S-I-3

Present Status and Perspectives of Studies on the Effects of Ion Beams in Plants


A little amount of studies has been done on the effects of heavy ion beams in plants compared with mammalian and human cells. We have started basic research on the ion beams by using plants, Arabidopsis thaliana. Maximum RBE value estimated from survival against LET was obtained at around 250keV/µm and the inactivation cross section for survival was saturated at several square microns.

We are expecting to use ion beams to induce specific mutations and to make an asymmetric cell fusion for introduction of cytoplasmic genes in plant breeding. And ion beams can supply an efficient tools, such as positron emitters, to physiological studies in plants.

S-I-4

Biological effect of heavy ions to animals - Cellular and molecular nature of biological response -


Several studies have focused on radiation-induced cellular and molecular damages, but only a few studies have been reported in the literature determining how the cellular and molecular nature of radiation-induced damages is affected by heavy ions. We previously reported that heavy ions were generally more effective in cell killing, chromosome aberration, mutation and neo-plastic cell transformation than gamma-rays in SHE cells. It is clear from track structure studies that heavy ions can deposit large clusters of ionization in DNA which may produce qualitatively different types of initial damage from those produced by the sparsely-ionizing radiations. In this study, I would like to discuss with the cellular and molecular nature of biological response in animals induced by heavy ions.

S-I-5

SPACE RADIATION HEALTH RESEARCH IN NASA

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For long duration space flights, such as space station, the crewmembers will unavoidably be exposed to ionizing radiation. The potential biological effects of space radiation must be understood and countered where possible to ensure the safety of the crewmembers and the success of their missions. The primary goal of NASA space radiation health program is to establish a sound scientific basis for radiation risk assessment, for mission support, and for countermeasures development. For operational needs, exposure limits for astronauts have been established and are being updated. Recently active radiation monitor, such as Tissue Equivalent Proportional Counter, and biodosimetry have been developed and used for long duration Shuttle-MIR flights. Preliminary results of MIR-18 flight indicate that crews received more than 12 rem during the 120-day mission. The uncertainty of quality factor is still large due to the lack of information on biological effects of charged particles in humans. Further space radiation health research is urgently needed before the initiation of interplanetary exploration. (Work supported by NASA Space Radiation Health Program)