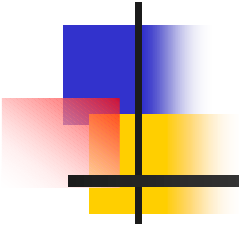


Modeling of chemical phase of radiobiological mechanism and oxygen effect



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1. Introduction

- Importance of oxygen effect in radiotherapy
 - Oxygen fixation hypothesis (Alper and Howard-Flander, 1956)
 - Criticism of Ewing (1998)
 - twofold role of oxygen



2. Mathematical model of chemical phase

- Physical phase:
 - Formation of radical clusters in water medium
- Chemical phase:
 - recombination of radicals
 - interaction of radicals with H_2O , O_2 , a.s.o.
(eventually: formation of other radicals)
 - diffusion of radical clusters
 - formation of SSBs and DSBs in chromosomal DNA
- Mathematical model (system of differential equations, etc.)
 - see: J. Barilla, M. Lokajíček: J. Theor. Biol. 207 (2000), 405
mainly Eqs. (20) - text attached to the poster

3. Comparison of model with experimental data



- Data: SSB and DSB formation in water solution of DNA
 - J. Blok, H. Loman: Radiat. Res. 9 (1977), 165
 - irradiation by gamma radiation of Co-60; dose - 5 Gy
 - different concentrations of O₂ in N₂ and N₂O
- Fitting: dependence of DSB numbers on oxygen concentration
- Results: see attached graphs
- Two roles of oxygen:
 - absorption of H-radicals (at low oxygen concentrations)
 - increasing damage effect by HO₂-radicals (at higher oxygen concentrations)see: attached table



4. Concluding remarks

- Model is now being further developed:
 - other radiomodifiers included, too
 - diffusion of radical clusters formed around ion tracks