

30 January 1981 • Vol. 211 • No. 4481

\$2.00

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



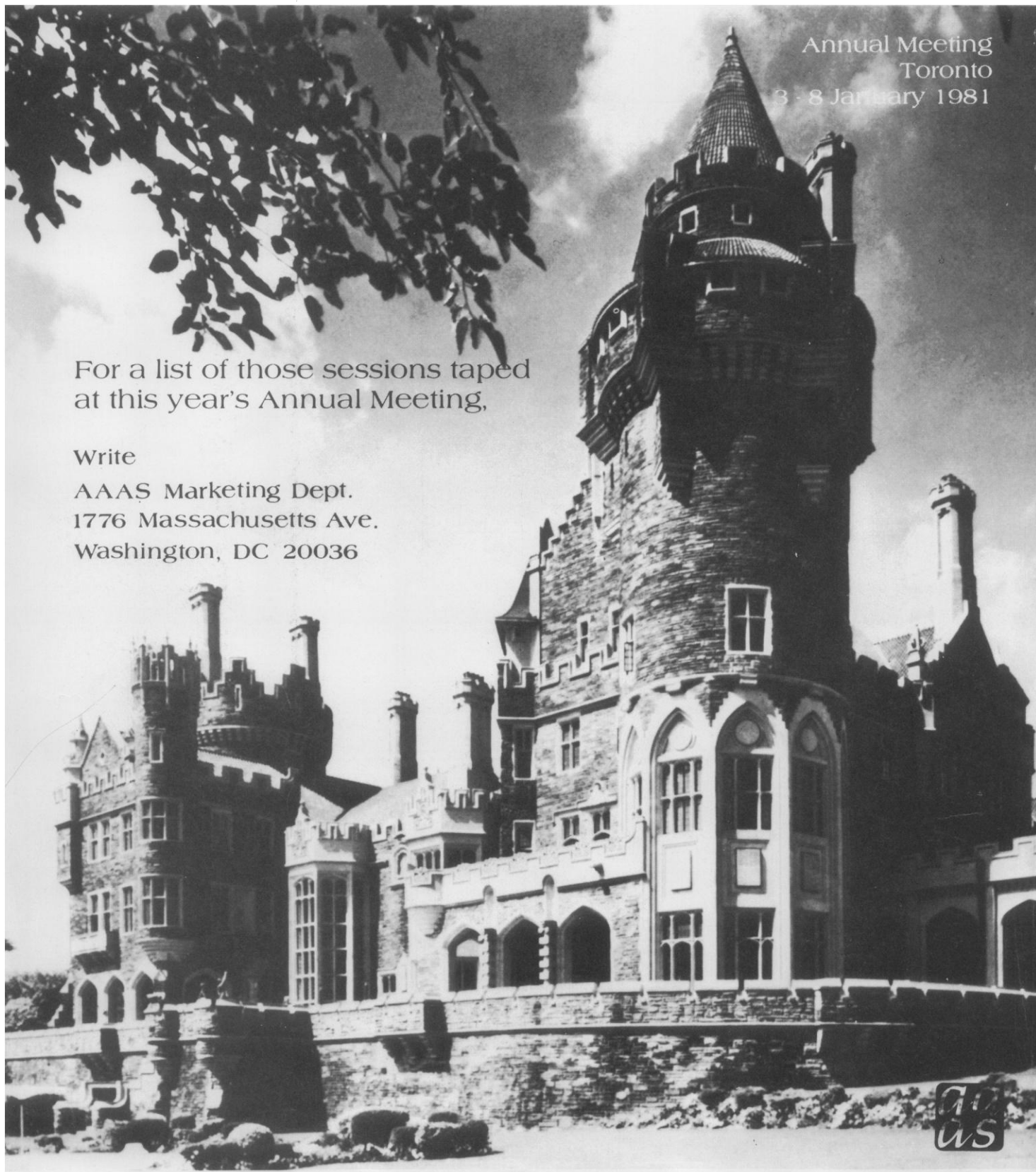
Toronto Tapes

Annual Meeting
Toronto
3 - 8 January 1981

For a list of those sessions taped
at this year's Annual Meeting,

Write

AAAS Marketing Dept.
1776 Massachusetts Ave.
Washington, DC 20036



FOR TODAY'S FACULTY AND COLLEGE STAFF MEMBERS* FROM 18 TO 80.

Whether you're thinking retirement or not, review the plan that provides for cash withdrawal and/or a lifetime income.

TIAA-CREF Supplemental Retirement Annuities (SRAs) offer you substantial flexibility including cash withdrawal and/or lifetime retirement income. You can even reduce your income taxes now!

You can begin contributions to an SRA at any age and begin benefits at any age up to age 71 unless you are still employed (then you can delay beginning benefits until age 80). For example, you could start contributions at age 25, and choose to begin benefits or withdraw cash at age 34, 40 or 50, regardless of your employment status.

Get your money at any time.

You can receive benefits as a lifetime income or over a fixed period of from 2 to 10 years. What's more, if you need it (even while employed by your current employer), you can withdraw all the money you have accumulated by surrendering your contracts. Or, you can withdraw \$1,000 or more every six months. There is never a cash surrender charge.

Contributions are tax-deferred, so you pay less income taxes now.

The federal income tax on your contributions is deferred until they are paid to you as benefits. So, you pay less tax now.

Changing employers? Take SRAs with you.

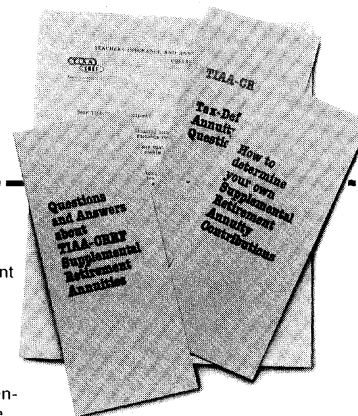
Since you own your Supplemental Retirement Annuities, you take them with you if you leave your current employer. You can make contributions through any institution that makes Supplemental Retirement Annuities available to staff members. Contributions can be as little as \$25 a month.

Full information.

Complete and mail the coupon for an SRA Information Kit today. You'll get full details about all the advantages SRAs have to offer, why this plan suits so many financial situations and age groups and how much you may contribute to the plan.

*TIAA-CREF provides annuities and other services for employees of colleges, universities, private schools and certain other nonprofit tax-exempt educational and research institutions.

**HELP YOURSELF TO A BRIGHTER FINANCIAL FUTURE
... SEND FOR A FREE INFORMATION KIT.**



Teachers Insurance and Annuity Association of America—College Retirement Equities Fund
730 Third Avenue
New York, N.Y. 10017

Please send me full details about TIAA-CREF Supplemental Retirement Annuities, the flexible tax-deferred annuity plan that offers the opportunity to accumulate funds for additional retirement income and the option for cash withdrawal.

Name _____

Address _____

City _____

State _____ Zip _____ Date of Birth _____

Name of Institution _____

Please let us know if you are participating in a TIAA-CREF retirement plan at your institution. ☐ YES ☐ NO

S 13681

SCIENCE

LETTERS	Mouse Pox Threat: <i>G. D. Wallace</i> ; Radioactive Biomedical Waste: <i>R. E. Cunningham</i> ; Scientific Spoofs: <i>P. Woolf</i>	438
EDITORIAL	It Is People Who Use Energy: <i>K. Davis</i>	439
ARTICLES	The Great Tumaco, Colombia Earthquake of 12 December 1979: <i>D. G. Herd et al.</i>	441
	Acid Lakes from Natural and Anthropogenic Causes: <i>R. Patrick, V. P. Binetti, S. G. Halterman</i>	446
	Transport of Energy in Muscle: The Phosphorylcreatine Shuttle: <i>S. P. Bessman and P. J. Geiger</i>	448
	The Framing of Decisions and the Psychology of Choice: <i>A. Tversky and D. Kahneman</i>	453
NEWS AND COMMENT	Carter Transmits an Interim Budget	459
	Biomedical Budget: A Slight Boost	459
	Utilities Lose Power on Wall Street	461
	<i>Briefing:</i> Carter Team Departs with Words of Warning; By Flood, if Not by Fire, Says CEQ; EPA to Investigate Tree Smog	462
	Priority War: Discord in Pursuit of Glory	465
RESEARCH NEWS	Sickle Cell (II): Many Agents Near Trials	468
	Massive Neutrinos: Masters of the Universe?	470
BOOK REVIEWS	Seeds of Famine, reviewed by <i>J. Swift</i> ; Cardiovascular Risk Factors in Children, <i>D. R. Labarthe</i> ; Aspects of Vertebrate History, <i>K. Padian</i> ; Ninth Texas Symposium on Relativistic Astrophysics, <i>G. Lake</i> ; Books Received	473

BOARD OF DIRECTORS

FREDERICK MOSTELLER
Retiring President, Chairman

D. ALLAN BROMLEY
President

E. MARGARET BURBIDGE
President-Elect

ELOISE E. CLARK
NANCIE L. GONZALEZ

DAVID A. HAMBURG
ANNA J. HARRISON

CHAIRMEN AND SECRETARIES OF AAAS SECTIONS

MATHEMATICS (A)
Ralph P. Boas
Ronald Graham

PHYSICS (B)
Maurice Goldhaber
Rolf M. Sinclair

CHEMISTRY (C)
Robert W. Parry
William L. Jolly

ASTRONOMY (D)
Owen Gingerich
Donat G. Wentzel

PSYCHOLOGY (J)
George A. Miller
Meredith P. Crawford

SOCIAL AND ECONOMIC SCIENCES (K)
James G. March
Gillian Lindt

HISTORY AND PHILOSOPHY OF SCIENCE (L)
Harry Woolf
Diana L. Hall

ENGINEERING (M)
Michael Michaelis
Donald E. Marlowe

EDUCATION (Q)
Ann C. Howe
Roger G. Olstad

DENTISTRY (R)
Maynard K. Hine
Harold M. Fullmer

PHARMACEUTICAL SCIENCES (S)
Anthony P. Simonelli
Robert A. Wiley

INFORMATION, COMPUTING, AND COMMUNICATION (T)
George W. Tresselt
Madeline M. Henderson

DIVISIONS

ALASKA DIVISION

John Bligh
President

T. Neil Davis
Executive Secretary

PACIFIC DIVISION

Beatrice M. Sweeney
President

Alan E. Leviton
Executive Director

SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION

Sam Shushan
President

M. Michelle Balcomb
Executive Officer

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. 484480) paid at Washington, D.C., and at an additional entry. Now combined with *The Scientific Monthly*. Copyright © 1981 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): \$38. Domestic institutional subscription (51 issues): \$76. Foreign postage extra: Canada \$14, other (surface mail) \$17, air-surface via Amsterdam \$45. First class, airmail, school-year, and student rates on request. Single copies \$2 (\$2.50 by mail); back issues \$3 (\$3.50 by mail); classroom rates on request. **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. **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

REPORTS	Early Proterozoic Microfossils and Penecontemporaneous Quartz Cementation in the Sokoman Iron Formation, Canada: <i>A. H. Knoll and B. Simonson</i>	478
	Effects of Trace Gases and Water Vapor on the Diffusion Coefficient of Polonium-218: <i>G. Frey, P. K. Hopke, J. J. Stukel</i>	480
	Arsenic Accumulation in Great Barrier Reef Invertebrates: <i>A. A. Benson and R. E. Summons</i>	482
	Phenytoin-Induced Teratogenesis: A Mouse Model: <i>R. H. Finnell</i>	483
	Potassium Chloride versus Voltage Clamp Contractures in Ventricular Muscle: <i>M. Morad, S. Reeck, M. Rao</i>	485
	Therapy of Mouse Lymphoma with Monoclonal Antibodies to Glycolipid: Selection of Low Antigenic Variants in vivo: <i>W. W. Young, Jr., and S. Hakomori</i>	487
	Water Intake in Hypovolemic Sheep: Effects of Crushing the Left Atrial Appendage: <i>M. B. Zimmerman, E. H. Blaine, E. M. Stricker</i>	489
	Nonenzymatic Browning in vivo: Possible Process for Aging of Long-Lived Proteins: <i>V. M. Monnier and A. Cerami</i>	491
	Opiate Antagonist Improves Neurologic Recovery After Spinal Injury: <i>A. I. Faden, T. P. Jacobs, J. W. Holaday</i>	493
	Myosin Phosphorylation and the Cross-Bridge Cycle in Arterial Smooth Muscle: <i>P. F. Dillon et al.</i>	495
	Chemical Defense Mechanisms on the Great Barrier Reef, Australia: <i>G. J. Bakus</i>	497
	Extinctions and Introductions in the New Zealand Avifauna: Cause and Effect?: <i>J. M. Diamond and C. R. Veitch</i>	499
	Associative Learning in <i>Aplysia</i> : Cellular Correlates Supporting a Conditioned Fear Hypothesis: <i>T. J. Carew, E. T. Walters, E. R. Kandel</i>	501
	Associative Learning in <i>Aplysia</i> : Evidence for Conditioned Fear in an Invertebrate: <i>E. T. Walters, T. J. Carew, E. R. Kandel</i>	504
	Suckling Infant Rats Learn a Preference for a Novel Olfactory Stimulus Paired with Milk Delivery: <i>S. C. Brake</i>	506
	Difference in Brain Densities Between Chronic Alcoholic and Normal Control Patients: <i>C. J. Golden et al.</i>	508
	Competition in Desert Rodents: An Experiment with Semipermeable Enclosures: <i>J. C. Munger and J. H. Brown</i>	510

WALTER E. MASSEY
RUSSELL W. PETERSON

HARRIET ZUCKERMAN

WILLIAM T. GOLDEN
Treasurer

WILLIAM D. CAREY
Executive Officer

GEOLOGY AND GEOGRAPHY (E)
Jack A. Simon
J. Thomas Dutro, Jr.

MEDICAL SCIENCES (N)
Morton D. Bogdonoff
Lilah M. Lowenstein

STATISTICS (U)
Stephen E. Fienberg
Ezra Glaser

BIOLOGICAL SCIENCES (G)
John A. Moore
Walter Chavin

AGRICULTURE (O)
Martin A. Massengale
Coyt T. Wilson

ATMOSPHERIC AND HYDROSPHERIC
SCIENCES (W)
Julius London
Glenn R. Hilt

ANTHROPOLOGY (H)
Alan R. Beals
Priscilla Reining

INDUSTRIAL SCIENCE (P)
John Diebold
Robert L. Stern

GENERAL (X)
Herman Pollack
S. Fred Singer

COVER

San Juan, Colombia, a small Pacific Coast village about 100 kilometers north of the Ecuadorian border, was nearly destroyed by a magnitude 8 earthquake that struck southwest Colombia on 12 December 1979. The coastline tectonically subsided nearly 1.6 meters during the earthquake, only 15 minutes before a 2.2-meter high tsunami swept inland. The tsunami overtopped the barrier island on which the village stood. Now inundated at high tide, the village has been abandoned. See page 441. [Darrell G. Herd, U.S. Geological Survey, Menlo Park, California]

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.

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.

Editorial Board

1981: PETER BELL, BRYCE CRAWFORD, JR., E. PETER GEIDUSCHEK, EMIL W. HAURY, SALLY GREGORY KOHLSTEDT, MANCUR OLSON, PETER H. RAVEN, WILLIAM P. SLICHTER, FREDERIC G. WORDEN

1982: WILLIAM ESTES, CLEMENT L. MARKERT, JOHN R. PIERCE, BRYANT W. ROSSITER, VERA C. RUBIN, MAXINE F. SINGER, PAUL E. WAGGONER, ALEXANDER ZUCKER

Publisher

WILLIAM D. CAREY

Editor

PHILIP H. ABELSON

Editorial Staff

Managing Editor ROBERT V. ORMES
Assistant Managing Editor JOHN E. RINGLE
Business Manager HANS NUSSBAUM
Production Editor ELLEN E. MURPHY

News Editor: BARBARA J. CULLITON
News and Comment: WILLIAM J. BROAD, CONSTANCE HOLDEN, ELIOT MARSHALL, R. JEFFREY SMITH, MARJORIE SUN, NICHOLAS WADE, JOHN WALSH
Research News: RICHARD A. KERR, GINA BARI KOLATA, ROGER LEWIN, JEAN L. MARX, THOMAS H. MAUGH II, ARTHUR L. ROBINSON, MITCHELL WALDROP

Administrative Assistant, News: SCHERRAINE MACK.
Editorial Assistants, News: FANNIE GROOM, CASANDRA WATTS

Consulting Editor: ALLEN L. HAMMOND
Associate Editors: ELEANORE BUTZ, MARY DORFMAN, SYLVIA EBERHART, RUTH KULSTAD

Assistant Editors: MARTHA COLLINS, CAITILIN GORDON, STEPHEN KEPPLE, EDITH MEYERS, LOIS SCHMITT
Book Reviews: KATHERINE LIVINGSTON, **Editor:** LINDA HEISERMAN, JANET KEGG

Letters: CHRISTINE GILBERT

Copy Editor: ISABELLA BOULDIN

Production: NANCY HARTNAGEL, JOHN BAKER; ROSE LOWERY; HOLLY BISHOP, ELEANOR WARNER; MARY MCDANIEL, JEAN ROCKWOOD, LEAH RYAN, SHARON RYAN

Covers, Reprints, and Permissions: GRAYCE FINGER, **Editor:** GERALDINE CRUMP, CORRIE HARRIS

Guide to Scientific Instruments: RICHARD G. SOMMER
Assistants to the Editors: SUSAN ELLIOTT, DIANE HOLLAND

Membership Recruitment: GWENDOLYN HUDDLE

Member and Subscription Records: ANN RAGLAND
EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., 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 Contributors," write to the editorial office or see page 187, *Science*, 9 January 1981.

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

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); 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); DORSET, VT. 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581).

ADVERTISING CORRESPONDENCE: Tenth floor, 1515 Broadway, New York, N.Y. 10036. Phone: 212-730-1050.

It Is People Who Use Energy

Seldom are public policies constrained only by scientific and engineering limitations; they are also limited, consciously and unconsciously, by social norms. Solutions to the energy problem, for example, usually take one of two forms: to conserve energy, or to increase or at least maintain the total supply. Both approaches fit prevalent, if conflicting, moral attitudes, and so find ready justification. Finding and harnessing more energy fits the modern ethic of "development," and conserving energy fits the asceticism of major religions. A third approach—stopping or reversing population growth—is seldom treated as a part of energy policy, mainly because the effective means required would offend deep sentiments.

The cost of neglecting the third approach is illustrated by the United States. Between 1955, the last time we produced as much energy as we consumed, and 1978, our energy consumption rose 99 percent. More than a third (38.3 percent) of that increase was due to population growth—52.6 million in the 23-year period—the rest being due to rising per capita consumption. Since very little manpower is required to produce energy (less than half of 1 percent of the labor force), the growth of population contributed nothing to the production of energy but did contribute greatly to its consumption. According to the Census Bureau's medium projection, our population in 2000 will be 38 million greater than it is now. In that case, our energy supply will have to rise by 17 percent in two decades just to maintain per capita consumption, or per capita use will have to be cut by one-sixth to hold total consumption to the present amount.

The entire world's population is growing more rapidly than ours—currently about 75 million annually. By the year 2000, the projected human population will be 2.3 billion greater than it is today. This relentless expansion is the main cause of the rising worldwide consumption of energy—recently 3.5 percent per year.

It follows that stopping or reversing population growth could play a major role in solving the energy problem. When we take into account the environmental problems that heroic efforts to increase the total energy supply will entail, or the human problems that reducing average per capita consumption throughout the world will bring, we conclude that population control is not only a desirable but also a necessary part of any effective energy policy. To "solve" the energy problem otherwise is like fixing a leaky roof by putting more containers on the floor.

The U.S. government is inconsistent when it gives priority to energy independence, and at the same time admits each year hundreds of thousands of immigrants. With 232,000 refugees being admitted by special dispensation in 1980 and 217,000 in 1981, in addition to regular entrants and illegal immigrants, approximately one-third of our population growth—probably some 700,000—is now due directly to immigration.

Clearly, our attitude toward population is still normative rather than instrumental. We confuse favoring fewer people with being inhumane, whereas the greatest inhumanity is to bring into the world children whose probable fate is extreme deprivation. Historically, and for good reason, social norms favored having many children. These norms are now inappropriate, but we still construe energy policy as producing or saving energy for however many people there are, not as producing fewer people so as to give each one as much energy as he or she needs.

Yet it is people who use energy. With fewer people, less energy is needed. This may seem obvious, but so far we have tragically postponed acting on it. Only when things have reached an extreme impasse, as in contemporary China, does population control become part of the solution to the energy problem.—KINGSLEY DAVIS, *Fellow, Center for Advanced Study in the Behavioral Sciences, Stanford, California 94305*

ANNOUNCING THE NEW AAAS SCIENCE COVER CALENDAR FOR 1981

Featuring

- a new 13" x 26", easy-to-read wall format
- 14 striking full-color reproductions of Science covers, with detailed descriptions
- birth dates of notable contributors to scientific thought
- dates of AAAS meetings, symposia, and conferences
- legal holidays
- AAAS membership information
- large blocks for making notations

The 4th annual AAAS Science Cover Calendar is a useful, informative, and attractive complement to home or office and also makes a great gift. Send for copies for you and your friends today!

Please mail me _____ copy(ies) of the 1981 Science Cover Calendar (\$4.00/\$3.50 to AAAS members).

Name _____ Address _____

City _____ State _____ Zip _____

Please send _____ copy(ies) to a friend (\$4.00/\$3.50 to AAAS members).

Name _____ Address _____

City _____ State _____ Zip _____

All orders must be prepaid. Please allow 4 weeks for delivery. Mail to: AAAS Calendar, Box 1, 1515 Massachusetts Ave., NW, Washington, DC 20005.