

Science Indicators: Healthy . . . For Now

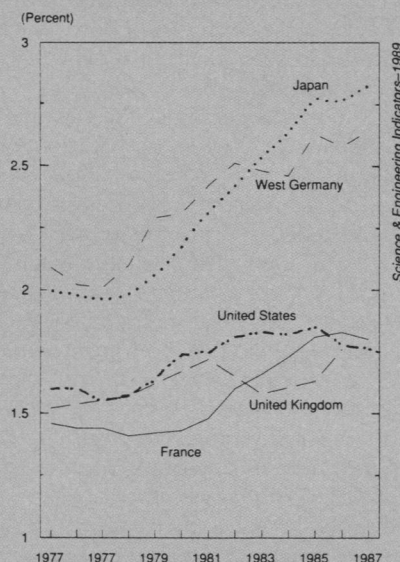
Detailed statistics on the state of U.S. science reveal many strengths but some troubling weaknesses

THE U.S. SCIENTIFIC ENTERPRISE has emerged from its biennial statistical checkup with indications of chronic ailments that could prove troubling in the years ahead.

The diagnosis, contained in the 1989 edition of the National Science Board's richly detailed *Science and Engineering Indicators** series, shows that, overall, U.S. science has been relatively well nourished in the 1980s. But the United States' chief industrial competitors, West Germany and Japan, have been devoting a greater share of their resources to areas of R&D related to future economic health. And, most troubling of all, the report documents in depressing detail the dismal state of science education and scientific literacy in the United States.

In terms of total expenditures on R&D, the United States still outspends Japan, West Germany, France, and Britain combined. But in the mid-1980s, West Germany and Japan both overtook the United States in one key measure: the proportion of gross national product devoted to R&D. And, while virtually all the R&D investments in West Germany and Japan are going into the civilian economy, 65% of U.S. government R&D funds are being poured into defense projects, mostly highly specific development

Nondefense R&D as a percentage of GNP, by selected country: 1977-87



and engineering of weapons systems, with little or no commercial spinoff. A comparison of the share of gross national product spent on civilian R&D in fact shows the United States is now dead last among the five major industrial countries (see chart).

Spending on R&D by U.S. companies has increased steadily over the past three decades, the report indicates, and it is now running about even with government expenditures. However, in a study completed too late to be included in the report, the National Science Foundation recently found that U.S. industry increased its R&D outlays in 1989 by about 3%, which was less than the rate of inflation. It was the first time in more than a decade that corporate spending on R&D declined in real terms. And next year's expected outlays will barely keep pace with inflation.

The report's most disturbing statistics are also its most familiar: U.S. students continue to be less well versed in science and mathematics than their counterparts in most other industrial countries, though there has been a slight upturn in test scores in recent years. And a smaller proportion of U.S. college students major in natural science and engineering. Just 20% of first degrees in the United States are in science and engineer-

ing, compared with 26% in Japan (mostly engineering) and more than 40% in Britain and France.

Among the report's other findings:

- Between 1980 and 1988, the number of people employed in science and engineering jobs by private industry increased almost twice as fast as the total work force. But the scientific work force remains largely a white male preserve. By 1986, only 13% of science and engineering jobs were held by women (up from 11% in 1980) and just 2.2% were held by blacks.

- Industry's share of total university research funding rose from 3.9% in 1980 to 6.6% in 1989. By the end of the decade, industry was putting more than \$900 million into academic research.

- U.S. researchers authored 36% of the scientific papers published in 1986, a share that has held constant since 1973. But there have been marked changes in some characteristics of the world's scientific literature. For example, the proportion of papers with multiple authors has increased sharply (see chart), and increasing numbers of U.S. researchers are coauthoring papers with foreign colleagues. In 1986, 10.2% of publications with at least one U.S. author had coauthors from other countries, up from 5.6% in 1981.

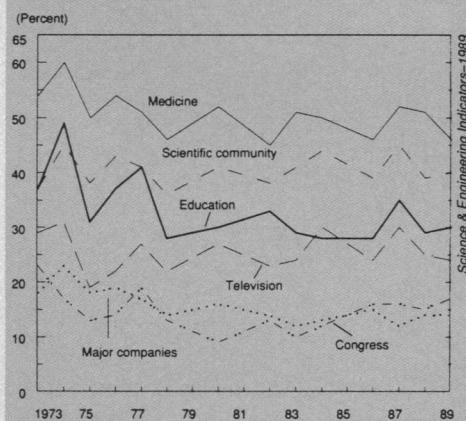
- Only 15% of American adults correctly answered all of seven simple questions on physics and earth science. Less than half, for example, knew that electrons are smaller than atoms. Knowledge of the biological sciences is not much better. About 43% of Americans, for example, doubted that humans are descended from other animal species and 45% said that early humans lived at the same time as dinosaurs.

- But at least scientists are well regarded. They rank second only to physicians in terms of public respect, and well above members of Congress.

■ COLIN NORMAN

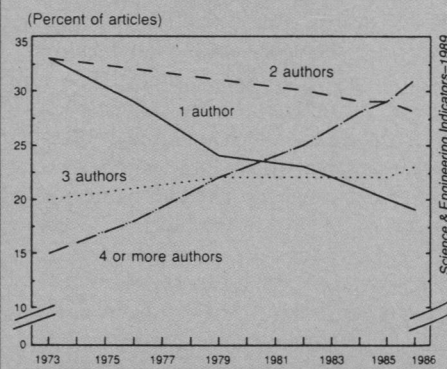
**Science and Engineering Indicators—1989* (Government Printing Office, Washington, D.C. 20402; stock number 038-000-00583-9).

Percentage of public expressing great confidence in people running selected institutions



High esteem. Scientists continue to enjoy public respect for the way science is managed.

Percentage of world S/E publications with 1, 2, 3, and 4 or more authors: 1973-86



Decline of the individual investigator. Or the rise of group science.