Stroke Recovery: Focus on the Upper Limb

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Who is here?

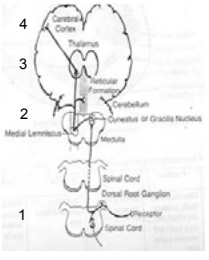
The Sensory-motor System: Structure, Function, and Clinical Implications

Sensory System: Parietal Lobe

- Function: provide the CNS with a representation of the external world
- Information carried (peripheral receptors) to brain structures (e.g. thalamus, S1) where it is interpreted
- Strong interaction between ascending (stimulus-driven) and descending (goal-driven) mechanisms
- What is the relationship to the Motor System?

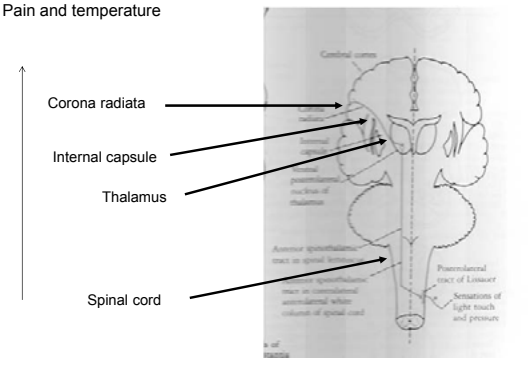
Sensory System Overview

- Afferent information from muscle, golgi tendons etc arrive in the DORSAL HORN
- Ascend spinal column in respective tracts to respective nuclei of thalamus
- Ascend and terminate in the somatosensory cortex



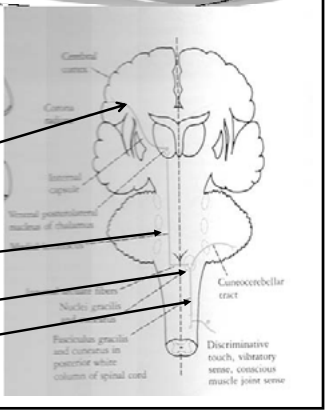
Lateral Spinothalamic Tract

Pain and temperature



Posterior White Column
Fasciculus Gracilis
Fasciculus Cuneatus

Discriminative touch, Vibration, conscious muscle joint sense



Motor System

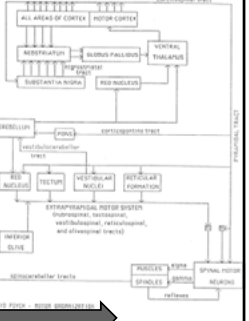
Cortices

Basal Ganglia

Cerebellum

Brain stem

Spinal Cord



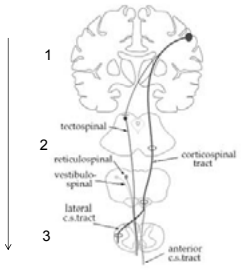
Projections from Primary Motor Cortex

Corticospinal Tracts

Voluntary, discrete, skilled movement of the distal part of the limbs

Confers speed and agility, used in rapid skills

Other tracts mediate basic Voluntary movement

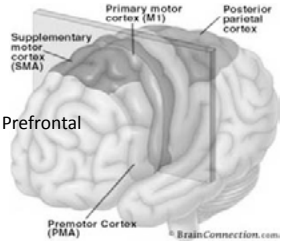


Primary Motor Area

- Execution of voluntary movement

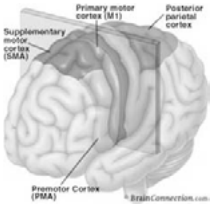
1. Force modulation e.g. grip
2. Fine tuning of volitional movements
3. Skilled finger movement

Prefrontal cortex involves the planning, prioritizing and sequencing of actions into GOAL directed behavior



Premotor Cortex

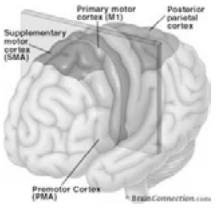
- Preparation for movements that require sequencing
- Planning phase of movement (PET scans)
- Not active during movement
- May guide "motor programs" e.g. reaching



Supplementary Motor Cortex

- Cells are active BEFORE muscle activity
- Preparation of movement
- React to instructions given

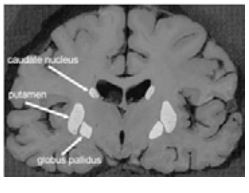
Implications for us?



Lesions to Motor Cortices: Upper motor neuron dysfunction

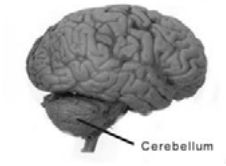
Primary Motor	Supplementary Motor	Premotor Motor
Contralateral (paresis)	Lack of movement, loss of facial expression	Slow and clumsy movement
Spasticity develops over time	Difficulty with tasks that require use of both hands	Ability to perform sequential tasks deteriorate
Postural reactions reduced, recover, become hyper-active	Problems with self-initiated tasks	Rythmic movments e.g tapping, typing are disrupted
Most drastically affected: finger movements		Perseveration may occur

Basal Ganglia



- Activate and inhibit movement
- Alter movement to accommodate demands
- Initiation and coordination of movement
- Maintenance of tone
- Postural control

Cerebellum



- stores learned sequences of movements,
- participates in fine tuning and co-ordination , postural control
- it integrates all of these things = fluid movement

Lesions to Cerebellum

- Posture and balance deteriorates
- **Eye-hand coordination is disrupted**
- **Motor programs degrade into parts**
- Loss of muscle synergy – tremor, ataxia (wide stance gait)
- **Errors in generating direction, force, velocity, amplitude, and timing of movement**