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X-RAY PHASE CONTRAST TOMOGRAPHY REVEALS EARLY VASCULAR ALTERATIONS AND NEURONAL LOSS IN NEUROLOGICAL DISORDERS

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Techniques previously used to investigate damage to vascular and neuronal networks in neurological disorders suffer from several limitations. In particular, 2D imaging restricts spatial coverage, entails destructive sample preparation, and may lead to data misinterpretation due to lack of information on the third dimension. In contrast, recent ex-vivo study in mice demonstrated that imaging by X-ray phase-contrast tomography (XPCT) enables the study of the 3D distribution of both vasculature and neuronal networks, without sample sectioning or specific preparation. We have generated and quantified multiscale XPCT to evaluate alterations in vascular and neuronal networks at relevant disease phases of the animal model for multiple sclerosis, experimental autoimmune encephalomyelitis (EAE), in affected mice and to understand how treatment with mesenchymal stem cells (MSC) modifies them. A direct 3D morphological description of EAE lesions is provided at both vascular and neuronal levels at two different length scales, from the whole spinal cord up to capillaries and single cell. Such a multi-scale direct analysis has never been performed to understand EAE pathology and address the effect of an innovative therapeutic strategy. The results strongly indicate i) a trend in alteration of the micron vessels and occlusions in the capillaries, an observation never obtained in tissue without the use of a contrast agent; ii) neuronal alterations with massive loss of lower motor neurons. Such vascular and neuronal alterations were considerably reduced in MSC-treated mice. We have also applied XPCT to the investigation of other neurodegenerative disorders, i.e. Alzheimer and amyotrophic lateral sclerosis (ALS) and the results will be presented.

Biography

A Cedola completed her PhD degree at the University Joseph Fourier in Grenoble (France) with an experimental thesis at European Synchrotron Radiation Facility (ESRF). She is currently permanent Senior Scientist of the National Research Council (CNR) at Institute of Nanotechnology in Rome. She is enabled Associate Professor of Experimental Physics. She is responsible of the X-ray physics group at CNR in Rome; Member of Two Management Committees of the European Science Foundation Project COST and Scientific Committee of several international conferences on physics and X-ray optics. She is in the Editorial Board of the Journal *Scientific Reports –Nature* , She is currently principal investigator of the following financed projects: H2020 FET-Open *VOXEL* 665207 project. She holds Marie Skłodowska-Curie Individual Fellowship (*BiominAB-3D*). She works on X-ray imaging, X-ray Phase Contrast Tomography applied to Biomedical applications. She received several invitation to plenary and talks. She has more than 120 publications with citations about 1400 citations.

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