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COVER: Light organ beneath the eye of the flashlight fish nurtures luminous bacteria. The light, thought to be the most intense of any luminescent organism, is used by the fish for seeing, communicating, attracting prey and frightening predators. Biologists are now investigating the bacterial side of the partnership. See p. 106. (Photo: David Powell, Steinhart Aquarium, San Francisco)

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LETTERS

Off with your head

I protest your misleading headline "Air-pollution study: Controls too strict" (SN: 1/14/78, p. 21).

The article under this headline reviewed a cost/benefit study of the investment costs of air pollution control programs versus the dollar savings in pollution-related human death and disease.

The analysis produced two major findings: (1) control programs for stationary air pollution sources as of 1979 will yield *savings on the order of \$16 billion annually*; (2) control programs for mobile emission sources produce a negative payback of some \$3 to \$6 billion annually — even while producing \$5 billion in savings.

But even more momentous than the study's findings was the comment of one of the authors of the analysis: "Perhaps the most serious deficiency we encountered in investigating the air pollution-mortality relationship was ... obtaining adequate air quality data."

Since, obviously, the results of such a study can be no better than the data that produced them, a far more appropriate headline would have been: "Air-pollution study: Adequate data lacking," or something similar.

To distill the import of the study into "controls are too strict" is a serious editorial distortion.

Carol C. Wagner
Burlington, Vt.

The scientist as critic

I read with great interest of the plight of the "refuseniks" in the Soviet Union and of their counterparts in Argentina: lamentable situations yet encouraging to those who wish to offer aid (SN: 1/7/78, p. 7).

But in the same issue we read of Ralph Moss, fired from Sloan-Kettering Institute for co-authoring a critique of an SKI report on Laetrile. And we recall last year's SCIENCE NEWS exposure of firings and blacklistings of engineering personnel from respected firms for criticizing those firms. And who can forget J. Robert Oppenheimer or Linus Pauling?

Given the system of job procurement in the United States, with its reliance on a previous employer's determination of the "good behavior" of an applicant, a scientist of critical mind may suffer long periods of unemployment and find the laboratory and the journal inaccessible.

We haven't gotten around to midnight police raids yet, have we?

J. P. Mayer
Chicago, Ill.

Japanese Science

There is only one crucial remark in John H. Douglas's outstanding article (SN: 12/3/77, p. 378) which could lull the United States into an

even deeper underestimation of the remarkable achievements by Japan. It is regrettably not the case that Japan is investing *less* than the United States in crucial areas of R&D support, as could be concluded from Douglas's remark that "the Japanese government budget for science and technology remains the lowest of any major developed country."

As a matter of fact, the increasingly apparent demise of a number of U.S. industries — including most recently U.S. electronics and computer businesses — in the face of Japanese competition may be directly ascribed to an increasingly inadequate training of students graduating from American universities, particularly in engineering. This is a result of dramatically decreased government funding of academic research programs which support the educational process in high-technology fields in American universities.

According to the most recent OECD data (for 1971-72), the percentage of the gross national product devoted to *government funding* for the "advancement of science" was 0.04 percent for the United States, 0.4 percent for West Germany (10 times higher) and 0.2 percent for Japan (five times higher).

The initial interpretation of these data given in *Science Indicators — 1974*, published by the National Science Board, is even more suggestive: "The fraction of GNP of the United States devoted to R&D has declined steadily over the last 10 years, falling to nearly one-fourth of its peak level in 1964. The decline ... is primarily due to the reduced growth of expenditures by the Federal Government." The report goes on to say that in the same period "both Japan and West Germany recorded substantial growth in the proportion of the GNP devoted to R&D."

What is at stake for the United States, indeed, are its computer and electronic business, two of our premier industries. And the failure is, I believe, in an inadequate university training of graduating engineers and scientists to meet the challenge of competitiveness needed for our survival.

George W. Stroke
State University of New York
Stony Brook, N.Y.

(Prof. Stroke's basic point — the inevitable effect of proportionately decreasing Government funding on the quality of U.S. science — is well taken and has been documented by SCIENCE NEWS for several years. There are, however, some difficulties in further dramatizing the effect of this decline using the statistics given.)

The main trouble in using the OECD/NSB figures tabulated under the heading of "advancement of science" is that they deal mainly with university financing and include funds for science instruction. In countries with national universities, such as Japan and West Germany, such funds are substantial, but in the United States — where public universities are supported by states rather than the federal government —

Continued on p. 110.

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... Letters

such funds are a minuscule portion of the national budget. Also, support for federally funded R&D centers should be added to the American figure, since comparable efforts in other countries would likely be included under general university funds. In the particular case of Japan another problem arises: Japanese universities have chief responsibility for R&D associated with the country's space and nuclear programs. Finally, the proportion of private funds available for university research in the United States is higher than in Japan.

A really fair comparison of university R&D funding between the two countries is probably impossible, but the following figures for overall R&D are based on the Japanese government's official statistics: In fiscal 1975, total expenditures for R&D in the United States were about 4.4 times those of Japan. The percentage of the national income devoted to this effort was 2.55 percent in the U.S. and 2.06 percent in Japan. Both figures are below 1972 levels. Government support for all R&D amounted to just over one-quarter of the total in Japan and just over half the total in the United States. Universities in Japan spent about 20 percent of the total R&D funds; those in the U.S. spent 12 percent. Although both countries nominally spend about the same proportion of their R&D funds for basic research (roughly 14 percent), closer examination of the figures reveals irreconcilable discrepancies in the way the respective governments define "basic."

Thus both of the quoted statistics are correct as stated, but interpretation is difficult. A more detailed examination of the Japanese government's science policy and funding is being presented by Mr. Douglas in a series of articles in NATURE. — Ed.)

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