to provide the means for employment of more scholars in careers of research.

Solutions to the cancer problem, to the still larger medical problem of heart disease, or to the many problems of pollution associated with a high standard of living are not going to be found by untrained individuals. The great advances in biology in recent years may be directly correlated with the support given by certain foundations and by the National Institutes of Health, support that made it possible for universities to maintain men committed in large part to research. It was this kind of support, for example, that resulted in a vaccine against polio and thereby saved millions of dollars that would otherwise have had to be spent for hospitalization and therapy of people crippled in youth by this disease. It is this kind of support that now permits some to contemplate a "final push" against cancer.

Rather than curtail training programs, we should work for future increases in job opportunities. One way to do this is to establish graduate universities and research institutions affiliated with them. The latter might be centered on practical problems but could approach these problems with a long-range view and in an interdisciplinary way. The Woods Hole Oceanographic Institution and its new graduate school of oceanography affiliated with the Massachusetts Institute of Technology provide an excellent working example.

It is already clear that such research and training centers are needed in diverse fields. They have to be staffed with scientists who have an equivalent of the Ph.D. A sharp curtailment in training of Ph.D.'s now will leave us short of the young people we will need.

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Breath Test Machines

In his letter (2 July) criticizing my report on alcohol breath tests (2 Apr., p. 57) Edwards raises three questions explicitly or implicitly. These are: (i) Are the data presented correct? (ii) Was the report really necessary in view of the fact that the defects described were "well known"? and (iii) Whose problem is alcholism and whose problem is the correct calibration of an instrument used by traffic police?

Neither Edwards nor anyone else has questioned the accuracy of my data. I stated in my report that "There have been occasional warnings about the inaccuracy of Breathalyzer or other alveolar gas tests . . . but these are rare, generally nonquantitative, and inaccurate." To date, I have found no evidence to indicate that this statement was incorrect. Edwards does not cite any previous paper in which the Breathalyzer or any similar instrument was properly calibrated. In addition to the disputed time factor, still inaccurately stated by Edwards, other errors in usage of breath test machines needed to be corrected. For example, it has been assumed that "true reactions with alcohol in expired breath from other than alveolar air (eructation, regurgitation, vomiting) will, of course, vitiate the breath alcohol results, but can be detected by observation of the test subject, and [italics mine] *prevented by having the subject rinse out his mouth with water*" (*1*). This assumption, also, was demonstrated in my report to be false.

Alveolar gas tests are also used in scientific laboratories. It was for this purpose that a Breathalyzer, with its book of instructions (omitting mention of time factors), was sold to the NASA Langley Research Center for use in a study of alcohol effects upon human motor, sensory, and mental performance. Convinced that, in principle, this instrument could not perform as claimed by the manufacturers, I suggested to Maraman, of the Langley center, that we should test the accuracy of the instrument. As indicated in reference 7 of my report, I presented these data to a plenary session of the 16th International Symposium on the Prevention and Treatment of Alcoholism at Lausanne, Switzerland, in June 1970. None of the assembled (scientific, medical, and legal) experts hinted to me, in the lively discussion that followed, that they were old hat. Indeed, I was persuaded by my colleagues at this meeting to give wider circulation to these data. After my report was published in *Science*, M. V. Stack, of the Medical Research Council Dental Research Unit in Bristol, England, called to my attention that he had reported to a meeting in 1957 some of the difficulties with residual mouth alcohol in usage of the Breathalyzer. Unfortunately this information (apparently not published in a journal) was to be found neither in the instruction book issued with the Breathalyzer 11 years later, nor in recent reviews of this subject.

I had and have no interest in pro-

claiming a new "discovery." The publication of some technical details about the correct use of an instrument is more a duty than a claim to fame. Such calibrations are performed every day in the laboratory by every working scientist.

Neither I, nor my colleagues in physiology, will relinquish our interests in the correct calibration of instruments, in the neurophysiological bases of alcoholism, in the etiology of alcoholism, or in the sociological problems of alcoholism, including that of slaughter on the highways. The fact that there are more than 6 million persons with serious alcohol problems in the United States alone (and similar percentages in most other countries) is the concern of each human, be he bureaucrat, physiologist, or Mr. Everyman.

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Reference

1. Committee on Medicolegal Problems, *Alcohol and the Impaired Driver: A Manual on the Medicolegal Aspects of Chemical Tests for Intoxication* (American Medical Association, Chicago, 1968), p. 104.

"Back-to-the-Wall" Effect?

Twenty-seven World Series have been played since the end of World War II. Of these, 15 have lasted seven games. For equally matched teams the probability (p) of the series lasting seven games is

$$p = C_{6}^{6}\,(1/2)^{6} = 0.312$$

where C is the binomial coefficient.

For unequally matched teams it is, of course, lower. The probability that 15 or more out of 27 such series would run seven games is

$$\sum_{n=15}^{27} C_{6}^{n}\, p^{n}\,(1-p)^{n-6} = 0.0076$$

There are, of course, theoretical difficulties associated with statistical interpretation of rare events defined after the fact, but this case is so easily defined, and the probability is so low, that its occurrence virtually demands investigation.

Upon detailed examination of individual games, one finds a peculiar anomaly in the results of the sixth games. Of 19 World Series that have gone to the sixth game, the team that was ahead going into the sixth game