

9

LET-Dependence of Wing-hair and Eye-color Mosaic Spots Inductions at the Somatic Cells of *Drosophila* Larva Irradiated with ^{12}C (290MeV/u) Ion Beams

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Somatic reversion at the *white* locus and somatic recombination of *multiple wing hairs* (*mwH*) and *flare* (*flr*) genes in *D. melanogaster* were quantitatively examined after larval irradiation with carbon beam (290 MeV/u) as heavy ions and X-rays. The reverse eye color mutation from *white-ivory* (*wⁱ*) to wild type (*w⁺*) is associated with the loss of a 2.9kb DNA fragment duplicated in the *white* locus on the X-chromosome. The formation of mutant spot on the wing blades is resulted from recombination at wing anlage cells in larvae trans-heterozygous for the mutations *mwf* and *flr* on the 3rd chromosome. The results showed that frequencies of both mosaic spots increase linearly with exposure doses in any radiation. In producing the mosaic spots of wing hair resulting from mitotic crossing over, RBEs for ^{12}C particles with compared to X-rays increased with LET values of ^{12}C particles. Higher LET (around 90 keV/ μm) particles were very effective as about 6 times or more. In lower LET range as around 13keV/ μm , the estimated RBE values are less than 2. In contrast, ^{12}C particles showed no LET dependent and to be almost equal efficient in comparison with X-rays for induction of the mosaic spot of eye color caused by 2.9-kb loss in the white locus.

10

Effects of NIRS HIMAC Carbon Beam on Hematopoietic System in Mice.

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The effects of carbon beam on hematopoietic stem cells in mice (ddY-SLC, male) were investigated and compared between the group given X-rays. The mice were exposed to the carbon beam of 290 MeV/u at 3 Gy/min which was produced by NIRS HIMAC or X-rays of 200 kVp at 0.7 Gy/min with graded doses. Exogenous CFU-S in bone marrow and spleen and endogenous CFU-S were assayed for determining dose relationships. The femoral CFU-S showed exponential types of survival curves for both the carbon beam and X-rays. The RBE value in terms of $D_{0.1}$ was 1.2. For splenic CFU-S the slope of the terminal resistant portion of the curves was modified by the carbon beam. The results also indicated that the RBE obtained for endogenous CFU-S was 1.2.

11

Dependence of Interphase Cell-Death Induction on LET Values of Accelerated Heavy-Ions

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Apoptosis was induced by caffeine almost synchronously in CHO cells which were arrested at the G_2 phase and destined to undergo interphase death after irradiation. Based on this fact, the effectiveness for induction of interphase cell death was compared between accelerated heavy-ions (^{12}C , ^{20}Ne) with different LET values. Results with neon-ions accelerated by RRC (RIKEN) suggested the maximum effectiveness (RBE \approx 5) at the LET value around 200 KeV/ μm . Similar trends were noted with carbon-ions accelerated both by HIMAC (NIRS) and RRC. Therefore, we assume that production of locally multiply damaged sites (LMDS) leads to interphase cell death.