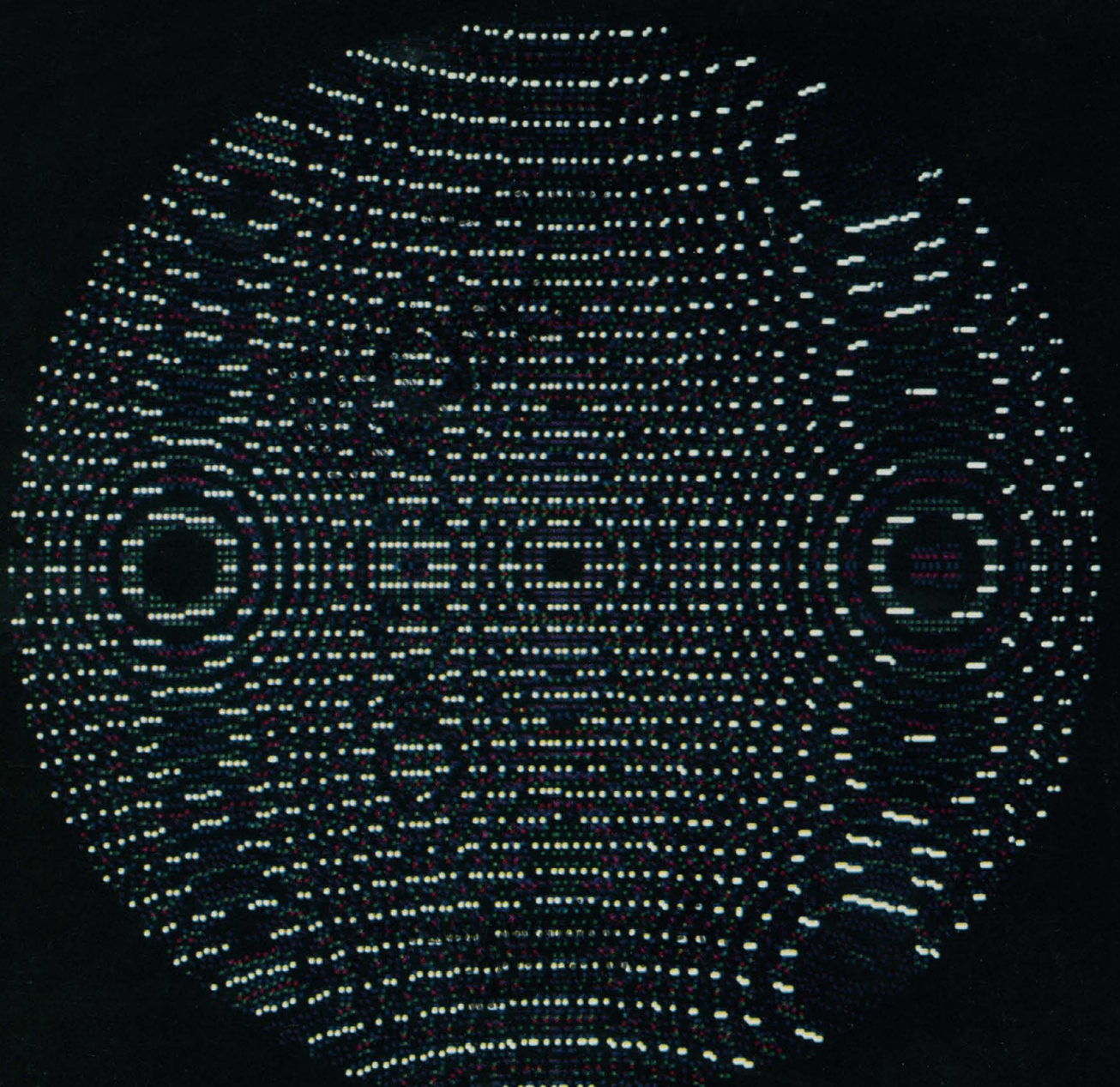
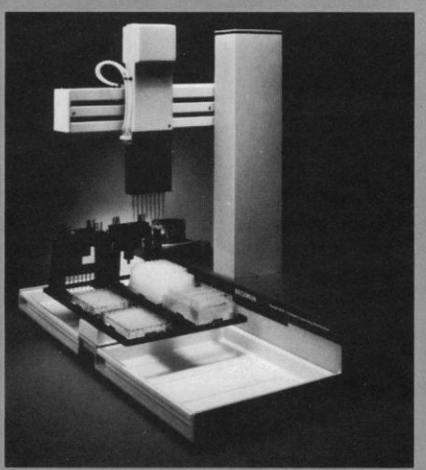
American Association for the Advancement of Science

SCIENCE

8 JANUARY 1988 $2.50
VOL. 239 ■ PAGES 117–232



BECKMAN SYMPOSIUM



Automation in Your Lab: ELISAs, DNA Sequencing and More!

The Biomek™ 1000 Workstation

Beckman Instruments is pleased to announce a symposium on the use of the Biomek™ 1000 Automated Laboratory Workstation for increased laboratory efficiency and productivity in ELISA and DNA sequencing applications. This symposium will provide you with opportunities to talk to experts in these fields.

To extend the opportunity to the greatest number of interested researchers, the symposium will be repeated in six locations across the U.S.A.

Topics to be covered include:

- Automation of the dideoxy reaction steps in DNA sequencing.
- Development of automated ELISA test for antibody detection by direct antigen binding and competitive antibody assay.

Each session will last from 10:00 A.M. until 1:00 P.M., and lunch will be served.

A Biomek Users' Meeting will follow, to provide a forum for the exchange of applications information. The users' meeting will include a demonstration of the new ImmunoFit™ EIA/RIA Data Analysis Software, an advanced curve-fitting analysis package designed for immunological data reduction with an easy-to-use graphics interface. The meeting will also include an in-depth explanation of the marks function and additional advanced programming theory. You are encouraged to bring your own research data and actively participate with your questions.

Schedule

Palo Alto, California	Hyatt Rickeys	Monday, December 7, 1987
Indianapolis, Indiana	Embassy Suites	Thursday, December 10, 1987
Somerset, New Jersey	Somerset Marriott	Friday, December 11, 1987
Swedeland, Pennsylvania	King of Prussia Hilton	Monday, January 25, 1988
Bethesda, Maryland	Marriott Pooks Hill	Wednesday, January 27, 1988
Chicago, Illinois	North Shore Hilton	Friday, January 29, 1988

Symposium attendance is free, but advance registration is required. To register, contact Beckman Instruments, Inc., 1050 Page Mill Road, Palo Alto, CA 94304, phone: 415/859-1431.

BECKMAN

A SMITHKLINE BECKMAN COMPANY

It started in an IBM lab in Zurich, Switzerland.
Who knows where it will stop?

In January 1986, two IBM scientists, J. Georg Bednorz and K. Alex Müller, ended a long quest. They discovered a whole new class of superconducting materials, represented by the formula above.

Their breakthrough sparked enormous activity in an area of research most scientists had abandoned as hopeless.

Today, researchers at IBM, and throughout the world, are expanding on what these two started. And although no one can be sure where superconductor research will lead, there is potential for advances in everything from computers to medicine.

In October 1987, just 21 months after their breakthrough, Bednorz and Müller were chosen to receive the Nobel Prize in Physics.

Naturally, we're proud of these two scientists, just as we are of the two IBM scientists who won the 1986 Nobel Prize in Physics.

Providing a climate that fosters achievements like these has always been important at IBM. After all, advances of this magnitude do more than contribute to a company. They contribute to the world. IBM®

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE

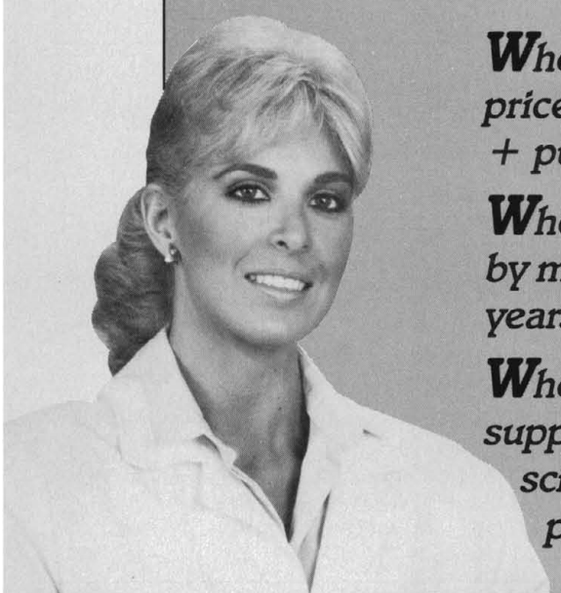
ISSN 0036-8075
8 JANUARY 1988
VOLUME 239
NUMBER 4836

■ **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®** 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 $3.00 ($3.50 by mail); back issues $4.50 ($5.00 by mail); Biotechnology issue, $5.50 ($6 by mail); classroom rates on request; Guide to Biotechnology Products and Instruments $16 ($17 by mail). **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. **Postmaster:** Send Form 3579 to *Science*, 1333 H Street, NW, Washington, DC 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

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

COVER A computer-simulated field ion microscope image of a yttrium-barium-copper-oxygen high T_c superconductor, assuming uniform visibility of atoms in the orthorhombic unit cell (c-axis vertical). The dots correspond to the various surface atoms—white: copper and oxygen atoms in the unit cell end planes; green: the other copper atoms; purple: the other oxygen atoms; red: yttrium; and blue: barium atoms. See page 176. [Computer graphics by Richard Freemire and original photography by Bessmarie Young, National Bureau of Standards, Gaithersburg, MD 20899]

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. 402 For Sales Call Circle No. 403

This Week in
SCIENCE

Ion spectroscopy

KNOWLEDGE of the actions and interactions of charged molecules is important for explaining astrophysical phenomena (how stars and planets form from interstellar dust clouds), organic and physical chemical processes (what influences chemical bonding), and dynamics of biologic systems (how electrons and protons are transferred) (page 157). Although a number of stumbling blocks have hampered the study of charged molecules (they are difficult to obtain in high concentrations and are often a minority in a background of mostly neutral species of molecules that are also absorbing), Saykally reports that the "molecular ion revolution" is well under way with observations of charged molecules in plasmas being made in microwave, infrared, and visible regions of the spectrum. One technique described in detail—velocity modulation spectroscopy that uses tunable infrared laser radiation—has already yielded valuable information about more than 50 cations and anions. The diverse spectroscopic strategies can be used to probe structures, behaviors, and other properties of charged species, and for many ions the predictions of theoretical analyses are finally being confirmed.

Diagnosis of brain dysfunctions

THE diagnosis of learning disabilities, mental retardation, depression, dementia, schizophrenia, alcoholism, and other psychiatric and neurologic disorders is gaining precision through the application of neurometric methods (page 162). John *et al.* describe the neurometric approach by which a 60-second electroencephalographic sample is analyzed with detailed statistical methods. A mathematical profile is produced from which a map can be generated that shows the distribution of the brain's electric activity. A baseline "normal" profile characterizes brain functioning in most "normal" individuals; statistically significant deviations from this signature characterize brain activity in a high proportion of individuals with clinically defined psychiatric, neurologic, and cognitive disturbances. For many disorders, the extent of the deviation correlates with clinical severity. Neurometric methodology shows that characteristic abnormalities in neurophysiologic processes correspond to distinctive psychiatric categories. Neurometrics is already a valuable adjunct to clinical diagnosis and classification and is expected to improve therapies and the management of a range of central nervous system dysfunctions.

Drosophila gene aids neurogenesis

HOW certain cells of the *Drosophila* central nervous system develop depends on the gene *fushi tarazu (ftz)*, whose name comes from the Japanese meaning "less than the normal number of segments" (page 170). *Ftz* is a "segmentation" gene that initially functions early in development when the segmented body of the fruitfly takes form; Doe *et al.* show that later, during neurogenesis when undifferentiated ectodermal tissue transforms into highly differentiated nervous tissue, the *ftz* gene undergoes a second period of activity in a subset of cells. (The gene product, a protein, remains in the cell nucleus where it is presumed to be a DNA-binding regulatory substance.) Of seven neurons that were followed and that normally express *ftz*, one showed abnormal axon growth when *ftz* and an associated gene, *eve*, were made dysfunctional. This neuron's unorthodox development and altered identity—it acquired characteristics of a different neuron—appear to be directly associated with the lost expression of *ftz*, a gene that thus may have a regulatory role not only in segmentation but also in neurogenesis.

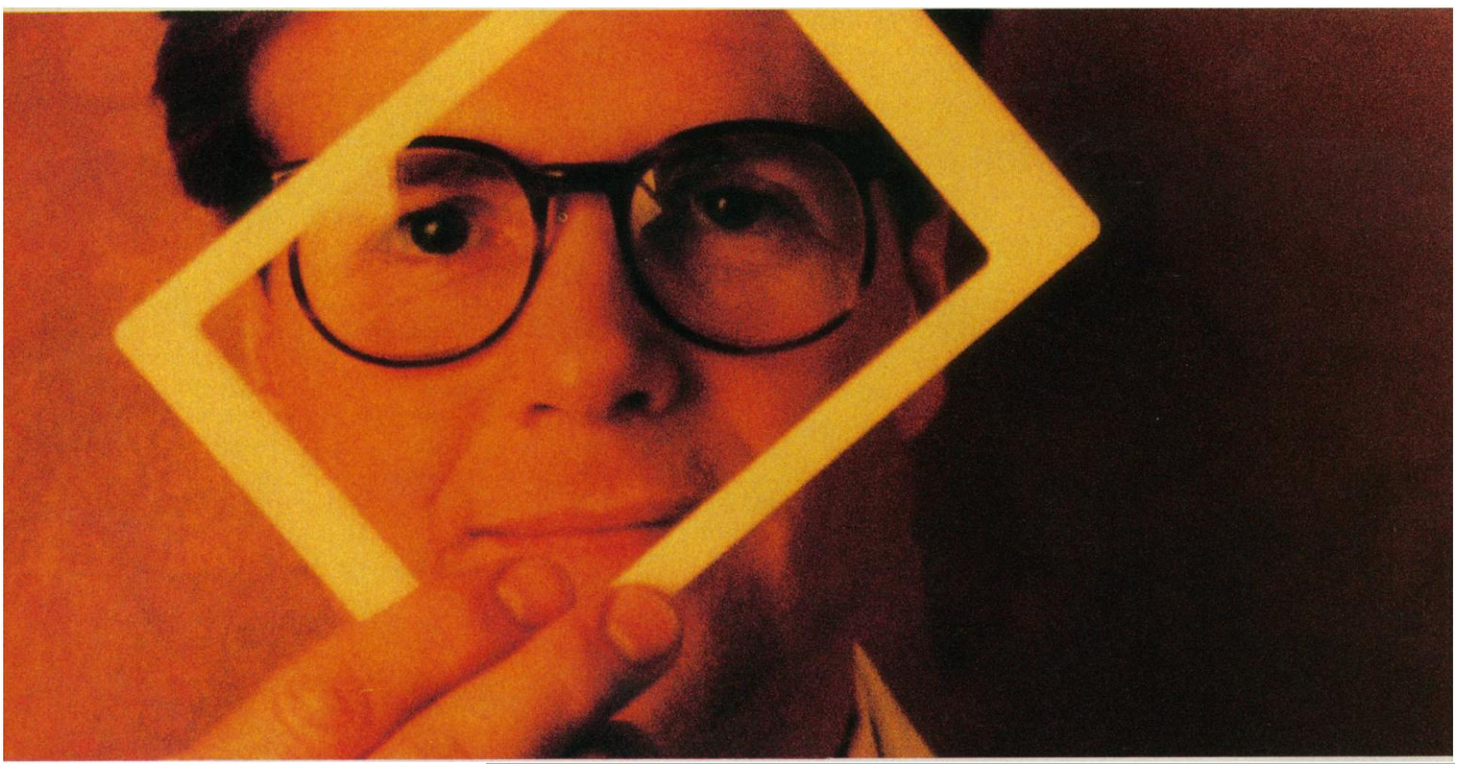
Superconducting layers

IN field ion micrographs of high-temperature superconducting ceramics, more or less parallel rows of spots are seen across much of the image (page 176). A nonsuperconducting phase of the same type of material lacks such rows. The parallel rows extend (as the sample is evaporated) to depths of at least several hundred atomic layers. These superconductors have two major phases: the orthorhombic phase predominates and has been associated with the property of superconductivity; the tetragonal phase predominates in similar nonsuperconducting materials. Melmed *et al.* associate the rows in the micrographs with the orthorhombic phase and interpret these layers as the end planes of Cu-O atoms of the unit cell (cover). The Cu-O planes evaporate differently in superconducting and nonsuperconducting phases, and it may be along these planes that superconductivity occurs.

Tracking AIDS

NINETY-THREE cases of AIDS were reported from Belle Glade, Florida, between July 1982 and August 1987; seven individuals (8%) appeared to have no identifiable risk factors for the disease (page 193). The high number of cases and the high percentage not fitting a known risk category (nationally that average is 3%) suggested that a previously unrecognized risk factor—most likely an environmental one—might be involved in transmission. Belle Glade is an inland agricultural community to which thousands of migrant workers (American blacks, British West Indians, Haitians, and Hispanics) come each year to harvest sugar cane and other crops. Castro *et al.* conducted detailed seroepidemiologic analyses and extensive personal interviews throughout the community. No unusual modes of transmission of the human immunodeficiency virus were found: most was through needle sharing by intravenous drug users and through heterosexual and homosexual contact. There was no evidence that insects or other local industry or other life-style factors promoted transmission. Incomplete information may account for many AIDS cases for which no known risk factors can be identified.

INTRODUCING GENETIC IMAGING IN A WHOLE NEW TIMEFRAME



INTRODUCING THE BIOS TIMEFRAME™ SYSTEM A new system for generating and analyzing DNA blots of unsurpassed quality in less time.

The BIOS Timeframe System is an integrated family of supplies and instruments featuring the revolutionary *BIOS Timeframe* framed membrane that allows each step in the blot preparation process to work more efficiently.

◂**BIOS TIMEFRAME** To support and protect the blot, BIOS has developed a rigid carrier piece as a frame for the membrane. These easy to handle framed membranes come in sizes and membrane types that are compatible with your molecular genetic requirements. They are designed to fit together with the other instruments in the *BIOS Timeframe System.*

BIOS BLOT GENERATION STATION Included here are instruments for electrophoresis and blotting. Unique is the use of thin, horizontal agarose gels (<1.5 mm) that speed fractionation and transfer of DNA. DNA blots of unsurpassed quality are generated in less than two hours.

BIOS HYBRIDIZATION CASSETTE This unit assures uniform probe contact with the membrane, requires a minimum amount of probe, helps protect the user from radioactivity and permits easy removal of excess probe.

BIOS IMAGE CASSETTE Accidental movement of blots and blurred images are now a thing of the past. The unique design provides an efficient means of developing quality images virtually every time.

BIOS BLOT SAVER Organizing and storing blots is simple. The *BIOS Blot Saver* provides a convenient means for storing blots either in a wet or dry state.

FIND OUT MORE. *The BIOS Timeframe™ System* allows you to process blots in a whole new timeframe. BIOS DNA blotting equipment and supplies can be purchased individually or as a complete system. Either way they are sure to help you prepare top quality DNA blots in less time and at a lower cost.

Look for us at the Miami Winter Symposia or contact us directly at 203-773-1450.

BIOS CORPORATION

291 Whitney Avenue
New Haven, Connecticut 06511

Circle No. 68 on Readers' Service Card

SCIENCE

8 JANUARY 1988
VOLUME 239
NUMBER 4836

Materials Science

Materials science is currently one of the most vital areas of research and development. This was evident in Boston in early December at the annual meeting of the Materials Research Society. A broad spectrum of topics was treated in 18 symposia, including those on superconductors, advanced processes for microelectronics, plasma deposition of diamonds, and catalysts.

The 90 K superconductors have captured attention around the world. Thirty percent of the 260 papers or posters on the topic were furnished by contributors from 22 countries. There have been few times in human history when a scientific finding has been replicated by so many investigators so rapidly in so many places. Many different preparative procedures were mentioned, and the products examined by a variety of instruments. Two impediments to some large-scale applications remain. Thin films of oxides such as $YBa_2Cu_3O_{7-x}$ can carry up to 10^6 amperes per square centimeter. But superconductivity vanishes when a substantial magnetic field is present. A second impediment is the difficulty of forming a flexible wire from the superconductors. Bell Laboratories announced a substantial advance (see Research News, 18 Dec., p. 1649). By melting the oxide and cooling it in a controlled way, they obtained a product that can carry 1,000 A/cm^2 in a magnetic field of 10,000 or more gauss. Many applications will require 10 to 100 times greater currents in larger magnetic fields. The Bell Labs people are optimistic that they can make further progress.

Information processing is becoming the largest industry in the world. Further rapid progress in microelectronics seems guaranteed. During the past 3 years, there has been a 400 percent increase in the density of memory bits, and the practical limit recedes as a result of the ingenuity of scientists and engineers. Excimer lasers employing XeCl, KrF, or ArF are being used to make experimental chips having features with dimensions as small as 0.5 micrometer. The use of molecular-beam epitaxy continues to grow, permitting the construction of complex sandwiches of differing materials with layers a few atoms thick. Ion beams of oxygen with energies of the order of 200 kiloelectron volts are being employed to form an insulating layer of SiO_2 within a silicon wafer. A beam of cobalt can yield an internal conducting layer of cobalt silicide within silicon.

The large-scale synthesis of diamonds has long been a goal of industry. Diamonds are employed extensively in machine tools, and were synthesis of diamonds easy, they might be used with advantage as semiconductors. Diamonds and graphite are both forms of pure carbon, but it is graphite that is stable thermodynamically. In the 1950s, scientists and engineers at General Electric were able to produce diamonds in an apparatus capable of 5500°C and pressures of 2.8 million pounds per square inch. Now diamonds are being produced using plasma in a partial vacuum. The Russian Deriagin was a pioneer, but his papers were largely ignored. From 1983 on, however, there has been intense activity in Japan and recently in the United States. When a mixture of CH_4 and H_2 is introduced into a plasma, highly active and metastable forms of carbon and carbon-hydrogen entities are produced. When these metastable forms are adsorbed on a surface whose temperature is about 900°C, the carbon atoms form a crystalline structure. Sometimes the structure will be that of diamond, sometimes graphite. When a large fraction of the gas in the plasma is hydrogen, copious amounts of atomic hydrogen are made which reacts about a hundredfold faster with graphite than with diamonds. Thus nearly pure diamonds are the net product.

Industrial catalysts take many forms, one of which is a cave-like structure present in zeolites. Once process molecules enter the caves, they encounter active sites that catalyze reactions. In the past, the size of the opening in zeolites limited the kind of molecule that could be processed. At the meeting, new structures having larger openings were described. These included pillared micas and a zeolite type of structure formed predominantly from alumina and P_2O_5.

At Boston many more topics were treated than those touched on above. A 564-page book devoted to the program and abstracts and of presentations provides a further indication of the international character and broad scope of the program.

—PHILIP H. ABELSON

*The Materials Research Society, *Final Program and Abstracts*, Boston, MA, 30 November to 5 December 1987.

ELECTRON MICROSCOPY SOCIETY OF AMERICA

46th Annual Meeting. August 7-12, 1988, The Milwaukee Exposition and Convention Center, Milwaukee, Wisconsin

WITH THE MICROBEAM ANALYSIS SOCIETY & THE MICROSCOPICAL SOCIETY OF CANADA

SYMPOSIA -- TUTORIALS -- WORKSHOPS

The **EMSA** scientific program features symposia on *Grain Boundaries*; *Precipitation in Semiconductors*; *Phase Transformations*; *Surfaces, Small Particles and Catalysis*; *Composite Materials*: *Ceramics & Polymers; Ceramic Superconductors*; *Scanning Tunneling & Related Microscopies*; *Instrumentation and Computer Applications* (A Joint Phys./Bio. Symposium); *Confocal Microscopy; Imaging of Macromolecular Assemblies; 3-D Reconstruction; Techniques for Microanalysis in Surgical Pathology, Including the Pneumoconioses; Insights into Biological Questions from Studies with Antibodies; Assembly of Biological Structures*. There will also be 3 joint symposia with MAS on *SEM*; *Analytical Microscopy; Light and Electron Microscopy: Detection vs Resolution.* There will also be a special session on *Amorphous Materials* and a Mid-West EM Society 30th Anniversary Symposium.

A full **MAS** program will include other techniques and applications utilizing focussed beams.

The **commercial exhibition** will feature a large range of instrumentation, accessories, supplies and publications for electron microscopy, electron probe analysis and specimen preparation. Demonstrations will be offered on the state-of-the-art microscopes. It is anticipated that more than 100 companies will participate.

Biological Tutorials: Function and Applications of Confocal Scanning-Light Microscopies, Correlative Video-Enhanced Light Microscopy with High-Resolution Transmission Electron Microscopy, Cryotechniques for Application of X-Ray Microanalysis to Biological Systems. **Physical Sciences Tutorials**: Identification of Unknown Phases by Electron Diffraction/EDS, Characterization of Planar Defects, TEM Characterization of Precipitates. **Joint Phys./Bio. Tutorials**: Computers in Electron Microscopy -- Data, Control, Simulation, Low-Voltage SEM, Asbestos Identification Techniques Using Electron Microscopy. The **Technologists' Forum** will be on "Quantitative Techniques for the Electron Microscopist: Morphometry, Stereology and 3-D Reconstruction". **Computer Workshop & Software-Exchange** for spectra analysis, image processing, etc., will be coordinated with MAS and will run throughout the week.

Program Chair (EMSA, Physical Sciences): Professor C. Barry Carter, Cornell University. **Program Vice-Chair (EMSA, Biological Sciences):** Professor Ross Johnson, Univ. of Minnesota. **Program Chair (MAS)**: Dr Dale Newbury, National Bureau of Standards. **Local Arrangements Chair:** Professor Joseph B. Harris, Univ. of Wisconsin. **Membership Information:** Dr Mort Maser, EMSA Business Office, P.O. Box EMSA, Woods Hole, MA 02543.

For copies of the **Call For Papers, Abstract Forms, Registration Materials - Please contact:**

The Exhibition and Meeting Manager:
Mr Ed Ruffing, Scherago Associates, 1515 Broadway, New York, NY 10036

All papers should be submitted on the EMSA Abstract form to the Program Chair.

THE DEADLINE FOR *RECEIPT* OF ALL PAPERS IS MARCH 15 1988

The care to meet to know, to understand.

Ares-Serono Symposia is an independent foundation, created in 1971, to promote scientific research in all disciplines which contribute towards improving human health. This aim is pursued by means of congresses, courses, seminars and specialized studies.

Some of the international meetings scheduled for 1988 are:

5th European Workshop on the Molecular and Cellular Endocrinology of the Testis
Brighton, UK / April 13-16
Scientific Organization: B.A. Cooke (UK)

Endocrinology Under 35
Florence, Italy / May 23-25
Scientific Organization: M. Maggi (I) and C.J. Johnston (USA)

Platelets and Vascular Occlusion
Rome, Italy / June 1-3
Scientific Organization: G.A. FitzGerald (USA) and C. Patrono (I)

Advances in Biotechnology of Membrane Ion Transport
L'Aquila, Italy / September 19-20
Scientific Organization: R. Verna (I), P.L. Jörgensen (DK) and R.P. Garay (F)

Third Conference on Differentiation Therapy
Villasimius (CA), Sardinia/September 6-9
Scientific Organization: G.B. Rossi (I), F. Takaku (J) and S. Waxman (USA)

The Adrenal and Hypertension: From Cloning to Clinic
Tokyo, Japan / July 25-26
Scientific Organization: E.G. Biglieri (USA), J. Funder (AUS), F. Mantero (I) and R. Takeda (J)

No form of advertising or promotional activity by any pharmaceutical company is allowed at Ares-Serono Symposia Congresses.

ARES SERONO SYMPOSIA

Do you know all the advantages that the Ares-Serono Symposia Congress Card offers?
Please fill in this form and mail to Ares-Serono Symposia for information.

CONGRESS CARD 1988 | ARES SERONO SYMPOSIA

swissair Official Carrier

I would like to receive information about:
☐ Ares-Serono Symposia Congress Card
☐ All the above Congresses
☐ In particular the Congress on .....
.....
.....
☐ Ares-Serono Symposia Publications
Name .....
Address .....
Institution .....

Please send to Ares-Serono Symposia, Via Ravenna 8 - 00161 Rome - Italy

THE LIGHT OF DISCOVERY

MICROPHOT

Now the most advanced, integrated and versatile instrument for research light microscopy...The Nikon Microphot. So advanced it will enhance the very process of discovery itself.

Available in two models, the Microphot FX has a built-in camera, while the Microphot may be equipped with any camera from Nikon's FX system.

The Microphot FX microscope uses a microprocessor and software program to provide flawless, automatic photography. Features include binocular focusing for photography with *moveable* 1% spot metering or 30% averaging. FX direct-projection provides fast shutter speeds, maximum metering sensitivity, and reduced glare and flare.

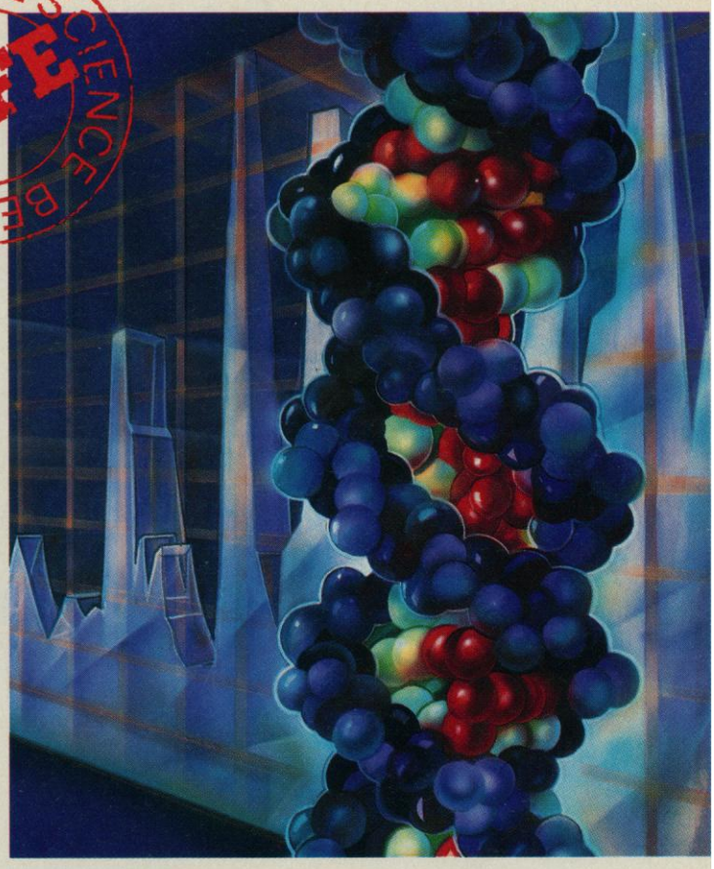
Both the Microphot FX and Microphot allow you to perform *all* viewing and analytical techniques in transmitted and reflected light...with a single instrument. You have the option of multiple functions simultaneously—photomicrography, image analysis, CCTV, microspectrophotometry.

Discover the Microphot FX and Microphot for yourself. Contact Nikon Inc., Instrument Group, 623 Stewart Avenue, Garden City, New York 11530. (516) 222-0200.

Nikon
Extending Man's Vision

For information circle reader service number 27
For a demonstration circle reader service number 28

DNA, FPLC.® PURE AND SIMPLE



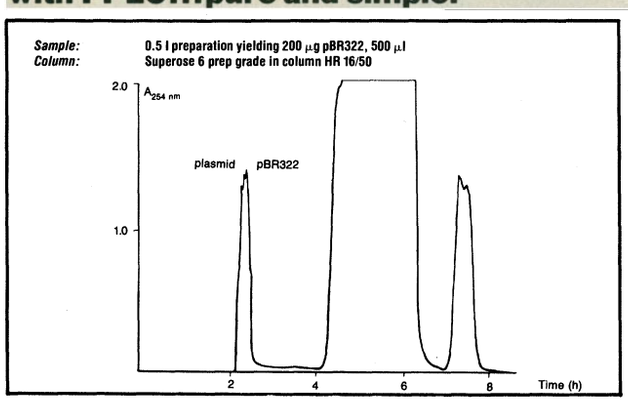
FPLC improves plasmid purification, with high recovery and between 3 to 6-fold time savings. Without the high costs and concerns of a centrifuge, Superose® 6 prep grade purifies pBR322 in just two hours.

FPLC clearly resolves restriction fragments of up to 3000 base pairs with sample loads of up to 100 μg. Hae III digest products of pBR322, including 123 and 124 base pairs fragments, have been separated to base line resolution on the ion exchanger Mono Q.®

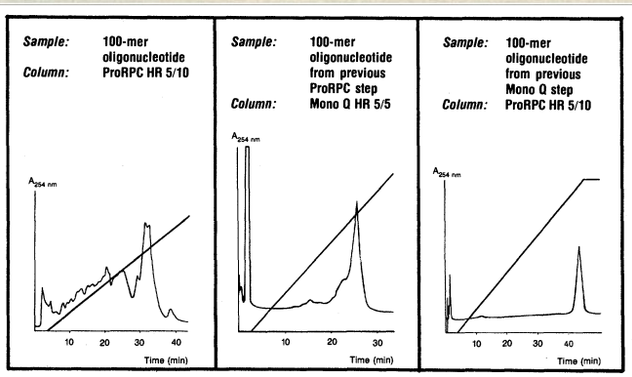
FPLC excels at rapid, high resolution purification of synthetic oligonucleotides. Even large oligonucleotides of 100-mer or more can be purified with high recovery and greater than 98% purity by using Mono Q and ProRPC.™

To serve all your separation needs, high performance chromatography with FPLC now adds DNA to the already impressive list of proteins, peptides, monoclonal antibodies, and amino acids.

Request more information on DNA separated with FPLC...pure and simple.



Preparative purification of the plasmid pBR322.



Three-step purification of 100-mer oligonucleotide. ProRPC, Mono Q and ProRPC again.

Pharmacia

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

Circle No. 39 on Readers' Service Card

OLYMPUS®

The Image of Quality

Introducing the IMT-2.

The new inverted tissue culture microscopy system with extended routine and research capabilities.

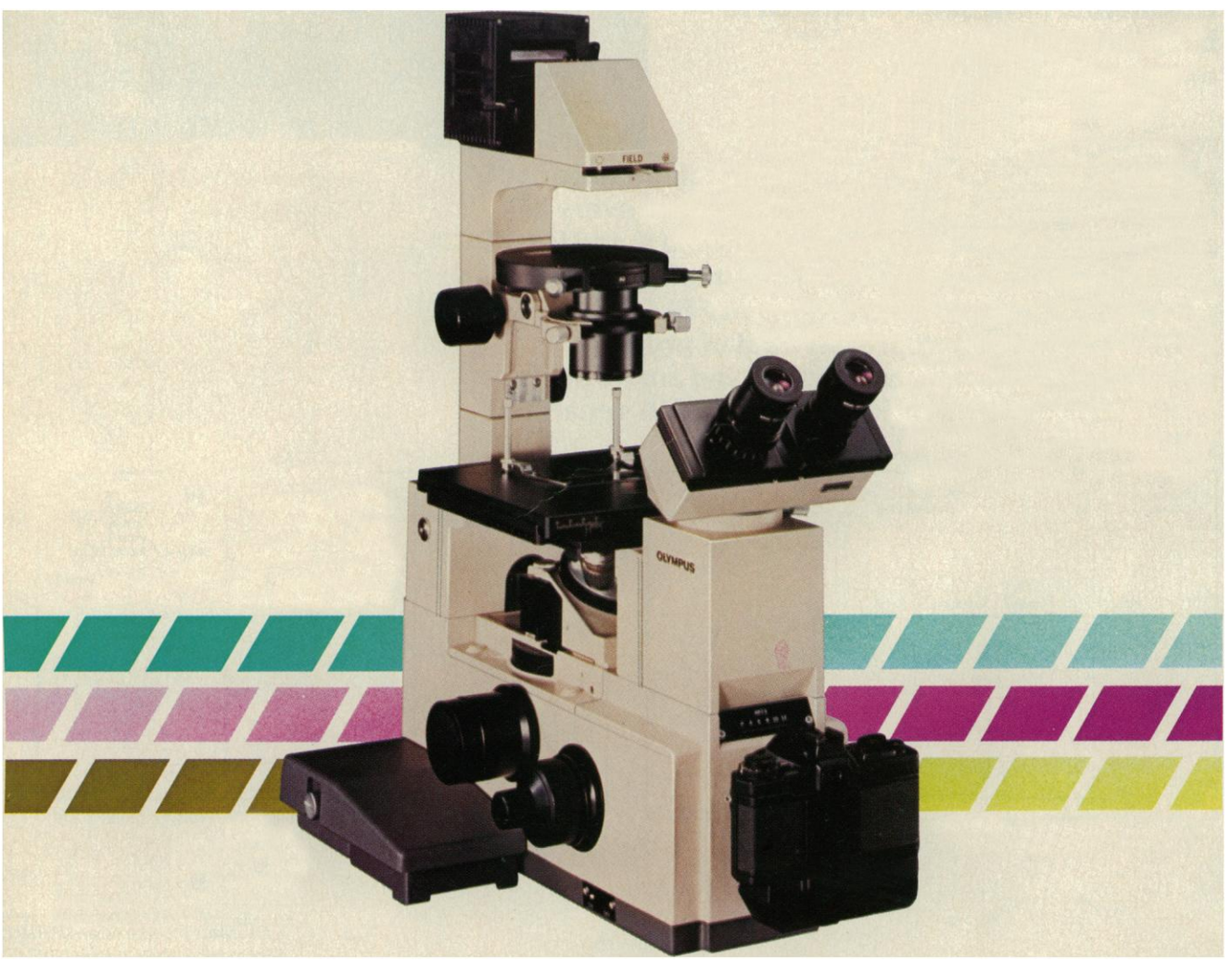
The quality of any microscope system relies on the interrelationship of optical performance, mechanical design and the component support system that increases its versatility as your needs grow. That is the Olympus IMT-2 advantage!

Whether used for laboratory routine or research study, the IMT-2 offers greater capability, its low-profile fixed stage and focusing optics permitting use with a large variety of vessels from ordinary slide to Petri dish and flask. A wide choice of components offers brightfield, phase contrast, differential interference contrast, Nomarski, epi-fluorescence and polarizing microscopy, as well as parfocal multiple-format photomicrography and multiple unit viewing. Combined with built-in magnification changer, 3-way light path selector and superior long barrel LB optics, IMT-2 represents a significantly advanced new generation in inverted microscope design ideally suited to cell manipulation, monoclonal antibody and tissue culture research.

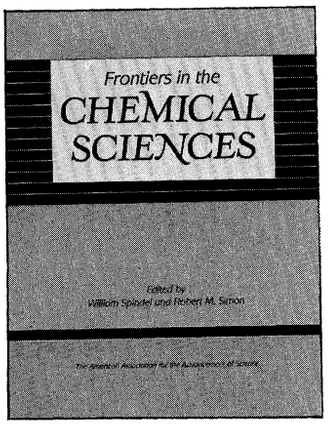
See for yourself by contacting Olympus Corporation, Precision Instrument Division, 4 Nevada Drive, Lake Success, New York 11042-1179. Phone toll-free 1 (800) 446-5967 for demonstration.

In Canada: W. Carsen Co., Ltd., Ontario.

OLYMPUS®



For information circle reader service number 2
For demonstration circle reader service number 3



Explore New Directions in Chemical Research

Frontiers in the Chemical Sciences

Selected and with an introduction by
William Spindel and Robert M. Simon, National Research Council

This collection of 38 articles from the pages of ***Science*** shows chemists unraveling the mysteries of molecular reactivity, developing powerful analytical and theoretical tools, exploring and exploiting new pathways for catalysis and synthesis, and contributing to disciplines as diverse as biology and materials science. Focusing on such themes as fundamental chemical change and extreme molecular complexity, this volume takes the reader on a tour of the contemporary research frontiers in chemistry. Articles by some of the leading scientists in their respective fields cover new work in seven key areas: understanding chemical reactivity, chemical analysis, theoretical chemistry, chemical catalysis, organic synthesis, the chemistry of life processes, and the chemistry of new materials. Two Nobel lectures are included.

592 pp.; fully indexed and illustrated
Hardcover $29.95 ($23.95 for AAAS members)
Softcover $17.95 ($14.35 for AAAS members)

Order from: AAAS Marketing, Dept. C, 1333 H St., NW, Washington, DC 20005. Add $1.50 postage and handling per order. Allow 4–6 weeks for delivery.

American Association for the Advancement of Science

Yes! Please send me the following copies of *Frontiers in the Chemical Sciences*

____ hardcover $29.95 (AAAS member price $23.95) $ _____
____ softcover $17.95 (AAAS member price $14.35) $ _____
Postage and handling $ 1.50
TOTAL $ _____

☐ Check ☐ VISA ☐ MasterCard _____
credit card number expiration date signature

Name _____
Street Address _____
City _____ State _____ Zip _____
AAAS member number (from *Science* mailing label) _____

Thank you for your order. Please send it to: AAAS Marketing, Dept. C, 1333 H Street, NW
Washington, DC 20005. Please allow 4–6 weeks for delivery.