Letters

Extraterrestrial "Geology": Finding the Right Words

In a recent report (23 Oct., p. 514), John A. O'Keefe described a conspicuous ridge on one of the Ranger 7 lunar photographs which he interpreted as resulting from volcanism. He proposed the name "arête" for such a curious feature.

Although "arête" refers to a knife-like ridge or rugged crest in mountainous topography, the term is usually restricted to glacial features; an arête is a serrate ridge between two cirques. Even if O'Keefe's choice of term can be justified, it is misleading, because it may be interpreted as implying that the ridge has been glaciated, which was not the author's intention.

This raises a general problem concerning the development of terminology for newly discovered features on bodies in space. The present confusion in terminology for earth features should not be further aggravated by applying similar terms to different features or different terms to the same features. When origin is unknown, a nongenetic term should be applied in keeping with present classification systems.

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American Research Vessel

In "Renewal of oceanography in Germany" (Report from Europe, 2 Oct. 1964, p. 45), Victor K. McElheny writes: "Unlike the recently constructed or adapted American oceanographic vessels, the *Meteor* will serve all branches of marine science instead of specializing in physical or biological studies." Apparently McElheny has overlooked the National Science Foundation's Antarctic research ship, the USNS *Eltanin*.

The *Eltanin* is equipped for studies in a multitude of scientific disciplines. She is a carefully planned floating mobile research station, capable of supporting these studies in frozen seas, and has been operating as such since 23 May 1962. Investigations being carried out aboard ship at present include work in meteorology, upper atmospheric physics, marine biology, entomology, oceanography, and geophysics. The scientific program is coordinated by the ship's sponsor, the National Science Foundation; the ship is manned and operated by the Military Sea Transportation Service.

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Testing: The Phrenological Approach

Scientists can frequently be observed discussing problems of human behavior without benefit of the rigorous scientific attitudes they customarily apply to nonhuman problems. We would not presume to discuss the molecular structures of wood, for example, simply because we have "been around trees all our lives." Humans can deal with human behavior in this way, but scientists, though human, have an additional commitment.

Barr's proposed "forum" on educational testing (Letters, 7 Aug., p. 533) might be a useful source of hypotheses concerning the nature, nurture, and measurement of the acquisition of knowledge. But it should not be expected to arrive at, or even attempt, the definitive conclusions implied by Hoffmann's "distinguished committee of inquiry" (Letters, 6 Mar., p. 997). One of the values of multiple-choice tests is that item functioning may be analyzed by means of established statistical procedures, may be evaluated against any of many criteria, and may subsequently be modified *on the basis of student performance*. One may argue with the choice of criterion but not directly with the items that meet it. Seldom are essay examinations so evaluated, although they could be. Incidentally, neither are textbooks; like essay questions, texts are evaluated largely through the subjective opinions of colleagues. The implicit assumption that the cognitive structures of teachers and students are comparable is absurd. One of the values of programmed instruction is that it requires the evaluation of instructional materials in terms of student performance. There should be little room for unsupported opinion with respect either to tests or to texts.

Do *all* multiple-choice items require only "superficial" memory? Do *all* essay questions require only "depth, subtlety, and creativity?" To cite an admittedly extreme example, a philosophy examination once consisted of the single, one-word question, "Why?" One student's answer was "Why not." Can the distinction between superficiality and depth of understanding be made in terms other than graders' perceptions of mystical characteristics like "theoretical-thinking ability and creativity" (LaFave, Letters, 9 Oct., p. 171) or such phrenological absurdities as "tapping the wells of thoughtfulness" (*ibid.*)? Aside from the ability question, evidence on relations between study habits and type of test is still inadequate [see J. Balch, *Am. Educ. Res. J.* **1**, 169 (1964)].

More intensive research is needed on this issue, and certainly free discussion should be encouraged while the evidence accumulates. But in these discussions there should be some recognition that we may not yet know what we are talking about.

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Massivity in Financing Research

In the account of the efforts of William Fox, the scientist-policeman (News and Comment, 30 Oct., p. 621), Greenberg has underscored the serious weaknesses of the "massive theory," according to which massive doses of federal money plus massive numbers of bureaucrats equal massive results. The lone researcher, such as Fox, simply can no longer compete with the streamlined laboratories and the mass production techniques. The individual is

brushed aside amidst the demands of the mob, the establishment, or the great society, depending upon one's view of things. And what concerns me most of all is that certain federal agencies are now in the business of underwriting the financial success of many educational institutions in this country. This fact, I feel certain, will one day rise to haunt us.

Perhaps it is true, as Greenberg suggests, that Fox's proposals simply did not meet certain standards and that he has only himself to blame, but somewhere, somehow, we must make room for the individual in the research world who wishes to pursue his own quiet ways, even while we are establishing priorities for federal research money. I can only echo Kusch's words that there must be something wrong with the system.

I have been disturbed that the science-underwriting federal agencies seem, much too often, to rely on the same individuals or institutions, time after time, to carry out research projects. I know, for example, that there are agencies which "suggest" to one of their favorites that a certain research project would be favorably viewed within that agency, but to get the personnel of that agency to admit to such a practice in an appropriations hearing is understandably impossible. I have been trying for the past several years in the Appropriations Committee to force the agencies to broaden the distribution of their research funds. Greenberg's article, if widely read, could be of considerable value in this regard.

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A Calculus for Journal Publishers

In a recent editorial, "Basic research journals" (13 Nov., p. 869), Wolfle, describing the difficulties associated with the publication of 500 research journals, argues: "If we assume that no individual subscribes to more than five journals . . . 500 journals provide approximately 2.5×10^{11} different combinations to satisfy the individualistic needs of some 2.5×10^{5} scientists." From this he concludes that fewer journals would suffice and many journals should be merged.

I submit that this is a publisher's view and that many scientists see the problem differently. In the first place, the computation of combinations of 500 things taken 5 at a time is much more sensitive to the 5 than to the 500. Thus, if one assumes that a present subscriber to five journals would continue to receive about 1 percent of the literature as the journals merge, then the combinations available drop very rapidly to 19,900 when the total number of journals reaches 200 and the subscriber takes two.

Quite apart from the combinatorial question, however, is the problem presented to the scientist by the sheer bulk that 1 percent of the journals represents. You may remember Sherlock Holmes's comment that "A man should keep his little brain attic stocked with all the furniture that he is likely to use, and the rest he can put away in the lumber-room of his library, where he can get it if he wants it." It is my own view that most journals should be in libraries and that a scientist needs a much *greater* choice of printed material to stock his "brain attic." The *Physical Review* has recently split into two sections in an effort to meet the needs of its subscribers more effectively. Perhaps much more drastic methods should be considered.

There is much to be said for the view that most scientific journals in their present form should be considered archival and be held as reference material in libraries to which scientists have ready if not constant access. The material subscribed to by scientists for their own direct use could then be (i) one or two journals of broad scope and general impact, such as *Science*, and (ii) expanded abstracts of articles in retrievable form (such as perimeter punched cards) in the research field or fields selected by the subscriber. The scientist could then obtain reprints of the more relevant articles (if, indeed, he did not already have preprints) and could consult others in the library as necessary.

In all of this the principal question remains. Are the added costs (savings) of a proposed system offset by the increases (decreases) in usefulness of the system to the research scientist? This is the kind of criterion that Wolfle should be using.

Finally, let me say that I am aware that 100,000 scientific articles taken 100 at a time yield about 10^{342} combinations. Is it obvious that these are too many?

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