Contribution ID: **11** Type: **Oral presentation**

Assessing the biomolecular effects of carbon minibeam radiation therapy via synchrotron-based infrared microspectroscopy

Thursday 21 March 2024 09:30 (20 minutes)

A higher therapeutic index might be achieved in carbon therapy when used in combination with Minibeam Radiation Therapy (CMBRT). Nevertheless, the biochemical effects underlying CMBRT are not profoundly known. This work aims to study the nature of these effects by employing synchrotron-based Fourier Transform Infrared microspectroscopy (SR-FTIRM).
Cancer cell irradiations (LM8 mouse osteosarcoma) were carried out at the GSI (Germany). Broad beam (BB) and minibeam (MB) irradiations were performed with two mean doses (2 and 8 Gy). SR-FTIRM measurements were held at ALBA synchrotron. Principal Component Analysis (PCA) was used to evaluate spectral modifications related to proteins, nucleic acids, and lipids.
PCA score plots indicate that the biochemical signatures obtained from the BB-treated cells are closer to control cells, while CMBRT infrared spectral features clearly differ from BB for both peak and valley MB groups. The peaks that contribute the most to BB-MB data separation in the PCA score plot are Amide I (1598-1710 cm−1), Amide II (1483-1590 cm−1), Phosphate I (1240 cm−1), and Phosphate III (970 cm−1). Changes in the amides have been previously related to protein secondary structure modifications, while Phosphate I might account for cell death, oxidative stress, or DNA backbone modifications. Phosphate III has been related with deoxyribose damage, backbone single and double strand breaks, and crosslinks. Regarding lipids, changes in the CH2 and CH3 vibrational modes (3000-2800 cm-1) were detected, which were previously correlated with changes in the lipid chain length, oxidative stress and membrane alterations. Several differences were also encountered between MB peak and valley groups. Specifically, in the Amide I and Phosphate II regions, as well as in the ester vibration mode located at 1740 cm-1.
The above-described changes suggested distinct biochemical effects on irradiated tumor cells, adverting differences in the impact of CMBRT against homogeneous radiation.

Authors: COTS-COSTA, Martina (Universitat Autònoma de Barcelona); GONZÁLEZ VEGAS, Roberto (Universitat Autònoma de Barcelona); Dr BERTHO, Annaïg (Institute Curie); Dr GILBERT, Cristele (Institute Curie); Dr SEKSEK, Olivier (Centre National de la Recherche Scientifique (CNRS), IJCLab); Dr GRAEFF, Christian (GSI Helmholtz Centre for Heavy Ion Research); Dr TINGANELLI, Walter (GSI Helmholtz Centre for Heavy Ion Research); YOUSEF, Ibraheem (ALBA Synchrotron); PREZADO, Yolanda (Institute Curie); MARTÍNEZ-ROVIRA, Immaculada (Universitat Autònoma de Barcelona)

Presenter: COTS-COSTA, Martina (Universitat Autònoma de Barcelona)

Session Classification: Biological Mechanisms of the effect of Particle Minibeams