High LET and particle radiation (1-22)

1 Generalized Track Model for the LET-RBE Relationship

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Frequency of chromosome aberrations per traversal of a charged particle at low dose is proportional to a square of LET, but it arrives at peak near 100 keV/μm and decreases with farther increase of LET. This has been previously interpreted as an abortive energy deposition over the necessary energy required for the production of a biological event. Here we present an alternative interpretation. Cells traversed by many charged particles must have large frequency of chromosome aberrations. But, these cells have a large probability of direct death before arriving at metaphase and hence decreases the RBE at high LET. Such situation brings about the decrease of effective dose to surviving cells at high LET. We have constructed a model with this concept. Dose dependence and LET dependence of chromosome aberrations, mutations and chronogenic survival may be explained by this model inclusively.

2 Absorbed Dose in Cells Exposed to Heavy Charged Particles

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The energy loss to atomic electrons along the path of a heavy charged particle in a medium is called the stopping power of the medium for the particle and is used to estimate the absorbed dose of biological cells irradiated by the heavy charged particles.
The value of the stopping power is composed of two groups of the energy losses: the one in the distant collision and the other in the close collision. These groups are equivalent in energy, but in the close collision secondary electrons with higher energies than in the distant collisions are emitted. R. Katz uses the absorbed dose due to the distant collision for the biological cells in the track of the heavy charged particles and the one due to the close collision for the cells near the track. In this report the ratio of these two absorbed doses is considered.