Letters

Quality and Quantity

Lee DuBridge [*Science* **124**, 299 (17 Aug. 1956)] tells us many wise and useful things in "Scientists and engineers: quantity plus quality." However, one of his arguments should be questioned. He advocates that "a few [a dozen] schools of science and engineering be encouraged to devote their resources to the sole task of improving quality." For the remaining schools, he somewhat reluctantly suggests that they "should face more frankly the range of intellectual caliber to be found among their students . . . [and] admit [if not openly, at least to themselves] . . . that [they are] going to cater to the middle or lower third of college students rather than the upper third," thereby supplying the quantity of second- and third-rate engineers and scientists he apparently feels we can use.

First, how does this suggested separation of schools into a few "quality" and a large number of "quantity" schools differ from what we now have? DuBridge would apparently more or less formalize and freeze the present status. In addition he would raise salaries at the "quality" schools, presumably leaving them as they are (for he ignores the point) at the "quantity" schools. These moves would undoubtedly aggravate the present situation.

Second, a school that openly admitted to its faculty (not to "itself") that it would "cater to the middle or lower third of college students" would be violating the most fundamental principle of psychology—the principle of self-respect. The natural impulses of all psychologically healthy teachers and students would be to reverse the admission of mediocrity or leave the institution as quickly as possible.

I believe that DuBridge is placing the blame for the generally low level of science and engineering graduates at the wrong point. There are strong reasons to believe that low-quality graduates result mainly from low-quality opportunities in mediocre schools rather than that they are the result of low-quality brains, as DuBridge seems to believe.

As an alternative approach to this problem, I suggest that we pursue the "swarming" principle. Let us continue to cultivate and maintain our present "quality" hives. But instead of encouraging them to grow bigger and bigger, and loftier and loftier, let us encourage them to "swarm" and start new (or help old) colonies to grow strong in "quality" also. For example, let the California Institute of Technology assist the Oklahoma Frontiers of Science Foundation to establish an "Oklahoma Institute of Technology." I would be willing to bet that C.I.T. would soon be convinced in education that "quantity" and "quality" need not and should not be separated.

JOSEPH W. STILL
2231 California Street, NW, Washington, D.C.

Research and Freedom

I see no paradox in conjunction with the editorial "Research and freedom" [*Science* **124**, 427 (7 Sept. 1956)]. The argument quoted from the *Baltimore Sun* could be reduced to: "Russia is making much scientific progress; Russian scientists are considerably restricted by their government; therefore governmental restriction is not harmful to scientific progress!" The American premise is that governmental restriction *is* harmful to scientific progress—hence, the seeming paradox.

The *Sun*'s argument does not consider the transcendental nature of Russia's science. There is no doubt that the Russian scientist has been highly restricted in the past (and his work in general was of debatable merit) and he is apparently politically channeled today; but we can hardly say that he is *scientifically* inhibited these days. His government gives him much prestige and relatively better pay than his countrymen and cooperation in international scientific events (the Geneva exhibition and conference and his own nuclear "open house"). In a sense he is made to feel a leader in his community.

Another inference in the *Sun*'s argument is that Russia's rapid progress has come not only *in spite of* but possibly *because of* governmental control of the scientist, and that perhaps some more of the same might help this country; but I say Russia's progress has come largely from making her scientists feel needed and important. This intelligent governmental policy cannot be assigned to Lenin; it is a simple outgrowth of one of the basic concepts of 20th-century psychology: the greatest motivator of man is his desire to win mankind's approval. Our own government would be smart in giving its own scientists more public recognition and prestige—rather than treating them as would-be international delinquents.

If we must get ideas from Russia, let us select the better ones; by this I mean let us have less regimentation and domination of man by man and more recognition of our scientists.

WILLIAM S. JARNAGIN
5009 Stadium Drive, Forth Worth, Texas

Terminology

Attention should be drawn to the fact that substitution of the word *autoradiography* for *radioautography* is incorrect. In radioautography an image is obtained which corresponds to the distribution of a radioisotope within an object. The image is the result of radiation from the contained radioisotope and does not necessarily correspond to the internal structure. On the other hand, radiography is a process in which an image of internal structure is obtained. This image results from differential absorption or deflection of external, penetrating radiation. The information derived from the two methods and, indeed, the methods themselves are not analogous. Placing *auto* before *radiography*, which indicates some form of self-operating radiography, gives no indication of what is intended when the term is used. Furthermore, the implication of an external source of radiation which *radiography* carries is misleading when *autoradiography* is used.

Tauxe *et al* [*Science* **120**, 149, (1954)] and George Boyd [*Autoradiography in Biology and Medicine* (Academic Press, New York, 1955)] support the use of *autoradiography* on etymological grounds. They also deplore the use of a word in which four consecutive vowels occur as in *radioautography*. While there must be due regard for etymology, we believe that semantic accuracy is far more important and that the meanings and connotations that roots have acquired in recent times are those by which we must be governed in the creation of scientific terms. Furthermore, we do not think that *radioautography* is any more

difficult to say, write or read than is *autoradiography*.

Happily we do agree with these authors on the suffix to be used to denote the results of radioautography—namely, *-gram*. *Radioautogram* and the contraction, *autogram*, are perfectly good terms.

We hope that those who have occasion to deal with radioautography will give a little thought to the semantic problem and henceforth use the correct terminology.

DAVID L. JOFTES
SHIELDS WARREN
Cancer Research Institute, New England Deaconess Hospital, Boston, Massachusetts

Training of High-School Teachers

The shortage of teachers usually is attributed mainly to their low economic and social status, but improvement in this direction alone, however desirable, does not guarantee a sufficient increase in the number and quality of students entering colleges of education, because the training programs offered at present may not be attractive enough. Therefore, alternative methods of teacher recruitment should be explored.

It is not widely recognized that the whole concept of training secondary-school teachers in the United States is basically different from that of all European countries: it stresses professional training at the university, leaving little time for the study of subject matter, whereas in Europe the emphasis is on a broad education and study of subject matter. For example, prospective teachers in a German Oberschule, which corresponds closely to our high school, study at a university for 4 years, without being attached to a separate department of education. They follow curriculums like those offered by our liberal arts colleges with a wide choice of major subjects. After a comprehensive examination, the preparation of teachers is completed by 2 years of in-service training with pay and a professional examination. Other European countries have similar training programs. There can be little doubt that under such a system many teachers could be procured also in the United States, because most of the graduates of our liberal arts colleges would become eligible for a teaching career.

Because in Europe little or no educational training is given to prospective high-school teachers at the university, many of these students are attracted to the university primarily by their interest in subject matter. Whether this has a favorable or unfavorable effect on selection of teachers may remain undecided, but it should be considered that the training offered opens their careers as well and that the decision to become a teacher need not be made when one is entering the university. For example, many European scientists have emerged from this large pool of students. Conclusive evidence about the merits of the European teacher training probably could be obtained rather readily by comparing the results achieved in European and American schools.

The present crisis is so urgent that all possibilities of improving the supply of well-trained teachers should be considered. Experiments with untried methods may not be necessary, because the apparently successful European system points toward a solution of the problem.

EMIL BOZLER
Department of Physiology, Ohio State University, Columbus

Hidden History of a Dictionary

In his kindly review of *The International Dictionary of Physics and Electronics* [*Science* **124**, 728 (19 Oct. 1956)], Bowen Dees states that it would be interesting to know who conceived the idea of this volume. Apparently he has learned, as I have, that the title page of a book does not always reveal its history. I am glad that he has given me an excuse to complete the record and to give credit where credit is due.

The idea of a modern dictionary of physics was conceived in a conference of the officers of the Van Nostrand Company, under the leadership of E. M. Crane, Sr. The success of the *Chemists' Dictionary*, published in 1953, led this group to believe that a volume dealing with physics would find use and acceptance. The problem of its production was turned over to William R. Minrath, who brought to it considerable experience in scientific and technical lexicography. It was he who searched the literature for a list of terms to be included, collected definitions approved by professional organizations, and did the basic spade work on which the final compilation was based. Only after he had completed this process were the editors chosen. We added to Minrath's list; we deleted from it; we revised definitions; we felt throughout a great debt to the man who had contributed more than any of us but who, as an officer of the publishing house, refused to have his name included among the editors.

WALTER C. MICHELS
Bryn Mawr College, Bryn Mawr, Pennsylvania

Australia Free from Rabies

In a report on zoonoses [*Science* **123**, 94 (20 Jan. 1956)], based on a recent article by Meyer [*Bull. Med. Research* **10**, No. 1, 2 (Sept.–Oct. 1955)] there is the statement: "No part of the world is free of rabies." In point of fact, there is a very large part of the world that is free of rabies in the Pacific area, even though much of it is water; however, one could start from the west coast of North and South America, across to a line skirting the east coastlines of Japan and the Philippines, thence down west of New Guinea to our Australian west coast, and say that within that vast area there is no rabies known to be present.

This area includes Hawaii, Fiji, Samoa, Solomon Islands, New Hebrides, New Guinea, New Zealand, and many smaller groups of islands, and Australia which in area is in itself almost as large as the United States. Have I proved my point?

At the time of writing, I have not read Meyer's article, but in many publications on zoonoses by the World Health Organization and publications by the Office International des Epizooties, mention is invariably made of the freedom of Australia and New Zealand from rabies.

R. N. WARDLE
Division of Veterinary Hygiene, Canberra, Australia