The probability of obtaining zero cases in a trial sample of size *n*, when the true incidence is *p*, is given by the last term of the binomial expansion $[p+(1-p)]^n$, $(1-p)^n$. Thus, if an agent were capable of producing 100,000 cases of cancer in the United States population at risk ($p = .001$), there would be about one chance in three $[(1-.001)^{1000}]$ that the agent would be classified as "safe." Even if we make the common assumption (which is not always legitimate) that dividing the dose level by 100 would be equivalent to obtaining no cancers in 100,000 test animals, in such a test of an agent which could produce 1000 cases in a population of 100 million ($p = .00001$), there is a one-in-three chance $[(1-.00001)^{100,000}]$ that no experimental tumors would occur.

The present alternative to direct estimation of risk probabilities is extrapolation from dose-response curves. The report states that "dose-response curves for certain potent carcinogens in animals have been worked out from which can be reliably predicted the probability of an individual, in a given size population, developing a tumor from a given dose of carcinogens." This statement requires qualification. While a given technique (such as probit analysis) will often be adequate for ordinary applications (which involve interpolation or very limited extrapolation), the extrapolation required here makes the estimate heavily dependent on the assumption about the underlying distribution (such as the normal distribution). This point is evident when several alternative linearizing transformations (probits, logits, angits, and so on) are used on the same data. While all may provide a fair fit to the observed points and very similar estimates for the LD_{50} (50-percent probability), the *extrapolated* estimates for very small probabilities will not even be of the same order or magnitude. Such predictions are clearly not reliable enough to be used in a decision where human lives are involved.

Until reliable decision-making procedures for the food additive situation are developed—and to develop them is certainly not an easy task—we would question the advisability of vesting an advisory board with power to exempt chemicals that have some experimental carcinogenic effect from the present Food Additive Amendment of the Food, Drug, and Cosmetic Act. An advisory board to review procedure to be considered adequate for testing chemicals for carcinogenic effect in man would, of course, be useful. The creation of such a board probably does not require any amendment to existing legislation.

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Goals of Secondary School Teachers

As a secondary school teacher (in biology), I feel I must reply to Merritt A. Williamson's letter in *Science* [**132**, 1732 (1960)].

In his statement, "college teaching, as contrasted with secondary school teaching, is concerned with the development within the student of the power to think, reason, appreciate, and discriminate . . . ," he implies that these are not the objectives of the secondary school teacher. He is very wrong. These are the objectives I had when I taught sixth-grade and eighth-grade biology and which I now have in teaching tenth-grade biology. That I am not alone is evidenced in the fact that, through the American Institute of Biological Science's Biological Sciences Curriculum Study program, hundreds of secondary school teachers (among others) contributed to the development of three different approaches to the teaching of biology, all of which embodied these same objectives.

There are 118 teachers now using

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