Letters

National Security

In his recent letter (24 Dec., p. 1270) commenting on articles by William J. Broad (News and Comment, 19 Nov., p. 769) and by Hans Bethe (*1*), Edward Teller makes some statements about me and my views. He is basically correct about my views on the superbomb program; his statements about my general views are not correct.

Far from being "unwilling to acknowledge any danger," I believe the United States and the world face two very serious and closely connected problems. The common shorthand name for one is the Russian Threat; the common shorthand name for the other is the Nuclear Arms Race, with a Nuclear Holocaust as its logical final result. In our search for solutions to either one of these problems it is absolutely essential to take the other into account, and it is truly dangerous to propose and carry out programs designed to mitigate one of these problems that ignore or exacerbate the other. Unfortunately, many people in high places and at both extremes do just that, and the net result has been a steady worsening of our absolute national security position for at least the last 30 years.

For 25 years I have believed and said that the United States seriously undervalues and underutilizes nuclear arms control and disarmament as a major means for coping with its national security problems, and I have supported programs and worked in projects designed to rectify that situation. Similarly, for my entire career, I have supported programs and worked on projects whose main or sole purpose has been to improve the quality of Western military preparedness, and I still do.

Teller also speaks of "self-delusion." I suppose all of us are vulnerable to it from time to time, but surely one of the outstanding delusions of recent times has been the notion that a technological means for defending the nation against a general nuclear attack is just around the corner. This grand self-delusion has been shared by a number of technologists (including Teller) for at least 25 years now, but to date the record clearly shows that they have been quite wrong. Of course, it is conceivable that among the discoveries and inventions yet to be made will be one which will in fact lead to a solution to this problem. Like Bethe and Teller, I believe that would be a good thing, and I have always supported work intended to lead to such a possibility. However, I believe it is very unlikely that an effective general defense will be invented in the foreseeable future. I further believe, along with most others who have had experience with this particular technological issue, that if the necessary "breakthrough" does turn up, it will probably not involve either nuclear fission or fusion in an essential way.

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References

1. H. A. Bethe, *Los Alamos Science* (Fall 1982), pp. 43–53.

Homology

In evolutionary studies, homology implies common ancestry. When the biochemist Margoliash (*1*) in 1969 defended that simple and historically correct usage, he had been arguing against an earlier contention of protein chemists. They had stated, in effect, that "homology" should merely be a synonym for "similarity" because the evolutionary biochemist "has not and cannot have any independent experimental evidence relative to the question of ancestral genes" (*2*). Now with DNA sequences, one can reasonably evaluate the probability that two genes shared a common ancestor. Margoliash's stricture stands with even more force today.

Yet many concerned with DNA, protein, or karyotype evolution have not heeded the century of usage of the term homology in evolutionary biology. A recent extremely interesting report in *Science* concerned chromosomal comparisons of human, gorilla, chimpanzee, and orangutan (19 Mar., p. 1525). Unfortunately, the authors wrote that comparisons of chromosomes "have revealed a general homology of chromosomal bands in the four species and suggested a common ancestor for chimpanzee, gorilla, and man." This is the cart before the horse. Similarity in karyotype banding (or sequence comparisons) can lead to the inference of a common ancestor, in which case, if the inference is accepted, the structures (or sequences) can be referred to as homologous. If these similarities were owing to convergence caused by similar function or simply chance, they would only be analogous to each other. The advantage for the confinement of homology in papers with evolutionary implications to mean similarity by common ancestry is that it prevents what were rightly referred to as "insidious misunderstandings" (*1*).

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References

1. E. Margoliash, *Science* **163**, 127 (1969).
2. W. P. Winter, K. A. Walsh, H. Neurath, *ibid.* **162**, 1433 (1968).

Ranking Carcinogens for Regulation

When I compare the ranking scheme proposed for regulating carcinogens by Robert A. Squire (20 Nov. 1981, p. 877) to one which employs the fitting of mathematical models, I find that most of the factors considered important by Squire could be included more objectively in a mathematical model approach. The most surprising feature of his ranking system is the lack of weight given to carcinogenic potency. In fact, two chemicals that are identical in their carcinogenic effect, except that one is 1 million times more potent than the other, could be given the same recommendation for regulation in Squire's system (if, for example, 0.75 gram per kilogram of body weight per day of one carcinogen caused the same response as 0.75 microgram per kilogram per day of another). Most any data-fitting scheme, on the other hand, would lead to the correct conclusion that, all other things being equal, the allowable exposures of the more potent carcinogen should be 1/1,000,000 of those allowable for the less potent one. If malignant neoplasms are deemed to be important, then those could be used in fitting a model. It would seem that the absolute numbers of neoplasms are more important than the ratio of malignant to nonmalignant. According to Squire's ranking system, finding 10 malignant and no nonmalignant neoplasms would be more cause for concern than finding 10 malignant and 50 nonmalignant ones—which seems illogical.

It is possible to incorporate negative