**Meeting 27/05: Ambizione presentation from Marco**

There are two main descending pathways:

1. Indirect: Motor Cortex-Brainstem-SpinalCord
2. Direct: Motor Cortex- SpinalCord🡪 CorticospinalTract, (includes the α motoneurons)

Reasons for working on monkeys:

* The corticospinal tract is found just in non-human primate (this is weird not sure of what I heard) and humans (though in humans the CST fibers density is much higher).
* Arm kinematics in monkeys and humans is the same (Nathan proposes to verify, check it out)

Check out work from Moritz (not sure about the spelling): he did something similar but in intra-spinal stimulation on rats, might be interesting

In our work:

The lesion is done between the brainstem and the SC.

Locomotion works as a dual mechanism:

1. Through the recruitment of primary sensory afferences in the lumbar region. The afferent fibers provide a gate to the SC circuitry, which is ALL switched on. There is no specific muscle engagement. The output of this is locomotion because the sensory feedback is sufficient to provide alternation and locomotion activation. Therefore, the sensory feedback is the activation mechanism (the treadmill starts) and once the circuitry is activated the spinal cord provides the coordination. In fact, the flexor and the extensor muscles are activated by the same dorsal root and there is reciprocal inhibition among the two. The stimulation acts on top of the natural firing rate, providing an amplified version of the natural firing rate. (Comment out of nothing: the spindle of the extensor fires more that the one from the flexor because of gravity🡪 maybe this is what justifies the stepping🡪 check it out).
2. The point 2 lacks but I have a comment on the fact that there is some descending pathway remaining, so maybe this is the dual side of the sensory induced stepping. NB: the agonist and antagonist muscles have two different neurons in the brain but they converge at the same α moto-neuron.

Two mains questions:

1. What is the role of feedback in upper limb?
2. How does the stimulation interacts with the spinal circuitry?

The Computational Model:

1. FEM🡪 provides information on where to stimulate
2. Spiking model🡪 provides the validation of spindle networks.
3. Biomechanical model: strictly interacts with the spiking model, must provide the expected output in terms of movement.

The hypothesis is that there is presynaptic inhibition of proprioceptive input to the spinal cord, therefore in the beginning what for sure we have to do is:

1. On healthy monkey:
   1. EMG recording during reaching task, without stimulation
   2. EMG recording during reaching task, with stimulation.
2. On model, with proprioceptive path:
   1. EMG “recording” during reaching task, without stimulation
   2. EMG “recording” during reaching task, with stimulation
3. On model, without proprioceptive path:
   1. EMG “recording” during reaching task, without stimulation
   2. EMG “recording” during reaching task, with stimulation

Comparing case A B and C we should evaluate the proprioceptive inhibition. (This is not 100% clear).

Comment out of nothing: Voluntary movements inhibits the sensory fibers (???).