
Newly developing methodologies to investigate health hazards posed by ionizing radiation to space travel

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Abstract

Human space explorations to Mars or the Near-Earth Objects are severely limited by the health hazards posed by ionizing radiation of solar and cosmic origin. Several strategies are possible in order to understand the effects of this radiation on living organisms like for instance in vitro experiments and animal models. Unfortunately, we are still far from the goal of establishing safe career dose limits for astronauts involved in missions beyond the low Earth Orbit (BLEO).

In the first part of this talk the conclusions will be presented of a study of both the short and long-term effects of radiation based on statistics and data available from the exposure of humans due to accidents or other causes.

Next, after reviewing the state-of-the-art of in vitro and in vivo experiments, the possible application of new methodologies will be discussed.

The problem of establishing safe career dose limits for astronauts involved in BLEO missions is of great relevance in space exploration, see for instance [1] and [2] for reviews on the subject. This problem has also been the main focus of the Study Group 3.19 of the International Academy of Astronautics [3] and [4]. The results that will be presented have been obtained in the frame of the activities of that group. We concentrate on intermediate equivalent doses of the order of 1 Sv that can be received in a typical space mission to Mars.

Basing on statistical techniques, we show that the probability of most deterministic effects for such doses are extremely low. However, surprisingly there are a few pathologies that could occur more frequently and endanger the activities of the astronauts in space. Under certain assumptions we are able to predict that the number of mutations leading to fatal cancer in a mission to Mars lasting about 400 days amounts very roughly to 0.0460 events.

Next, the outcomes of experiments in vitro or on animal models will be illustrated. Finally, the feasibility of new methodologies at the intersection of disciplines like precision oncology, molecular medicine and organoid technologies will be discussed.

Bibliography

*Speaker

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