


Use Your Brain!

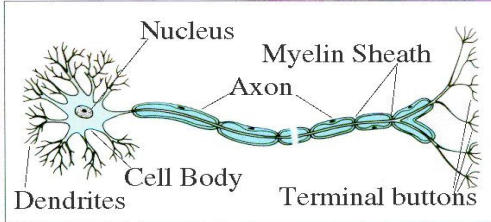


Gray Matter Ribbon Campaign

- What is the difference between “gray matter” and “white matter”?

Book Fig. 1.1

Parts of the Neuron

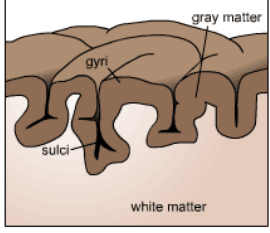


Although blue in this figure, the myelin sheath is actually a white, fatty insulating coating on many axons. Any part of the CNS with lots of axons looks white as a result, in contrast to areas with lots of cell bodies.

Gray & White Matter

- Brain areas with lots of neuron cell bodies/dendrites look darker (“gray matter”) and function like information processors – receiving & combining input
- Areas with lots of myelinated axons appear lighter (“white matter”) and function like cables connecting regions
- A group of neuron cell bodies = “nucleus” (in CNS) or “ganglion” (in PNS)
- A group of axons = “tract” or “pathway” (in CNS) or “nerve” (in PNS)

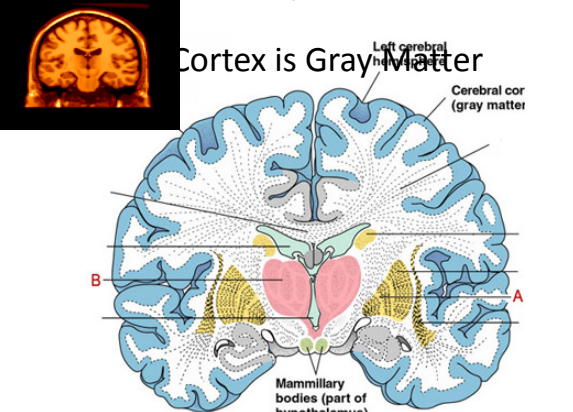
Figure AB-9: White / Gray Matter



Cortex (the outer layer) is gray matter. Beneath cortex is dense white matter – all the axons carrying messages to and away from cortex.

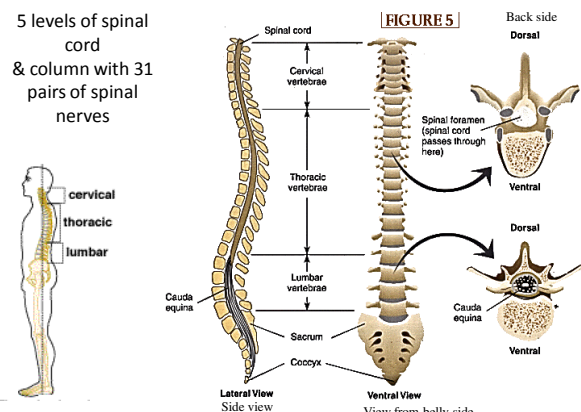
Book Fig. 1.22

Cortex is Gray Matter



5 levels of spinal cord & column with 31 pairs of spinal nerves

FIGURE 5



Labels include: Spinal cord, Cervical vertebrae, Thoracic vertebrae, Lumbar vertebrae, Sacrum, Coccyx, Cauda equina, Spinal foramen (spinal cord passes through here), Dorsal, Ventral, Back side, View from belly side, Lateral View Side view.

Book Fig. 1.4 and 1.16

Cross Section of Cord

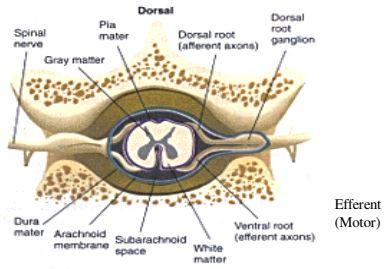
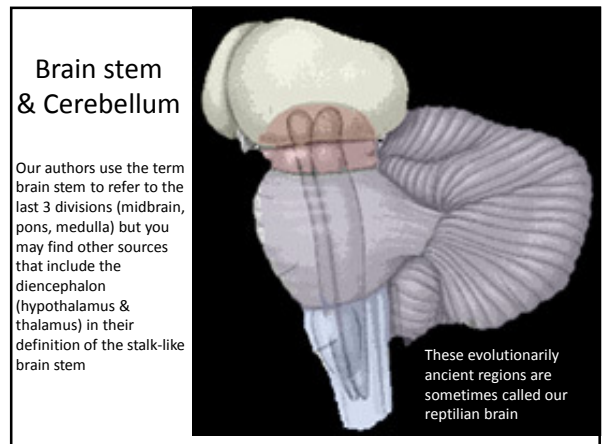
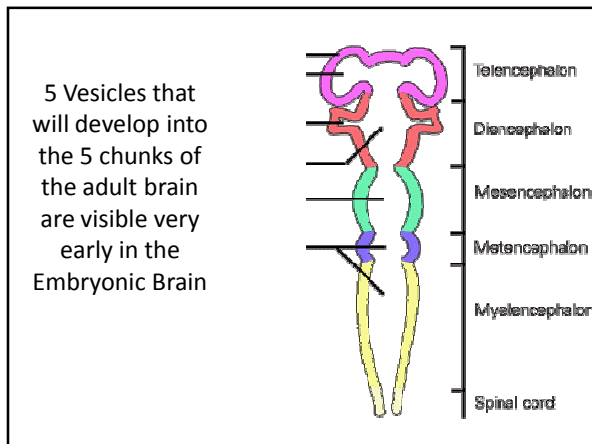
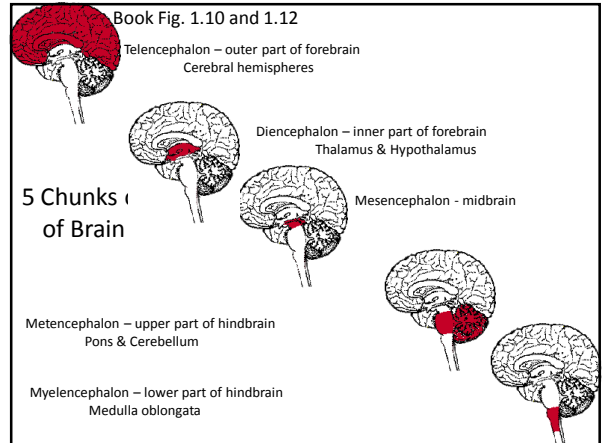
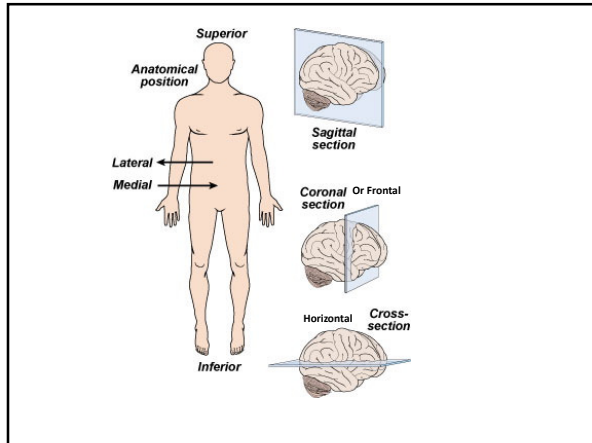
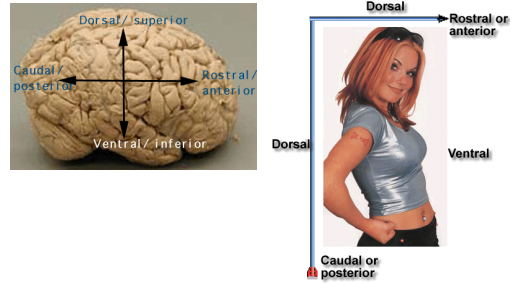


FIGURE 3
A cross section through a vertebra, showing the spinal cord, dorsal and ventral roots, and spinal nerves.

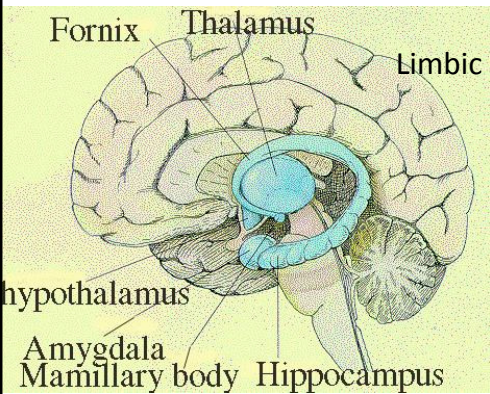
Directional Terms



The Brain is Like a Tootsie Pop



16



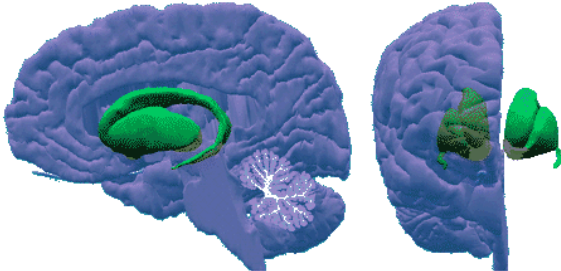
Fornix Thalamus Limbic System

hypothalamus

Amygdala Mamillary body Hippocampus


Part of the "middle layer" - wraps around the brainstem core.

Basal Ganglia



Also part of the "middle layer"

Cortex - the outer layer



Protection of the CNS

Bones, Meninges & Cerebrospinal Fluid (CSF) do a good job under normal everyday conditions.

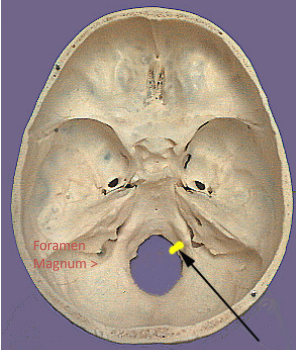
Book Fig 5.1

Looking Into the Bottom of the Skull

Anterior Fossa →

Middle Fossa →

Posterior Fossa

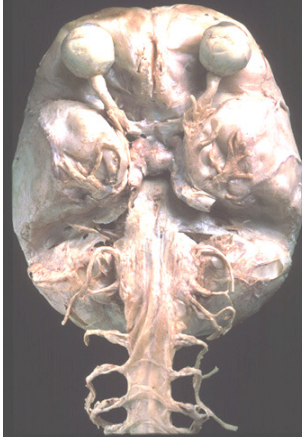


Foramen Magnum →

The Meninges

- 3 layers of connective tissue enclosing brain & spinal cord
- Starting from the outside, the layers are:
 - **dura mater**
 - **arachnoid mater**
 - **pia mater**
- **Meninges mnemonic (from the inside →out) = PAD (the meninges PAD the outside of the brain)**

The Dura Mater
("Tough Mother"
Or
"Tough Matter")



Dura Mater ("tough mother")

- Actually has 2 layers which run close together in most locations
 - **outer layer** is anchored to skull bone in certain places
 - **inner layer** forms folds that partition skull cavity into compartments
 - one between R & L hemispheres: **falx cerebri**
 - one between occipital lobe & cerebellum: **tentorium cerebelli**
- spaces between layers at those folds form "dural venous sinuses" for blood leaving brain

Falx is Latin for "sickle"



A sickle



Falx cerebri – sickle shaped membrane of the cerebrum between R and L hemispheres

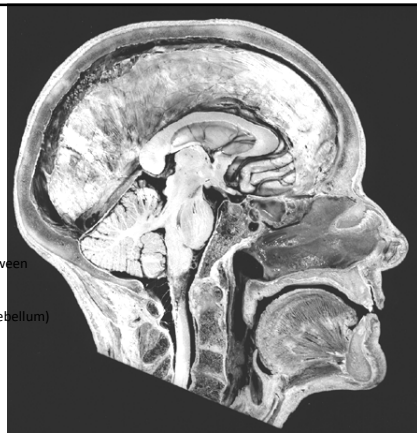
Falx cerebri model

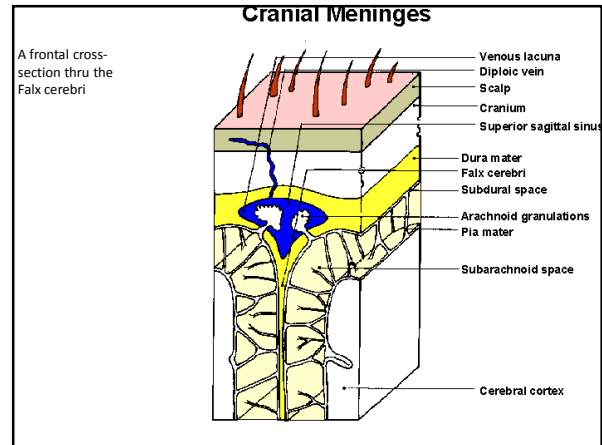
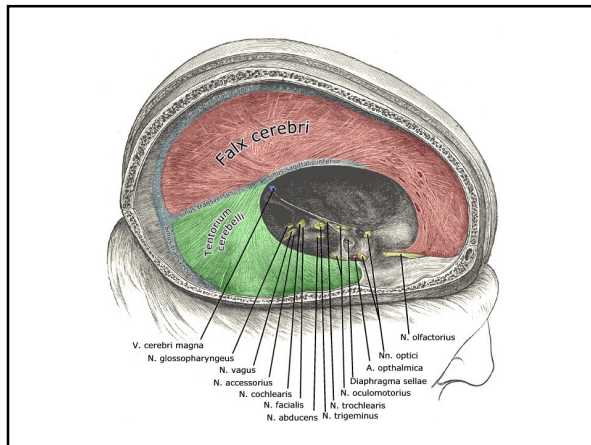
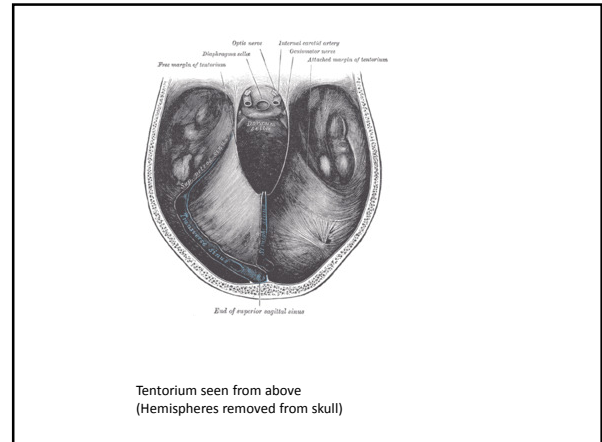
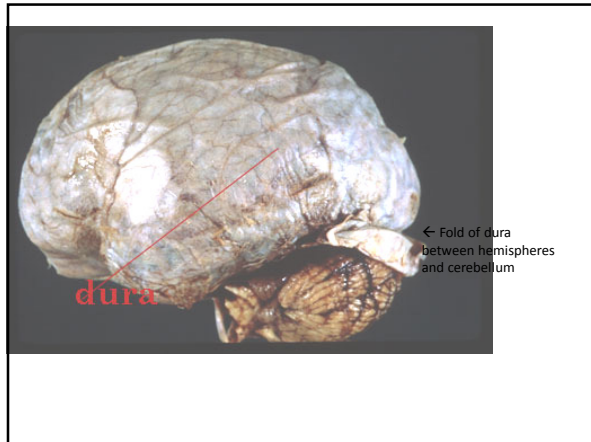


Book Fig. 5.3

Falx Cerebri – dural partition dividing upper cranium in half →

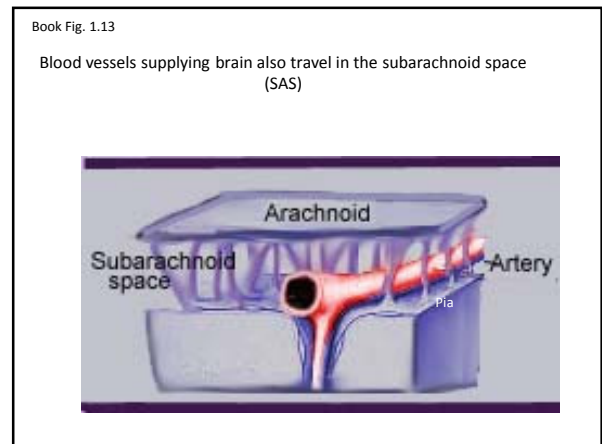
Cross-Section of →
Tentorium cerebelli between hemispheres & cerebellum (the "tent" over the cerebellum)

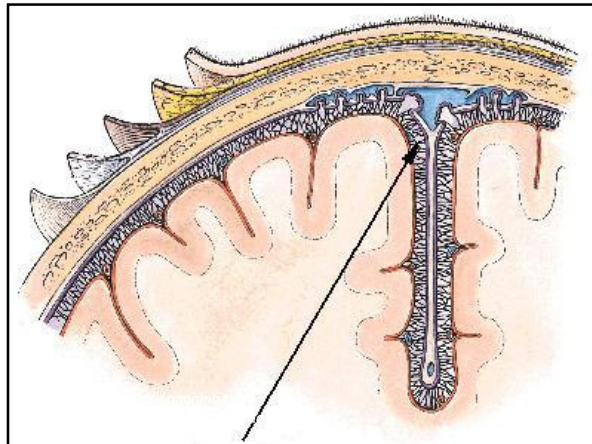




Arachnoid Mater ("spiderlike")

- Thinner layer loosely enclosing CNS
- Space beneath arachnoid is filled with cerebrospinal fluid (CSF)
- Spider-like filaments cross this "subarachnoid space" to the inner most layer of meninges, the pia mater

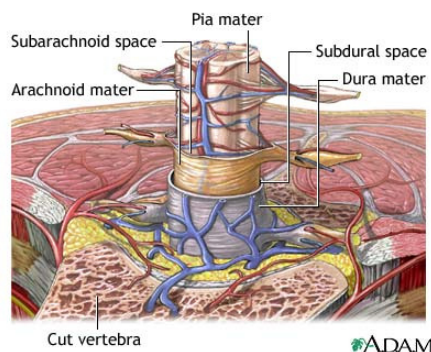




Pia Mater (“tender matter”)

- Very thin layer that tightly follows brain surface
- Contains lots of small capillaries supplying blood to the CNS

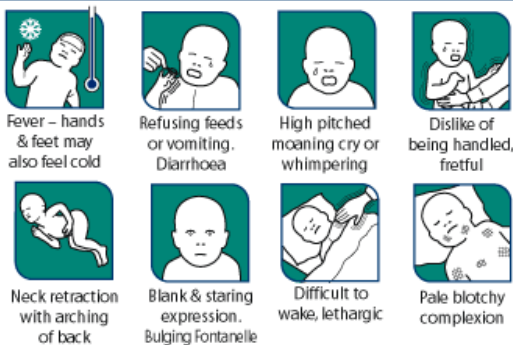
Meninges also cover the spinal cord



Clinical Applications

- Dural partitions (Falx cerebri & tentorium cerebelli) play a significant role in brain damage related to head injuries as well as that resulting from increased intracranial pressure. Although partitions normally hold the brain in place, they become a firm barrier soft brain tissue rams up against in extreme movements or sudden stops.
- Meningioma- “brain tumors” arising from the meninges (“oma” ending means tumor)
- Meningitis – infection/inflammation of the meninges (we’ll come back to this shortly) (“itis” ending means infection/inflammation)

MENINGITIS SYMPTOMS IN BABIES



Bacterial Meningitis

(infection/inflammation of meninges)

- Most common acute CNS infection
- **Medical Emergency**- progression to permanent brain injury or death (10%) can occur in hours
- Symptoms: headache, fever, stiff neck, confusion, irritability, photophobia, nausea, vomiting, possible seizures, altered mental state, rash – but some will not show these signs
- Several common bacteria – if they gain access to the CNS – can cause it (Haemophilus influenzae B (Hib)*, Streptococcus pneumoniae, Neisseria meningitidis (the cause of the meningococcal meningitis in the news), & others

*Weak stomach warning



The Glass Test – “rash” doesn't disappear when pressed on

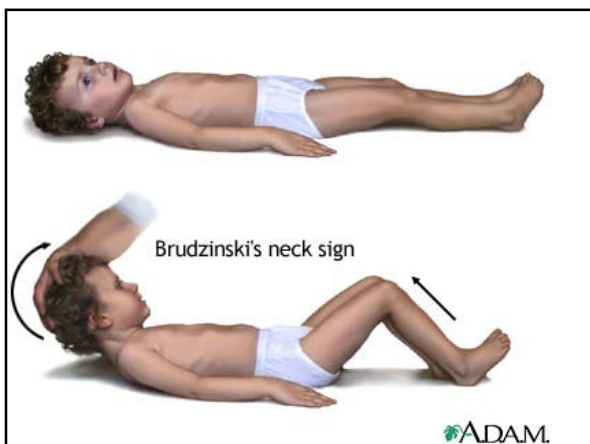
Bacterial Meningitis continued

- Infection may get to CNS 1) via blood, 2) spread from nearby ear or sinus infections, or 3) through congenital or acquired defects in protective coverings of CNS
- Bacteria release toxins damaging capillaries & causing dangerous cerebral edema (swelling) and **increased intracranial pressure**. Can also trigger hydrocephalus, increasing the rapid rise in pressure. Antibiotics do not decrease edema but corticosteroids help.
- Causes lasting deficits in 20-30% (impaired hearing, vision or movement, retardation, epilepsy, hydrocephalus) of survivors, especially in neonatal cases or if treatment is delayed.
- <http://www.pbs.org/wgbh/nova/meningitis/>
- (click on news minute on right)

Tests

- CT scan can show swollen meninges
- Lumbar puncture (spinal tap) to identify infection
- Kernig's sign
- Brudzinkski's sign

- Now vaccines for 2 varieties available: Hib and Meningococcal (Menomune and Menactra for Neisseria strains A,C,Y) No vaccine for for the strain B. Menomune lasts 3-5 yrs, Menactra up to 10 years.



Viral Meningitis Less Serious

- Initial symptoms similar but mental status and brain usually unaffected. Excellent prognosis.
- More serious risks if a virus affects the brain itself (“viral encephalitis”).
- Sometimes drug reactions can cause a similar syndrome (ibuprofen, naproxen, trimethoprim, carbamazepine)
- Fungal infection of meninges can occur in those with compromised immune systems (like in AIDS)