IBFM-CNR, Cefalù team, aims at studying the biological effects of ionizing radiations used in conventional radiotherapy (electrons, X rays and γ rays) and in particle therapy (protons and carbon ions) produced by conventional machine (LINACs and Cyclotrons) or by innovative systems (laser driver accelerators), used alone or in combination with radiosensitizers, with the main goal to develop innovative radiotherapy treatments for solid tumors, to overcome radioresistance mechanisms and going towards personalized treatments planning.

This radiobiological research is conducted with the integration of interdisciplinary skills, which is peculiar to the Cefalù IBFM team, consisting of biologists, medical physics, computer engineers. Then, three different contributes feature the radiobiological studies:

a. Cellular and molecular biology, to describe cell survival, biochemical and molecular pathways featuring the response to ionizing radiations; animal science to perform in vivo studies.

b. Physical-medical contribution for the dosimetric and beam simulation aspects, useful for the configuration of irradiations, as well as for the results modelling;

c. Computer engineering contribution for the imaging analysis, necessary for monitoring the effectiveness of treatments on small animals using microPET/CT images, and for automatic cell analysis on microscope images.

In particular, in the vast field of radiobiology, the main active research topics at the Cefalù unit are:

- Radiobiological characterization studies on in vitro models, using immortalized and primary cells of breast cancer and glioblastoma multiforme, subjected to different types of beams (photons, protons), by the definition of dose-response curves, Linear Quadratic (LQ) model and α/β parameters derivation, as well as by the description of the genomic response to RI. On in vivo, to evaluate the Relative Biological Effectiveness (RBE), TCP/NTCP window of the various irradiation configurations, supported by the use of molecular imaging with μPET/CT.

- Personalization of radiotherapy treatments, trying to define administration protocols of different total dose to the various molecular subtypes of breast cancer.

- Development of innovative combined treatments by the use of radiosensitizers, such as targeted compounds or nuclear reactive species, in order to enhance the radiotherapy efficacy.

- Development of new strategies to reduce hypoxia radioresistance in GBM.

- Space Radiobiology studies to characterize microgravity and radiation combined effects on tumor models for oncological therapy applications.

References:


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