

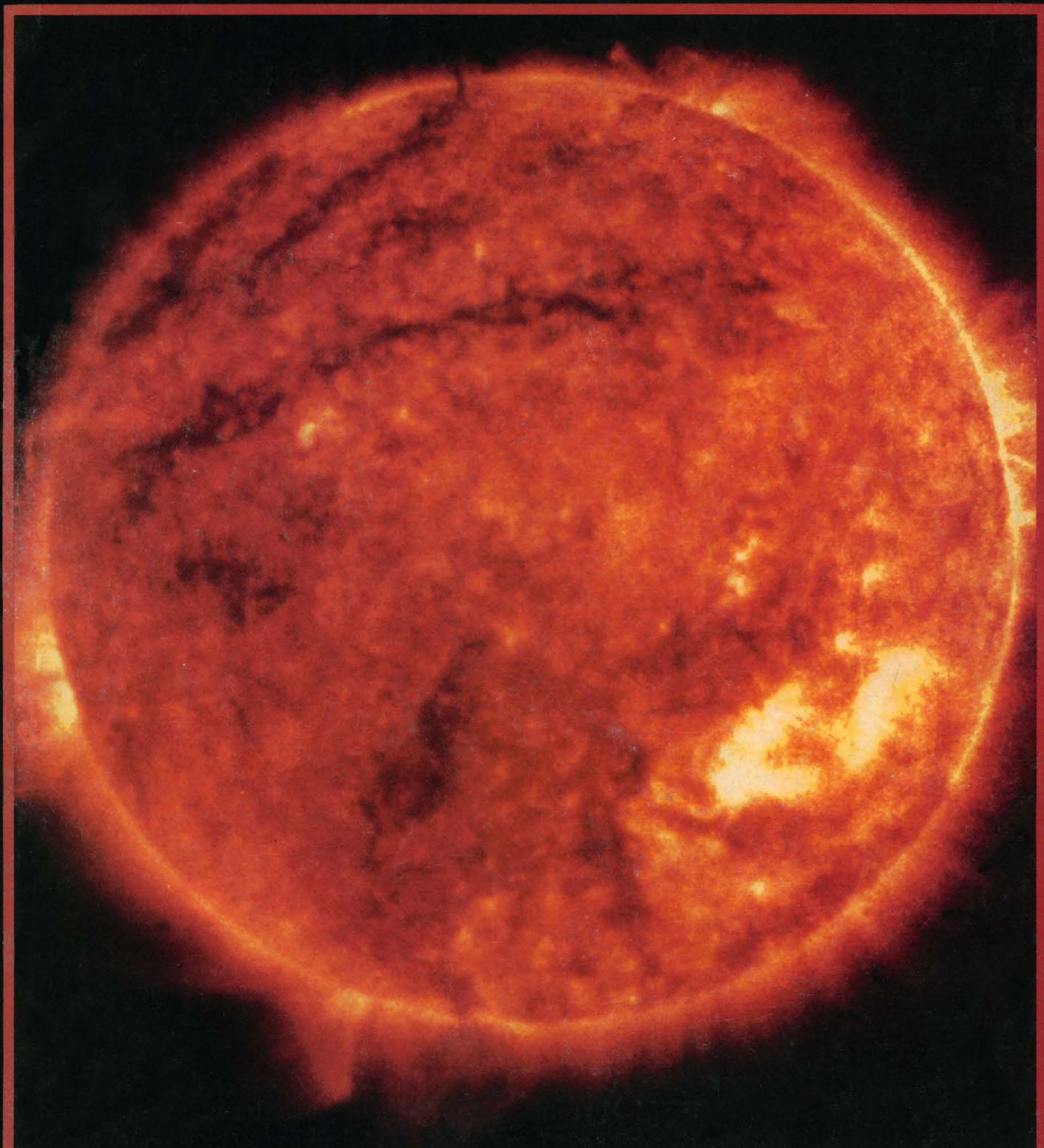
AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

30 SEPTEMBER 1988

\$3.00

VOL. 241 ■ PAGES 1725-1868





When Du Pont scientists solve life science research problems you have immediate access to their "working knowledge"

Du Pont's life science research programs have led to hundreds of new and innovative products that are helping provide new solutions to complex problems in molecular biology, protein biochemistry, virology and other research areas.

For example, when our progress in nucleic acid research was slowed because of a time-consuming method traditionally used for sequencing, we used our working knowledge to explore new areas of fluorescent chemistry. And we achieved a major breakthrough that permits automatic and direct reading of the DNA sequence to provide you with the revolutionary GENESIS™ 2000 DNA analysis system. In all, Du Pont research insights are offered to you in more than 2000 biotechnology products.

Our working knowledge also provides personal help. Through customer applications laboratories, our specialists can focus on your applications and provide the assistance you need. You also have access to the scientists who developed the products you are using, for in-depth consultation or potential collaboration.

If you need precise and accurate results in synthesis, sequencing, separations, purification and characterization, call us and talk to someone who speaks your language—1-800-551-2121. In Canada call 1-800-387-2179. In Europe call W. Germany 69-2195-561. Or write Du Pont Company, Biotechnology Systems, BRML, G-50951, Wilmington, DE 19898.

**Working Knowledge
in Biotechnology**



Circle No. 1 on Readers' Service Card

1731 This Week in *Science*

Editorial

1733 Fetal Tissue in Research

Letters

1736 Mature Accelerators: L. M. LEDERMAN ■ The Global Carbon Cycle: R. A. HOUGHTON; G. M. WOODWELL; R. A. SEDJO; R. P. DETWILER AND C. A. S. HALL; S. BROWN; Cataract Removal: R. L. JOHNSTON

Association Affairs

1740 AAAS Presidential Lecture: Voices from the Pipeline: S. E. WIDNALL

News & Comment

1748 Scientists Confront Misconduct
1749 Army Shifts on Dugway Lab
1750 The Shroud of Turin: An Answer Is at Hand
1751 Science Achievement in Schools Called "Distressingly Low"
1752 Chemical Genocide in Iraq
Academic Search for NCI Head
Watson Will Head NIH Genome Office
1753 Experts Ponder Simian Well-Being
1755 Open Season on USDA

Research News

1756 DNA Clock Conflict Continues
1759 Hard Choices Ahead on Biodiversity
1761 Chips Made with X-ray Lithography
1762 Ecologists' Opportunity in Yellowstone's Blaze
1764 *Random Samples*: What's in a Name? ■ Going Far on a B.S. ■ Guacamole, Anyone?

Articles

1769 Industrial Innovation in Japan and the United States: E. MANSFIELD
1775 Hormonal Control of Behavior: Amines and the Biasing of Behavioral Output in Lobsters: E. A. KRAVITZ

Research Articles

1781 Soft X-ray Images of the Solar Corona with a Normal-Incidence Cassegrain Multilayer Telescope: A. B. C. WALKER, JR., T. W. BARBEE, JR., R. B. HOOVER, J. F. LINDBLOM

Reports

1788 X-ray Standing Waves: A Molecular Yardstick for Biological Membranes: M. J. BEDZYK, D. H. BILDERBACK, G. M. BOMMARITO, M. CAFFREY, J. S. SCHILDKRAUT
1791 Single Strands, Triple Strands, and Kinks in H-DNA: H. HTUN AND J. E. DAHLBERG

- **SCIENCE** is published weekly on Friday, except the last week in December, and with an extra issue in February by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005. Second-class postage (publication No. 484460) paid at Washington, DC, and at an additional entry. Now combined with **The Scientific Monthly** © 1988 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): \$70. Domestic institutional subscription (51 issues): \$110. Foreign postage extra: Canada \$32, other (surface mail) \$32, air-surface via Amsterdam \$85. First class, airmail, school-year, and student rates on request. Single copies \$3.00; back issues \$5.00; 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 The solar corona at 1,000,000 K photographed (23 October 1987) by a multilayer Cassegrain x-ray telescope on the Stanford/MSFC Rocket X-ray Spectroheliograph. This telescope provides images of solar emission between 171 and 175 Å which is dominated by Fe IX and Fe X emission lines. See page 1781. [Center for Space Science and Astrophysics, Stanford University, Stanford, CA 94305; NASA Marshall Space Flight Center, Huntsville, AL 35812; and Lawrence Livermore National Laboratory, Berkeley, CA 94550]

- 1797 Identification of Germline and Somatic Mutations Affecting the Retinoblastoma Gene: J. M. DUNN, R. A. PHILLIPS, A. J. BECKER, B. L. GALLIE
- 1800 The S1-Sensitive Form of d(C-T)_nd(A-G)_n: Chemical Evidence for a Three-Stranded Structure in Plasmids: B. H. JOHNSTON
- 1804 Changing the Acceptor Identity of a Transfer RNA by Altering Nucleotides in a "Variable Pocket": W. H. McCLAIN AND K. FOSS
- 1807 Deficit of Spinal Cord Glycine/Strychnine Receptors in Inherited Myoclonus of Poll Hereford Calves: A. L. GUNDLACH, P. R. DODD, C. S. G. GRABARA, W. E. J. WATSON, G. A. R. JOHNSTON, P. A. W. HARPER *et al.*
- 1810 Synaptic Transmission Between Dissociated Adult Mammalian Neurons and Attached Synaptic Boutons: J. A. DREWE, G. V. CHILDS, D. L. KUNZE
- 1813 Overexpression of Metallothionein Confers Resistance to Anticancer Drugs: S. L. KELLEY, A. BASU, B. A. TEICHER, M. P. HACKER, D. H. HAMER, J. S. LAZO
- 1815 Induction of B Cell Unresponsiveness to Noninherited Maternal HLA Antigens During Fetal Life: F. H. J. CLAAS, Y. GIJBELS, J. VAN DER VELDEN-DE MUNCK, J. J. VAN ROOD
- 1817 Hyperthermia Protects Against Light Damage in the Rat Retina: M. F. BARBE, M. TYTELL, D. J. GOWER, W. J. WELCH
- 1820 Human IL-3 and GM-CSF Act Synergistically in Stimulating Hematopoiesis in Primates: R. E. DONAHUE, J. SEEHRA, M. METZGER, D. LEFEBVRE, B. ROCK, S. CARBONE, D. G. NATHAN, M. GARNICK, P. K. SEHGAL, D. LASTON *et al.*
- 1823 Developmental Expression of PDGF, TGF-α, and TGF-β Genes in Preimplantation Mouse Embryos: D. A. RAPPOLEE, C. A. BRENNER, R. SCHULTZ, D. MARK, Z. WERB
- 1826 Influences of Dietary Sodium on Functional Taste Receptor Development: A Sensitive Period: D. L. HILL AND P. R. PRZEKOP, JR.
- 1828 Middle Archaic Period Domestic Architecture from Southern Peru: M. ALDENDERFER

AAAS Meetings

- 1831 1989 AAAS Annual Meeting ■ Preliminary Program, Part 3 ■ Social & Behavioral Sciences ■ Science & Technology Policy ■ Science & Technology Education ■ Advance Registration and Housing Form

Book Reviews

- 1837 Psychology in Twentieth-Century Thought and Society, *reviewed by* F. SAMELSON ■ The Making of Cognitive Science, J. M. ANGLIN ■ Physics at Surfaces, R. L. PARK ■ New Perspectives in Basin Analysis, L. L. SLOSS ■ Some Other Books of Interest ■ Books Received

*Author Index to Volume 241 is found on pages I-X
Information for Contributors is found on pages XI-XII*

Board of Directors

Sheila E. Widnall
*Retiring President,
Chairman*

Walter E. Massey
President

Richard C. Atkinson
President-elect

Floyd E. Bloom
Mary E. Clutter
Eugene H. Cota-Robles
Mildred S. Dresselhaus
Joseph G. Gavin, Jr.
John H. Gibbons
Beatrice A. Hamburg
Donald N. Langenberg
William T. Golden
Treasurer
Alvin W. Trivelpiece
Executive Officer

Editorial Board

Elizabeth E. Bailey
David Baltimore
William F. Brinkman
E. Margaret Burbidge
Philip E. Converse
Joseph L. Goldstein
F. Clark Howell
James D. Idol, Jr.
Leon Knopoff
Oliver E. Nelson
Helen M. Ranney
David M. Raup
Howard A. Schneiderman
Larry L. Smarr
Robert M. Solow
James D. Watson

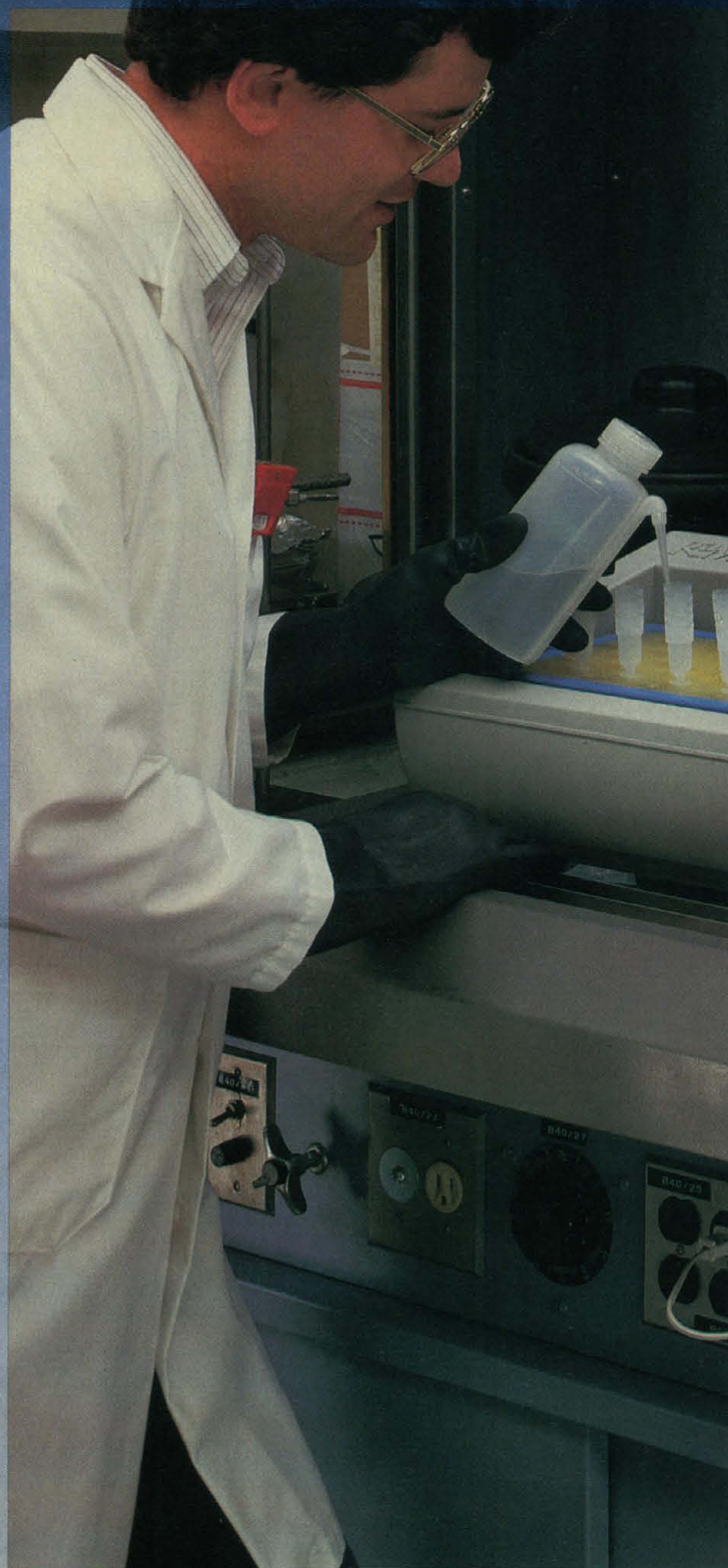
Board of Reviewing Editors

John Abelson
Qais Al-Awqati
Don L. Anderson
Stephen J. Bankovic
Floyd E. Bloom
Henry R. Bourne
James J. Bull
Charles R. Cantor
Ralph J. Cicerone
John M. Coffin
Robert Dorfman
Bruce F. Eldridge
Paul T. Englund
Theodore H. Geballe
Roger I. M. Glass

Stephen P. Goff
Robert B. Goldberg
Corey S. Goodman
Jack Gorski
Stephen J. Gould
Richard M. Held
Gloria Heppner
Eric F. Johnson
Konrad B. Krauskopf
Charles S. Levings III
Richard Losick
Karl L. Magleby
Philippa Marrack
Joseph B. Martin
John C. McGiff
Mortimer Mishkin
Jiri Novotny
Gordon H. Orians

Carl O. Pabo
Yeshayau Pocker
Michael I. Posner
Dennis A. Powers
Jean Paul Revel
Russell Ross
James E. Rothman
Daniel V. Santi
Ronald H. Schwartz
Vernon L. Smith
Otto T. Solbrig
Robert T. N. Tjian
Virginia Trimble
Geerat J. Vermeij
Harold Weintraub
Irving L. Weissman
George M. Whitesides
Owen N. Witte
William B. Wood

Synthesize up to 150 mg each of 25 peptides in 1 operation with RaMPS™ from Du Pont



RaMPS™ Multiple Peptide Synthesis System is the ideal tool for screening because it synthesizes up to 150 mg each of 25, 20-mer peptides. The simple, step-by-step protocol assures even inexperienced personnel the ability to synthesize and select peptides quickly and efficiently.

RaMPS™ enhances safety by reducing manipulations, minimizing handling and replacing hydrofluoric acid equipment with safe Fmoc chemistry. Also, the self-contained RaMPS system uses RapidAmide™ resin for simplicity, flexibility and cost-effectiveness.

For more information call:
In the United States, 1-800-551-2121
In Canada, 1-800-387-2179

Or write: Du Pont Company
Biotechnology Systems Division
BRML, G-50985,
Wilmington, DE 19898.

**Working Knowledge
in Biotechnology**

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

Circle No. 2 on Readers' Service Card

This Week in SCIENCE

Lobster body language

WHEN two lobsters are put together in a tank they become aggressive, lock claws, push and shove, and engage in other "fighting" behaviors until one of the two (the larger one) emerges as dominant. This individual remains dominant as long as they are together or until one of them molts. The "standing tall" posture of the dominant lobster—it moves on the tips of its walking legs with claws open in front and abdomen tucked downward—can be elicited by injecting a freely moving lobster with the hormone serotonin; the crouching posture of the subordinate lobster can be induced by injecting the hormone octopamine. These amines appear to prime the lobster's nervous system, bringing it from one stable state to a second one that can respond quickly when an appropriate stimulus comes along. What is known of where and how these hormones act in the nervous system to influence behavior in the lobster model and also in other invertebrate and vertebrate models are the subjects of Kravitz's review (page 1775).

Solar corona

IN the solar corona there are magnetically confined loops of hot plasma, polar holes devoid of closed magnetic structures in which hot plasma might be confined, loops of cool dense gas embedded in hotter coronal gas, plumes and streamers marking the interface with the solar wind, and other interesting substructures. Some of these features of the corona, described by Walker *et al.*, were captured in images obtained with a normal-incidence Cassegrain multilayer telescope (page 1781). Evaluated in conjunction with observations made in other spectral regions, these images illustrate how the structure of the plasma varies with temperature and how magnetic fields help to shape the plasma. The telescope flew on a sounding rocket launched in 1987. Recordings were made in a narrow band in the soft x-ray to extreme ultraviolet region of the spectrum, one that

corresponds to solar emissions at temperatures of 0.8×10^6 to 1.4×10^6 K. The multilayer optics provided images that were of both high spatial resolution (expected in the near future to achieve 0.1 arc second) and high spectral resolution (the surfaces are reflective only in a certain bandpass and therefore can isolate a particular emission line); such images could not be made with earlier x-ray telescope designs.

Atomic resolution in multilayer structures

THE precise locations of heavy atoms in ultrathin layered structures called Langmuir-Blodgett trilayer films, the spacing between the layers, and the widths of individual layers have been determined at the sub-angstrom level with a new x-ray technique (page 1788). Bedzyk *et al.* explain how the long-period x-ray standing waves are generated with x-ray beams, how the fluorescence of heavy atoms—in this case cadmium and zinc—is monitored as the standing wave passes through the material, and how precise information on the position of the atoms in the layers is obtained from the raw fluorescence data. When the temperature of the layer was changed, the atomic structure of the multilayer underwent a corresponding change that could be mapped with the x-ray technique. Langmuir-Blodgett films have served in a number of previous studies as proxies of biologic membranes; they are expected to have many direct applications in electronics, optics, biosensing, energy conservation, and other fields.

Neurologic disease of beef cattle

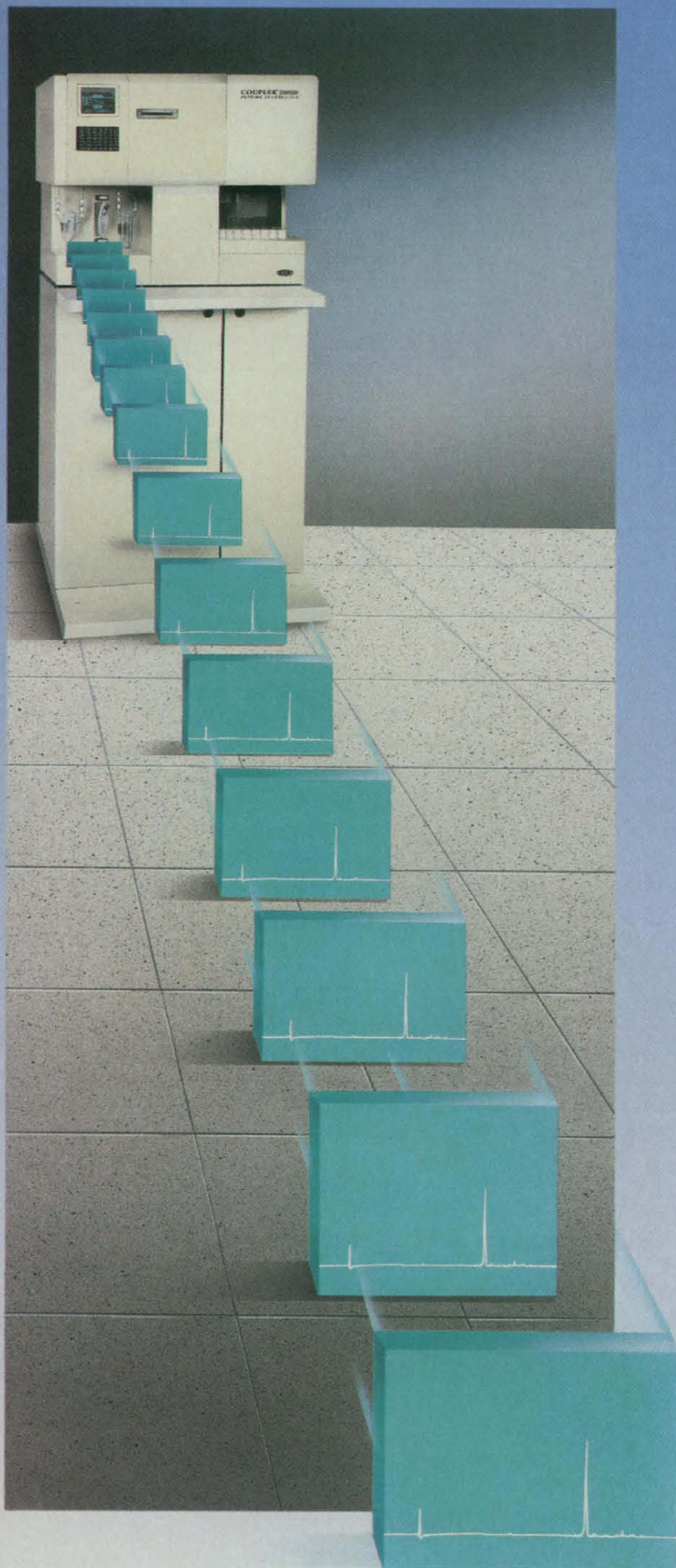
THE biochemical basis of a fatal disease of Poll Hereford calves has been determined (page 1807). Cattle that have inherited congenital myoclonus are hypersensitive to tactile, visual, and auditory stimuli; in response to such stimuli, or even without stimulation, they show uncon-

trolled jerking, muscle spasms, and convulsions; thus, they cannot stand or eat and consequently do not survive very long. Gundlach *et al.* show that the spinal cord membranes of affected animals lack or have defects in receptors for the amino acid glycine. The receptors normally take up glycine, and when this occurs neurotransmission is damped. In the affected animals, neurotransmission goes on unchecked because glycine is not absorbed postsynaptically; there is, however, compensatory uptake of glycine by receptors associated with nerve axons. These cattle are in many ways similar to *spastic* mutant mice, and both should be of value in providing information on how nervous system receptors function.

Improved transplantation options

THE success of a kidney transplant or of other organ transplants depends on finding a donor organ that the recipient can tolerate. The best match is one in which the major histocompatibility complex antigens, called HLA antigens, match perfectly between donor and recipient, but, because such matches are not always available, kidneys that have "permissible mismatches" with the tissues of the host are often sought. Claas *et al.* report that among a group of patients who had received numerous blood transfusions and were sensitized as a result of the transfusions to a variety of "non-self" HLA antigens (and thus would not be able to tolerate kidneys expressing these antigens), a common permissible mismatch was one in which the kidney expressed those HLA antigens of the patient's mother that the patient had not inherited (page 1815). Eighty-five percent of such kidneys, when transplanted into a recipient, were still functional after 1 year. These results provide evidence that humans, like mice, may develop a lifelong tolerance to antigens that they are exposed to in utero or at birth. The finding should facilitate transplantation for multiply transfused patients by expanding for them the pool of acceptable grafts.

Du Pont introduces the COUPLER® 2200 for unmatched efficiency and accuracy in peptide synthesis.



You can count on the COUPLER® 2200 peptide synthesizer to deliver consistent, reproducible results, through flexible, easy-to-use computer software. For optimum coupling, you have the choice of using either protocols of your own design or those already selected by the Integrated Synthesis Logic (ISL) system. For both BOC and Fmoc chemistries.

Flexible

All protocols are stored on a 3.5 inch diskette. This feature makes it easy to add protocol improvements coming from your own laboratory or from Du Pont's continuing synthesis research. You can also choose between 0.5mM or 2.0mM scales of synthesis to meet your research needs.

Fully automated

The onboard computer software works with prepackaged, protected amino acids (Du Pont's COUPLER-PAKS), the X-Y robotic arm liquid handling system, and specialized solvents to automatically and reproducibly construct your chosen peptide sequence. Printed status reports of synthesis directions and parameters for each operational step help you document every synthesis.

Easy to use

Whether you are experienced in solid phase synthesis or just need peptides for your research program, you will find the COUPLER® 2200 convenient and easy to operate. Fail safe systems are part of the COUPLER® 2200 design. For example, once the amino acid sample packs are loaded into the instrument, a robotic arm "scans" the rack to verify that all amino acids needed to synthesize your peptide are in place.

Option

If you're looking for lower cost, semiautomated synthesizers, Du Pont also produces the COUPLER® 1000 and 250.

For more information, in the United States call 1-800-551-2121. In Canada, call 1-800-387-2179. Or write Du Pont Company, Biotechnology Systems Division, BRML, G-50986, Wilmington, DE 19898.

**Working Knowledge
in Biotechnology**



Circle No. 3 on Readers' Service Card

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: Alvin W. Trivelpiece

Editor: Daniel E. Koshland, Jr.

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

EDITORIAL STAFF

Managing Editor: Patricia A. Morgan

Assistant Managing Editor: Nancy J. Hartnagel

Senior Editors: Eleanore Butz, Ruth Kulstad

Associate Editors: Martha Coleman, R. Brooks Hanson, Barbara Jasny, Katrina L. Kelnner, Edith Meyers, Linda J. Miller, Phillip D. Szuroni, David F. Voss

Letters Editor: Christine Gilbert

Book Reviews: Katherine Livingston, *editor*; Deborah Field Washburn

This Week in Science: Ruth Levy Guyer

Contributing Editor: Lawrence I. Grossman

Chief Production Editor: Ellen E. Murphy

Editing Department: Lois Schmitt, *head*; Mary McDaniel, Patricia L. Moe, Barbara E. Patterson

Copy Desk: Jol S. Granger, Beverly Shields, Anna Victoreen, Barbara Wittig

Production Manager: Karen Schools Colson

Assistant Production Manager: James Landry

Graphics and Production: Holly Bishop, James J. Olivari, Yolanda M. Rook

Covers Editor: Grayce Finger

Manuscript Systems Analyst: William Carter

NEWS STAFF

News Editor: Barbara J. Culliton

Deputy News Editors: Roger Lewin, Colin Norman

News and Comment/Research News: Deborah M. Barnes, William Booth, Gregory Byrne, Mark H. Crawford, Constance Holden, Richard A. Kerr, Eliot Marshall, Jean L. Marx, Robert Pool, Leslie Roberts, Marjorie Sun, M. Mitchell Waldrop, John Walsh

European Correspondent: David Dickson

BUSINESS STAFF

Business Staff Manager: Deborah Rivera-Wienhold

Classified Advertising Supervisor: Karen Morgenstern

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

Traffic Manager: Donna Rivera

Traffic Manager (Recruitment): Gwen Canter

Advertising Sales Manager: Richard L. Charles

Employment Sales Manager: Edward C. Keller

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 60194: Jack Ryan, 525 W. Higgins Rd. (312-885-8675); 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); Damascus, MD 20872: Rick Sommer, 24808 Shrubbery Hill Ct. (301-972-9270); U.K., Europe: Nick Jones, +44(0647)52918; Telex 42513; FAX (0647) 52053.

Information for contributors appears on page XI of the 30 September 1988 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, New York, NY 10036. Telephone 212-730-1050 or WU Telex 968082 SCHERAGO, or FAX 212-382-3725.

Fetal Tissue in Research

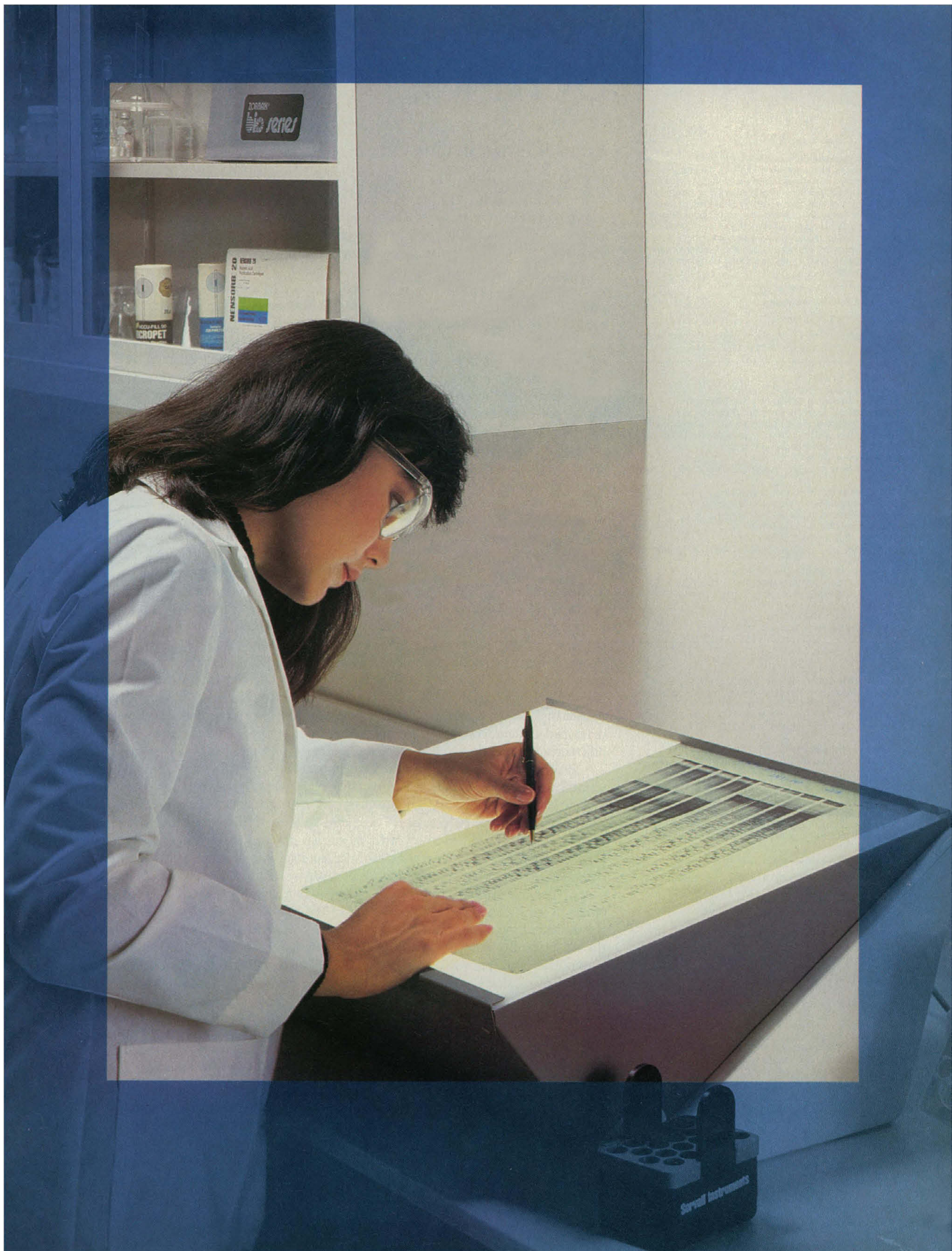
There is an element of nostalgia in many of the current attacks on research, a vague wish for a simpler era in which further scientific advances are not needed. The antivivisectionists in the 1800s said that research had gone far enough. Few take such an extreme stand now, but there is a wistful questioning. "What if we could do research without animals? What if we could do research that was never applied to weapons? What if we could do research with no toxic side products?" The list of "what if's" is endless. And scientists have their own nostalgia. What if we could be allowed to do our research without getting embroiled in moral and political issues? None of these "what if's" will be realized because each addresses part of a problem without examining it in its entirety.

The issue of fetal research was in the forefront of the news last week because it was the subject of a soul-searching debate, the focus of a possible executive order, and the source of a scientific breakthrough. To some it is a simple issue: fetal tissue is discarded tissue that cannot live on its own, cannot do the mother any good, and might provide us with research knowledge or medical therapy. Organs are donated from living people; blood is provided at request; placentas are routinely used for studies in medicine. Why should there be any particularly emotional response to discarded fetal tissue? The answer is that the most useful and appropriate fetal tissue is that from induced abortion, and the issue of induced abortion is highly controversial. Scientists, like all other citizens, have a right to political opinions on the controversy, but there is a big stake in making certain that the scientific aspects are separated from the political ones.

The importance of fetal tissue has already been demonstrated. The use of this material in therapy for certain kinds of neurological diseases has had some encouraging results in animals and some mixed results in humans. The incorporation of human fetal tissue into a mouse, reported in *Science* last week (see J. M. McCune *et al.*, page 1632), offers an opportunity of untold dimension for study of the development of the human immune system and for possible therapy in specific human diseases, such as AIDS. The alternative animal model in that case involves infection of chimpanzees, primates whose use creates emotional responses also, and they are a species that is endangered. Other applications of fetal tissue are for therapy against infectious diseases and in diabetes, for patients receiving cancer chemotherapy at levels that wipe out the bone marrow, and for bone marrow transplants in preparation for other organ transplants. To the nonscientist, fetal tissue may seem like any other, but fetal cells are less developed and are more malleable and willing to grow than mature cells. Mature cells are too differentiated to be useful in many circumstances.

Prohibition of use of such a major new means to prevent and alleviate suffering seems unthinkable. And yet such a prohibition may come about if scientists are not sensitive to the inevitable consequences of such advances on moral precepts and social traditions that are centuries old. It will be crucial for scientists to make it clear that they do not intend to encourage induced abortion in order to supply material for research. Encouragement of abortion for the purpose of research is unacceptable. Scientists must take the stand that the decisions to live or die, decisions in such cases as abortion, brain-dead individuals on life support, or terminally ill individuals, are matters for decision based on political considerations in a complex society. Once the live or die decision has been made on these grounds, the decision to use tissue that would otherwise be discarded seems straightforward. Taking the kidney from a brain-dead victim of an automobile crash has not led scientists to encourage automobile accidents, and fetal tissue can be used without reference to the arguments surrounding induced abortion. There are some who will regard all such options around death as ghoulish. But to most individuals donation of organs to help others provides a touch of altruism and an intimation of immortality that mitigate the sting of death.

The nostalgia of those who long for a smaller and simpler world is romanticized to include only those features that the wisher advocates. What if we had all the advantages of modern civilization with one-tenth the people on the globe? A far better world, as long as I am one of those who survive. What if research had been stopped in the 1800s? We would have had no polyethylene or nuclear bombs or chlorinated insecticides, but we also would have had no penicillin, no vaccines, no television, and no central heating. The fetal research issue is one of many in which shouting about rights—the right to choice, the right to life, the right to do research—is not helpful. A *modus vivendi* in which progress is ensured and sensitivities are recognized is the only right way.—DANIEL E. KOSHLAND, JR.



Thousands of new and innovative NEN[®] Research Products have been released over the years. Expect more than 100 this year alone!

We have an unmatched history of providing the scientific community with new tools to meet current research challenges. Last year, for example, we increased our line of AIDS-related research products to more than 50. This includes the new HIV structural core protein to be quantified in infected samples, and several novel HIV, DNA, and RNA probes.

NEN[®] Research Products from DuPont include a complete line of ³²P, ³⁵S, ³H, and ¹²⁵I nucleotides; the NENSORB[™] Prep Nucleic Acid Purification Cartridge; probes for infectious disease and molecular genetics research; GeneScreen[™] and GeneScreenPlus[™] nylon transfer membranes and the new line of NitroScreen[™] supported nitrocellulose; CRONEX[®] Lightening Plus Intensifying Screens; NEN-TRAC[™] microspheres; a wide selection of liquid scintillation and autoradiography detection products; in all, thousands of labeled and non-labeled products.

In addition, DuPont offers complementary products to help you meet new demands in the areas of your research: SORVALL[®] centrifuges, CODER[®] and COUPLER[®] DNA and peptide synthesizers, ZORBAX[®] Bio Series chromatography columns and the revolutionary GENESIS[™] 2000 DNA analysis system. Call us. You can talk directly with technical specialists and scientists who can help you with your special applications.

Access DuPont's "Working Knowledge" for faster results—call 1-800-551-2121. In Canada call 1-800-387-2179. In Europe call W. Germany 69-2195-561. Or write: DuPont Company, Biotechnology Systems, BRML, G-50953, Wilmington, DE 19898.

**Working Knowledge
in Biotechnology**



Circle No. 5 on Readers' Service Card



Span the separation spectrum
ultraspeed in one centrifuge—the new



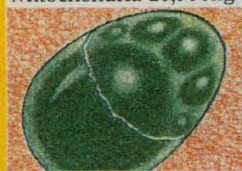
from superspeed to low-end SORVALL® RC-28S *SUPRA*speed™!



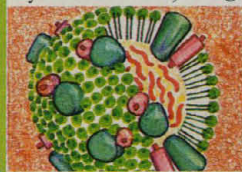
Nucleus 1000xg



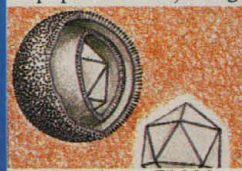
Mitochondria 20,000xg



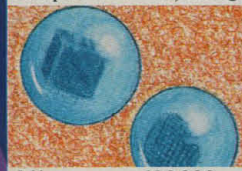
Lysosomes 30,000xg



Lipoprotein 72,000xg



Herpes virus 75,000xg



Microsomes 100,000xg



Cytosol 100,000xg

This new *SUPRA*speed™ centrifuge is in a class by itself. It sets new standards in versatility, economy, ease of operation and safety:

VERSATILITY: A SPECTRUM OF APPLICATIONS

Instead of using both a superspeed and an ultraspeed centrifuge for multi-step separations, now you can run a spectrum of isolations in one instrument—the RC-28S. A top force of 100,000 x g makes the SORVALL® RC-28S the most efficient instrument for antibody, DNA/RNA, enzyme, protein, lipoprotein, membrane separations, virus isolations, and much more. That's versatility.

ECONOMY: A SPECTRUM OF ROTORS

You can use all SORVALL® superspeed rotors from your existing inventory in the RC-28S. Or, select from a wide range of economical new SORVALL® fixed angle and swinging bucket *SUPRA*speed rotors. Free up your ultraspeed centrifuge for the longer, higher g-force work it was designed for by running your low-end ultra separations in the RC-28S. Ultraspeed separations at *SUPRA*speed prices. That's economy.

EASE OF OPERATION: A SPECTRUM OF CONVENIENCES

Everything on the RC-28S has been designed for user convenience—from the new automatic rotor recognition system that sets optimum run conditions, to the 2x40 LCD display with multiple programming, RCF, and diagnostic messages. No more rotor codes to remember and enter, no more concern about proper seating of the rotor... the RC-28S takes care of it all. That's convenience.

SAFETY: A SPECTRUM OF PROTECTION BENEFITS

Because the sophisticated rotor recognition system of the RC-28S prevents any overspeed condition, your personnel and your capital investments are provided an extra measure of safety. Also, because the RC-28S can automatically enter optimum temperature, speed and acceleration/deceleration conditions, protection for your precious samples is assured. That's safety.

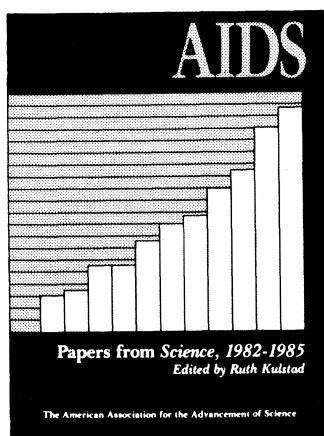
The SORVALL® RC-28S—one more example of how the benefits of Du Pont's "Working Knowledge" can be put to use in your lab. Count on Du Pont to meet all your biotechnology needs for: AIDS Related Research Products; CODER®/COUPLER® Synthesizers; GENESIS™ 2000 DNA Analysis System; Instrument Service; MAGNISORT™ Separation Products; NEN® Research Products; SORVALL® Centrifuges; ZORBAX® Separation Products.

For a copy of our 12-page RC-28S brochure, call 1-800-551-2121. In Canada, call 1-800-387-2179. In Europe (W. Germany): 69-2195-561. Or write Du Pont Company, Biotechnology Systems, BRML, G-50950, Wilmington, DE 19898.

**Working Knowledge
in Biotechnology**



Circle No. 4 on Readers' Service Card



A One-Volume Library of Essential AIDS Research

AIDS: Papers from Science, 1982-1985 Edited by Ruth Kulstad

Some of the most frequently cited papers on acquired immune deficiency syndrome (AIDS) that appeared in *Science* between August 1982 and September 1985 are included in this volume. Arranged chronologically, these 108 research papers and *Science* news reports show how far AIDS research has come and provide an indication of the directions in which it might go. This fully indexed collection is useful not only for the experimental data and conclusions, but also as an excellent source of references to AIDS work in other major journals worldwide.

An overview of research in AIDS to date is provided in the introduction by Dr. Myron Essex, chairman of the Department of Cancer Biology, Harvard University School of Public Health.

654 pp.; fully indexed and illustrated
Hardcover \$32.95 (AAAS member price \$26.35)
Softcover \$19.95 (AAAS member price \$15.95)

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

American Association for the Advancement of Science

Yes! Please send me the following copies of *AIDS: Papers from Science, 1982-1985*:

_____ hardcover \$32.95 (AAAS member price \$26.35) \$ _____

_____ softcover \$19.95 (AAAS member price \$15.95) \$ _____

Postage and handling \$ 1.50

TOTAL \$ _____

☐ Check ☐ VISA ☐ MasterCard

_____ credit card number

_____ expiration date

_____ signature

Name _____

Street Address _____

City _____ State _____ Zip _____

AAAS member number (from *Science* mailing label) _____

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



DuPont: More products, more support for AIDS research

More than 50 AIDS-related products—with the sensitivity and specificity you need for fast, accurate results. And, a team of scientists ready to help.

- **NEW, IMPROVED HIV p24 Core Antigen ELISA Kit** offers more sensitivity and maximum specificity to detect and quantify HIV structural core protein in infected culture samples as well as serum/plasma with no cross-reactivity to other human or viral proteins.
- **Purified HIV Oligonucleotide, DNA and RNA Probes** eliminate time-consuming preparation procedures. For *in situ* hybridizations and blot studies of the HIV virus. Superior sensitivity (1×10^5 copies of target DNA or 500-1000 infected H-9 cells detected in a 24-hour development) and negligible cross-reactivity with non-HIV DNA (usually less than one percent) ensure rapid, dependable results.
- **HIV Antibody ELISA Kits** with 99.3% sensitivity, 99.7% specificity. No sample predilution needed. Uses microplates for high throughput. Removable strip wells make processing of partial plates cost-effective.
- **HIV Western Blot Kit** uses a Biotin-Avidin system for enhanced signal amplification. A conjugate of Biotin-labeled goat anti-IgG binds readily to antigen-antibody complexes. An HRP-labeled Avidin substrate, with its exceptionally high affinity for Biotin, "tags" these complexes.
- **HIV Monoclonal Antibodies** to p17, p24, gp41, gp120, and 3'ORF. Suitable for Western Blots, direct or indirect Immunofluorescence, Immunocytochemistry, and Viral Capture assays.

Other virus-specific ELISA Kits, nucleic acid probes and monoclonal antibody products are available for HTLV-1, CMV, EBV, HSV, and HBV. Each brings to your research the benefit of state-of-the-art technology.

These AIDS-related products are among more than 2000 provided by Du Pont to assist you in molecular genetics, protein and virus research. Access Du Pont's AIDS-Related Research Team at 1-800-551-2121. In Canada, call 1-800-387-2179. Or write: Du Pont Company, Biotechnology Systems, BRML, G-50952, Wilmington, DE 19898.

Working Knowledge
in Biotechnology



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

Circle No. 6 on Readers' Service Card

*From our local star to the ends
of the universe*

ASTRONOMY & ASTROPHYSICS

This volume contains 24 articles published in *Science* between 1982–84, ranging from the solar system to the pulsars at the very edge of the observable universe. Research techniques and instruments described cover such diverse topics as proton decay, the Very Large Array, and the planned Space Station as a platform for future experiments.

Each article is self-contained, yet as a whole, the volume reveals a broad, coherent, and contemporary picture of our astronomical universe. Selected for their depth of coverage and breadth of topics by Morton S. Roberts, past Director of the National Radio Astronomy Observatory, these articles are of interest to the entire scientific community.

Contents

I. SOLAR SYSTEM

Sun's Influence on Earth's Atmosphere and Interplanetary Space, *J.V. Evans*
Solar Flares, Proton Showers, and Space Shuttle, *D.M. Rust*
Cosmic-Ray Record in Solar System Matter, *R.C. Reedy, J.R. Arnold, D. Lal*
Ultraviolet Spectroscopy and Composition of Cometary Ice, *P.D. Feldman*

II. STRUCTURE AND CONTENT OF THE GALAXY

New Milky Way, *L. Blitz, M. Fich, S. Kulkarni*
Most Luminous Stars, *R.M. Humphreys and K. Davidson*
Chromospheres, Transition Regions, and Coronas, *E. Böhm-Vitense*
Interstellar Matter and Chemical Evolution, *M. Peimbert, A. Serrano, S. Torres-Peimbert*
Formation of Stellar Systems from Interstellar Molecular Clouds, *R.D. Gehrz, D.C. Black, P.M. Solomon*
Binary Stars, *B. Paczyński*

Dynamics of Globular Clusters, *L. Spitzer, Jr.*
Magnetic Activity of Sunlike Stars, *A.H. Vaughan*
Stars, Their Evolution and Stability, *S. Chandrasekhar*

III. GALAXIES AND COSMOLOGY

Most Distant Known Galaxies, *R.G. Kron*
Galactic Evolution...*K.M. Strom and S.E. Strom*
Rotation of Spiral Galaxies, *V.C. Rubin*
Quasars and Gravitational Lenses, *E.L. Turner*
Windows on a New Cosmology, *G. Lake*
Origin of Galaxies and Clusters...*P.J.E. Peebles*
Jets in Extragalactic Radio Sources, *D.S. DeYoung*
Quest for Origin of Elements, *W.A. Fowler*
Dark Night-Sky Riddle...*E.R. Harrison*

IV. INSTRUMENTATION

Radio Astronomy with Very Large Array, *R.M. Hjellming and R.C. Bignell*
Space Research in the Era of the Space Station, *K.J. Frost and F.B. McDonald*

400pp., fully indexed and illustrated; color plates

Hardcover \$29.95, AAAS member price \$23.95 ISBN 0-87168-311-3
Softcover \$17.95, AAAS member price \$14.35 ISBN 0-87168-275-3

Order from Sales Department, Box AA, AAAS, 1333 H Street, NW, Washington, DC 20005. Add \$1.50 postage and handling per order; allow 4-6 weeks for delivery.

Information for Contributors

THE EDITORS OF *SCIENCE*

Manuscripts should be addressed to the Editor, *Science*, 1333 H Street, NW, Washington, DC 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 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.

In addition, include with your manuscript:

- (i) any paper of yours that is in press or under consideration elsewhere and includes information that would be helpful in evaluating the work submitted to *Science*;
- (ii) written permission from any author whose work is cited as a personal communication, unpublished work, or work in press but is not an author of your manuscript;
- (iii) for review of manuscripts based on crystallographic data, two copies of the coordinates.

It is assumed that all those listed as authors of a work have agreed to be so listed, have seen and approved the manuscript, and are responsible for its content.

Before being reviewed in depth, most papers are rated for their interest and overall suitability by a member of the Board of Reviewing Editors. Papers submitted in disciplines for which there is no appropriate member of the Board of Reviewing Editors may be screened by editorial staff members in consultation with outside experts. Papers that are not highly rated are returned to the authors within about 2 weeks; the title page and abstract from one copy are retained for our files. The others are reviewed in depth by two or more outside referees. Authors are

notified of acceptance, rejection, or need for revision, usually within 6 to 10 weeks. Papers cannot be resubmitted, either after initial screening or after in-depth review.

Conditions of Acceptance

When a paper is accepted for publication in *Science*, it is understood by the editors that (i) any materials and methods necessary to verify the conclusions of the experiments reported will be made available to other investigators under appropriate conditions; (ii) sequence and crystallographic data will be offered for deposit to the appropriate data bank; and (iii) the paper will remain a privileged document and will not be released to the press or the public before publication. If there is a need in exceptional cases to publicize data 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.

Accepted papers 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 for approval and retyping before the type is set.

Categories of signed papers include: general articles, research articles, reports, letters, technical comments, book and software reviews, perspectives, and policy forums.

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) de-

scribe a current research problem or a technique of interdisciplinary significance; or (iii) discuss some aspect of the history, logic, policy, or administration of science. 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, but unsolicited articles are welcome. Both solicited and unsolicited articles undergo review.

General articles should include a note giving the authors' names, titles, and addresses; a summary (50 to 100 words); an introduction that outlines for the general reader the main point of the article; and brief subheadings to indicate the main ideas. The reference list should not be exhaustive; a maximum of 50 references is suggested. Figures and tables should occupy no more than one printed page.

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. A maximum of 40 references is suggested. Figures and tables together should occupy no more than one printed page.

Reports. Reports (up to 2000 words) are expected to contain important research results. They should include an abstract (no more than 100 words) and an introductory paragraph. A maximum of 30 references is suggested. Figures and tables together with their legends should occupy no more than one 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 paper in question is usually given an opportunity to reply.

All letters are acknowledged by postcard; authors are notified if 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 comments (up to 500 words) may criticize articles or reports published in *Science* within the previous 6 months or may offer useful additional information. Minor issues should

be resolved by private correspondence. The authors of the original paper are asked for an opinion of the comment and are given an opportunity to reply in the same issue if the comment is published. The comments, and sometimes the reply, are subject to the usual review procedures. Priority disputes undergo extensive review and are published only when action is recommended.

Book and Software Reviews. The selection of books and software packages to be reviewed and of reviewers is made by the editors. Instructions and length specifications accompany items to be reviewed 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 80 characters and spaces; for research articles and reports the maximum is 100 characters.

Summaries or abstracts. These should include a sentence or two explaining to the general reader why the research was undertaken and why the results should be viewed as important. The abstract should convey the main point of the paper and outline the results or conclusions.

Text. A brief introduction should indicate the broad significance of the paper. The whole text should be intelligible to readers in different disciplines. Technical terms should be defined. All tables and figures should be cited in the text in numerical order.

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

Units of measure. Use metric units. If measurements were made in English units, give metric equivalents.

References and notes. Number references and notes in the order in which they are cited, first through the text and then through the table and figure legends. List a

reference only one time. References that are *always* cited together may be grouped under a single number. 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. See issues of the journal for examples.

Unpublished observations. Reference to unpublished data should be given a number in the text and placed, in correct sequence, in the references and notes.

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.

Animal welfare. Authors using experimental animals must state that their care was in accordance with institutional guidelines. For animals subjected to invasive procedures, the anesthetic, analgesic, and tranquilizing agents used, as well as the amounts and frequency of administration, must be stated.

Figures. For each figure submit three high-quality glossy prints or original drawings of sufficient size to permit relettering but not larger than 22 by 28 centimeters (8½ by 11 inches). On the back of every figure write the first author's name and the figure number and indicate the correct orientation. *Manuscripts with oversized figures will be returned to the author without review.* Photocopies of figures are not acceptable; transparencies, slides, or negatives cannot be used because they cannot be sent to reviewers.

On acceptance of a paper, authors requesting the use of color will be asked to supply slides or negatives of the color artwork and to pay \$600 for the first color figure or figure part and \$300 for each additional figure or figure part as a contribution toward printing costs.

Illustrations reprinted from other publications must be credited. It is the author's responsibility to obtain permission to re-

print 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.

Uncertainties and reproducibility. Evidence that the results are reproducible and the conditions under which this reproducibility (replication) was obtained should be explicitly stated. The effect of limitations in experimental conditions on generalizability of results should be discussed. Uncertainties should be stated in terms of variation expected in independent repetitions of the experiments; they should include an allowance for possible systematic error arising from inadequacies in the assumed model and other known sources of possible bias. Probabilities from statistical tests of significance should be subordinated to the reporting of results and associated uncertainties.

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. Papers with tables or figures that present problems in layout, or with color figures or cover pictures, or that exceed the length limits may be subject to delay.

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.