Nervous System

The Peripheral Nervous System

The Peripheral Nervous System
Agenda

- Review of CNS v. PNS
- PNS Basics
- Cranial Nerves
- Spinal Nerves
- Reflexes
- Pathways
  - Sensory
  - Motor

The Peripheral Nervous System
Review of CNS v. PNS

- Central nervous system (CNS)
  - Brain
  - Spinal cord
- **Peripheral nervous system** (PNS)
  - All the neural tissue outside CNS
  - *Afferent* division (sensory input)
  - *Efferent* division (motor output)
    - Somatic nervous system
    - Autonomic nervous system

The Peripheral Nervous System
The Basics

- What does the PNS do?
  - Links the CNS with the body
  - Carries all sensory information and motor commands
  - Axons bundled in *nerves*
  - Cell bodies grouped into *ganglia*
  - Includes *cranial* and *spinal nerves*

The Peripheral Nervous System
Cranial Nerves

12 Pairs of nerves that connect to the brain & not to the spinal cord.

Mnemonic Devices:

Name:

Oh Oh Oh To Touch And Feel Very Green Vegetables Always Healthy

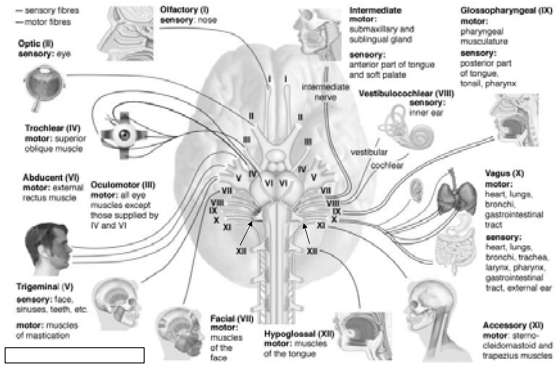
Function:

Some Say Marry Money But My Brother Says Bad Business Marry Money

General Naming Order:

Anterior to Posterior

The Peripheral Nervous System
Cranial Nerves



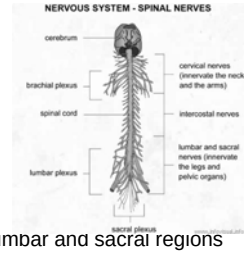
The Peripheral Nervous System
Cranial Nerves

- *Olfactory* (CN I)
  - Sense of smell
- *Optic* (CN II)
  - Sense of vision
- *Oculomotor* (CN III)
  - Eye movement *Trochlear* (CN IV)
  - Eye movement
- *Trigeminal* (CN V)
  - Eye, jaws sensation/movement
- *Abducens* (CN VI)
  - Eye movement

The Peripheral Nervous System
Cranial Nerves

- *Facial* (CN VII)
  - Face, scalp, tongue sensation/movement
- *Vestibulocochlear* (CN VIII)
  - Hearing, balance
- Glossopharyngeal (CN IX)
  - Taste, swallowing
- Vagus (CN X)
  - Autonomic control and sensory function of viscera
- Accessory (CN XI)
  - Swallowing, pectoral girdle movement
- Hypoglossal (CN XII)
  - Tongue movement

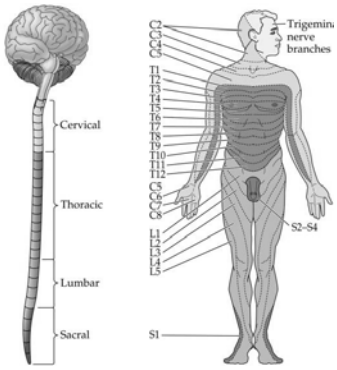
The Peripheral Nervous System
Spinal Nerves



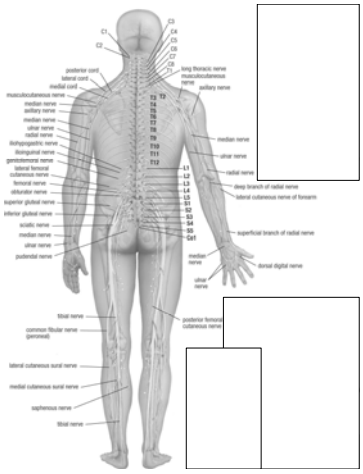
- The Spinal Nerves
  - 31 Pairs
    - 8 Cervical
    - 12 Thoracic
    - 5 Lumbar
    - 5 Sacral
  - Nerves of the cervical, lumbar and sacral regions form plexuses
    - From these plexuses nerves exit to/from destination
  - *Dermatome*—Region of the body surface monitored by a pair of spinal nerves

The Peripheral Nervous System
Spinal Nerves

- The Dermatomes



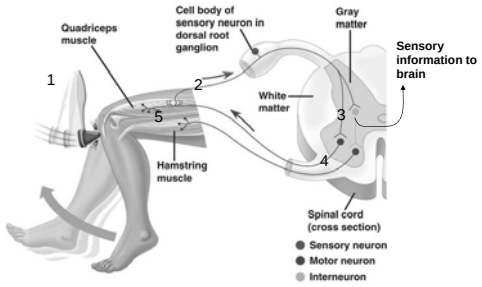
The Peripheral Nervous System
Spinal Nerves



The Peripheral Nervous System
Reflexes

- What is a reflex?
  - An automatic involuntary motor response to a specific stimulus
    - The 5 steps in a *reflex arc*
      1. Arrival of stimulus and activation of receptor
      2. Activation of sensory neuron
      3. CNS processing of information
      4. Activation of motor neuron
      5. Response by effector (muscle or gland)

The Peripheral Nervous System
Reflexes



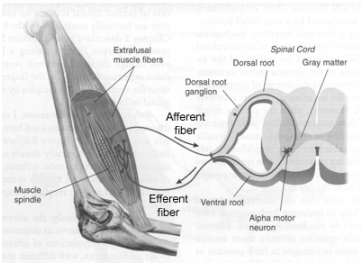
The Peripheral Nervous System
Reflexes

Types of Reflexes

- Monosynaptic Reflex
  - simplest reflex arc – sensory neuron synapses directly on effectors motor neuron
  - Sensory structure in muscle is the muscle spindle –
    - when stretched it stimulates the sensory neuron
  - Example: stretch reflex – monosynaptic reflex to regulate muscle length and tension such as the patellar reflex.
- Polysnaptic Reflex
  - A reflex arc with at least one interneuron (may allow for brain influence) between the sensory and motor neurons.
  - Slightly longer response (due to extra synaptic events) than a monosynaptic reflex arc.
  - Results can be much more complex; involving other spinal nerve segments, inhibition and excitation of muscles…

The Peripheral Nervous System
Reflexes

- Monosynaptic Reflex Example:



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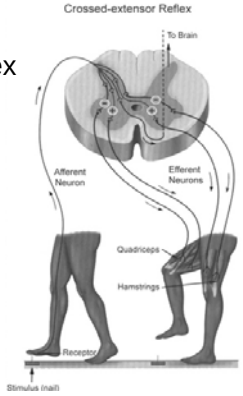
Reflexes

- Polysynaptic Reflex Example



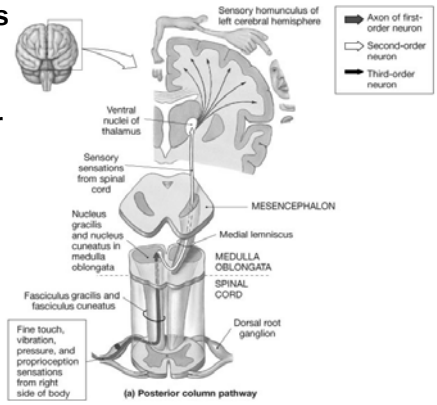
The Peripheral Nervous System
Pathways

Sensory Pathways

- Afferent axon signals from a sensory receptor
  - *Posterior column pathway*
    - Carries fine touch, pressure, *proprioception*
    - Ascending neurons synapse in *medulla oblongata*
    - Axons cross over and synapse in thalamus
    - Thalamus sends axons to primary sensory cortex
    - Organized as sensory *homunculus*

The Peripheral Nervous System
Pathways

Posterior Column Pathway

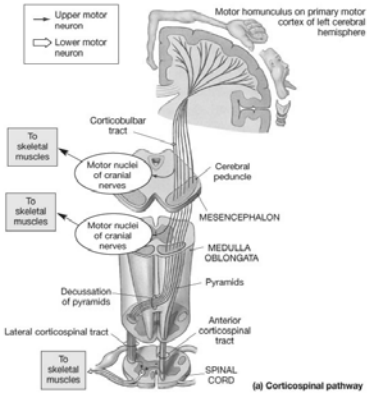


The Peripheral Nervous System
Pathways

- Motor Pathways
  - Efferent neurons conduct action potentials to effectors
  - Corticospinal pathway (tract)
    - Provides conscious muscle control
    - Organized as motor *homunculus*
  - Medial & lateral pathways (tract)
    - Provide subconscious muscle control
      - Medial = gross movement of trunk and proximal limbs
      - Lateral = distal limb movement (more precise)

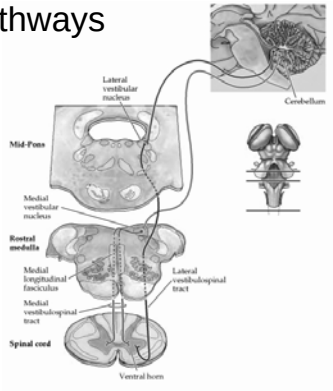
The Peripheral Nervous System
Pathways

The Corticospinal Pathway



The Peripheral Nervous System
Pathways

- Example of subconscious pathway



The Peripheral Nervous System

Key Items

- The PNS is the connection to the CNS
  - Afferent to the CNS
  - Efferent from the CNS
- The PNS also is the site for some integration, allowing for divergence, convergence and reflex pathways
- Spinal nerves are “mapped” by dermatomes, allowing for diagnosis of injury/pain