Protecting the Brain and Spinal Cord Injuries

**Protecting the Brain & The Spinal Cord**

- Neurons are easily damaged
- Layers of protection:
  - Bones of the skull
  - Meninges (membranes)
  - Cerebrospinal fluid (watery cushion)
  - Blood-brain barrier

**Protection**

**Meninges**

- 3 connective tissue membranes surrounding the brain:
  - Dura mater ("tough mother") - outermost meninx (sing.)
  - Arachnoid mater - middle meninx, loose covering
  - Pia mater ("gentle mother") - innermost meninx, clings tightly to the brain, lots of blood vessels
- Functions:
  - Protect and cover brain
  - Protect blood vessels
  - Contain cerebrospinal fluid
  - Form partitions in the skull
- Imbalances:
  - Meningitis - inflammation of the meninges may spread to CNS

**Cerebrospinal Fluid**

- Formed in the choroid plexuses of the brain
- Watery, nutrient-rich "broth" surrounding brain and spinal cord
- Acts as a liquid cushion and gives buoyancy to brain and spinal cord
- Reduces brain weight by 97%
- Average adult has 150 mL of CSF which is completely replaced every 8 hours
- About 500 mL produced daily
- Imbalances:
  - Hydrocephalus - CSF accumulates and puts pressure on the brain

**Blood-Brain Barrier**

- Junction between capillaries and neurons
- Selective:
  - Nutrients (glucose, essential amino acids, some electrolytes) move passively
  - Bloodborne metabolic waste, proteins, certain toxins denied access
  - Nonessential amino acids and potassium actively pumped out of brain
- Ineffective against fats, fatty acids, oxygen, carbon dioxide
  - Ex. alcohol, nicotine, anesthetics

**Imbalances of the Brain**

- Traumatic brain injury:
  - Concussion - alteration in brain function following a blow to the head
  - Contusion - bruising of the brain and permanent neurological damage
  - Subdural or subarachnoid hemorrhage - bleeding from ruptured vessels
  - Cerebral edema - swelling of the brain
- Strokes (cerebrovascular accidents) - Blood circulation to a brain area is blocked (ischemia) and brain tissue dies
- Degenerative brain disorders:
  - Alzheimer’s Disease - progressive, results in dementia
  - Parkinson’s Disease - degeneration of dopamine releasing neurons
  - Huntington’s Disease - hereditary disorder that causes protein to build up in brain cells and destroy tissue
Protecting the Brain and Spinal Cord Injuries

**Spinal Cord**
- **structure**
  - extends from foramen magnum to 1st or 2nd lumbar vertebrae
  - divided into 31 segments each with a pair of spinal nerves
  - mostly composed of interneurons
  - gray matter inside, white matter outside (butterfly)
  - cauda equina
- **functions**
  - conducts info to and from the brain
  - center for spinal reflexes

**Imbalances of the Spinal Cord**
- spinal cord trauma
  - paralysis - loss of motor function
  - paresthesias - sensory loss
- poliomyelitis - inflammation of gray matter
  - poliovirus enters body through feces-contaminated water
- amyotrophic lateral sclerosis (ALS or Lou Gehrig's disease) - progressive destruction of spinal cord
- cerebral palsy - voluntary muscles are poorly controlled or paralyzed as a result of brain damage (typically caused by a lack of oxygen during birth)