

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*® Copyright © 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)<sub>n</sub>·d(A-G)<sub>n</sub>: 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  
Beatrix 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. Benkovic  
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 V. Vermeij  
Harold Weintraub  
Irving L. Weissman  
George M. Whitesides  
Owen N. Witte  
William B. Wood

**American Association for the Advancement of 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:** Joi 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. Oivari, Yolanda M. Root

**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. Burklund

**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. Mc Cune *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.