

Effect of track structure on radiobiology efficiency

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Ion-induced cell killing has been reported to be dependent on ion dose and ion LET (Linear Energy Transfer), but also on ion velocity (or equivalently ion atomic number). As a consequence, any predictive model of cell-killing efficiency has to include a detailed representation of the energy deposited along the ion trajectory as, for instance, a track-structure description.

While the track-structure geometry is sometime suspected to induce spatial correlations in the distribution of damage sites, and therefore, an efficiency to generate *lethal events* from interaction of sub-lethal lesions, the standard scenario for ion efficiency is the generation of complex damage, resistant to repair process; by the huge concentration of ionizations and free radicals, in particular in the track core.

Two approaches have been extensively developed and studied to predict cell survival in response to ion irradiation: the Local Effect Model [1] and the Katz's model [2]. Both these models are based on a track-structure description through the radial dose. Radial dose is the expected local dose deposited by one ion impact expressed as a function of the radial distance to the ion trajectory. Radial dose includes therefore ion-charge and ion-velocity parameters, and, gives to both models the ability to predict important features for the radiobiological effects of ions. However radial dose is an average quantity. After a brief description of both models, the paper will present a Monte-Carlo simulation of the local dose and discuss the stochastic effects in the framework of these track-structure models.

[1] Scholz M, Kellerer AM, Kraft-Weyrather W, et al. Computation of cell survival in heavy ion beams for therapy. The model and its approximation. *Radiat Environ Biophys* 1997;**36**:59–66.

[2] Katz R, Ackerson B, Homayoonfar M *et al.* Inactivation of cells by heavy ion bombardment. *Radiat Res* 1971;**47**:402-425.