

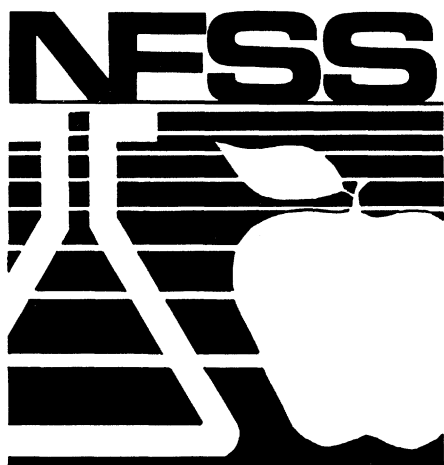
2 AUGUST 1985 · VOL. 229 · NO. 4712

\$2.50

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





AAAS announces the
**National Forum
for School Science**

10–11 October 1985

Forum '85, **Science Teaching**, is designed to meet the challenge of improving the quality of science instruction in our nation's schools. The participants in Forum '85 will develop a plan of action to restructure science teaching to meet the increasing demands of our technological society.

What are the topics?

- Setting and Maintaining Standards of Quality for Science Teachers
- Changing the Social, Economic, and Professional Environment of Teaching
- What Rational Policy Is Possible?

Who should attend?

- Scientists
- School educators and administrators
- Business leaders
- State and local political leaders
- All who care about the quality of school science instruction

Who are the speakers?

- Paul Peterson, *Brookings Institution*
- Donald N. Langenberg, *University of Illinois at Chicago*
- Edward Harvey, *Ontario Institute for Studies in Education*
- Patricia A. Graham, *Harvard Graduate School of Education*
- Newt Gingrich (R-GA), *Member of Congress*
- Other speakers to be announced.

To register, please use the form on the following page.

If you need further information, please write or call: National Forum for School Science, AAAS, 1333 H Street, NW, Washington, DC 20005.

Telephone: (202) 326-6620.

Jointly funded by AAAS and the Carnegie Corporation of New York
American Association for the Advancement of Science



National Forum for School Science

10–11 October 1985

The Shoreham Hotel, Washington, D.C.

Advance Registration Form

Registrant's Name _____
(last name) (first name and initial)

Affiliation _____

Mailing Address _____
(street address)

(city)

(state & zip)

(telephone number)

☐ Please check here if you need special services due to handicap. We will contact you before the meeting.

Enclosed is a check, purchase order, or credit card information (see below) for:

- ☐ \$100 Full registration (registration materials, sessions, and two luncheons)
☐ \$ 75 Partial registration (registration materials and sessions only)
☐ \$ 35 Student registration—full-time graduate and undergrad. only (registration materials and sessions only)

Separate Meal Tickets: ☐ Lunch, Thursday, 10 October (\$18) ☐ Lunch, Friday, 11 October (\$18)

All registrants will receive program, registration badge, and copies of background papers. Preregistration and payment must be received by 16 September to ensure receipt of preliminary materials; registrations received after this date will be held at the AAAS Registration Desk in The Shoreham. **Refund policy:** Advance registration fees and meal tickets will be refunded for cancellations received by 7 October; no refunds will be made after this date.

Charge to my ☐ **VISA** or ☐ **MASTERCARD**. Number _____ Expiration Date _____

Cardholder's signature _____

Mail registration form to: AAAS, Forum '85 Registration, Dept. FR
1333 H Street, N.W., Washington, D.C. 20005

Shoreham Hotel Reservation

AAAS Forum '85 • 10–11 October 1985

(Reservations received after 9 September cannot be guaranteed)

Send confirmation to:

Name _____ Street _____

City _____ State _____ Zip _____ Telephone No. _____

Other occupants of room: Name _____ Name _____

Room: ☐ Single (\$105)* ☐ Double (\$125)* ☐ Twin (\$125)* *Add 10% D.C. sales tax and \$1 occupancy tax.

Arrival: Date _____ Time _____ **Departure:** Date _____ Time _____

Be sure to list definite arrival and departure date and time. Check-in time is 3:00 p.m.; check-out time is 12 noon.

Special housing needs due to handicap _____

Enclose separate check, made out to The Shoreham, for first night's room deposit **or** indicate major credit card number:

Credit Card Name _____ Number _____ Expiration Date _____

Cardholder's signature _____

Mail hotel reservation form to: Reservations, The Shoreham, 2500 Calvert Street, N.W., Washington, D.C. 20008

SCIENCE

This Week in *Science* 427

LETTERS Uranium Enrichment: *M. Steinberg*; Morphological Correlations: *C. T. Nuzum*; A Glimpse of the Future?: *A. S. Bechhoefer* 428

EDITORIAL Addons and Catchons 429

ARTICLES Dispersal Pathways for Particle-Associated Pollutants: *R. A. Young, D. J. P. Swift, T. L. Clarke, G. R. Harvey, P. R. Betzer* 431

Wallace H. Carothers and Fundamental Research at Du Pont: *J. K. Smith and D. A. Hounshell* 436

Mainbelt Asteroids: Dual-Polarization Radar Observations: *S. J. Ostro, D. B. Campbell, I. I. Shapiro* 442

NEWS AND COMMENT HHS Halts Animal Experiment 447

Low-Level Waste Deadline Looms 448

Briefing: Wildlife Group Files Suit on Wilderness Access; U.S. Meat Inspection Needs Modernization; OECD Warns of Technological Nationalism; Committee Hits DOE on Project Write-offs 450

Panel Says Warheads Are Too Costly 452

RESEARCH NEWS X-ray Drought Ending at Brookhaven's NSLS 453

BOARD OF DIRECTORS

DAVID A. HAMBURG
Retiring President, Chairman

GERARD PIEL
President

LAWRENCE BOGORAD
President-Elect

ROBERT W. BERLINER
MILDRED DRESSELHAUS

DONALD N. LANGENBERG
DOROTHY NELKIN

CHAIRMAN AND SECRETARIES OF AAAS SECTIONS

MATHEMATICS (A)
Daniel Zelinsky
Lynn Arthur Steen

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

CHEMISTRY (C)
Rustum Roy
Jean'ne M. Shreeve

ASTRONOMY (D)
David Morrison
John E. Gaustad

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

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

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

ENGINEERING (M)
Henry McGee
W. Edward Lear

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

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

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

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

DIVISIONS

ARCTIC DIVISION

Robert White
President

Gunter E. Waller
Executive Secretary

CARIBBEAN DIVISION

Juan A. Bonnet, Jr.
President

Lucy Gaspar
Secretary-Treasurer

PACIFIC DIVISION

Walter Gardner
President

Alan E. Leviton
Executive Director

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, D.C. 20005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with *The Scientific Monthly* © Copyright © 1985 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): \$60. Domestic institutional subscription (51 issues): \$98. Foreign postage extra: Canada \$24, other (surface mail) \$27, air-surface via Amsterdam \$65. First class, airmail, school-year, and student rates on request. Single copies \$2.50 (\$3 by mail); back issues \$3 (\$3.50 by mail); Biotechnology Issue, \$5 (\$5.50 by mail); classroom rates on request. **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$1 per copy plus \$0.10 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/85 \$1 + .10. **Postmaster:** Send Form 3579 to *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Antibodies Made to Order 455

BOOK REVIEWS Engineers and Electrons and The Making of a Profession, reviewed by D. K. Allison; Science and Scientific Researchers in Modern Society and An Introduction to Science Studies, P. T. Durbin; Perspectives in Theoretical Stereochemistry, J. Brocas; Electron-Molecule Collisions, D. W. Norcross; Reprints of Books Previously Reviewed; Books Received 457

REPORTS Molecular Resolution Electron Micrographs of Monolamellar Paraffin Crystals: F. Zemlin, E. Reuber, E. Beckmann, E. Zeitler, D. L. Dorset 461

Aluminum Mobilization in an Acidic Headwater Stream: Temporal Variation and Mineral Dissolution Disequilibria: R. P. Hooper and C. A. Shoemaker 463

Smoke Production from Multiple Nuclear Explosions in Nonurban Areas: R. D. Small and B. W. Bush 465

Neurovisceral and Skeletal G_{M1}-Gangliosidosis in Dogs with β -Galactosidase Deficiency: J. Alroy et al. 470

Trans-4-Hydroxy-2-Hexenal: A Reactive Metabolite from the Macrocyclic Pyrrolizidine Alkaloid Senecionine: H. J. Segall, D. W. Wilson, J. L. Dallas, W. F. Haddon 472

Protein-Specific Helper T-Lymphocyte Formation Initiated by Dendritic Cells: K. Inaba and R. M. Steinman 475

Uromodulin: A Unique 85-Kilodalton Immunosuppressive Glycoprotein Isolated from Urine of Pregnant Women: A. V. Muchmore and J. M. Decker 479

Cis- and Trans-Acting Transcriptional Regulation of Visna Virus: J. L. Hess, J. E. Clements, O. Narayan 482

Technical Comments: Carbyne Forms of Carbon: Evidence for Their Existence: A. G. Whittaker; P. P. K. Smith and P. R. Buseck; Graft Compatibility and Clonal Identity in Invertebrates: R. K. Grosberg, W. R. Rice, S. R. Palumbi; J. Neigel 485

JOHN E. SAWYER
SHEILA E. WIDNALL

LINDA S. WILSON

WILLIAM T. GOLDEN
Treasurer

WILLIAM D. CAREY
Executive Officer

GEOLOGY AND GEOGRAPHY (E)
William H. Matthews III
Helen M. McCammon

BIOLOGICAL SCIENCES (G)
Betty M. Twarog
Judith P. Grassie

ANTHROPOLOGY (H)
Albert C. Spaulding
Priscilla Reining

MEDICAL SCIENCES (N)
Alfred P. Fishman
Jonathan E. Rhoads

AGRICULTURE (O)
Roy G. Creech
Ralph J. McCracken

INDUSTRIAL SCIENCE (P)
Robert H. Fry
Robert L. Stern

STATISTICS (U)
J. Stuart Hunter
Edward J. Wegman

ATMOSPHERIC AND HYDROSPHERIC (W)
F. Kenneth Hare
Bernice Ackerman

GENERAL (X)
Harold P. Green
Rodney W. Nichols

SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION

Donald J. Nash
President

M. Michelle Balcomb
Executive Director

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

COVER

Flowering and fruiting stages of *Senecio vulgaris* L. (common groundsel). It is a member of the Compositae (Asteraceae), commonly called the sunflower family, which is now distributed worldwide. These plants contain macrocyclic pyrrolizidine alkaloids which, when consumed, are known hepatotoxins to both humans and livestock. Trans-4-hydroxy-2-hexenal, a metabolite recently isolated from the macrocyclic pyrrolizidine alkaloid senecionine appears to play an important role in the hepatotoxicity. See page 472. [A. Mariassy, in collaboration with H. J. Segall, Veterinary Pathology and Veterinary Pharmacology and Toxicology, University of California, Davis 95616]

Announcing a new book from *Science*

Neuroscience

This volume consists of 27 papers from *Science* representing the work of 84 researchers at private and federal laboratories, hospitals, universities, and medical schools in six countries. The book presents discoveries made during the recent burgeoning in neuroscience research in areas ranging from genetic engineering to clinical therapy. Within its four sections — neuroplasticity, molecular biology, synaptic transmission, and behavior — the volume provides an integrative treatment of brain anatomy, physiology, and chemistry as it addresses fundamental questions concerning nervous system functioning. The volume is fully indexed and available in both hard and soft copies.

Topics covered

Neuronal degeneration • Neurotransmitter plasticity • Cell recognition molecules
Limb regeneration • Synaptic plasticity • Functional identification
Cell adhesion molecules • Synaptogenesis regulation • Neuropeptides
Brain specific messenger RNA • Postnatal brain development • Alternative RNA processing
DNA markers • Neuronal mapping • Acetylcholine receptor • Ionic channels
Neuronal excitability • Adenylate cyclase system • Neuronal phosphoproteins
Signal transduction • Brain peptides • Drug and neurotransmitter receptors
Pain control systems • Behavioral regulation • Learning • Memory
Alzheimer's disease

Edited by

Philip H. Abelson, Editor, *Science*

Eleanore Butz, Senior Editor, *Science*

Solomon H. Snyder, Director, Department of Neuroscience,
Johns Hopkins University School of Medicine

Hardcover \$29.95, AAAS member price \$23.95 ISBN 0-87168-309-1
Paperbound \$14.95, AAAS member price \$11.95 ISBN 0-87168-268-0
460 pages, illustrated with tables and figures

Order from AAAS Marketing Department, 1101 Vermont Avenue, NW,
Department N, Washington, DC 20005

The bight of the Big Apple

The wastes of 20 million people—sewage, dredge materials, construction debris, acids, and oil—are dumped or spilled into the New York Bight, the bay formed where the Atlantic coastline bends inward and New York and New Jersey meet (page 431). Pollutants become intimately associated with sediment particles and are transported and dispersed by natural circulation processes. Young *et al.* found that particles typically remain suspended in the bight for days, are thoroughly mixed, and move slowly southward or settle until the next tide, storm, or current resuspends them. By following dispersal of an organic compound made exclusively in the mammalian gut, they found that sewage is greatly diluted within and outside the bight. Currents, waves, storms, and winds may widely disperse other pollutants in a similar way.

Crystals undamaged by electron microscopy

A technique that causes no discernible damage to organic crystals has been developed for studying crystal structure in exquisite detail (page 461). Zemlin *et al.* analyzed thin microcrystals of the hydrocarbon paraffin that had been cooled in liquid helium to help stabilize the specimen against radiation damage. A low dose of electrons in the beam of a cryoelectron microscope resolved the specimen to 0.25 nanometers. Fast photographic film recorded the structure in electron micrographs. Both the regular crystal structure and crystal lattice defects were defined. It is now feasible to study other biological materials and linear polymers previously thought not to be analyzable at this resolution because of their extreme sensitivity to radiation.

Aluminum in streams

Aluminum is an important buffer in dilute acidic water but, when present in high concentrations, it can be toxic to fish (page 463). In an idealized system, an equilibrium exists between mineral and water-soluble forms of aluminum; in natural waters, there is evidence for disequilibrium. Hooper and Shoemaker studied aluminum concentrations in a New Hampshire stream during 5 months when two snowmelts and two storms occurred. Whenever acid water entered the stream, the pH dropped and the aluminum concentration rose. Melting snow transported aluminum from the soil into the stream; more was mobilized in the first thaw than in subsequent thaws, perhaps because continued leaching depleted the soil's aluminum stores. Fast water carried dissolved aluminum downstream before conversion to the mineral form could occur, keeping the concentration higher than would be expected at equilibrium. Acid episodes complicate the process of predicting how, during sensitive life-cycle stages, biological systems in the stream will be affected by aluminum.

Metabolic disease in dogs

English springer spaniel puppies can inherit a metabolic disorder that leads to neurological, motor, and developmental impairments resembling those of a debilitating disease of humans, infantile G_{M1}-gangliosidosis (page 470). Both diseases stem from dysfunctions or deficiencies of the enzyme β -galactosidase, which degrades gangliosides. When gangliosides accumulate in cells throughout the body, abnormal cellular development occurs. Loss of motor coordination, accumulation of undegraded metabolites in the brain, mental retardation, and deformation of bones are among the major disease manifestations. Alroy *et al.* found the ganglioside concentration to be five times the normal level in the brain of an affected dog. Unusual sugars excreted in the dog's urine were reminiscent of the sugar pattern in the human disease. Affected dogs should be helpful in testing new therapies—enzyme and bone marrow replacements and gene insertions—for diseases that result from single enzyme deficiencies.

Dendritic cells assist immune responses

Dendritic cells (DC's) are efficient initiators of immune responses; they present foreign material (antigens) to helper lymphocytes (T cells) that then help B lymphocytes produce the appropriate antibody (page 475). This priming role of DC's has now been demonstrated in culture. DC's are irregularly shaped white blood cells found in the spleen and other lymphoid organs. Stretching out from the main cell body are long processes that, like a spider's web, mechanically trap lymphocytes and perhaps antigens that pass through the spleen. Inaba and Steinman separated DC's from other spleen cells; when T cells were cultured with DC's and antigen, a set of helper T cells was generated that could recognize the antigen. Then, when a small number of these T cells were cultured with B cells, a specific antibody response to the antigen was made.

Immune suppressor during pregnancy

A substance that can suppress or modulate immune responses has been isolated from the urine of pregnant women (page 479). The 85,000–molecular weight molecule uromodulin consists of a single protein chain and sugar. Muchmore and Decker found that purified uromodulin suppressed immune responses by lymphocytes in culture and inhibited the spontaneous cellular toxicity characteristic of certain monocytes. It has been puzzling why pregnant women do not react immunologically to the fetus, which contains not only “self” components but also foreign materials from the father. A nonspecific suppressor produced during pregnancy might curtail immune responses of the mother against fetal tissues and thereby help protect the fetus.

AMERICAN ASSOCIATION FOR
THE ADVANCEMENT OF SCIENCE

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

Publisher: WILLIAM D. CAREY

Editor: DANIEL E. KOSHLAND, JR.

Deputy Editors

PHILIP H. ABELSON (*Engineering and Applied Sciences*), JOHN I. BRAUMAN (*Physical Sciences*), GARDNER LINDZEY (*Social Sciences*)

Editorial Board

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

Board of Reviewing Editors

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

Editorial Staff

Managing Editor: PATRICIA A. MORGAN
Assistant Managing Editors: NANCY J. HARTNAGEL, JOHN E. RINGLE
Production Editor: ELLEN E. MURPHY
News Editor: BARBARA J. CULLITON
News and Comment: COLIN NORMAN (deputy editor), MARK H. CRAWFORD, CONSTANCE HOLDEN, ELIOT MARSHALL, R. JEFFREY SMITH, MARJORIE SUN, JOHN WALSH
European Correspondent: DAVID DICKSON
Research News: ROGER LEWIN (deputy editor), RICHARD A. KERR, GINA KOLATA, JEAN L. MARX, ARTHUR L. ROBINSON, M. MITCHELL WALDROP
Administrative Assistant, News: SCHERRAINE MACK; **Editorial Assistant, News:** FANNIE GROOM
Senior Editors: ELEANORE BUTZ, RUTH KULSTAD
Associate Editors: MARTHA COLLINS, SYLVIA EBERHART, CAITILIN GORDON, WILLIAM GREAVES, BARBARA JASNY, STEPHEN KEPPEL, EDITH MEYERS, LOIS SCHMITT
Assistant Editor: LISA MCCULLOUGH
Book Reviews: KATHERINE LIVINGSTON, **Editor:** LINDA HEISERMAN, JANET KEGG
Letters Editor: CHRISTINE GILBERT
Contributing Editor: RUTH L. GUYER
Production: JOHN BAKER, HOLLY BISHOP, KATHLEEN COSIMANO, ELEANOR WARNER, ISABELLA BOULDIN, SHARON RYAN, BEVERLY SHIELDS
Covers, Reprints, and Permissions: GRAYCE FINGER, **Editor:** GERALDINE CRUMP, CORRIE HARRIS
Guide to Scientific Instruments: RICHARD G. SOMMER
Manuscript System Analyst: WILLIAM CARTER
EDITORIAL CORRESPONDENCE: 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Telephone: 202-467-4400. For "Information for Contributors" see page xi, *Science*, 28 June 1985.

Business Staff

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

Advertising Representatives

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

Addons and Catchons

I wish to announce the discovery of a new particle. It has none of the properties of a boson, meson, operon, or even a solon. For reasons that will become apparent, I will call it an addon. The properties of this particle were predicted by applying the Schroedinger equation to the law of supply and demand. The particle has highly interesting properties in that it is fully visible to one fraction of the population and invisible to another. The particle is both contagious and addictive. Its mass is between 10^7 and 10^{10} , measured in dollars.

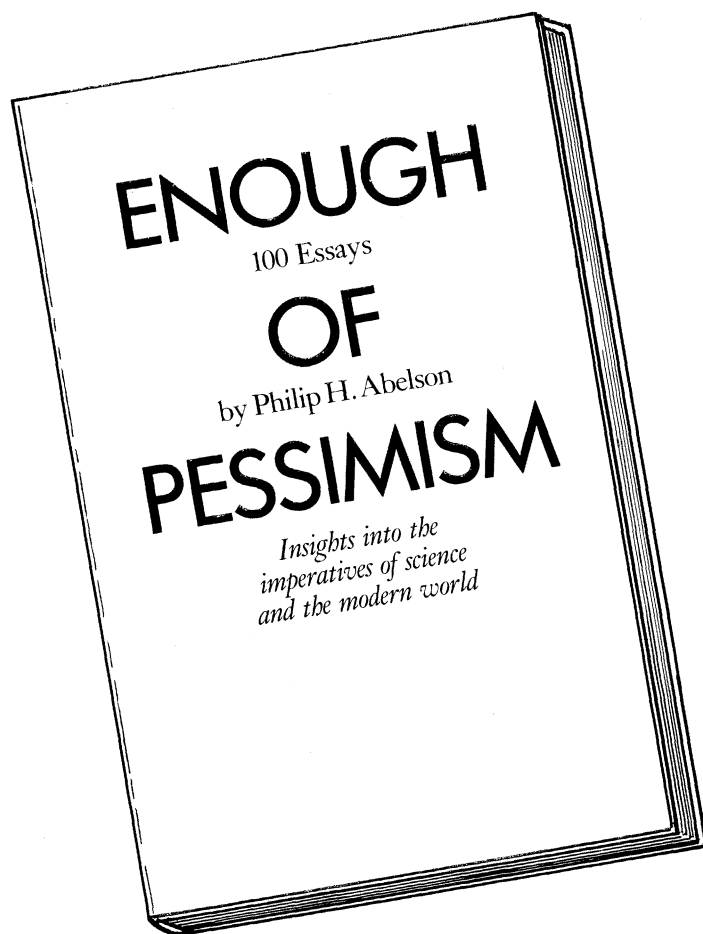
Evidence of addons has been described in such reputable journals as the *New York Times*, the *Wall Street Journal*, and the *Chicago Tribune*. Funded by Congress with no peer review, certain addon particles (such as a chemistry building in New York, a supercomputer in Florida, and a Science Park in Illinois) are a source of pride to the local communities. According to their proponents, they are invisible to budget-makers at the Office of Management and Budget and in Congress because they qualify as "addons" and are not in competition for funds with other science projects.

Unfortunately for addons there is an antimatter particle, called the catchon, which has the capacity to make addons visible to everyone. Catchons have the property of gaining momentum over time and become critical when funding crunches arise. At that time budget designers "catch on" to the fact that a decision that they made several years before is more expensive than expected and in fact should be reevaluated in terms of present circumstances. [One example of a catchon is visible in Europe, where a committee headed by Sir John Kendrew is reevaluating past commitments to the European Laboratory for Particle Physics (CERN), in particular, and high energy physics, in general. The committee, in a report released in June, suggested cutbacks as high as 25 percent because previous funding decisions in this area were impairing developments in other areas in science.] Catchons can even cause addon visibility to be exaggerated in regard to original understated costs or overstated scientific values.

Addon aficionados have a defense against catchons. It is the destroyer. Destroyers, as everyone knows, are (i) unlovable, (ii) in vast surplus, and (iii) costly, ranging from 10^7 to 10^{10} dollars. I have not checked out the accuracy of these figures, but individuals whom I respect always explain that the pet project they are championing can be easily funded if the government would build just one less destroyer. As favorite projects become more extravagant—for example, space stations, supercolliders, and orbiting telescopes—the cost of destroyers appears to increase conveniently.

Some individuals who are most indignant at the evasion of peer review for the relatively low-priced chemistry building are among the leading advocates of the supercollider, the Big Bang of budget busting, which they see as an addon. This forces us to reexamine what we mean by peer review and addons. If a group of chemists decides that there must be more money for instrumentation, if a group of biochemists says that the number of grants must be increased for the National Institutes of Health, if a group of high energy physicists says that we need a new particle accelerator, are they peer reviewers or diligent lobbyists for their own areas of science? Are they different from university presidents who are trying to help their institutions, or congressmen watching out for their districts?

In the case of addons, the question is one of facts. Will there really be a net increase in the total budget for science (true addons), or will costs be added initially and then frozen into an inflexible budget that prevents growth in other areas? Right now it cannot be shown convincingly that many of the projects mentioned above fall into either category. New procedures may be needed to evaluate the large projects and to increase funding for scientific research. *Science* expects to contribute to this crucial policy debate in the future. At the moment, I am off to check on the current price of destroyers.—DANIEL E. KOSHLAND, JR.



Enough of Pessimism

A collection of 100 essays written by Philip H. Abelson, Editor of Science from 1962-1984

The 100 essays contained in *Enough of Pessimism* were written by Philip Abelson during an extraordinary era of modern science when space exploration, the computer, nuclear energy, and genetic engineering were all coming of age. Abelson provides a chronicle of how science and society came to terms with each other during this period while each was suffering growing pains of its own.

Readers of *Enough of Pessimism* have the opportunity to share with Philip Abelson his remarkable affinity for science. He proves to be an astute observer whose ideas are consistently ahead of their time. Abelson demonstrates in his writing a clarity of thought and a toughness of mind that are rare, as well as an overriding spirit of optimism from which this book derives its name.

Hardcover \$16.95; AAAS members \$13.95
Paperbound \$11.95; AAAS members \$9.95
1985 224 pp.

Order from AAAS Marketing Department, 1101 Vermont Avenue, NW,
Department E, Washington, DC 20005
Available in bookstores through Birkhauser Boston.