

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 opportuni-

ties 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.

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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* argu-

ment 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.

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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

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