AbstractID: 11761 Title: Saturation of repair model for cell survival applied to X-ray and Carbon-ion irradiation

Purpose: To develop and test a model for cell survival after irradiation which ascribes differences in effect of x-ray and Carbon-ion beams to dependence on LET of effective available repair units.

Methods and Materials: A model by Goodhead of the saturation of the mechanism for cellular repair of radiation damage is shown to behave as a log survival linear-quadratic (LQ) function of dose at levels which do not saturate the repair and linearly for doses that do. This model is applied to published data for both X-ray and C^{+6}-ion beam survival data extending to ~ 4 x 10^{-3} survival for stationary phase Chinese hamster lung (V-79) cells irradiated in the plateau and in the extended Bragg peak of a 400 MeV per amu heavy-ion beam at LBL by Chapman *et al.* The same parameters of the model that fit the X-ray survival data are used to fit the C^{+6}-ion beam data, except that the parameter defining the available cellular effective repair is allowed to vary according to the location of the irradiation in the extended Bragg peak. The model is also fitted to recently published data, including irradiated cultured cells of human lung cancer origin extending to a single dose 16 Gy and a survival fraction < 2 x 10^{-7}.

Results: The saturation of repair model provides an excellent fit to both the x-ray and C^{+6}-ion beam data for the V-79 cells, with a systematic decrease of the parameter of effective available repair with increase of LET. The model also provides excellent representations of recently-published survival data for NSCLC and other cell lines with parameters that are comparable to those for the CH V-79 cells.

Conclusion: The Saturation of Repair model provides a viable mechanistic modeling of survival for Carbon-ion and X-irradiation, and may be tested in further experiments.