PROJECT 1

DoS: Maria Assunta Rocca

Title: Advanced multiparametric MR imaging assessment of cognitive dysfunction in multiple sclerosis: from pathophysiology to treatment monitoring

Curriculum: Neuroscience and Experimental Neurology

Link to OSR/UniSR personal page:
http://www.hsr.it/research/organization/divisions-centers/division-of-neuroscience/maria-a-rocca/

Project description (Number of characters, including spaces: 2.000 - 3.000):
Cognitive impairment affects a large proportion of multiple sclerosis (MS) patients, ranging from 40% to 70%. Fatigue and depression are also highly prevalent in these patients and have complex interactions with cognitive disturbances. During the past decade, much effort has been spent to characterize cognitive impairment in MS and to investigate the type, extent, and topography of brain structural and functional abnormalities associated with cognitive and behavioral dysfunctions in MS patients at different stages of the disease. Thanks to the application of advanced MRI techniques sensitive and specific to the different pathological processes of the disease, many advances have been made in the understanding of the substrates of cognitive impairment, fatigue and depression in MS. However, several aspects still need to be fully evaluated, including a longitudinal evaluation of the MRI measures associated with the progression of cognitive dysfunction. Moreover, the application of such advanced MRI techniques is likely to provide relevant pieces of information regarding the effects of pharmacologic and rehabilitative treatments aimed to enhance, or at least preserve, cognitive performances as well as to improve fatigue and mood disorders in MS patients.
In this project, the student will combine advanced MRI techniques (e.g., diffusion-weighted imaging, atrophy assessment, resting state functional MRI) to characterize the structural and functional substrates associated with cognitive impairment, fatigue and depression in MS patients spanning the main clinical phenotypes, their longitudinal evolution in relation with cognitive deterioration, and the role of MRI to monitor pharmacologic and rehabilitative effects on cognitive dysfunction. This will allow to increase our understanding of the pathophysiology of cognitive impairment, fatigue and depression in the main MS clinical phenotypes, to identify reliable MR measures useful for predict cognitive impairment in these patients, and to identify novel MR measures to monitor treatment response.

Skills to be acquired by the student:
During the project the student will acquire the following skills:
- Pre-processing and post-processing of advanced MRI data;
- Interpretation of MRI data in MS patients;
- Definition of the patterns of cognitive dysfunctions, fatigue and depression in MS patients with the main clinical disease phenotypes and the associations with structural and functional advanced MRI measures, including diffusion tensor MRI, neurite orientation and dispersion density imaging (NODDI), atrophy quantification and resting state fMRI);
- Understanding of the structural and functional brain correlates of longitudinal evolution of cognitive dysfunctions in MS patients;
- Evaluation of the structural and functional brain correlates of pharmacologic and rehabilitative treatments aimed to improve cognitive performances in MS patients;
- Presentation of works at National and International congresses;
- Drafting of research reports and articles.

References (max. 3)