

Dr. Cirstea's overall career objective is to better understand the cellular/molecular mechanisms underlying brain plasticity in humans using state-of-the-art neuroimaging and behavioral techniques. Her studies focus on motor function, where deficits readily lend themselves to measurement. The main tools she uses are proton magnetic resonance spectroscopy, functional and structural MRI, diffusion tensor imaging, non-invasive brain stimulation, and human motion analysis. Such understanding would allow her and her team to develop new or modify current treatments to better target neural mechanisms underlying different neurological diseases.

The goal of her laboratory activity is to study brain plasticity or repair at different levels, systemic and cellular/molecular, and its functional relevance in patients suffering from a variety of medical conditions, i.e., stroke, traumatic brain injury, cervical spondylitic myelopathy, upper limb amputation, chronic pain, autism. Her main focus is to optimize clinical care after stroke. She has more than 11 years of experience using state-of-the-art neuroimaging tools, including MR Spectroscopy, to study non-invasively, for the first time, cellular/molecular levels of brain plasticity and repair after stroke. She has more than 14 years in applying principles of motor control and 3D motion analysis to investigate what is actually altered in the motor control after stroke and how these patients exploit the redundancy of the motor system, i.e., using the available degrees of freedom, to compensate motor impairment. Another line of her research examined whether the concepts of motor learning derived from the study of neurologically healthy population are applicable in stroke population.

All of her projects have been grounded in current theoretical developments derived from the behavioral and movement sciences. Such understanding will help her team develop new or modify current treatments to better target neural mechanisms to increase the rate and the extent of recovery. For this, we will explore pharmacological agents, non-invasive brain stimulation, and/or certain motor training paradigms. Finally, identifying and adding reliable biomarkers into predictive models will significantly improve the prognosis. Due to the high frequency of motor impairment after stroke and its impact on post-stroke disability, such understanding could massively impact this field.