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BERKELEY: DONNER LABORATORY

December 13, 1957

DR. ERNEST O. LAWRENCE

Dear Ernest:

You may recall the other day we discussed on the telephone that for human and animal proton irradiation the energy requirement would be between 200 Mev and 250 Mev protons. You are probably aware that for some time I have been interested in the biological hazards due to cosmic radiations in space flying. A good part of these effects is due to the heavy nuclear component of cosmic rays, and our present estimates indicate that in a single week of flight away from the earth's magnetic field as much as 1 Roentgen equivalent man might be encountered. In a flight lasting a few months this might add up to an appreciable dose. We are already obtaining some biological information from the HILAC beam on the biological effects of multiply charged particles, but it seems quite clear that these effects will not be well known at the level of animal physiology until particles with long enough range have been accelerated with sufficient energy to penetrate at least a mouse. An energy of 200 Mev per nucleon might be a good range. I think that although biological considerations alone may not warrant the construction of a new machine, nevertheless one should look into the future of space flight and think about such machines. I believe that the scheme I proposed some years ago whereby partially ionized nuclei would be injected into a synchrocyclotron might be workable, but there may be other schemes also.

Already high altitude balloon experiments have shown that single heavy primary cosmic ray particles can cause irreversible damage in skin of mice, and some lesions were recently found in brain that may be due to such particles. Since brain tissue will not regenerate, accumulative doses of heavy particles to the brain may conceivably cause serious deleterious effects.

I should be glad to discuss these problems with you any time you wish.

Sincerely yours,

Cornelius

Cornelius A. Tobias

CT:hpt

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 Dr. Ernest Lawrence

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