

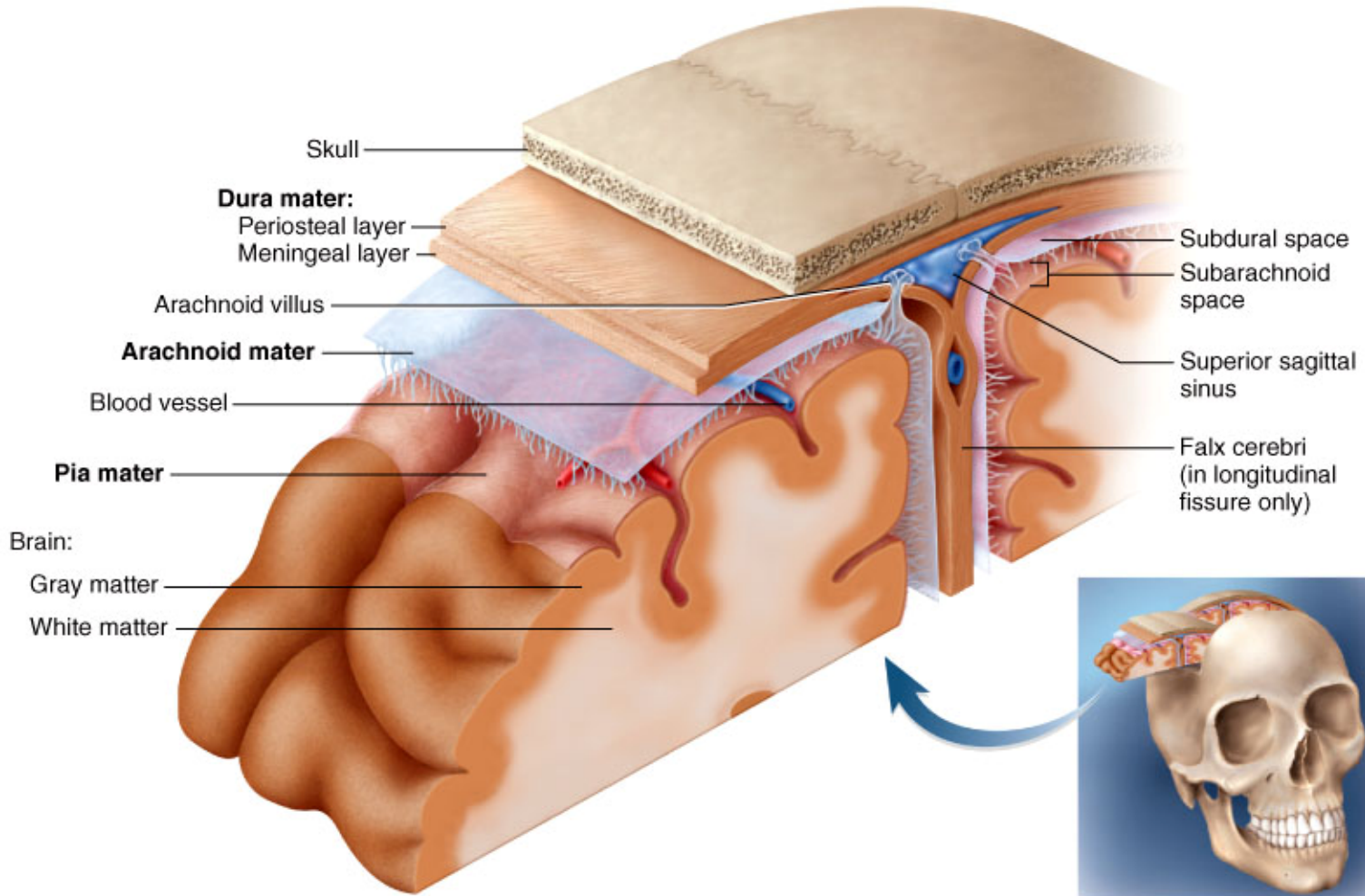
# The Meninges of the Brain

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# The Flow of Cerebrospinal Fluid

# Meninges of the Brain

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# Meninges

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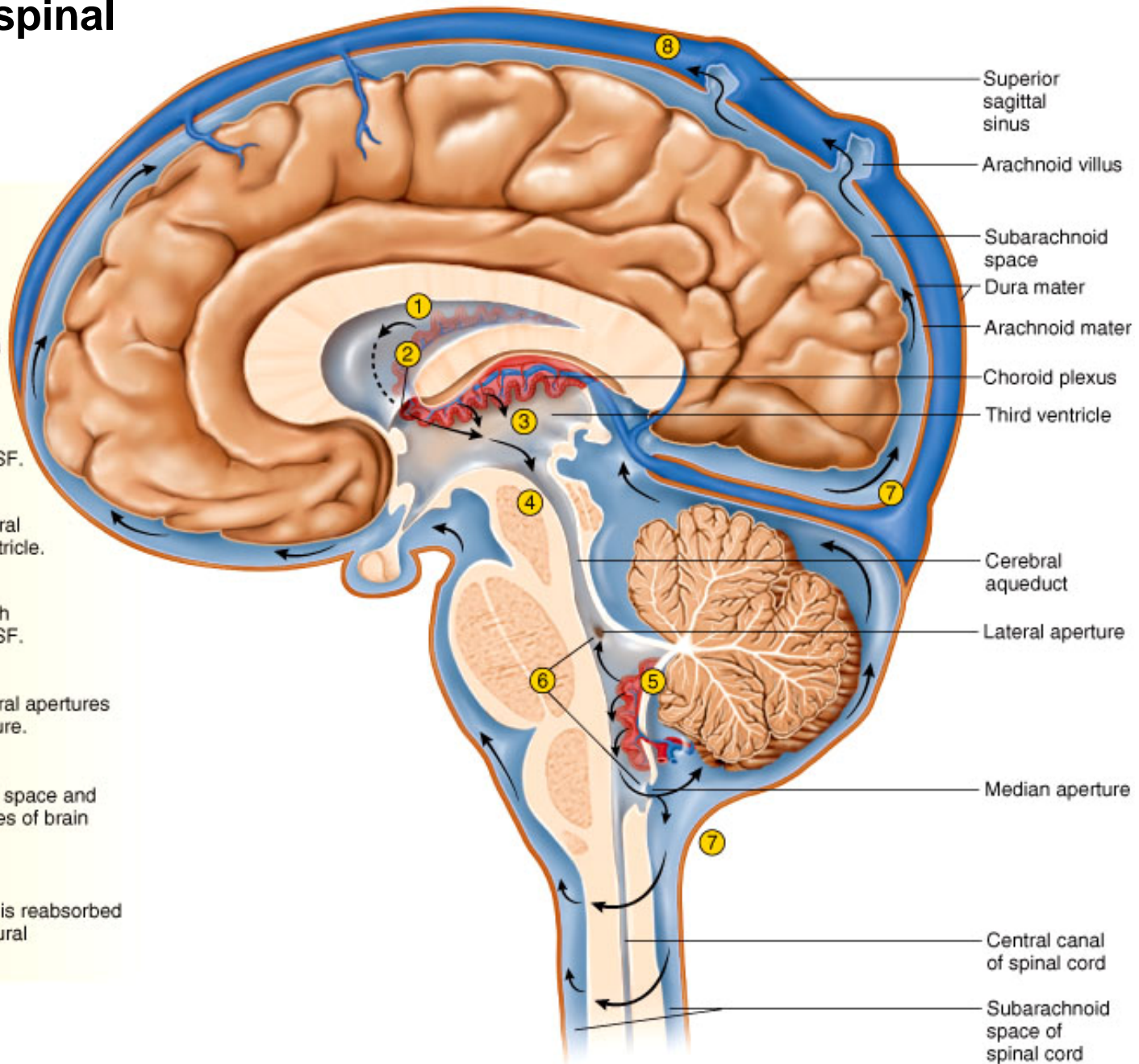
- **Dura mater -- outermost, tough membrane**
  - **Dura matter actually two layers**
    - outer periosteal layer against bone (periosteum)
    - inner meningeal layer (only layer that extends into spinal cord)
  - **Two layers separate to form sinus, the dural venous sinuses that drain blood from brain into internal jugular vein**
    - Superior sagittal sinus
    - Transverse sinus
  - **supportive structures formed by dura mater**
    - falx cerebri, falx cerebelli and tentorium cerebelli
  - **epidural space filled with fat in spinal cavity**
    - No epidural space within cranial cavity
    - epidural anaesthesia during childbirth
- **Arachnoid and pia mater – continue into spinal cord**
  - **subarachnoid and subdural spaces**

# **Meningitis**

- **Inflammation of the meninges**
- **Disease of infancy and childhood**
  - **between 3 months and 2 years of age**
- **Bacterial and virus invasion of the CNS by way of the nose and throat**
- **Signs include high fever, stiff neck, drowsiness and intense headache and may progress to coma**
- **Diagnose by examining the CSF**
  - **lumbar puncture (spinal tap)**
  - **CSF pressure 80mmHg to 180 mmHg**

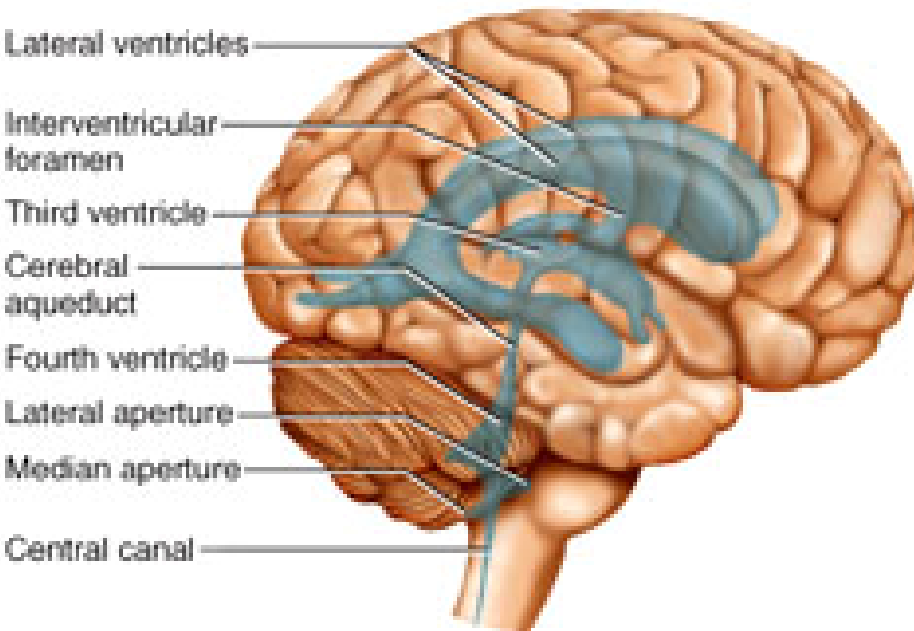
# Flow of Cerebrospinal Fluid

- 1 CSF is secreted by choroid plexus in each lateral ventricle.
- 2 CSF flows through interventricular foramina into third ventricle.
- 3 Choroid plexus in third ventricle adds more CSF.
- 4 CSF flows down cerebral aqueduct to fourth ventricle.
- 5 Choroid plexus in fourth ventricle adds more CSF.
- 6 CSF flows out two lateral apertures and one median aperture.
- 7 CSF fills subarachnoid space and bathes external surfaces of brain and spinal cord.
- 8 At arachnoid villi, CSF is reabsorbed into venous blood of dural venous sinuses.

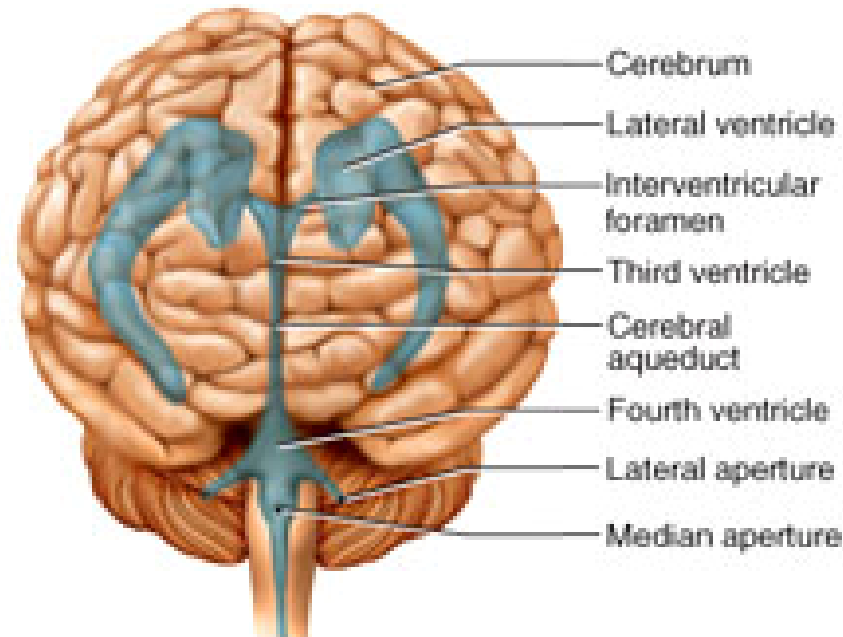


# Brain Ventricles

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(a) Lateral view

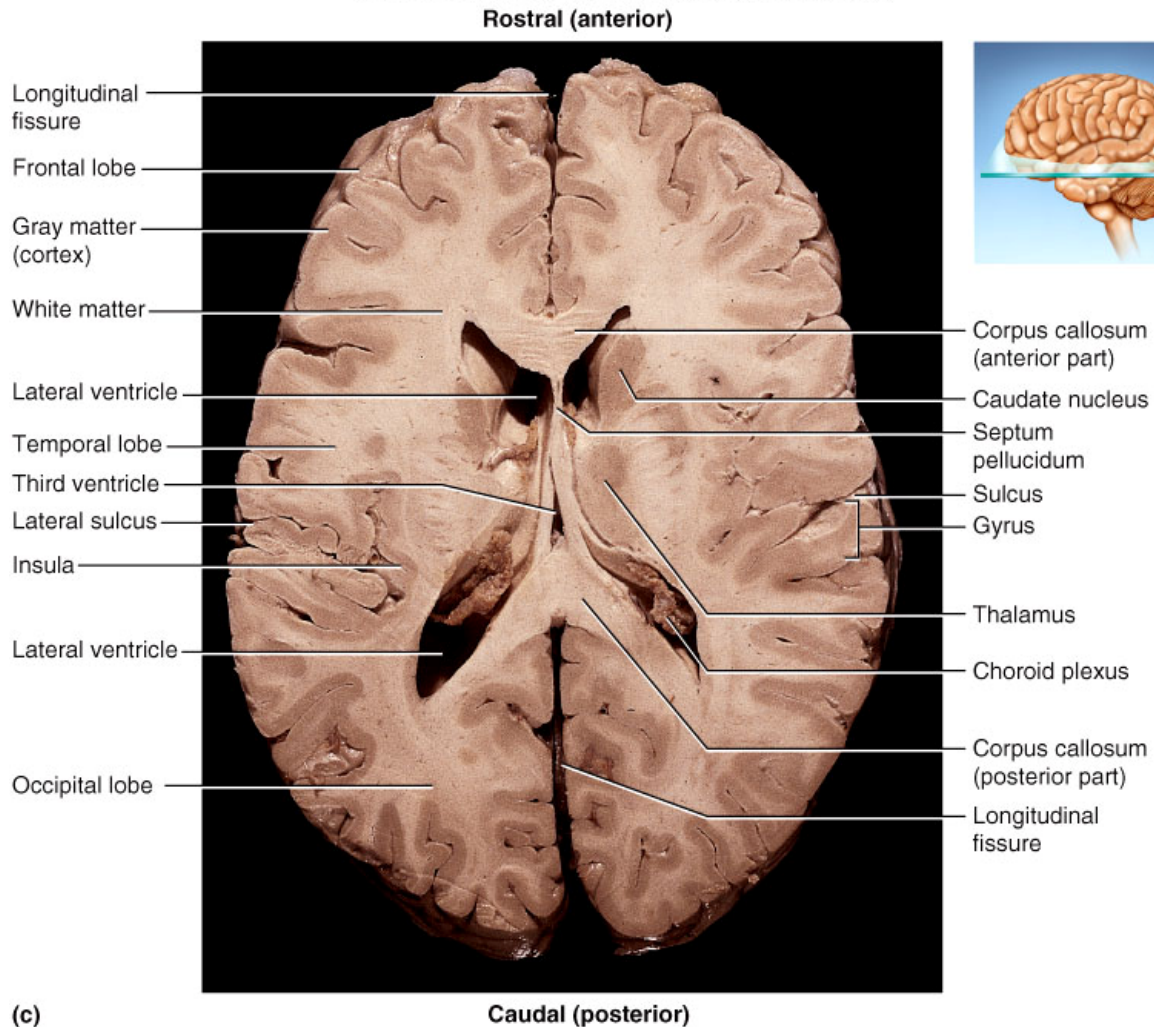


(b) Anterior view



# Ventricles of the Brain

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# Blood-Brain and Blood-CSF Barriers

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- **Blood-Brain Barrier**
  - endothelium / astrocyte / neuron
  - permeable to lipid-soluble materials
    - glucose, alcohol, O<sub>2</sub>, CO<sub>2</sub>, nicotine and anesthetics
  - circumventricular organs
    - in 3rd and 4th ventricles are breaks in the barrier where blood has direct access
    - monitors glucose, pH, osmolarity and others
    - route for HIV virus to invade the brain
- **Blood-CSF Barrier**
  - at choroid plexus is ependymal cells joined by tight junctions
- **No CSF-Brain Barrier**
  - CSF needs to be in contact with brain tissue



# Ventricles and Cerebrospinal Fluid

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- **Internal chambers within the CNS**
  - lateral ventricles in cerebral hemispheres
  - third ventricle = single vertical space under corpus callosum
  - cerebral aqueduct runs through midbrain
  - fourth ventricle = chamber between pons and cerebellum
  - central canal runs down through spinal cord
- **Lined with ependymal cells**
- **Choroid plexus produce CSF**

# Cerebrospinal Fluid

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- **Fills ventricles and subarachnoid space**
- **Brain produces and absorbs 500 ml/day**
  - choroid plexus creates by filtration of blood
- **Functions**
  - floats brain so it is neutrally buoyant
  - cushions from hitting inside of skull
  - chemical stability -- rinses away wastes
- **Escapes (4th ventricle) to surround brain**
- **Absorbed into venous sinus by arachnoid villi**