

PSY 302 8/31/17

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Brain diversity (mammalian)

- different sizes
- lots of folds on it
- smallest brain = mouse, largest brain = elephant
- human brain = 3 pounds, middle largest
- mammalian brains are remarkably similar in overall structure

Animal Brains (vertebrates)

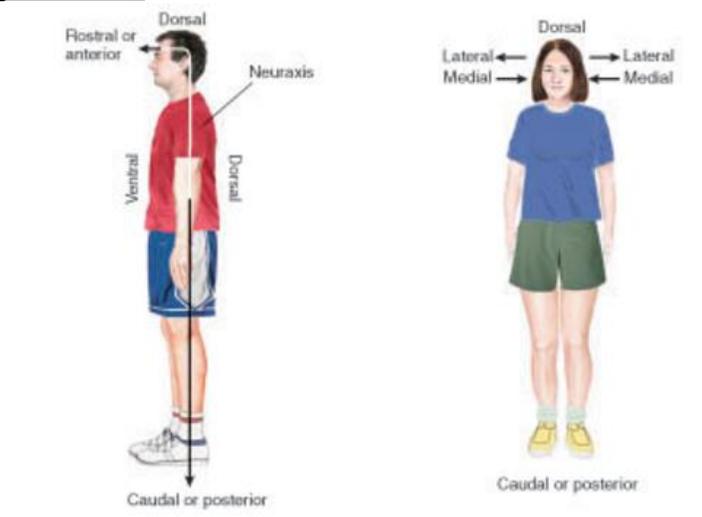
Brain/body weight

- Generally, the bigger the body the bigger the brain
- Humans = brain is bigger than expected by body size

Brain diversity

- different brains... different people
- Parietal lobe: association cortex (any associations between things such as sight & smell), language
- Prefrontal cortex: planning, attention, working memory (2 + 2 = 4)
- Einstein had more glial cells & more sulci (grooves)
- Smarter = better support system? Such as having more glial cells

Giving directions



Neuraxis: tube
Rostral: anterior
Ventral: interior, belly
Dorsal: back side
Caudal: posterior
Lateral: towards side
Medial: towards middle
Contralateral: different side of body (left hand, right foot)

Ipsilateral: same side of body (left hand, left foot)

Brain Planes of Section

- Frontal, coronal, transverse section
- Horizontal section
- Sagittal section
- Cross section
- **Gray matter:** cell bodies (somas)
- **White matter:** axons (myelin sheaths)
- Spinal cord= white matter on outside, gray matter on inside

Nervous System: Overview

- **Nervous system:** made up of central and peripheral nervous system
- **Central nervous system:** brain (skull), spinal cord (vertebral column/spine)
- **Peripheral nervous system:** nerves, peripheral ganglia

Meninges

Three Membranes meninges consists of

1. **Dura mater:** outer part, thick, stretchable
 2. **Arachnoid membrane:** soft, spongy, holes,
 - a. Sub-arachnoid spaced filled Cerebral Spinal Fluid (CSF)
 3. **Pia mater:** follows brain surface, contains blood vessels
- Small infection of meninges: headaches
 - Large infection of meninges: meningitis
 - Cauda equina: "horse tail", end of spinal cord

Brain Vasculature

Brain= 2% of body, uses 20% of oxygen absorbed by lungs

- Contains large network of capillary vessels
- Capillary vessels are dense: can tell which neurons are active by looking at where blood flows (fMRI: glucose & oxygen)
- Migraine, stroke

Cerebral Ventricles

Holes in brain, chambers= cerebral ventricles

- Cerebro-Spinal Fluid (CSF)
- 2 lateral ventricles → third ventricle connects → cerebral aqueduct connects → fourth ventricle connects → central canal
- CSF produced by choroid plexus from blood
- **Choroid plexus:** line inside of vesicles, takes substances from blood to produce CSF
- CSF: absorption in the sinuses, fully replaced every 6 hours
- 1 meninx, 2 meninges

Hydrocephalus

- Disorder when produce CSF but CSF is not recycled back to blood like it should, so CSF accumulates & vesicles enlarge. Brain tissue is compressed & pushed back to skull
- Occurs in 2/1000 children, mostly congenital (at birth) & a result of meningitis

- Treatment: tube inserted into lateral ventricle, valve to regulate pressure, tube to abdominal cavity (shunting)

CSF Summary

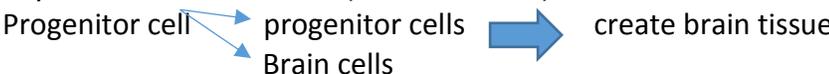
- Produced from blood by the choroid plexi (all ventricles)
- Full replacement every 6 hours
- Flows all around the brain & spinal cord
- Reabsorbed in to the blood

Neural Migration

- On 18th day, we start as a tube (neural tube) made of progenitor cells
- Radial glial cells:
- By 20 weeks, the brain looks “superficially” like an adult brain

Neural development

- Symmetrical cell (lasts 7-8 weeks)

- Asymmetrical cell division (lasts 3 months)

- Longer a/symmetrical divisions stages → larger brains
- **Apoptosis:** suicide signal for progenitor cells after 5 months
- Ventricles produce 2x more neurons than necessary, unused neurons progressively die by apoptosis

New cells in the adults

- **Neurogenesis:** in adult brain. In rats: hippocampus (learning & memory) and olfactory bulb (sense of smell)
- Physical exercise ↑ neurogenesis
- Stress/depression ↓ neurogenesis

Developmental stages

- Major divisions of brain are provided for by major ventricles
- Forebrain Midbrain Hindbrain

- telencephalon: cognitive & emotional areas
- **Diencephalon:** early sensory & hormonal
- **Mesencephalon:** motivation, regulation of behavior
- **Metencephalon:** basic motor actions & plans
- **Myelencephalon:** interface with spinal cord

Neuroanatomy

- Fore brain= telencephalon & diencephalon
- Telencephalon= 2 hemispheres
 - 1 hemisphere cerebral cortex, basal ganglia, limbic system
- 3 major Fissures
 - 1. Longitudinal fissure
 - 2. Lateral fissure
 - 3. central fissure

- Fissure – fissures, Sulcus – Sulci, Gyrus – Gyri, corpus callosum → contralateral perceptual & motor information flow
- Sulci + gyri → surface x 3
- VIDEO: Joe was epileptic & had a corpus callosum split. Doing same task with both hands is difficult