Letters

Frontal Attack on Radiation

"Radiation risk: A scientific problem?" by Robert Holcomb (6 Feb., p. 853) is an amazingly accurate report of the "direct frontal attack" on existing guidelines for limiting radiation exposure and recommendations of the world's experts in mammalian radiation biology. Holcomb's report echoes the unemotional aspects of many radiobiologists' reactions to the Gofman-Tamplin challenge; however, when dissecting the "attack" in terms of opinion versus evidence, risk versus benefit, and extrapolation versus measurement, some key issues perhaps have been camouflaged.

Dose rate, and not the total dose, is probably the most important single factor which distinguishes an anticipated radiation exposure risk to the general population from the known or inferred relationship of human cancer and ionizing radiation. It has now been demonstrated that, as the rate of dose is lowered, the incidence of cancer in animals is diminished, as are genetic effects in animals, and chromosomal aberrations in man and animals. For some biological systems an effective threshold at low dose rate has been demonstrated. The environmental dose rate we are concerned with is 10,000 to 1 million times less than the dose rate of nearly all human exposures from which arithmetic inferences have been made about cancer or leukemia induction. This is also true for the controversial in utero radiation leukemogenesis issue and F_2 sex ratio anomaly findings.

The radiation effect may be a single point mutation independent of the dose rate, but the repair or regenerative mechanism might be exquisitely sensitive to dose rate. There is no reason to believe recovery and repair mechanisms, known for animals, do not operate for human radiation carcinogenesis and longevity.

The Division of Biology and Medicine of the Atomic Energy Commission has taken its responsibilities seriously, as evidenced by the fact that we have more knowledge of radiation than of any other potential pollutant. We can apply the scientific method to understanding radiation risk from the standpoint of dose rate, as is being done for chromosome changes, carcinogenesis, and genetic changes. More work and less opinion might unequivocally show the radiation pollution "frontal attack" is treating a splinter in a patient dying of suffocation.

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The large number of animals needed to observe radiation effects at low doses and the expense of maintaining these animals raises a question of whether possible results justify the effort.

The automobile industry faces similar problems in measuring the effect of promotional and marketing efforts upon sales. In a 10-million-a-year car market, an increase in sales as small as 1/10 of 1 percent might mean as much as $5 million additional profit. Companies in the industry do not try to measure changes in sales of quite that small a magnitude but they are nevertheless forced to use panels of 200,000 or so car buyers in some of their advertising effectiveness studies.

It seems to me that the measurement of the risk of low levels of radiation would be equally important.

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It is frequently misleading, when evaluating cancer risks associated with low doses of radiation, to say: "There are no studies that show increases in cancer at low (below 50 or 100 rad) doses, although there are a few that should have detected it if it had occurred." Actually, in three large-scale studies (*1–3*), the cancer risk in children exposed prenatally to doses of not more than a few rads (from diagnostic x-ray examinations of their mothers) was significantly higher, and higher by a factor of at least 1.4, than the cancer risk in children not so exposed.

The only study (*4*) cited by Holcomb in support of the aforementioned statement actually showed that in a population of hyperthyroid patients treated with radioiodine, surgery, or both, the age-adjusted leukemia mortality rate was significantly higher, and higher by a factor of 1.5, than the leukemia mortality rate in the general population. This, as yet, inconclusive study by no means excluded radiation as the cause of an observed higher leukemia mortality in the patients treated with radioiodine.

Clearly, the relation between cancer risk and radiation doses below 50 rads can be studied. Indeed, it is essential to do so, not only for the rational setting of standards but also for an understanding of cancer itself.

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References and Notes

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. . . I have accumulated some 3200 references on low dose radiobiology as part of a report for the U.S. Public Health Service ("Low and very low dose influences of ionizing radiations on cells and organisms, including man . . ."). When one views the total picture, it becomes essential to employ a linear, nonthreshold model in any evaluation of human radiation risks, although not all low dose effects are necessarily detrimental. The many variables and interactions which subtly influence the radiobiological end point may have a more compelling role with low dose exposures than with higher doses, adding another unknown measure of uncertainty to the final results. Despite the accumulation of low dose radiation data, it will be most difficult for some time to provide limits to a range of estimated risk, but this must be done. As recently noted by the National Acad-

emy of Sciences Panel on Technology Assessment, nuclear technology with appropriate assistance could provide and preserve "future options" and give more "attention and support to research and monitoring programs calculated to minimize technological surprise and to deal rationally with the burdens of uncertainty."

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The University Is Not a Highway Department

There is much wisdom and sophisticated opinion expressed in F. Kenneth Hare's article "How should we treat the environment?" (23 Jan., p. 352). But his arguments are based on an implicit assumption which is unfortunately shared by many influential people in our universities, and which needs to be seriously questioned: The assumption that the university *should* answer the current call to solve society's very pressing social problems.

Since World War II those of us in the universities have done many things other than objective, detached scholarship and research, but most of us did stop short of taking the responsibility for the solution of practical social and political problems. Where we did take on such responsibilities we usually assumed them as a personal responsibility, without making them a university or institutional commitment, for we were aware that politics is a difficult and not always a gentlemanly game and that what is valuable in the university—intellectuality—is fragile and likely to be damaged in the arena of real, national politics.

We should seriously consider the possibility of letting ourselves be bypassed, as Hare suggests may happen, if we do not answer the call to solve social problems. Will it be damaging to the general welfare if we in the universities say to federal and state officials: build new institutions for groups of intellectuals who are "more flexible," who will share with you the direct responsibility for the solution of practical problems. Being so bypassed would not be such a terrible fate. We would still have many worthwhile tasks to accomplish in the university. We can devote ourselves to undergraduate education which in the past has not received a fair share of the resources of the major universities; we can devote ourselves to the education and training of fewer but more scholarly graduate students, allowing the less scholarly and more politically interested students to enter the new institutions. We can devote ourselves to our fundamental and applied research activities which will, *perhaps,* help in the solution of social problems. Some of us can engage in intellectual activities designed to assist in the solution of social problems, but we can leave the actual responsibility for the solution of those problems to others in the new institutions—with, perhaps, some consultation if the new institutions need assistance.

I am aware that in some sense the university will be "hurt" if such a strategy is adopted. It will not receive the sums of money that the private foundations and the federal and state governments promise to those who will actively try to solve our current, pressing social problems. But what the university will lose in the race for resources, it will gain by not suffering the blows that inevitably come to the more "flexible" and politically responsive organizations.

Perhaps we in the university should leave the actual solution of political and social questions to men of action as we have in the past. These men control enormous resources and can create laboratories and research organizations to assist them. Perhaps the universities should leave the actual solution of foreign policy problems to the President, the Secretary of State, and the groups of scholars and advisers they call upon. Perhaps the universities should leave the actual defense of the country to the Department of Defense and its intellectual advisers. Perhaps we should leave conservation to the Department of the Interior together with the intellectual apparatus it creates. Perhaps we can leave the construction of highways and trains to the Department of Transportation.

As individuals and citizens we can contribute to the solution of all these problems by political action. As scholars we can produce ideas that may help men of action. But it might be best to recall that the university is not the Department of State, nor the Department of Defense, nor the Department of Housing. Most of all, we can remind ourselves that the university is not a highway department.

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