Laboratory title : CNRS UMR 5293 - Erwan Bézard

Supervisor

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Thesis title :

Decision making: Neuronal basis of cognitive control of action in humans

Keywords : Prefrontal cortex, EEG, TMS, Human, Behavior

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Abstract

A major issue in Neuroscience is to understand the neuronal basis of decision-making and cognitive control of action. Imaging studies suggest that prefrontal structures play a key role in these functions, particularly in situations requiring-conflict monitoring and post-error behavioral adjustments. However, how these functions are processed at the neuronal level remains largely unknown.

Several hypotheses of how the brain regulates cognitive aspects of motor control propose that the anterior cingulate cortex (ACC) plays a prominent role. Among them, the ‘conflict-monitoring’ theory postulates that the ACC detects the occurrence of conflict or competition between incompatible response tendencies while other structures actually implement the adjustments to resolve conflict. This leading theory, supported by event related potential, functional magnetic resonance imaging and single unit recording studies in human is, however, still debated.

The goal of this thesis project is to study the properties of the ACC, the supplementary motor area and prefrontal dorsolateral cortices in the context of such processes in humans. To this end, we’ll use several behavioral tasks during which electroencephalography (EEG) will be recorded. These tasks make possible the investigation of several aspects of action planning (attention, conflict monitoring, decision-making) and critically challenged the role of motor or cognitive processes in the conflict monitoring function.

In addition to EEG we’ll use repetitive transcranial magnetic stimulation (rTMS), a non-invasive technique that induces transient disruption of neuronal activity within the targeted region. This allows a direct assessment of the causal relationship between recorded region and a particular behavioral function.

Qualification required

Physiology, Neuroscience or Cognitive Neurosciences background