Project type: **Appropriate for Master or PhD students in Neurosciences, or related fields such as Biology, Physics, Informatics and Engineering**

Title: **Cortical sensorimotor networks for visually guided reaching**

Laboratory: **Institut de Neurosciences de la Timone (INT), Marseille, France**
CNRS & Aix-Marseille University

Supervisor: **Dr. Bjørg Kilavik, member of the team Cognitive Motor Control (CoMCo)**

Project summary:

Motor cortex is considered the final cortical output in a large network binding sensation and action. Lately it has become clear that visuomotor processes do not follow a simple serial processing from sensory to motor areas. Rather, they occur in parallel in different areas, as evidenced from motor selectivity being observed in visual areas [Mirabella, Bertini, Samengo, Kilavik et al. (2007) Neuron 54:303] and premature visual cue anticipation and processing being observed in motor areas [Confais, Kilavik et al. (2012) J Neurosci 32:15359; Kilavik et al. (2010) J Neurophysiol 104:2338]. Anatomical connections possibly underlying this parallel sensorimotor processing are largely known. However, while the functional specializations of either sensory or motor areas have been extensively studied in isolation, only few studies have aimed at studying the complex interactions between areas. This prevents understanding the functions of for instance the premature visual processing in motor areas, and the motor selectivity in visual areas. Indeed, primate motor behavior is remarkably accurate and appropriate even though the properties of the body and the objects with which it interacts vary over time. For proper adjustment the brain needs to continuously monitor the external world, update its representation, relate the world to the internal state of the body, select the desired (motor) response and anticipate its outcome. This dynamic process of continuous sensorimotor transformation makes it possible to perform the required motor response with sufficient accuracy, and evidently relies heavily on dynamical inter-areal interactions.

In this project we perform recordings in multiple motor cortical areas in macaque monkeys trained in complex visuomotor tasks. We use linear (laminar) electrode arrays, which enables simultaneous recordings from all cortical layers. The analysis of these laminar data allows unprecedented exploration of the local dynamics within motor cortical networks during sensorimotor behavior.

The student will participate in recording intra-cortical neuronal activity in behaving macaque monkeys. He (she) will also participate in the analysis of neuronal spiking activity or local field potentials (LFPs), to study task-related functional specializations in different motor cortical areas and layers. Notably, the laminar recordings will allow determining the functional properties of different cortical layers in relation to feed-forward and feedback communication, and in relation to cortico-cortical and cortico-spinal projections.

The larger research program entailing this student project is on-going. We already have data from one monkey, and recordings from a second animal will soon commence. The CoMCo team has the required expertise for both the experimental and analytical parts of the research and can provide a broader view of the project and results in the context of human and non-human primate research in sensorimotor functions.

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See also: http://www.int.univ-amu.fr/KILAVIK-Bjorg?lang=en