

Voluntary Movement II.

Cortical representation of movements and parameters.

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1. Primary motor cortex: how are movement parameters coded

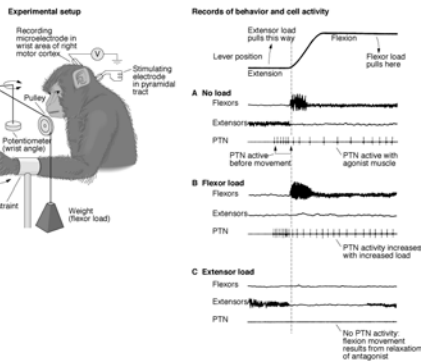
- Distal movements
- CM neurons.
- Population coding.

2. Premotor areas higher order features of movement

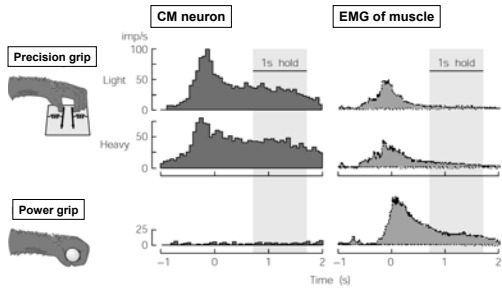
- Supplementary motor area: Sequences
- Lateral dorsal premotor area: sensorimotor transformations
- Lateral ventral premotor area: grasping

3. Experience modifies representations

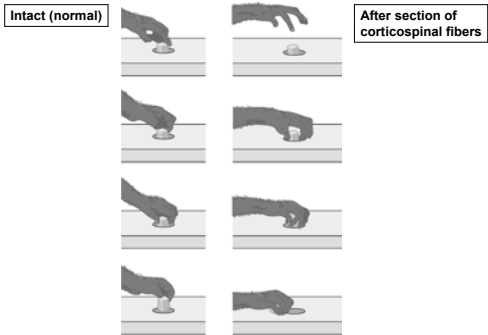
Corticospinal neurons (PTN) code direction and force



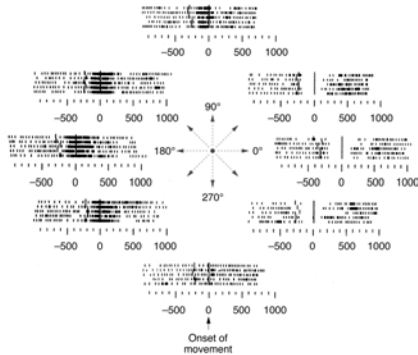
CM neurons are preferentially recruited for tasks requiring topographical precision



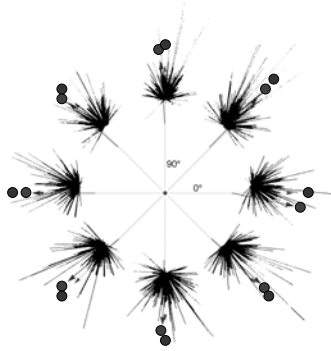
Section of pyramidal tracts in monkeys produces loss of independent "individuated" digit control



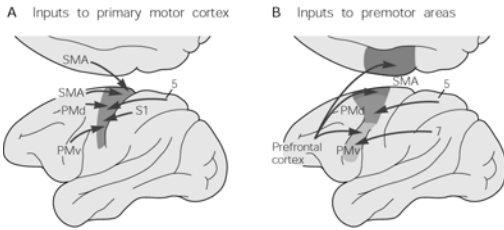
Neurons in proximal motor cortex regions are broadly tuned for direction



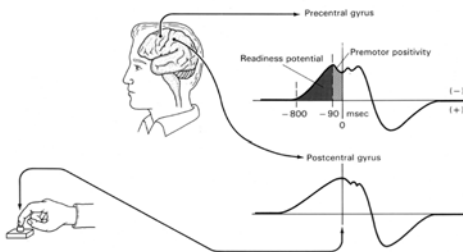
Movement direction can be coded precisely by the population responses of broadly tuned neurons



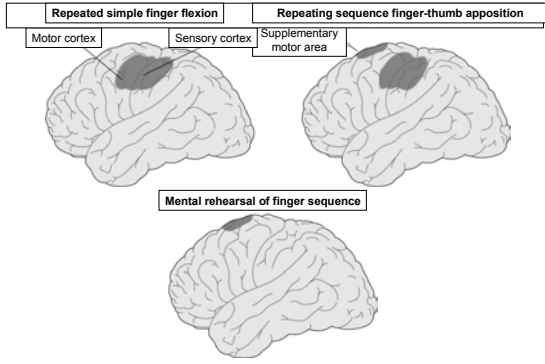
Primary motor cortex receives direct input from 5 premotor areas
These premotor areas also project to the spinal cord



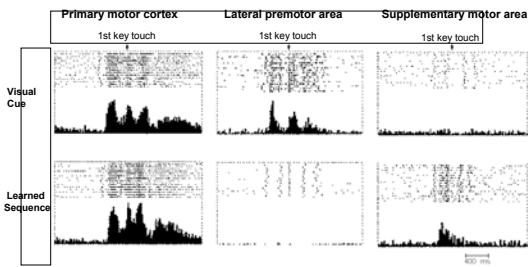
"Self initiated" voluntary movement are preceded by premotor activation:
early evidence from evoked potentials



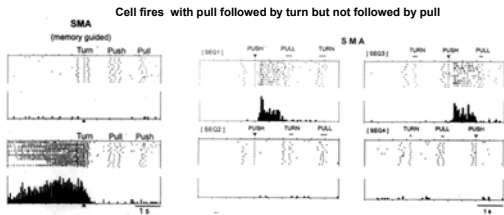
Planning movement sequence without moving activates SMA
First neuroimaging data



Activation of motor areas depend different on behavioral context

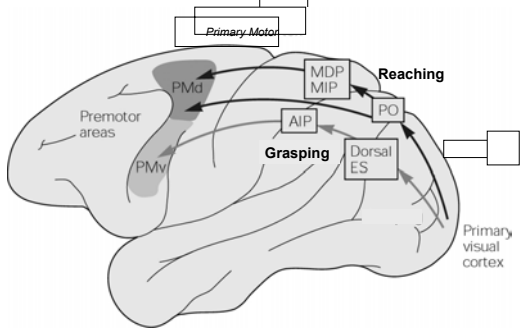


Supplementary motor area neurons code movements in specific context of movement sequence.

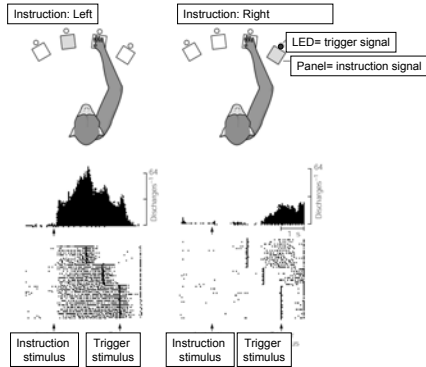


Cell fires with turn followed by pull and push but not just with pull

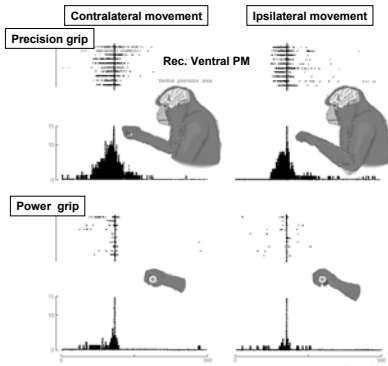
Separate pathways convey visual inputs to premotor areas for reaching and grasping



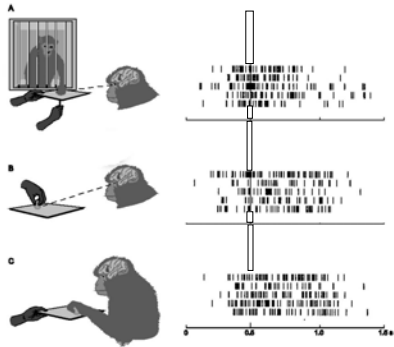
Instructed delay task: coding of "preparatory set" for directed reach by dorso-lateral premotor neurons



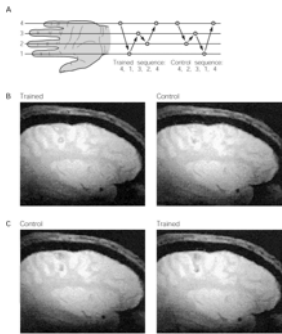
Neurons in ventral premotor area (PMv) code for hand configuration of grasp



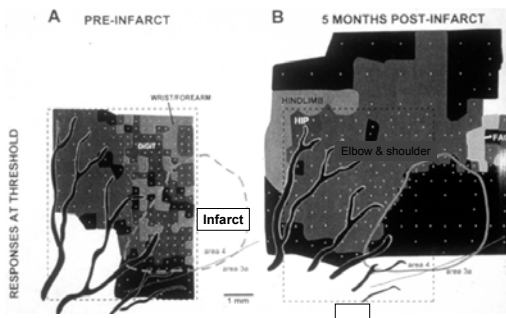
“Mirror neurons” in PMv represent types of movement independent of its actualization: motor vocabulary



Practice and learning of finger sequence can alter motor representations in primary motor cortex



Damage to local region of motor cortex induces change in representation of nearby areas



**Motor practice can alter functionality and motor mapping
In motor cortex**

