

1443 This Week in *Science*

Editorial

1445 Nature, Nurture, and Behavior

Letters

1447 Accuracy and Truth: R. R. WHITE; D. E. KOSHLAND, JR. ■ Universe Creation: H. TOPOFF ■ Basic Research Funding: J. PRATT ■ Vietnam Report: M. J. LEVY, JR.; S. P. HUNTINGTON

Perspective

1450 A New Agricultural Frontier: P. H. ABELSON AND J. W. ROWE

News & Comment

1452 Chemical Weapons Pact Edging Closer

1453 Politics of the Genome

1454 Genentech Sues FDA on Growth Hormone

1455 The Vatican Weighs In

1456 Soviet Union Accused of Treaty Violations ■ Denmark OK's Radar ■ When Nunn Speaks. . .

1458 NSF Goes to Congress with Plans for Growth

1459 California's Debate on Carcinogens
Textbook Ruling Sparks Concern

Research News

1460 Man and Machine Forecast Big Snow

1461 Supernova Neutrinos at IMB

1462 Imminent Marketing of AZT Raises Problems
Marrow Suppression Hampers AZT Use in AIDS Victims

1464 Mathematical Model Predicts AIDS Spread

1465 Life Thrives Under Breaking Ocean Waves

Articles

1467 Impending United States Energy Crisis: R. L. HIRSCH

1473 Chemical Reactions on Clays: P. LASZLO

1478 Model Studies in Molecular Recognition: J. REBEK, JR.

Reports

1485 Two Gamma-Ray Sources and Ancient Guest Stars: Z.-R. WANG

1486 Post-Transcriptional Control of Class I MHC mRNA Expression in Adenovirus 12-Transformed Cells: R. T. M. J. VAESSEN, A. HOUWELING, A. J. VAN DER EB

■ **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*® Copyright © 1987 by the American Association for the Advancement of Science. The title SCIENCE is a registered trademark of the AAAS. Domestic individual membership and subscription (51 issues): \$65. Domestic institutional subscription (51 issues): \$98. Foreign postage extra: Canada \$32, other (surface mail) \$27, air-surface via Amsterdam \$65. First class, airmail, school-year, and student rates on request. Single copies \$2.50 (\$3 by mail); back issues \$4 (\$4.50 by mail); Biotechnology issue, \$5.50 (\$6 by mail); classroom rates on request; Guide to Biotechnology Products and Instruments \$16 (\$17 by mail). **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$1 per copy plus \$0.10 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 \$1 + .10. **Postmaster:** Send Form 3579 to *Science*, 1333 H Street, NW, Washington, DC 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

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



COVER Domains of a synthetic molecular cleft. Regions of high polarity (red and blue) in the lining of the cleft combine with hydrophobic methyl groups (yellow) and an aromatic acridine nucleus (green). These domains provide surfaces for binding smaller molecules of complementary size, shape, and functionality in studies of molecular recognition. See page 1478. [W. C. Still, University of Pittsburgh, Pittsburgh, PA 15260]

- 1489 Molecular Cloning and Expression of a Human B-Cell Growth Factor Gene in *Escherichia coli*: S. SHARMA, S. MEHTA, J. MORGAN, A. MAIZEL
- 1492 Elevated Levels of Glucose Transport and Transporter Messenger RNA Are Induced by *ras* or *src* Oncogenes: J. S. FLIER, M. M. MUECKLER, P. USHER, H. F. LODISH
- 1495 Transformation of Rat Fibroblasts by FSV Rapidly Increases Glucose Transporter Gene Transcription: M. J. BIRNBAUM, H. C. HASPEL, O. M. ROSEN
- 1498 The Immunoglobulin Octanucleotide: Independent Activity and Selective Interaction with Enhancers: T. G. PARLOW, S. D. JONES, B. BOND, K. R. YAMAMOTO
- 1501 Characterization and Clinical Association of Antibody Inhibitory to HIV Reverse Transcriptase Activity: J. LAURENCE, A. SAUNDERS, J. KULKOSKY
- 1504 Human CSF-1: Molecular Cloning and Expression of 4-kb cDNA Encoding the Human Urinary Protein: G. G. WONG, P. A. TEMPLE, A. C. LEARY, J. S. WITEK-GIANNOTTI, Y.-C. YANG, A. B. CIARLETTA, M. CHUNG *et al.*
- 1509 Vertical Distribution of an Estuarine Snail Altered by a Parasite: L. A. CURTIS
- 1511 F-Actin and Microtubule Suspensions as Indeterminate Fluids: R. E. BUXBAUM, T. DENNERLL, S. WEISS, S. R. HEIDEMANN
- 1514 Two Mammalian Genes Transcribed from Opposite Strands of the Same DNA Locus: J. P. ADELMAN, C. T. BOND, J. DOUGLASS, E. HERBERT
- 1517 Optical Trapping and Manipulation of Viruses and Bacteria: A. ASHKIN AND J. M. DZIEDZIC

Book Reviews

- 1521 The Therapeutic Perspective *reviewed by* M. S. PERNICK ■ The Murals of Bonampak, C. C. COGGINS ■ Wave Interactions and Fluid Flows, T. R. AKYLAS ■ On the Economy of Plant Form and Function, J. A. TEERI ■ Books Received

Products & Materials

- 1525 Four Restriction Enzymes ■ FORTRAN Graphics Library ■ Publication-Quality Computer Graphics ■ Eye Wash Station ■ Software for Data Collection ■ Pharmacokinetic Analysis Software ■ Literature

Board of Directors

Lawrence Bogorad
*Retiring President,
Chairman*

Sheila E. Widnall
President

Walter E. Massey
President-elect

Robert McC. Adams
Floyd E. Bloom
Mary E. Clutter
Mildred S. Dresselhaus
Beatrix A. Hamburg
Donald N. Langenberg
Frank von Hippel
Linda S. Wilson

William T. Golden
Treasurer

William D. Carey
Executive Officer

Editorial Board

Elizabeth E. Bailey
David Baltimore
William F. Brinkman
Philip E. Converse
Joseph L. Goldstein
James D. Idol, Jr.
Leon Knopoff
Seymour Lipset
Oliver E. Nelson
David V. Ragone
David M. Raup
Vera C. Rubin
Larry L. Smarr
Solomon H. Snyder
Robert M. Solow
James D. Watson

Board of Reviewing Editors

John Abelson
Qais Al-Awqati
James P. Allison
Don L. Anderson
Elizabeth H. Blackburn
Floyd E. Bloom
Charles R. Cantor
James H. Clark
Bruce F. Eldridge
Stanley Falkow
Theodore H. Geballe
Roger I. M. Glass
Stephen P. Goff
Robert B. Goldberg

Corey S. Goodman
Stephen J. Gould
Richard M. Held
Gloria Heppner
Eric F. Johnson
Konrad B. Krauskopf
I. Robert Lehman
Karl L. Magleby
Joseph B. Martin
John C. McGiff
Alton Meister
Mortimer Mishkin
Peter Olson
Gordon H. Orians
John S. Pearce

Yeshayau Pocker
Jean Paul Revel
James E. Rothman
Thomas C. Schelling
Ronald H. Schwartz
Stephen M. Schwartz
Otto T. Solbrig
Robert T. N. Tjian
Virginia Trimble
Geerat J. Vermeij
Martin G. Weigert
Harold Weintraub
Irving L. Weissman
George M. Whitesides
Owen N. Witte
William B. Wood

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*)

EDITORIAL STAFF

Managing Editor: Patricia A. Morgan

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

Senior Editors: Eleanore Butz, Ruth Kulstad

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

Letters Editor: Christine Gilbert

Book Reviews: Katherine Livingston, *editor*; Deborah F. Washburn

This Week in Science: Ruth Levy Guyer

Chief Production Editor: Ellen E. Murphy

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

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

Production Manager: Karen Schools

Graphics and Production: Holly Bishop, Kathleen Cosimano, Eleanor Warner

Covers Editor: Grayce Finger

Manuscript Systems Analyst: William Carter

NEWS STAFF

News Editor: Barbara J. Culliton

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

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

European Correspondent: David Dickson

BUSINESS STAFF

Associate Publisher: William M. Miller, III

Business Staff Manager: Deborah Rivera-Wienhold

Membership Recruitment: Gwendolyn Huddle

Member and Subscription Records: Ann Ragland

Guide to Biotechnology Products and Instruments: Shauna S. Roberts

ADVERTISING REPRESENTATIVES

Director: Earl J. Scherago

Production Manager: Donna Rivera

Advertising Sales Manager: Richard L. Charles

Marketing Manager: Herbert L. Burkland

Sales: New York, NY 10036: J. Kevin Henebry, 1515 Broadway (212-730-1050); Scotch Plains, NJ 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); Chicago, IL 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-337-4973); San Jose, CA 95112: Bob Brindley, 310 S. 16 St. (408-998-4690); Dorset, VT 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581); Damascus, MD 20872: Rick Sommer, 24808 Shrubbery Hill Ct. (301-972-9270); U.K., Europe: Nicholas Jones, +44(0647)52918.

Instructions for contributors appears on page xi of the 19 December 1986 issue. Editorial correspondence, including requests for permission to reprint and reprint orders, should be sent to 1333 H Street, NW, Washington, DC 20005. Telephone: 202-326-6500.

Advertising correspondence should be sent to Tenth Floor, 1515 Broadway, NY 10036. Telephone 212-730-1050 or WU Telex 968082 SCHERAGO.

Nature, Nurture, and Behavior

The recent reports of the chromosomal localization of genes related to Alzheimer's disease and manic depression are major discoveries that bring promise of help to those suffering from these dread mental illnesses. These advances also contribute important information to the continuing argument about the roles of nature and nurture in behavior.

Many of the news stories that accompanied the description of the manic-depressive gene mentioned this new discovery as a watershed in this traditional debate. Although the recent finding in manic depression is a major advance, it was not a surprise to those who have followed developments in neurobiology. Seymour Kety's classical study following parents and their adopted and biological children in Scandinavian countries provided evidence that schizophrenia has a hereditary component; he also provided a methodology that has been used to study other behavioral disorders. These studies, however, met with major resistance, not only from a large segment of the public but also from many scientists and doctors who maintained that such behavioral disorders must be due to stress.

In retrospect it is easy to ask how anyone could have doubted the mounting evidence. The brain is, after all, an organ, like the kidney, the heart, or the liver, and organs are known to fail because of hereditary factors as well as environmental ones. The answer is probably that to many people the brain is much more than an organ: it is the center of the poetry, the sophistication, the special qualities that make human beings an order of magnitude more complex than the closest related species. To believe that the brain is merely a series of chemical reactions is to denigrate free will, to remove humans from the responsibility for their actions, to eliminate the relation between sin and guilt. Moreover, the recent findings are just the beginning; many other behavioral characteristics have been analyzed by studies of adopted children and identical twins and by biochemical approaches. Those who dread complexity will try to reduce the new evidence to the old confrontation of extremes: chemistry versus free will, heredity versus environment, fate versus responsibility. In fact, the neurobiological evidence indicates that part of the brain is "hard-wired" in advance of birth and part is designed to be plastic and learn from experience.

The relation of nature and nurture in manic depression is probably typical of what we can expect to discover about other behavioral disorders. Some individuals who have normal genes become overwhelmed by adversity in their environment, sink into depression, and attempt suicide. At the other extreme, some who have loving parents, ideal schooling, and a stress-free life are overwhelmed by their internal chemistry and also succumb to depression and suicidal intentions. Still others are pushed into depression by stresses that are easily surmounted by individuals with different genetic components. Some of these people will be helped by drug therapy (in the manic-depressive case, lithium is a highly effective drug with minimal side effects). Some will be helped by counseling, and some by a combination of the two.

This picture may seem obvious to a scientist, but our judges, journalists, legislators, and philosophers have been slow to learn this lesson. When children do not behave, parents or schools must be at fault. If prisoners are not rehabilitated, prison programs must be inadequate. If suicides are not prevented, stress must be excessive. Equally simplistic is the contention that there is no crime, only disease; no guilt, only a bad combination of genes. The truth is that we are dealing with a very complex problem in which the structure of society and chemical therapy will play roles. Better schools, a better environment, better counseling, and better rehabilitation will help some individuals, but not all. Better drugs and genetic engineering will help others, but not all. It is not going to be easy for those without scientific training to cope with these complicated relationships even when all the factors are well understood. It will be even harder while the scientific research is still unfolding. However, the debate on nature and nurture in regard to behavior is basically over. Both are involved, and we are going to have to live with that complexity to make our society more humane for the individual and more civilized for the body politic.

—DANIEL E. KOSHLAND, JR.