Three principles:
1-limited space
2-irreversible damage
3-limited time
Arteries of the brain
Arteries of the brain

Anterior circulation – internal carotid artery, from common carotid in the neck. Bifurcates to MCA and ACA

Posterior circulation – vertebral arteries that join to form the basilar artery that will then bifurcate to 2 PCA
Circle of Willis

- Communication between 2 sides anterior communicating (a-com)
- Communication between anterior and posterior circulation – posterior communicating (p-com)
- Many anomalies may exist
Arteries in the subarachnoid space
Arteries of the brain
Each hemisphere has lobes:

- Frontal lobe
- Parietal lobe
- Temporal lobe
- Occipital lobe
- Insular lobe
- Limbic lobe
Functional areas
Function 2

[Diagram of the brain highlighting various functions]

- Central sulcus
- Motor control
- Speech
- Smell
- Hearing
- Touch and pressure
- Taste
- Body awareness
- Language
- Reading
- Vision
- Face recognition
Brodmann Map
The Motor Strip
CSF Pathways
Physiology
Blood supply to the brain

The brain gets 15% of the cardiac output and 20% of the oxygen consumption.

The brain tissue gets, in average, 50 ml of blood per 100 gr of tissue per minute. The gray matter receives about 3 to 4 times more than the white matter.

Total blood supply to the brain is about 500-600 ml per minute.
Factors Affecting the blood supply

- Autoregulation
- Biochemical changes – $O_2$ and $CO_2$
- Blood brain barrier - BBB
Autoregulation

Maintains a regular blood supply to the brain ✓ in changing blood pressures
The range is 50-150 mm mercury ✓
Possible mechanisms are the myogenic ✓ control, neurogenic and biochemical control
The most important and powerful mechanism that controls brain blood flow. A change in 1mm PCO$_2$ changes the flow in 4-5%. PCO$_2$ of 70 gives a maximal vasodilatation. Above that the flow is pressure dependent.
Hyperventilation

Hyperventilation lowers the PCO$_2$
It has a strong effect but it is limited in time
Could be dangerous if not regulated- ischemia
Can be regulated with a jugular bulb oximeter
BLOOD BRAIN BARRIER

The BBB is composed of the **tight junctions** in the endothelium cells of the blood vessels. Prevents passage of large molecules and even small ions like Na and Cl. Specific substances pass the BBB like glucose and amino acids.
Because of the BBB, in the brain hydrostatic and oncotic pressures are not significant. The important parameter is the osmotic pressure. The BBB is damaged in trauma, tumor, infarct, SAH and infection.
BLOOD BRAIN BARRIER

![Diagram of blood brain barrier]

4 cells comprising the CNS microvasculature

[200 nm scale]