figures and tables, and type composition and correction. All the other costs —of printing, binding, and mailing multiple copies—are recouped from other sources of income to the journal (subscriptions, sale of back issues, and advertising). Now the costs of producing a single microfilm copy are the same as those of setting a single copy in type: reviewing, editing, and copy-editing costs are unchanged, and one needs, instead of a skilled compositor, a skilled typist (with multitudinous special attachments to cope with the complexities of scientific work) plus a microfilmer. Hence the page charges would be unchanged.

Incidentally, it should be pointed out that several leading journals are now available in microfilm or microfiche as well as in the conventional form. They remain cumbersome to read or consult.

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References

1. W. S. Brown, J. R. Pierce, J. F. Traub, *Science* **158**, 1153 (1967).
2. M. Scal, *Sch. Publ.* **1**, 71 (1969).

Deterioration of Teaching

In describing the hue and cry over a retrenchment in support of higher education and science, the ex-advisors apparently did not mention that the quality of the teaching staff in higher education has been deteriorating for some time ("Recession in science: ex-advisors warn of long-term effects," 1 May, p. 555). The decline in quality—measured by the percentage of full-time senior teaching staff with the doctorate—set in several years ago, long before talk of curtailing the support of graduate education.

A 1963–64 study of James F. Rogers (*1*) showed 49 percent of the full-time senior instructional staff held the doctorate. A 1966 survey by R. Beazley (*2*) showed the percentage had declined to 43.7. Preliminary findings of another survey indicate it may have dipped to 42 percent in 1967.

Increasing numbers of freshmen students are enrolling in 2-year institutions where only about 10 percent of the teaching faculty held the doctorate some 10 years ago and where only 6 percent held the degree in 1966. About 35 percent of the fall 1969 first time enrollees entered 2-year institutions, a percentage that is rising.

The percentage of full-time instructional staff with the doctorate is an inadequate measure of the quality of education, but at present it is about all we have. It is directly relevant to the need to produce more doctorates with the view to assuming teaching responsibilities, particularly in the burgeoning institutions below the rank of universities.

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References

1. J. F. Rogers, *Staffing American Colleges and Universities*, Report OE-53028 (U.S. Office of Education, Washington, D.C., 1967).
2. R. Beazley, *Numbers and Characteristics of Employees in Institutions of Higher Education, Fall, 1966*, Report OE-50057-66 (U.S. Office of Education, Washington, D.C., 1969).

Biology Editors' Definition

An ad hoc Committee on a Proposed Definition of a Primary Publication appointed by the Council of Biology Editors has developed the following definition which was adopted by a vote of the full membership of CBE on 23 May 1968:

An acceptable primary publication must be the first disclosure containing sufficient information to enable peers (1) to assess observations, (2) to repeat experiments, and (3) to be susceptible to sensory perception, essentially permanent, available to the scientific community without restriction, and available for regular screening by one or more of the major recognized secondary services [e.g., currently, *Biological Abstracts, Chemical Abstracts, Index Medicus, Excerpta Medica, Bibliography of Agriculture* (since discontinued), etc.] in the United States and similar facilities in other countries.

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Progress in Desalination

Gerard (Letters, 20 Mar.) presents a distorted picture of the potential of desalting when he states that only 5 percent of all operating plants show costs below $1 per 1000 gallons. It is not the *number* of plants that is pertinent but the date of construction and the size, since costs have gone down both with improved technology and

with large-scale operation. For example, the largest current plant, recently completed near Tijuana, Mexico, is producing 7.5 million gallons per day at a reported cost of 65 cents.

Gerard is correct in his application of cold, deep-level seawater for the condensation of atmospheric moisture into freshwater. However, he is not correct when he applies this argument to desalination plants that work on the distillation principle. There the effectiveness depends on the maximum water temperature obtained in the brine heater, and it is obviously better to start with as high a feed water temperature as possible. The temperature of the brine effluent should be as low as possible but is in no way related to the ocean temperature. One direction of progress therefore lies in increasing the upper operating temperature. When the Office of Saline Water constructed its first large experimental (1 million gallons per day) multistage flash distillation plant in 1961, this temperature was restricted by scale formation to about 93°C (200°F). Within 2 years, through the development of scale prevention techniques, the plant was operating at temperatures up to 121°C (250°F), and the performance ratio was increased to 10 to 1. An advanced multistage multieffect plant at San Diego has operated successfully at temperatures up to 138°C (280°F). This development, together with the improved flow cycle, has increased the performance ratio to 20 to 1. A new pretreatment system now under development by OSW has enabled an experimental multistage flash pilot plant to operate free of scale at temperatures of 163°C (325°F.)

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Apollo 13: Cost of Abortion

I have the utmost respect for the bravery of our Apollo 13 astronauts. However, the total appropriation to the National Science Foundation for fiscal year 1969 was $400 million, while the cost of this unsuccessful Apollo 13 moon shot was about $380 million. Surely this must be the most expensive legal abortion in history.

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Insightful Amateur Astronomer

Among the interesting correspondence which I have received since the publication of my article "Moon illusion explained on the basis of relative size" (20 Feb., p. 1092) are three articles and a letter from Patrick Rizzo, secretary of the Amateur Astronomers Association of New York. In the articles, published in 1963 in *The Eyepiece*, a monthly bulletin, and a 1960 issue of *Asterisks*, a publication on instructional topics in astronomy, he arrives at essentially the conclusion I drew in my article; namely, that the zenith moon appears small because of the great expanse of sky near it. Rizzo also clearly states the principle of relativity of perceived size, which is fundamental to my argument, and points out that the moon illusion so conceived is but a special case of such relativistic phenomena, not a peculiarity.

In addition, Rizzo provides a good thought experiment in *The Eyepiece* and an excellent history of theories of the moon illusion in *Asterisks*, along with several related observations and phenomena, including information about the changes in size of constellations, and the occurrence of a related illusion seen in the lobby of a movie theater.

Rizzo submitted his articles to the *American Journal of Physics* (where Boring's experiments were recounted) and to *Popular Astronomy*, but they were not accepted for publication, and consequently were not conveniently available to the general scientific public. I acknowledge his priority in formulating and publishing this relativistic theory of the moon illusion. It is possible that his institutional affiliation, which cannot be identified wih the scientific establishment, may have retarded publication of his work. It is frightening to consider that an idea may be unpublishable when offered by a comparative unknown, but published in a very prominent journal when offered by a professor of the correct department from a respectable university. We must be alert to open science to the insightful amateur—especially when we consider what a large fraction of the literature published by professionals is derivative, and how little can really be said to break new intellectual ground.

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