W01–3 Fractionated irradiation with carbon ions induced resistance in mouse gut crypt cells

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Mouse crypt survivals after fractionated irradiation with 290 MeV/u carbon ions of 20 keV/μm carbon ions were investigated. The interval time between each fraction was 4 hr. After equal dose per fraction, crypt cells showed similar response to 20 keV/μm carbon ions and X rays. Do values increased from 1.4 Gy to more than 2.5 Gy when number of fractions increased from single dose to 6. Total isoeffect doses to produce 10 crypts were stable and unchanged when the preceding doses of 1 Gy-carbon ions were repeated less than 5 times, but increased when number of 1 Gy-per-fraction increased from 7 to 11. Isoeffect top-up doses indicated that 20 keV/μm induced resistance. Do values increased when number of 1 Gy-per-fraction increased from 7 to 11. X rays did not show such Do increase after multiple doses of 1 Gy-per-fraction. It is concluded that an intermediate LET of 20 keV/μm carbon ions induces radioresistance by modifying radiosensitivity of crypt cells.

W01–4 Reversed dose-rate effect of high LET radiation in mutation induction

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Reversed dose-rate effect in mutagenesis has been thought to be a specific phenomenon in fission neutrons. Our previous study revealed that the G2/M cells were uniquely sensitive to mutation induction by neutrons but not to gamma-rays, and that a radiation-induced G2 block might be a major determinant of the phenomenon. A subsequent study using carbon beams with different LETs showed that higher LET beam always produced the highest mutation frequency at the G2/M stage. The result suggests that the reversed dose-rate effect might be seen in any high LET radiation regardless of the particles composing radiations. Because the conventional mutation assay needs a total dose of several Gray to see any significant effects, it is difficult to apply accelerators as a radiation source at low dose-rate due to their limited exposure duration. To solve the problem, a hypersensitive mutation system was developed using hamster/human X-hybrid cells. The effectiveness of the new system to study the reversed dose-rate effect will be discussed.

W01–5 Cellular Responses after Heavy-ion Exposure

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To better understand cellular responses in human lymphoblastoid cell TK6 after exposure to C-ion (22 keV/μm) and Fe-ion (1000 keV/μm), both protein induction and cell-cycle progression have been extensively analyzed by the recently developed techniques. Exposure to Fe-ion demonstrated a delay in cell-cycle progression compared to X-ray irradiation. This delay was found to be due to the stall in S-phase by the analysis using prelabeled BrdU methodology. Since the DNA lesions produced by high-LET radiation were considered to include DNA double-strand break, foci formation of RAD51 protein playing a key role in DNA homologous recombination was determined by cell staining technique. Rad51-foci observed after Fe-ion was localized in cell in contrast to uniform distribution after X-ray irradiation. These results suggest that the heavy-ion specific damage is difficult to be repaired by DNA homologous recombination.