Introduction

- Protection of the brain
  - Bone (skull)
  - Membranes (meninges)
  - Watery cushion (cerebrospinal fluid)
  - Blood-brain barrier (astrocytes)

The Nervous System

Meninges

CSF

The Meninges

- Series of membranes
- Cover and protect the CNS
- Anchor and cushion the brain
- Contain cerebrospinal fluid (CSF)

The Meninges

- Three layers
  - Dura mater
  - Arachnoid mater
  - Pia mater

The Meninges

- Dura mater – “Tough mother”
  - Strongest meninx
  - Fibrous connective tissue
  - Limit excessive movement of the brain
  - Forms partitions in the skull
The Meninges

- Arachnoid mater – “Spider mother”
  - Middle layer with weblike extensions
  - Separated from the dura mater by the subdural space
  - Subarachnoid space contains CSF and blood vessels

- Pia mater – “Gentle mother”
  - Connected to the dura mater by projections from the arachnoid mater
  - Layer of delicate vascularized connective tissue
  - Clings tightly to the brain

Meningitis

- Inflammation of meninges
- May be bacterial or viral
- Diagnosed by obtaining CSF sample via lumbar tap
Cerebrospinal Fluid (CSF)

- Solution that bathes the CNS
- Composition
  - Watery solution
  - Modified plasma (less protein, different ion concentrations)
  - Constant volume (about 150 ml)
    - About 500 ml formed daily
    - Replaced every 8 hours or so

Cerebrospinal Fluid (CSF)

- Functions
  - Gives buoyancy to the CNS organs
  - Reduces brain's effective weight by 97%!
  - Protects the CNS from blows & other trauma
  - Nourishes the brain & carries chemical signals

Cerebrospinal Fluid (CSF)

- Choroid plexuses
  - Produce CSF at a constant rate
  - Hang from the roof of each ventricle
  - Clusters of capillaries enclosed by pia mater & a layer of ependymal cells
Cerebrospinal Fluid (CSF)

- Hydrocephalus
  - Due to blockage or overproduction of CSF
  - Internal hydrocephalus
    - CSF accumulates in the ventricles, expanding them outward
  - External hydrocephalus
    - CSF accumulates in the subarachnoid space, compressing the brain

Cerebrospinal Fluid (CSF)

- Hydrocephalus
  - Due to blockage or overproduction of CSF
  - Infants
    - Head enlarges because skull bones have not yet fused
  - Adults
    - Accumulating fluid compresses blood vessels and soft nervous tissue, causing brain damage

Cerebrospinal Fluid (CSF)

- Hydrocephalus
  - Treatment
    - 6/10 will die without treatment
    - Shunts are placed to divert excess fluid to other areas of the body