Influence of high-energy proton and gamma-radiation on DNA structure in solution

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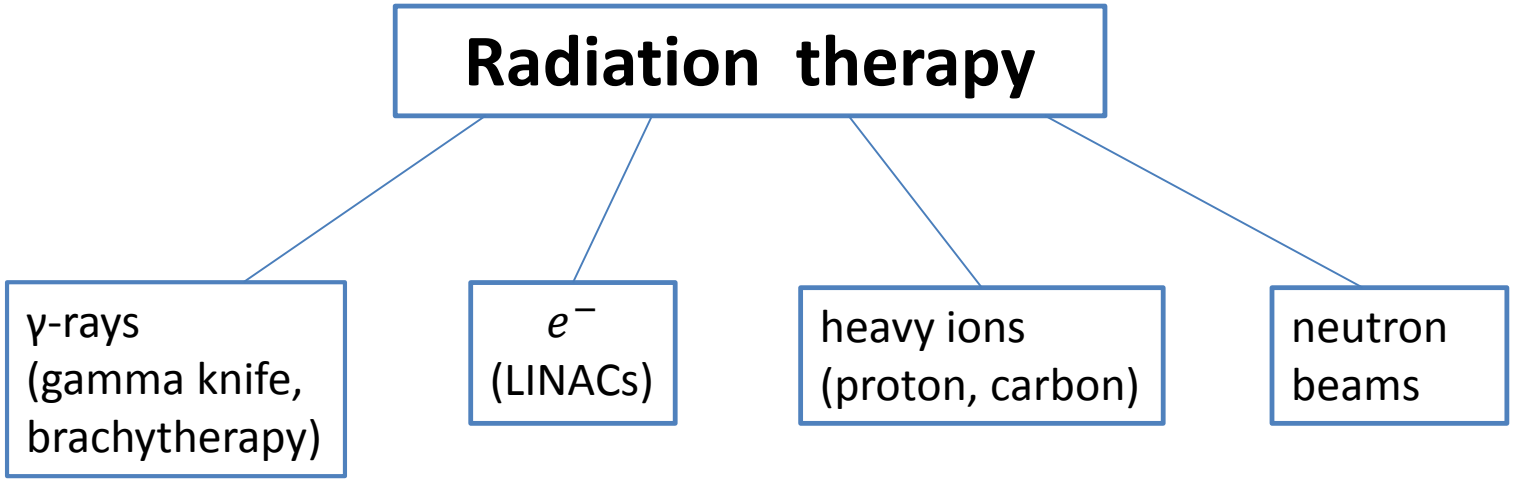
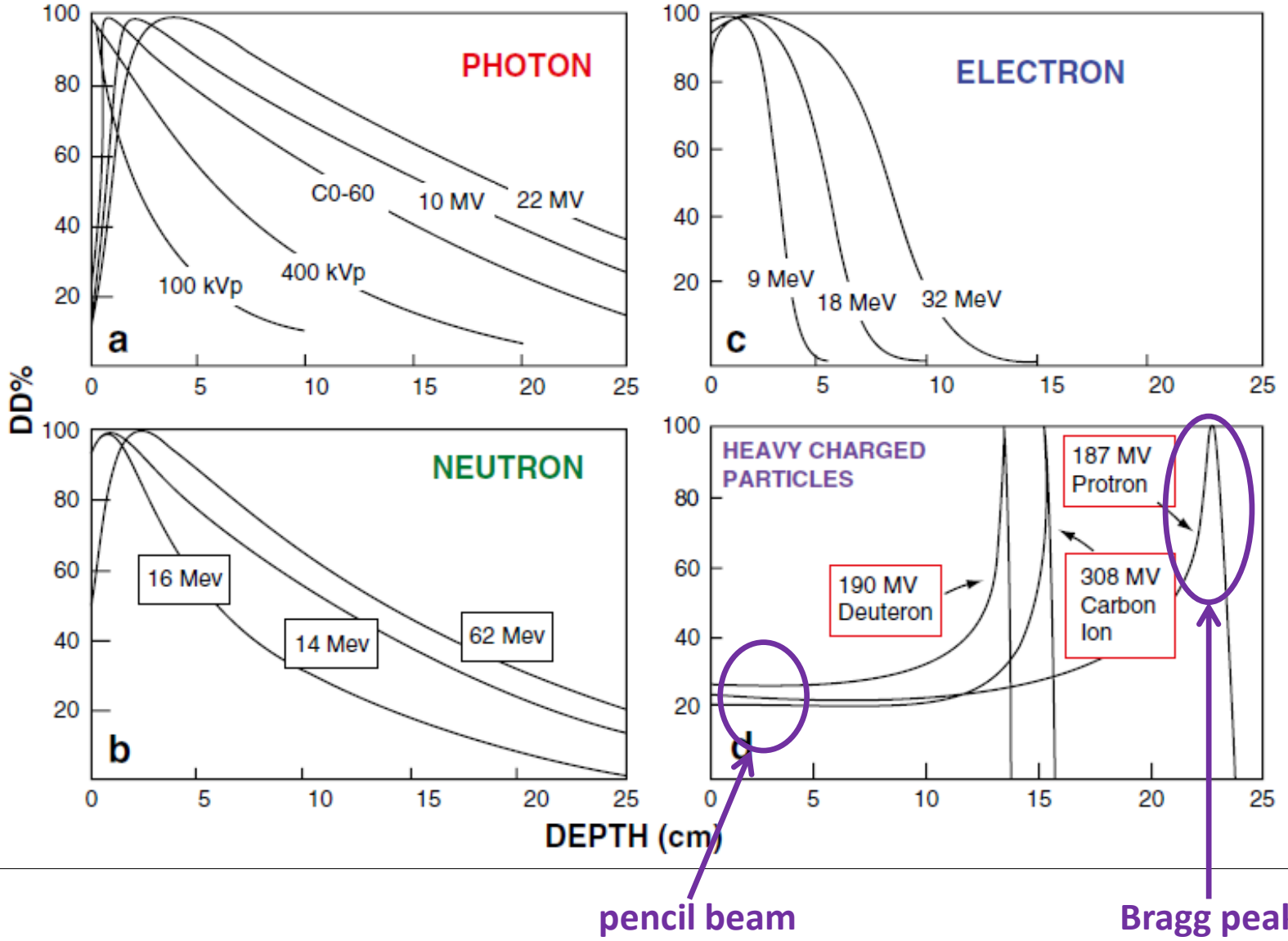




Beyzadeoglu M., Ozyigit G., Ebruli C. Basic Radiation Oncology. Springer, 2010.

Experimental

^{60}Co γ-rays
1,17MeV, 1,3325 MeV

"Researcher" facility, Department of Molecular and Radiation Biophysics, St. Petersburg Institute of Nuclear Physics NRC "Kurchatov Institute"

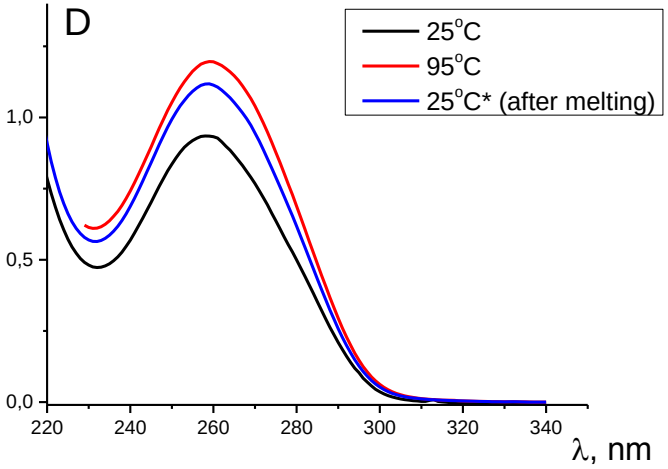
1GeV proton beam

Medical channel of the synchrocyclotron of the St. Petersburg Institute of Nuclear Physics NRC "Kurchatov Institute" SC-1000

LET=0.3 keV / µm

DNA solutions
of different concentrations
and ionic composition

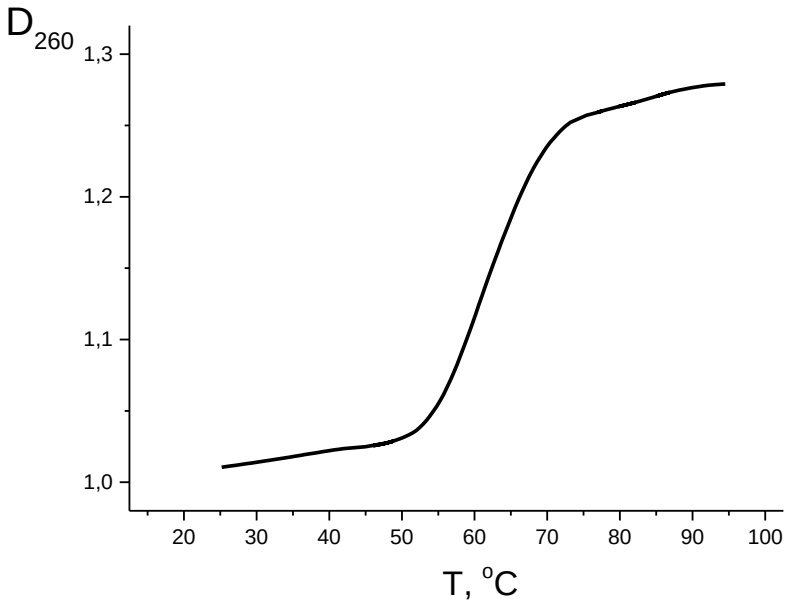
DNA UV absorption spectra

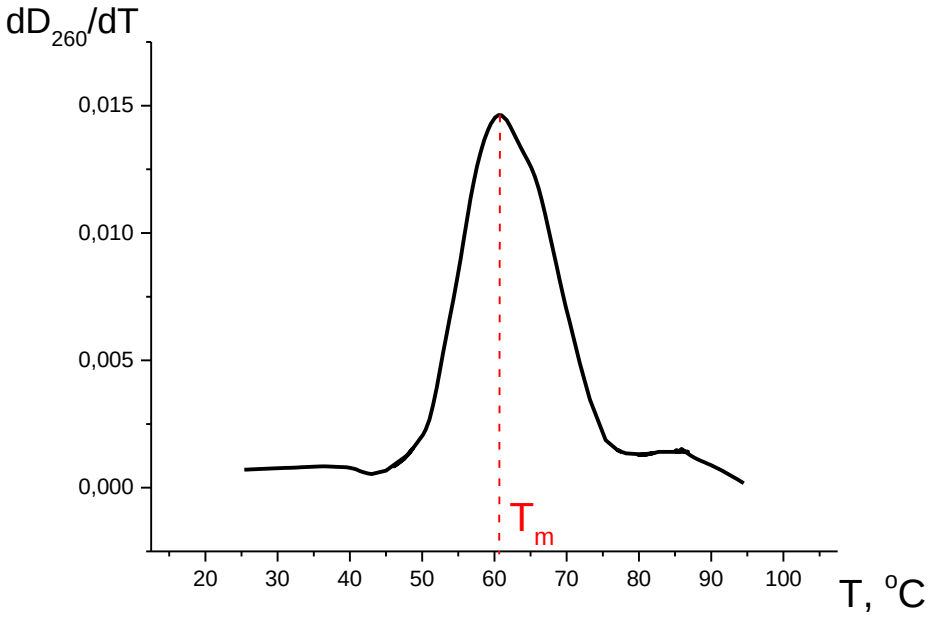


The hyperchromicity of DNA:

$$\delta = \frac{D_{260}^{98^oC} - D_{260}^{25^oC}}{D_{260}^{25^oC}}$$

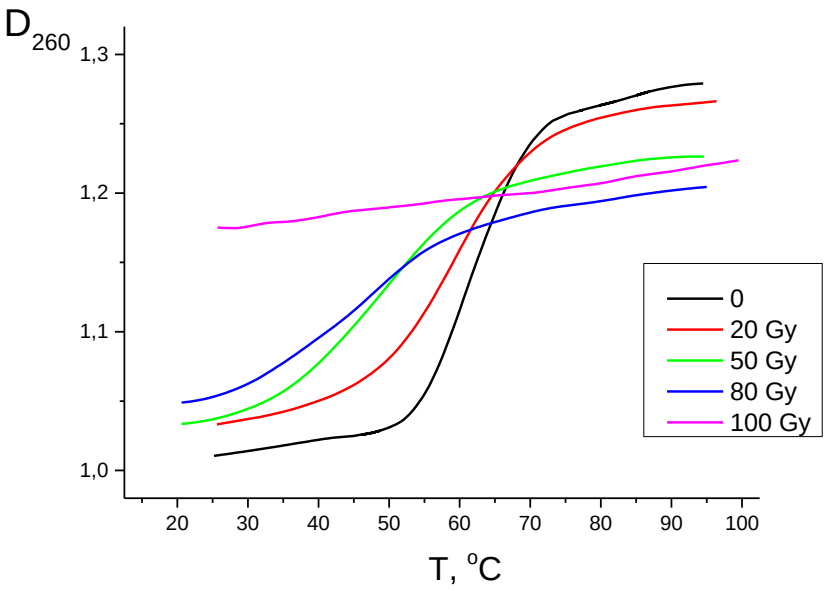
Spectrophotometric melting of DNA in solution

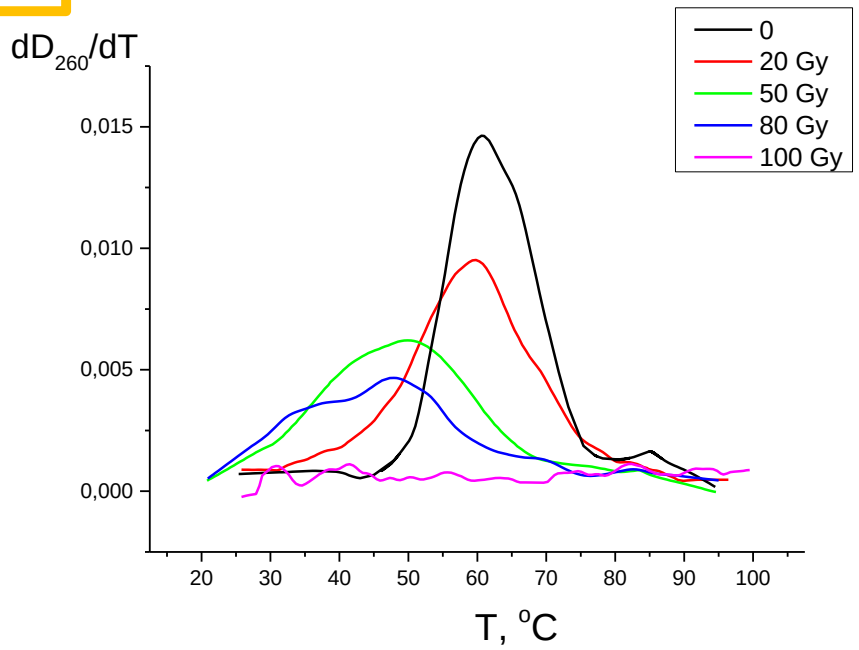




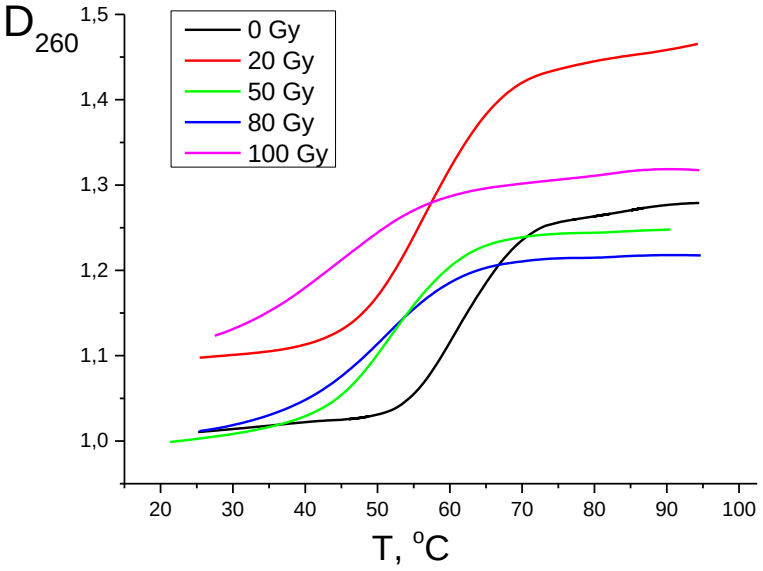
μ = 5mM NaCl

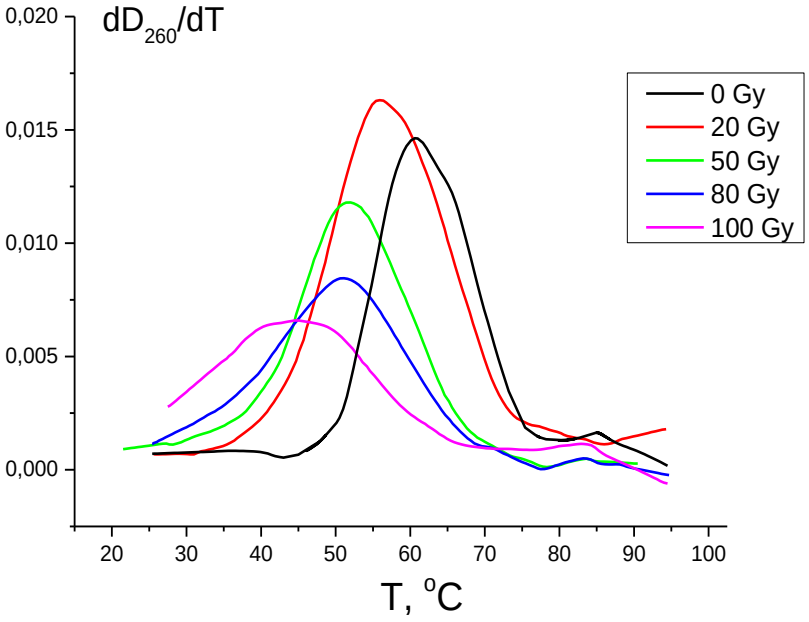
γ-radiation





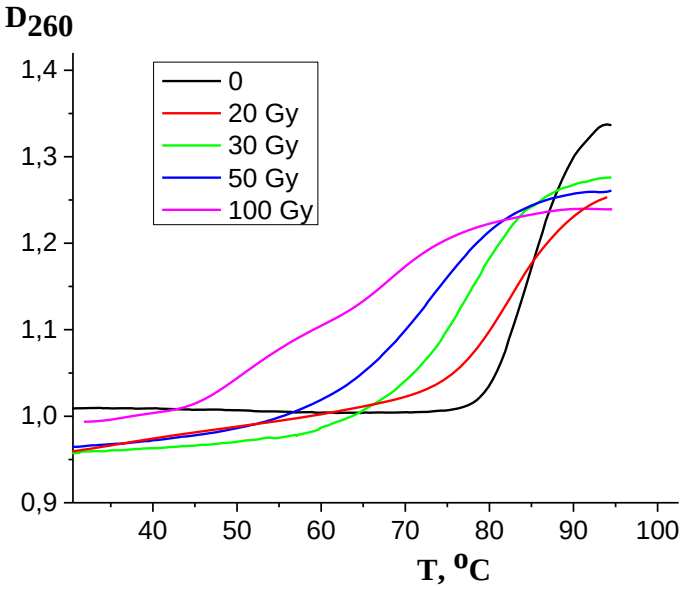
protons

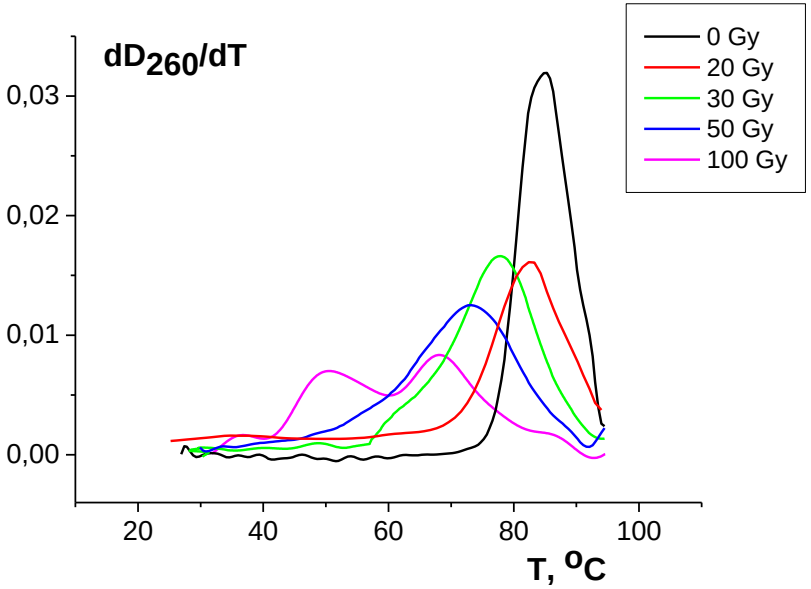




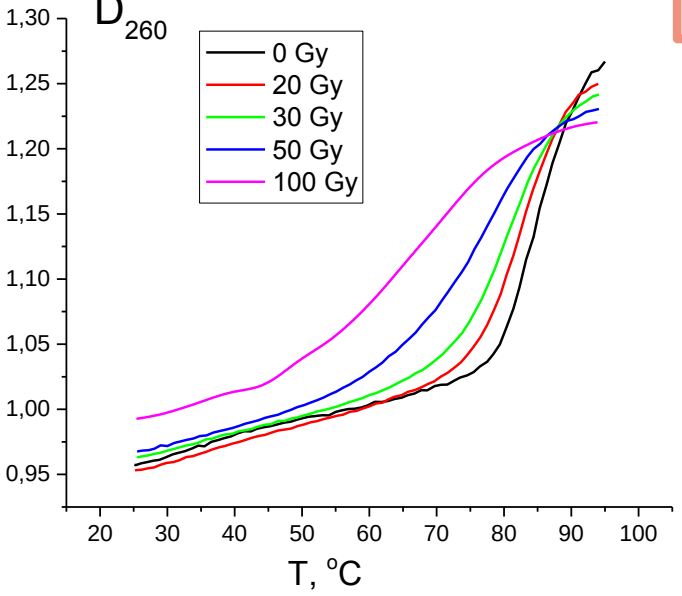
μ = 150mM NaCl

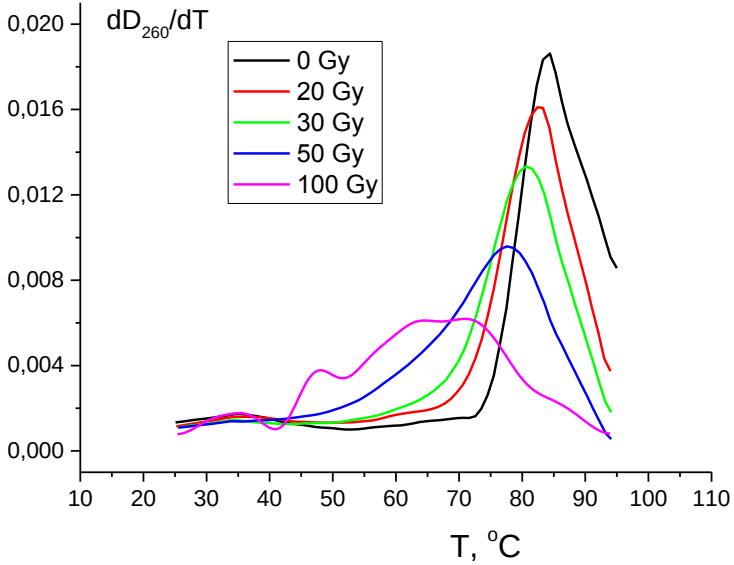
γ-radiation



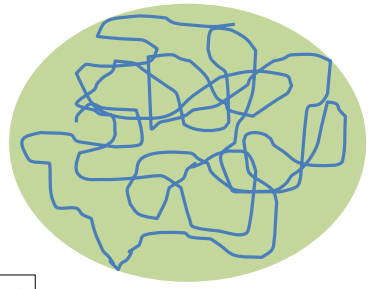


protons



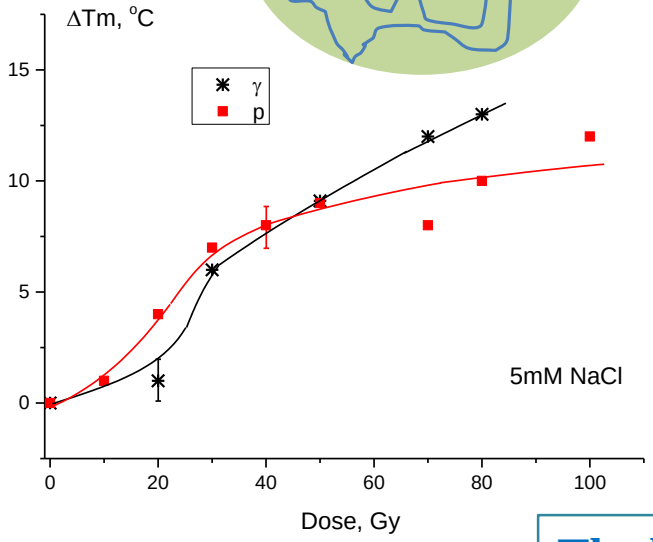


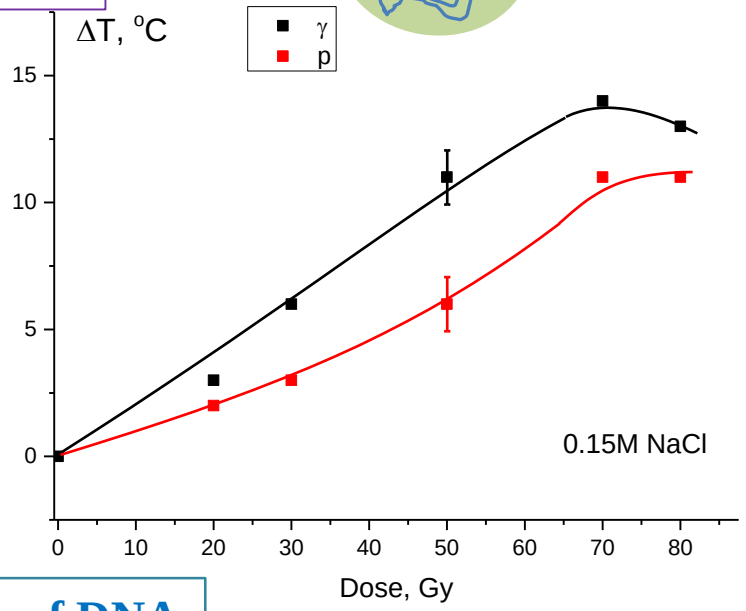
5mM NaCl



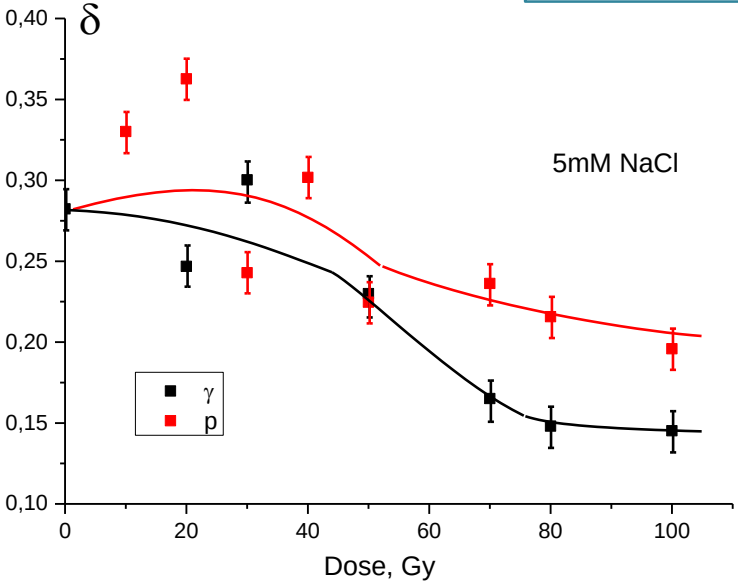
Change in the DNA melting temperature

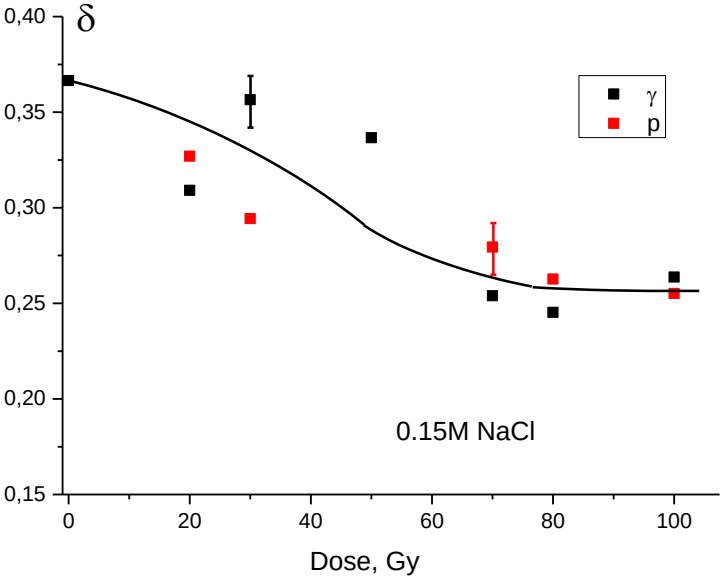
150mM NaCl



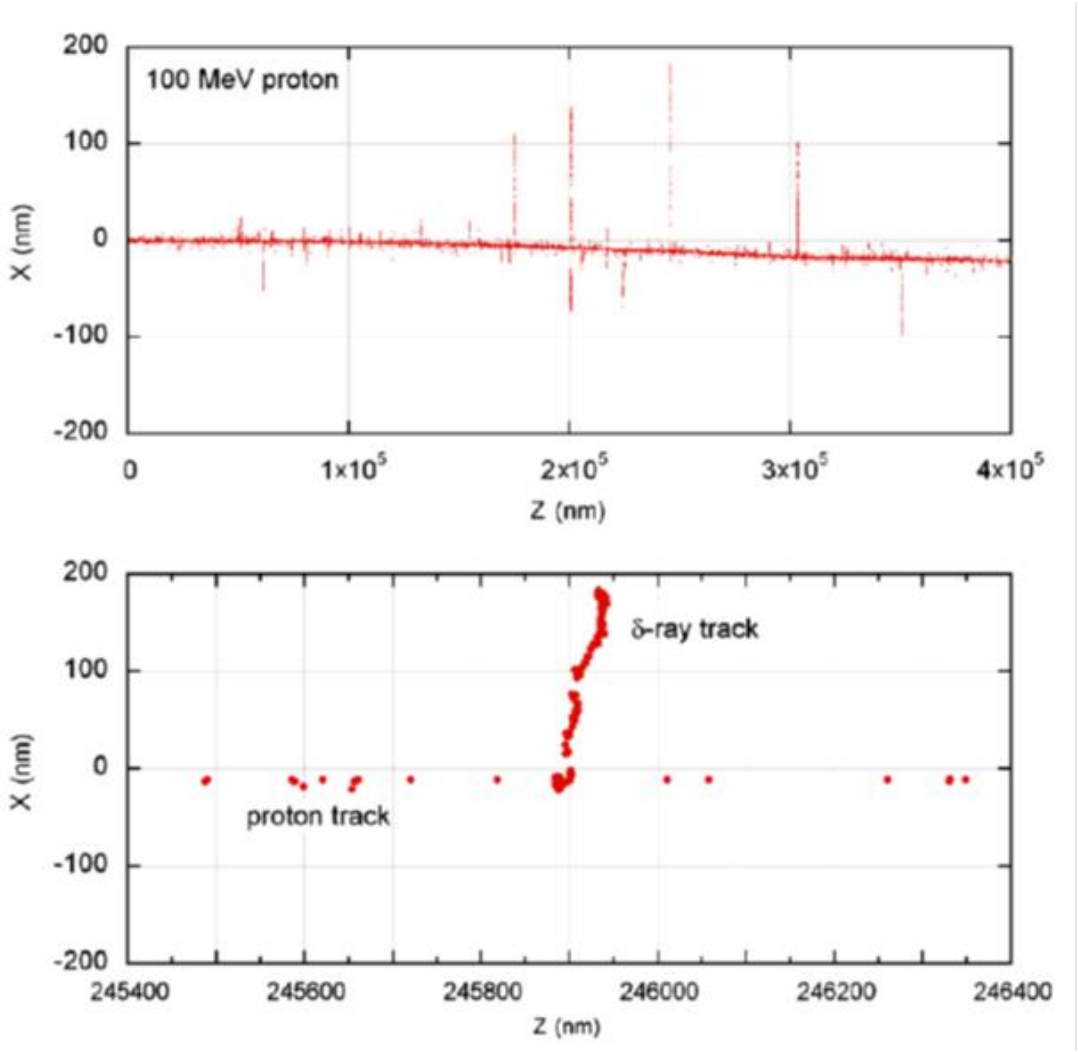


The hyperchromicity of DNA





The acts of ionization and excitation in solution distribute **homogenuously in the case of γ-radiation** and **very unhomogenuously in the case of proton radiation**.



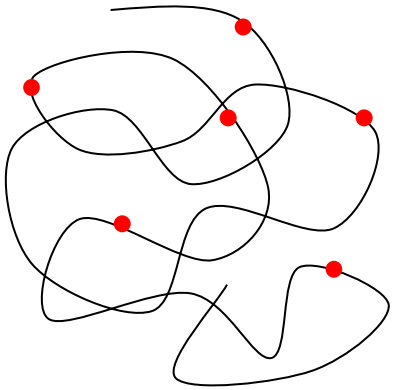
Nikjoo H. et al. Radiat. Phys. Chem. 2008. Vol. 77, 12.

γ-radiation

- homogenuous distribution of ionization
- more intense changes in DNA secondary structure

isolated DNA lesions

quick and efficient repair

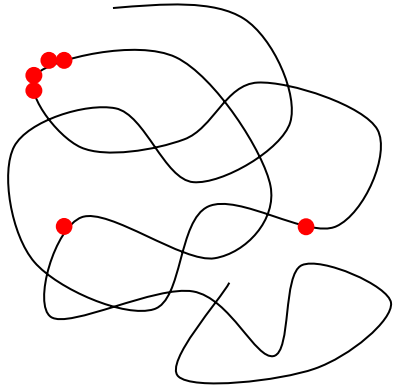


proton radiation

- unhomogenuous distribution of ionization
- lesser changes in DNA secondary structure
- probable fragmentation of DNA chains (ssbs, dsbs)

clustered DNA damage

slowly repairable or unrepairable sites



Thank you for the attention!