

# Innovative radiotherapies (1)

*Monday, September 9, 2024 8:30 AM (1 hour)*

These lectures will cover an introduction to the physical and radiobiological characteristics of the different approaches and technological issues associated with their development.

The approach in developing new radiotherapy (RT) approaches is to succeed in increasing the therapeutic window for different types of cancer, either by sparing healthy tissues, or by being more effective on the tumor tissue to be treated, ideally both at the same time. An introduction will be given presenting different developments in modern X-ray RT with successive generations of irradiation techniques improving the conformation of the dose to the tumor and optimized dose delivery for the patient's response. The limits of external RT will be discussed and a broad description of development strategies developed to overcome these limits will be given, in particular to see how we can play on the physical aspects of irradiation to induce a different biological response. We will emphasize the interest of using beams different from photons, such as light ions (H, C) used in hadrontherapy, which have the dual advantage of providing better irradiation ballistics and increased biological efficiency for radioresistant cancers. Other approaches also play on the temporal and spatial aspects of dose delivery, such as "FLASH" radiotherapy using a very high dose rate and "spatial fractionation" using very heterogeneous irradiation with micrometric beams, to induce better tolerance of healthy tissues to irradiation for the same tumor control. Finally, non-localized or metastatic cancers can benefit from combined approaches with the use of a pharmaceutical agent allowing molecular targeting of cancer cells, as is the case with internal radiotherapy or boron neutron capture (BNCT). Finally, we will briefly introduce the questions that these RT raises, whether in terms of understanding the induced radiobiological mechanisms or the technological developments that they require in terms of production, dosimetry or detection, these different aspects being the subject of specific courses in the following.

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