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February 16, 1951

Dr. Joseph G. Hamilton *JH*  
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Dear Joe:

Subsequent to our conversations of last December, we have kept a weather-eye out for specific high priority problems which might be successfully attacked with the unique facilities and talents available at Crocker. It appears that there are four general areas which may be worth considering.

First, the AEC has recently adopted a set of permissible levels for mixed fission products in contamination of food and water supplies for consumption over short periods of time under acute emergency conditions. It might be desirable to set up some short-term experiments in which experimental animals, possibly dogs, are permitted to consume food and water contaminated with fission products to the maximum permissible dose over a period of several months. This would give added backing to the validity of the calculations and assumptions on which the figures are based. As a corollary to this problem it might be desirable to place a group of animals on rations and water contaminated at a level several orders of magnitude higher, in order to determine the concentration necessary to produce detectable physiological changes in a limited period of time. Following these experiments the animals could be farmed out for observation of any late radiation effects which may develop over a period of months or years.

The second problem which is of considerable interest to both the Armed Forces and to Civil Defense planners, concerns the degree of hazard associated with the inhalation of dust contaminated with fission products to a degree comparable with that which might exist after a low-air or ground burst of atomic weapons. The objective would be to determine the minimum level of contamination with mixed beta-gamma activity which would produce early physiologic changes following short-term inhalation under simulated tactical conditions. The exposed animals should then be observed for a period of time to determine late sequelae. From this and additional series at lower levels, we should be able to establish interim emergency levels similar to the food and water figures. We have in mind a purely practical approach without too much concern for precise particle-size determinations.

The third field upon which further information is needed is that of determining to the extent scientifically feasible, the precise molecular reorientations produced in pure solutions of organic metabolites by ionizing radiation. There is some reason to believe that the ultimate answer to the problems of radiation injury may not be

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determinable on the basis of studies of entire organisms, cells or complex enzyme systems, but by fundamental molecular considerations. Subsequent to the exposure of pure organic solutions to large doses of radiation, it might be possible to separate and identify the altered molecules by chromatographic or other techniques. It might be desirable to give these studies a biochemical orientation by studying the physiological effects following injection of such modified metabolites. As far as I know, Howard Andrews at NIH is doing some work in this direction, but I believe that he is confining himself to the studies of influence of added inorganic substances and oxygen on peroxide formation in aqueous solutions.

The fourth area of research for which the Crocker cyclotron may be uniquely adapted is that of fundamental investigations of the damage produced by very low fluxes of heavy nuclei. This area is of particular interest to the Air Force. The problem might be attacked by the use of the carbon beam, or perhaps a beam of even heavier nuclei. One approach might be to determine the effect of single ionizing particles upon tissue, perhaps using the nictitating membrane of the rabbit or the hamster's pouch. The concern, as you know, arises from the fact that there is a significant flux of highly energetic particles of masses in the neighborhood of  $^{40}$  charge 20 in the stratosphere. The possibility exists that even a single particle may produce a cylinder of cellular damage which would set up conditions leading to the development of neoplasia.

Would you care to think of these suggestions in terms of feasibility in the light of existing laboratory commitments and technical personnel available. Please understand that these are suggestions and are subject to modification or rejection in the light of existing circumstances. They have been reviewed by Dr. Warren and the staff who concur in their importance. Perhaps it would be possible to discuss them in more detail when you get back this way in March or at the time of the Program Assumptions meeting early in April.

Sincerely yours,

L. E. Tuttle  
Asst. Chief, Medical Branch  
Division of Biology & Medicine

Enclosure:  
Emergency Contamination Limits

cc: H. Hones - Donner Lab., U. of Calif.  
S. Warren - Div. of Biol. & Med.

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