

607 This Week in *Science*

## Editorial

609 The Willingness to Risk Failure: H. T. SHAPIRO

## Letters

611 Bridges Committee Procedures: R. A. BRADSHAW, A. J. ADLER, F. CHYTIK, N. D. GOLDBERG, B. J. LITMAN ■ Metrification Oversold?: B. M. OLIVER ■ Minority Sciences?: A. R. PALMER

## News & Comment

614 Key Primate Research Institute Flounders  
617 Final Verdict on Science Budget: Not Bad at All  
618 How Geography Boosted DOE's Budget  
Slick Fix for Hubble Space Telescope?  
619 Does Medical Mystery Threaten Biotech?  
620 *Briefings*: Peer Review of Peer Review? ■ Women in Science Policy ■ Kyoto Laureates ■ Stanford Fights Back ■ Ecology Hero in Interior Department ■ Simulated Travel in Inner Spaces ■ NAS to Study Federal Environmental Role ■ EPA Flipflops on Smoking Critic

## Research News

622 Gerontology Research Comes of Age ■ A New Bestiary for Aging Research  
626 Putting Chaos to Work  
628 How African Are "Killer" Bees?  
Saturn Mission Backed, Europeans Relieved  
629 Materials Tips from Sea Urchins

## Perspective

632 Out on a Limb: Arthropod Origins: R. K. GROSBERG

## Articles

634 In Search of Methuselah: Estimating the Upper Limits to Human Longevity: S. J. OLSHANSKY, B. A. CARNES, C. CASSEL  
640 The Interdiffusion of Polymers: J. KLEIN

## Research Articles

646 A Thermodynamic Scale for the Helix-Forming Tendencies of the Commonly Occurring Amino Acids: K. T. O'NEIL AND W. F. DEGRADO  
651 Protein Splicing Converts the Yeast *TFP1* Gene Product to the 69-kD Subunit of the Vacuolar H<sup>+</sup>-Adenosine Triphosphatase: P. M. KANE, C. T. YAMASHIRO, D. F. WOLCZYK, N. NEFF, M. GOEBL, T. H. STEVENS

## Reports

658 Land Animals in the Silurian: Arachnids and Myriapods from Shropshire, England: A. J. JERAM, P. A. SELDEN, D. EDWARDS  
661 Hydroxyl Radical Photoproduction in the Sea and Its Potential Impact on Marine Processes: K. MOPPER AND X. ZHOU  
664 Intercalation of Sea Urchin Proteins in Calcite: Study of a Crystalline Composite Material: A. BERMAN, L. ADDADI, A. KVICK, L. LEISEROWITZ, M. NELSON, S. WEINER

■ **SCIENCE (ISSN 0036-8075)** 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, DC 20005. Second-class postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Copyright © 1990 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): \$80. Domestic institutional subscription (51 issues): \$150. Foreign postage extra: Canada \$46, other (surface mail) \$46, air mail via Amsterdam \$85. First class, airmail, school-year, and student rates on request. **Change of address:** allow 6 weeks, giving old and new addresses and 11-digit account number. **Postmaster:** Send change of address to *Science*, P.O. Box 1723, Riverton, NJ 08077. **Single copy sales:** Current issue, \$3.50; back issues, \$5.00; Biotechnology issue, \$6.00 (for postage and handling, add per copy \$0.50 U.S., \$1.00 all foreign); Guide to Biotechnology Products and Instruments, \$20 (for postage and handling add per copy \$1.00 U.S., \$1.50 Canada, \$2.00 other foreign). Bulk rates on request. **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, 27 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 \$1 + .10. *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 objectives 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, to advance education in science, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.



**COVER** The Virginia opossum on the cover comes from a long-lived population on Sapelo Island, Georgia, that is being used to study mammalian aging. New animal models are an important part of current gerontology research (see news stories on page 622). Research on aging processes is critical, because even cures for heart disease and cancer probably would have little effect on overall life expectancy (see article on page 634). [Photograph by David Scott]

- 667 The Origin of Crustacean Biramous Appendages and the Evolution of Arthropoda: M. J. EMERSON AND F. R. SCHRAM
- 669 Side Chain Contributions to the Stability of Alpha-Helical Structure in Peptides: P. C. LYU, M. I. LIFF, L. A. MARKY, N. R. KALLENBACH
- 673 Increased Activity of Calcium Leak Channels in Myotubes of Duchenne Human and *mdx* Mouse Origin: P. FONG, P. R. TURNER, W. F. DENETCLAW, R. A. STEINHARDT
- 676 An Unusual Form of Lipid Linkage to the CD45 Peptide: A. TAKEDA AND A. L. MAIZEL
- 679 Expression of Murine CD1 on Gastrointestinal Epithelium: P. A. BLEICHER, S. P. BALK, S. J. HAGEN, R. S. BLUMBERG, T. J. FLOTTE, C. TERHORST
- 682 Down-Regulation of LFA-1 Adhesion Receptors by *C-myc* Oncogene in Human B Lymphoblastoid Cells: G. INGHIRAMI, F. GRIGNANI, L. STERNAS, L. LOMBARDI, D. M. KNOWLES, R. DALLA-FAVERA
- 686 An Organ-Specific Differentiation Gene, *pha-1*, from *Caenorhabditis elegans*: H. SCHNABEL AND R. SCHNABEL
- 688 Changes in Sodium Channel Gating Produced by Point Mutations in a Cytoplasmic Linker: J. R. MOORMAN, G. E. KIRSCH, A. M. BROWN, R. H. JOHO
- 691 Behavioral Effects of Progesterone Associated with Rapid Modulation of Oxytocin Receptors: M. SCHUMACHER, H. COIRINI, D. W. PFAFF, B. S. MCEWEN

## Inside AAAS

- 695 Fang Lizhi Heads List of Plenary Speakers Set for 1991 AAAS Annual Meeting ■ AAAS Forum on School Science Convenes in Washington Next Week ■ Science Journalists Selected for Awards ■ New Photo Exhibit Examines Threatened Rainforest ■ Delegate Needed for Bangladesh Meeting ■ Resources Available on Education Issues ■ Workshop to Focus on Ethics, Values ■ How to Apply for the Minority Ethics and Values Workshop ■ Policy Changes Affect Back Issues ■ Member Donations Aid AAAS Efforts ■ AAAS Washington Fellowships Place Scientists, Engineers in Year-Long Assignments on Science, Diplomacy and Security

## Book Reviews

- 699 Science and the Soviet Social Order, *reviewed by*: J. BROOKS ■ The Chemical Industry in the USSR, R. W. CAMPBELL ■ Thirst and Sodium Appetite, J. T. FITZSIMONS ■ Supernovae, S. VAN DEN BERGH ■ Books Received

## Products & Materials

- 704 Cooling Block for Microcentrifuge Tubes ■ Microwave Sterilizers for Microbiological Media ■ Microprotein Analyzer ■ High- and Low-Temperature Chamber ■ Low-Volume Ultrafiltration Devices ■ Cleavable Peptide Kit ■ Kit for Rapid Isolation of Messenger RNA ■ Literature

### Board of Directors

Richard C. Atkinson  
*Retiring President,  
Chairman*

Donald N. Langenberg  
*President*

Leon M. Lederman  
*President-elect*

Mary Ellen Avery  
Francisco J. Ayala  
Eugene H. Cota-Robles  
Robert A. Frosch  
Joseph G. Gavin, Jr.  
John H. Gibbons  
Beatrice A. Hamburg  
Florence P. Haseitine  
William T. Golden  
*Treasurer*  
Richard S. Nicholson  
*Executive Officer*

### Editorial Board

Elizabeth E. Bailey  
David Baltimore  
William F. Brinkman  
E. Margaret Burbidge  
Pierre-Gilles de Gennes  
Joseph L. Goldstein  
Mary L. Good  
F. Clark Howell  
James D. Idol, Jr.  
Leon Knopoff  
Oliver E. Nelson  
Yasutomi Nishizuka  
Helen M. Ranney  
David M. Raup  
Howard A. Schneiderman  
Larry L. Smarr  
Robert M. Solow  
James D. Watson

### Board of Reviewing Editors

John Abelson  
Don L. Anderson  
Stephen J. Benkovic  
Gunter K.-J. Blobel  
Floyd E. Bloom  
Henry R. Bourne  
James J. Bull  
Kathryn Calame  
Charles R. Cantor  
Ralph J. Cicerone  
John M. Coffin  
Robert Dorfman  
Bruce F. Eldridge  
Paul T. Englund  
Fredric S. Fay  
Harry A. Fozzard

Theodore H. Geballe  
Roger I. M. Glass  
Stephen P. Goff  
Corey S. Goodman  
Stephen J. Gould  
Eric F. Johnson  
Stephen M. Kosslyn  
Konrad B. Krauskopf  
Charles S. Levings III  
Richard Losick  
Joseph B. Martin  
John C. McGiff  
Anthony R. Means  
Mortimer Mishkin  
Roger A. Nicoll  
William H. Orme-Johnson III  
Carl O. Pabo  
Yeshayau Pocker

Dennis A. Powers  
Erkki Ruoslahti  
Thomas W. Schoener  
Ronald H. Schwartz  
Terrence J. Sejnowski  
Robert T. N. Tjian  
Virginia Trimble  
Emil R. Unanue  
Geerat J. Vermeij  
Bert Vogelstein  
Harold Weintraub  
Irving L. Weissman  
Zena Werb  
George M. Whitesides  
Owen N. Witte  
William B. Wood  
Keith Yamamoto

**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:** Richard S. Nicholson

**Editor:** Daniel E. Koshland, Jr.

**Deputy Editor:** Ellis Rubinstein

**Managing Editor:** Monica M. Bradford

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

## EDITORIAL STAFF

**Senior Editors:** Eleanore Butz, Martha Coleman, Barbara Jasny, Katrina L. Kelner, Phillip D. Szuromi, David F. Voss  
**Associate Editors:** R. Brooks Hanson, Pamela J. Hines, Kelly LaMarco, Linda J. Miller

**Letters Editor:** Christine Gilbert

**Book Reviews:** Katherine Livingston, *editor*; Teresa Fryberger

**Contributing Editor:** Lawrence I. Grossman

**Chief Production Editor:** Ellen E. Murphy

**Editing Department:** Lois Schmitt, *head*; Julianne Hunt, Patricia L. Moe, Barbara P. Ordway

**Copy Desk:** Joi S. Granger, Margaret E. Gray, MaryBeth Shartle, Beverly Shields

**Production Director:** James Landry

**Production Manager:** Kathleen C. Fishback

**Art Director:** Yolanda M. Rook

**Assistant Art Director:** Julie Cherry

**Graphics and Production:** Holly Bishop, Catherine S. Siskos

**Systems Analyst:** William Carter

## NEWS STAFF

**Managing News Editor:** Colin Norman

**Correspondent-at-Large:** Barbara J. Culliton

**Deputy News Editors:** John M. Benditt, Jean Marx

**News and Comment/Research News:** Ann Gibbons, David P. Hamilton, Constance Holden, Richard A. Kerr, Eliot Marshall, Joseph Palca, Robert Pool, Leslie Roberts, M. Mitchell Waldrop

**European Correspondent:** Jeremy Cherfas

**West Coast Correspondent:** Marcia Barinaga

**Contributing Correspondents:** Barry A. Cipra, Robert Crease, Karen Wright

## BUSINESS STAFF

**Marketing Director:** Beth Rosner

**Circulation Director:** Michael Spinella

**Fulfillment Manager:** Marlene Zendell

**Business Staff Manager:** Deborah Rivera-Wienhold

**Classified Advertising Supervisor:** Amie Charlene King

## ADVERTISING REPRESENTATIVES

**Director:** Earl J. Scherago

**Traffic Manager:** Donna Rivera

**Traffic Manager (Recruitment):** Gwen Canter

**Advertising Sales Manager:** Richard L. Charles

**Marketing Manager:** Herbert L. Burkund

**Employment Sales Manager:** Edward C. Keller

**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); Hoffman Estates, IL 60195: Jack Ryan, 525 W. Higgins Rd. (708-885-8675); San Jose, CA 95112: Bob Brindley, 310 S. 16th St. (408-998-4690); Dorset, VT 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581); Damascus, MD 20872: Rick Sommer, 11318 Kings Valley Dr. (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 29 June 1990 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. **Subscription/Member Benefits Questions:** 202-326-6417.

## The Willingness to Risk Failure

Let me focus for a moment on the willingness to take informed risks. The willingness to risk failure is an essential component of most successful initiatives. The unwillingness to face the risks of failure—or an excessive zeal to avoid all risks—is, in the end, an acceptance of mediocrity and an abdication of leadership. To use a sports metaphor, if you do not come to bat at all, or, when at bat, wait hopefully for a walk, you cannot hit a home run. At best, you can get to first base. Major leaguers can decide to play in the minor leagues, and they may have more hits and fewer failures there, but their impact on the game and on society would be very much diminished. The risk of failure is intrinsic to significant accomplishment. Even the great Babe Ruth struck out almost twice as often as he hit home runs. Successful change depends on experimentation with uncertain results. A willingness to occupy new ground always involves the risk of losing your footing along the way.

We must also beware of raising the flag of failure too quickly. The world too often calls it failure if we do not immediately reach our goals; true failure lies, rather, in giving up on our goals. When 10,000 experiments with a storage battery failed to produce results, Thomas Edison said, “. . . I have not failed. I've just found 10,000 ways that won't work.” Few battles result in immediate and full victory. For example, instead of being frustrated and immobilized by the continued hardship experienced by many around the world, we must keep alive the idea of eventual deliverance from suffering and oppression by demonstrating our willingness to move forward along those paths actually available to us.

As we begin to prepare for the challenges that will face humanity in the 21st century, we know that we need new ideas and a renewed determination. We face challenges in health care from infancy and childhood to elder care and long-term care. We confront challenges in education, the economy, and the environment. We have an inventory of unfulfilled aspirations for families and communities and in connecting ourselves to the rest of humankind in a world that becomes ever more interdependent.

If we approach these challenges with a grim determination to avoid risk, we will sentence ourselves to the status quo—or worse. If we rely exclusively on old solutions, we not only will resign our leadership position in economic, political, and cultural affairs, but also will fail to reach our objectives. If our collective fear of failure, our fear of taking the risks of listening to new voices, or our demand for all or nothing immobilizes us, we will achieve little change.

My own observation is that American society has become too risk averse for its own good. Moreover, as individuals become more risk averse in their own lives, they seem to become less and less tolerant of the risks taken by those in leadership positions. We are less tolerant of our leaders' mistakes and seem increasingly to exhibit a fear of failure even in the face of the compelling national challenges before us. Indeed we often speak of failure as malfeasance and at the same time accuse our leaders of lacking courage and vision. Courage, vision, and change require not only our personal willingness to shoulder the risks of failure, but also our willingness to understand that some failed projects are an inevitable part of the great successes that we hope will characterize the efforts of our leaders.

Let me reflect, for example, on the “failure” of last year's demonstrations in Beijing. In a certain sense they failed. The daring and courage of these students, workers, and others seem, in the short run, to have produced only a more repressive situation. History, however, has shown us that these seeming failures are often just threads of a larger tapestry; until this tapestry is on the wall, the nature of the final pattern is difficult to discern. Let me be clear, I do not recommend failure. Nor am I attracted to the idea that failure builds character. But a willingness to accept the risk of failure is one of the costs of leadership and, therefore, the price of all success.—HAROLD T. SHAPIRO, *President, Princeton University, Princeton, NJ 08544* [Excerpted from his commencement address, 12 June 1990]