Equal Opportunity

A tremendous amount of money has been and is currently being expended in an attempt to improve the scientific capabilities of American youth. Yet, do all youth receive an equal opportunity to benefit from this expenditure? Are these funds, many of which are derived from current taxes, actually being used to increase the subject-matter competency of future college science students within particular disciplines rather than to increase the scientific literacy of all youth as citizen-consumers? It would seem that a far greater number will become consumers rather than scientists.

During the past 10 years much has been said about the failure of elementary and secondary schools to provide adequate instruction in the sciences. Much has also been said to encourage these same schools to give students a better understanding of the relationships which exist between 20th century technology and modern social institutions. An ever-increasing emphasis seems to be placed upon the need for public and private elementary and secondary school teachers to acquire new factual information for dissemination to their students. However, it is extremely difficult to find publications concerning the degree to which the newly acquired information is communicated to and learned by high school students.

School administrators have been asked to indicate the necessary qualifications for secondary school science teachers. Is the science teacher unable to indicate the deficiencies which exist in his own subject-matter preparation? Further, to what degree does competent supervision exist in the public schools in general and, more specifically, within the sciences, when the administrator is likely to be less adequately prepared in them than the science teacher he supervises? This may be particularly true of smaller schools, but the debility appears to be general.

Is the college science teacher also shirking responsibility? Do those of us who work with science teachers in training attempt to determine the problems encountered by those working in the smaller schools? Do the present course-improvement programs involve a thorough analysis of the ways in which the discipline can be learned by high school students? Little evidence would indicate an affirmative answer.

While substantiating evidence is lacking, are institute participants selected on the basis of their previous college marks? Are some participants being selected because they teach in a particular community? It would seem that many people who are less well prepared academically, both in terms of marks and the number of science courses completed, should be the first to be invited to participate in an institute. Such teachers still remain in the classroom, while others have attended as many as 8 or more institutes.

In essence, while a large number of us welcome the opportunity to obtain grants, is there an abrogation of responsibility on our part? We apparently fail to investigate any values which may accrue from such expenditure in terms of an increase in the scientific literacy of high school students. If we are evaluating outcomes of institutes course-improvement programs, and the many other existing attempts to improve scientific literacy, then our failure to communicate and publicize our findings is also an abrogation of responsibility.

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Critical Evaluation of Reviews

Margaret Mead has raised an important issue in her letter concerning "literary" versus "scientific" book reviews [*Science* **141**, 312 (26 July 1963)]. There is a vast difference between a literary work—which is evaluated by the reviewer on the basis of emotional impact, craftsmanship, persuasiveness, or even the reviewer's personal opinion of the author and what he may be trying to say—and a serious book on some scientific specialty that has become of interest to a literary review journal.

The critical evaluation of the work of one professional scientist by another is based on the assumption that both author and reviewer are engaged in a common enterprise: the search for scientific truth. This is not the situation between the author of a novel and its reviewer. Thus when the scientific work seems to contain erroneous logic, insufficient supporting evidence, or unjustified conclusions, the reviewer should point this out—and the author's reply should also be printed. Many times the critic aids the author by pinpointing weaknesses in logic (or even arithmetic) and science benefits.

It does not matter where the review appears. When a scientific work is appraised for its content by another scientist, the "scientific reviewing ethic" must govern. For when one scientist criticizes the work of another, the fact that he stakes his reputation in public, keeping in mind the possibility of a sharp rejoinder, serves to maintain responsible discussion. As Arthur Freeman pointed out in the letter printed below Mead's, a reviewer can do himself discredit, as well as the author, if he is inaccurate or hypercritical. The possibility of an immediate rejoinder thus serves the community well.

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Is not Margaret Mead's "mare" actually a swarm of hornets [*Science* **141**, 312 (26 July 1963)]?

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Identity of Organized Elements in Carbonaceous Chondrites

A recent report in *Science* (*1*) highlighted the present controversy about the identity of organized elements found in carbonaceous chondrites. In this regard, it may be observed that none of the reported organized elements appear to be from "out of this world" in terms of morphology, structures, and reaction to stains (*2*). This can be seen by the presence of pores, spines, processes, ornamentation, protist size, canals, plates, necks, collars, tissues, walls, acid-resistant pellicles, apparent pectic substances in some walls, ribs or thickenings, reactions to a broad band of biological stains (*2*, Table 1). At the New York Academy of Sciences Conference on Fossil and Recent Protobionta last spring, I recall a conversation with Bourrelly in which he expressed surprise that many of the organized elements were reminiscent of terrestrial chrysophytes (which are his specialty) (*3*).

It follows that for such organized objects, an equivalent biochemistry to that known on earth is indicated. Thus, we may assume that all such objects are carbon-based, that nucleic material compares with that of similar terrestrial objects, that reproduction (fission and copulation) may closely resemble that of terrestrial equivalents (*2*, Fig. 6a).

This complete terrestriality of the organized elements places a sharp focus on a possible explanation. Either we are dealing with an example of extraterrestrial homeomorphy with terrestrial protists or the terrestrial aspect of the organized elements arises because they are, in fact, terrestrial contaminants (*1*). The latter explanation, being simplest, has first claim on our attention.

1) *Possibility of terrestrial contamination.* Claus *et al.* (*2*, Table 2) recently provided a valuable reference to the biological material found in soil and rock samples in the Orgueil impact area. These objects included various chrysophytes and in one rock fragment from a quarry (location not indicated on map), a fragment of an armored dinoflagellate, *Peridinium*. In addition, there was a varied suite of other protists, pollens, and other organic items.

The new data on the microbiology of the impact area becomes important when viewed in the light of observations of the organized elements made by several specialists. Claus, Bourrelly, and others have noted that several of the organized elements resemble chrysophytes. Staplin, Ross, and others have noted that some of the organized elements suggest hystrichosphaeres, dinoflagellate cysts, or dinoflagellate structures. Clearly, some chrysophytes and dinoflagellates are available in the impact area today (*2*, Fig. 9a-b). If a chondrite impacted in the Orgueil area today, one might reasonably expect incorporation of some of these forms and others listed in Claus's Table 2.

Claus *et al.* (*2*) cited Bourrelly and noted that the present soil microbiota in the impact area should be similar to that of 1864. Hence, we may conclude that such protists were available in the Orgueil area in 1864 at the time of impact. However, none of the organized elements were found to be "identical" with elements of the existing microbiota of the area. Does that close the case for contamination at the time of impact? I do not think so.

Almost a century has elapsed since the original fall in the Orgueil area and some changes in the biota might have occurred. As the next point to be discussed will show, based on the data of Claus, *et al.*, some changes apparently did occur.

2) *Aquatic contaminants in Anders's sample of the Orgueil chondrite.* Having recently processed a sample of the Orgueil meteorite provided by Anders (*4*), I was surprised