MOTOR CORTEX

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Motor Cortex

- Center of voluntary motor movements
- Located anterior to the central sulcus
- Includes:
  - Primary motor cortex
  - Premotor area
  - Supplementary motor area
Motor Cortex

- **Primary motor cortex**
  - Primary source for the motor commands to lower motor neurons.

- **Somatotopical organization**
  - “Motor homunculus”

- **Finer muscle control** – more motor units – more motor neurons – larger representation areas
Motor Cortex

- **Premotor area**
  - Topographic organization
  - Complex movement patterns
  - Construction of “motor image”

- **Supplementary motor area**
  - Bilateral complex movement patterns
  - Body posture maintainance
Motor Cortex

- Supplemental and premotor areas
- Primary motor cortex

- Hand skills
- Head rotation
- Contralateral eye movements
- Word formation (Broca’s area)

- Choice of words
- Eye fixation

- Vocalization
- Jaw
- Tongue
- Swallowing
- Chewing

- Neck
- Trunk
- Arms
- Legs
- Fingers
- Feet
Mirror neuron system
Motor Cortex

- **Cortical columns**
  - Motor patterns for synergistic muscle groups
  - Stimulus amplification for contraction
- **Dynamic and static neurons**
  - In motor cortex and Red nucleus (n. Ruber)
    - Dynamic neurons: Building up force at the beginning
    - Static neurons: Maintain the movement or posture
Corticospinal tract
Motor Cortex

- Betz cells
  - 3% of the pyramidal tract
Corticospinal tract

- Axons of corticospinal tract
  - Primary motor cortex (30%)
  - Premotor & Supp. Motor areas (30%)
  - Somatosensory areas (40%)
Other motor pathways

- Collaterals of Betz cells (*lateral inhibition*)
- To Basal ganglia (*postural contractions*)
- To Red nucleus (*rubrospinal tract*)
- To Reticular system (*reticulocerebellar tracts*)
- To Vestibular system (*vestibulocerebellar tracts*)
- To Pons nuclei (*pontocerebellar tracts*)
- To Nuc. olivarius inferior (*olivocerebellar tracts*)
Corticospinal tract

- Lateral system
  - Pyramidal tract
  - Rubrospinal tract
    - Alternative/complementary
    - Movements of distal extremities
Corticospinal excitation
Sensory Feedback

- From muscle spindles…
- From tendon organs…
- From skin-touch receptors…
Motor Control from Brainstem

- “Defying gravity”
  - Pontine reticular nuclei (spontaneous excitatory signals to antigravity muscles)
  - Medullary reticular nuclei (strong cortical input; inhibitory signals via medullary reticulospinal tr.)
  - Vestibular nuclei (selective signals for balance)

- Section below the pontine level
  - Decerebration rigidity
Lesions of the motor system

- Primary motor cortex lesion
  - Paralysis…

- Premotor area; Caudate nucleus lesions
  - Loss of voluntary control of fine movements

- Widespread “stroke”
  - Overexitability and spasticity
The End...