

AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

12 SEPTEMBER 1986

\$2.50

VOL. 233 ■ PAGES 1125-1232



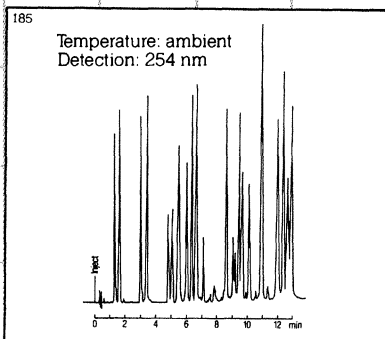
Optimal Chromatography **6**
IN A SERIES



Some call it PICO-TAG™ analysis

And some simply call it PITC. But what you call PTC-amino acid analysis isn't as important as the results. And results are what you'll get from Beckman's system AA-1.

The AA-1 is optimized for PTC-AA analysis. It's as fast, sensitive and easy to use as the so-called "exclusive" method. But since you don't need expensive special purpose columns or reagents, it's more cost-efficient.



The System AA-1...just one of a complete line of Beckman HPLC systems optimized for amino acid analysis. Call us. Or send for our new guide to amino acid analysis by HPLC.

Beckman Instruments, Inc.,
Altex Div., 2350 Camino Ramon,
San Ramon, CA 94583.
In U.S. call 800/742-2345.
Offices in major cities worldwide.

BECKMAN

PICO-TAG™ is a trademark of Waters Associates
©1985 Beckman Instruments, Inc. AX 85-2035A

Optimal Chromatography **7**
IN A SERIES

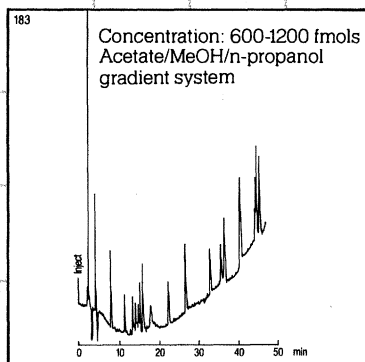


Pin down your sequence

Pin down high femtomole PTH amino acids fast with the AA-4 HPLC System from Beckman.

It's optimized for gradient PTH analysis in protein micro-sequencing.

Results are quick, quantitative and convenient, too. With high-precision pumping, zero dead volume injections, proven Ultrasphere® C₁₈ microbore columns, and a controller that makes it easy to store and link methods.



The System AA-4...just one of a complete line of Beckman HPLC systems optimized for amino acid analysis. Call us. Or send for our new guide to amino acid analysis by HPLC.

Beckman Instruments, Inc.,
Altex Div., 2350 Camino Ramon,
San Ramon, CA 94583.
In U.S. call 800/742-2345.
Offices in major cities worldwide.

BECKMAN

© 1985 Beckman Instruments, Inc. AX 85-2035C

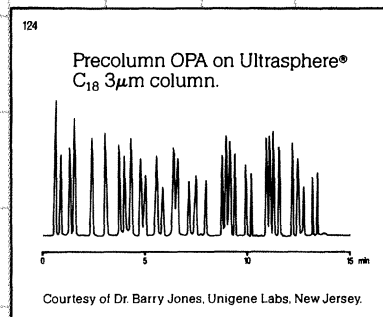
Optimal Chromatography **8**
IN A SERIES



ID amino acids fast

Now you have a choice of HPLC systems optimized for OPA amino acid analysis.

For pre-column derivatization, choose the Beckman System AA-2. It's optimized for fast OPA analysis with excellent resolution.



For quantitative results, the Beckman System AA-3 gives you high sensitivity with post-column derivatization. Ideal for profiling amino acids in complex samples such as cell culture media, physiological fluids, and foods.

With both systems, you are assured optimal results.

Systems AA-2 and AA-3... just two of a complete line of Beckman HPLC systems optimized for amino acid analysis. Call us. Or send for our new guide to amino acid analysis by HPLC.

Beckman Instruments, Inc.,
Altex Div., 2350 Camino Ramon,
San Ramon, CA 94583.
In U.S. call 800/742-2345.
Offices in major cities worldwide.

BECKMAN

©1985 Beckman Instruments, Inc. AX 85-2035B

Productivity Personified

A new era in cell culture has arrived. Invitron's **Static Maintenance Reactor** (U.S. Patent No. 4,537,860) is the result of a 15 year marriage of cell biology with bioengineering. This revolutionary cell culture bioreactor approaches—**within a pharmaceutical environment**—the condition under which cells exist in living tissue.

Just one of these reactors has the capacity to produce multi-gram quantities of product...**everyday**...for months at a time. Annualized, this means that each reactor has **multi-kilogram** capacity.

Eighteen such reactors, each exquisitely interfaced with computer automated life support systems, are the centerpiece of our new, **million-liter** pharmaceutical manufacturing facility.

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

For further information contact:

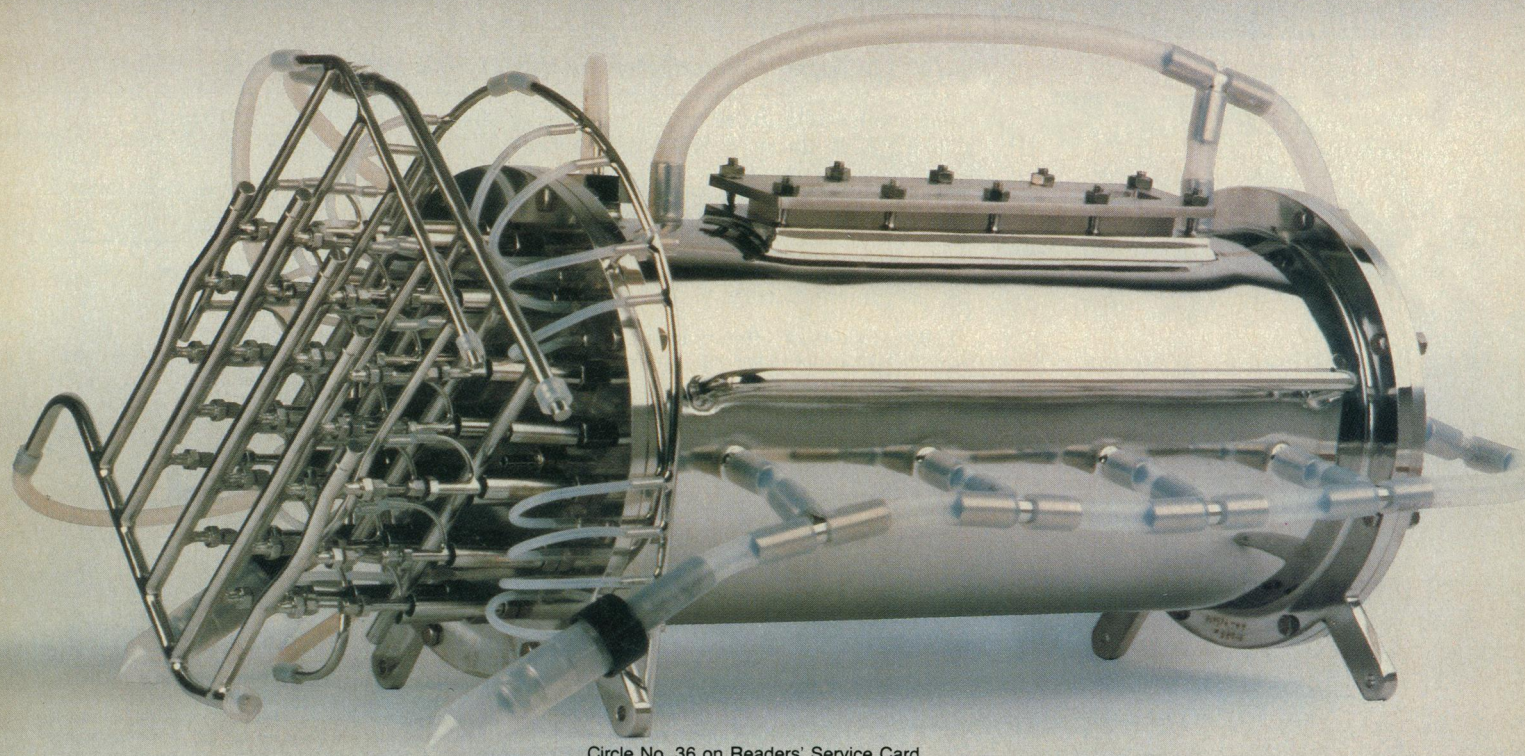


INVITRON

8000 Maryland Ave. • Suite 860

Clayton, MO 63105

314 727-8255 • 800 325-1792



Circle No. 36 on Readers' Service Card



1131 This Week in *Science*

Editorial

- 1133 A Mission in Transition: W. D. CAREY

Letters

- 1135 Supercollider Funding: R. L. HIRSCH ■ Biotechnology Regulation: H. I. MILLER AND F. E. YOUNG; D. E. KOSHLAND, JR.

News & Comment

- 1141 The Aftermath of Chernobyl
1143 EPA Proposal on Alachlor Nears
1145 Famine Early Warning Closer to Reality ■ Satellite of Choice
1147 *Briefing*: Test of Tobacco Containing Bacterial Gene Approved ■ AID Withholds U.N. Population Funds ■ Two More Rocket Launches Fail ■ Heavy Water: Where Did India Obtain It?

Research News

- 1149 Strategies for an AIDS Vaccine ■ The Challenge of Testing Potential AIDS Vaccines
1154 *Briefing*: What Makes a Volcanic Lake a Killer? ■ Charleston Quakes Are Larger or Widespread

Articles

- 1155 Macroeconomics in an Open Economy: R. N. COOPER
1159 Molecular Transformations on Single Crystal Metal Surfaces: R. J. MADIX

Research Articles

- 1167 Double-Labeled Metabolic Maps of Memory: E. R. JOHN, Y. TANG, A. B. BRILL, R. YOUNG, K. ONO
1175 A Yeast Gene That Is Essential for Release from Glucose Repression Encodes a Protein Kinase: J. L. CELENZA AND M. CARLSON

Reports

- 1181 North American-Pacific Relative Plate Motion in Southern California from Interferometry: G. A. LYZENGA AND M. P. GOLOMBEK
1183 Colors of Objects in the Field of the Double Quasi-Stellar Object 1146+111B,C: J. A. TYSON AND C. A. GULLIXSON

■ **SCIENCE** is published weekly on Friday, except the last week in December, and with a plus issue in May by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005. Second-class postage (publication No. 484460) paid at Washington, DC, and at an additional entry. Now combined with **The Scientific Monthly**® Copyright © 1986 by the American Association for the Advancement of Science. 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 \$24, other (surface mail) \$27, air-surface via Amsterdam \$65. First class, airmail, school-year, and student rates on request. Single copies \$2.50 (\$3 by mail); back issues \$4 (\$4.50 by mail); Biotechnology issue, \$5.50 (\$6 by mail); classroom rates on request; Guide to Biotechnology Products and Instruments \$16 (\$17 by mail). **Change of address**: allow 6 weeks, giving old and new addresses and seven-digit account number. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$1 per copy plus \$0.10 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 \$1 + .10. **Postmaster**: Send Form 3579 to *Science*, 1333 H Street, NW, Washington, DC 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

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



COVER MV-3 mobile very long baseline interferometry receiver during operations on Monument Peak in southern California. The system is used for the acquisition of geodetic baseline measurements as a part of the NASA Crustal Dynamics Project. This 5-meter-diameter radio telescope records quasar microwave emissions simultaneously with other mobile and fixed receivers. See page 1181. [Tony Ibbot, Jet Propulsion Laboratory, Pasadena, CA 91109]

- 1187 Females' Choice of "Good Genotypes" as Mates Is Promoted by an Insect Mating System: W. B. WATT, P. A. CARTER, K. DONOHUE
- 1190 Replacement of Liver Function in Rats by Transplantation of Microcarrier-Attached Hepatocytes: A. A. DEMETRIOU, J. F. WHITING, D. FELDMAN, S. M. LEVENSON, N. R. CHOWDHURY, A. D. MOSCIONI, M. KRAM, J. R. CHOWDHURY
- 1192 Correction of Murine β -Thalassemia by Gene Transfer into the Germ Line: F. COSTANTINI, K. CHADA, J. MAGRAM
- 1195 Ion Channels in Yeast: M. C. GUSTIN, B. MARTINAC, Y. SAIMI, M. R. CULBERTSON, C. KUNG
- 1197 Altered K^+ Channel Expression in Abnormal T Lymphocytes from Mice with the *lpr* Gene Mutation: K. G. CHANDY, T. E. DECOURSEY, M. FISCHBACH, N. TALAL, M. D. CAHALAN, S. GUPTA
- 1200 High Nitrite Levels off Northern Peru: A Signal of Instability in the Marine Denitrification Rate: L. A. CODISPOTI, G. E. FRIEDERICH, T. T. PACKARD, H. E. GLOVER, P. J. KELLY, R. W. SPINRAD, R. T. BARBER, J. W. ELKINS *et al.*
- 1202 Paleoenvironment of the Earliest Hominoids: New Evidence from the Oligocene Avifauna of Egypt: S. L. OLSON AND D. T. RASMUSSEN

AAAS Meetings

- 1206 *Annual Meeting*: Call for Contributed Papers

Book Reviews

- 1207 Guila Naquitz, *reviewed by* M. D. COE ■ Phanerozoic Diversity Patterns, M. J. Benton ■ Fur Seals, D. M. Lavigne ■ Some Other Books of Interest ■ Books Received

Products & Materials

- 1211 Chromatography Software ■ Liquid Scintillation Analyzer ■ Gamma Counter ■ Controller for Freeze-Drying ■ Peptide Cleavage ■ Chemistry Analyzer ■ Literature

Board of Directors

Gerard Piel
*Retiring President,
Chairman*

Lawrence Bogorad
President

Sheila E. Widnall
President-elect

Robert McC. Adams
Robert W. Berliner
Floyd E. Bloom
Mary E. Clutter
Mildred S. Dresselhaus
Donald N. Langenberg
Dorothy Nelkin
Linda S. Wilson

William T. Golden
Treasurer

William D. Carey
Executive Officer

Editorial Board

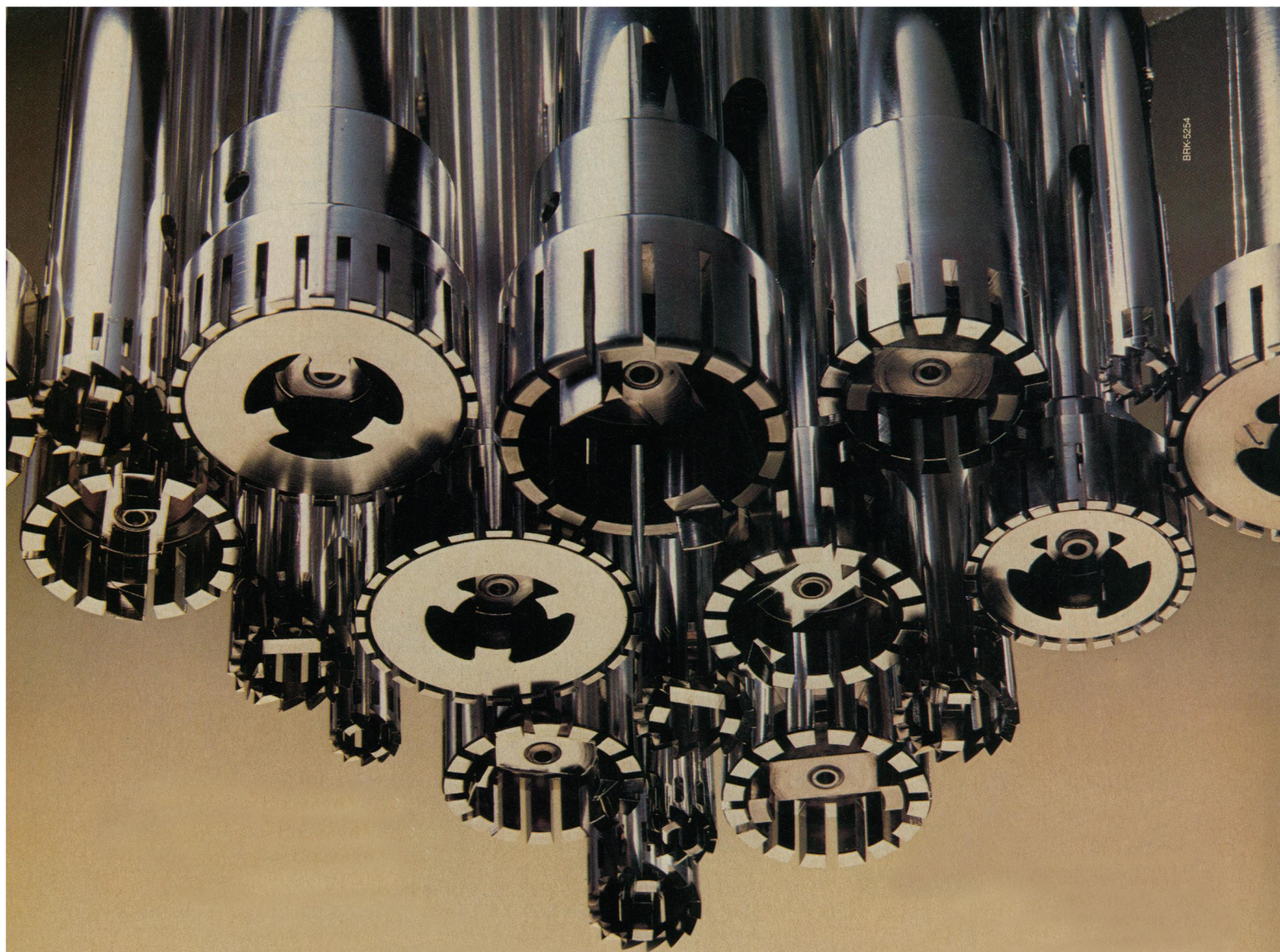
David Baltimore
William F. Brinkman
Ansley J. Coale
Joseph L. Goldstein
James D. Idol, Jr.
Leon Knopoff
Seymour Lipset
Walter Massey
Oliver E. Nelson
Allen Newell
Ruth Patrick
David V. Ragone
Vera C. Rubin
Howard E. Simmons
Solomon H. Snyder
Robert M. Solow

Board of Reviewing Editors

Qais Al-Awqati
James P. Allison
Luis W. Alvarez
Don L. Anderson
C. Paul Bianchi
Elizabeth H. Blackburn
Floyd E. Bloom
Charles R. Cantor
James H. Clark
Bruce F. Eldridge
Stanley Falkow
Theodore H. Geballe
Roger I. M. Glass

Stephen P. Goff
Robert B. Goldberg
Patricia S. Goldman-Rakic
Corey S. Goodman
Richard M. Held
Gloria Heppner
Eric F. Johnson
Konrad B. Krauskopf
Karl L. Magleby
Joseph B. Martin
John C. McGiff
Alton Meister
Mortimer Mishkin
Peter Olson
Gordon H. Orians
John S. Pearce
Yeshayau Pocker
Jean Paul Revel

Frederic M. Richards
James E. Rothman
Thomas C. Schelling
Ronald H. Schwartz
Stephen M. Schwartz
Otto T. Solbrig
Robert T. N. Tjian
Virginia Trimble
Geerat J. Vermeij
Martin G. Weigert
Irving L. Weissman
George M. Whitesides
Owen N. Witte
William B. Wood
Harriet Zuckerman



Only the sample breaks down.

Brinkmann homogenizers make the difference
—in 30 seconds.

Rapid action preserves biological integrity.

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



Powerful, durable motors work harder...longer.

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

One system meets all your homogenization needs.

Brinkmann homogenizers handle samples from 0.5 mL to 25 L with 21 generators, two motors, and a complete range of accessories.

For complete information or a demonstration, call or write:

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



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

For literature circle reader service number 54
For a demonstration circle reader service number 55

This Week in SCIENCE

El Niño and marine denitrification

A cold anomaly along the coast of Peru, thought to be related to the 1982–1983 El Niño, may have caused increased denitrification in the Pacific Ocean that, in turn, affected the global nitrogen balance (page 1200). Marine denitrification is mediated by bacteria; it involves conversion of combined nitrogen (nitrates, nitrites, nitrous oxide) to free nitrogen gas. It proceeds best in regions of the ocean deficient in oxygen and amply supplied with nitrates and organic matter. Codispoti *et al.* estimate that a 2 to 25% increase in total marine denitrification occurred in 1985 and speculate on its cause. Changes in ocean dynamics that were associated with El Niño and the following cold anomaly could have transported excess nutrients and fixed nitrogen to shallower regions: in the upper waters, plants grew and abundant organic matter was generated; this material sank to regions where bacterial metabolism (including denitrification) then flourished.

Fossil birds, climate, and primate evolution

ANCESTORS of humans and apes that were developing in the Fayum depression of Egypt during the Oligocene Epoch (25 to 37 million years ago) probably lived in a warm, wet, tropical swamp rich in floating vegetation, having little seasonal variability, and bounded by forests, open woodlands, and grasslands (page 1202). Bird fossils found in deposits in a region that also contains remains of the earliest known hominoid primates have provided clues to the past climate because many of the avifaunal fossils belong to families that are alive today (whereas most of the mammalian fossils are from taxa that are now extinct). Through identification of the habitat requirements (some of which are quite restricted) of contemporary birds from these families, the early climate and biologic conditions that affected the

evolution of species in the past have been deduced. Olson and Rasmussen found fossils of jacanas, shoebilled storks, herons, cranes, cormorants, ospreys, eagles, and other, mostly aquatic, birds; their habitats today overlap only in Uganda north and west of Lake Victoria where the climate is warm and tropical. Today, as in the Oligocene, a number of primate species coexist with the birds in the vicinity of the swamp.

Gene transfer in β -thalassemia

SATISFACTORY treatments are not currently available for hereditary β -thalassemias, and some forms of the disease are fatal early in life (page 1192). Costantini *et al.*, using a mouse model of β -thalassemia, show that the genetic deficiency can be corrected by gene transfer into the germ line. Cloned β -globin genes (human or mouse) were injected into fertilized mouse eggs and the eggs transferred into foster mothers. Transgenic progeny could make normal β -globin chains from the foreign gene; so could their progeny. In some mice that had received the human gene, anemic signs and symptoms were completely alleviated; in others that had received the mouse gene, partial (perhaps because of the lower level of gene expression) repair of the defect and reduction of anemia were noted. While transfer of a gene into the germ line would not be appropriate for correcting thalassemias in humans (transfer into somatic cells—specifically those stem cells from which red blood cells arise—is required), these experiments demonstrate that a cloned gene can substitute for a defective gene in thalassemic red blood cells.

Mate selection in butterflies

THE mating system that has evolved among *Colias* butterflies helps perpetuate fitness within the population with regard to flight,

mating, and other traits (page 1187). Males visually locate females to court by virtue of the females' colorful wing patterns. They perform flight and "wing-flicking" maneuvers, and their successful courting performance depends on the fueling of flight muscles; fueling, in turn, depends on biochemical processes involving the enzyme phosphoglucose isomerase (PGI). Females select males for mating and become more choosy as they age. They can mate several times, but the eggs they lay all have the genes of the most recent mate. Watt *et al.* found that older, more discriminating females chose males with "superior" PGI genes (for the form of the enzyme that has been associated with increased flight capacity, survivorship, and overall mating success) roughly 92% of the time; younger females on a first mating chose such males only about 71% of the time. Females exercising greater discrimination therefore get mates and produce progeny having the optimal genotype for PGI-related traits.

Beads assist in liver cell transplantation

LIVER transplantation is the only option available at present for treating patients with acute liver failure, but a strategy for transplantation of normal liver cells attached to beads, described by Demetriou *et al.*, may change the clinical prospects (page 1190). Liver cells were attached to collagen-coated dextran beads and injected into the peritoneal cavities of mutant rats that had protein deficiencies related to liver disfunctions. The transplants "took" (in contrast to transplants of liver cells without beads). Bead-delivered cells became embedded in a network of fibroblasts and connective tissue within the peritoneal cavity. Blood vessels began connecting the aggregates to the circulation, and albumin and conjugated bilirubin in bile were measurable in the previously deficient animals. The first results are extremely promising both because functions were restored and because no toxicity or inflammatory reactions were noted.

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.

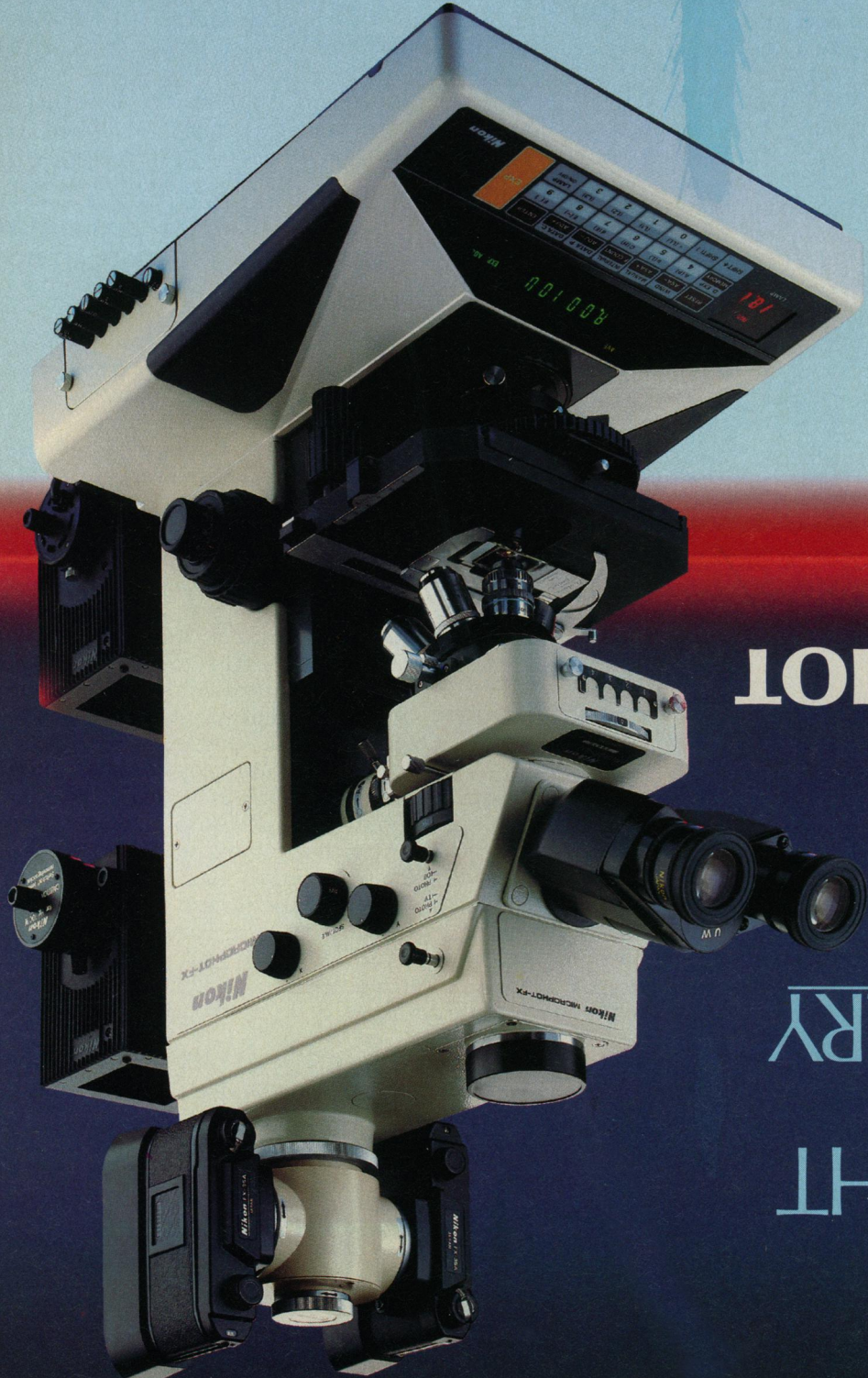
Available in two models, the Microphot FX has a built-in camera, while the Microphot may be equipped with any camera from Nikon's FX system. The Microphot FX microscope uses a microprocessor and software program to provide flawless, automatic photography. Features include binocular focusing for photography with moveable 1% spot metering or 30% averaging. FX direct-projection provides fast shutter speeds, maximum metering sensitivity, and reduced glare and flare.

For information circle reader service number 85
For a demonstration circle reader service number 86

Nikon
Extending Man's Vision

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.



American Association for the Advancement of Science

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

Publisher: William D. Carey

Editor: Daniel E. Koshland, Jr.

Deputy Editors: Philip H. Abelson (*Engineering and Applied Sciences*); John I. Brauman (*Physical Sciences*); Gardner Lindzey (*Social Sciences*)

EDITORIAL STAFF

Managing Editor: Patricia A. Morgan

Assistant Managing Editors: Nancy J. Hartnagel, John E. Ringle

Senior Editors: Eleanore Butz, Lawrence I. Grossman, Ruth Kulstad

Associate Editors: Martha Collins, Barbara Jasny, Katrina L. Kelner, Edith Meyers, David F. Voss

Letters Editor: Christine Gilbert

Book Reviews: Katherine Livingston, *editor*

This Week in Science: Ruth Levy Guyer

Chief Production Editor: Ellen E. Murphy

Editing Department: Lois Schmitt, *head*; Caitlin Gordon, Mary McDaniel, Barbara E. Patterson

Copy Desk: Lyle L. Green, Sharon Ryan, Beverly Shields, Anna Victoreen

Production Manager: Karen Schools

Graphics and Production: John Baker, *assistant manager*; Holly Bishop, Kathleen Cosimano, Eleanor Warner

Covers Editor: Grayce Finger

Manuscript Systems Analyst: William Carter

NEWS STAFF

News Editor: Barbara J. Culliton

News and Comment: Colin Norman, *deputy editor*; Mark H. Crawford, Constance Holden, Eliot Marshall, Marjorie Sun, John Walsh

Research News: Roger Lewin, *deputy editor*; Deborah M. Barnes, Richard A. Kerr, Gina Kolata, Jean L. Marx, Arthur L. Robinson, M. Mitchell Waldrop

European Correspondent: David Dickson

BUSINESS STAFF

Associate Publisher: William M. Miller, III

Business Staff Manager: Deborah Rivera-Wienhold

Classified Advertising: Leo Lewis

Membership Recruitment: Gwendolyn Huddle

Member and Subscription Records: Ann Ragland

Guide to Biotechnology Products and Instruments: Shauna S. Roberts

ADVERTISING REPRESENTATIVES

Director: Earl J. Scherago

Production Manager: Donna Rivera

Advertising Sales Manager: Richard L. Charles

Marketing Manager: Herbert L. Burkland

Sales: New York, NY 10036: J. Kevin Henebry, 1515 Broadway (212-730-1050); Scotch Plains, NJ 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); Chicago, IL 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-337-4973); San Jose, CA 95112: Bob Brindley, 310 S. 16 St. (408-998-4690); Dorset, VT 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581).

Instructions for contributors appears on page xi of the 27 June 1986 issue. Editorial correspondence, including requests for permission to reprint and reprint orders, should be sent to 1333 H Street, NW, Washington, DC 20005. Telephone: 202-326-6500.

Advertising correspondence should be sent to Tenth Floor, 1515 Broadway, NY 10036. Telephone 212-730-1050.

A Mission in Transition

The task of enhancing public literacy where science and technology are concerned is at once compelling and uphill. Undeniably, this task needs to be approached primarily through early and intermediate education so as to build a foundation of principles and perceptions that one will carry through life in an era of growing complexity and troubling choices. But this is a large order as things now stand, and the limits to public understanding of science are large and troubling.

For 40 years AAAS has had the stated goal of increasing the public understanding of science. Among a variety of AAAS initiatives directed to that goal, two stand out. The first was the AAAS role in aiding the launching of "Nova," the prized public television program that has earned a large audience. The second was the creation in 1979 of a new magazine dedicated expressly to bridging the distance between science and the citizen, an initiative emanating from the concept of Allen Hammond, at that time editor of Research News at *Science*.

When AAAS ceased publishing *Science 86* this summer and sold its assets to Time Inc., we could reflect on both good and bad news. The good news was that *Science 86* and its predecessor editions had been a roaring editorial success beyond all expectations, with a high circulation and a fascinated cohort of readers. The bad news was a severe advertising famine, resulting in a heavy burden on AAAS's financial resources and an unacceptable exposure to indefinite adversity.

The decision to cut losses, at the expense of a magazine that was a demonstrable achievement for the public understanding of science, was acutely painful. What has been learned from our 7-year venture? On the business side of the matter, a built-in economic risk was present from the beginning because of the unpredictability of advertisers' perceptions of a science magazine as a medium for selling consumer goods. Additionally, it is plain that a nonprofit organization should have had greater discretionary resources than we did if it hoped to take on stiff competition from the profit sector of the publishing industry and to hang tough over a prolonged cycle of deficit financing.

Turning to the mission itself, the lessons are quite different. With a talented staff, AAAS demonstrated that science can be made both understandable and absorbing through the print medium. The loss of *Science 86* has been accompanied by a flood of letters from readers whose evident deprivation is keen and inconsolable. Indeed, a number of readers have offered to pay more for their subscriptions if this would resuscitate the magazine. There is a clear message here. The demand for responsible science journalism is strong, very strong. That is a highly positive sign that the well-documented problem of scientific literacy is by no means insoluble.

Now AAAS must decide how best to continue addressing its responsibility to communicate science to an avidly interested nonscientist audience. We have had good success with radio programming over the years, beginning with a public radio program called "Focus" and continuing with "Report on Science" on CBS, with an estimated listening audience of about 5 million, and perhaps our radio efforts can be scaled up. A different option would be to greatly enlarge our Mass Media Science and Engineering Fellows program that places young scientists and engineers at print and broadcast sites, a project designed to familiarize scientists with the needs of the media in reporting and commenting on scientific and technical news developments. We have, at intervals, looked longingly at the attractions of television as a medium for explaining science, but although the economics of communicating on commercial channels are discouraging, the potential of cable could be another story. And from a strategic point of view, enhancing the capabilities of the professional science reporters and writers could turn out to be an option with much promise.

The troubling outcome of our venture with a general interest science magazine has in no way deflected AAAS from its objective. The Board of Directors has begun to explore a broad range of initiatives in the arena of communication about science and its place in an informed society, and it welcomes the counsel of our members at this transition point in the association's work.—WILLIAM D. CAREY

In Mathematical and Statistical FORTRAN Programming **IMSL** Gets You to the Solution **Faster**

There is a faster way to get from problem to solution. A way to reduce development time, simplify maintenance, improve accuracy. A way to measurably increase productivity by selecting from hundreds of complete, fully tested mathematical and statistical FORTRAN subprograms:

IMSL subroutine libraries

Comprehensive, economical, and supported by the world's leading supplier of FORTRAN libraries for mathematics and statistics.

Calling a routine from an IMSL library is faster than writing it. It's a simple fact, but it can mean a big improvement in the productivity of both people and computers. It's why professional problem solvers in more than 60 countries have chosen IMSL libraries as their standard resource for FORTRAN programming. **IMSL libraries get you to the solution faster.**

Return this coupon to:
IMSL Sales Division
2500 ParkWest Tower One
2500 CityWest Boulevard
Houston, Texas 77042-3020, USA.
Telephone: (713) 782-6060
Telex: 791923 IMSL INC HOU
**In the U.S. (outside Texas) call toll-free
1-800-222-IMSL.**

- ☐ The IMSL Library ☐ MATH/PC-LIBRARY
☐ SFUN/LIBRARY ☐ STAT/PC-LIBRARY

Name _____

Department _____

Title _____

Organization _____

Address _____

City _____

State _____

Postal Code _____

Area Code/Phone _____

Telex _____

Computer Type _____

SC18609

IMSL®

Problem-Solving Software Systems

Broad Scope.

IMSL libraries provide the most comprehensive selection of mathematical and statistical FORTRAN subprograms available. In almost any numerical programming application, IMSL libraries will meet your current *and* future needs with over 700 high-quality subprograms.

Standard User Interface.

Uniform calling conventions and documentation for all supported computer environments make IMSL libraries easy to learn and easy to use. Programs developed using IMSL libraries are much simpler to de-bug and maintain than programs containing undocumented, non-standard or unverified code.

Wide Compatibility.

IMSL libraries are affordably priced and compatible with most computing environments, from supercomputers to personal computers. Making IMSL libraries available on all of your computer systems can expand development flexibility and enhance application portability in your multiple-computer environment.

Comprehensive Support.

IMSL product support includes expert consultation, regular software enhancement, and maintenance. These services are performed entirely by IMSL personnel to ensure quality and consistency. IMSL's systematic, comprehensive support is the best way to protect the value of your software investment.

Accuracy and Reliability.

IMSL subroutines are designed, and exhaustively tested, for accuracy and reliability—and continually verified through thousands of hours of computation by customers around the world. Using IMSL libraries not only increases productivity, but can also enhance the accuracy and robustness of your programs and applications.

The IMSL Library MATH/PC-LIBRARY

STAT/PC-LIBRARY

SFUN/LIBRARY

Over 500 mathematical and statistical subroutines
Subroutines for mathematical applications (for IBM personal computers)
Subroutines for statistical analysis (for IBM personal computers)
Subprograms for evaluating special functions

Letters

Supercollider Funding

M. Mitchell Waldrop did a fine job of reporting issues related to the Supercollider (SSC) (Research News, 25 July, p. 420). However, he did not note the important comments on the SSC that were made in the Department of Energy (DOE) Energy Research Advisory Board (ERAB) study "Guidelines for DOE long-term civilian research and development," which was issued in December 1985 and which I chaired. ERAB looked at all DOE civilian R&D and made the following summary statements regarding the SSC:

- Increased funding of the SSC must not preempt other DOE civilian R&D priorities, as there are important, less expensive projects to fund in the near term.

- The SSC site selection contest under way may be premature.

- Because of its size, the SSC will require a national commitment, which must be based on (i) adequate research and engineering studies to support capital costs and project schedules; and (ii) international participation to defray a part of the costs. Initiation of the SSC is a basic science issue, not an energy issue.

ERAB member opinions on the SSC varied dramatically. Some felt that money for construction should be found, no matter what. At the other extreme, some members felt that the high energy physics "emperor has no clothes" and even \$550 million per year for such abstract research is a national waste.

To believe that the SSC can be funded in these days of severe federal budget deficits without having an impact on other research is totally unrealistic. Available funds for research are and will continue to contract. Nevertheless, it may be in the national interest to sacrifice other research in order to move ahead with this exciting new venture.

ROBERT L. HIRSCH
*Research and Technical Services,
ARCO Oil and Gas Company,
2300 West Plano Parkway,
Plano, TX 75075*

Biotechnology Regulation

By analogy to molecular biology's "one gene—one enzyme" hypothesis, Daniel E. Koshland, Jr., proposed recently (Editorial, 2 May, p. 561) a "one-license—one hearing" policy toward federal agencies' evaluation of new biotechnological products. Koshland

correctly decried some of the regulatory and litigation-related delays and described the frustrations of industrialists and academics, but his solution is oversimplistic.

It is obvious that biotechnology is neither well circumscribed nor homogeneous, but encompasses many disciplines from molecular biology and entomology to crystallography and bioprocessing engineering. New biotechnology ranges from fish farming enhanced by recombinant DNA-derived hormones and food plants with improved protein quality to microbes programmed to produce interferon or to degrade toxic wastes. Thus, governmental oversight for ensuring that products do not compromise public health or safety cuts across the jurisdiction of many regulatory agencies. These agencies, in turn, have various statutory mandates, different agency missions, and disparate degrees of scientific expertise.

Recognizing these complexities, the Administration in 1984 formed an interagency working group under the former White House Council on Natural Resources and the Environment (now the Domestic Policy Council). The working group has sought to achieve a balance between regulation adequate to ensure health and environmental safety and flexibility sufficient to avoid impeding the implementation of the new technologies. It concluded that existing laws—perhaps with some clarification—were adequate for oversight of the new products, but that some mechanism for coordinating scientific information and regulatory philosophy would be useful. Consequently, in November 1985 the Biotechnology Science Coordinating Committee (BSCC) was formed. Its function is *not* to perform redundant reviews of individual product applications or to second-guess agency decisions but rather to ensure that there is coordination among the various agencies overseeing biotechnology product regulation and that comparable principles and rigor are employed in agency evaluations.

The agencies recently published major statements of policy on oversight of biotechnology (1), in which the BSCC attempted in two important ways to avoid the regulatory redundancy and delays of concern to Koshland. First, for the situations where more than one agency could share jurisdiction, a *lead* agency was identified; second, the principle was established that where there is shared jurisdiction, one agency can defer to the scientific review of another. While "one license—one hearing" could be the goal to which we aspire, there are examples where it cannot suffice; for example, the nature and extent of the review (by the Environmental Protection Agency) of an enzyme intended as a drain cleaner would of necessity be quite

IMSL Redefines The PC Site License

IMSL's new Organizational Site License can put IMSL mathematical and statistical FORTRAN libraries to work on every IBM personal computer in your organization—quickly, easily and economically.

A Better Idea in Site Licensing

IMSL's Organizational Site License doesn't impose the geographical limitations of other site licenses. It allows you to duplicate and use IMSL PC Libraries wherever you need them—in the office, at home, or around the world.

Manageable Software Costs

The Organizational Site License costs far less than multiple individual licenses, and the one-time license fee effectively puts a ceiling on your PC software costs.

Instant Availability, Higher Productivity

The Organizational Site License lets you distribute IMSL software when you need it, eliminating the cost and delay of one-at-a-time purchases and the problem of unauthorized copying. And with IMSL libraries as your standard FORTRAN resource, you can achieve faster program development, easier maintenance, and higher productivity.

For Complete Information ...

Write to:

IMSL Sales Division
2500 ParkWest Tower One
2500 CityWest Boulevard
Houston, Texas 77042-3020
USA

Or

Call 1-800-222-IMSL
(toll-free)

In Texas or outside the
U.S., call (713) 782-6060.

Telex: 791923

IMSL INC HOU.

Facsimile (Gp I/II)

(713) 782-6069.

Copyright © 1986 IMSL, Inc. All Rights Reserved.

different from the review [by the Food and Drug Administration (FDA)] if the same enzyme were intended for use as a thrombolytic agent administered intravenously to patients.

We are convinced that protection of human health and the environment, stimulation of industries using new biotechnology, and assurance of safety of products are mutually compatible. The FDA's record of having approved more than 150 products (including in recent weeks the first interferons and a monoclonal antibody that treats acute renal transplant rejection) that use recombinant DNA or hybridoma techniques in their manufacture is evidence of this conviction.

However, government cannot perform regulatory oversight of scientific and commercial endeavors in a vacuum. We require the advice and criticism of academics and of the public. And while we welcome such commentary as Koshland's in *Science*, there are alternatives to effecting better regulation. The most direct is to analyze and comment on the scientific assumptions in statements of policy, and we urge individual scientists and professional organizations to make the required investment in time and energy to do so. The FDA's last statement of

policy on biotechnology elicited a dismal response: a mere 34 official comments. Can that really be all the interest there is in the scientific and regulatory approaches of a major regulatory agency—with responsibility for products accounting for 25 cents of every consumer dollar—to important new technologies?

In addition, public education via lectures and articles directed at nonspecialists, while less direct, is a worthy investment.

Perhaps there was appropriate but unintended irony in Koshland's metaphor of "one gene—one enzyme," which is not an invariant principle. It is now known that certain messenger RNA precursors can be spliced in alternative ways, such that a single primary messenger RNA transcript may ultimately yield two or more very different polypeptides. Likewise, "one license—one hearing" can be a useful, although not universally applicable, model.

HENRY I. MILLER
FRANK E. YOUNG

*Food and Drug Administration,
Rockville, MD 20857*

REFERENCES

1. *Fed. Regist.* 51, 23301 (26 June 1986).

Response: The Biotechnology Science Coordinating Committee appears to be an excellent approximation of the simplicity and responsibility that were advocated in my editorial. I do not think the lack of letters indicates lack of interest but perhaps a past experience of scientists having suggestions fall on deaf ears. Miller and Young deserve great credit for their good solution to a difficult problem and for a receptiveness that will encourage responses.

I hope that Washington bureaucracy does not get as complex as gene expression. If it does, we may have to extend the adage "Ontogeny recapitulates phylogeny" to "Sociology recapitulates enzymology."

—DANIEL E. KOSHLAND, JR.

Erratum: In the article "Mathematicians recognize major discoveries" by Gina Kolata (Research News, 15 Aug., p. 722), Fields Medal winner Michael Freedman was incorrectly described as being a member of the University of Southern California faculty. Freedman is Charles Lee Powell Professor of Mathematics at the University of California, San Diego. In addition, several names in the article were spelled incorrectly. Field's should have been Fields, Nevalinna and Navanlinna should have been Nevanlinna, Kirky should have been Kirby, Atyyah should have been Atiyah, and Strasen should have been Strassen.

Patented Gene Transfer Technology with Proven Success:

Applicable to all Biological Systems

BAEKON2000 Advanced Gene Transfer System



PRECISELY CONTROLLABLE
PARAMETERS: Amplitude,
Number of Pulses, Burst Time,
Cycle, and Intensity of
Turbulence.

CONSISTENT QUALITY RESULTS
TIME AFTER TIME.

Unique merits of BAEKON2000

- STERILITY by the use of a sterile disposable receptacle;
- TWO modes of operation: Non-contact and Contact;
- CONTINUOUS output of electric discharges;
- Virtually NO limit in species and number of cells and DNA;
- CONTROLLED turning and mixing of gene-cell mixture DURING transfer.

Our clients are leading scientists in the area of animal, plant and bacterial biotechnology.

BAEKON2000: THE OPTIMAL SOLUTION!

BAEKON, INC.

18866 Allendale Avenue, Saratoga, CA 95070
(408) 741-0404

Complete details upon inquiry.

BURN YOUR REFERENCE CARDS!

REF-11™

Computerizes your REFERENCES
and prepares your BIBLIOGRAPHIES

- ☐ Maintains a data base of references
- ☐ Searches for any combination of authors, years of publication, reference title (or any words in the title), and topics covered by the reference
- ☐ Formats bibliographies exactly as you want them
- ☐ Alphabetizes references
- ☐ Abbreviates journal titles
- ☐ Runs on any video terminal and printer
- ☐ Menu driven dialogue
- ☐ Compact storage format
- ☐ 20 lines of comments for each reference

IBM PC/XT/AT, MS-DOS, CP/M 80 . . . **\$195⁰⁰**

RT-11, TSX-Plus, RSX-11, P/OS **\$250⁰⁰**

VAX/VMS (native mode) **\$350⁰⁰**



ANY
MANUAL **\$15⁰⁰**

ANY
MANUAL & DEMO **\$20⁰⁰**

322 Prospect Ave., Hartford, CT 06106
(203) 247-8500

Connecticut residents add 7½% sales tax.

Circle No. 97 on Readers' Service Card

Circle No. 13 on Readers' Service Card

Western gold...

Immunogold blotting reagents to make your mark — permanent!

AuroDye*

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

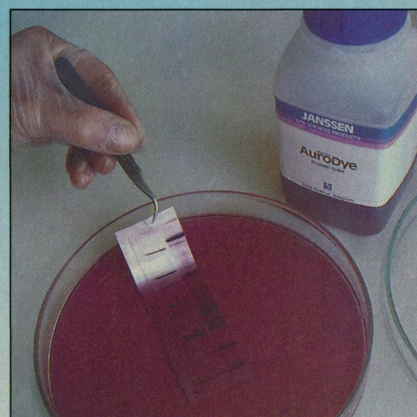
AuroProbe* BL

Superior reagent system for antigen detection — without enzyme development.

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

IntenSE*

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



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

* Trademark

 **JANSSEN**
LIFE SCIENCES PRODUCTS

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

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

Circle No. 40 on Readers' Service Card

JANSSEN
pioneering in Life Sciences technology

Olympus gives you Fluorescence microscopy of unprecedented brightness.

With fluorescent systems of incomparable brightness for both reflected and transmitted light observation, the Olympus AH2 and BH2 Series microscopes and UV optics bring a new level of ease and efficiency to fluorescence microscopy. No longer must you be faced with rapid quenching during long-term viewing at 100% exciting light intensity, or suffer viewing strain while working with faint fluorochromes.

Unparalleled illumination quality starts with greater original light intensity due to the ultra-sophisticated collector lens design of our fluorescence systems. Then the integral aperture and field diaphragms with

centering mechanisms eliminate light loss and irregularities. So you get illumination of exceptional evenness and efficiency.

To usual light control options, Olympus has added a 25% exciting light intensity. With the increased brightness, you can view FITC stained specimens at 25%, thus minimizing quenching during long-term observation.

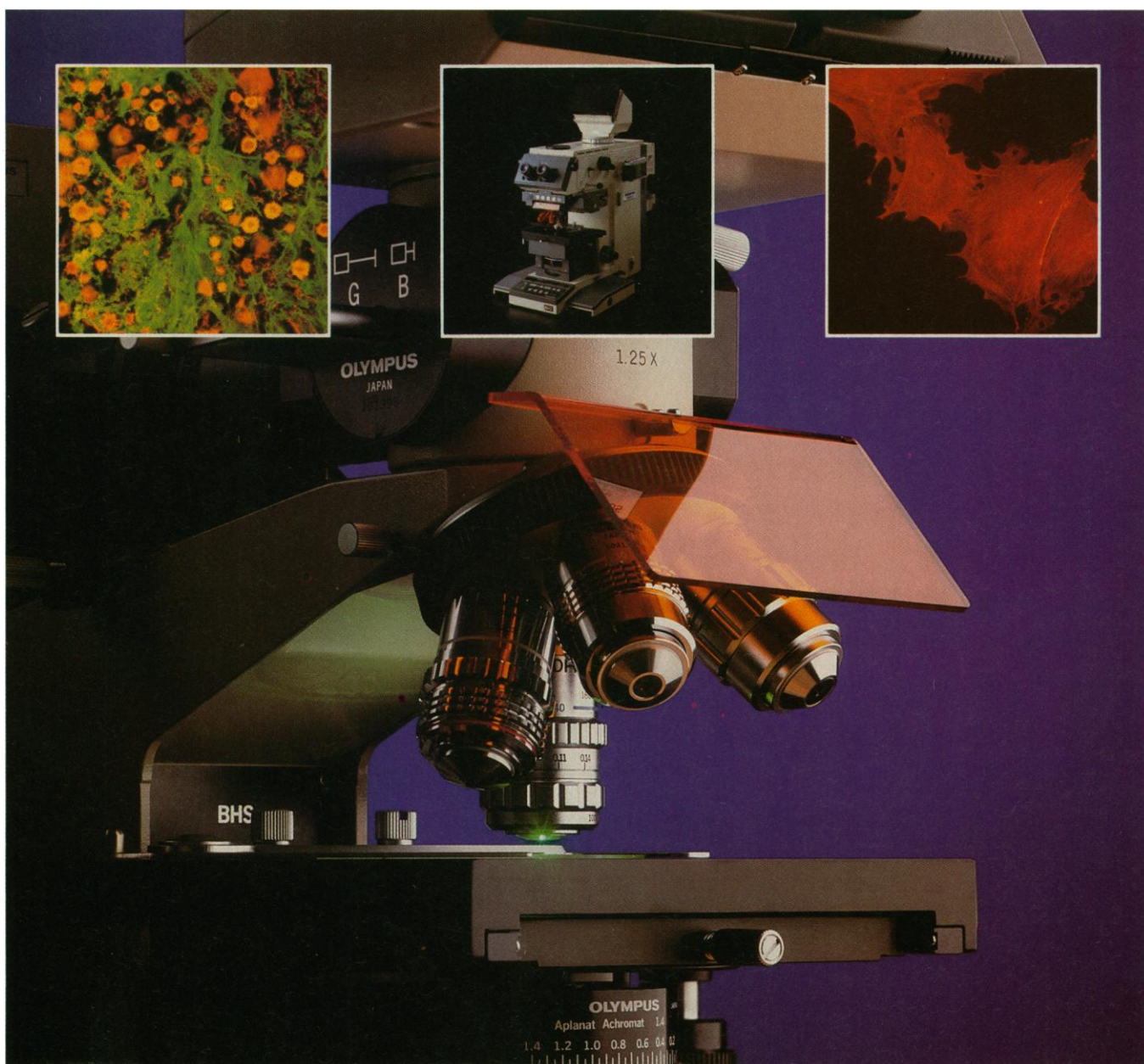
From 1-touch switching between an exciting filter's wavelengths to the newly developed series of UV objectives, the Olympus fluorescence systems are designed for ease of operation, and comprehensive applications. The Olympus UV

objectives range from 10X to 100X, for both dry and oil immersion use. And the UVPL series allows simultaneous reflected light fluorescence and transmitted light phase contrast observation.

For a hands-on demonstration of the new standard in fluorescence microscopy, call toll-free: 800-446-5967. Or write Olympus Corporation, Precision Instrument Division, 4 Nevada Drive, Lake Success, New York 11042-1179.

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

OLYMPUS®



**DON'T OVERSPEND
YOUR GRANTS!**

GRANT MANAGER™

SOFTWARE FOR THE IBM PC/XT AND COMPATIBLES

- Up-to-the-Minute Grant Balances
- Configurable Order Form Printing
- Tracks your Purchase Orders
- Customized Vendor Catalogs
- Monthly Expense Summaries
- Reconciles to Outside Ledgers

IN USE AT OVER 50 UNIVERSITIES

FREE 8 Page Brochure Demonstration Disk \$10
User's Manual \$25 Complete System \$425

Call: (415) 548-3129

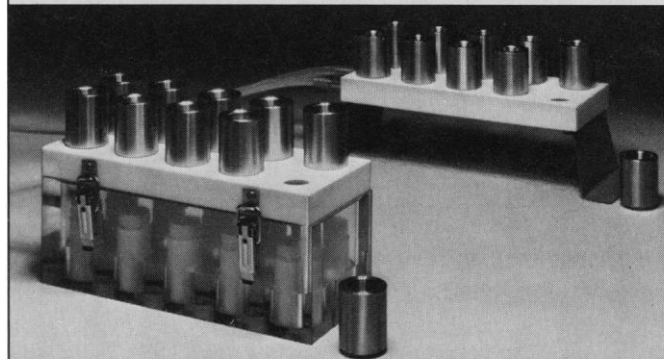


Niles & Associates

1545 Scenic Avenue, Berkeley CA 94708

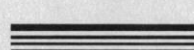
Circle No. 121 on Readers' Service Card

S&S SELECTRON® MANIFOLDS TEN IN THE TIME OF ONE.



- Process multiple small-volume samples quickly.
- Accommodate both 24 and 25 mm paper, glass or membrane filters.
- Applications include TCA precipitation, receptor binding assay, specific elution and serial washing.

The fast, easy way to filter up to ten 10 ml samples simultaneously. Model without vacuum plenum is designed for analysis of material retained on filter surface. Model with acrylic vacuum plenum holds 10 vials, scintillation tubes, etc., for collection of individual filtrates. Filter plates are made of chemically resistant PTFE; cylinder and filter supports are stainless steel. Call or write for more information.



Schleicher & Schuell

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

Circle No. 78 on Readers' Service Card

NEW AAAS PUBLICATION

Scientists and Human Rights

Present and Future Directions

*Proceedings from a 1984 AAAS Annual Meeting
Workshop*

The second workshop report of the AAAS Clearinghouse on Science and Human Rights, a project of the AAAS Committee on Scientific Freedom and Responsibility, examines the activities of scientific societies in the human rights field. Workshop speakers also review mechanisms available within international inter-governmental organizations to address human rights violations of scientific and medical professionals.

Prepared by Kathie McCleskey, Senior Program Associate, AAAS Clearinghouse on Science and Human Rights.

\$3.00, paperbound, 70 pp.

Order from AAAS Sales Department, 1333 H St., NW, Washington, DC 20005. Please add \$1.50 postage and handling per order. Make checks payable to AAAS.

New recombinant HTLV-III peptides for AIDS research

New recombinant source HTLV-III antigens for immunoblots and for related AIDS research studies.

Two homogeneous preparations: envelope peptide and core peptide.

- High sensitivity for sera containing antibodies to viral core or envelope proteins.
- Provides clear, clean, reproducible bands in immunoblots.

For Research Use Only.
Not for use in diagnostic procedures.



CENTOCOR

For complete information, please call or write:
CENTOCOR • 244 Great Valley Parkway •
Malvern, PA 19355 • (800) 345-2401 •
Facsimile (215) 644-7558 • Telex 834823

Circle No. 111 on Readers' Service Card

SCIENCE / SCOPE®

You are reading perhaps the most successful corporate advertising campaign ever, Science/Scope, which marked its 20th anniversary in September 1986. The campaign—distinguished by its editorial style of writing, newsletter format, and yellow background color—was created in September 1966 to inform readers of advances in technologies and programs at Hughes Aircraft Company. It has won scores of awards for creative excellence and for leading readership surveys in a variety of publications. The first ad reported on such technological advances as a technique for keeping a satellite stable in orbit, an infrared-guided missile, and a spacecraft instrument that could categorize the surfaces of planets. Today Science/Scope appears in approximately 80 publications worldwide and 10 languages. We thank our readers for their continued support.

Four sophisticated antennas will let Intelsat VI communications satellites concentrate signals on four major population areas on Earth. The four squareax antennas used in combination represent a multitude of technology breakthroughs made possible through advanced computer-aided design/computer-aided manufacturing (CAD/CAM) techniques. The antennas receive microwave signals from Earth and retransmit them with pinpoint precision. Without the squareax antennas, those signals would be uselessly dispersed over populated and unpopulated areas alike. Hughes designed and built the antennas and is heading a team of international aerospace companies that is building the Intelsat VI satellites.

A new process called vacuum brazing will soon help manufacture advanced radar components for U.S. fighter aircraft. Vacuum brazing forms extremely strong joints between lightweight metals, allowing engineers to design parts that previously could not be manufactured. The process involves treating parts with a special brazing alloy and a small amount of magnesium. The parts are placed inside the vacuum furnace, which normally operates at a pressure of one millionth of an atmosphere, and heated to temperatures of 1100°F. Because vacuum brazing requires no flux, it is far more economical than conventional flux dip brazing, in which components are dipped into molten salts. The process also eliminates corrosion caused by trapped or residual flux. Hughes engineers are investigating how vacuum brazing might be used to fabricate heat dissipators and other radar parts.

Helping to trim energy consumption is one major use of a hand-held infrared viewer. The device is a Hughes Probeye® viewer, which senses heat and displays images through an eyepiece. Mining officials use the device to inspect electrical systems and mechanical equipment because it detects potentially dangerous short circuits and overheating hardware. Real estate owners, developers, and appraisers use the viewer to determine the structural and thermal integrity of buildings. The unit reveals moisture spots in roofing and spots where buildings might be gaining or losing heat.

Hughes is seeking experienced engineers and scientists to further develop advanced spacecraft systems and components for communications satellites. Openings are in the fields of: software, computers, and data processing systems; electrical components; microwave/RF communication systems development; on-board spacecraft electronics and control systems; satellite design, integration, propulsion, and electrical power system development; spacecraft manufacturing, systems test and evaluation; GaAs applications R&D. Send your resume to Dan Frownfelter, Hughes Space & Communications Group, Dept. S2, S4/A300, P.O. Box 92919, Los Angeles, CA 90009. Equal opportunity employer. U.S. citizenship required.

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

AUTOMATE MEASUREMENT ON YOUR IBM PC

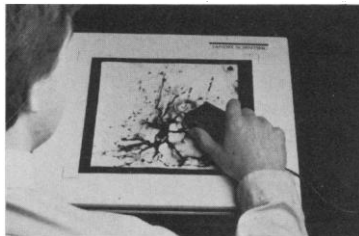


Photo Courtesy/Edward Jones, M.D.

New digitizing tablet with Sigma-Scan™ measurement software. \$1195

Cat #3011 — 12" x 12" system

Resolution of .025 mm, accuracy of at least .25 mm. Comes with state-of-the-art software for area, linear, perimeter, length of curvy line, and angular measurements. X, Y point or stream digitizing. Descriptive statistics. Transfer data to other programs in standard ASCII or DIF format.

Call or write today for more information.

JANDEL SCIENTIFIC

MICROCOMPUTER TOOLS FOR THE SCIENTIST
2656 Bridgeway, Sausalito, CA 94965
800-874-1888

(In Calif. call 415-331-3022)

Circle No. 46 on Readers' Service Card

SCIENCE

Posters

The following posters of *Science* covers are available:

30 March 1979, Tropical flowering tree;

23 February 1983, Landsat photo of Detroit, Michigan;

29 July 1983, Cheetah;

2 December 1983, Snowshoe hare;

23 December 1983, Cathedral window/DNA molecule.

Combination of space covers in scroll format: 1 June 1979, 23 November 1979, 10 April 1981.

Price is \$5 each (prepaid).

Write to AAAS, Department POST,
1333 H Street, NW, Washington,
D.C. 20005.

Have you ever had an idea that could change the world, only to have someone else beat you to it? After months of painstaking research, there's nothing more frustrating than reinventing the wheel. Again.

DIALOG® is the online information system that can give you a flying head start on your competition. Dialog goes right to the source, with 10 to 15 years of data on every subject, from aerospace to zoology. Even if you're in a specialized area of research, you

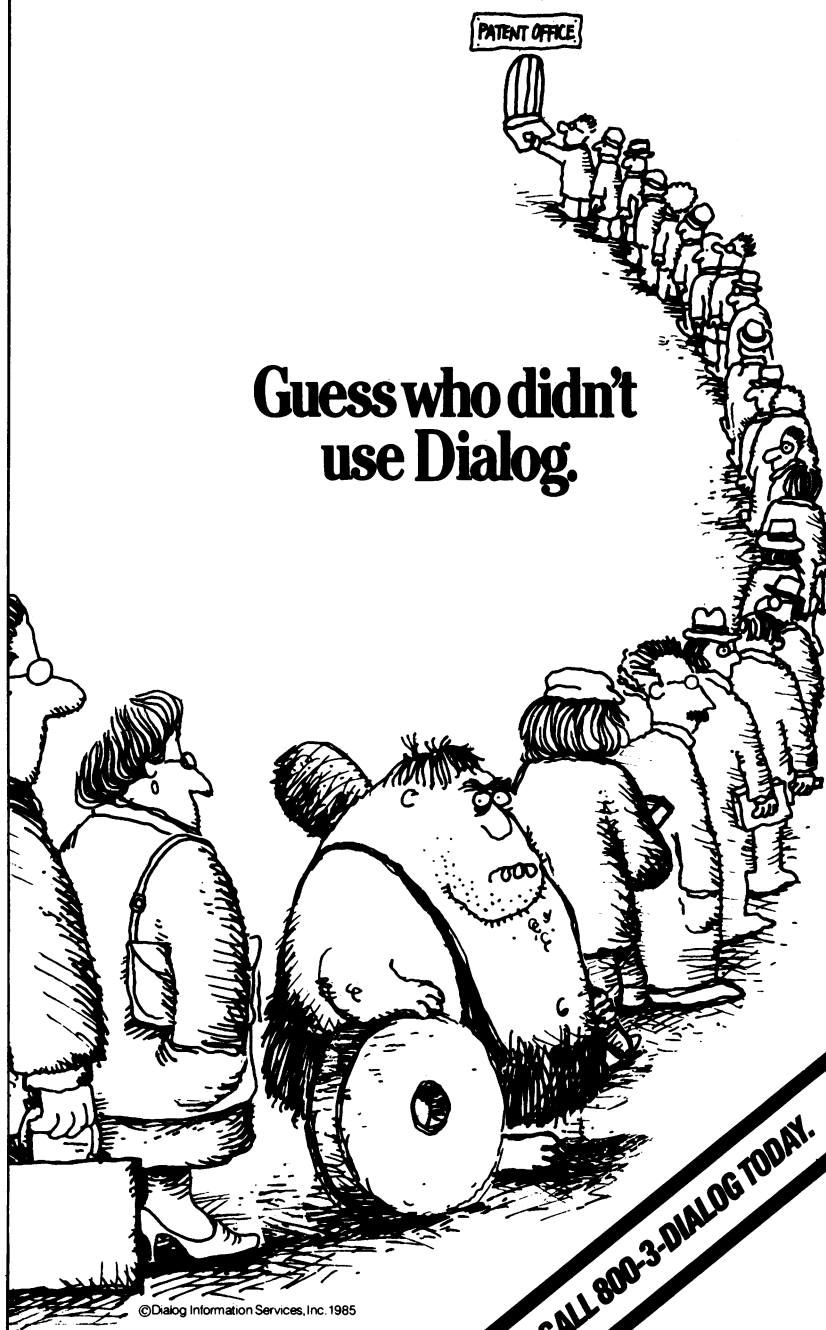
never know when you'll need something from another field. With Dialog, it's all available instantly.

Anyone can learn to use Dialog, too. In fact, Dialog is so useful if it didn't already exist, you'd just have to invent it.

To find out about Dialog now, call 800-3-DIALOG. Or write: Dialog, Dept. 21, 3460 Hillview Ave., Palo Alto, CA 94304.

DIALOG® Find out about it.™
A subsidiary of Lockheed Corp.

Guess who didn't use Dialog.



©Dialog Information Services, Inc. 1985

Call for Contributed Papers

1987 AAAS Annual Meeting ♦ Chicago ♦ 14 – 19 February

Deadline: 10 October 1986

Plan to attend the next Annual Meeting of the AAAS in Chicago, IL, 14–19 February 1987 at the Hyatt Regency Hotel. Although it is too late to propose symposia for the 1987 Annual Meeting, contributed paper abstracts can be submitted up to 10 October 1986.

The privilege of submitting a contributed paper for a presentation at the Annual Meeting is open **only** to AAAS members and fellows. Although the member/fellow need not be one of the authors, their endorsement (indicated by his or her signature on the original abstract) is required.

There are two types of presentation formats—poster and slide:

POSTER PRESENTATION: Each contributor will be assigned to a poster session and will have a bulletin board on which to display large, easy to read text and graphics for approximately 1½ hours so that the work can be discussed with interested parties.

SLIDE PRESENTATION: Unlike papers submitted for a poster session, those sent as slide presentations will go through a second selection process. Abstracts whose subject matter closely relates to that of an accepted symposium will be chosen for a coordinated slide session. Each contributor will have approximately 10 minutes to present their work and show 2"x2" (35mm) slides or overhead transparencies. If a paper is not selected for a slide session, the contributor will be notified and given the option of presenting at a poster session or withdrawing the submission.

Instructions for Contributors

Your abstract will be reproduced directly from your copy at about two-thirds the original size. Therefore, it is very important that you follow our guidelines precisely.

- ♦ Submit a clean, easily readable original copy of your abstract on ordinary white bond paper.
- ♦ The typed abstract must fit within a 5-inch square.
- ♦ Indent, space, underline, and capitalize specifically as in the example at right.
- ♦ Use only reproducible black ink for symbols and signs which must be hand lettered.
- ♦ Use only a letter quality printer if you use a word processor.
- ♦ Do not draw a box around the abstract.
- ♦ Do not cut and paste your abstract onto another piece of paper.

At the top of the page, indicate which broad scientific discipline encompasses your subject matter. Also, provide up to 3 index words which specifically describe the area or specialty within this scientific discipline. You must specify the type of presentation you wish to give (slide or poster). As stated above, not all submissions for a slide presentation will be accepted.

At the bottom left of the page, type the full name, mailing address, and telephone number of the person to be notified regarding scheduling and other information. At the bottom right, type the name and affiliation of the AAAS member or fellow submitting the abstract leaving adequate space for their signature.

Send the original plus one copy of your abstract no later than 10 October 1986 to:

**Contributed Papers
AAAS Meetings Office
1333 H Street, N.W.
Washington, DC 20005**

AAAS ANNUAL MEETING IN CHICAGO (14-19 FEBRUARY 1987)
Abstract submitted for a contributed paper presentation

Scientific discipline of subject matter: _____

Specialty of this discipline (provide up to 3 index words): _____

Type of presentation (indicate one): _____ POSTER _____ SLIDE

5 inches (12.7 cm)

Indent Five Spaces and Type Title in Upper and Lower Case Letters and Underline. AUTHOR'S NAME IN UPPER CASE (Institution Name in Upper and Lower Case), SECOND AUTHOR (Institution).*

Double-space and type abstract. The full width of the column of typed material should be 5 inches (12.7 cm) and must not extend beyond that. The total length of the material, from top of title to bottom of footnotes must not exceed 5 inches (12.7 cm). Abstracts which exceed these parameters will be returned. All special symbols and signs which must be hand lettered (e.g., γ) should be rendered in reproducible black ink as clearly and carefully as possible. The entire submission should be of camera-ready quality so that it can be photographed, turned into a plate, and printed. The printed abstract will be about 2/3 the size of the typed version. Avoid paragraphing as this wastes space. However, you may use your allotted space to neatly letter in equations and diagrams as you deem necessary.

$$r_{\lambda\nu}^{\mu} = \frac{1}{2} g^{\mu\sigma} \left(\frac{\partial g_{\sigma\lambda}}{\partial x^{\nu}} + \frac{\partial g_{\sigma\nu}}{\partial x^{\lambda}} - \frac{\partial g_{\lambda\nu}}{\partial x^{\sigma}} \right)$$
$$R_{\mu\nu}^{\lambda} = \frac{\partial \Gamma_{\mu\nu}^{\lambda}}{\partial x^{\sigma}} - \frac{\partial \Gamma_{\mu\sigma}^{\lambda}}{\partial x^{\nu}} + \Gamma_{\mu\lambda}^{\sigma} \Gamma_{\nu\sigma}^{\lambda} - \Gamma_{\mu\nu}^{\sigma} \Gamma_{\lambda\sigma}^{\lambda}$$

as indicated in this example.

*Double-space and type footnotes.

Person to be contacted
about abstract:

Full Name
Mailing Address

Submitted by AAAS member:

Type name of member
Type affiliation of member

(signature of member)