LETTERS

A Poet's "Education"

The highly asymmetric notion of "education" embodied in the Harvard Core Curriculum (News and Comment, 8 Dec. 1978, p. 1063) perpetuates a historical accident. The humanists were the first to define "education" long ago; and, not surprisingly, they defined themselves as the model of what ought to be. We are all still imbued with that old idea. We think it terrible if a person studies chemistry/math/physics and learns nothing of the humanistic side of the world. But no one looks askance if a person spends 4 years in history/literature/poetry and remains ignorant of the physical world.

A science school such as Caltech requires its students to spend one-quarter of their time in the humanities: that's what it means to be "learned" after all. But is there a humanities department, anywhere, that believes it is important for people to comprehend the issues behind recombinant DNA research, or the trade-offs between nuclear and fossil fuels?

Despite the increasing importance of science in our society, most people remain ignorant of even its simplest concepts. For such "educated" people, the world operates as though by magic; they are at the mercy of any random failure of a device or any dishonest technician. And we, in turn, are all at their mercy when they are asked to make policy decisions involving scientific matters.

Those who will not understand science become, instead, its prisoners. Such people can feel smug in their cultural knowledge until the pilot light in the furnace goes out or until they are asked to use, or not use, a particular chemical compound, because of tests they cannot understand, performed according to the principles of a scientific methodology whose purpose they do not comprehend.

Has our "educated" poet really been liberated from the suffering of Chemistry I or merely been made the slave of a cancer quack?

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Occupational Cancer Risk

In his article of 10 November 1978 (News and Comment, p. 602) Thomas H. Maugh II summarizes various industry-generated criticisms of the Department of Health, Education, and Welfare

(HEW) draft report "Estimates of the fraction of cancer in the United States related to occupational factors" (*1*)—criticisms that unfortunately lead him to conclude that the HEW projections are invalid. While this letter is not intended to present a detailed rebuttal to these criticisms, it offers a general response to Maugh's comments and puts the issue of occupational cancer risk estimation in better perspective.

Because of the numerous assumptions that must necessarily be made about the level of past exposures, size of the population at risk, and so forth, it is difficult, if not impossible, to generate any single estimate of the number of occupationally related cancers that is not vulnerable to at least some degree of criticism. Nevertheless, the purpose of the HEW report was to demonstrate that a careful consideration of the *multifactor* etiology of most cancers would indicate that occupational exposures play a more significant role in the onset of this disease than has been generally recognized.

One of the major arguments offered to support the claim that the HEW figures are grossly inflated rests on assertions that the risk estimates used in the government document are far too high, and that they do not reflect current industrial exposure levels. Maugh states that the HEW investigators "in each case" took "the highest risk ratio available" in making their projections. This is clearly not true, as inspection of table 2 (*1*, p. 33), the accompanying notes (*1*, pp. 34-38), and the related references—particularly (*2*)—would reveal. Furthermore, as the average latency period for most occupational cancers ranges from 15 to 35 or more years, it is obvious that the bulk of industry-associated cancers that will appear over the next one to two decades will result from initial exposures that occurred typically before 1960. (For example, many of the current mesothelioma deaths are likely to be related to initial exposures during World War II.) Thus, recent reductions in exposure levels—often brought about by federal regulation and intervention—are not likely to markedly alter the incidence of tumors in these cohorts in the next one to two decades.

The HEW investigators are also accused of having ". . . rather sloppily equated deaths with incidence." Although this statement is not really accurate, as a careful reading of the footnotes to table 2 of the HEW document will attest, it is a "strawman" issue in any event. The major occupational cancer of concern in the HEW report is respiratory tract cancer, which is characterized by an exceedingly poor prognosis. Thus,

the case detected this year is almost sure to become next year's fatality.

Finally, the HEW document is severely criticized for (allegedly) overestimating the magnitude of the population at risk. The use of figures derived from the National Occupational Hazard Survey of 1974 is particularly condemned on the basis that the survey data reflected potential exposures at any level rather than actual exposures at levels sufficiently elevated to increase risk. Clearly population-at-risk figures are among the most difficult to ascertain in making the projections under discussion: in some cases populations at risk could be overestimated, in other cases underestimated. However, the error associated with this potential overestimate may not be so significant as industrial critics suggest because turnovers among the cohort of workers who will contract the occupational cancers of the next two decades have not been taken into account. Furthermore, the HEW projections did not include any estimates of the industry-related tumors likely to occur among the many occupational groups in which excess cancer incidence has been reported but for which a specific etiologic agent has not yet been identified. Nor did they include any projections of excess risk from exposures to chemicals, such as epichlorohydrin, shown to be carcinogenic in laboratory animals but not yet studied in human populations. For these reasons, any present estimate of future occupational cancer risk could be conservative.

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References

1. "Estimates of the fraction of cancer in the United States related to occupational factors" (National Cancer Institute-National Institute of Environmental Health Sciences-National Institute of Occupational Safety and Health, Washington, D.C., 15 September 1978).
2. P. Cole and M. B. Goldman, in *Persons at High Risk of Cancer: An Approach to Cancer Epidemiology*, J. F. Fraumeni, Ed. (Academic Press, New York, 1975), pp. 167-184.

Hypothesis Testing

The authors of the important article "Cognitive development and social policy" (23 June 1978, p. 1357) quote, as have so many others, a conclusion of Record, McKeowan, and Edwards (*1*) pertaining to the intelligence of twins. The latter authors erred, however, in concluding *from their data* that the in-