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Theme: Physics

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MOLECULAR DOSIMETRY TO EXPLICITLY ACCOUNT FOR LET EFFECTS IN TREATMENT PRESCRIPTION AND PLANNING*

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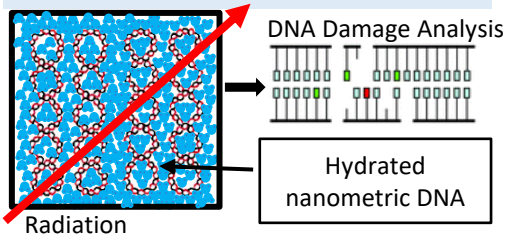
Background / Aims:

- Current radiation dosimetry unit, Gy, is based on measurement of absorbed ionization energy exclusive of biomolecular changes. Assessment of outcome response is insensitive to the effects of LET, leading to the need of empirical RBE factor.
- We investigate the use of a ***molecular dosimetry metric (MoD)*** based on the distribution of radiation-induced clustered lesions in cell-free DNA, to explicitly account for the differential effects of LET; replacing Gray and the need of RBE

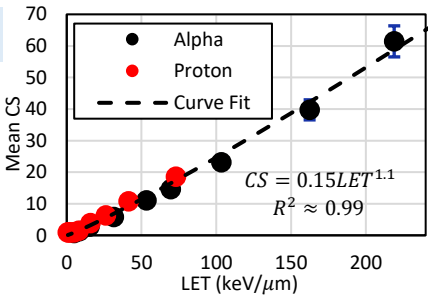
Methods: Biomolecule as dosimeter

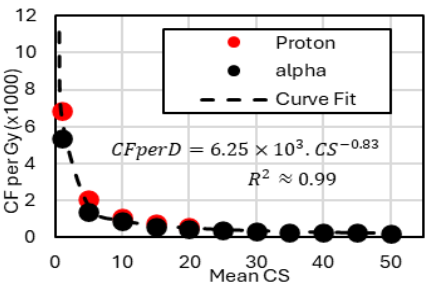


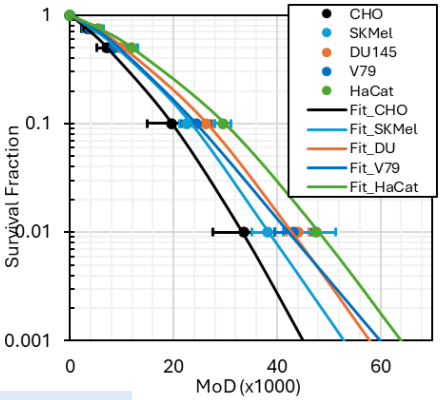
- Cell-free DNA avoids repair processes

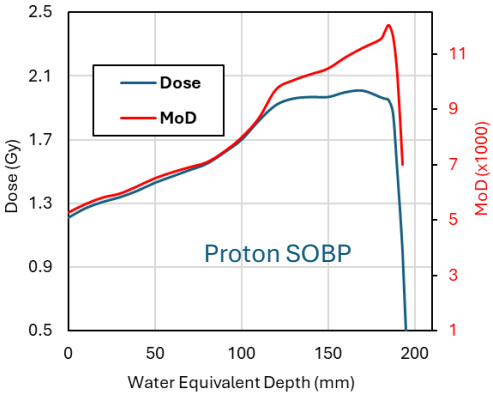
- **MoD = Σ CS(i) * CF(i)**
- **Cluster Size, CS(i)**: ith molecular alterations in a nanometric DNA volume (e.g. 15 bp)
- **Cluster Frequency, CF(i)**: No of nanometric volumes of DNA with CS (i)
- CS and CF are molecular determinants of dose and LET; presently extracted from radio-chemistry data using Monte Carlo ionization simulations

Results:









Discussions:

- Molecular Dosimetry Unit (*MoD*) resolves disparate cell survival curves into one curve.
- Mod consolidates the effects of LET on particle therapy dosimetry for treatment planning, without RBE. In principle, MoD also accommodates the effects of dose-rate
- Advanced biomolecular technologies to measure CS and CF is needed to establish MoD as a radiation assessment metric

** JHU IP filed*