Project Title: Deciphering the Brain-to-spinal communication controlling skilled hand function.

Background:

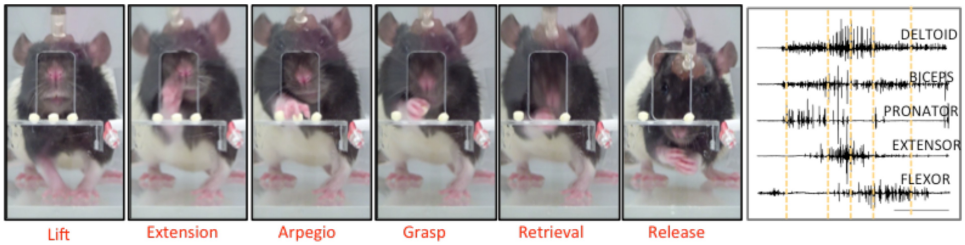
Manual dexterity is indispensable for carrying out the vast majority of our normal daily activities, ranging from object manipulation to nonverbal communication. Damage to the neuronal circuits controlling the upper extremities inflicts devastating consequences as a patient's lifestyle becomes dependent on supportive devices, which drastically reduce their freedom to move. Spinal cord injuries have devastating effects on the patients life style, as they suffer from reduced, or even abolished, freedom to move and sense. Although the incidence rate of spinal cord injuries is lower than other neurological diseases, the severity of the injury and the lack of reliable treatments cause the impairments associated with the injury to persist over a lifetime. From all the physio-pathological symptoms developed following a cervical spinal cord injury, patients have highlighted a high priority for finding therapies to restore arm/hand function among others. Our longterm goal is to translate the findings from animal models on the repair of the usage of hand and arm movements for performing skilled tasks to human patients. Doing this will require an understanding of how cortical, subcortical and spinal cord networks act in concert to drive fine motor control. This project will be an important step in this direction.

Project Description:

This project involves data analysis from animal experiments, computational modeling and translation of the results to a clinical setting. The candidate will study how cortical, brain stem and spinal cord circuits interact to drive motor function. This will involve analysis and modeling of high-dimensional data from experiments with stimulating electrodes in the motor cortex and spinal cord, and recording electrodes in forelimb muscles of rats, as well as experiments in which the EMG activity of muscles is recorded while the animal is engaged in a reaching and grasping task. In addition, we are initiating a collaboration with the Guttmann Institute for Neurorehabilitation to translate our results to human patients, in order to find a therapy to recover arm/hand function in patients with high spinal cord injuries. The candidate will work in close collaboration with Alex Roxin at the Group for Computational Neuroscience at the CRM and Guillermo Garcia Alias at the Neuroscience Institute at the UAB.

Candidate Profile:

We are looking for an enthusiastic and scientifically curious researcher with a strong technical background, ideally in mathematics, physics, engineering or related fields. A background in biology or neuroscience is not required.



The reaching and grasping model permits to study voluntary and skilled arm/hand movements in rats. The pictures show the fractioned sequence of movements performed by trained rats to reach and grasp single pellets. In addition, the animals have implanted stimulating electrodes on the cortex and spinal cord to evaluate the conductivity along the CNS axes, and recording electrodes in the forelimb muscles. Both the behaviour and the electrophysiology testing are in the stat of the art of rodents models to study spinal cord injury and plasticity