Neuroanatomy: Organization of Motor Systems

Laurie L. Wellman Ph.D.
Theodore Tzavaras MD2015
Eastern Virginia Medical School

Major Objectives

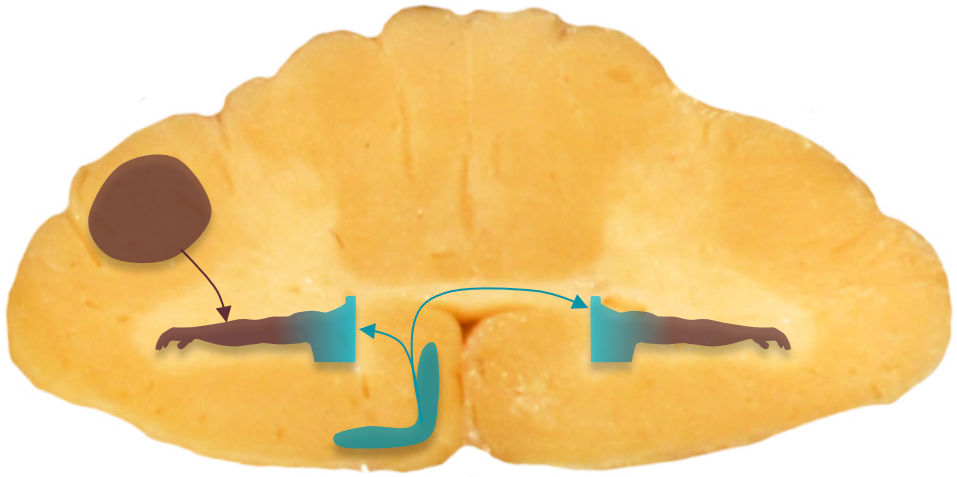
1. Name the two major descending motor systems
   - Compare and contrast these systems
2. Identify the two lateral motor system tracts
3. Identify the four medial motor system tracts
4. Outline the major motor feedback loops.
5. Discuss abnormal posturing: decorticate and decerebrate

Descending Motor Systems

Lateral & Medial systems

Named for their location

- The lateral system (2 tracts)
  →decussates
- The medial system (4 tracts)
  →travels bilaterally



Descending Motor Systems

Lateral Systems

- Lateral corticospinal tract
  - Origin: primary motor cortex
  - Decussation: cervicomedullary junction (pyramidal decussation)
  - Extent: entire cord
  - Function: movement of contralateral limbs

Descending Motor Systems

Lateral Systems

- Rubrospinal tract
  - Origin: red nucleus
  - Decussation: midbrain
  - Extent: cervical cord
  - Function: movement of contralateral limbs (human function uncertain)

Descending Motor Systems

Medial Systems

- Anterior corticospinal tract
  - Origin: primary motor cortex
  - Decussation: none
  - Extent: cervical & upper thoracic cord
  - Function: bilateral axial & girdle muscles

Descending Motor Systems

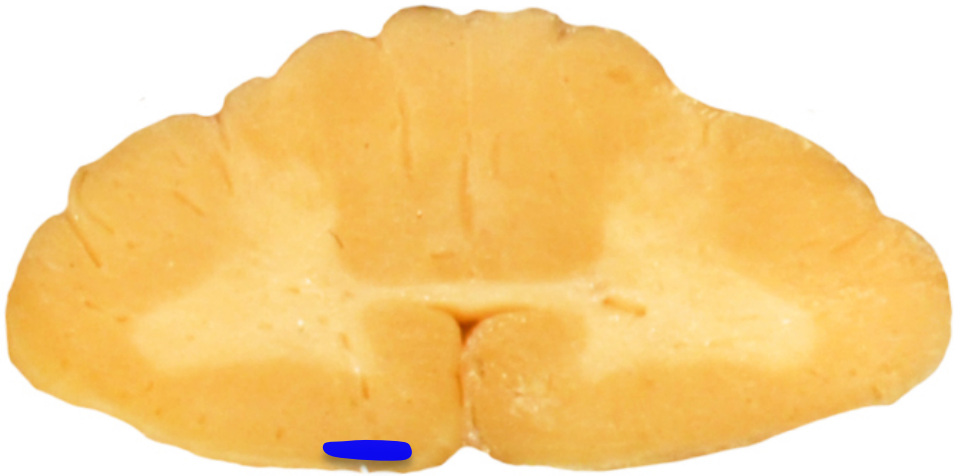
Medial Systems

- Vestibulospinal tracts (med. & lat.)
  - Origin: M→med. & inf. vestibular n.
    L→lat. vestibular nuclei
  - Decussation: none
  - Extent: M→cervical and thoracic
    L→entire cord
  - Function: M→head & neck
    L→balance

Descending Motor Systems

Medial Systems

- Reticulospinal tract
  - Origin: pontine & medullary reticular formations
  - Decussation: none
  - Extent: entire cord
  - Function: gait & posture related movements



Descending Motor Systems

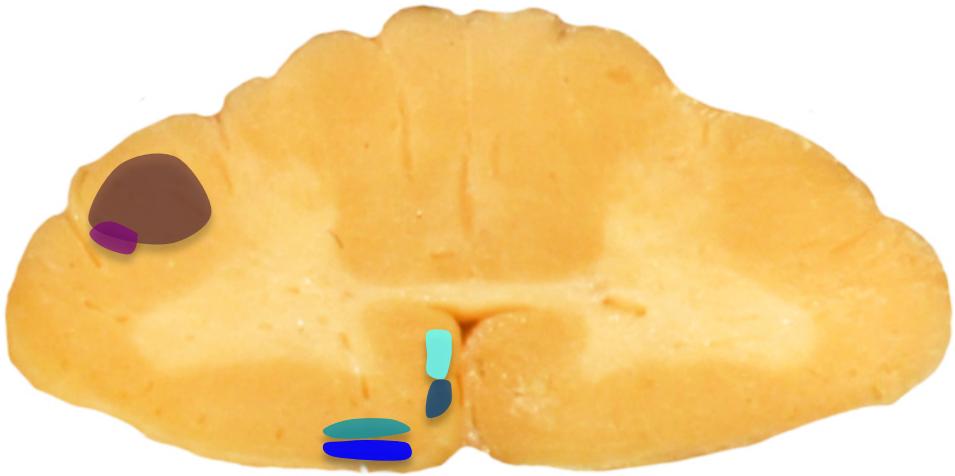
Medial Systems

- Tectospinal
- Origin: superior colliculus
- Decussation: midbrain
- Extent: cervical cord
- Function: head & eye movement coordination

Descending Motor Systems

Lateral & Medial tracts

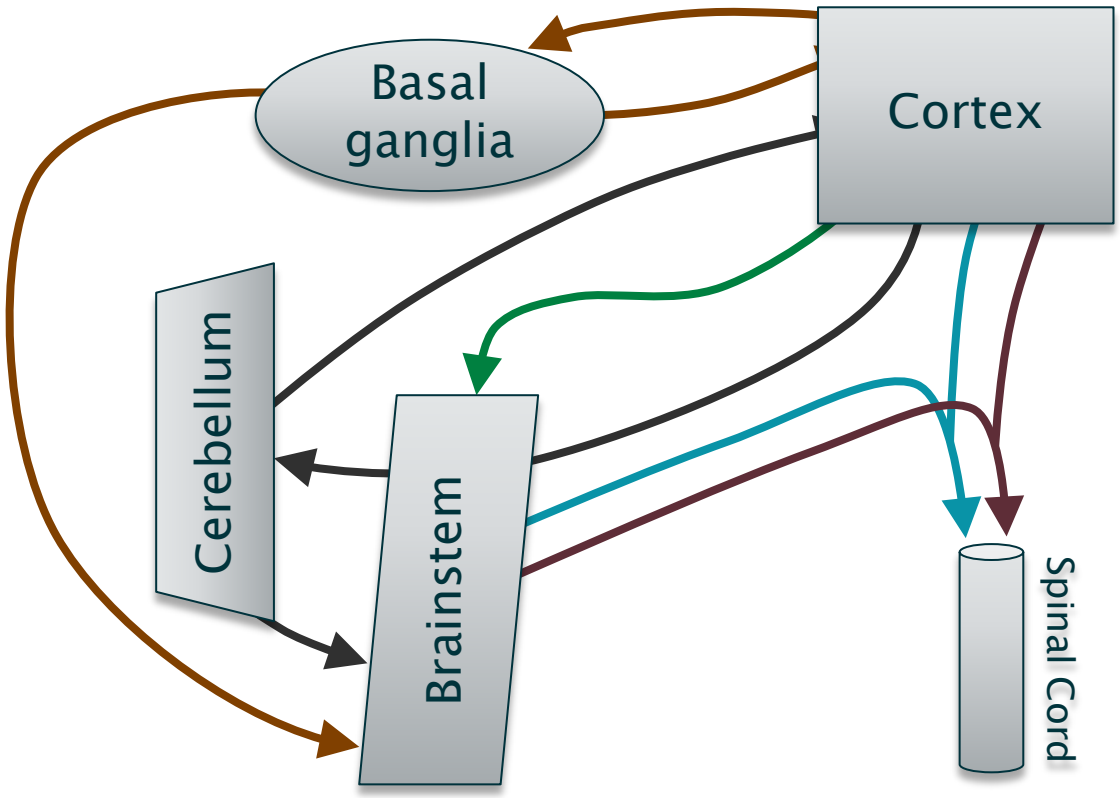
1. Lateral motor system [unilateral]
   - Lateral corticospinal tract
   - Rubrospinal tract
2. Medial Motor System [bilateral]
   - Anterior Corticospinal
   - Vestibulospinal tract
   - Reticulospinal tract
   - Tectospinal Tract



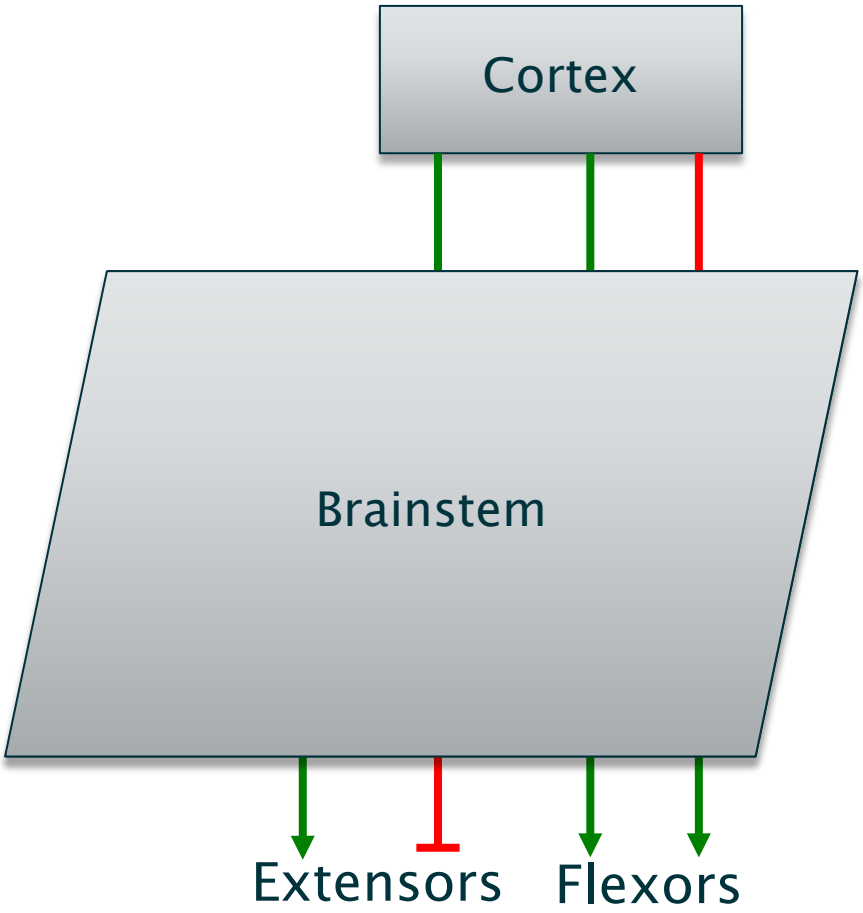
Major Feedback Loops

Don't project directly to LMNs

- Cortico-basal ganglia loop
- Cortico-cerebellar loop



Abnormal Posturing



Abnormal Posturing

Decorticate (flexor)

- Damage rostral to the red nucleus

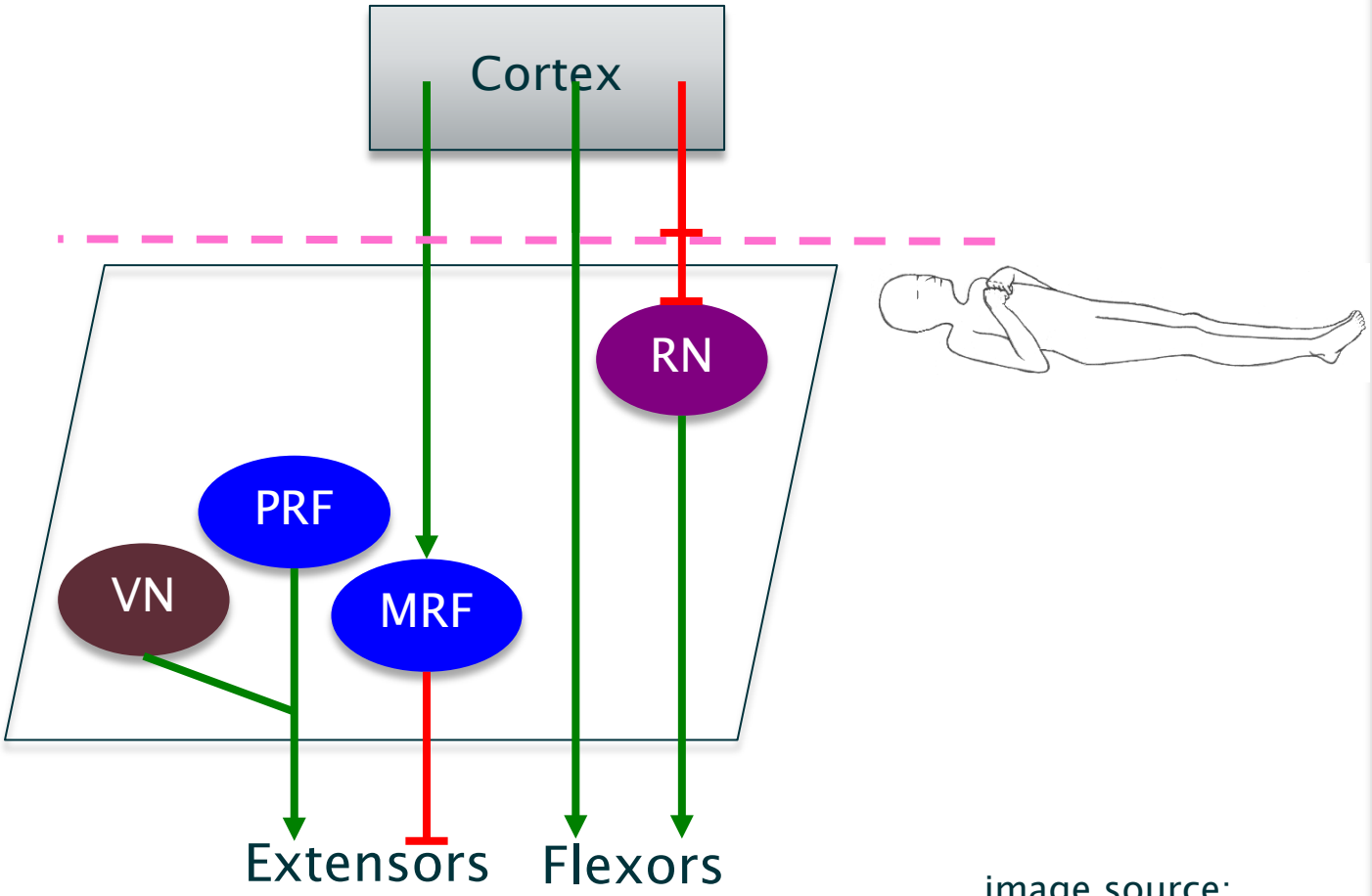
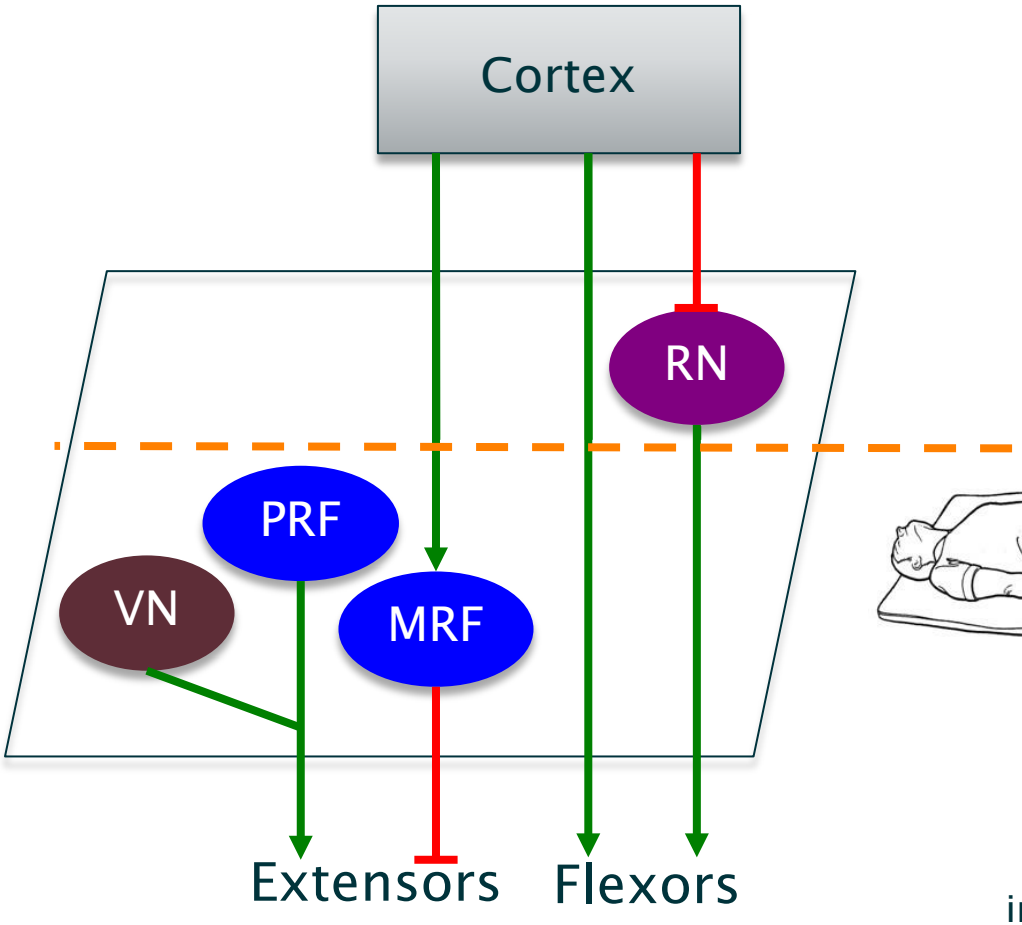


image source:
wikimedia commons

Abnormal Posturing

Decerebrate (extensor)

- Damage caudal to the red nucleus



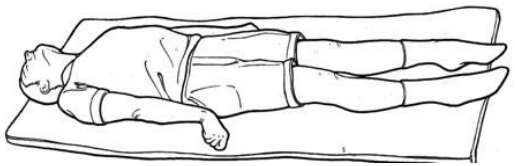


image source:
wikimedia commons

Pearls & Problems

Don't
- ✓ Get overwhelmed by the details.

Do
- ✓ Break-down the motor loops into the two major feedback systems.

Don't
- ✓ Approach the tracts as one unit.

Do
- ✓ Locate each tract within the spinal cord. Then, add it's extent, origin, decussation, and function while keeping an eye out for patterns.
- ✧ Recall the "red nucleus flexes the elbows," & in flexor posturing, "the red nucleus is de-corticated."