Motor System

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LEARNING OBJECTIVES

• Identify the elements of the motor system
• Describe the pathway of the pyramidal tracts
• Identify some diseases related to the motor system
### Elements of Motor System

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<th>MOTOR SYSTEM</th>
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<td><em>Smooth Muscle</em></td>
<td>AUTONOMIC MOTOR SYSTEM (sympathetic and Parasympathetic)</td>
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<td><em>Glands</em></td>
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<td><em>Skeletal Muscle</em></td>
<td>SOMATIC MOTOR SYSTEM</td>
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Autonomic Motor System

sympathetic response
Spinal Cord

- **anterior root** - motor
- **posterior root** - sensory
- **Lateral root** - autonomic
Somatic Motor System
Somatic Motor System

Upper Motor Neuron

Lower Motor Neuron

Skeletal Muscle

Auxiliary Motor Pathways

descending pathways from brain stem

motor nerve

pyramidal tract

reflex arc
LOWER MOTOR NEURON

Spinal Cord

Anterior Horn Cell (Lamina IX) -------- spinal n.

Brain Stem

General Somatic Efferent (GSE) Nuclei

Hypoglossal Nucleus --------------- XII
Abduces Nucleus ------------------- VI
Trochlear Nucleus ------------------ IV
Oculomotor Nucleus ----------------- III

Special Visceral Efferent (SVE) Nuclei

Ambiguus Nucleus -------------- IX, X, XI
Facial (Motor) Nucleus ----------- VII
Trigeminal Motor Nucleus --------- V
Anterior Horn Cell - Lower Motor Neuron -
Lower Motor Neuron

cell body: anterior horn
axon: anterior root, spinal nerve
axon terminal: neuromuscular junction

Effector: skeletal muscle
Muscle weakness which is greatly increased by exertion or repeated contraction.

- Autoimmune disease with autoantibodies against Ach receptor.
- Maybe fatal if untreated by respiratory paralysis.
- Treated with AchT inhibitors, thymectomy, and corticosteroids.

Defects in Neuromuscular Transmission.
Upper Motor Neuron

Pyramidal Tract are:

Corticospinal tract & Corticobulbar tract
Corticospinal Tract

Origin: Cerebral Cortex

- Brodmann Area 4 (Primary Motor Area, M I)
- Brodmann Area 6 (Premotor Area, PM)
- Brodmann Area 3,1,2 (Primary Somesthetic Area, S I)
- Brodmann Area 5 (Anterior Portion of Sup. Parietal Lobule)

Corona Radiata
- Internal Capsule, Posterior Limb
- Crus Cerebri, Middle Portion
- Longitudinal Pontine Fiber
- Pyramid - pyramidal decussation
- Corticospinal Tract - Lateral and Anterior

Termination: Spinal Gray (Rexed IV-IX)
Upper Motor Neuron

Pyramidal Tract

1. corona radiata
2. internal capsule, posterior limb
3. crus cerebri
4. longitudinal pontine fiber
5. pyramid
6. pyramid decussation
7. lateral corticospinal tract
8. anterior corticospinal tract
1. corona radiata
2. internal capsule
3. crus cerebri
4. pontine longitudinal fiber
5. pyramid
6. pyramid decussation
7. lateral corticospinal tract
8. anterior corticospinal tract
Corticospinal Tract

- completion of myelination in 2nd year of life
- time of standing and walking
Corticobulbar Tract

- Corticofugal fibers projecting to, and terminating in the portions of lower brainstem

- **Termination:**
  1) motor nuclei (upper motor neuron pathway)
     hypoglossal, ambiguus, facial motor,
     trigeminal motor, abducens, trochlear
     and oculomotor nucleus
  2) sensory relay nuclei
     nuclei gracilis and cuneatus, trigeminal
     sensory nucleus, solitary tract nucleus
  3) reticular formation (*corticoreticular fiber*)
Corticobulbar Tract (UMN Pathway)

- Corticofugal fibers projecting to, cranial motor nuclei
  
  GSE - hypoglossal (XII), abducens (VI),
  trochlear (IV) and oculomotor (III) nucleus
  
  SVE - ambiguus (IX, X, XI), facial motor (VII),
  trigeminal motor (V) nucleus

- largely *bilateral*
  
  laryngeal, pharyngeal, palatal and upper facial
  muscles of mastication and extraocular muscles

- *unilateral*
  
  lower facial musculature (facial palsy)
  SCM and trapezius (uncrossed) --- spinal accessory

- *Pseudobulbar Palsy* --- syndrome of bilateral UMN lesion
Pyramidal Tract and Associated Circuits

Upper Motor Neuron (UMN)

CEREBELLUM

Lower Motor Neuron (LMN)

BASAL GANGLIA