

AAAS Report IX Research and Development FY 1985

Intersociety Working Group

This timely document analyzes major budget and policy issues relating to R&D in the FY 1985 budget, presents data on federal agency and industry support for R&D, and discusses trends in R&D funding in light of current policy issues. The report looks in detail at the R&D programs of major federal agencies and provides cross-cutting analyses of the budget by several scientific and engineering disciplines.

284 pp.

Paperback \$10.00

Also Available:

R&D in FY 1985: Budgets, Policies, Outlooks. Proceedings of the 1984 AAAS Colloquium on R&D Policy.

Approx. 175 pp. Paperback \$7.00

Congressional Action on R&D in the FY 1985 Budget. Willis H. Shapley, Albert H. Teich, and Jill H. Pace. Fall 1984

Approx. 50 pp. Paperback \$3.00

Books may be purchased by writing to the AAAS Sales Department, 1515 Massachusetts Avenue, NW, Washington, DC 20005. Please allow 6-8 weeks for delivery. All orders under \$10 must be prepaid. Visa and MasterCard customers include account number, expiration date, and signature. Past reports in the series are available; contact the Sales Department for more information.

Spacelab 1

Special Issue of Science, 13 July 1984

First Results of Research Conducted Using Spacelab 1

Overview

The Spacelab Experience: A Synopsis-C. R. Chappell & K. Knott

Payload Crew Members' View of Spacelab Operations-O. K. Garriott et al.

Atmospheric Physics and Earth Observations

Mapping from Space: The Metric Camera Experiment-G. Konecny et al.

Atmospheric Spectral Imaging-M. R. Torr & D. G. Torr Sample Performance of the Grille Spectrometer-M.-P. Lemaitre et al.

Waves in the OH Emissive Layer-M. Herse

Observations of Lyman-Alpha Emissions of Hydrogen and Deuterium-J. L. Bertaux et al.

Astronomy and Solar Physics

X-ray Gas Scintillation Spectrometer Experiment-R. D. Andresen et al.

Very-Wide-Field Ultraviolet Sky Survey-G. Courtes et al.

Solar Irradiance Observations-D. Crommelynck & V. Domingo

Astronomical Observations with the FAUST Telescope-J. Bixler et al.

Measurement of the Solar Spectrum from 170 to 3200 Nanometers-G. Thullier et al.

Space Plasma Physics

Electron Flux Intensity Distributions Observed in Response to Particle Beam Emissions-K. Wilhelm et al.

Atmospheric Emissions Photometric Imaging Experiment-S. B. Mende et al.

Phenomena Induced by Charged Particle Beams-C. Beghin et al.

Space Experiments with Particle Accelerators-T. Obayashi et al.

Isotopic Stack: Measurement of Heavy Cosmic Rays-R. Beaujean et al.

Materials

Maragoni Convection in Space Microgravity Environments-L. Napolitano

Solidification and Ostwald Ripening of Near Monotectic Zinc-Lead Alloys-A. Kneissl & H. F. Fischmeister

Unidirectional Solidification of Cast Iron-T. Luyendijk et al.

Tribology Experiment in Zero Gravity-C. H. T. Pan et al.

Protein Single Crystal Growth Under Microgravity-W. Littke & C. John

Life Sciences

Spatial Orientation in Weightlessness and Readaptation to Earth's Gravity-L. R. Young et al.

Effects of Rectilinear Acceleration and Optokinetic and Caloric Stimulations in Space-*R*. von Baumgarten et al.

Vestibulospinal Reflexes as a Function of Microgravity-M. R. Reschke et al.

Prolonged Weightlessness and Humoral Immunity-E. W. Voss, Jr.

Influence of Spaceflight on Erythrokinetics in Man-C. S. Leach & P. C. Johnson

Venous Pressure in Man Under Microgravity-K. A. Kirsch et al.

Mass Discrimination During Prolonged Weightlessness-H. Ross et al.

Eye Movements During Sleep in Weightlessness-O. Quadens & H. Green

Radiation Measurement Aboard Spacelab 1-E. V. Benton et al.

Radiobiological Advanced Biostack Experiment-H. Bucker et al.

Microorganisms in the Space Environment-G. Horneck et al.

Cell Sensitivity to Gravity-A. Cogoli et al.

Neurospora Circadian Rhythms in Space: A Reexamination of the Endogenous-Exogenous Question-F. M. Sulzman et al.

Circumnation Observed Without a Significant Gravitational Force in Spaceflight-A. H. Brown & D. K. Chapman

Single copy, \$3.50 (prepaid). Write to AAAS, Department SPACE, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005.

ISSN 0036-8075 29 June 1984

Volume 224. No. 4656

SCIENCE

| LETTERS | Gas Reactors: H. M. Agnew and T. A. Johnston; C. A. Anderson, Jr.; E. Marshall; Biological Survey: A. L. Gardner; M. Kosztarab | 1382 |
|------------------|--|--------------|
| EDITORIAL | Knowledge Is Power: D. P. Gardner | 1383 |
| ARTICLES | The Origin of Galaxies and Clusters of Galaxies: P. J. E. Peebles | 1385 |
| | Blood Pressure and Nutrient Intake in the United States: D. A. McCarron et al. | 1392 |
| | Inherently Safe Reactors and a Second Nuclear Era: A. M. Weinberg and I. Spiewak | 1398 |
| | Molecular Cloning of the Chromosomal Breakpoint of B-Cell Lymphomas and Leukemias with the t(11;14) Chromosome Translocation: Y. Tsujimoto et al. | 1403 |
| NEWS AND COMMENT | Estrangement on the Launch Pad | 1407 |
| | Do Seminars Leak Navy Secrets? | 1409 |
| | Skirmish on the Industrial Policy Front | 1410 |
| | NSF Studies Cooperative R&DBriefing: Senate Creates Pressure for ASAT Negotiations; Navy Scuttles Disposal Plan for Nuclear Subs; UCLA Plans to Dismantle Its Research Reactor; GAO Dismisses Bank Street Protest; French Take Steps for European Space Station; New Chief for OSHA | 1411 1412 |
| | Animal Rights Bill Defeated in California | 1414 |
| | | |
| RESEARCH NEWS | Instability in Plants and the Ghost of Lamarck | 1415 |
| | Unique Enzyme Targets Neuropeptide | 1417 |
| | Continental Drilling Heading Deeper | 1418 |
| | The Deepest Hole in the World | 1420 |

| BOARD OF DIRECTORS | ANNA J. HARRISON Retiring President, Chi | DAVID A. HAN airman President | IBURG GERARD P President-E | | | ALTER E. MASSEY |
|---|--|---|--|---|---|---|
| CHAIRMEN AND SECRETARIES OF AAAS SECTIONS | MATHEMATICS (A) Gail S. Young Lynn Arthur Steen | PHYSICS Chen Nin Rolf M. Si | g Yang | CHEMISTRY (C) Fred W. McLafferty Jean'ne M. Shreeve | Patrick P | IOMY (D) almer Wentzel |
| | PSYCHOLOGY (J) Gregory A. Kimble William N. Dember | SOCIAL, ECONOMIC, AND F Robin M. Williams, Jr. David L. Sills | POLITICAL SCIENCES (K) | HISTORY AND PHILOSOF Wesley C. Salmon David L. Hull | PHY OF SCIENCE (L) | ENGINEERING (M) Raymond L. Bisplingt W. Edward Lear |
| | EDUCATION (Q) Marvin Druger Joseph D. Novak | DENTISTRY (R) Robert J. Fitzgerald Harold M. Fullmer | PHARMACEUTICAL SCIEI Stuart Feldman David A. Knapp | Joseph | MATION, COMPUTING, A Becker le M. Henderson | AND COMMUNICATIC |
| DIVISIONS | ARCTIC DIVISION | | PACIFIC DIVISION | | SOUTHWESTERN AND ROCKY MOUNTAIN | |
| | John Davies President | Gunter E. Weller Executive Secret | | Alan E. Leviton Executive Director | Charles E. Holley, President | Jr. M. Michelle E Executive Dir |

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, 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 © 1984 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): \$56. Domestic institutional subscription (51 issues): \$58. Foreign postage extra: Canada \$24, other (surface mail) \$27, ari-surface via Amsterdam \$65. First class, airmail, school-year. and student rates on request. Single copies \$2.50 (35 by mail); block issues \$3 (53.50 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 Ceitarace Center (CCC) Transactional Reporting Service, travided that the base fee of \$1 per copy los \$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, 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

| BOOK REVIEWS | Laté-Quaternary Environments of the United States, reviewed by W. R. Farrand; Neuroethology and Behavioral Physiology and Animal Behavior, R. R. Hoy; Cartilage, H. Muir; Reprints of Books Previously Reviewed; Books Received | 1421 |
|--------------|--|------|
| REPORTS | Replication in Plastic of Three-Dimensional Fossils Preserved in Indurated Clastic Sedimentary Rocks: H. T. Zapasnik and P. A. Johnston | 1425 |
| | Proliferation of Astroglia and Oligodendroglia in Response to Human T Cell– Derived Factors: J. E. Merrill et al. | 1428 |
| | Site-Specific Mutagenesis of the Human Interleukin-2 Gene: Structure-Function Analysis of the Cysteine Residues: A. Wang, SD. Lu, D. F. Mark | 1431 |
| | Identification and Location of Brain Protein 4.1: S. R. Goodman et al | 1433 |
| | α-Cardiac Actin Is the Major Sarcomeric Isoform Expressed in Embryonic Avian Skeletal Muscle: B. M. Paterson and J. D. Eldridge | 1436 |
| | 1,25-Dihydroxyvitamin D ₃ : A Novel Immunoregulatory Hormone: C. D. Tsoukas, D. M. Provvedini, S. C. Manolagas | 1438 |
| | Virus Persists in β Cells of Islets of Langerhans and Is Associated with Chemical Manifestations of Diabetes: <i>M. B. A. Oldstone</i> et al | 1440 |
| | Acetolactate Synthase Is the Site of Action of Two Sulfonylurea Herbicides in Higher Plants: R. S. Chaleff and C. J. Mauvais | 1443 |
| | Human Colon Cells: Culture and in Vitro Transformation: M. P. Moyer and J. B. Aust | 1445 |
| | Duchenne Muscular Dystrophy Involving Translocation of the <i>dmd</i> Gene Next to Ribosomal RNA Genes: <i>R. G. Worton</i> et al | 1447 |
| | Corticotropin-Releasing Factor Receptors in Rat Forebrain: Autoradiographic Identification: <i>E. B. De Souza</i> et al | 1449 |
| | Dopaminergic Neurotoxicity of 1-Methyl-4-Phenyl-1,2,5,6-Tetrahydropyridine in Mice: R. E. Heikkila, A. Hess, R. C. Duvoisin | 1451 |
| | Identification of Common Interneurons Mediating Pre- and Postsynaptic Inhibition in the Cat Spinal Cord: <i>M. Solodkin, I. Jiménez, P. Rudomin</i> | 1453 |
| | Sequencing the <i>erbA</i> Gene of Avian Erythroblastosis Virus Reveals a New Type of Oncogene: <i>B. Debuire</i> et al. | 1456 |

| SLAUGHTER SAWYER | | E. WIDNALL WILSON | WILLIAM T. GOLDEN Treasurer | | WILLIAM D. CAREY Executive Officer | | |
|-----------------------------------|---------|---|--------------------------------|---------|--|--|---|
| Y AND GEOGRAF | PHY (E) | BIOLOGICAL SCIENC Dorothy M. Skinner | ES (G) | ANTH | ROPOLOGY (H) | | |
| Dutro, Jr. | | Walter Chavin | | Priscil | la Reining | COVER | |
| SCIENCES (N) Good E. Rhoads | | AGRICULTURE (O) John Pesek Ralph J. McCracken | | J. Ker | STRIAL SCIENCE (P) nneth Craver t L. Stern | Scanning electron micrograph of trepo- | , |
| CS (U) , Bailar Wegman | | ATMOSPHERIC AND William W. Kellogg Bernice Ackerman | HYDROSPHERIC (W) | Georg | :RAL (X) le C. Sponsler ay W. Nichols | stomate bryozoan recovered from the Ulladulla Mudstone (Permian, Austra- lia) using a new plastic-replication tech- nique. See page 1425. [Photography by | • |

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

)le **1**-۱v R. M. Webster, The Australian Nation-al University, Canberra, A.C.T. 2600]

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 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 *Sci-ence*—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 authors are affiliated.

Editorial Board

FREDERICK R. BLATTNER, BERNARD F. BURKE, AR-NOLD DEMAIN, CHARLES L. DRAKE, ARTHUR F. FINDEIS, E. PETER GEIDUSCHEK, GLYNN ISAAC, NEAL E. MILLER, FREDERICK MOSTELLER, ALLEN NEWELL, RUTH PATRICK, BRYANT W. ROSSITER, VERA C. RUBIN, WILLIAM P. SLICHTER, SOLOMON H. SNYDER, PAUL E. WAGGONER, JOHN WOOD

Publisher: WILLIAM D. CAREY Associate Publisher: ROBERT V. ORMES

Editor: PHILIP H. ABELSON

Editorial Staff Assistant Managing Editor: JOHN E. RINGLE Production Editor: ELLEN E. MURPHY

Business Manager: HANS NUSSBAUM News Editor: BARBARA J. CULLITON

News Laitor: BARBARA J. CULLITON News and Comment: COLIN NORMAN (deputy editor), JEFFREY L. FOX, CONSTANCE HOLDEN, ELIOT MAR-SHALL, R. JEFFREY SMITH, MARJORIE SUN, JOHN WALSH

European Correspondent: David Dickson Contributing Writer: Luther J. Carter Research News: Roger Lewin (deputy editor), Rich-rd A. Kerr, Gina Kolata, Jean L. Marx, Thomas ARD A. KERR, GINA KOLATA, JEAN L. MARX, THOMAS H. MAUGH II, ARTHUR L. ROBINSON, M. MITCHELL

Administrative Assistant. News: SCHERRAINE MACK:

Editorial Assistant, News: FANNIE GROOM Senior Editors: ELEANORE BUTZ, MARY DORFMAN, RUTH KULSTAD Associate Editors: Martha Collins, Sylvia Eb-

erhart, Calitlin, Gordon, Lois Schuitt Assistant Editors: Stephen Kepple, Lisa McCullough, Edith Meyers Book Reviews: Katherine Livingston, Editor; Lin-

DA HEISERMAN, JANET KEGG Letters: Christine Gilbert

Copy Editor: Isabella Bouldin Production: John Baker; Holly Bishop, Eleanor WARNER; JEAN ROCKWOOD, SHARON RYAN, BEVERLY

SHIELDS Covers, Reprints, and Permissions: GRAYCE FINGER, Editor; GERALDINE CRUMP, CORRINE HARRIS

Guide to Scientific Instruments: RICHARD G. SOMMER Guida to Scientific Instruments: RICHARD G. SOMMER Editorial Administrator: SUSAN ELLIOTT Assistant to the Associate Publisher: Rose Lowery Assistant to the Managing Editor: NANCY HARTNAGEL Membership Recruitment: GWENDOLYN HUDDLE

Membership Recratinent: Gweibberth Hobble Member and Subscription Records: ANN RAGLAND EDITORIAL CORRESPONDENCE: 1515 Massachu-setts Avenue, NW, Washington, D.C. 20005. Area code 202. General Editorial Office, 467-4350; Book Reviews, 467-4367; Guide to Scientific Instruments, 467-4480; News and Comment, 467-4430; Reprints and Permissions, 467-4483; Research News, 467-4321. Cable: Advancesci, Washington. For "Information for Contribu-tors", write to the editorial office or see page vi write to the editorial office or see page xi, e, 30 March 1984.

BUSINESS CORRESPONDENCE: Area Code 202. Membership and Subscriptions: 467-4417.

Advertising Representatives Director: EARL J. SCHERAGO Production Manager: GINA REILLY Advertising Sales Manager: RICHARD L. CHARLES

Advertising Sales' Manager: RICHARD L. CHARLES Marketing Manager: HERBERT L. BURKLUND Sales: NEW YORK, N.Y. 10036: Steve Hamburger, 1515 Broadway (212-730-1050); SCOTCH PLAINS, N.J. 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); CHI-CAGO, 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. Dief-fenbach, Kent Hill Rd. (802-867-5581). ADVERTISING CORRESPONDENCE: Tenth floor, 1515 Broadway. New York 10036 (212-730-1050).

1515 Broadway, New York 10036 (212-730-1050)

Knowledge Is Power

The effect on our lives of recent scientific and technological developments is just the latest manifestation of a profound truth summed up by Francis Bacon 400 years ago: knowledge is power. For the United States, knowledge and skilled intelligence are the new raw materials of international commerce and will define our nation's place in the world's future economic order. Yet our national investment in basic research, the source of new knowledge, has declined as a percentage of gross national product since the late 1960's.

SCIENCE

Another trend, further reaching in its implications, is the deterioration in the quality of our nation's schools. The 1983 report of the National Commission on Excellence in Education asserts that the educational foundations of our society are badly damaged, a condition threatening our future as a nation and as a people. Here are some statistics brought to the commission's attention:

• Comparisons of student achievement, completed a decade ago, reveal that on 19 academic tests U.S. students were never first or second and, in comparison with other industrialized nations, were last seven times.

• Some 23 million U.S. adults are functionally illiterate as judged by the simplest tests of everyday reading, writing, and comprehension.

• From 1963 to 1980, average verbal scores on the College Board's Scholastic Aptitude Tests dropped over 50 points, and average mathematics scores dropped nearly 40 points.

• The proportion of high school students in general studies programs was 12 percent in 1964 and 42 percent in 1979. This is a telling statistic: a general program of study prepares students neither for college nor for work.

In light of these and similar findings, the commission arrived at three major conclusions. First, our educational problems are real enough and serious enough to put the nation at risk. Second, there is a growing impatience with the shoddiness in many walks of American life, a shoddiness that is all too often reflected in our schools and colleges. Third, the decline in American education stems more from weakness of purpose, confusion of vision, underuse of talent, and lack of leadership than from conditions beyond our control.

The good news is that this country is ready for educational reform. Many encouraging developments have occurred, at least partly in response to the various reports issued last year. Department of Education figures, as of April 1984, indicate that (i) 47 states have proposals to increase high school graduation requirements, and 34 states have enacted them; (ii) 34 states are in the process of raising college admission requirements, and 22 have done so; (iii) 37 states are experimenting with ways to find more time for academic instruction-7 have enacted a longer school day, 7 have instituted a longer school year, and 18 are enacting policies for participation in athletic programs and limiting extracurricular activities during the school day; (iv) 17 states are exploring merit pay proposals, 29 are examining career ladders for teachers, and 6 have adopted such programs; (v) 275 state-level task forces have been established in 50 states, including among their members professional educators, parents, legislators, employers, and other concerned citizens. A gratifying number of local school districts have begun comprehensive planning efforts, reviewing the curriculum, studying the status of teaching, and improving school leadership.

The educational reforms now under way will help our society make the transition from the old economic order to the new. This transition will not be easy. But if we care about our future economic strength and the vitality of our social institutions, we will pay attention to this transition and to the educational system that underpins it, for it is upon the success or failure of our schools, colleges, and universities that America's place in the world will be either secured or forfeited.-DAVID PIERPONT GARDNER, President, University of California