Nervous system II
Spinal cord

• Part of the Central Nervous System
• Sends afferent/efferent signals towards/away from the brain
• Process & integrates info
• Responsible for reflexes

The spinal cord ends between L1 & L2
Position in body:

- Foramen Magnum → L1/L2 (conus medullaris)
- Spinal Cord growth stops at about age 4
- Vertebral column (bones) continues to grow until full height

- Tapers to conus medullaris
- Filum terminale originates at tip
  - Strand of fibrous tissue
  - Joins coccygeal ligament
Protection of spinal cord

- Spinal meninges within spinal cavity
  - meninges (end at S2)-
- Epidural space- filled with connect. tissue, fat.
  separates dura mater from walls of vertebral canal
- Cerebral Spinal Fluid- cushions cord
- Meninges
  - Superficial
    - Dura mater
    - Arachnoid
    - Pia mater
  - Deep
    - Denticulate ligaments-lateral extensions of the pia mater
• Dura Mater in cranial cavity- anchors spinal cord superiorly
• Filum Terminale (coccygeal lig.)- anchors spinal cord inferiorly

Fig 14.2
Fig 14.2 Dorsal root

(d) Superior view
Transverse section of spinal cord

- Superficial white matter
- Deep grey matter H/butterfly shape
- **D.A.V.E.**
  - Dorsal region of the spinal cord carry afferent signals
  - Ventral region of the spinal cord carry efferent signals
Grey Matter of Spinal Cord

- Mostly cell bodies and interneurons that are unmyelinated
- The “wings” of the grey matter represent the:
  - Dorsal (posterior) horn (somatic/visceral sensory nuclei)
  - Ventral (anterior) horn (somatic-voluntary-motor cell bodies).
  - Lateral horn- visceral motor neurons.
• lateral horns only in thoracic and upper lumbar areas

• Gray commissures
  – Axons of interneurons crossing from right & left sides
White Matter of Spinal Cord

• arranged in funiculi/columns
  – (lateral / anterior / posterior)
  – Each column contains tracts
  – Axons that share structural or functional similarities
Fig 14.5

Central canal
clinical

• **Lumbar Punctures/Spinal Taps**
  • Between L3 & L4
  • Small amt of CSF from Sub-Arachnoid space.
  • Analysis- For presence of WBC, pathogens, metabolic wastes, etc.

• **Epidural/Spinal Blocks**
  • Anesthesia is placed into the epidural space
  • In sacral region produces a “causal block” common for childbirth.
Spinal nerves

• 31 pairs of spinal nerves

• Femoral nerve branches to the saphenous nerve

• Sciatic nerves branches to the tibial & peroneal nerves

• Peronreal nerve = common fibular nerve
Nerve connective tissue layers

Outermost epineurium
  Dense network of collagen fibers
Middle perineurium
  Partitions nerve into fascicles
Inner endoneurium
  Connective tissue around each axon/myelin sheath
Plexus is a branching network of nerves

Fig 14.3
Reflex arc-immediate motor to stimulus

- Five components:
- Sensory receptor
- Sensory neuron
- Interneuron
- Motor neuron
- Effector organ (muscle/gland)
Step 1: Arrival of stimulus and activation of receptor

Step 2: Activation of a sensory neuron

Step 3: Information processing in CNS

Step 4: Activation of a motor neuron

Step 5: Response by effector

interneuron
Nervous system

CNS

Afferent, sensory
Signal travels from PNS to CNS

Efferent, motor
Signal travels from CNS to PNS

PNS

Afferent, sensory
Signal travels from PNS to CNS

Efferent, motor
Signal travels from CNS to PNS

Somatic sensory
Receives signals from receptors in muscles, skin, joints

Visceral sensory
Receives signals from receptors in smooth muscle, digestive organs

Visceral motor
Autonomic nervous system
 involuntary control
Unconscious control
Sends signals to smooth, cardiac muscle, glands

Somatic motor
Voluntary control
Conscious control
Sends signals to skeletal muscles

S.A.M.E.
Sensory/afferent-sends signal towards the brain
Motor/efferent-sends signal away from the brain
Visceral motor

- Autonomic nervous system
- Two divisions: opposing effects
- Parasympathetic
- Sympathetic
Sympathetic (thoracolumbar) division

• Effects of sympathetic innervation:
  • Increased alertness
  • Feeling of energy & euphoria
  • Increased blood pressure, heart rate, & ventilation rate
  • The 4 F’s: sudden intense physical activity
  • Flight, Fighting, Feeding (hunting), Mating (orgasm)
Adrenal gland

• Sympathetic neuron:
• Bypasses S. Chain Gang.
• Controls release of hormones from adrenal medulla

• Hormones cause longer lasting sympathathetic effect on body
Parasympathetic (craniosacral) division

- Effects of parasympathetic innervation:
  - Stimulation of digestive glands
  - Increased activity in digestive tract
  - Stimulation of urination & defecation
  - Sexual arousal
Fig 17.10

Sympathetic

- Preganglionic neuron
- Ganglionic neurons
- Adrenal medulla
- Sympathetic ganglion
- Via circulatory system
- Postganglionic fiber
- Target

Parasympathetic

- Preganglionic fiber
- Neurotransmitters:
  - Acetylcholine
  - Norepinephrine
  - Epinephrine
- Parasympathetic ganglion
- Ganglionic neuron
- Postganglionic fiber
- Target
Fig 17.8

Preganglionic neurons = 
Ganglionic neurons = ————
break
• Motor cortex of cerebrum (frontal lobe)
• Internal capsule
• mesencephalon
• pons
• Medulla oblongata
• Anterior horn
• Ventral root
• Ventral ramus
• Brachial plexus
• Radial nerve
• Wrist extensor muscles  

Extending wrist
- Mechanoreceptors
- thoracic nerves
- dorsal ramus
- dorsal root ganglion
- dorsal root
- dorsal horn
- Thalamus
- internal capsule
- cerebral cortex in parietal lobe
Fig 14.9

Peroneal nerve
Fig 14.13

Peroneal nerve