these three BSCS approaches this year, and I know secondary school teachers in other areas as well as in science who work toward these same goals in their regular teaching programs.

That we do not achieve nearly so much as we would like can be explained by the fact that time is necessary for continuous planning, evaluation, and reorganization of any teaching program as it relates to the individual student and his progress. At the elementary and secondary levels this time is available each day only after a continuous sequence of periods of meeting students in either academic or extracurricular pursuits (periods that often include the noon hour), broken only by the 3-minute interval for changing classes.

Even so, secondary (and elementary) school teachers are concerned and do work toward helping the student develop his ability to think, reason, appreciate, and discriminate. We need, somehow, to provide time for regular professional interchange of ideas in the school day, both within a school system and between school systems, so that all teachers will be stimulated to work more directly to accomplish these aims in spite of many seemingly insurmountable difficulties.

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Books and Advertising

W. H. Oldendorf [*Science* **133**, 198 (1961)] should be advised that one very good reason for not contaminating books with advertising as he suggests is the very costly increase in postage that results.

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Radiation Exposure

The article by Newell and Naugle on radiation in space [*Science* **132**, 1465 (1960)] is an interesting and timely treatment of the subject. However, it contains several references to ionizing radiation exposure standards for human beings which I feel may be misleading.

A figure of 0.3 r per quarter is referred to as an exposure standard for radiation workers. To my knowledge, this has not been proposed by any group. It probably represents a simple decimal-point slip from the 3.0 rem (close enough to the roentgen for this discussion) per quarter recommended by the National Committee on Radiation Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), and

the Federal Radiation Council (FRC). This error then resulted in the value 1.2 r per year given in Table 4. Neither 0.3 r per quarter nor 1.2 r per year is consistent with the value 5.0 r per year given in the same table.

The long-term occupational dose in the numerical recommendations of the three groups mentioned above is $5(N-18)$ rem, where the individual's age is N and greater than 18. Thus, a person over the age of 18 would be permitted 12 rem every year (3 rem times 4 quarters) until he reached the dose derived by the formula.

The reference to a 25-roentgen "maximum permissible emergency dose" leaves the impression that some serious biological effect will ensue from a higher dose. The article seems to have taken a portion of the NCRP's *Handbook 59* (as revised) out of context. The complete thought is, "An accidental or emergency dose of 25 rems to the whole body or a major portion thereof, occurring only once in the lifetime of the person, need not be included in the determination of the radiation exposure status of that person. . . ."

The NCRP and ICRP are unofficial groups. More recent in origin, and more directly related to NASA, is the FRC, whose recommendations have been approved by the President for the guidance of federal agencies. One recommendation of the FRC would permit a dose exceeding that set forth in the radiation exposure guides after careful consideration of the reason for the larger dose. Surely, a man in space would qualify for consideration.

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As noted by Ely, our article contains an error in Table 4. The maximum permissible dosage for radiation workers should be 3 r per quarter and 12 r per year, provided the individual's total long-term occupational dose does not exceed $5(N-18)$ r, where N is his age in years. The statement, "In 10 hours a man would receive his allowable yearly dose even with this amount of shielding," should then read, "In 6 hours a person would receive his allowable quarterly dose even with this amount of shielding."

The statement, "After taking such a dose [25 r] the man would not be permitted to take any more radiation in his lifetime," should, as noted by Ely, be deleted.

It was our intent in the article to give the relative orders of magnitude of the radiation levels in space and permissible dosages to indicate the magnitude of the problem presented by this radiation environment. It was not our intent to give the impression that we

were specifying the permissible dosages for manned space flight.

There are three errors in the second section of Table 2. Item *b* should read: "Electrons, $E>200$ kev: omnidirectional intensity: $\leqq 1 \times 10^{8}$ cm^{-2} sec^{-1}." Item *c* should read: "Protons, $E>60$ Mev: omnidirectional intensity: $\leqq 10^{2}$ cm^{-2} sec^{-1}" (*1*).

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Note

1. The symbol $\leqq$ here means "less than or approximately."

Sustained Swimming in Dolphins

Johannessen and Harder, authors of the report "Sustained swimming speeds of dolphins" [*Science* **132**, 550 (1960)], imply that the "length of time at observed speed" (in their Table 1) necessarily represents in each case a time during which the animals swam continuously and unaided at the indicated speeds. It is this implication on which I wish to comment.

Establishing the sustained work capacity of dolphins by the observational methods used by these authors requires identification of the individual animals during the indicated timing periods. The valdity of using groups of dolphins for this purpose is questionable. How can the authors be sure that a group, seen from a quarter of a mile to several miles away, is necessarily made up of the same individuals, or is even the same group, as one seen a few minutes earlier or later?

Part of the problem of proving the marine animal's capacity for sustained swimming at high speed seems to be that of showing that a portion or all of the required energy is not derived from waves. Observations have shown that in some cases no apparent swimming effort is required for dolphins in a bow wave to move through the water at 10 knots (*1*). They have also been seen riding natural waves near shore (*2*).

The numerous observations of "wave-riding" dolphins have been variously explained as resulting from gravity (*3*), buoyancy (*4*), and pressure (*5*)—forces associated with the waves. The question of the origin of the force or forces actually producing the "wave riding" seems at present unresolved.

The work referred to above suggests strongly that observational programs designed to demonstrate the work capacity of marine animals swimming near the surface should give particular attention to waves. The sizes and directions of motion of local wind waves and of swell may be important, especially as they are related to the directions and speeds of motion of the observing ship and of the animals observed.

If dolphins and other marine animals can indeed utilize the energy of waves on the open sea, as well as bow and coastal waves, then the virtual absence of wave data in the observations reported by Johannessen and Harder makes it seem doubtful that these observations can be regarded as clear evidence of the sustained-work capacity of the animals concerned.

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3. A. H. Woodcock and A. F. McBride, *J. Exptl. Biol.* **28**, 215 (1951).
4. W. D. Hayes, *Nature* **172**, 1060 (1953).
5. P. F. Scholander, *Science* **129**, 1085 (1959); A. A. Fejer and R. H. Backus, *Nature* **188** (1960).

In answer to Woodcock's comments we suggest that the questions raised are not applicable to our report to the extent that Woodcock infers. He wonders at our using groups of dolphins instead of individuals. Anyone experienced in shepherding even a well-disciplined group of children will testify that group velocity is equal to and usually less than the velocity of the individual. This