true images. SI-architecture for multi-purpose flexibility. Ergonomical design for fatigue-free hours of work.



In 1986 a new Zeiss age in microscopy dawned with the Pyramids of Zeiss – the *Axioplan*, *Axiophot*, and *Axiotron* microscopes. Now Carl Zeiss expands the series: The more-than-routine microscope: *Axioskop*.



Demanding routine becomes easy: examinations of stained or unstained cells and tissue, fluorescence-stained specimens, specimens with primary fluorescence.

For literature circle reader service number 62. For literature and demonstration circle reader service number 63.

Zeiss *Axioskop*
For demanding routine microscopy – and more!

Superb ICS-optics
The Infinity Color-Corrected System, with newly computed optics from light source to eyepieces. Objectives with infinite image distance.
For color-corrected and astigmatism-free images with a consistent large 20 mm field of view. Ideal for scanning and observation of details. High image quality in all techniques.

Flexible SI-architecture
System-Integration of all microscopy techniques into the microscope for rapid change from any one method to any other. In seconds, with no performance loss, no compromises.

Reliable photomicrography and TV
35 mm, large format, instant photography are all easy with the MC 63 S microscope camera.
TV cameras readily accepted.
The stability of the Pyramids.

Carl Zeiss, Inc.
Thornwood, NY 10594
(914) 747-1800

The Pyramids of Zeiss: The new Geometry for Microscopes

ZEISS
West Germany

SCIENCE

20 NOVEMBER 1987
VOLUME 238
NUMBER 4830

Frontiers in Immunology

It could be said that immunology is both the most ancient and the most modern of sciences, the most theoretical and the most practical. The basic concept of immunology was mentioned by Thucydides writing during the time of the Peloponnesian Wars. He noted that the sick could be treated by those who had recovered since they were free of fear. The idea that survivors of infection were immune to a second infection thus appeared long ago. Edward Jenner's perception in regard to milk maids' smooth complexions—that is, with faces unscarred by smallpox—led to the idea that vaccination with cowpox might protect against smallpox. Louis Pasteur built on this concept of an attenuated virus to start the era of ever more extensive vaccination and immunities in the world today. But this highly effective approach to public health has in turn led to a theoretical framework that has extended beyond immunology into the understanding of differentiation, gene expression, and protein structure. Bennett and Dreyer's postulation and Tonegawa's demonstration of "two genes–one polypeptide chain" launched a study of DNA relationships to the antibody structure that has extended insights far beyond the field of immunology itself.

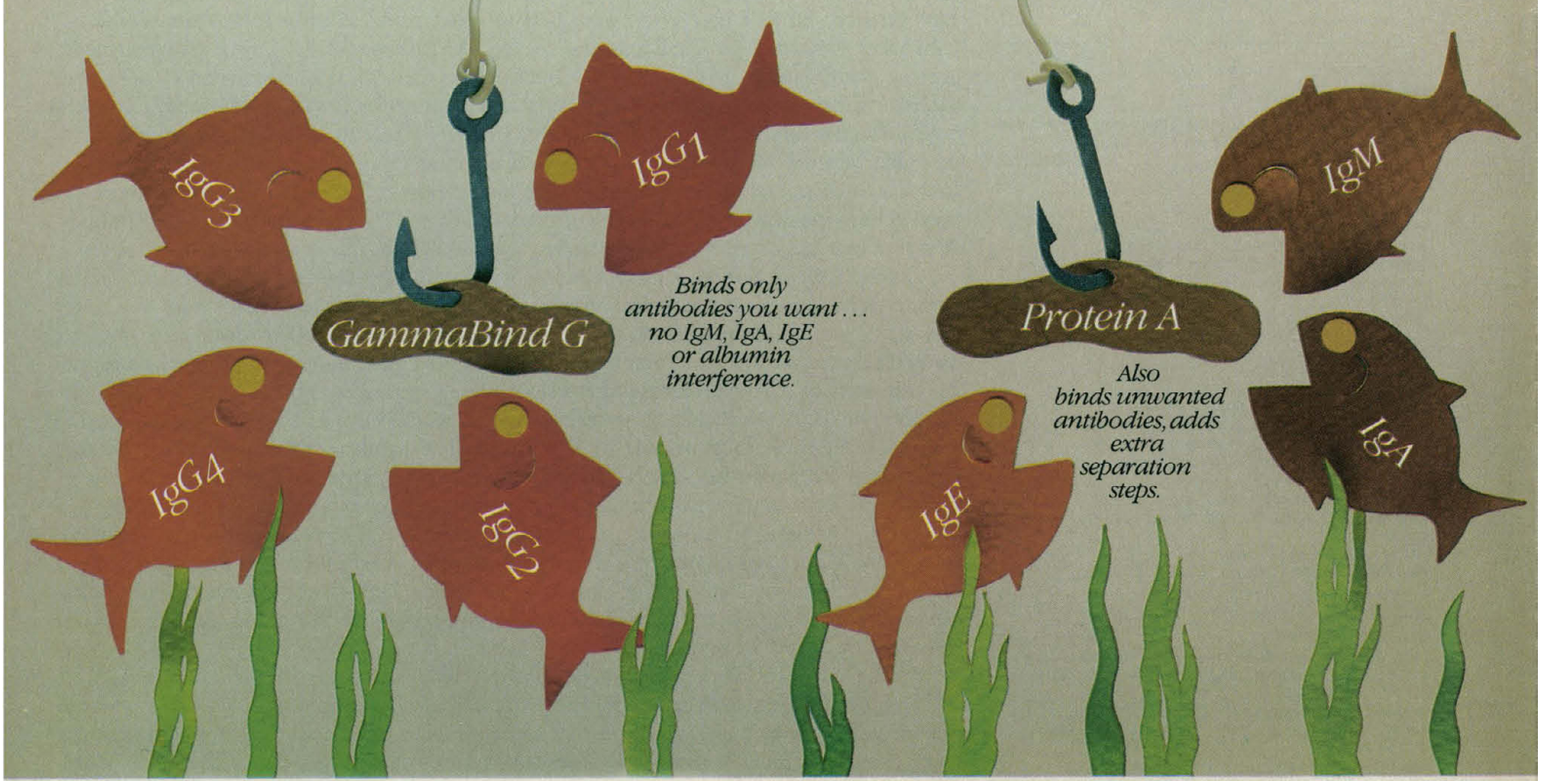
In this issue of *Science*, some of the forefronts in this prolific area are described. One of the incredible puzzles is the ability of the immune system to make a specific response to an almost infinite spectrum of man-made and natural molecules and to distinguish protein molecules made by self from almost identical proteins from non-self. The newest insights into the mechanism for producing the preimmune repertoire of approximately 10^7 different antibody molecules in B cells are described by Alt, Blackwell, and Yankopoulos, who focus mainly on the diversity generated by joinings of gene segments that make up the variable region of B cell antibodies. The subsequent expansion of particular B cell clones during an immune response and the generation of new variable regions by somatic hypermutations are the subjects treated by Rajewsky, Förster, and Cumano. The other half of the immune system, the T cell, uses many of the joining mechanisms of B cells but has the added need to recognize the major histocompatibility complex. How this system creates the additional capacity for distinguishing between self and non-self is an intriguing problem that is discussed by Marrack and Kappler.

These advances in knowledge do not preclude surprises. In the early history of immunology, the bursas of chickens were found to be a source of antibody diversity and the human analog, bone marrow, was deduced to be similar. Imagine the consternation created by the finding that chickens use an entirely different mechanism for diversity, one involving gene conversion instead of gene rearrangement. That subject, explored by Weill and Reynaud, provides a cautionary flag in regard to too easy generalization from one to all species.

Immunology has been a field in which practical application has been ahead and has led to theoretical understanding, and two other articles illustrate this fact. Vitetta *et al.* describe a flourishing field in which a biological guided missile, an immunotoxin, is created by combining an antibody to a tumor cell and a cellular toxin in order to specifically kill tumor cells. The application of immune techniques, described by Capron *et al.*, to the cure of schistosomiasis, a debilitating parasitic disease affecting 200 million people, reveals that parasites have developed incredible stealth systems to evade the immune apparatus of higher vertebrates. Vaccines against such parasites still remain one of the most difficult goals of modern immunology, and understanding the fundamental mechanism is going to be essential for the development of successful vaccines.

The importance of the immune system is indicated by the fact that the number of cells in our bodies devoted to the immune system is approximately equal to the number of cells in the brain. Only a few years ago, immunologists elicited derision from "hard scientists" by defining an antibody as "a molecule generated by an antigen" and an antigen as "a molecule which reacts with an antibody." That seemingly circuitous reasoning has revealed the most sophisticated molecular and practical applications of any biological system. This field has mysteries still unsolved but it is one in which every step along the path produces some benefit to mankind.—D. E. KOSHLAND, JR.

Introducing GammaBind™ G Catches Only IgG Subclasses.



GammaBind G, a new engineered Protein G.

Now there's an improved form of Protein G, GammaBind G, which binds all IgG subclasses . . . even human IgG_3 . . . and engineered free of albumin cross-reactivity.

Binds the subclasses you need.

Human	*GammaBind G*	*Protein G**	*Protein A*
IgG_1	+	+	+
IgG_2	+	+	+
IgG_3	+	+	–
IgG_4	+	+	+
IgM	–	–	+
IgA	–	–	+
IgE	–	–	+
IgD	–	–	–
Albumin	–	+	–

**non-recombinant*

GammaBind G separates IgG for higher yields in less time; efficiently binds monoclonal antibodies for improved purification.

To order GammaBind G, call 1-301-258-0552.

Find out how GammaBind G can simplify your research with antibodies from rats, mice, rabbits, goats, humans and more.

Available for immediate delivery.

GENEX™

Genex Corporation
16020 Industrial Drive
Gaithersburg, MD 20877
(301) 258-0552

Designed For In Vitro Stability. Built To Save Gas. Priced To Sell.

CO_2 And Oxygen Incubators From Forma

The problem with buying a high technology incubator is that you get high technology problems. At a high technology price.

So much for expensive technology.

At Forma, we continue to develop economical, dependable water-jacketed incubators with common sense improvements to solve problems you know and understand.

Like better gas sensors for more accurate, more economical CO_2 control.

Easy oxygen control for **in vitro** modeling of any **in vivo** environment.

Self-diagnostic control modules that speed calibration and reduce maintenance.

Proven cabinet designs to inhibit contamination, reduce media desiccation, and to improve uniformity.

And because we build more incubators than anyone else in the world, we build them for less and pass the cost savings on to you.

That's the beauty . . . and the best technology of all.

Call Us!

Free Offer!
A handcrafted silk rose, for your time and interest in Forma water-jacketed incubators.

Detailed information on CO_2 automatics, controlled oxygen and constant flow models, all at attractive prices, is available now.

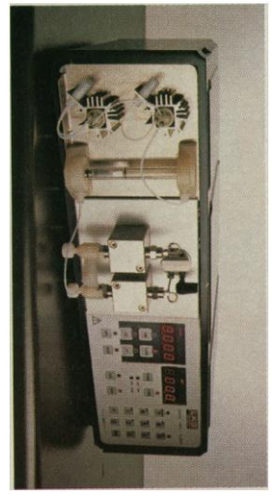
Call us today, toll-free.

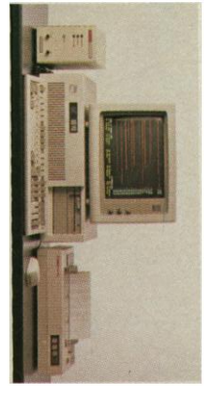
Forma Scientific
DIVISION OF MALLINCKRODT, INC.
BOX 649 MARIETTA, OH 45750 TELEX 29-8205

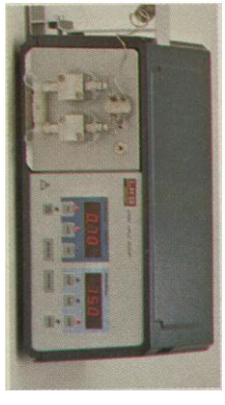
Toll-Free USA 800-848-3080 **In Ohio 800-848-3080** **In Canada 800-848-3080**

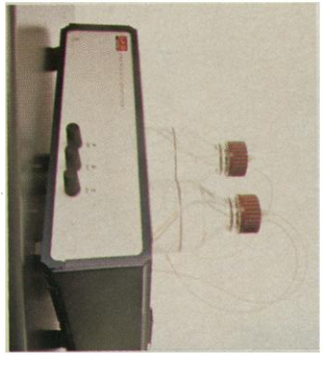
Circle No. 2 on Readers' Service Card

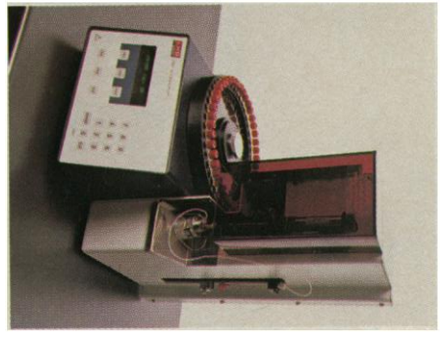
HPLC











The systems of choice

When selecting an HPLC system, the smart choice is the smart system—the one that gives you a choice.

For decades, LKB has been a name you can rely on for smart LC systems—modular components designed to help you make an intelligent choice. This tradition continues.

Pharmacia LKB Biotechnology believes that the world's research, industrial and clinical laboratories need more smart choices. That's why it's commitment to the continued development of high-quality instrumentation for analysis and purification of peptides, amino acids and other biomolecules is as strong today and tomorrow as ever before.

All LKB HPLC systems are flexible, versatile and compatible. Mix and match components to suit your particular chromatographic needs. Build as you grow. Pharmacia LKB representatives can help you choose between four principal categories of system types:

ISOCRATIC SYSTEMS offer a simple and effective approach to getting started. Choose an HPLC injector, precision pump, monitor and column—now you're ready for isocratic reversed-phase or gel filtration chromatography.

BASIC GRADIENT SYSTEMS add a gradient pump and solvent conditioner to provide greater functionality, for RPC, IEC or HIC gradient techniques.

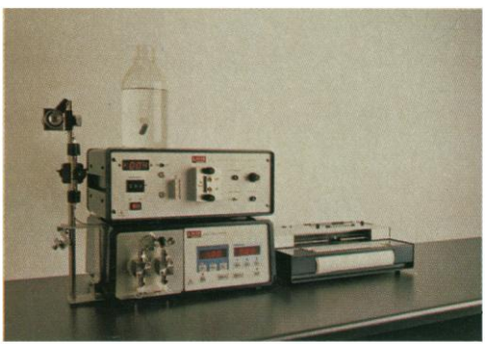
ADVANCED GRADIENT SYSTEMS give you the choice of automating your gradient chromatography in a configuration designed to deliver the highest possible reproducibility in results.

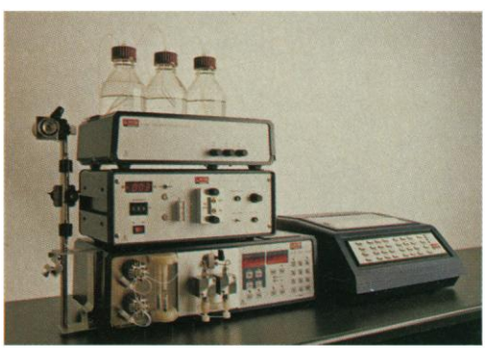
INERT SYSTEMS combine glass, titanium and inert polymers for totally inert fluidics whenever you need the extra security of a completely inert system.

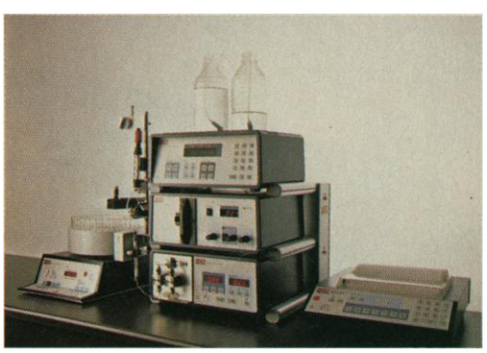
Your choice is a smart one, whichever LKB HPLC system you choose. That's because the built-in compatibility of the instruments allows you to add on or change your system as your needs change. It's a kind of guarantee against obsolescence.

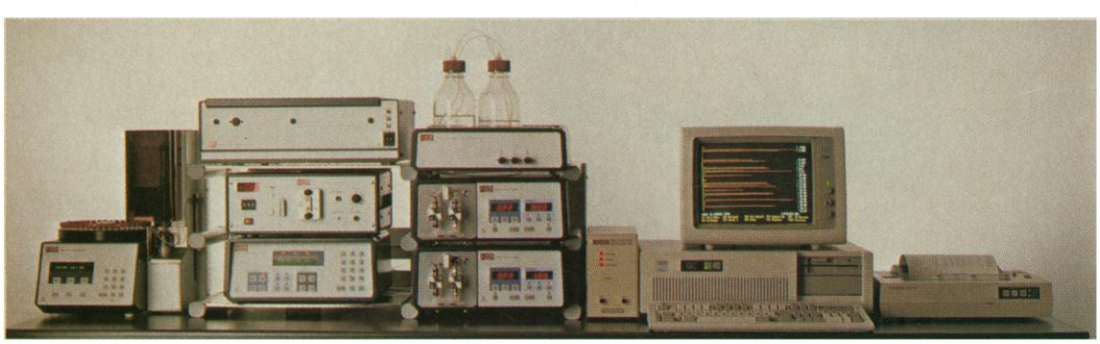
But LKB HPLC systems are a smart choice for other reasons, as well. In addition to precision instrumentation, Pharmacia LKB offers a long-standing tradition of quality and know-how, a worldwide network of service and support, a wide range of high performance separation media, technical assistance and training, application notes, seminars, workshops, etc.

Most of all, however, they offer the quality systems of choice. Contact your nearest Pharmacia LKB representative and ask for a copy of the complete HPLC Product Guide. It's a smart choice you won't regret.









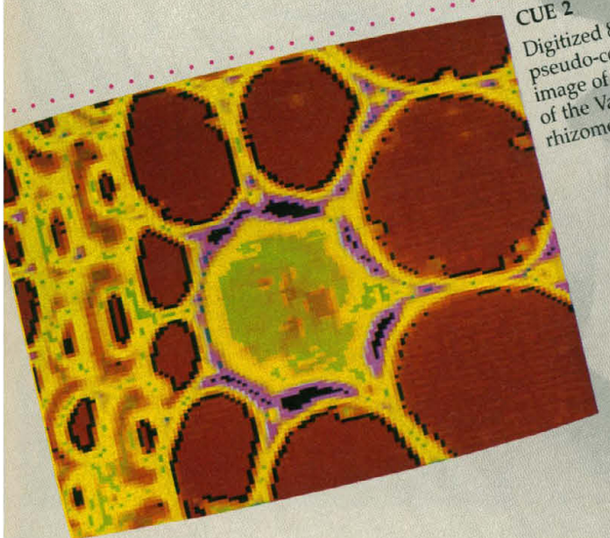
LKB

Pharmacia LKB Biotechnology AB, 751 82 Uppsala, Sweden, Tel. 018-16 30 00, Telex 760 70, Telefax 018-14 38 20.

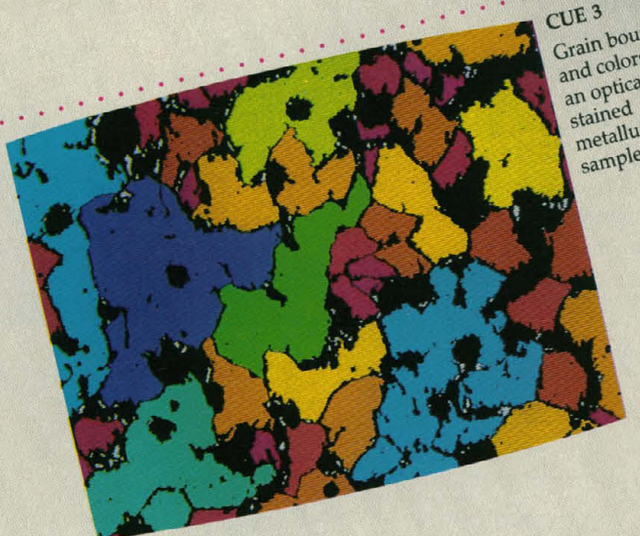
LKB products: Box 305, S-161 26 Bromma, Sweden, Tel. 08-799 80 00, Telex 10492, Telefax 08-98 63 64.
Australia (02)888 36 22 • **Austria** (0222)69 16 01 0 • **Austria-Eastern European Countries** +43(222)92 16 07 • **Belgium** (02)242 4660
Canada (0514)684 88 81 • **Denmark** (02)26 52 00 • **Finland** (021)67 81 11 • **France** (01)64 46 36 36 • **Greece-Middle East** +30(1)894 73 96
Great Britain (0908)66 11 01 • **Holland** (034)80 77 911 **Hong Kong-Far East** (852)5-814 84 21 • **India** (0812)57 37 88 • **Italy** (02)253 913 21 • **Japan** (03)444-4811
Norway (02)54 90 95 • **People's Republic of China** (Beijing) 89 06 21 • **Soviet Union** (095)255-6984 • **Spain** (03)230 05 01 • **Sweden** (08)799 80 00
Switzerland (01)821 18 16 • **United States** (0201)457 80 00 • **West Germany** (0761)490 30. Over 60 qualified representatives throughout the world.

Circle No. 66 on Readers' Service Card

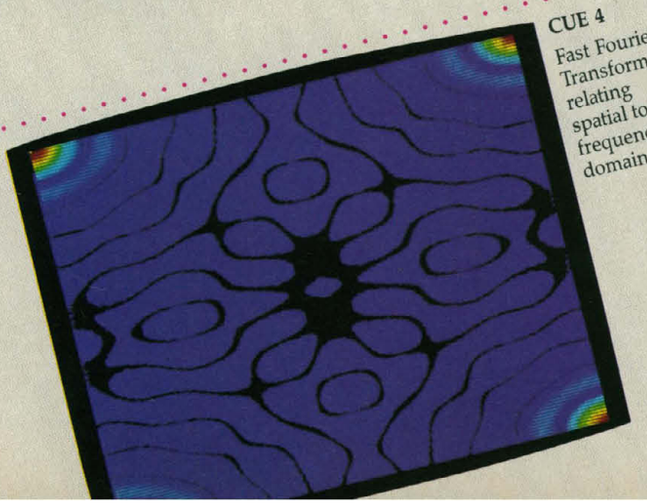
CUE now gives you three ways to enter analysis.



CUE 2
Digitized 8X, pseudo-colored image of Lily of the Valley rhizome



CUE 3
Grain boundaries and colors in an optically stained metallurgical sample



CUE 4
Fast Fourier Transform relating spatial to frequency domain

Speed. Precision. Versatility. Ease. Economy. These have been the hallmarks of image analysis on The CUE Series.

Now CUE gives you something more: Selection.

The CUE 2, for image analysis made swift and simple. The CUE 3, offering the performance of the CUE 2 with true color analysis. And the powerful CUE 4, with a high-level array processor and enhanced frame grabber, for research-level applications.

"Dedicated" performance, desktop profile

With all three CUE systems, highly refined software provide capabilities rivaling those of "dedicated" image analyzers. At a fraction of the space required. And a fraction of the cost.

Specialized programs for densitometry, metallography, 3D reconstruction and autoradiography are available. More are continually being developed to further expand your range of applications on each system. And all CUE systems offer the innovative Auto Route, which enables you to customize your own storable "one-touch" program, greatly simplifying your job.

Without sacrificing precision or accuracy. The CUE systems display 256 gray levels or pseudo-colors (true colors in the CUE 3) with a display resolution of 512 x 512 pixels. And they give you the flexibility of a modular system operable on the full line of IBM personal computers.

Don't miss your CUE

For a hands-on demonstration of any of the CUE systems for *your* applications, call toll-free: 1-800-446-5967. Or write Olympus Corporation, Precision Instrument Division, 4 Nevada Drive, Lake Success, NY 11042.

CUE 2, CUE 3 and CUE 4 Image Analysis Systems

OLYMPUS®

The Image of Quality.

For information circle reader service number 55
For a demonstration circle reader service number 56

RECENT TITLES IN IMMUNOLOGY

AUTOIMMUNITY

edited by *Terence J. Wilkin*, General Hospital, Southampton, UK
Written for those with an interest in autoimmunity, its immunology, genetics, pathogenesis and clinical expression.
Four issues per volume; Volume 1, Issue 1 due January 1988*
ISSN: 0891-6934
Subscription prices per volume: $200.00, Corporate; $124.00, University and academic; $62.00**, Individual.
A Harwood Journal

IMMUNODEFICIENCY REVIEWS

edited by *Fred S. Rosen*, Harvard Medical School, Boston, USA and *Maxime Seligmann*, Hopital Saint-Louis, Paris, France
Provides the most recent information on primary and secondary immunodeficiency diseases, and relevant experimental models.
ISSN: 0893-5300 First issue due Spring 1988
Subscription prices per volume: $200.00, Corporate; $124.00, University and academic; $62.00**, Individual.
A Harwood Journal

INTERNATIONAL REVIEWS OF IMMUNOLOGY

edited by *Heinz Köhler*, IDEC, La Jolla, CA 92037, USA, and *Constantin Bona*, Mount Sinai School of Medicine of the City of New York, USA
Provides current information on research in immunology. Of interest to immunologists, molecular biologists, microbiologists, and physicians.
Four issues per volume; 1987 volume block: Volumes 3-4*
ISSN: 0883-0185
Subscription prices per volume: $208.00, Corporate; $140.00, University and academic; $70.00**, Individual.
A Harwood Journal

NEUROIMMUNOMODULATION

A new section of the INTERNATIONAL JOURNAL OF NEUROSCIENCE
Regional Editors: NOVERA HERBERT SPECTOR (US), BRANISLAV D. JANKOVIC (Western Europe), and ION BACIU (Eastern Europe) Editor-in-chief: *Sidney Weinstein (US)*

NEUROIMMUNOMODULATION will cover all aspects of the topic including immunology, physiology, pharmacology, endocrinology, genetics, cell biology, molecular biology and behavior.
Six volumes per year; 1987 volume block: Volumes 38-43*
Subscription prices per volume: $550.00, Corporate; $338.00, University and academic; $169.00** Individual.
A Gordon & Breach Journal

ALSO OF INTEREST
NEUROIMMUNOMODULATION: PROCEEDINGS OF THE FIRST INTERNATIONAL WORKSHOP
Edited by N.H. Spector et al.
0-677-21960-1 Price not yet set
A Gordon & Breach Book

ALSO OF INTEREST

CHRONIC LYMPHOCYTIC LEUKEMIA

edited by *Aaron Polliack* and *Daniel Catovsky*
Presents papers by leading international clinicians and researchers on new developments in the biology, immunology, morphology and ultrastructure of the disease.
Spring 1988 3-7186-4802-4 Price not yet set
A Harwood Book

MEDIATORS OF THE IMMUNE RESPONSE

by *N.V. Medunitsyn, V.I. Litvinov* and *A.M. Moroz*, Institute of Immunology, and Institute of Tuberculosis, Ministry of Health of the USSR, Moscow.
Examines the "immunologic language" of cells, and explores the properties of the soluble mediators that function as key components of cell-cell interactions, describing their behavior during responses.
1987 340 pp. hardcover 3-7186-0310-1 $96.00
A Harwood Book

SOVIET MEDICAL REVIEWS SERIES

VIROLOGY REVIEWS 1
edited by *Victor M. Zhdanov*, D.I. Ivanovskii Institute of Virology, Academy of Medical Sciences, Moscow, USSR
Focuses on current Soviet research into the virology and ecology of viral infection, covering a range of topics such as virus morphology, genetics and pathogenicity, the interaction of viruses with cells.
1987 344 pp. hardcover 3-7186-0314-4 $180.00
A Harwood Book

VIROLOGY REVIEWS 2
edited by *Victor M. Zhdanov*
Contains papers on topics such as the early stages of virus-cell interaction, the action of ultraviolet radiation upon viruses, antigens of virus-induced tumors and the biosynthesis of arenaviral macromolecules.
1987 394 pp. hardcover 3-7186-0402-7 $180.00
A Harwood Book

IMMUNOLOGY REVIEWS 1: Cell Interaction, Myelopeptides, Artificial Immunogenes
edited by *Rem V. Petrov*, Institute of Immunology, USSR Academy of Medical Sciences, Moscow, USSR
Presents a detailed study of the regulation of immunogenesis. Of interest to researchers in immunology and immunogenetics, hematology, cytology, membrane biology and molecular engineering.
1987 462 pp. hardcover 3-7186-0315-2 $275.00
A Harwood Book

IMMUNOLOGY REVIEWS 2: Suppressor B Lymphocytes
edited by *Rem V. Petrov*, USSR Academy of Medical Sciences, Moscow
Provides a detailed review of the literature and the authors' own findings regarding the existence, properties and functions of B-suppressor cells.
3-7186-4800-8 Price not yet set.
A Harwood Book

ONCOLOGY REVIEWS 1
edited by *N.N. Blokhin* and *N.N. Trapeznikov*, All-Union Cancer Research Center, USSR Academy of Medical Sciences, Moscow.
Includes a description of a method for immunodiagnosis of lymphomas and lymphatic leukemia, and a brief review of the methodological principles of immunoelectronic microscopy.
1987 221 pp. hardcover 3-7186-0313-6 $140.00
A Harwood Book

* Subscriptions available by volume block only
* * Individual subscription price available only to individuals who order directly from the publisher and who pay by personal check or credit card. All prices subject to change without notice.

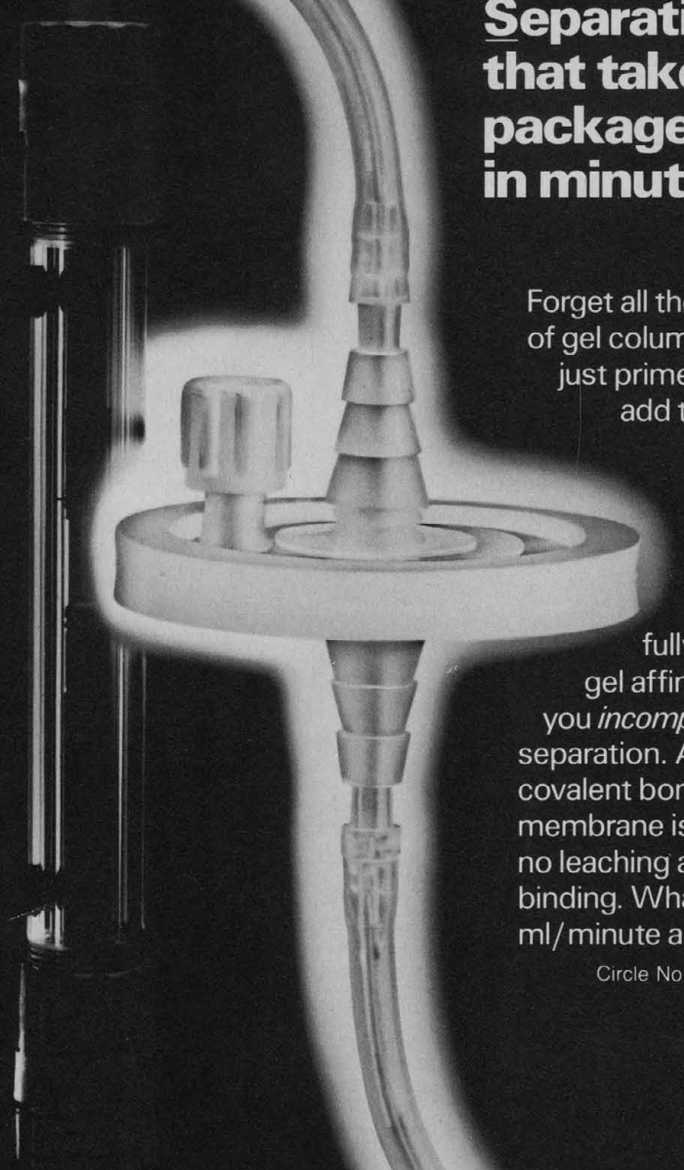
Order these Gordon & Breach and Harwood titles through:

SIBS

P.O. Box 786 Cooper Station, New York, NY 10276, USA • P.O. Box 197 London WC2E 9PX, UK

Circle No. 25 on Readers' Service Card

Pure Simplicity.



Introducing The new MASS™

Membrane Affinity Separation System that takes you from package to pure MAb in minutes, not hours!

Forget all the prep and process steps of gel columns and matrix packing—just prime the MASS™ device... add the sample...wash...and elute the bound IgG. And that's it—Pure Simplicity!

Beyond yields and purity fully comparable to the best gel affinity columns, MASS™ gives you *incomparable* speed and ease of separation. And, because the unique covalent bond of ligand to proprietary membrane is so stable, there's virtually no leaching and very low non-specific binding. What's more, flow rates of 1–10 ml/minute are easily attainable.

Circle No. 85 on Readers' Service Card

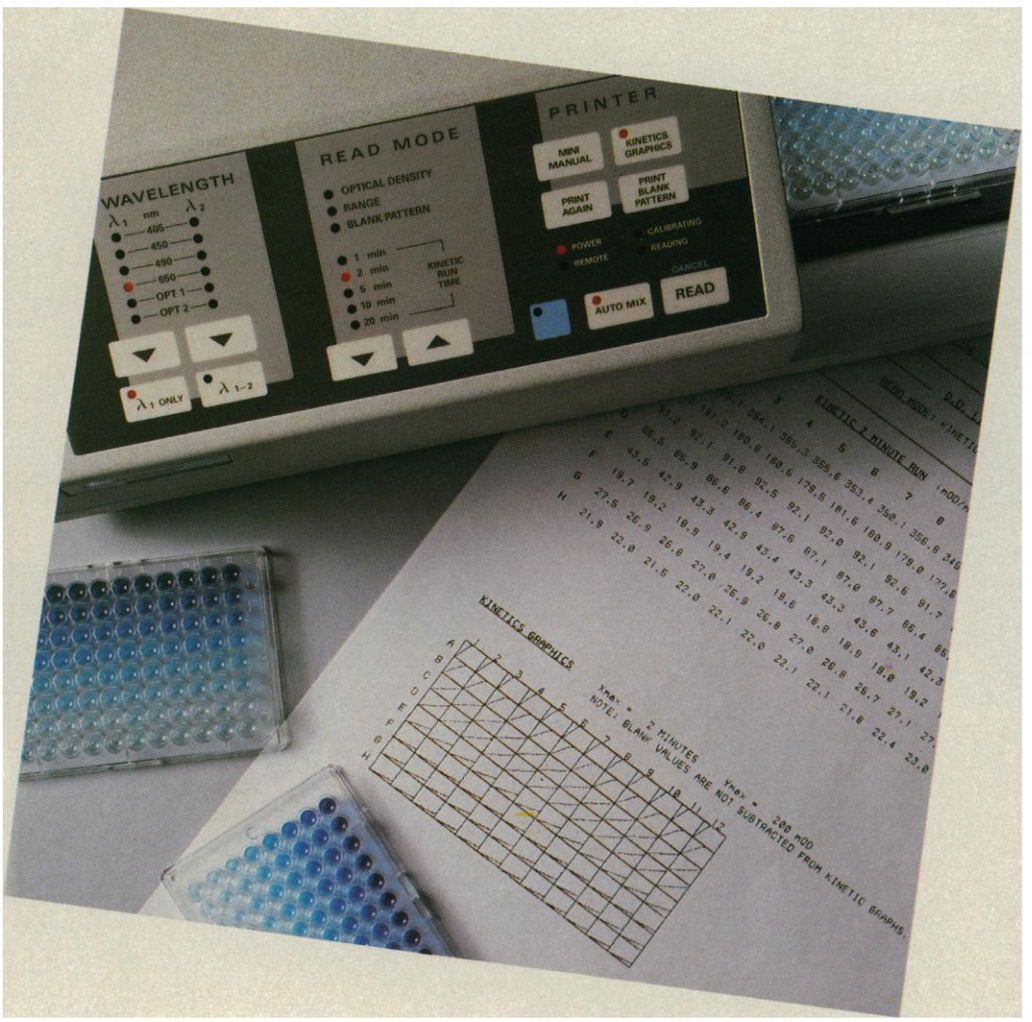
For faster results, call 1-800-622-3280

NYGENE

NYGENE CORP.
6 Executive Plaza
Yonkers, NY 10701

Risk-free trial offer! Call now for details!

Vmax™ introduces kinetics to ELISA.



Two systems in one.

The new Vmax Kinetic Microplate Reader reads all 96 wells in as few as 5 seconds. The result: a new level of throughput in endpoint analysis; and the ability to accurately monitor the initial linear portion of enzyme reactions for kinetic measurements.

More than a matter of speed.

Vmax meets the stringent instrumentation requirements of solid-phase enzyme kinetics. For excellent precision in ELISA, the unique AUTOMIX function mixes the contents of each well between readings. Because enzyme reactions are temperature-dependent, Vmax has an isothermal reading chamber. Furthermore, onboard microprocessors compute reaction rates automatically.

AUTOMIX Off AUTOMIX On

Expand your microassay capabilities.

Enzyme kinetics extends the usable dynamic range of ELISA on any microplate: from very low level enzyme activities to highly chromogenic samples. With Vmax, there is less need for multiple dilutions. Different assays can be performed on the same microplate.

For computational and data management requirements, the optional SOFTmax™ is a comprehensive, yet easy-to-use software package designed for IBM® and many IBM®-compatible microcomputers. SOFTmax also controls Vmax, providing yet another level of convenience and versatility.

Introduce Vmax to your lab.

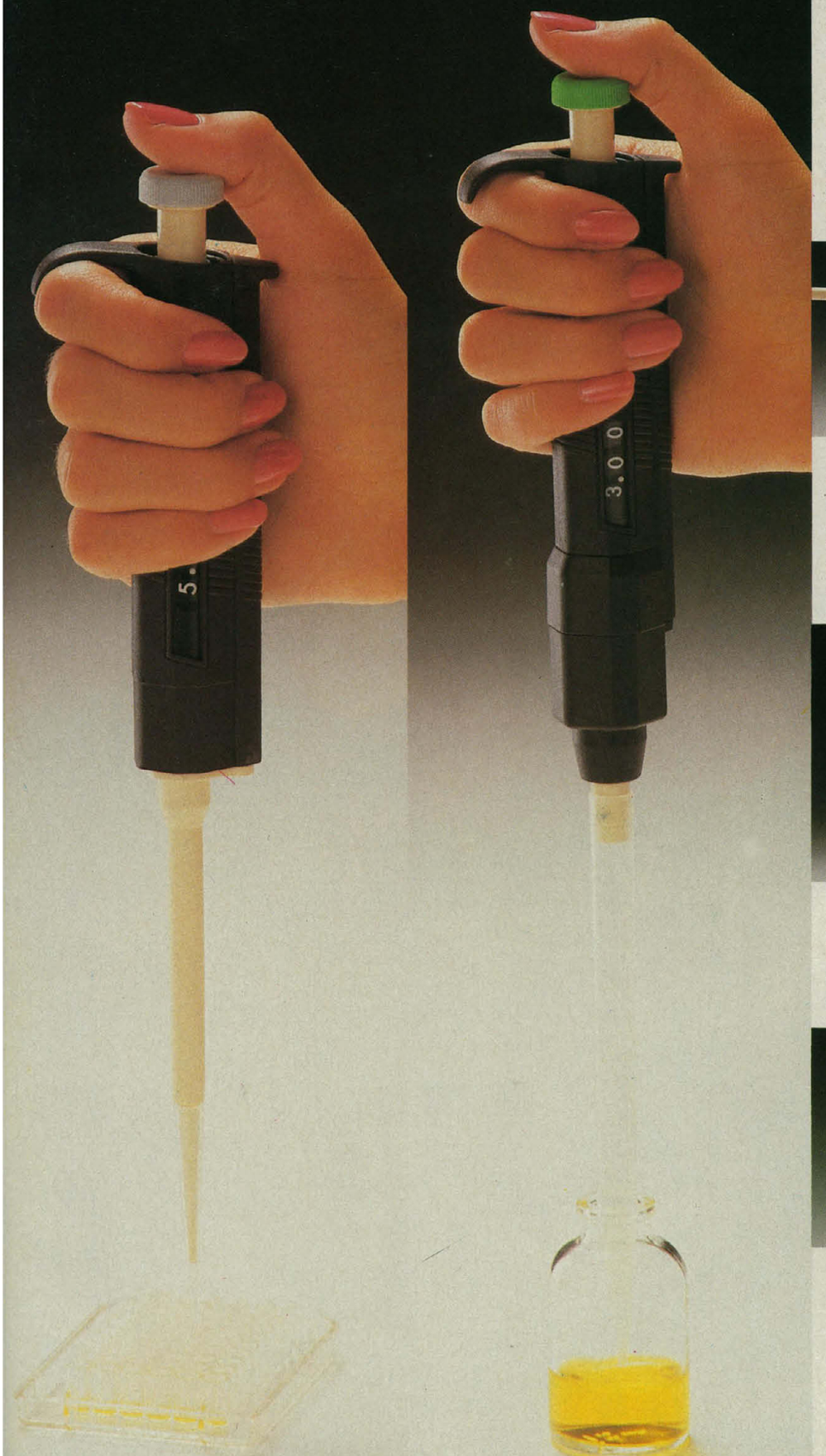
Whether you want to improve throughput of your endpoint analysis, or explore the new capabilities of solid-phase and liquid-phase enzyme kinetics in 96-well plates, contact Molecular Devices. Send for a copy of our new Application Note, *Kinetic Analysis for ELISA Using the Vmax.* We will also tell you about the special free trial program.

Molecular Devices

Molecular Devices Corporation
3180 Porter Drive
Palo Alto, CA 94304
(415) 493-0166
(800) 635-5577
(800) 635-5588 (within California)

Circle No. 86 on Readers' Service Card

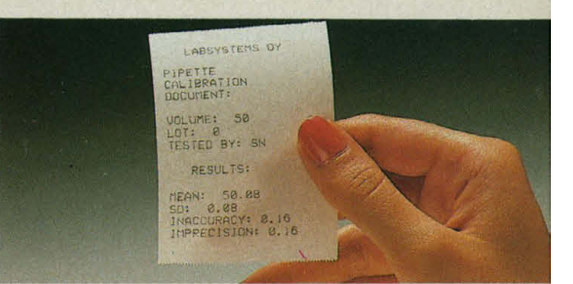
ipette's the answer.



From single-channel and multichannel pipettes through to the unique Diluter, Labsystems' Finnpipette range of liquid handling equipment offers you the widest choice on the market. The Digitals shown here for example go right down to 0.5 μl. All with fully validated accuracy and precision.
And because we understand the nature of your work, easy and above all comfortable to use. To ensure best results we also supply a full range of quality disposables and accessories. So whatever field you're working in – clinical chemistry, microbiology, genetechnology – take a tip and start using Finnpipettes.

Ease of use and comfort – Simply turn the thumb button. It clicks to the desired volume. No scales to align. Instead check the clear, easy-to-read digital display and start pipetting. Without straining your hand ... even after hours of use – thanks to the lightness and comfort common to all Finnpipettes.

Safety and durability – The streamlined unobtrusive tip ejector ensures safety even with biohazardous materials. And also prevents accidental detipping. Durable construction and space-age plastics mean longer bench life.

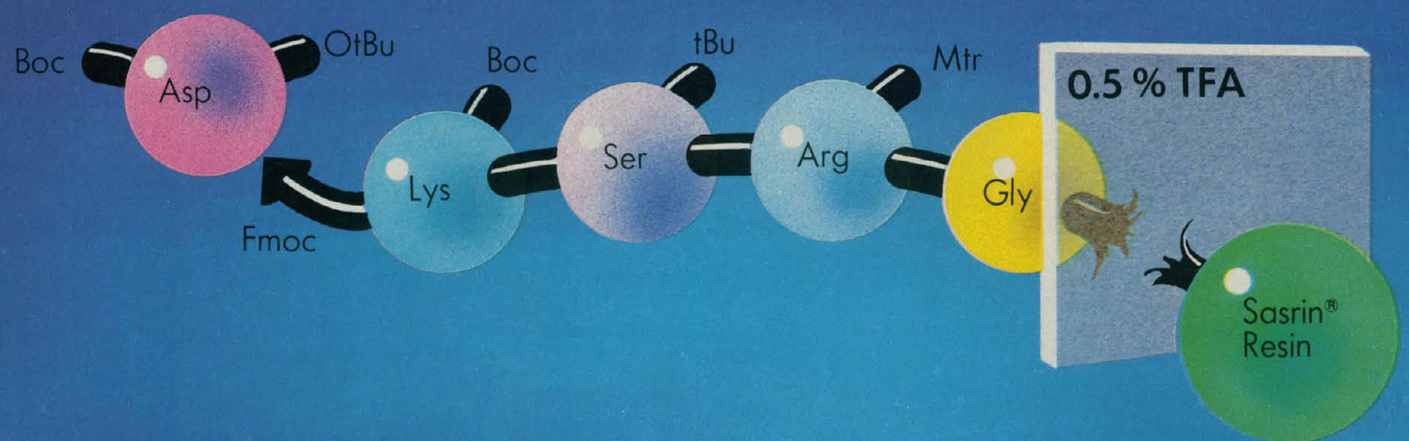


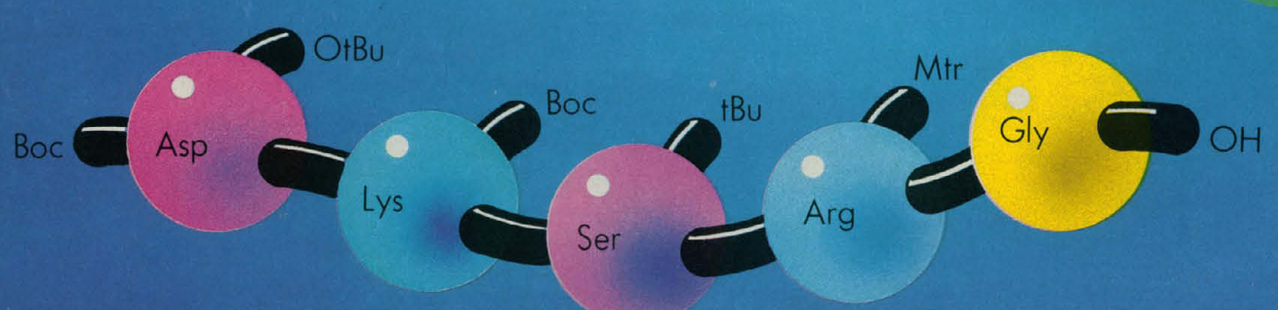
Accuracy and precision – Each Finnpipette arrives ready for use with its own accuracy validation certificate. What's more, recalibration can be carried out in your laboratory, quickly and easily.

Full range of quality disposables – for best results we recommend using Finntips. Made from clear contamination-free plastic, they are available vertically packed for added convenience in boxes, or bulk-packed in economically-sized bags and trays.

Circle No. 142 on Readers' Service Card

I ♥ SASRIN®





SASRIN®
Super Acid Sensitive Resin
The perfect resin for your building blocks prepared by Fmoc-solid phase chemistry

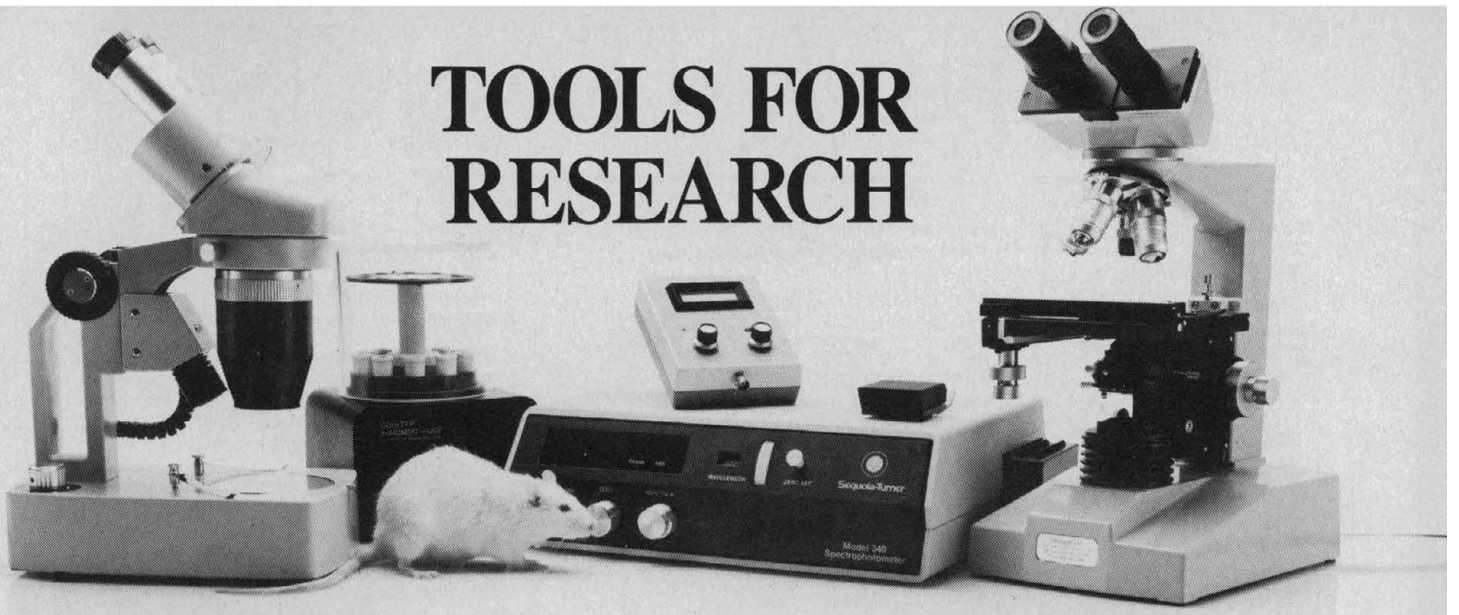
Synthesis and cleavage of protected fragments
Fragment condensations on resin
High loading 0.5 – 0.7 (meq/g)
Low racemization (< 1 %)
Ease of handling (polystyrene resin)
No scale-up problems
Mechanical stability
Economics
Simplifies FDA registration

For our infosheet and new catalog ask:

BACHEM Feinchemikalien AG
Hauptstrasse 144
CH-4416 Bubendorf/Switzerland
Phone 061/95 23 33 Fax 061/95 25 49
Telex 966 081

BACHEM Bioscience Inc.
Div. of BACHEM Switzerland
3700 Market Street
Philadelphia PA 19104
Phone 215/387 0011 Fax 215/387 1170
Telex 910/250 2352 Easy link 620/268 65

PS. BACHEM stands for BAsel CHEMistry



TOOLS FOR RESEARCH

Labeled compounds from Merck Sharp & Dohme/Isotopes.

MSD Isotopes – research products that work, bringing results to researchers in biology, chemistry, physics, medicine and related fields.

Did you know that we now offer thousands of compounds labeled with deuterium, carbon 13, nitrogen 15 and other stable isotopes too? And did you know that even if you require a compound which is not available from us immediately 'off-the shelf', we have the world's best facilities to custom synthesize it for you?

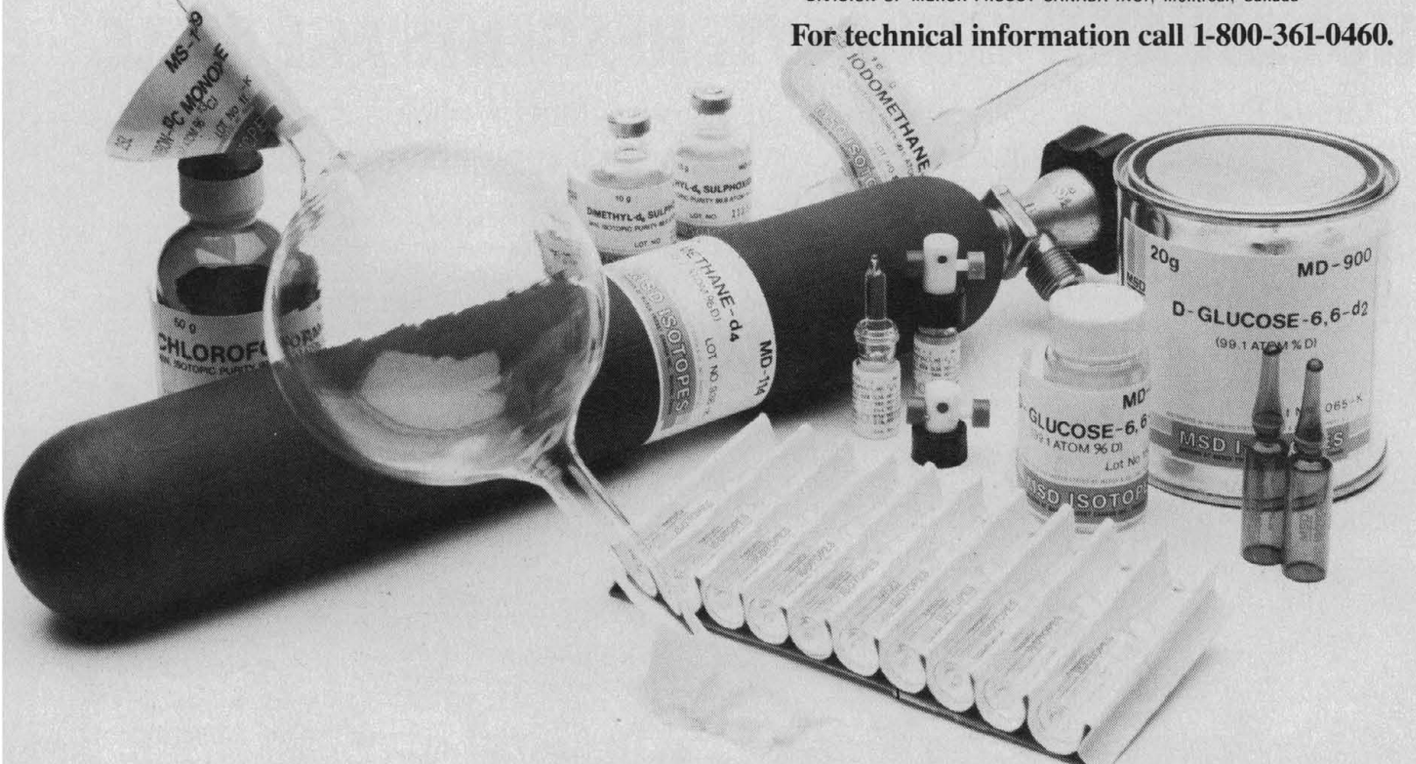
Just call or write to us for more information on what we have in stock and can make for you.

MSD

MSD ISOTOPES

DIVISION OF MERCK FROSST CANADA INC., Montreal, Canada

For technical information call 1-800-361-0460.



WEST COAST
P.O. Box 2951
Terminal Annex
Los Angeles, CA 90051
Los Angeles Area: (213) 723-9521
Outside State of CA: (800) 423-4977
State of CA: (800) 372-6454

EAST COAST & CENTRAL
4545 Oleatha Avenue
St. Louis, MO 63116
Outside state of MO: (800) 325-9034
State of Missouri: (314) 353-7000

CANADA
P.O. Box 899
Pointe Claire/Dorval, Quebec
Canada H9R 4P7
Telephone: (514) 697-2823

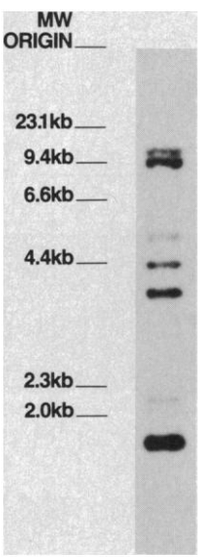
Circle No. 84 on Readers' Service Card

GENOMIC GRADE™

THE IBI GOLD STANDARD

IBI is proud to introduce the first **BLOT QUALIFIED** line of **GENOMIC GRADE™** restriction enzymes specifically designed for **RFLP, gene mapping** and **OFAGE/FIGE** applications. In addition to our normal stringent quality control procedures, **each lot is assayed on high molecular weight GENOMIC DNA**. Samples prepared from both **peripheral blood and cultured cells** are digested to completion, transferred to a nylon membrane and subsequently probed. By incorporating into our Quality Control assay procedures the same substrate used in your own experiments, **GENOMIC DNA**, many commonly observed artifacts related to genomic analysis are eliminated. These unique functional assays guarantee:

- ***STRONG UNIT EQUIVALENTS*** — The number of units required for complete digestion of DNA derived from both peripheral blood and cultured cells is reported for each lot of every Genomic Grade enzyme. By taking into account variations in activity due to substrate specificity (GENOMIC DNA vs. lambda), or the protocols employed in sample preparation (blood vs. cells), the likelihood of a **partial digestion in your hands is minimized.**
- ***OPTIMAL SIGNAL-TO-NOISE RATIO*** — Minimum acceptable signal-to-noise ratio is determined by laser densitometry of blot autoradiograms. High levels of background or smeared lanes can obscure complex or faint patterns making data difficult or impossible to interpret. Each lot of Genomic Grade enzyme has passed this sensitive functional assay.



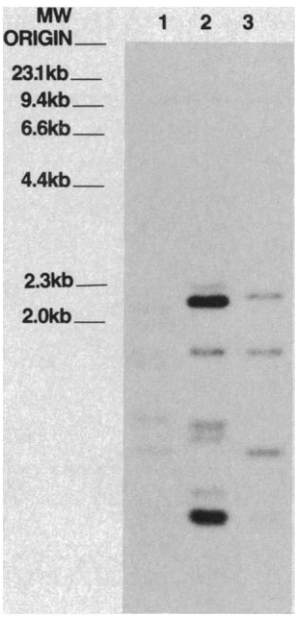
DNA was prepared from normal peripheral blood leukocytes, digested to completion with *Pvu* II (Genomic Grade) and transferred from a 1.5% agarose gel to a nylon filter membrane. A 1.2 Kb DRβ cDNA clone contained in the *Pst* I site of pBR322 was used as the probe. Densitometry values are presented as ratios in the following format: filter background/lane background/band signal or, in this example, an average signal-to-noise ratio of 30:1.

Quality Biologicals from...

Life on the Edge.

- ***NO DETECTABLE SPECIFIC ENDONUCLEASE CONTAMINATION*** — The level of detection of extraneous fragments is increased **1,000-fold** under blotting conditions as compared to sensitivities achievable by visual examination of an ethidium bromide stained agarose gel (5 picograms as compared to 5 nanograms). These dramatically improved levels of sensitivity are a prerequisite if easily misinterpretable artifacts are to be avoided.

- ***NO DETECTABLE PLASMID CONTAMINATION*** — **Only intact-vector probes are used** in IBI's Genomic Grade blotting assays to ensure that even trace amounts of vector DNA contaminants in the enzyme preparation are readily detected. This assay more closely resembles the conditions in your own lab where gel purified fragments invariably contain some vector material. The level of sensitivity exceeds 5 picograms plasmid DNA per lane, eliminating the possibility of false positives.



DNA was prepared from three different cultured β-lymphoblastoid cell lines, digested to completion with *Rsa* I (Genomic Grade) and transferred to a nylon filter membrane. A DRβ clone contained in the plasmid pBR322 was then nick-translated and used as the probe. DRβ was employed because of its highly polymorphic nature. As is evident in the autoradiogram, no signals are present in the molecular weight range >2.3 Kb, where one would expect to detect plasmid contamination.

Has your ability to interpret your southern blots become more of an art than a science? Protect the integrity of your precious samples, as well as your interpretations. **The highest level of confidence is assured with IBI Genomic Grade Enzymes. FUNCTIONAL TESTING** guarantees uncompromised enzyme performance and reliability in this specialized area of application.

GENOMIC GRADE™ restriction enzymes — ANOTHER IBI FIRST!

To find out more about this exciting new line of **GENOMIC GRADE** restriction enzymes please call 1-800-243-2555 today. International inquiries, call your local IBI affiliate or IBI at 203-786-5620. TELEX 643993. IBI CANADA, call TOLL-FREE 800-387-1525.

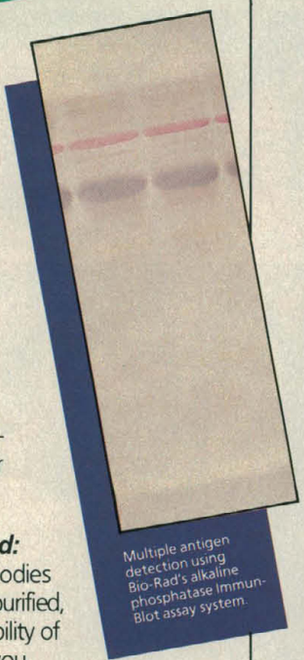
The Cutting Edge of Molecular Biology

Circle No. 159 on Readers' Service Card

IBI
A Kodak Company

Blot with the best.

Bio-Rad's Blotting Grade antibody conjugates.



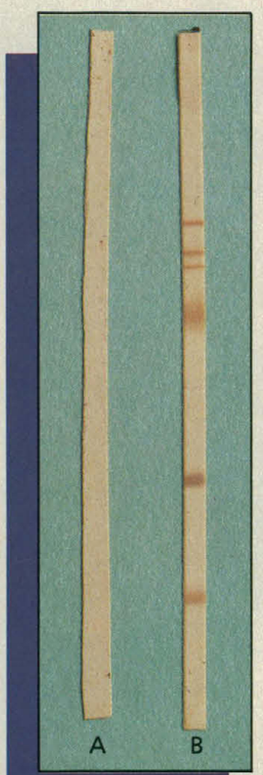
Multiple antigen detection using Bio-Rad's alkaline phosphatase Immun-Blot assay system.

How can you be certain that you're using the highest quality antibodies for your immune blotting applications? There's no doubt about it if you're using Bio-Rad's Affinity Purified Blotting Grade antibody conjugates or Protein A HRP.

■ ***No Background:*** These special antibodies are double affinity purified, avoiding the possibility of cross-reactivity, so you detect only the antigen of interest, not false positives. (See figure.) For monoclonals, our anti-mouse reagents will detect IgM and IgA antibodies as well as all IgG subtypes.

■ ***High Titer:*** Typically dilutions are 1/3000 to 1/6000 for antibody conjugates, and 1/10,000 for Protein A HRP. All Blotting Grade conjugated reagents are quality control tested by Western Blot analysis. Greater dilution of second antibody conjugates means elimination of background which is associated with non-specific antibody binding when increased antibody concentrations are used.

■ ***Multiple antigen detection on the same Blot:*** Using Bio-Rad's Blotting Grade color development substrates and Blotting Grade conjugated antibodies, you can perform multiple sequential detection of immune complexes on the same Western Blot. Immune complexes are visualized as purple and red bands on the membrane (as shown above).



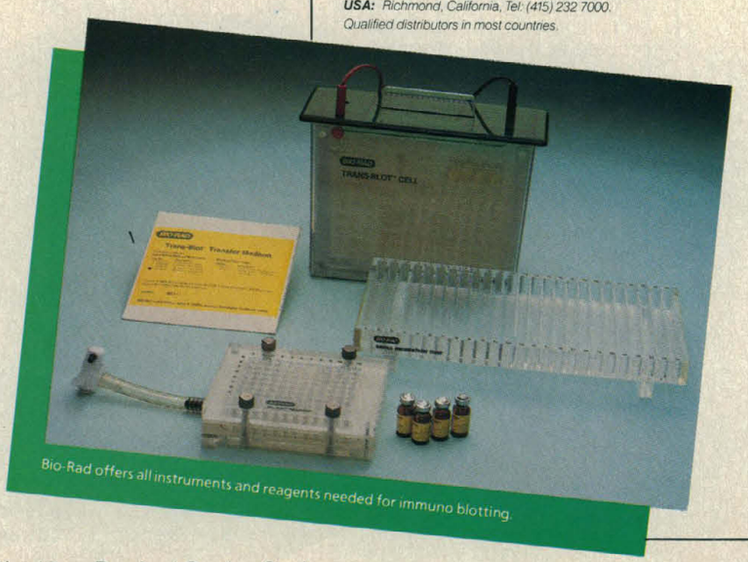
Western blot of HTLV III/LAV antibodies. Detection accomplished using Bio-Rad's Goat Anti-Human Immun-Blot™ Assay system. (A) HTLV III/LAV Antibody Negative Human Serum (B) HTLV III/LAV Antibody Positive Human Serum.

Blotting grade conjugated antibodies and color development substrates are included with all of Bio-Rad's Immun-Blot™ Assay Kits for picogram level, non-isotopic immune detection. Kits are available containing anti-rabbit, anti-mouse and anti-human HRP conjugated antibodies, anti-rabbit and anti-mouse alkaline phosphatase conjugated antibodies and HRP conjugated Protein-A.

Bio-Rad offers a complete selection of blotting membranes including nitrocellulose (0.2 μm and 0.45μm) and Zeta-Probe™ charge modified nylon membrane, as well as APT, ABM and DEAE blotting papers. We also provide detailed protocols that guarantee first time blotting success! For more details, contact us for our brochure, "Products and Techniques for the Monoclonal Antibody Laboratory."

BIO-RAD

AUSTRALIA: *Hornsby, Tel: 008-224354.*
AUSTRIA: *Vienna, Tel: (0222) 828901.*
BELGIUM: *Brussels, Tel: (02) 375 1240.*
CANADA: *Mississauga, Tel: (416) 624 0713.*
FRANCE: *Paris, Tel: (01) 45455010.*
GERMAN FEDERAL REPUBLIC: *Munich, Tel: (089) 1499050.*
HONG KONG: *Tel: 5-470333.*
ITALY: *Milan, Tel: (02) 2138751.*
JAPAN: *Tokyo, Tel: (03) 4315181.*
THE NETHERLANDS: *Utrecht, Tel: (030) 881141.*
SWITZERLAND: *Glattbrugg, Tel: (01) 8101677.*
UNITED KINGDOM: *Watford, Tel: (0923) 40322.*
USA: *Richmond, California, Tel: (415) 232 7000.*
Qualified distributors in most countries.



Bio-Rad offers all instruments and reagents needed for immuno blotting.

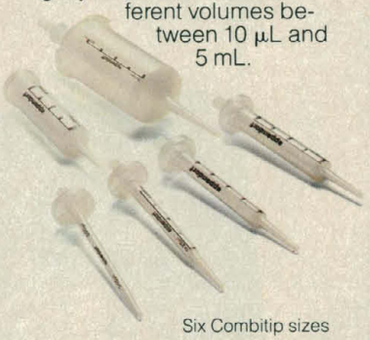
The repeater.

Eppendorf Repeater™ Pipette

Reliable, repetitive pipetting.
With the Eppendorf Repeater* Pipette, dispensing up to 48 samples without a refill is a snap. Just set the selection dial for the volume you need and your choice is locked in place to prevent errors. That means the last sample will be as accurate and precise as the first. And the unique Combitip™ polypropylene/polyethylene reservoir eliminates cleaning, contamination, and carryover because it's disposable.

1-second delivery.
The Repeater makes serial pipetting procedures faster than ever before. Simply press the lever to deliver your samples at 1-second intervals. The volume range is wide enough to accommodate almost any procedure. With six Combitip sizes and five dial settings, you choose from 22 different volumes between 10 µL and 5 mL.

*U.S. Pat. No. 4406170



Six Combitip sizes

A wide variety of applications.
The Repeater can handle any liquid easily. Even difficult or hazardous liquids aren't a problem, since the liquid contacts only the Combitip—not the instrument itself. The Combitip is available in nonsterile or sterile packaging for microbiologic and tissue culture techniques. And it can be refilled and reused as long as the same liquid is being pipetted.

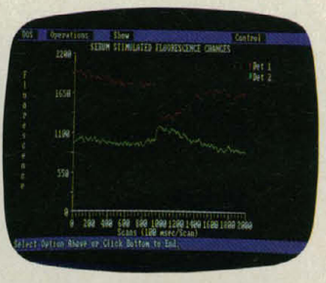
For more information: call 800-645-3050; in New York, 516-334-7500. Or write Brinkmann Instruments, Inc., Cantiague Road, Westbury, NY 11590. (In Canada: 416-675-7911; 50 Galaxy Blvd., Rexdale, Ont. M9W 4Y5)

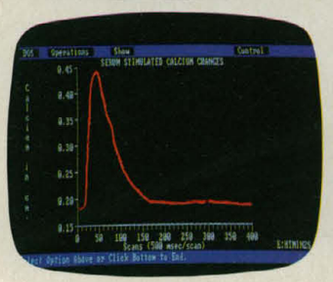
For information circle reader service number 79
For a demonstration circle reader service number 80

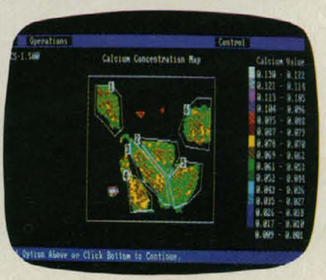
eppendorf
Shaping the future. **Brinkmann** INSTRUMENTS, INC.

BRK-5452

CALCIUM Measurements in Living Cells







Intracellular changes in free calcium concentrations control a variety of cellular processes. Significant calcium fluctuations may occur over periods from milliseconds to minutes.

You can measure calcium fluxes over these intervals with the

ACAS 470 Interactive Laser Cytometer.

The dual wavelength Simultaneous Detection System on the ACAS 470 measures emissions from both free and bound forms of the fluorescent calcium indicator, Indo 1. The ratio of these measurements can be used to calculate free calcium concentrations.

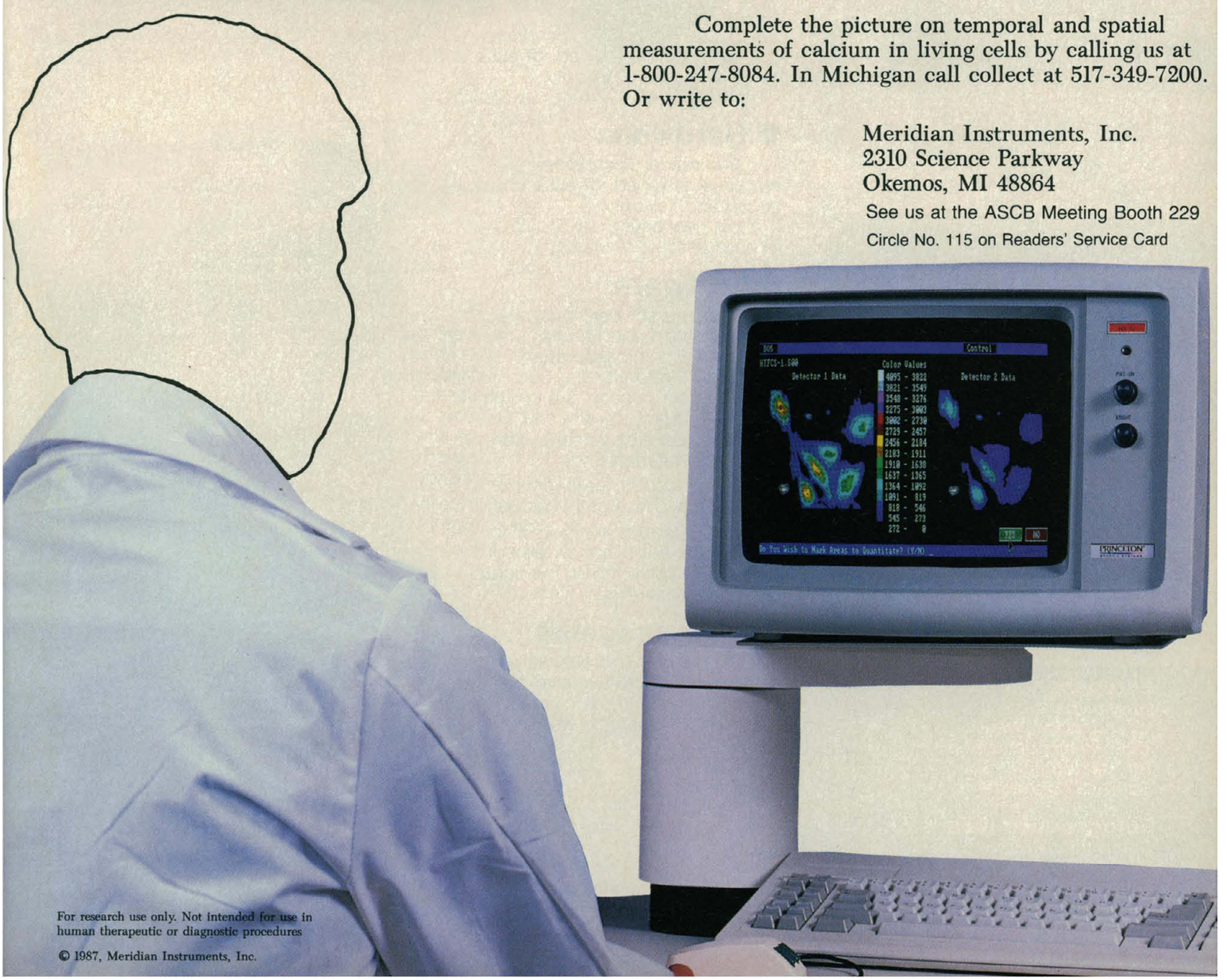
The simultaneous collection of data with the ACAS 470 provides ratio values that allow you to measure accurately very rapid changes in free calcium concentrations.

Complete the picture on temporal and spatial measurements of calcium in living cells by calling us at 1-800-247-8084. In Michigan call collect at 517-349-7200. Or write to:

Meridian Instruments, Inc.
2310 Science Parkway
Okemos, MI 48864

See us at the ASCB Meeting Booth 229

Circle No. 115 on Readers' Service Card



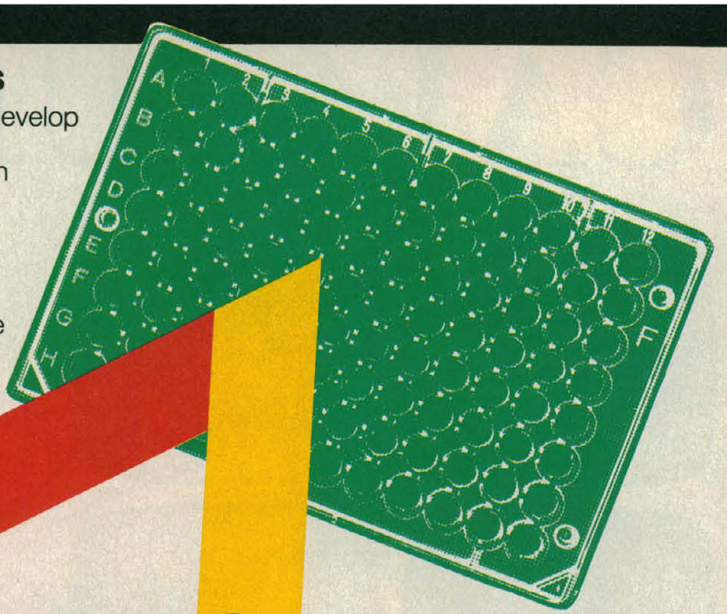
For research use only. Not intended for use in human therapeutic or diagnostic procedures

● Creative biotech from Eurogenetics

Based in Tessenderlo, Belgium, the company exists to develop and market diagnostic products. It provides a link between universities and industry to promote specifically European research projects.

Eurogenetics is a label of quality in the biotechnology and clinical laboratory market.

Now, Eurogenetics Bio-link program offers an integrated range of products for immunoassay : hardware, software and reagents.



the BIO-LINK

INTEGRATED
HARDWARE
SOFTWARE
IMMUNOASSAY

● Hardware:

The Euroreader microtiterplate reader is designed for ease of use, speed and flexibility.
It offers networking via RS232C with IBM compatible hookup.

● Software:

Elisa Aid is a software package for data reduction and analysis in the immunodiagnostic laboratory. Especially written for the Euroreader, it let the user concentrate on the lab work, the quality control and the resultinterpretation without worrying about the datahandling.

It allows in depth quality control follow-up, and histogram calculations.

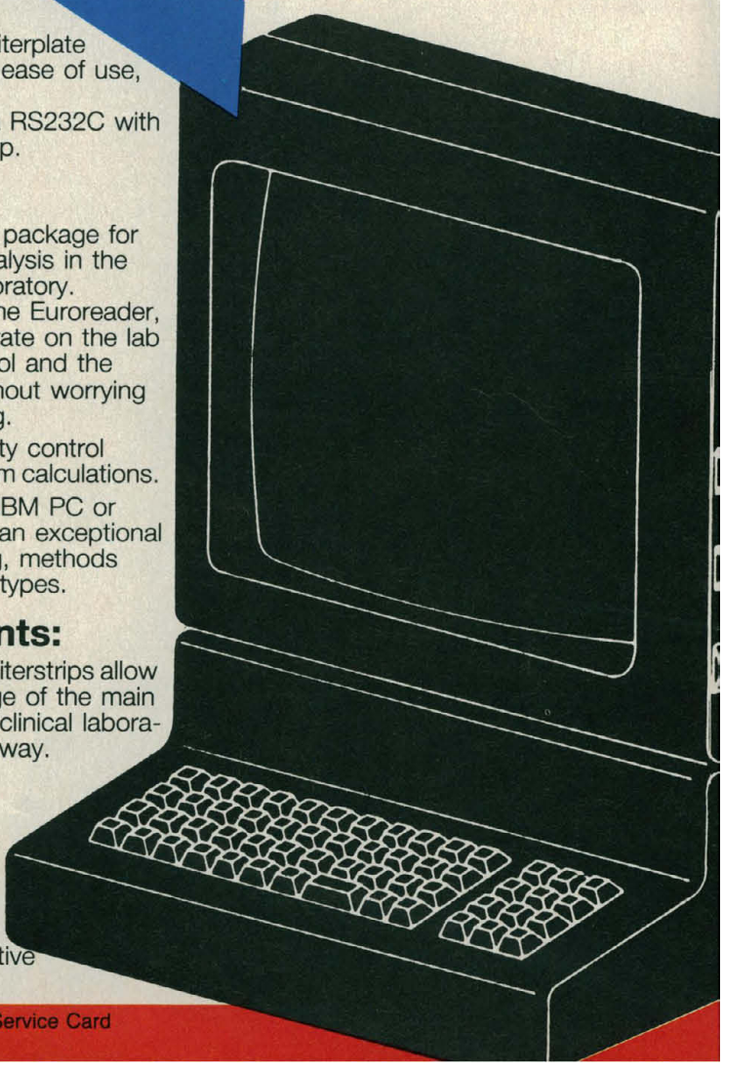
The package runs on IBM PC or compatible and offers an exceptional portfolio of curve-fitting, methods adaptable to all assay types.

● Elisa reagents:

ELISA assays on microtiterstrips allow a flexible rapid coverage of the main diagnostic tests in the clinical laboratory, in a non isotopic way.

- CMV
- TOXO
- CRF
- RF
- ASLO
- Ferritin
- IgE
- LH
- FSH
- HCG
- Prolactin
- TSH

All assays are quantitative determinations.



EUROGENETICS
CREATIVE BIOTECH.

Eurogenetics n.v.
Industriepark 24
Industriezone West
3980 Tessenderlo/Belgium
Tel. 013/66.88.30
Telex 39112 eurgen b

Eurogenetics Italia s.r.l.
Corso Vittorio Emanuele II n.52
10123 Torino
Tel. (011)561.20.60
Telefax (011)54.12.48

Annual Meeting Seminars

AAAS will present three research seminars at its forthcoming Annual Meeting in Boston (11–15 February 1988). These seminars are designed for those active in research and teaching in the rapidly developing fields of reproductive biology, protein folding, and marine ecosystem research. The major topics and invited speakers for each seminar are given below. To register for a seminar, complete the registration form (overleaf). Seminar registrants are also invited to submit abstracts of papers describing their current research; see "Call for Seminar Papers" on the following page. For further information, call the AAAS Meetings Office: 202/326-6466.

Frontiers of Reproductive Biology

Organized by a faculty committee of the ***Laboratory of Human Reproduction and Reproductive Biology, Harvard Medical School, John D. Biggers*** *(Chair).*

Session I: Gametogenesis (2/12, Fri/am)

Anthony R. Bellvé *(Columbia Univ. College of Physicians & Surgeons),* ***Richard M. Schultz*** *(Univ. of Pennsylvania),* and ***Anne N. Hirshfield*** *(Univ. of Maryland School of Medicine)*

Plenary Lecture by ***John D. Biggers***

Session II: Fertilization and Egg Activation (2/12, Fri/pm)

David Epel *(Stanford Univ., Hopkins Marine Station),* ***Paul M. Wassarman*** *(Roche Institute of Molecular Biology),* and ***Janet Rossant*** *(Mt. Sinai Hospital and Univ. of Toronto)*

Session III: Implantation (2/13, Sat/am)

Dale J. Benos *(Univ. of Alabama),* ***Allen Enders*** *(Univ. of California, Davis),* and ***R. Michael Roberts*** and ***Kazuhiko Imakawa*** *(Univ. of Missouri, Columbia)*

Session IV: Molecules Regulating Reproduction (2/13, Sat/pm)

R.L. Brinster *(Univ. of Pennsylvania),* ***William W. Chin*** *(Harvard Medical School),* and ***Benita S. Katzenellenbogen*** *(Univ. of Illinois)*

Session V: Neuroendocrinology (2/14, Sun/am)

Frederick Naftolin *(Yale Univ.),* ***Ernst Knobil*** *(Univ. of Texas Health Science Center, Houston),* and ***Wylie Vale*** *(The Salk Institute)*

Session VI: Reproductive Technology (2/14, Sun/pm)

Neal L. First *(Univ. of Wisconsin),* ***Barry D. Bavister*** *(Univ. of Wisconsin),* and ***Kurt Benirschke*** *(Univ. of California, San Diego)*

The Protein Folding Problem

Organized by ***Jonathan A. King*** *(MIT)* and ***Lila M. Gierasch*** *(Univ. of Texas Health Science Center, Dallas)*

Session I: Structural Themes in Native Proteins (2/12, Fri/am)

George D. Rose *(Hershey Medical Center, Pennsylvania State Univ.),* ***Cyrus Chothia*** *(Medical Research Council, Cambridge, England),* and ***Donald Bashford*** *(Harvard Univ.),* ***Martha M. Teeter*** *(Boston College),* and ***Barbara Brodsky*** *(Univ. of Medicine and Dentistry of New Jersey)*

Session II: Interactions and Conformations of Amino Acids in Peptides (2/12, Fri/pm)

Isabella L. Karle *(Naval Research Laboratory);* ***Susan Marqusee*** and ***Robert L. Baldwin*** *(Stanford Univ. Medical School);* ***Peter E. Wright, H. Jane Dyson,*** and ***Richard A. Lerner*** *(Research Institute of Scripps Clinic);* ***James T. Sparrow*** and ***Antonio M. Gotto, Jr.*** *(Baylor College of Medicine);* and ***Lila M. Gierasch, and C. James McKnight, David Hoyt,*** and ***Maria Rafalski*** *(Univ. of Delaware)*

Session III: Workshop–Recovering Active Proteins (2/12, Fri/6:30pm)

Stephen Anderson *(Genentech, Inc.);* ***Terrence G. Oas*** and ***Peter Kim*** *(Whitehead Institute for Biomedical Research);* ***David N. Brems*** *(Upjohn Co.);* ***Jeff Stock*** *(Princeton Univ.);* and ***Michel E. Goldberg, Anne Murray-Brelier,*** and ***S. Blond*** *(Pasteur Institute)*

Session IV: Intermediates in Protein Folding and Unfolding (2/13, Sat/am)

Lynne Regan, William DeGrado, Zelda Wasserman, James D. Lear, and ***Siew Peng Ho*** *(E. I. du Pont de Nemours & Co.);* ***Alfred Holtzer, Marilyn Emerson Holtzer,*** and ***Jeffrey Skolnick*** *(Washington Univ.);* ***C. Robert Mathews*** *(Pennsylvania State Univ.);* ***David P. Goldenberg*** *(Univ. of Utah);* and ***Barry T. Nall*** *(Univ. of Texas Health Science Center, San Antonio)*

Plenary Lecture by ***Jane Richardson*** *(Duke Univ. Medical Center)*

Session V: Protein Folding *in vivo* (2/13, Sat/pm)

Jonathan A. King, Ben Fane, Cameron Haase-Pettingell, and ***Robert Villafane*** *(MIT);* ***Linda L. Randall*** *(Washington State Univ.);* ***Joseph F. Sambrook, Karen McCammon, Mark Segal, Pat Gallagher,*** and ***Mary Jane Gething*** *(Univ. of Texas Health Science Center, Dallas),* and ***Janet Hearing*** *(SUNY, Stony Brook);* ***Peter H. Byers*** *(Univ. of Washington);* and ***Alfred L. Goldberg*** *(Harvard Medical School)*

Session VI: Modeling Protein Folding and Structure (2/14, Sun/am)

Fred E. Cohen, Lydia Gregoret, Donald Kneller, Irwin D. Kuntz, and ***Fernando Bazan*** *(Univ. of California, San Francisco);* ***Arnold T. Hagler, Frank Avbelj, David H. Kitson*** *(The Agouron Institute),* and ***John Moult*** *(Univ. of Alberta);* ***Robert E. Bruccoleri, Jiri Novotny,*** and ***Edgar Haber*** *(Massachusetts General Hospital);* ***David Eisenberg, Morgan Wesson,*** and ***Mason Yamashita*** *(UCLA);* ***Carl O. Pabo*** *(Johns Hopkins Univ. Medical School);* and ***Larry L. Smarr*** *(National Center for Super Computing Applications, Univ. of Illinois)*

Session VII: Protein Design: What Can

(continued on next page)

We Get Away With? (2/14, Sun/pm)

Daniel S. Kemp and ***Benjamin Bowen*** *(MIT)*; ***James A. Wells, Paul Carter, Brian C. Cunningham, David B. Powers, John Burnier, Richard R. Bott, Mark M. Ultsch*** *(Genentech, Inc.)*, ***Colin Mitchinson, Robert M. Caldwell, Thomas P. Graycar,*** and ***David A. Estell*** *(Genencor, Inc.)*; ***Jon Beckwith, Dana Boyd, Karen McGovern*** *(Harvard Univ. Medical School)*, ***Colin Manoil*** *(Univ. of Washington)*, ***Jose Luis San Milan*** *(Centro estal Ramon Y Cagal, Spain)*, ***Susan Froshauer*** *(Yale Univ. Medical School)*, and ***Neil Green*** *(Univ. of California, San Francisco)*; ***Peter Schultz*** *(Univ. of California, Berkeley)*; and ***Thomas E. Creighton*** *(Medical Research Council, Cambridge, England)*

Frontiers of Marine Ecosystem Research

Organized by ***Kenneth Sherman*** *(NOAA/NMFS Northeast Fisheries Center)*, ***Judith P. Grassle*** *(Marine Biological Laboratory, Woods Hole)*, and ***Barry D. Gold*** *(AAAS Office of International Science)*

Session I: Recruitment, Dispersal, and Gene Flow (2/12, Fri/am)

Christopher T. Taggart *(Dalhousie Univ. and Bedford Institute of Oceanography)*; ***Cheryl Ann Butman*** *(Woods Hole Oceanographic Institution)* and ***Judith P. Grassle; Joachim Bartsch*** and ***Jan Backhaus*** *(Univ. of Hamburg, West Germany)*; ***James E. Eckman*** *(Skidaway Institute of Oceanography)*; and ***Jerry A. Coyne*** *(Univ. of Chicago)*

Session II: Recruitment, Dispersal, and Gene Flow (2/12, Fri/pm)

Montgomery Slatkin *(Univ. of California, Berkeley)*; ***Andrew E. Dizon*** *(NOAA/NMFS Southwest Fisheries Center)*; ***Richard K. Koehn*** *(SUNY, Stony Brook)*; ***David Policansky*** *(National Research Council)*; ***Hal Caswell*** *(Woods Hole Oceanographic Institution)*; and ***William E. Evans*** *(NOAA)*

Session III: Recruitment, Dispersal, and Gene Flow (2/13, Sat/am)

David S. Wethey *(Univ. of South Carolina)*; ***Richard B. Forward, Jr.*** *(Duke Univ. Marine Laboratory)*; ***Richard K. Grosberg*** *(Univ. of California, Davis)*; ***Robert D. Burke*** *(Univ. of Victoria)*; and ***Steven D. Gaines*** *(Brown Univ.)* and ***Jonathan Roughgarden*** *(Stanford Univ.)*

Plenary Lecture by ***Robert E. Ricklefs*** *(Univ. of Pennsylvania)*

Session IV: Biodynamics of Large Marine Ecosystems (2/13, Sat/pm)

Thomas D. Dickey *(Univ. of Southern California)*; ***Thomas R. Osborn*** and ***Yidekatsu Yamazaki*** *(Johns Hopkins Univ.)*; ***Brian J. Rothschild*** *(Univ. of Maryland Chesapeake Biological Laboratory)*; ***Dennis A. Powers*** and ***Thomas T. Chen*** *(Johns Hopkins Univ.)*; ***Gene C. Feldman*** *(NASA–Goddard Space Flight Center)*; ***Jeffrey B. Frithsen*** and ***Candace A. Oviatt*** *(Univ. of Rhode Island Graduate School of Oceanography)*; and ***Geoff C. Laurence*** *(NOAA/NMFS Northeast Fisheries Center)*

Session V: Perturbation and Yield of Large Marine Ecosystems (2/14, Sun/am)

Gotthilf Hempel *(Alfred Wegner Institut fur Polarfurschung, West Germany)*; ***Anatoly A. Elizarov*** and ***V.M. Borisov*** *(VNIRO, USSR)*; ***Snorre Tilseth*** *(Institute of Marine Research, Norway)*; ***Erik Buch*** *(Greenland Fisheries Institute, Copenhagen, Denmark)* and ***Vagn Hansen*** *(Danmarks Fiskeri-og Havundersogelser, Hirtshals, Denmark)*; ***Keith Sainsbury, P. Craig,*** and ***C. Crossland*** *(Commonwealth Scientific and Industrial Research Organisation, Division of Fisheries Research, Australia)*; ***Jenne Zijlstra*** *(Netherlands Institute for Sea Research, Texel, The Netherlands)*; and ***Mark Berman*** *(NOAA/NMFS Northeast Fisheries Center)*

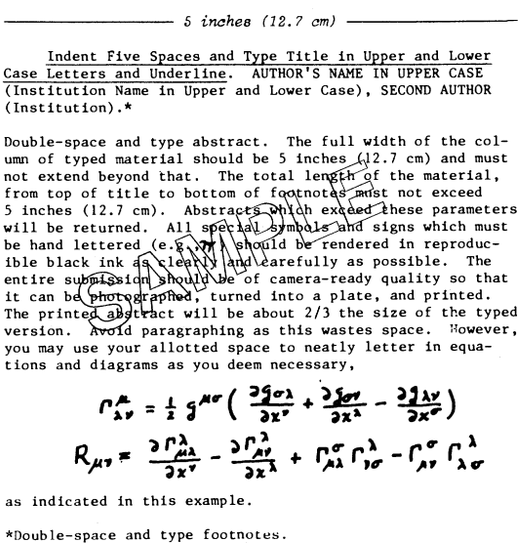
Session VI: Theory and Management of Large Marine Ecosystems (2/14, Sun/pm)

Simon A. Levin *(Cornell Univ.)*; ***Nicholas J. Bax*** and ***Taivo Laevastu*** *(NOAA/NMFS Northwest and Alaska Fisheries Center)*; ***Kenneth Sherman; Lewis M. Alexander*** *(Univ. of Rhode Island)*; and ***Martin Belsky*** *(Albany Law School)*

Call for Seminar Papers

Deadline for Abstracts: 4 January 1988

Presenting a contributed paper at a seminar poster session is **open only to registrants of that seminar.** For each accepted paper, a bulletin board will be provided for display of text and graphics. Abstracts of papers, if prepared in the format described, will be copied and distributed to all seminar registrants. **Preparation of abstracts:** ■ Copy must be typed on white paper to fit within a 5″ square. Use typewriter or letter-quality printer. ■ Indent, space, underline, and capitalize as in the example; do not double-space text. ■ Use reproducible black ink for all handlettering. ■ Do not box abstract or cut and paste it onto another piece of paper. **Transmittal:** ■ Outside the 5″ square, type the seminar's title and your complete name, mailing address, and phone number. ■ Send original plus 2 copies **with your advance registration form** to: Seminars, AAAS Meetings Office, 1333 H Street, NW, Washington, DC 20005.



Advance Registration Form

AAAS Annual Meeting Seminars ✦ Boston ✦ 11 – 15 February 1988

Please Print or Type

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

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

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

_____ (Spouse registrant)

Mailing address _____ (Street)

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

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

Check days on which you will attend meeting: Thu ☐ Fri ☐ Sat ☐ Sun ☐ Mon ☐

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

20 January deadline: ■ Register by this date at the advance discount (fees will be higher after 20 January), and we will mail to you in advance your registration badge, receipt, preliminary program, and voucher for the full program and abstracts. ■ Registrations received after 20 January will not qualify for the discount, and materials will be held at the Advance Registrants' Desk at the Hynes Convention Center. ■ Refund requests must be made by letter or telegram to the address below by 20 January and will be honored after the Meeting. **No refunds will be made for cancellations received after 20 January.**

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

Advance Registration Fees[1]

(Advance discount rate through 20 January 1988[2])

Please check one Seminar:

Reproductive Biology ☐
Protein Folding ☐
Marine Ecosystems ☐

	Regular	Student[3]	
AAAS Member	☐ $150	☐ $75	$ ____
Nonmember[4]	☐ $180	☐ $90	$ ____
		TOTAL:	$ ____

1. Includes admission to the selected Seminar and all other AAAS Annual Meeting activities.
2. After 20 January: Member and nonmember, $180.
3. Full-time graduate students only.
4. Nonmember registration fee includes introductory 6-month membership with 25 issues of *Science*.

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

_____ / _____
Card number Expires

_____
Signature

Hotel Reservation Form

AAAS Annual Meeting ✦ Boston ✦ 11 – 15 February 1988

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 _____

Hotel Rates (add 9.7% tax): Indicate 1st and 2nd choice of hotel; check appropriate box for type of room desired.

Choice	Hotel	Single	Double	Suites
_____	Sheraton Boston:			
	☐ Standard	☐ $ 65	☐ $ 75	☐ $175 & up
	☐ Tower	☐ $125	☐ $150	☐ $200 & up
_____	Boston Marriott	☐ $ 79	☐ $ 99	☐ $225 & up

Arrival date _____ Time _____

Departure date _____ Time _____

Please list definite arrival and departure dates and times. Rooms will be held only until 6 p.m. unless guaranteed with a credit card. The Housing Bureau will not accept checks.

■ Reservations must be sent to the AAAS Housing Bureau (address below) on this official form by **20 January 1988.** Reservations received after this cut-off date are conditional on space availability.

■ Confirmations will come directly from the hotels. Changes and cancellations must be sent to the Housing Bureau until the cut-off date; after 20 January, deal directly with the hotel.

■ Rollaway bed or extra person in room: Sheraton, $10; Marriott, $15.

■ Children free of charge in same room with parents: Sheraton to age 17; Marriott to age 18.

Mail to: AAAS Housing Bureau
P.O. Box 490
Boston, MA 02199

Gordon Research Conferences — Frontiers of Science —

	Colby-Sawyer College (N) New London, NH	Colby-Sawyer College (S) New London, NH	New Hampton School New Hampton, NH	Kimball Union Academy Meriden, NH	Tilton School Tilton, NH
June 13-17	Bioanalytical Sensors *R. A. Durst*	Multiphoton Processes *P. M. Johnson*	Nucleic Acids *H. Nash, N. Pace*	Second Messengers & Protein Phosphorylation *C. Rubin*	Theoretical Biology & Biomathematics *T. Othmer*
June 20-24	Nuclear Chemistry *J. Randrup*	Thermosetting Polymers *R. Bauer*	Environmental Sciences: Water *M. Hoffman*	Lipid Metabolism *G. Rothblatt*	Animal Cells & Viruses *F. Alt, T. Hunter*
June 27-July 1	Polymers *L. Taylor*	Synthetic Membranes *J. Schultz*	Energetic Materials, Chemistry of *C. B. Storm*	High Pressure, Research at *A. Ruoff*	Isotopes, Chemistry & Physics of *M. O'Leary*
July 4-8	Gravitational Effects on Living Systems *E. K. Ray*	Plant Senescence *J. Thompson*	Fuel Science *M. Gorbaty*	Enzymes, Coenzymes & Metabolic Pathways *W. Ray, J. Kirsch*	Nuclear Physics *M. Banerjee*
July 11-15	Elastomers *B. Eichinger*	Liquid Crystal Polymers *A. Blumstein, W. Krigbaum*	Heterocyclic Compounds *H. Gschwend*	Lasers in Medicine & Biology *J. Dixon*	Motile & Contractile Systems *D. Fischman*
July 18-22	Corrosion *D. J. Duquette*	Chemotherapy of Clinical & Experimental Cancer *T. Tritton*	Organic Reactions & Processes *M. Cooke*	Physical Metallurgy *F. Spaepen*	Magnetic Resonance in Biology & Medicine *D. Chasteen*
July 25-29	Crystal Growth *W. R. Wilcox*	Renewable Resources, Chemicals & Materials from *H. I. Bolker*	Natural Products *R. K. Boeckmann*	Interfaces, Chemistry at *W. C. Connor*	Nuclear Proteins, Chromatin Structure & Gene Regulation *W. T. Garrard*
August 1-5	Medicinal Chemistry *W. F. Johns*	Ion Channels in Muscle & Other Excitable Membranes *P. R. Adams*	Statistics in Chemistry & Chemical Engineering *G. H. Hahn*	Vascular Cell Biology *P. DiCorleto, S. Schwartz*	Glass *J. H. Simmons*
August 8-12	Separation & Purification *E. L. Cussler*	Physical Electrochemistry *J. R. Macdonald*	Analytical Chemistry *W. R. Heineman*	Hormone Action *B. S. Katzenellenbogen, T. Gelehrter*	Fractals *R. Voss*
August 15-19	Order/Disorder in Solids *R. O. Simmons*	Nondestructive Evaluation *R. B. Thompson*	Adhesion, Science of *J. Wightman*	Ceramics, Solid State Studies in *D. B. Marshall*	Plasma Chemistry *A. Garscadden*
August 22-26					

1989 Winter Schedule — California

	SITE A (135 maximum conferees)	SITE B (110 maximum conferees)
January 2-6	Polymers *E. A. DiMarzio*	Temperature Stress in Plants *C. J. Weiser*
January 9-13	Composites *R. M. Ikeda*	Quantitative Genetics *E. J. Eisen*
January 16-20	Electrochemistry *P. N. Ross, Jr.*	Agricultural Science *J. J. Menn*
January 23-27	Metals in Biology *P. Aisen*	Mammalian DNA Repair *A. E. Pegg*
January 30-February 3	Metabolic Sequences, Organization of *G. R. Welch*	Plant Herbivore Interaction *M. Martin*
February 6-10	Oxygen Radicals in Biology *S. D. Aust*	Fibronectin *D. F. Mosher*
February 13-17	Glycoproteins & Glycolipids *C. Hirschberg*	Kallikreins & Kinins *A. Nasjletti*
February 20-24	Polymers for Biomedical & Agricultural Application *D. J. Casey*	Angiotensin *I. Phillips*

GENERAL INFORMATION

The Summer Gordon Research Conferences will be held June 13-August 19, 1988 in New Hampshire and June 20-August 26, 1988 in Rhode Island.

The chairperson of each conference is requested to have the detailed program in our office January 1, 1988, and the entire Summer program with application will be published in the March 4, 1988 issue of *Science*.

Requests for applications to the Summer Conferences, or for additional information should be addressed to: Dr. Alexander M. Cruickshank, Director, Gordon Research Conferences, Gordon Research Center, University of Rhode Island,Kingston, RI 02881-0801. Telephone: (401) 783-4011 or (401) 783-3372.

1988 Schedule — New Hampshire & Rhode Island

Proctor Academy Andover, NH	Holderness School Plymouth, NH	Brewster Academy Wolfeboro, NH	Plymouth State College (N) Plymouth, NH	Plymouth State College (S) Plymouth, NH	Salve Regina College Newport, RI
Plant Molecular Biology *R. Meagher*	Proteolytic Enzymes & Their Inhibitors *R. Harpel*	Risk Assessment of Chemical Substances *S. Siegel*	Muscle: Excitation Contraction Coupling *C. Franzini-Armstrong*	Water & Solute Exchange in the Microvasculature *R. W. Gore*	Not Available
Hemostasis *J. White*	Tribology *S. M. Hsu*	Condensed Matter Physics *R. Westervelt, M. Cross*	Mutagenesis *F. Hutchinson*	Basement Membranes *P. Bornstein*	Proteins *L. Gierasch*
Proteoglycans *L. C. Rosenberg*	Biopolymers *P. Hagerman, P. Moore*	Radical Ions *M. A. Fox*	Periodontal Diseases *A. Polson*	Lysosomes *W. S. Sly*	Organometallic Chemistry *R. Eisenberg*
Extrachromosomal Elements *N. C. Martin*	Photosynthesis-Membranes *C. Wraight*	Reproductive Tract Biology *R. M. Roberts*	Bacterial Cell Surfaces *L. L. Randall*	Computational Chemistry *D. B. Boyd, P. Kollman*	Stereochemistry *C. M. Johnson*
Immunochemistry & Immunobiology *E. Shevach*	Particle-Solid Interactions *J. A. Davies*	Microstructure Fabrication, Chemistry & Physics of *M. W. Geis*	Fungal Metabolism *L. Lasure*	Drug Carriers in Medicine & Biology *R. Langer*	Radiation Chemistry *S. Lipsky*
Polymer Physics *W. Graessley*	Drug Metabolism *F. P. Guengerich*	Electron Spectroscopy *D. T. Pierce*	Mammalian Gametogenesis & Embryogenesis *N. B. Hecht*	Oscillations & Dynamic Instabilities in Chemical Systems *J. Ross*	Molecular Biology, Diffraction Methods in *J. L Smith*
Catecholoamines *D. Klein*	Dielectric Phenomena *J. Pochan*	Pyrrole Compounds *M. A. Correia*	High Temperature Chemistry *P. C. Nordine*	Solid State Chemistry *N. Bartlett*	Molecular Genetics *S. Tilghman*
Coatings & Films *F. L. Floyd*	Water & Aqueous Solutions *M. D. Newton*	Inorganic Chemistry *J. D. Armor*	Microbial Toxins & Pathogenesis *P. F. Sparling*	Atomic & Molecular Interactions *F. F. Crim*	Catalysis *M. J. Kelley*
Plant & Fungal Cytoskeleton, Cellular & Molecular Biology of *B. A. Palevitz*	Immobilized Systems & Biotechnology *J. Bonaventura*	Electron-Donor-Acceptor Interactions *H. D. Roth*	Photonuclear Reactions *B. Mecking*	Foams *R. B. Turner*	Peptide Growth Factors *H. L. Moses*
Bioengineering & Orthopedic Science *A. H. Reddi*	Organic Geochemistry *J. Hayes*	Vibrational Spectroscopy *W. H. Woodruff*	Bioelectrochemistry *B. F. Sisken*	Modeling of Flow in Permeable Media *J. B. Bell*	Cancer *S. Wolman*
					Microalgal Products, Biochemistry & Genetic Engineering of *P. G. Falkowski*

FIXED CONFERENCE FEES, 1988 — Same as 1987

NEW HAMPSHIRE — Double $310, Non-Resident $270, Guests $220
RHODE ISLAND — Double $325, Non-Resident $270, Guests $235

— IMPORTANT — Please Note — New Regulation on Registration —

1. Registration will be accepted by the office of the Director if postmarked three weeks prior to the Conference after which all registration will be on-site. The Board of Trustees voted unanimously to implement an on-site registration fee which will be fifty dollars ($50) higher than the standard registration fee ($360 double occupancy, $320 non-resident, $270 guests in New Hampshire and $375 double occupancy, $320 non-resident, $285 guests in Newport). This on-site fee will apply to all conferees including speakers, discussion leaders and guests.
2. Full fixed fee charged regardless of time conferee attends Conference. Please note fees.
3. Fixed fee cannot be prorated or reduced for anyone (speakers, discussion leaders, conferees).
4. Children must be at least 12 years of age to have accommodations and meals at any host site.
5. Non-resident conferees will be expected to eat all meals in the conference dining room.
6. Off-site accommodations (hotel, motel, etc.) are available near the host sites.

The 1989 Winter Gordon Research Conferences, as shown to the left, will be held January 2-February 24, 1989 in California. Fixed Conference fees and host sites have not been established at this time.

The chairperson of each conference is requested to have the detailed program in the Director's office September 1, 1988 and the detailed Winter program will be published in the October 7, 1988 issue of *Science*.