Chapter 8, Part B – The Spinal Cord

### Ch. 8, Part B - The Spinal Cord and Spinal Nerves

- Overview of spinal cord anatomy and functions
- Spinal meninges
- Internal organization of the cord
- Spinal nerves
- Spinal reflexes

### Spinal Cord Functions/Anatomy

**Spinal cord functions:**
- Conveys *sensory* information to brain
- Conveys *motor* information to PNS
- Reflexively *integrates* sensory and motor information (i.e. decides what to do without asking the brain for help)

**Length:**
- Extends from medulla to L2 in adults
- 16 to 18 in. long
- About 0.5 in. diameter
Gross Anatomy of the Spinal Cord

Enlargements:
Regions where cord is thicker
- Cervical enlargement
  Fibers to and from arms
- Lumbar enlargement
  Fibers to and from legs

**Conus medullaris**
Tapered end of the cord
About L1 or L2
Spinal Tap, Spinal Nerve Roots

Spinal tap
- Deliver anesthetics, sample CSF fluid or pressure
- Done below L3 - Cord not present here

Spinal nerves contain two roots.
Spinal nerves are mixed nerves.
Dorsal root - sensory
Ventral root - motor

Gross Anatomy of the Spinal Cord

Dorsal root: Sensory
White matter
Central canal: CSF
Dorsal root ganglion: Sensory neuron cell bodies
Spinal nerve: Mixed
Gray matter
Ventral root: Motor
The Spinal Cord and Spinal Meninges

From outside to inside:
- Dura mater
- Arachnoid (membrane)
- Pia mater

Meninges provide:
- Support
- Stability
- Shock absorption

Sectional Organization of the Cord

Dorsal (posterior)
- Dorsal horn
- Lateral horn
- Posterior median sulcus
- Dorsal root
- Ventricle
- Dorsal root ganglion

Ventral (anterior)
- Ventral horn
- Anterior gray commissure
- Pia mater
- Anterior median fissure
- Ventral root
- Dorsal root ganglion
Gray Matter and Gray Horns

Ventral (anterior) gray horns
- Somatic motor nuclei
- Efferent information to skeletal muscles

Lateral gray horns
- Visceral (autonomic) motor nuclei
- Only in thoracic and lumbar segments

Dorsal (posterior) gray horns
- Sensory area
- Somatic and autonomic nuclei

Spinal Nerves are *Mixed Nerves*  
Figure 13.7d

Mixed nerves:
Contain both motor and sensory nerve fibers (axons)
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**Spinal Reflexes**

Definition:
- Unconscious, rapid, stereotyped responses to a stimulus
- Involve a reflex arc

Advantages of reflexes - why important?
1. Fast response
   - Don’t have to think about it
2. Predictable
   - Absence indicates damage to N.S.

**Reflex Arcs**

Components of a reflex arc:
1. Sensory receptor
2. Sensory neuron
3. Integrating center
4. Motor neuron
5. Effector
### Spinal Reflexes - Reflex Arc Components

Spinal cord is the **integrating center** ("decision maker") of a spinal **reflex arc**

1. Sensory receptor  
   - Responds to stimulus  
   - Generates signal to be sent to integrator

2. Sensory neuron  
   - Cell body in dorsal root ganglion  
   - Carries info to integrating center (spinal cord)  
   - Info enters via dorsal root

### (Spinal) Reflex Arc (continued)

3. Integrating center = **spinal cord**  
   - *Usually* involves interneurons  
     Called a polysynaptic reflex  
   - *May not* involve interneurons  
     Called monosynaptic reflex

4. Motor neuron  
   - Transmits impulses to muscle or gland

5. Effector  
   - Muscle or gland that responds to motor neuron  
   - Effects a change in controlled variable
Components of a Spinal Reflex (Arc)

**Muscle Spindle (Stretch) Reflex**

A.K.A. knee-jerk or patellar reflex
Receptor (*muscle spindle*) located in muscle
Cord sends excitatory message to *muscle being stretched*
- Adjusts stretch on muscle
- Adjust muscle tone at rest
- Prevents overstretch
- A monosynaptic reflex
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The Patellar (Knee-jerk) Reflex

Integration and Control of Spinal Reflexes

Higher centers can modify spinal reflexes

- Can inhibit or facilitate reflex patterns
- Allows a few neurons from brain to control complex motor functions
  e.g. Walking, running based on spinal reflexes