

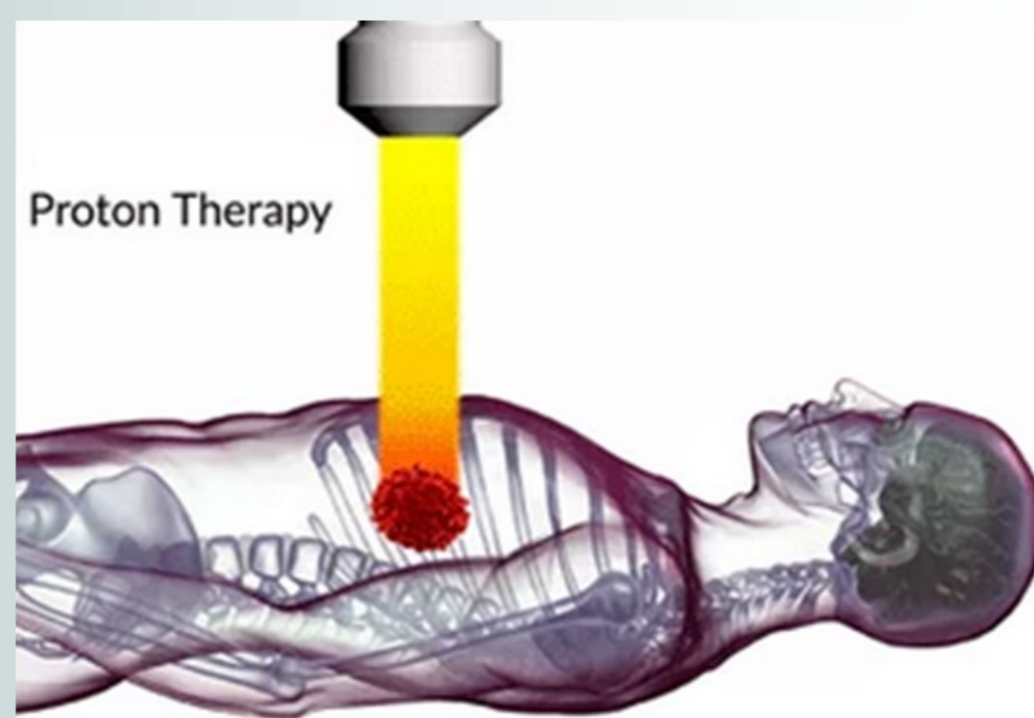
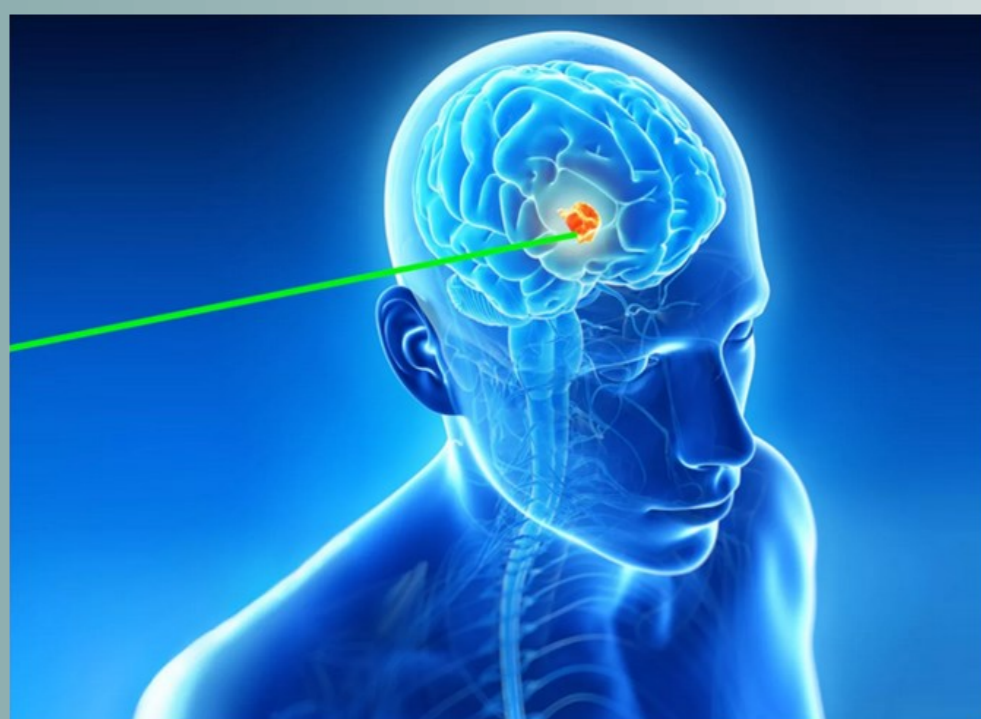


CYTOGENETIC EFFECTS OF PROTONS AT LOW DOSES

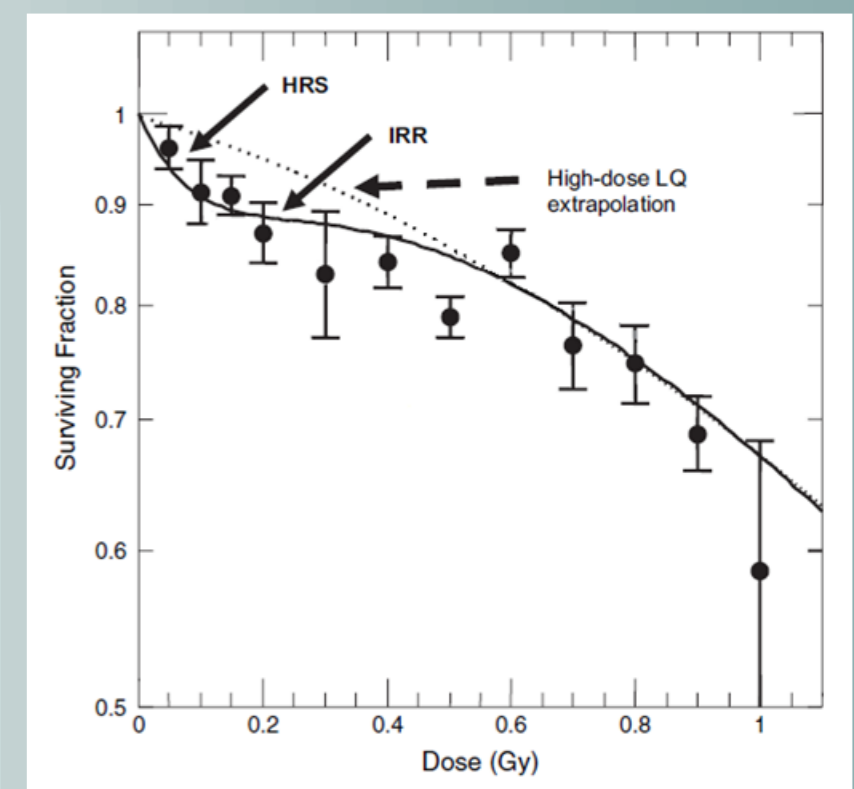
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Introduction

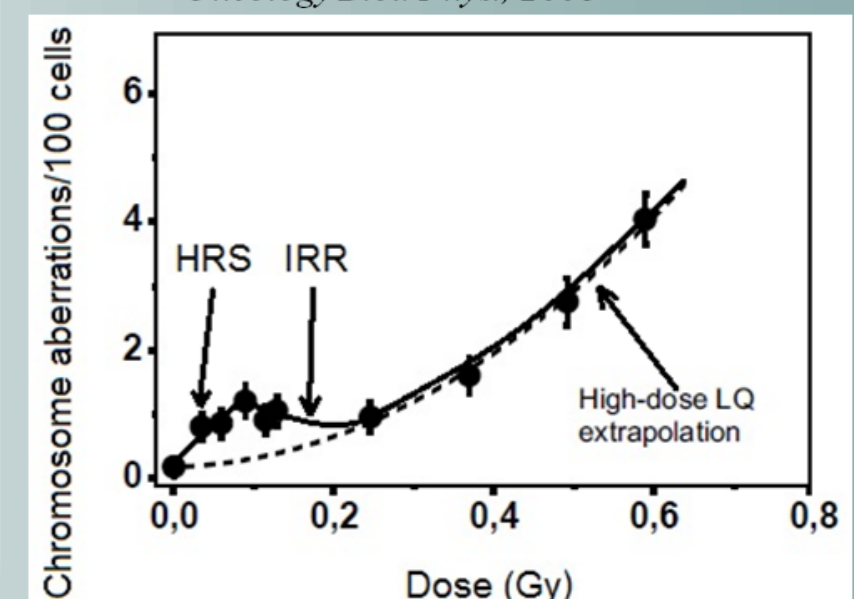
Proton therapy is a highly effective method of radiation therapy. The proton Bragg peak allows conformal irradiation of tumors including the deep-seated ones. At the same time, the radiation dose to the surrounding tissues is much lower.



- With multi-field proton irradiation, healthy tissues are irradiated at doses below 1 Gy per fraction.
- The biological effect of low-LET radiation may be non-linear dose-dependent in the range of 0.05-1 Gy, shows the phenomena of hypersensitivity and induced radioresistance (HRS and IRR).
- Direct extrapolation of the biological effect from higher doses can lead to errors in predicting damage to normal tissues.
- The investigation of the biological effects of scanning beam protons in mammalian cells at doses up to 1 Gy in terms of HRS/IRR is very important.



Marples B. et al., *Int. J. Radiation Oncology Biol. Phys.*, 2008



Sevan'kaev A.V. et al., *Radiation Biology: Radioecology*, 2012

Materials and methods

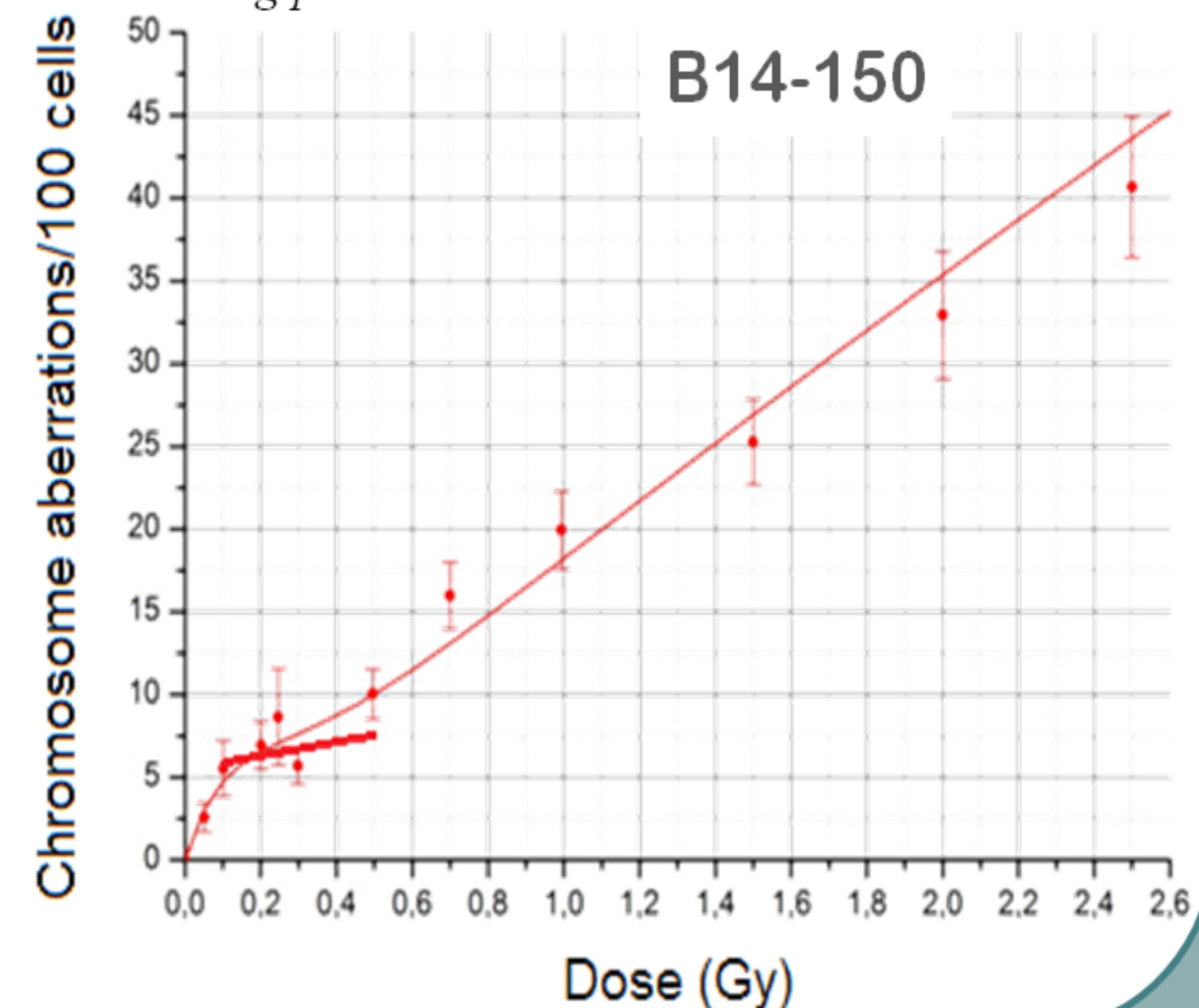
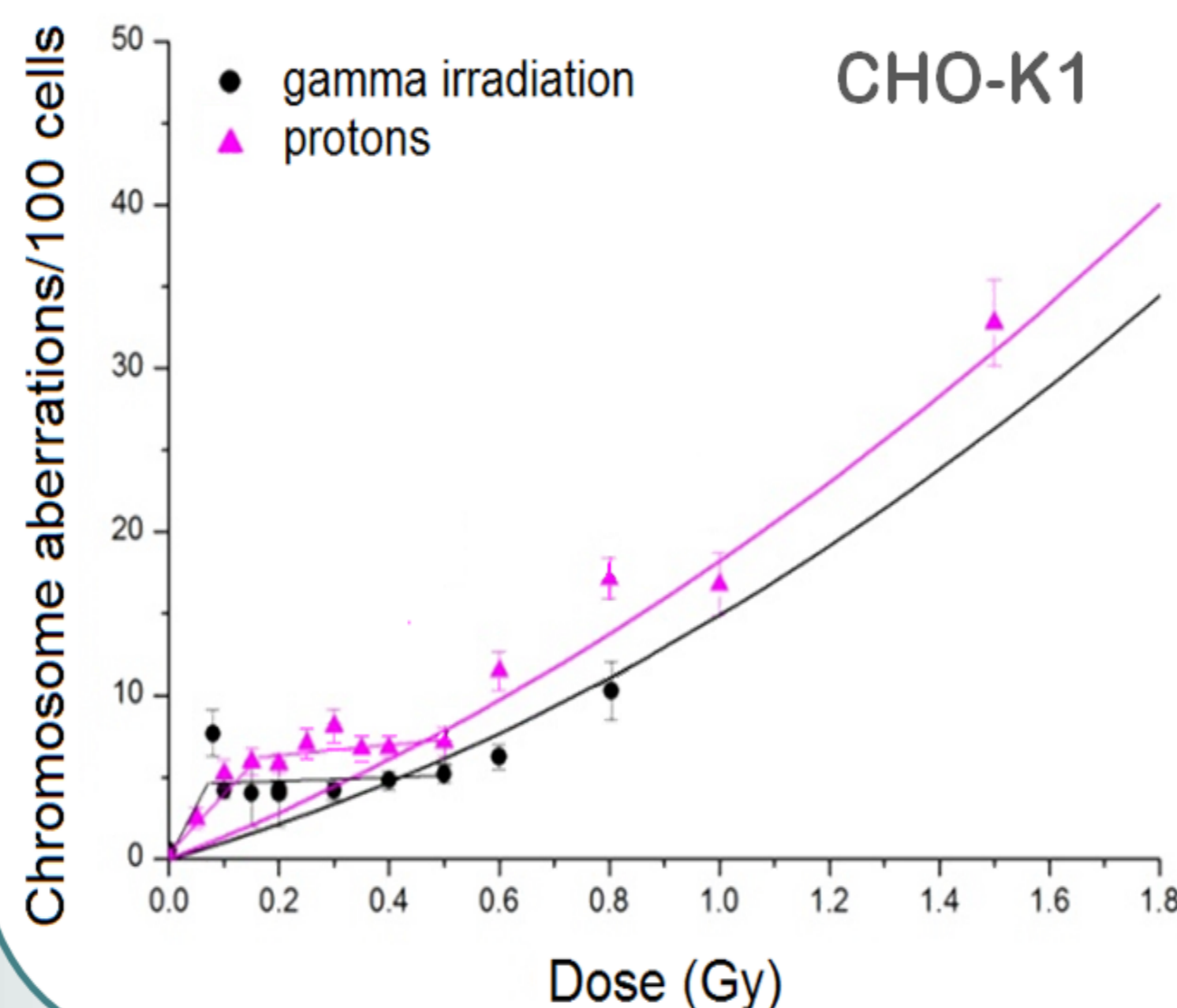
- Scanning proton beam – \varnothing 4–7 mm
- Proton energy under the experimental conditions – 83 MeV (LET \sim 2 keV/ μ m)
- Bragg curve plateau
- Cell monolayers of Chinese hamster ovary cells (CHO-K1) and fibrosarcoma cells (B14-150) in the stationary growth stage
- Slides of first mitosis metaphases
- Giemsa staining
- All types of structural chromosomal aberrations



Results

The irregular shape of the dose curves with the HRS and IRR regions for protons was established by the induction of chromosome aberrations both in normal (CHO-K1) and tumor (B14-150) cells

The dose-response curves for the total frequency of chromosome aberrations in CHO-K1 and B14-150 cells under the scanning proton beam irradiation



HRS regions with sharp effect increase were observed at 0.1–0.15 Gy, IRR plateaus were at dose ranges from 0.1 to 0.5 Gy, and then the curves turned into linear-quadratic ones



Treatment room of "Prometheus" proton accelerator ("Protom" Ltd.)



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