

MENINGES

Meninges: Connective tissue that protects the brain and spinal cord and encloses CSF.

There are three layers of the meninges:

1. **Dura mater**—"hard mother"

Periosteal layer (adheres to skull bones or to vertebrae)

Meningeal layer (adheres to arachnoid mater)

Falx cerebri is the dura mater that separates the right and left cerebral hemispheres. It attaches to the skull at a tiny projection called the crista galli "cock's comb", and extends downward to the bottom of the cerebrum.

Epidural space is the region between the skull and the dura mater. In the brain, this space does not exist except in the case of bleeding (an epidural hematoma); in the spinal cord, this space is filled with fat and blood vessels and is used for delivery of medications.

2. **Arachnoid mater**—"spider mother", named for thin webbing that reaches down toward pia mater. This is where the CSF circulates, in what is called the **subarachnoid space**. **Arachnoid villi** are tufts of arachnoid that reach into the superior sagittal sinus and allow CSF to pass back into the blood supply. You may notice blackened areas of coagulated blood in the *superior sagittal sinus* on the sheep brain.

3. **Pia mater**—"soft mother", adheres directly to the brain and spinal cord. When dissecting the sheep brain, this is what gives the brain its shiny surface.

Meningitis: inflammation of the meninges. It can be caused by bacteria, viruses or fungi. It is especially dangerous because if the infection spreads it can lead to encephalitis.

Neisseria meningitidis is a bacterial species that is known to cause meningitis.

Streptococcus agalactiae is a bacterial species (group B strep) that can cause meningitis in newborns.

Haemophilus influenza is a bacterial species that may cause meningitis in children. The Hib vaccine is intended to prevent this type of meningitis.

Epidural anesthesia: Procedure in which medications are delivered into the space between the vertebral joint capsule and the dura mater. This is usually performed below the bottom of the spinal cord, to be extra safe. If the needle punctures through the dura mater, CSF fluid can leak out, causing a terrific post-epidural headache due to the extra pressure on the brain from CSF loss. Epidural cortisone injections may be done anywhere along the spinal column for pain management. X-ray fluoroscopy helps guide the needle to the appropriate location. In the Fall of 2012 a number of people back east contracted fungal meningitis from contaminated cortisone used in these types of injections.

Cranial hematomas: Broken blood vessels beneath the skull

- **Epidural hematoma** – between the skull and the dura mater. Somewhat known for asymptomatic for a few hours, followed by loss of consciousness or fixed pupil on the side of the injury (due to pressure on cranial nerve III).
- **Subdural hematoma** –between the dura mater and the arachnoid mater. Somewhat known for gradual loss of consciousness as bleeding progresses.
- **Intracerebral/intracranial hematoma** – bleeding within the brain tissue, more likely due to an ischemic or hemorrhagic stroke