

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

1983: FREDERICK R. BLATTNER, BERNARD F. BURKE, CHARLES L. DRAKE, ARTHUR F. FINDEIS, E. PETER GEIDUSCHEK, GLYNN ISAAC, MILTON RUSSELL, WILLIAM P. SLICHTER, JOHN WOOD

1984: ARNOLD DEMAIN, NEAL E. MILLER, FREDERICK MOSTELLER, ALLEN NEWELL, RUTH PATRICK, BRYANT W. ROSSITER, VERA C. RUBIN, SOLOMON H. SNYDER, PAUL E. WAGGONER

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 and Comment: COLIN NORMAN (deputy editor), JEFFREY L. FOX, CONSTANCE HOLDEN, ELIOT MARSHALL, R. JEFFREY SMITH, MARJORIE SUN, JOHN WALSH

European Correspondent: DAVID DICKSON

Contributing Writer: LUTHER J. CARTER

Research News: ROGER LEWIN (deputy editor), RICHARD A. KERR, GINA KOLATA, JEAN L. MARX, THOMAS H. MAUGH II, ARTHUR L. ROBINSON, M. MITCHELL WALDROP

Administrative Assistant, News: SCHERRAINE MACK;
Editorial Assistant, News: FANNIE GROOM

Senior Editors: ELEANORE BUTZ, MARY DORFMAN, RUTH KULSTAD

Associate Editors: SYLVIA EBERHART, CAITILIN GORDON, LOIS SCHMITT

Assistant Editors: MARTHA COLLINS, STEPHEN KEPPEL, EDITH MEYERS

Book Reviews: KATHERINE LIVINGSTON, *Editor*; LINDA HEISERMAN, JANET KEGG

Letters: CHRISTINE GILBERT

Copy Editor: ISABELLA BOULDIN

Production: JOHN BAKER, SUSANNAH BORG; 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
Assistant to the Editor: SUSAN ELLIOTT

Assistant to the Associate Publisher: ROSE LOWERY
Assistant to the Managing Editor: NANCY HARTNAGEL

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 xi, *Science*, 30 September 1983.

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.

Competition in the International Marketplace

Americans must face the reality that strong international competition is here to stay. During the past several decades, the world industrial competitive order has undergone major transformation. Multinational corporations grew in importance. The European Common Market and Japan became major economic and competitive forces, and the Soviet Union consolidated its influence in substantial areas of the world. Meanwhile, newly industrialized and resource-rich nations emerged as competitors. After the oil crisis of 1973–1974, the industrial world's economic growth slowed as inflation surged. Finally, in many nations, government-managed social services grew rapidly, often at the expense of the private sector.

These changes have coalesced to create a dynamic global competitive environment of which the United States is, of necessity, a part. On a constant dollar basis, our exports have more than tripled since 1960, and imports have risen almost as rapidly. Yet our competitive margin in some industries has either disappeared or is shrinking.

In contemplating these problems, it is fashionable and often instructive to examine the elements of success in certain Japanese industries, but it is more directly helpful to look at successful industries here at home. Our computer and telecommunications industries remain in the vanguard. We lead in aerospace technology, with all that this means in many fields, including national defense. Our petroleum industry has remained the world's pacesetter in technology for finding and winning oil and gas. Progress in these and other industries is buttressed by exceptional science and engineering capabilities in the universities and industry, as well as by high competence in the construction and engineering crafts.

The chemical industry, which I know best, is a strong international competitor. Chemical production in this country has grown at almost twice the rate of total U.S. industrial output. Nearly 40 percent of world chemical sales are generated by American-owned companies. Five of the 17 leading U.S. exporters are chemical firms, and the industry's shipments abroad yielded an \$11 billion trade surplus in 1981. This competitive vitality has many sources. U.S. chemical companies have had a favorable raw material and energy base as well as a large domestic market. But chemical industry management has also paid attention to other elements:

- Research and development have been supported by top management, and the commitments important to a high rate of technological advance have been made. The industry accounts for 10 percent of all research expenditures in the United States, or close to twice its share relative to GNP.

- The industry has never viewed its opportunities as limited. It has steadily broadened its base by developing evolutionary product lines.

- Diversification into new, yet related, businesses and technologies, such as electronics and other high-technology areas, has been common.

- Productivity improvement and cost reduction have been pushed vigorously. Conservation programs have cut the industry's energy consumption per unit of output by 25 percent since 1972. Physical production per man-hour is twice the average level for total U.S. manufacturing.

- Investment in new plant and equipment has averaged between 6 and 8 percent of sales since 1970. This is roughly a third higher than the investment rate for the total manufacturing industry.

- Finally, the chemical industry has worked hard both to build exports and to establish plants and offices overseas. This two-track approach strengthens both domestic and international operations.

Most of these principles can be applied to other industries. The United States has the talent and resources and the toughness of mind to compete in the international marketplace. We must put our objectives in clearer focus and muster the will for their achievement.—EDWARD G. JEFFERSON, *Chairman of the Board, E. I. du Pont de Nemours & Company, Wilmington, Delaware 19898*

Based on an address presented at the Forum Club of Houston, Houston, Texas, 17 March 1982.