

# Does Heavy Ion Therapy Work Through the Immune System?

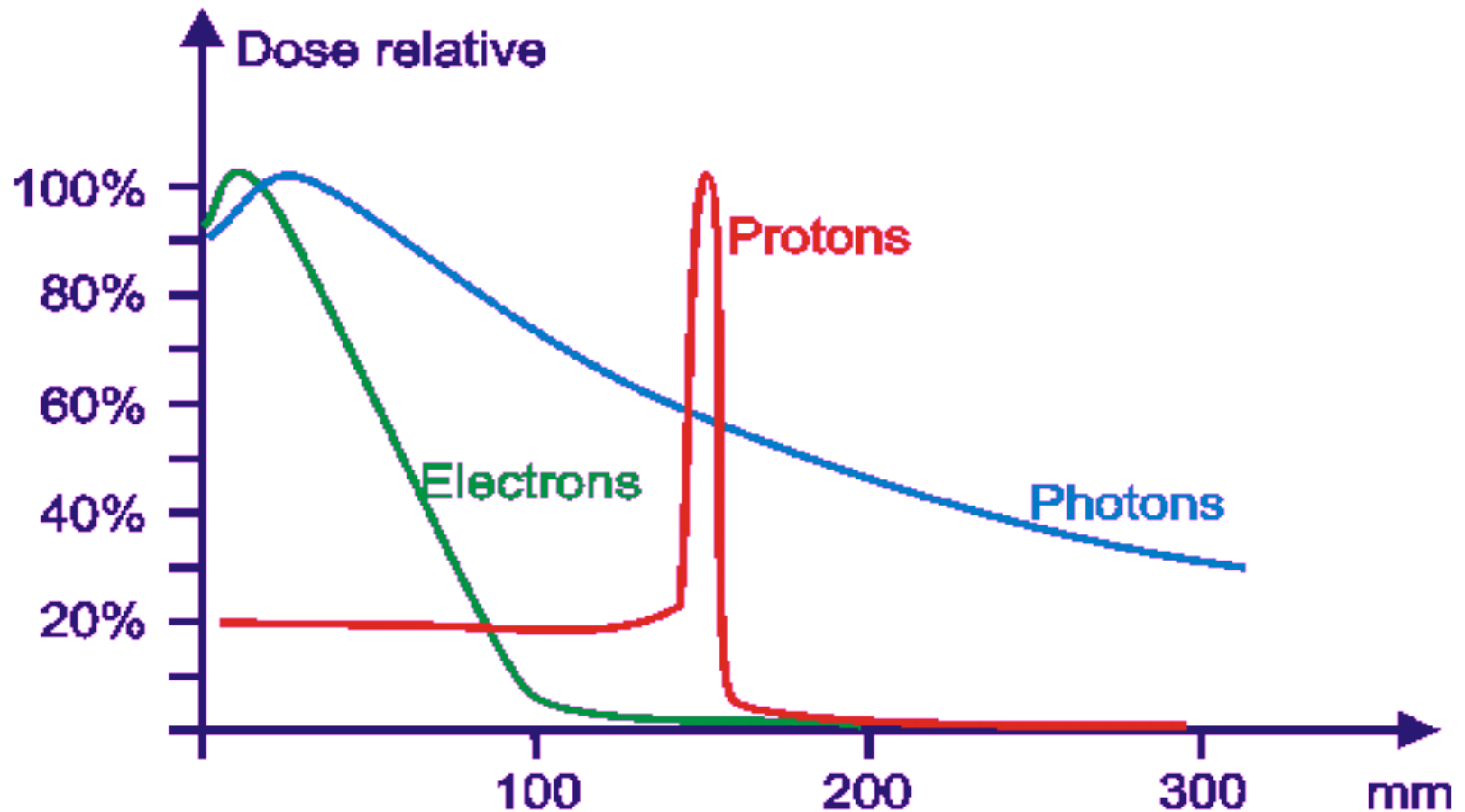
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Int J Radiation Oncol Biol Phys, Vol. 96, No. 5, pp. 934e936, 2016

# Forms of radiation in Radiotherapy

- Protons, heavy-ions
- Electrons
- Electromagnetic radiation (photons)

# Dose depth curve



Source: <https://physics.stackexchange.com/questions/169665/dose-depth-curve-of-photons-vs-protons>

# Objective of radiotherapy

- Apoptosis
- Necrosis
- Inhibition of proliferation

# Biological effects of radiation

- Direct effects
  - DNA, membrane, enzyme alteration
- Indirect effects
  - Radiolysis
    - Water decomposition

→ Local effects!

# Abscopal effect

- Ab = away, scopus = target
- Shrinking of non irradiated metastases during radiotherapy
- Rare

→ Systemic effect!

# The paper

- Review of several other papers, i.e.
  - The future of combining carbon-ion radiotherapy with immunotherapy: Evidence and progress in mouse models. Int J Particle Ther 2016 (Shimokawa et al.)
  - Tumor cells surviving exposure to proton or photon radiation share a common immunogenic modulation signature, rendering them more sensitive to T cell-mediated killing. Int J Radiat Oncol Biol Phys 2016;95:120-130 (Gameiro et al.)

# Findings I

- Alpha radiation and photons are able to induce immunogenic modulations of irradiated tissues
  - Upregulation → abscopal effect
    - E.g. increased calreticulin translocation
  - Immunotherapy can support a stimulation of the immune system
  - Alpha radiation also modulate cancer stem cells



# Findings II

- Downregulation
  - happens through accidental irradiation of lymphocytes
- Alpha radiation leads to less lymphopenia

**Thank you for your attention!**

# Sources I

- Durante et al.: Does Heavy Ion Therapy Work Through the Immune System?
  - Doi: 10.1016/j.ijrobp.2016.08.037
  - Int J Radiation Oncol Biol Phys, Vol. 96, No. 5, pp. 934e936, 2016
- Gameiro et al.: Tumor cells surviving exposure to proton or photon radiation share a common immunogenic modulation signature, rendering them more sensitive to T cell-mediated killing. Int J Radiat Oncol Biol Phys 2016;95:120-130

# Sources II

- <https://physics.stackexchange.com/questions/169665/dose-depth-curve-of-photons-vs-protons>
- Shimokawa et al.: The future of combining carbon-ion radiotherapy with immunotherapy: Evidence and progress in mouse models. Int J Particle Ther 2016