

Lecture 14

Anatomical organization of the motor system

- Premotor and supplementary motor cortex regions
 - Learning?
 - Integrating motor & other systems
- Cerebellum
 - Integration of feedback
 - Timing of motor movements
 - Learning
- Basal ganglia
 - Selection/initiation of actions
- Motor cortex
 - Planning motor cortex
- Brainstem
- Spinal cord
 - Reflex arc
 - Rhythmic movements

Pyramidal and extrapyramidal tracts

- The brain innervates the spinal cord via the pyramidal and extrapyramidal tracts
- The pyramidal tract is also called the corticospinal tract

Basal ganglia and cerebellum

- The basal ganglia and the cerebellum are two prominent subcortical components of the motor pathways

Cerebellum

- Motor execution
- Motor planning
- Balance and eye movements
- Not well imaged structure
- Ipsilateral control

Basal ganglia

- The basal ganglia consists of 5 motor-related nuclei
 - Striatum (Caudate & Putamen)
 - Globus pallidus
 - Substantia Nigra
 - Parkinson's
 - Dopaminergic neurons
 - Subthalamic nucleus
 - The basal ganglia appear to act in opposition to cortex

Motor-related areas of cortex

- Motor cortex: Planning, control & ec

Functional organization of the motor system

- The motor system is composed of many, anatomically distributed components

- Some of these components are cortical, many are subcortical
- The distributed components operate hierarchically and in parallel

The endpoint selection hypothesis of movement control

- One of the classic questions in motor system is **what the heck is motor cortex doing? What information is represented in motor cortex?**
- Seems unlikely there is a linear relationship between motor cortex and muscle movements
- One theory: motor goal, not how to achieve motor goal

Disorders of the motor system

- Spinal cord
 - Paraplegic: paralysis of lower limbs
 - Quadraplegic: paralysis of all limbs
- Motor cortex
 - Hemiplegia: paralysis of contralateral limbs
 - Hemiparesis: weakness or impaired control of contralateral limbs
- Secondary/association motor areas
 - Apraxia: loss of ability to generate coordinated actions, but not due to loss of muscle control
 - Ideomotor: difficulty in carrying out motor commands and sequential actions
 - Ideational: loss of knowledge about actions

- Parkinson's (substantia nigra): Resting tremor and loss of fine motor movements
- Cerebellum
 - Ataxia: poor coordination of distal limb movements and poor use of motor feedback
 - More diffuse impairment of cognitive functions: timing, number related functions

Effects of corpus callosum resection

- People with normal connected hemispheres have a very hard time drawing perpendicular axis
- People with callosotomy are really good at this

Parkinson's disease

- Parkinson's is caused by loss of dopaminergic neurons in substantia nigra