A Brief Introduction into the Peripheral Nervous System

Bianca Flores,
PhD Candidate, Neuroscience
Tuesday, October 15th, 2019
Brief overview:

- What are you hoping to learn?
- Subdivisions of the peripheral nervous system (PNS)
- Physiology
- Diseases associated with PNS
- Special topics (current research at Vanderbilt)
Is there a location in our body that does not have neurons (signals being sent to move or sense)?
The body’s nervous system is made up of two parts:
The Peripheral Nervous System (PNS) is divided into two parts:

- Sensory
  - Sensing external environment
  - Sensing internal environment

Peripheral Nervous System
PNS: Sensory components:

- Nociception
- Proprioception
- Mechanoreception
- Thermoception
Parasympathetic vs Sympathetic

**Sympathetic Nerves**
("fight-or-flight")

- Dilate pupils
- Inhibit salivation
- Relax airways
- Increase heartbeat
- Inhibit stomach activity

**Parasympathetic Nerves**
("rest and digest")

- Constrict pupils
- Stimulate saliva
- Constrict airways
- Slow heartbeat
- Stimulate stomach activity
PNS

• Includes everything outside of the brain and spinal cord
• Is divided into motor and sensory subsets
• Controls the “rest and relax” and “flight or fight” responses
PNS: Physiology & Anatomy
Dorsal Root ganglion are sensory body of the PNS
Anatomy of the PNS- Dorsal Root Ganglion
How the PNS sends signals to the CNS

Spinal Nerves

Dorsal root ganglion

Dorsal ramus

Ventral ramus

Spinal nerve

Axon of motor neuron

Ventral root

Neuromuscular junction

Sensory receptors in skin (e.g., free nerve endings of sensory neuron)
Nerve impulses carry electrical signals
Myelin sheath on surrounds to the nerve to contribute to signal propagation
Myelin sheath on surrounds to the nerve to contribute to signal propagation.
Nerve impulses carry electrical signals
PNS Physiology and Anatomy

• Dorsal root ganglion are the sensory bodies of the PNS
• The Ventral root is responsible for motor movement
• Myelin Sheath is imperative to proper nerve function
Diseases associated with the PNS: Peripheral Neuropathy
What is peripheral neuropathy?

Peripheral Neuropathy:
- Damage to peripheral nerves
- Unable to transmit information to the Central Nervous System (CNS)
How does peripheral neuropathy develop?

- Hereditary (Charcot Marie Tooth Disease)
How does peripheral neuropathy develop?

- Hereditary (Charcot Marie Tooth Disease)
- Traumatic injury
How does peripheral neuropathy develop?

- Hereditary (Charcot Marie Tooth Disease)
- Traumatic injury
- Exposure to poisons/toxins (lead & mercury)
How does peripheral neuropathy develop?

- Hereditary (Charcot Marie Tooth Disease)
- Traumatic injury
- Exposure to poisons/toxins (lead & mercury)
- Diabetes
How does peripheral neuropathy develop?

- Hereditary (Charcot Marie Tooth Disease)
- Traumatic injury
- Exposure to poisons/toxins (lead & mercury)
- Diabetes
- Alcoholism (Vitamin B12 deficiencies)
How does peripheral neuropathy develop?

- Hereditary (Charcot Marie Tooth Disease)
- Traumatic injury
- Exposure to poisons/toxins (lead & mercury)
- Diabetes
- Alcoholism (Vitamin B12 deficiencies)
There are three types subtypes of nerve damage in Peripheral Neuropathy

- Motor
  - Muscle twitching
  - Muscle atrophy

- Sensory
  - Our 5 senses

- Autonomic nerve damage
  - Inability to sweat normally
  - Loss of bladder control
Special topic- Current Research at Vanderbilt:

Hereditary Sensory Motor Neuropathy with Agenesis of the Corpus Callosum (HSMN/ACC)
Patients display motor and sympathetic dysfunction

Hypotonic feet

Edema

Andermann & Anderman., 1992
Agenesis of the corpus callosum results in cognitive disabilities

Paul et al., 2007
HSMN/ACC occurs because of a loss of function of the transporter KCC3
Loss of function results in nerve damage

Healthy mouse sample

Loss of function
What are we doing as researchers to help those with HSMN/ACC?

• Early intervention
• Surgery to correct scoliosis
• Physiotherapy
A loss of function of KCC3 results in cell swelling
Summary

• The PNS is comprised of sensory and motor components
• Dorsal Root ganglia are the sensory bodies of the PNS
• Peripheral Neuropathy is one of many diseases that can affect the PNS and have multiple causes
Questions?