

27 SEPTEMBER 1985 · VOL. 229 · NO. 4720

\$2.50

# SCIENCE

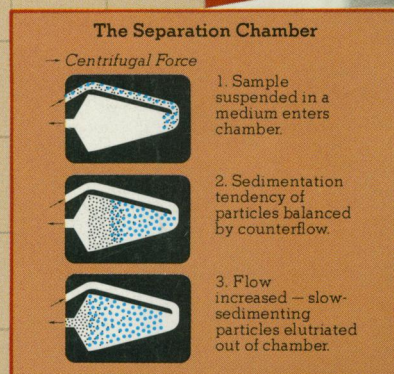
N ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





## ELUTRIATION:

*The gentle,  
rapid way to  
separate living  
cells*



For high yield harvesting of whole, living cells, hundreds of researchers use the Beckman elutriation system.

With centrifugal elutriation there's minimal cell loss. Recovery rates close to 100% are possible. Often in less than an hour.

Separation is by gentle washing action, so cells retain their

viability. Processing can be in isotonic media to avoid the osmotic effects and cellular ingestion of gradient materials. And there's no exposure to the effects of pelleting.

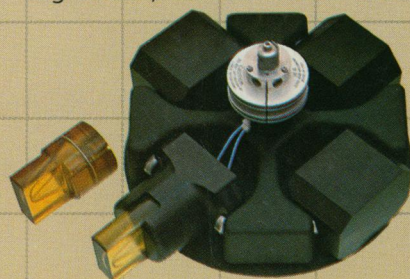
Cell concentration is high with the Beckman system. Typically  $10^{10}$  to  $10^{12}$  cells can be separated according to size, and synchronously dividing cells can be obtained for cancer research and drug inhibition studies.

The popular JE-6B Elutriator Rotor — with the standard chamber or the Sanderson chamber — is used in either J-6 or J-21 centrifuges.

### New Large Volume Rotor

Now there's a larger volume elutriator rotor for J-6 centrifuges. The new JE-10X Rotor with 40-ml separation chamber. It saves you time by processing nearly ten times more cells than the JE-6B Rotor.

Centrifugal elutriation. It's fast and gentle. And rapidly becoming the preferred method for living cell separations. For complete details and a bibliography of over 250 references, ask your Beckman representative or write: Beckman Instruments, Inc., Spinco Division, P.O. Box 10200, Palo Alto, CA 94304.

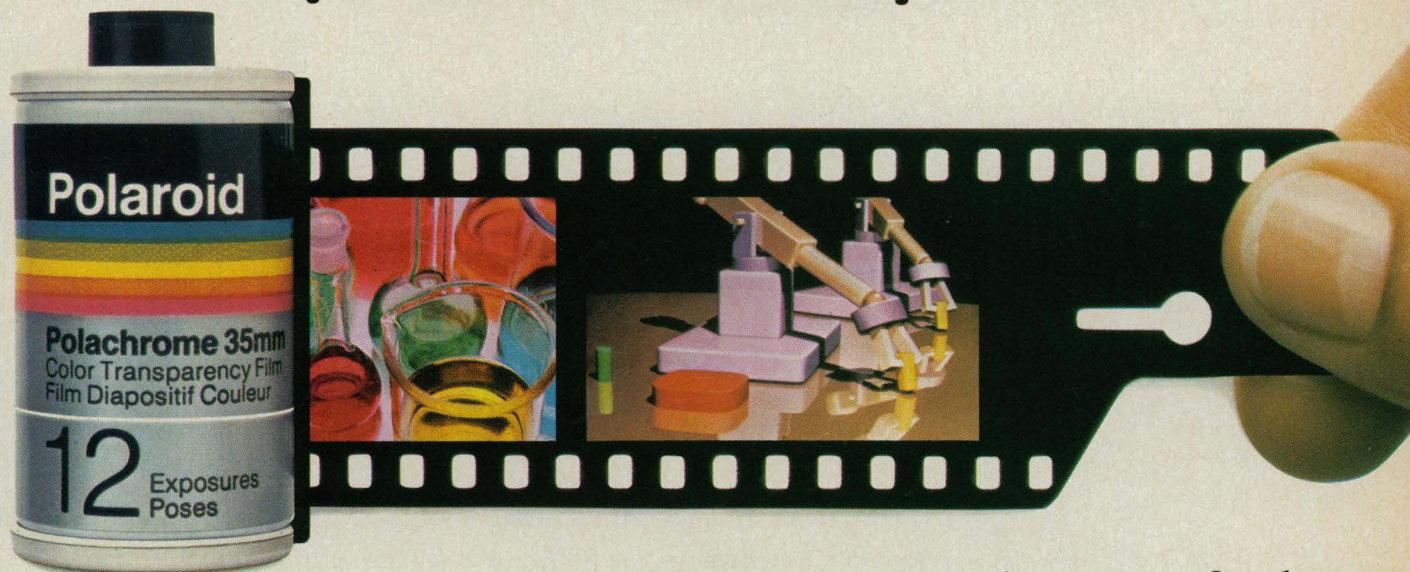


# BECKMAN

Circle No. 261 on Readers' Service Card



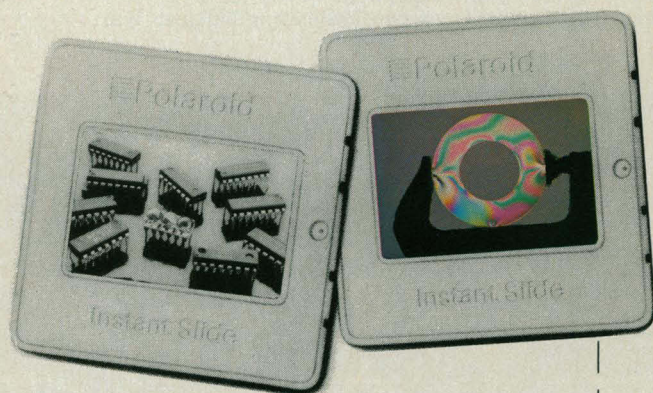
# The Polaroid Instant Slide System. It's yours for 15 days. Free.



## Now you can project your findings immediately.

For 15 eye-opening days, you'll see what it's like to get ready-to-show slides, instantly. You'll get the use of the Polaroid AutoProcessor and the new Polaroid Illuminated Slide Mounter. Free. All you supply is the film. You've got 3 instant slide films to choose from, in color or black-and-white, for any 35mm camera or instrument equipped with a standard 35mm back. You need no darkroom...and you're ready to project in under 5 minutes.

Try it and get a free gift. The lively and informative book, "How to Create Super Slide Shows," by E. Bert Close. A \$10.95 value (suggested list price) that will make you a more effective presenter. Act now! Offer ends November 30, 1985! Mail the coupon. Or call: **800-526-7843, Ext. 400\***



### POLAROID FREE TRIAL OFFER

5-9/27

P.O. Box 5011

Clifton, N.J. 07015

I'm definitely interested. I've completed the coupon and attached my business card. I understand an authorized Polaroid dealer will reach me and invite me to pick up my system for trial.

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Occupation \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone (\_\_\_\_) \_\_\_\_\_

For U.S. Residents Only.

\*In N.J.: 800-522-4503, Ext. 400.

Computer graphic image courtesy: Raster Technologies, Inc.

 **Polaroid 35mm Instant Slides**

Circle No. 18 on Readers' Service Card

Polaroid®

# SCIENCE

	This Week in <i>Science</i> .....	1333
<b>LETTERS</b>	The Granting System: <i>A. Nisonoff; J. S. Wicken</i> ; Biotechnology and the Biosphere: <i>E. P. Odum</i> .....	1336
<b>EDITORIAL</b>	Use of and Research on Pheromones .....	1343
<b>ARTICLES</b>	Multiphoton Ionization of Atoms: <i>C. K. Rhodes</i> .....	1345
	The Epidemiology of AIDS: Current Status and Future Prospects: <i>J. W. Curran et al.</i> .....	1352
	Three-Dimensional Structure of Poliovirus at 2.9 Å Resolution: <i>J. M. Hogle, M. Chow, D. J. Filman</i> .....	1358
	<i>Perspective: Picornaviruses Are No Longer Black Boxes: D. Baltimore</i> .....	1366
<b>NEWS AND COMMENT</b>	Americans and French Find the <i>Titanic</i> .....	1368
	The Rise and Decline of Temik .....	1369
	<i>Briefing: Avoiding Nuclear War; Congress Urged to Approve China Nuclear Agreement; Universities Urged to Enter the Information Age; Ignition Error Blamed for Ariane Failure</i> .....	1372
<b>RESEARCH NEWS</b>	Fermilab Tests Its Antiproton Factory .....	1374
	Making Better Planetary Rings .....	1376
	Breast Cancer Consensus .....	1378
<b>BOOK REVIEWS</b>	Sociology and Anthropology in the People's Republic of China, <i>reviewed by R. P. Madsen</i> ; Hawks, Doves, and Owls <i>and Preventing Nuclear War</i> ,	

## BOARD OF DIRECTORS

DAVID A. HAMBURG  
Retiring President, Chairman

GERARD PIEL  
President

LAWRENCE BOGORAD  
President-Elect

ROBERT McC. ADAMS  
ROBERT W. BERLINER

MILDRED DRESSELHAUS  
DONALD N. LANGENBERG

## CHAIRMEN AND SECRETARIES OF AAAS SECTIONS

MATHEMATICS (A)  
Daniel Zeilinsky  
Lynn Arthur Steen

PHYSICS (B)  
Ralph O. Simmons  
Rolf M. Sinclair

CHEMISTRY (C)  
Rustum Roy  
Jeanne M. Shreeve

ASTRONOMY (D)  
David Morrison  
John E. Gaustad

PSYCHOLOGY (J)  
John I. Lacey  
William N. Dember

SOCIAL, ECONOMIC, AND POLITICAL SCIENCES (K)  
David Mechanic  
David L. Sils

HISTORY AND PHILOSOPHY OF SCIENCE (L)  
Edward Grant  
Arthur L. Norberg

ENGINEERING (M)  
Henry McGee  
W. Edward Lear

EDUCATION (Q)  
John F. Schaff  
Joseph D. Novak

DENTISTRY (R)  
Gordon H. Rovelstad  
Harold M. Fullmer

PHARMACEUTICAL SCIENCES (S)  
Edward G. Rippie  
Betty-ann Hoener

INFORMATION, COMPUTING, AND COMMUNICATION (T)  
Karen B. Levitan  
Elliot R. Siegel

## DIVISIONS

### ARCTIC DIVISION

Robert White  
President

Gunter E. Weller  
Executive Secretary

### CARIBBEAN DIVISION

Juan A. Bonnet, Jr.  
President

Lucy Gaspar  
Secretary-Treasurer

### PACIFIC DIVISION

Walter Gardner  
President

Alan E. Leviton  
Executive Director

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, D.C. 20005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with *The Scientific Monthly*. Copyright © 1985 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): \$60. 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 \$3 (\$3.50 by mail); Biotechnology issue, \$5 (\$5.50 by mail); classroom rates on request. 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 0036-8075/85 \$1 + .10. Postmaster: Send Form 3579 to Science, 1333 H Street, NW, Washington, D.C. 20005. Science is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.



# AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

*G. H. Quester*; Plant Membranes, *R. S. Alberte*; The Geometry of Fractal Sets, *S. J. Taylor*; Books Received ..... 1379

<b>REPORTS</b>	Transformation of a Tundra River from Heterotrophy to Autotrophy by Addition of Phosphorus: <i>B. J. Peterson et al.</i> .....	1383
	Increase of Atmospheric Methane Recorded in Antarctic Ice Core: <i>B. Stauffer, G. Fischer, A. Neftel, H. Oeschger</i> .....	1386
	Transcription of Novel Open Reading Frames of AIDS Retrovirus During Infection of Lymphocytes: <i>A. B. Rabson et al.</i> .....	1388
	The t(14;18) Chromosome Translocations Involved in B-Cell Neoplasms Result from Mistakes in VDJ Joining: <i>Y. Tsujimoto, J. Gorham, J. Cossman, E. Jaffe, C. M. Croce</i> .....	1390
	Site-Specific Increased Phosphorylation of pp60 <sup>v-src</sup> After Treatment of RSV-Transformed Cells with a Tumor Promoter: <i>A. F. Purchio, M. Shoyab, L. E. Gentry</i> .....	1393
	Abnormal Visual Pathways in Normally Pigmented Cats That Are Heterozygous for Albinism: <i>A. G. Leventhal, D. J. Vitek, D. J. Creel</i> .....	1395
	Glucocorticoids Potentiate Ischemic Injury to Neurons: Therapeutic Implications: <i>R. M. Sapolsky and W. A. Pulsinelli</i> .....	1397
	Persistent Noncytopathic Infection of Normal Human T Lymphocytes with AIDS-Associated Retrovirus: <i>J. A. Hoxie, B. S. Haggarty, J. L. Rackowski, N. Pillsbury, J. A. Levy</i> .....	1400
	Characterization of gp41 as the Transmembrane Protein Coded by the HTLV-III/LAV Envelope Gene: <i>F. diM. Veronese et al.</i> .....	1402
	Atrial Natriuretic Factor Ameliorates Chronic Metabolic Alkalosis by Increasing Glomerular Filtration: <i>M. G. Cogan</i> .....	1405
	Deficient Vasoactive Intestinal Peptide Innervation in the Sweat Glands of Cystic Fibrosis Patients: <i>P. Heinz-Erian, R. D. Dey, M. Flux, S. I. Said</i> .....	1407
	<i>Technical Comments</i> : Spinal Reflexes in Microgravity: Measuring H Reflexes During Space Flight: <i>D. G. Rüegg; M. F. Reschke</i> ; Lunar Sample 14425: Corrected Analysis: <i>B. P. Glass and J. A. O'Keefe</i> .....	1409

<b>PRODUCTS AND MATERIALS</b>	Automated Sample Processing; Artificial Intelligence Systems; Labeled DNA; Pump; Pulse Generator for Monoclonal Antibody Production; Chart Recorders; Incubator Accessory; Coagulation Analyzer .....	1412
-------------------------------	---	------

DOROTHY NELKIN JOHN E. SAWYER	SHEILA E. WIDNALL LINDA S. WILSON	WILLIAM T. GOLDEN Treasurer	WILLIAM D. CAREY Executive Officer
GEOLOGY AND GEOGRAPHY (E) William H. Matthews III Helen M. McCammon	BIOLOGICAL SCIENCES (G) Betty M. Twarog Judith P. Grassle	ANTHROPOLOGY (H) Albert C. Spaulding Priscilla Reining	
MEDICAL SCIENCES (N) Alfred P. Fishman Jonathan E. Rhoads	AGRICULTURE (O) Roy G. Creech Ralph J. McCracken	INDUSTRIAL SCIENCE (P) Robert H. Fry Robert L. Stern	
STATISTICS (U) J. Stuart Hunter Edward J. Wegman	ATMOSPHERIC AND HYDROSPHERIC (W) F. Kenneth Hare Bernice Ackerman	GENERAL (X) Harold P. Green Rodney W. Nichols	
<b>SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION</b>			
Donald J. Nash President	M. Michelle Balcomb Executive Director		

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

Extremely rare tyrosinase-negative albino cat (*cc*) which completely lacks melanin pigmentation. Homozygous albinos (*cc*) and normally pigmented cats which carry the recessive allele for tyrosinase-negative albinism (*Cc*) exhibit congenital visual system defects. One to 2 percent of the human population carries a recessive allele for albinism. See page 1395. [Donnell J. Creel, Veterans Administration Medical Center, Salt Lake City, Utah 84148]



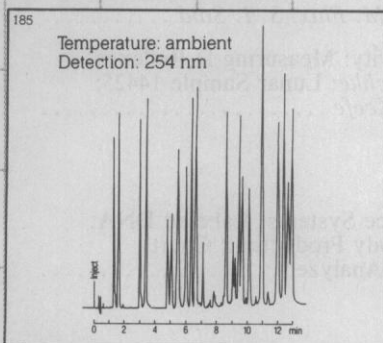
Optimal  
Chromatography **No. 6**  
IN A SERIES



## Some call it PICO-TAG™ analysis

And some simply call it PTC. 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 Division 1716 Fourth Street,  
Berkeley, CA 94710 (415) 527-5900  
Offices in major cities worldwide.

**BECKMAN**

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

Optimal  
Chromatography **No. 7**  
IN A SERIES

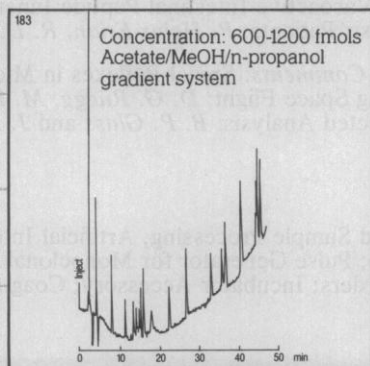


## Pin down your sequence

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® C<sub>18</sub> 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 Division 1716 Fourth Street,  
Berkeley, CA 94710 (415) 527-5900  
Offices in major cities worldwide.

**BECKMAN**

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

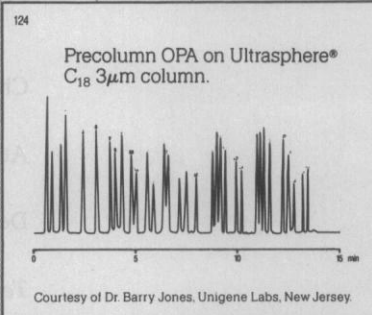
Optimal  
Chromatography **No. 8**  
IN A SERIES



## 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 Division, 1716 Fourth Street,  
Berkeley, CA 94710. (415) 527-5900.  
Offices in major cities worldwide.

**BECKMAN**

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



## **AIDS**

As many as 1 million people in the United States are estimated to have been exposed to the AIDS (acquired immune deficiency syndrome) virus (page 1352). As of 9 September, 13,074 cases of AIDS in the United States had been reported to the Centers for Disease Control and 12,000 new cases are forecast for the coming year. Curran *et al.* review the epidemiology and natural history of AIDS, a fatal and infectious disease for which there is not any control. Even before their effectiveness can be documented, community education and counseling programs are being recommended to help prevent further spread of the virus from both symptomatic and asymptomatic carriers to susceptible men, women, and children. Among these are programs to explain why certain sexual practices and the use of contaminated needles increase the risk of acquiring AIDS and why pregnancy should be postponed in women with AIDS virus infections. Also recommended is the institution of compulsory testing of all potential organ, blood, and sperm donors for the presence of antibodies to the virus. Studies that may ultimately contribute to development of an effective drug for AIDS and an AIDS vaccine are under way in many institutions. Results from three laboratories are described in this issue. Hoxie *et al.* found that in culture the virus could grow stably for many months in a subpopulation of blood lymphocytic cells for which the virus naturally has a strong tropism (page 1400). This could be an informative model of natural infections in which a long incubation period separates exposure to virus and disease onset. Rabson *et al.* determined the chromosomal locations of two novel genes that may be specific to the retroviruses grouping to which the AIDS virus belongs (page 1388). Veronese *et al.* characterized the outer envelope component of the virus against which most antibody responses seem to be made in infected individuals (page 1402).

## **3-D structure of the poliovirus**

The complete three-dimensional structure of the poliovirus is now known (page 1358). From x-ray crystallographic analysis, Hogle *et al.* constructed a picture of the virus and discussed how pathogenesis is effected at the molecular level, how this and similar viruses are assembled, and how variants of the virus differ structurally. The results will help in interpreting data already available from other types of studies and in the design of future experiments. Baltimore's Perspective (page 1366) explains how knowledge of the structure can be related to the behavior of the virus and how this provides a basis for future experimental approaches.

## **Changing a river ecosystem**

Immediate alterations in the ecosystem of a pristine arctic river took place as a result of addition of a single limiting resource, phosphorus (page 1383). Peterson *et*

*al.* added phosphate to the Kuparuk River in northern Alaska during a 6-week experiment. The organic carbon cycle of the river was quickly changed. In the undisturbed river, most energy is generated through microbial metabolism of either dissolved organic matter leaching from tundra soil or particulate organic material (peat) eroding from the banks. After phosphorus enrichment, the biota shifted toward photosynthetic organisms that synthesize organic compounds from simple inorganic ones. The biomass of photosynthetic algae on rocks quickly increased by a factor of 10, bacterial growth also accelerated, and insect growth increased as a consequence of the increased algal growth. The dramatic effect of phosphorus was visible downstream—increases in the numbers and relative proportions of species of diatoms (a group of algae) and in the composition of the bacterial community showed photosynthesis to be limited by this single element.

## **Methane increasing in the atmosphere**

Atmospheric methane has increased during the last two centuries; its abundance is now about twice what it was 300 years ago (page 1386). The levels since the 1700's were measured at Siple Station in western Antarctica by Stauffer *et al.* by analysis of gas trapped and preserved within bubbles in a 200-meter-long ice core. The increase in abundance may be contributing to the greenhouse effect. The source of this increase may reflect a combination of greater emissions of methane (through activities of the increasing world population) and removal of less methane by hydroxyl radicals. These radicals serve as sinks for methane but are being depleted by combination with pollutants and with gases emitted during the burning of fuels and biological materials.

## **Visual anomalies and albinism**

From 1 to 2 percent of the human population may have visual anomalies associated with the inheritance from one parent of a recessive allele (one of the alternative forms of a given gene) for albinism (page 1395). True albinism is rare in humans, but the heterozygous state is not. Albinism genes cause visual anomalies, including distortion of the visual field and reduced depth perception, in humans and cats (cover) that are homozygous for this condition. The anomalies can be attributed to the misrouting of an unusually large number of retinal cell axons to the wrong side of the brain, resulting in abnormal representation of the visual field. Leventhal *et al.* show by histochemical staining techniques and electrophysiologic measurements that similar, although less extreme, abnormalities are present in heterozygous pigmented cats that are progeny of one normally pigmented and one albino parent. Similar genetically determined anomalies in humans carrying a recessive allele for albinism may be more widespread than has been assumed.



# OLYMPUS®

*The Image of Quality*



## The BH-2 Series.

**Uniquely modular  
to meet your  
current and future  
requirements.**

The quality of any microscope series relies on the interrelationship of optical performance, mechanical capability, electronic sophistication and its component system of accessories and attachments. For more than six decades, Olympus has dedicated itself to development of a unique fusion of these distinct disciplines. That is the Olympus advantage.

Nowhere is this advantage better exemplified than in the BH-2 System. A totally new generation, this highly advanced series represents a significant contribution to microscopy and photomicrography. Focusing that is smoother, more effortless and in a lower and more comfortable position; freely reachable controls for the stage that is positioned lower for easier processing of multiple specimens; vastly improved illumination for ultra-low magnification in Koehler-type illumination from 1X to 100X; accurate and unvarying brightness control; an advanced, automated photomicrographic system; and a choice of newly formulated long barrel objectives, stands and modules that is second to none. And all of this, a breakthrough in cost-effectiveness.

For literature on the incomparable BH-2 System, write Olympus Corporation, Precision Instrument Division, 4 Nevada Drive, Lake Success, NY 11042-1179. Or phone for demonstration: East—(609) 482-1010; Midwest—(913) 648-8323; West—(415) 342-3384. In Canada: W. Carsen Co., Ltd., Ontario.

## OLYMPUS®

**FREE! \$15995 POLAROID® SLIDE KIT**  
Color photomicrographic slides in minutes with this complete Polaroid outfit. Contains AutoProcessor, Slide Mounter and Mounts, 2 rolls of Polachrome 35mm instant slide film. All free from Olympus with purchase of any PM-10 35mm camera or BH-2 Series microscope. Limited offer from your Olympus Microscope Dealer.

Polaroid® is a registered trademark of Polaroid Corporation.

For literature circle reader service number 26  
For a demonstration circle reader service number 27



# The collector that can't lose a drop, doesn't waste your time and won't cost a fortune.



*You'll find more LKB fraction collectors at work in laboratories throughout the world than any other.*

## The new HeliRac™ Fraction Collector from LKB

This new compact guarantees that no tube will ever change until the drop has been collected. So you won't waste your sample or your time. And the world's fastest time for tube change gives you perfect collection in any mode you choose: time, volume or drop. You'll also get simplified waste collection, with zero dead-volume and hence no contamination. So if you want reliability, HeliRac's got it. And if you want to save time, it's got every feature to automate your entire collection.

With more intelligence than many larger instruments, HeliRac is so simple to program and so easy to use. Let it run your system or be its slave. You'll get 6 time windows for optimal collection, 4 memories for program storage and an escape key to speed up parameter changes. That's the kind of flexibility you've always wanted in a collector so small—and with a price that's so sensible.

When you've seen it at work in your own laboratory, you'll know why the performance and value of HeliRac just can't be matched. Try it today and you'll see for yourself.



### NOW FILL THIS IN TODAY

- ☐ Send me the facts.
- ☐ Show me how HeliRac can help my lab.
- ☐ Send me a quotation.

Name \_\_\_\_\_

Dep \_\_\_\_\_

Comp/Instit \_\_\_\_\_

Address \_\_\_\_\_

Tel \_\_\_\_\_

Circle No. 248 on Readers' Service Card



340

Head office: LKB-Produkter AB, Box 305, S-161 26 Bromma, Sweden.  
Tel. +46 (8) 98 00 40, telex 10492

Antwerp (03) 218 93 35 · Athens-Middle East +30 (1) 894 73 96  
Copenhagen (01) 29 50 44 · Hongkong (852) 5-555555 · London (01) 657 88 22  
Lucerne (041) 57 44 57 · Madras (044) 45 28 74 · Moscow (095) 256-9002  
Munich (089) 85 830 · Paris (06) 928 65 07 · Rome (06) 39 90 33  
Stockholm (08) 98 00 40 · Tokyo (03) 293-5141 · Turku (021) 678 111  
Vienna +43 (222) 92 16 07 · Washington (301) 963 3200 · Zoetermeer (079) 31 92 01  
Over 60 qualified representatives throughout the world.



## What is the Next Challenge for Biotechnology?

With GIBCO/BRL, you will be involved in the forefront of biotechnology research and development. GIBCO/BRL, a leading supplier of specialty products for biotechnology is seeking highly qualified individuals (Ph.D/M.S./B.S.) with experience in Nucleic Acid Chemistry and Hybridization Technology; Molecular Genetics, Virology and Immunology; and Cell Biology.

Your insight is needed to help identify and meet the challenges that will lead to the next generation of new products and commercial applications.

These new, professional positions offer competitive salaries and benefits with opportunities for advancement in a growing company. If you are a dedicated scientist interested in the challenges of industrial applications, please send your resume, in confidence to:

**Mr. Wayne E. Fowler**  
**GIBCO/BRL**  
**Division**

Life Technologies, Inc.  
Dept. SR1  
8717 Grovemont Circle  
Gaithersburg, MD 20877

*An equal opportunity  
employer, M/F/H.*

## LETTERS

### The Granting System

In his editorial, "Modest proposals for the granting system" (19 July, p. 231), Daniel E. Koshland, Jr., notes that better priority scores are being awarded, on the average, to the National Institutes of Health grants in 1985 as compared to those in 1975. This is ascribed to attempts by members of panels to outguess the system and help their fellow scientists. From personal experience on one such panel I can say that part of the "score inflation" is due to the fact that many of the weaker applicants have given up, so that the average quality of applications has improved substantially. Not only are we getting stronger applications, but a much smaller fraction of those received is being funded.

Serious consequences are the disruption of good laboratories and the discouragement of the most competent prospective young scientists. The situation can be remedied only with more funds or, in part, by shifting available funds to the support of investigator-initiated applications.

ALFRED NISONOFF

*Department of Biology,  
Rosenstiel Basic Medical Sciences  
Research Center, Brandeis University,  
Waltham, Massachusetts 02254*

I applaud Koshland's editorials (21 June, p. 1387; 5 July, p. 9; 19 July, p. 231) on the "gentle changes" that might make the granting-peer-review system more economical and equitable. I am afraid, however, that what we smugly call "peer review" has much in common with the spoils system we claim to want to avoid. Proposals are written with an anxious eye toward those who will be deciding their value. Since those who decide value have their own ideological allegiances, objectivity is a hard commodity to come by. The structure of scientific change has always involved a struggle of the new against the entrenched, and the peer-review system can hardly be expected to be exempt from these dynamics. But we should try to minimize their damages. Some suggestions follow.

First, the principal investigator of a project *owes* it to the academic community to exercise a responsible degree of restraint concerning salary requests. Among the few proposals I have personally been asked to referee, I have seen salary expectations extravagant enough to qualify for Senator Proxmire's "Golden Fleece" awards. When one adds to

this largess the overhead percentage that must then flow to the university coffers, the fact that there is not enough money to go around follows as ineluctably as the night the day.

Second, simplifications are needed. Where academics are concerned, the government that governs least is most certainly the one that governs best. The government-academic complex is such a labyrinth of special-interest groups that it is a wonder science is ever accomplished at all. It may be, as Koshland says, that scientists do not feel they write too many proposals. It is most definitely certain that they wish they did not *have* to write so many. Track records should count for far more than specificities in methodology—which, if taken literally, can only prove to be Procrustean beds for the creative process. Besides, detailing what one might know about a subject in 2 years is not only silly and pretentious, it subtracts from time available for real research.

Another small and quite workable way to debrutalize the grant industry is simply to lessen the pressure for *having* a grant. One such pressure is the universal presumption, perhaps an ivory-tower hangover from the Great Society optimism of the 1960's, that everyone who publishes regularly *does* have a grant. This presumption is reflected in those well-intended but infernal postcard requests for "this and related work"—at the expense of the sender. I am all for the dissemination of research results. But the costs in photoduplications, postage, and sheer address-writing, envelope-licking *time* involved in accommodating hundreds of such requests year after year is burdensome for someone not in the grant-money lane. Peer-review assessments of worth notwithstanding, unfunded researchers continue to do their work and turn out results. Why should those researchers, or their schools, have to underwrite the edification or simple curiosity of the rest of the community? Why not apply the same standards of consumer responsibility that every other aspect of life demands to the information business and require that one pay for what one gets?

There are two ready possibilities for implementation. One would be reasonable postage-and-handling charges made out to the researcher's place of affiliation. Another would be for journals to direct reprint requests to themselves for a profit-yielding charge. The second alternative would have the double benefit of easing the considerable financial stress under which most journals seem perpetually to operate, while relieving



**THE FIFTH ANNUAL CONGRESS FOR  
HYBRIDOMA RESEARCH  
JANUARY 26 - 29, 1986  
BALTIMORE CONVENTION CENTER, BALTIMORE, MARYLAND**

*Co-Chairmen:*

Zenon Steplewski  
The Wistar Institute  
Philadelphia, PA

Hilary Koprowski  
The Wistar Institute  
Philadelphia, PA

Joseph Davie  
Washington University  
St. Louis, MO

The Annual Congress for Hybridoma Research, now in its fifth year, is recognized as the premier symposium on the subject, and presents the important developments that impact on current and future work.

**Keynote Speaker:** Mark Davis, Stanford University, Stanford, CA

**Title:** T-cell Receptor Gene Structure and Function

**Workshop Topics & Chairmen:**

HUMAN REPERTOIRE and AUTOIMMUNE DISEASE

A. Notkins, NIH, Bethesda, MD.

GENETIC PROBES

J.D. Capra, University of Texas, Dallas, TX.

MONOCLONAL ANTIBODIES in DISSECTING NORMAL and MALIGNANT STEM CELLS

I. Bernstein, Fred Hutchinson Cancer Center, Seattle, WA.

ISOTYPE SWITCH VARIANTS IN ANALYSIS of ANTIBODY FUNCTION

M. Scharff, Albert Einstein College of Medicine, New York, NY.

NEW TECHNOLOGIES

G. Rovera, The Wistar Institute, Philadelphia, PA.

**Poster Sessions:** TECHNOLOGICAL ADVANCES IN HYBRIDOMA RESEARCH

**Participants are invited to submit abstracts for the poster sessions. These abstracts will be reviewed up until the time of the meeting; however, only those accepted by Nov. 15 will be published in the journal, Hybridoma. Contact Dr. Zenon Steplewski (215) 898-3924.**

**Organized by Scherago Associates, Inc., in conjunction with  
Mary Ann Liebert, Inc.**

**REGISTRATION FEES:**

\$400 On-site registration – includes a one year subscription or renewal to the journal, Hybridoma.

\$350 ADVANCE REGISTRATION – (Received by Nov. 15) – Includes a one year subscription or renewal to the journal, Hybridoma.

\$ 75 STUDENT REGISTRATION – Student status must be confirmed in writing by department chairman.

4-7 registrations received together from same organization \$300 each. Includes 4 journal subscriptions only.

8-10 registrations received together from same organization \$200 each. Includes 4 journal subscriptions only.

Larger group rates available upon request.

Cancellations must be received in writing by December 19, 1985.

Attendance will be limited. Make checks payable to: **Scherago Associates, Inc., DNA/HYBRIDOMA** S-9-27

☐ Please reserve \_\_\_\_\_ space(s): Registration Fee of \$ \_\_\_\_\_ enclosed.

☐ Please send abstract form.

Name \_\_\_\_\_

Dept. \_\_\_\_\_ Organization \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone: ( ) \_\_\_\_\_

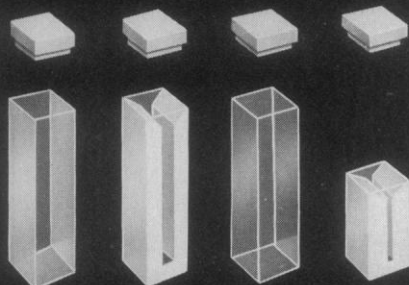
Return to: **Hybridoma; c/o Scherago Associates, Inc.**

1515 Broadway, Dept. S-9-27, New York, NY 10036 • (212) 730-1050



# IN SPECTROPHOTOMETER CELLS... NSG PRECISION HAS THE ANSWER

FUSED, FROSTED  
THICK-WALL CONSTRUCTION



The thick frosted walls of our cells  
reduce light scattering to a minimum.  
Call or write for free catalog on the  
complete NSG Precision line.

COMPARE OUR QUALITY  
AND OUR PRICE!

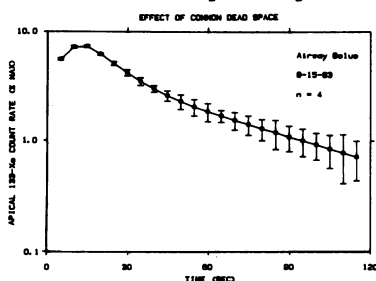


NSG PRECISION CELLS, INC.  
195G CENTRAL AVE., FARMINGDALE, NY 11735  
(516) 249-7474

Circle No. 230 on Readers' Service Card

## PUBLICATION QUALITY CHARTS AND GRAPHS

from your IBM PC, XT, AT  
and HP or compatible plotter



- Error Bars • Smooth lines,  
Clean diagonals • Movable  
Labels • Log and Semi-log scales  
• and more...

Load data from Keyboard or disk,  
any ASCII or DIF file (including  
LOTUS 123)

This and other new microcomputer  
tools for the scientist. Call or write  
for our FREE catalog.

### JANDEL SCIENTIFIC

2656 Bridgeway, Sausalito, CA 94965

800-874-1888 (outside CA)

415-331-3022 (inside CA)

Circle No. 208 on Readers' Service Card

researchers—and what secretarial help they can muster—from an expensive, time-absorbing, and largely thankless task that distracts from serious communications. In the spirit of personal statements coming before institutional ones, I have adopted a policy of accommodating postcard requests only from scholars working in countries where journal availability is low.

JEFFREY S. WICKEN

Division of Science and Engineering,  
Behrend College,  
Pennsylvania State University,  
Erie 16563

### Biotechnology and the Biosphere

There may be another dimension to the case of the ice-nucleating bacterium *Pseudomonas syringae* that was not mentioned in Gina Kolata's article "How safe are engineered organisms?" (Research News, 5 July, p. 34). According to Russell Schnell (1) of the National Oceanic and Atmospheric Administration Laboratory in Boulder, Colorado, *Pseudomonas syringae* enhances rainfall. It seems that the lipoprotein coats of this and other species of bacteria found on plants and in detritus when shed and wafted up into the clouds form ideal nuclei for ice formation that is absolutely necessary for rain to fall. Furthermore, contrary to what was previously thought, recent studies show that particles without organic materials derived from bacteria and plants (that is, "clean dust") are useless as nuclei for the formation of raindrops (raising the possibility that the Sahel drought could be prolonged by the absence of organic nuclei).

If *Pseudomonas syringae* does indeed have a beneficial role in enhancing rainfall, then the ecologist's concern about possible secondary or indirect effects of releases of genetically altered organisms is vindicated—incredibly, at the very first major controversy over release of engineered organisms. To the agriculturist the ice-nucleating bacteria are viewed only as pests, something to destroy or at least neutralize. But before such action is taken we should try to find out if the organisms in question have other functions that are of redeeming value. Reduction in rainfall due to lack of ice-nucleating capacity could be a lot worse than crop loss due to frost. At least we ought to consider such possibilities and assess indirect as well as direct impacts before we conclude that the alteration is "benign" (as inferred for current proposals in Kolata's article). Essentially, this is

the position of the ecologist when it comes to proposals for genetic alteration in open systems; it is not an "alarmist" position but just commonsense caution when one is dealing with complex environmental systems that are poorly understood.

Since microorganisms play major roles in maintaining earth's life-support systems, we need to be especially careful about tinkering with decomposition and other recycling processes. Unlike the life-support system of a spacecraft, which is mechanical and man-made, the biosphere is bioregenerative and self-regulating. Since we did not build it we don't know much about how it really works, and we have shown little interest in studying it at the necessary large scale until recently, when malfunctions have begun to appear due to human impacts. The case of the ice-nucleating bacteria is an excellent example of the need for a more holistic assessment that allows for consideration of roles and functions other than the one that seems undesirable.

What is needed now is a reasonable procedure for assessment at the ecosystem level that leans to the side of caution when there are a lot of unknowns. Accordingly, there is urgent need for increased support for research in environmental microbiology (that is, microbial ecology) and ecosystem science.

One consequence of the industrialization of agriculture is that food tends to become a market commodity rather than something to nourish us (that is, a life-support necessity). While a strong market economy is necessary for efficient food production, enthusiasm for biotechnology should not lead us to treat all organisms merely as "commodities" to be manipulated for short-term economic gain when there are nonmarket values and long-term consequences to be considered.

It is high time we became concerned with the health of the biosphere. A new technology for benefit-cost assessment could balance in an objective manner the short-term economic (market) benefits and the long-term costs in terms of damage to nonmarket goods and services that might be affected by proposed alterations. Advances in biotechnology should be accompanied by advances in the technology of ecosystem impact assessment if we are to minimize mistakes and disappointments.

EUGENE P. ODUM

Institute of Ecology, University of  
Georgia, Athens 30602

#### References

1. S. Weisburd and J. Raloff, *Science News* 127, 282 (1985).



# Did you say "QVECs"?

"Have you heard about QVECs?"

"Q-Vecks? That's the new mathematical theory developed by that fellow from Cambridge."

"Kuveck? Of course. Those small Russian game birds."

"Cuevecks? You mean those things you use to polish the ends of cue sticks?"

"Que-vecques? Oh, sure. They're little French pastries oozing with whipped cream."

"Cuvecs? I think it has something to do with wine."



Try it yourself. Take any half-dozen well-informed staff members and say knowingly, "Of course, you've heard about these new QVECs." You'll be treated to at least five different versions of precisely what QVECs are *not*.

What no one will admit to—especially at the Dean's annual reception—is that they have no idea whether QVECs are a cream-filled French pastry or the focus of the latest microchip research.

A pity. Because for many of your people, TIAA-CREF's QVECs (short for *Qualified Voluntary Employee Contributions*) represent an intelligent, convenient and highly competitive *tax-deferred* alternative to an IRA.

In fact, if any members of your staff are considering buying IRAs, your institution should be offering them TIAA-CREF QVECs—for these important reasons.

- ☐ QVECs provide a lifetime income, unlike most IRAs.
- ☐ QVECs currently offer attractive rates of return.
- ☐ QVECs offer the investment choice between two funds—TIAA and CREF.
- ☐ QVECs are portable—when staff move to another institution that offers QVECs, their QVECs can go right along.

So sooner or later you can expect to be interrogated on the subject of QVECs by the head of business studies or the rising star of the history department. And you'll want to have the facts at your command.

We can provide them. For a full briefing, simply return the form below or write us at QVECs, TIAA-CREF, 730 Third Avenue, New York, New York 10017. Then, when the subject comes up, as it's sure to do, you'll be ready to set the record straight.

## **QVECs. The educated alternative to an IRA.**



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

**Y**es. Please send me *free* all I need to become an instant expert on QVECs, so I can pass the word on to my staff members.

Name \_\_\_\_\_  
Title \_\_\_\_\_  
Institution \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

SCI 9-27-85



## All that you can ask for in a UV-VIS spectrophotometer.

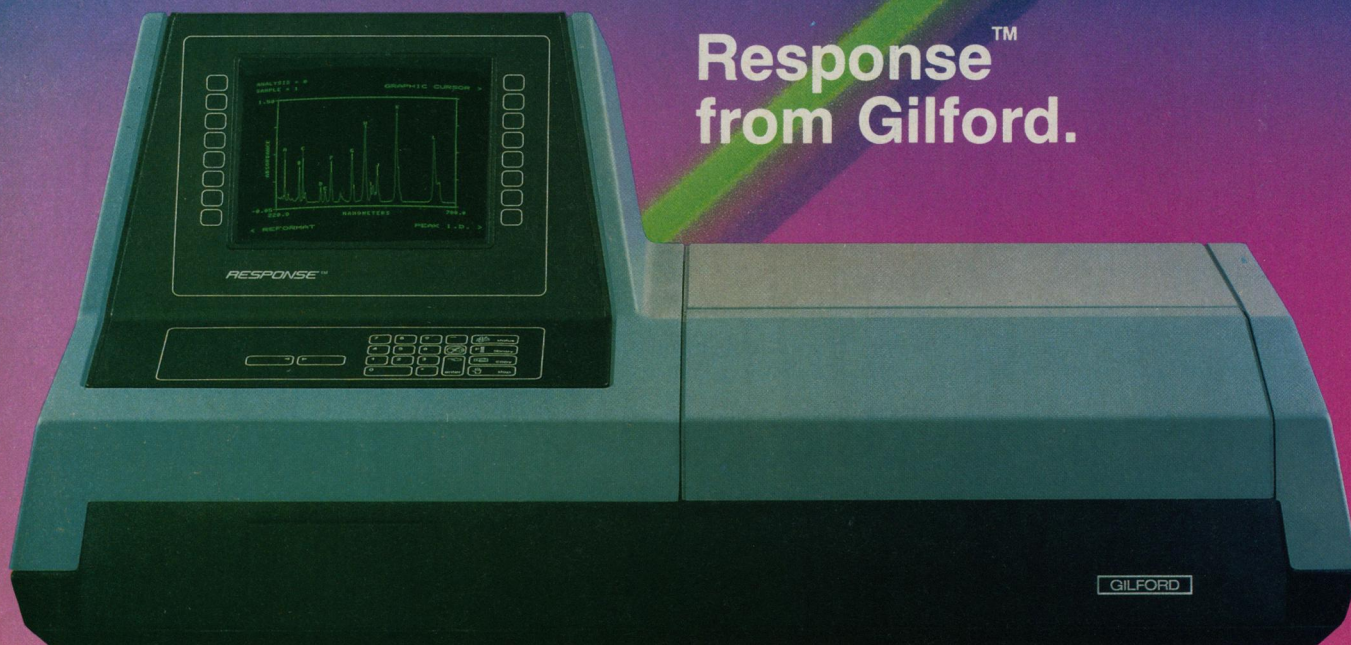
Scientific and technical problems, today, demand quick, accurate analytical computation. Gilford meets the needs of laboratory research with the finest in analytical systems.

The Response™ spectrophotometer, by Gilford, combines photometric, optical and microprocessor technology to assure you of highly accurate, consistently reliable measurements.

### Standard features include:

- Wavelength and time scanning, kinetics, multi-wavelength analysis and curve fitting routines.
- Graphic and tabular data display via high resolution CRT.
- Microprocessor controlled absorbance and wavelength calibration routines.
- Program storage and data storage to 10,000 points. RS-232C computer interface.
- Video copier for a publication quality hard copy.

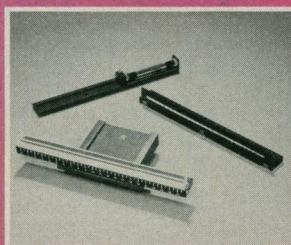
## Response™ from Gilford.



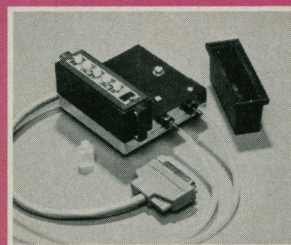
### A combination of sophistication and efficiency.

Response™ was designed with user interaction in mind with easy-to-operate controls, dedicated function keyboard, function changing dynamic keys and a convenient, transverse sample compartment that accepts accessories including six-position cell holders, 20cm gel and film scanners and a rapid sampler.

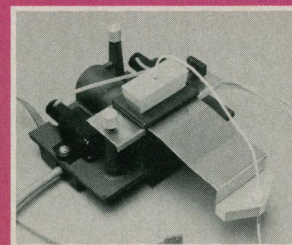
### Application Extending Accessories



Gel Scanning



Temperature Control



Rapid Sampling

Gilford  
132 Artino Street  
Oberlin, Ohio 44074  
800.221.7527

## GILFORD

a CORNING Laboratory Sciences Company



# Choose the EXACT power supply you need!

Some people think you should be satisfied with three or maybe four all-purpose units... at custom model prices.

E-C offers you the largest power supply line in science, with more models and more features for more applications, at prices we are proud to publish... from \$225 to \$1995.

Send now for our free Power Supply Catalog or telephone Technical Service free of charge at 1-800-624-2232. In Florida call 1-800-282-7932.

E-C Apparatus Corp.,  
3831 Tyrone Blvd. N.  
St. Petersburg, FL 33709  
TELEX 51-4376 HALA

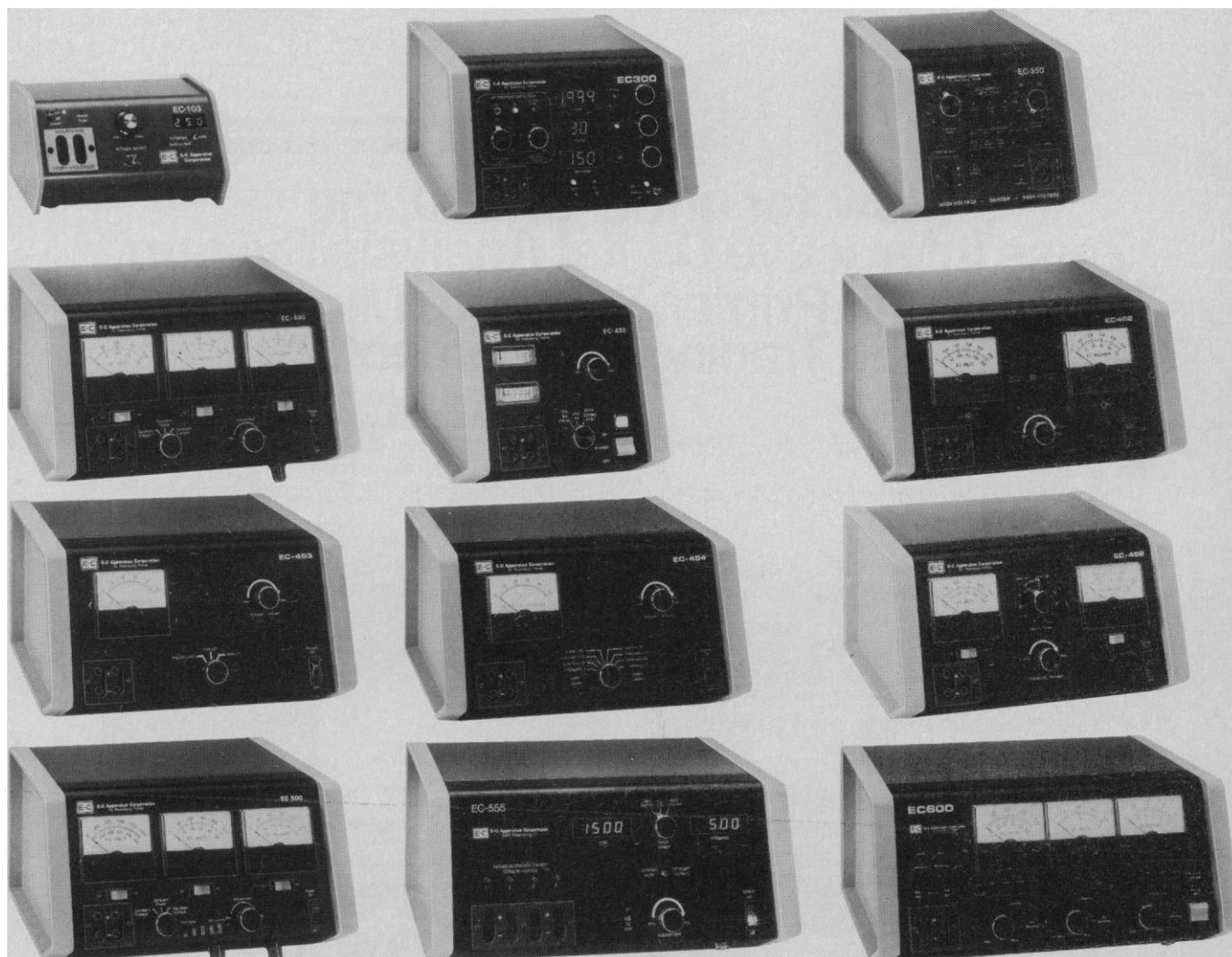


Circle No. 320 on Readers' Service Card

FEATURE	EC103	EC420	EC453	EC454	EC458	EC452
Constant Voltage (V)*	250	25/250	1000	500	500	500
Constant Current (mA)*	100†	5000/250†	200†	400†	400†	500
Constant Power (W)*	—	—	—	—	—	—
Voltage Limit Control	—	—	—	—	—	—
IEF Endpoint Detection	—	—	—	—	Timer	—
Automatic crossover	—	—	—	—	—	—
Digital LED readout	Y	—	—	—	—	—
Large dual-range meters	—	Y	Y	Y	Y	Y
Hi-Lo range switching	Y	—	Y	Y	Y	Y
Safety Interlock	—	—	Y	Y	Y	Y
Electrical Safety	Y	Y	Y	Y	Y	Y
Adapts to any cell	Y	Y	Y	Y	Y	Y
Price	\$ 225	295	495	495	595	695

FEATURE	EC350	EC400	EC500	EC300	EC555	EC600
Constant Voltage (V)*	500	1000	2000	2000	1500/500	4000
Constant Current (mA)*	100†	200	150	150	500/1500	200
Constant Power (W)*	—	200	300	30	—	200
Voltage Limit Control	—	Opt	Opt	—	—	Y
IEF Endpoint Detection	Y	—	—	Y	—	—
Automatic crossover	—	Opt	Opt	Y	—	Y
Digital LED readout	—	—	—	Y	Y	—
Large dual-range meters	—	Y	Y	—	—	Y
Hi-Lo range switching	—	Y	Y	—	—	Y
Safety Interlock	Y	Y	Y	Y	Y	Y
Electrical Safety	Y	Y	Y	Y	Y	Y
Adapts to any cell	Y	Y	Y	Y	Y	Y
Price	\$ 895	995	1295	1495	1595	1995

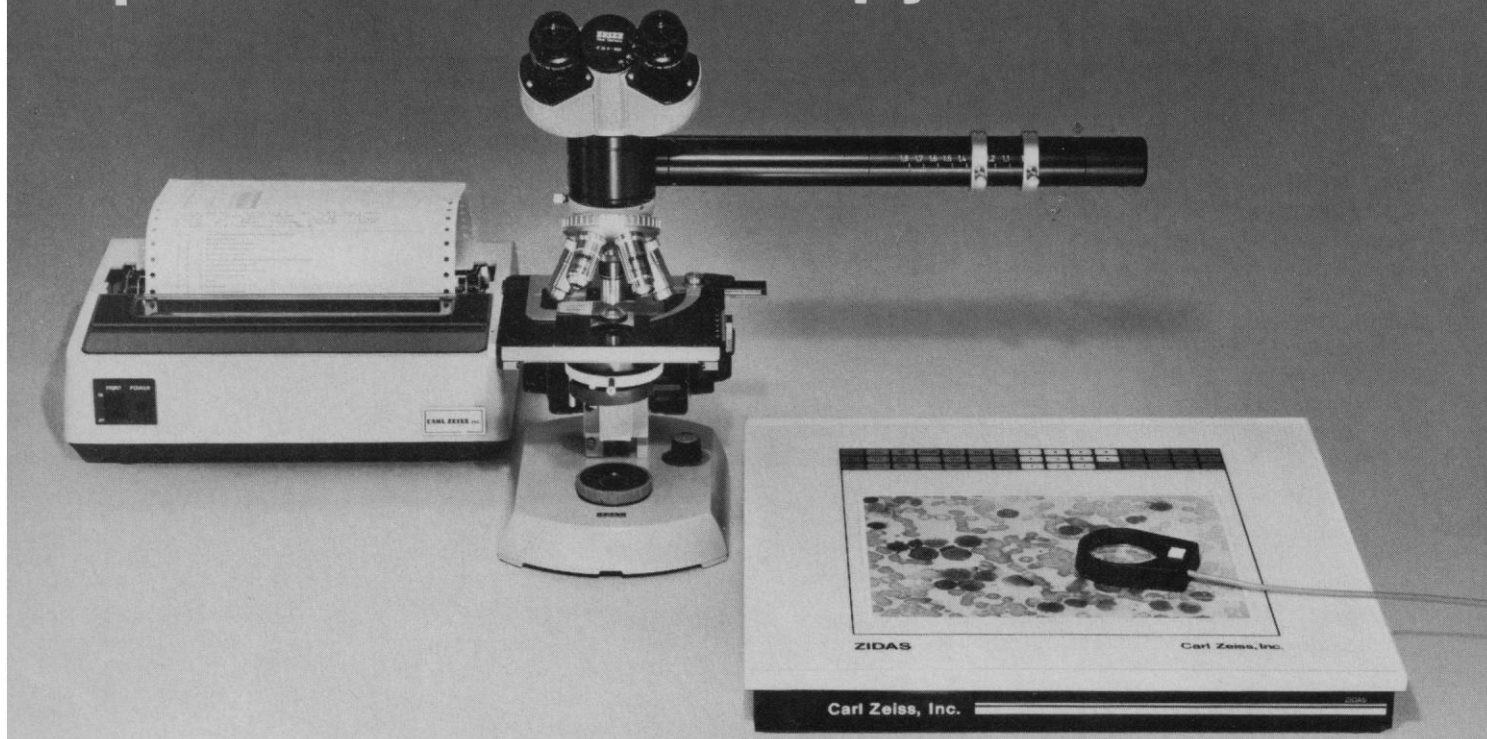
(\*)=maximum (†) not Constant





# ZIDAS<sup>TM</sup>

## cuts the cost of quantitative microscopy down to size.



## Now, for under \$7,500, the Zeiss Interactive Digital Analysis System... ZIDAS...with Printer, Standard Microscope, and Tracing Attachment.

### VERSATILE

- ☐ 18 geometric and morphometric measurement functions
- ☐ Statistics, stereology, distribution histograms
- ☐ **ZIDAS** will operate:
  - As stand-alone system
  - With practically any computer
  - With practically any serial or parallel printer
  - With display terminals

### BUILT-IN SOFTWARE

- ☐ Internal auto-diagnostic and test programs
- ☐ All programs permanently resident in EPROM
- ☐ Up to 5 user-defined programs can be stored in memory at one time
- ☐ 9 separate registers

### SIMPLE TO OPERATE

- ☐ Clear, easy-to-understand menufield
- ☐ Images are traced with stylus or cursor
- ☐ Direct microscopic observation, prints, photos, drawings
- ☐ Tracing speeds up to 100mm/second
- ☐ Tablet resolution better than 0.1 mm

### HIGHEST QUALITY MICROSCOPE

- ☐ Unmatched for versatility
- ☐ Compact, strong, simple
- ☐ Classic design, superb optics, precision mechanics
- ☐ 131 objectives, host of accessories
- ☐ Usable in every known technique in transmitted- and reflected-light microscopy

One Zeiss Drive  
Thornwood, NY 10594  
(914) 747-1800



## The great name in quantitative microscopy

For literature circle reader service number 216  
For a demonstration circle reader service number 217



# 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 Board

PHILIP W. ANDERSON, DAVID BALTIMORE, ANSLEY J. COALE, JOSEPH L. GOLDSTEIN, LEON KNOPOFF, SEYMOUR LIPSET, WALTER MASSEY, OLIVER E. NELSON, ALLEN NEWELL, RUTH PATRICK, VERA C. RUBIN, HOWARD E. SIMMONS, SOLOMON H. SNYDER, ROBERT M. SOLOW

## Board of Reviewing Editors

JAMES P. ALLISON, QAIS AL-AWOATI, LUIS W. ALVAREZ, DON L. ANDERSON, KENNETH J. ARROW, C. PAUL BIANCHI, ELIZABETH H. BLACKBURN, FLOYD E. BLOOM, MICHAEL S. BROWN, JAMES H. CLARK, STANLEY FALKOW, NINA V. FEDOROFF, GARY FELSENFELD, DOUGLAS J. FUTUYMA, THEODORE H. GEBALLE, STEPHEN P. GOFF, PATRICIA S. GOLDMAN-RAKIC, RICHARD M. HELD, GLORIA HEPPNER, JOHN IMBRIE, ERIC F. JOHNSON, KONRAD B. KRAUSKOPF, PAUL E. LACY, JOSEPH B. MARTIN, JOHN C. MCGIFF, MORTIMER MISHKIN, JOHN S. PEARSE, YESHAYAU POKER, FREDERIC M. RICHARDS, JAMES E. ROTHMAN, RONALD H. SCHWARTZ, OTTO T. SOLBRIG, ROBERT T. N. TJIAN, VIRGINIA TRIMBLE, GEERAT J. VERMEIJ, MARTIN G. WEIGERT, GEORGE M. WHITESIDES, WILLIAM B. WOOD, HARRIET ZUCKERMAN

## Editorial Staff

**Managing Editor:** PATRICIA A. MORGAN  
**Assistant Managing Editors:** NANCY J. HARTNAGEL, JOHN E. RINGLE  
**Production Editor:** ELLEN E. MURPHY  
**News Editor:** BARBARA J. CULLITON  
**News and Comment:** COLIN NORMAN (deputy editor), MARK H. CRAWFORD, CONSTANCE HOLDEN, ELIOT MARSHALL, R. JEFFREY SMITH, MARJORIE SUN, JOHN WALSH  
**European Correspondent:** DAVID DICKSON  
**Research News:** ROGER LEWIN (deputy editor), RICHARD A. KERR, GINA KOLATA, JEAN L. MARX, ARTHUR L. ROBINSON, M. MITCHELL WALDROP  
**Administrative Assistant, News:** SCHERRAINE MACK; **Editorial Assistant, News:** FANNIE GROOM  
**Senior Editors:** ELEANORE BUTZ, RUTH KULSTAD  
**Associate Editors:** MARTHA COLLINS, SYLVIA EBERHART, CAITILIN GORDON, WILLIAM GREAVES, BARBARA JASNY, STEPHEN KEPPEL, EDITH MEYERS, LOIS SCHMITT  
**Assistant Editor:** LISA MCCULLOUGH  
**Book Reviews:** KATHERINE LIVINGSTON, *Editor:* LINDA HEISERMAN, JANET KEGG  
**Letters Editor:** CHRISTINE GILBERT  
**Contributing Editor:** RUTH L. GUYER  
**Production:** JOHN BAKER, HOLLY BISHOP, KATHLEEN COSIMANO, ELEANOR WARNER; ISABELLA BOULDIN, SHARON RYAN, BEVERLY SHIELDS  
**Covers, Reprints, and Permissions:** GRAYCE FINGER, *Editor:* GERALDINE CRUMP, CORRINE HARRIS  
**Guide to Scientific Instruments:** RICHARD G. SOMMER  
**Manuscript System Analyst:** WILLIAM CARTER  
**EDITORIAL CORRESPONDENCE:** 1333 H Street, NW, Washington, D.C. 20005. Telephone: 202-326-6500. For "Information for Contributors" see page xi, *Science*, 28 June 1985.

## Business Staff

**Chief Business Officer:** WILLIAM M. MILLER III  
**Business Manager:** HANS NUSSBAUM  
**Assistant to Chief Business Officer:** ROSE LOWERY  
**Business Staff Supervisor:** DEBORAH JEAN RIVERA  
**Membership Recruitment:** GWENDOLYN HUDDLE  
**Member and Subscription Records:** ANN RAGLAND

## Advertising Representatives

**Director:** EARL J. SCHERAGO  
**Production Manager:** DONNA RIVERA  
**Advertising Sales Manager:** RICHARD L. CHARLES  
**Marketing Manager:** HERBERT L. BURKLUND  
**Sales:** New York, N.Y. 10036: J. Kevin Henebry, 1515 Broadway (212-730-1050); SCOTCH PLAINS, N.J. 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); CHICAGO, ILL. 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-337-4973); BEVERLY HILLS, CALIF. 90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-2772); SAN JOSE, CALIF. 95112: Bob Brindley, 310 S. 16 St. (408-998-4690); DORSET, VT. 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581).  
**ADVERTISING CORRESPONDENCE:** Tenth floor, 1515 Broadway, New York 10036 (212-730-1050).

# Use of and Research on Pheromones

This editorial was written in response to the stimulus of an interesting symposium on pheromones and to stories in the media about a large-scale infestation of gypsy moths in northeastern United States. The symposium, held at the annual meeting of the AAAS, dealt with some of the current frontiers of research on the physiology and regulation of pheromones.\* Enthusiasm of the participants was contagious and led to a scan of some of the literature and to a telephone stroll to tap the knowledge and judgment of some of the leaders in the field.

During the past 20 years, more than 1000 insect sex attractants have been identified. Many have been synthesized in the laboratory and tested. The pheromones of some of the insects are single, optically active compounds. Other pheromones are made up of closely controlled mixtures of several compounds. Sometimes both enantiomers of a compound are employed, but in other cases a racemic mixture is ineffective.

The early enthusiasm about the use of pheromones to control insect populations has dwindled. Although there is a consensus that pheromones are excellent baits for traps, their successful application has been largely confined to monitoring, for which they are highly useful. Experience with the gypsy moth in the Northeast is illustrative. In the area of maximum infestation, populations of moths greater than 10,000 per hectare have been noted. When a female moth emerges, she is close to a large number of males. Under these circumstances, almost all the females are mated before they can begin to emit pheromones. Therefore, the use of the attractant in traps is of little help. In contrast, when populations of gypsy moths are limited, the attractant has a major role. Today the Department of Agriculture maintains 400,000 traps in areas of the country that are currently not infested. These have served an alerting function that has led to eradication or control of local infestations.

A notable success in control of agricultural pests has involved the use of a pheromone for monitoring and trapping coupled with application of pesticides. In North and South Carolina, cotton farmers participate in a program against the boll weevil. The numbers of insects are monitored in 250,000 traps, and insecticides are applied only when needed to hold down the population. As a result, the amount of fertilizer used has been decreased by about 70 percent, and costs of control have dropped.

Infestation of conifers by beetles leads to large-scale destruction of trees. In forests, the use of pesticides is not practical, and the best hope is trapping, disruption of the beetles' behavior by the use of attractants or repellents, or fostering natural enemies of the beetles, including predators and pathogens. Large-scale use of pheromones in about a million traps in forests in Norway and Sweden during a massive infestation by spruce beetles was accompanied by a decrease in the number of insects, but experts are unsure about the relative roles of traps and natural enemies.

Some of the current research frontiers include studies of modes of biosynthesis of pheromones, mechanisms of their modes of action, and attempts to discover amines that mimic in structure natural neuroamines employed by insects. Some of the questions being asked are: What are the pathways of synthesis of pheromones? How do genes regulate specific blends? What are the genetic controls on reception and perception? Is the system tightly controlled or plastic? Can the pheromone system mutate? When a male moth is flying on the plume of a pheromone emitted by a female, the sensory detection apparatus must be very efficient, and once a molecule has been detected, the molecule must be destroyed if sensitivity is to be maintained. Studies with a moth that uses an ester have shown that the sensors contain an esterase that quickly degrades the ester. Are related phenomena active in other insects?—PHILIP H. ABELSON

\*"Bio-organic Chemistry of Insect Hormones and Pheromones," symposium arranged by G. D. Prestwick at the AAAS annual meeting, Los Angeles, Calif., 29 May 1985.



**THE SIXTH ANNUAL CONGRESS FOR  
RECOMBINANT DNA RESEARCH  
JANUARY 26 - 29, 1986  
BALTIMORE CONVENTION CENTER, BALTIMORE, MARYLAND**

John D. Baxter  
Univ. of California  
San Francisco, CA

*Co-Chairmen:*  
Walter L. Miller  
Univ. of California  
San Francisco, CA

Peter Gruss  
Univ. of Heidelberg  
West Germany

The Annual Congress for Recombinant DNA Research, now in its sixth year, is recognized as the premier symposium on the subject, and presents the important developments that impact on current and future work.

**Keynote Speakers:** Charles Weisman, University of Zurich, Switzerland  
Interferon Genes and their Expression

Philip Sharp, Massachusetts Institute of Technology, Cambridge, MA  
Gene Expression in Mammalian Cells

**Session Chairman**

**ONCOGENES**

Peter Gruss, Univ. of Heidelberg, W. Germany

**TRANSCRIPTION**

Pamela Mellon, Univ. of CA, San Diego

**MEDICAL MOLECULAR BIOLOGY**

Walter L. Miller, Univ. of CA, San Francisco

**PLANTS**

Frederich Ausubel, Mass. Genl. Hosp., Boston, MA

**HORMONES**

John Baxter, Univ. of CA, San Francisco

**DEVELOPMENTAL BIOLOGY**

Shirley Tilghman, Fox Chase Cancer Ctn., Phila, PA

**NEUROBIOLOGY**

James R. Roberts, Columbia Univ., N.Y., N.Y.

**YEAST**

Jack Szostak, Mass. Genl. Hosp., Boston, MA

**Poster Sessions: ADVANCES IN RECOMBINANT DNA RESEARCH**

**Participants are invited to submit abstracts for the poster sessions. These abstracts will be reviewed up until the time of the meeting; however, only those accepted by Nov. 15 will be published in the journal, DNA. Contact Edward Ruffing, Scherago Associates, Inc., (212) 730-1050.**

**Organized by Scherago Associates, Inc., in conjunction with  
the journal, DNA, and Genetic Engineering News**

**REGISTRATION FEES:**

\$400 On-site registration – includes a one year subscription or renewal to the journal, DNA.

\$350 ADVANCE REGISTRATION – (Received by Nov. 15) – Includes a one year subscription or renewal to the journal, DNA.

\$ 75 STUDENT REGISTRATION – Student status must be confirmed in writing by department chairman.

4-7 registrations received together from same organization \$300 each. Includes 4 journal subscriptions only.

8-10 registrations received together from same organization \$200 each. Includes 4 journal subscriptions only.

Larger group rates available upon request.

Cancellations must be received in writing by Dec. 19, 1985.

Attendance will be limited. Make checks payable to: **Scherago Associates, Inc., DNA**

S-9-27

☐ Please reserve \_\_\_\_\_ space(s): Registration Fee of \$ \_\_\_\_\_ enclosed.

☐ Please send abstract form.

Name \_\_\_\_\_

Dept. \_\_\_\_\_ Organization \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone: ( ) \_\_\_\_\_

Return to: **DNA; c/o Scherago Associates, Inc.**

Dept. S-9-27, 1515 Broadway, New York, NY 10036 • (212) 730-1050



## Information for Contributors

### The Editors of *Science*

Manuscripts should be addressed to the Editor, *Science*, 1333 H Street, NW, Washington, D.C. 20005. Submit three copies together with a letter of transmittal giving

- 1) the names and telephone numbers of the authors;
- 2) the title of the paper and a statement of its main point;
- 3) three to eight keywords to be used for indexing;
- 4) the names, addresses, telephone numbers, and fields of interest of four to six persons in North America but outside your institution who are qualified to referee the paper;
- 5) the names of colleagues who have reviewed the paper;
- 6) the total number of words (including text, references, and figure and table legends) in the manuscript; and
- 7) a statement that the material has not been published and is not under consideration for publication elsewhere.

Before being reviewed in depth, most papers are rated for their interest and overall suitability by a member of the Board of Reviewing Editors. When papers are submitted in disciplines for which there is no appropriate member of the Board of Reviewing Editors, the initial screening is done by editorial staff members in consultation with outside experts in those areas. Papers that are not in the highest rating category are returned to the authors within about 2 weeks. The others are reviewed in depth by two or more outside referees. Authors are then notified of acceptance, rejection, or need for revision within 6 to 10 weeks from the date of receipt. As stated in the editorial of 18 January 1985 (*Science*, volume 227, page 249), there can be no resubmissions, either of papers returned after initial screening or of papers returned after in-depth review.

### Conditions of Acceptance

When a paper is accepted for publication in *Science*, it is understood by the editors that any materials necessary to

verify the conclusions of the experiments reported will be made available to other investigators under appropriate conditions.

It is also understood that a paper accepted by *Science* will not be released to the press or the public before its publication.

If there is a need in exceptional cases to publicize research findings in advance of publication, the AAAS Office of Communications (202-326-6440) must be consulted.

### Selection of Manuscripts

In selecting papers for publication, the editors give preference to those of general significance that are well written, well organized, and intelligible to scientists in different disciplines. An attempt is made to balance the subject matter in all sections of *Science*. Membership in the AAAS is not a factor in selection.

Papers accepted for publication are edited to improve the accuracy and effectiveness of communication and to bring them within the specified length limits. When the author's meaning is not clear, the editor may consult the author by telephone; when editing is extensive, the manuscript may be returned to the author for approval and retyping before the type is set.

Six categories of signed papers are published: general articles, research articles, reports, letters, technical comments, and book reviews.

**General articles.** General articles (up to 5000 words) are expected to (i) review new developments in one field that will be of interest to readers in other fields; (ii) describe a current research problem or a technique of interdisciplinary significance; or (iii) discuss some aspect of the history, logic, philosophy, or administration of science and public affairs. Readers should be able to learn from a general article what has been firmly established and what are unresolved questions; speculation should be kept to a minimum.

Many of the general articles are solicited

by the editor. Both solicited and unsolicited articles undergo review.

General articles should include a note giving authors' names, titles, and addresses; a summary (50 to 100 words); an introduction that outlines for the general reader the main point of the paper; and brief subheadings to indicate the main ideas. The reference list should not be exhaustive; a maximum of 40 references is suggested.

**Research articles.** A research article (up to 4000 words) is expected to contain new data representing a major breakthrough in its field. The article should include an author note, abstract, introduction, and sections with brief sideheads. There should be a short introductory section outlining for the general reader the main point of the paper, a description of the experiments and the results, and then a discussion or conclusion. A maximum of 30 references is suggested.

**Reports.** Reports are expected to contain important research results or reliable theoretical calculations whose essence can be expressed briefly. Preference is given to reports of discoveries that will be of broad interdisciplinary interest or of unusual interest to the individual discipline. Reports should include an abstract and an introductory paragraph. The total number of words, including the references and notes and figure and table legends, should not exceed 2000. A maximum of 20 references is suggested. Figures and tables together should occupy no more than half a printed page.

**Letters.** Letters are selected for their pertinence to material published in *Science* or because they discuss problems of general interest to scientists. Letters pertaining to material published in *Science* may correct errors; provide support or agreement; or offer different points of view, clarifications, or additional information. Personal remarks about another author are inappropriate. Letters may be reviewed by outside consultants. Letters selected for publication are intended to reflect the range of opinions received. The author of the *Science* paper in question is usually given an opportunity to reply.

Letters must be typed double-spaced. All letters are acknowledged by postcard; authors are duly notified as to whether or not their letters are to be published. Preference is given to letters that do not exceed 250 words. Letters accepted for publication are frequently edited and shortened in consultation with the author.

**Technical Comments.** Technical com-



ments (up to 500 words) may criticize articles or reports published in *Science* within the previous 6 months or may offer useful additional information. Discussions of minor issues or priority claims are not appropriate, nor are questions that can be resolved by private correspondence. The authors of the original paper are usually asked for an opinion of the comments and are given an opportunity to reply in the same issue if the comments are accepted. The comments, and sometimes the reply, are subjected to the usual review procedures.

**Book Reviews.** The selection of books to be reviewed and of reviewers is made by the editors. Instructions and length specifications accompany the books when they are sent to reviewers.

## Manuscript Preparation

**Typing.** Use double-spacing throughout the text, tables, figure legends, and references and notes and leave margins of at least 2.5 centimeters. Put your name on each page and number the pages starting with the title page.

**Titles.** Titles should be short, specific, and amenable to indexing. For general articles the maximum length is 52 characters and spaces; for research articles and reports the maximum is 108 characters.

**Summaries or abstracts.** These should convey to the general reader the main point of the paper and outline the results or conclusions. A reader should be able to learn from the summary the purpose of the study and the reason for its importance.

**Text.** A brief introduction should portray the broad significance of the paper.

The whole text should be intelligible to readers in more than one discipline. Technical terms should be defined.

**Units of measure.** Use metric units. If

measurements were made in English units, give metric equivalents.

**Symbols and abbreviations.** Define all symbols, abbreviations, and acronyms.

**References and notes.** Number references and notes in the order in which they are cited in the text. Place references cited only in tables or figure legends after the text references. Use conventional abbreviations for well-known journals; provide complete titles for other journals. For references with up to five authors provide all the names; for more than five, provide the name of the first author only. For style, see a recent issue of *Science*.

**Acknowledgments.** Gather all acknowledgments into a brief statement at the end of the references and notes.

**Informed consent.** Investigations on human subjects must include a statement indicating that informed consent was obtained after the nature and possible consequences of the studies had been fully explained.

**Figures.** For each figure submit three glossy prints of sufficient size to permit relettering but not larger than 22 by 28 centimeters (8½ by 11 inches). Transparencies, slides, negatives, or oversized figures cannot be accepted. On the back of every figure write the first author's name and the figure number and indicate the correct orientation. Authors requesting the use of color will be asked to pay \$600 for the first figure and \$300 for each additional figure, to cover the cost of reprints. Illustrations reprinted from other publications must be credited. It is the author's responsibility to obtain permission to reprint such illustrations in *Science*.

**Tables.** Tables should supplement, not duplicate, the text. They should be numbered consecutively with respect to their citation in the text. Each table should be typed, with its legend (double-spaced), on a separate sheet. Give each column a heading with units of measure indicated

in parentheses. Do not change the unit of measure within a column.

**Equations and formulas.** Use quadruple-spacing around equations and formulas that are to be set off from the text. Define all symbols.

**Statistical presentations.** Report the uncertainty associated with results, including the specific measure of uncertainty used and the sources of error in it. Probabilities from statistical tests of significance should be subordinated to the reporting of results and associated uncertainties. Limitations to the generalizability of the results should be explicitly stated.

## Printing and Publication

**Proofs and reprints.** One set of galley proofs is sent to the authors. An order blank for reprints accompanies the proofs.

**Scheduling.** Papers are scheduled for publication after *Science* has received corrected galley proofs from the authors. The time between acceptance of papers and mailing of galley proofs to authors may be 4 to 8 weeks, and the time between receipt of authors' galley proofs by *Science* and publication may be 4 to 6 weeks. There may be delays for papers with tables or figures that present problems in layout, for papers with color figures, for papers accompanied by cover pictures, and for papers that exceed the length limits.

## Cover Photographs

Particularly good photographs that pertain to a paper being submitted will be considered for use on the cover. Submit prints (not slides, negatives, or transparencies) with the manuscript and indicate in the letter of transmittal that a possible cover picture is enclosed.



# SCIENCE, ARMS CONTROL & NATIONAL SECURITY

This pressing issue for all scientists is the focal point of these new titles from the American Association for the Advancement of Science:

**THE VERIFICATION CHALLENGE: Problems and Promise of Strategic Nuclear Arms Control Verification**, by Richard A. Scribner, Theodore J. Ralston, and William D. Metz

A broad, authoritative examination of strategic nuclear arms control verification that addresses principles and tasks of verification, technology and monitoring, compliance issues, future verification needs, and views on what constitutes adequate verification. Available from Birkhäuser Boston, November 1985; ca. 200pp., \$15. (Order from the publisher, 380 Green St., Cambridge, MA 08540)

**STRATEGIC NUCLEAR ARMS CONTROL VERIFICATION TERMS AND CONCEPTS: A Glossary**, by Richard A. Scribner and Kenneth N. Luongo

A comprehensive glossary of weapons technology, arms control, and treaty terminology. Published by AAAS (1985) 48pp., \$2.50\*.

**STRATEGIC NUCLEAR ARMS CONTROL VERIFICATION: An Annotated Bibliography, 1977-1984**, by Richard A. Scribner and Robert Travis Scott

A comprehensive, up-to-date guide to books and articles suitable for class or research use. Published by AAAS (1985) 96pp., \$7.50\*.

**THE STRATEGIC DEFENSE INITIATIVE: Some Arms Control Implications**, by Jeffrey Boutwell and Richard A. Scribner

Implications of SDI for the Antiballistic Missile Treaty, for nuclear arms control negotiations, for limiting antisatellite weapons, and for the NATO alliance and counteractions by the Soviet Union. Contains Congressional action recommendations. Published by AAAS (1985) 48pp., \$2.50\*.

**To order these books, as well as AAAS audiotapes, educational videotapes and symposia volumes on science, arms control, and national security topics (and for discounts on quantity orders), write to:**

Committee on Science, Arms Control,  
and National Security  
American Association for the  
Advancement of Science  
1333 H Street, N.W.  
Washington, D.C. 20005

(\*Please include \$1.50 postage and handling per order. Allow 4-6 weeks for delivery. AAAS members receive a 20 percent discount on listed prices.)



## CALL FOR RESEARCH PROPOSALS FOR THE U.S. ENVIRONMENTAL PROTECTION AGENCY BIOTECHNOLOGY RISK ASSESSMENT PROGRAM

The **BIOTECHNOLOGY RISK ASSESSMENT PROGRAM** of the U.S. Environmental Protection Agency anticipates funding of new extramural **RESEARCH GRANTS AND/OR CONTRACTS** in FY 1986. Research must relate to agency needs and must address one or more of the following general topics regarding recombinant microorganisms or strains which are potential candidates for genetic engineering. EPA is now soliciting 2-page preproposals which will clearly summarize the idea, express the concept for the study and present the experimental approach(es) anticipated. A breakdown of the total project costs and the applicant's resume must be provided on separate pages. Indicate which topic (1-9) is being addressed. More than one preproposal may be submitted.

Areas of primary interest which preproposals must address include the following topics.

Effects of released recombinant microbes on ecological processes:

1. research involving how genetically engineered microbes, their activities, or biological products can "disturb" the environment, an ecosystem or a microbially mediated process;
2. measurement of potential influences of recombinant microbes released to the environment on ecological processes such as cycling of N, C, P, or S;
3. development of microcosms for studying effects of engineered microbes on ecological processes.

Hazards to exposed species (including humans):

4. development of approaches for studying movement of released microbes throughout various trophic levels and nontarget species;
5. study of fate, effects, and possible hazards of non-engineered species released to the environment compared with corresponding influences of the engineered strain released into a contained environment.
6. study possible hazards to nontarget species by genetically engineered microbes (pathogenicity, virulence).

Detection, genetic exchange, and fate/survival:

- 7a. quantitative measurement of genetic exchange among gram positive bacteria released to terrestrial microcosms;
- 7b. quantitative measurement of genetic exchange among bacteria released to aquatic microcosms;
8. identification of physiological, metabolic, and/or ecological factors which influence maintenance of RDNA molecules in the ecosystem;
9. development of procedures for detection/quantitation of recombinant microorganisms and their DNA, especially as it applies to automated procedures.

**For more complete descriptions of these topics, mail requests to Corvallis E.P.A. LABORATORY (for address see below). Deadline for receiving preproposals is November 30, 1985. For research related to TERRESTRIAL SYSTEMS, send preproposals to Ramon J. Seidler, U.S.E.P.A., 200 SW 35th St., Corvallis, OR. 97333; for research related to AQUATIC SYSTEMS, send preproposals to Al Bourquin, U.S.E.P.A., Sabin Island, Gulf Breeze, FL. 32561; for research related to HEALTH EFFECTS, send preproposals to Clint Kawaniishi, U.S.E.P.A., Research Triangle Park, North Carolina 27711.**