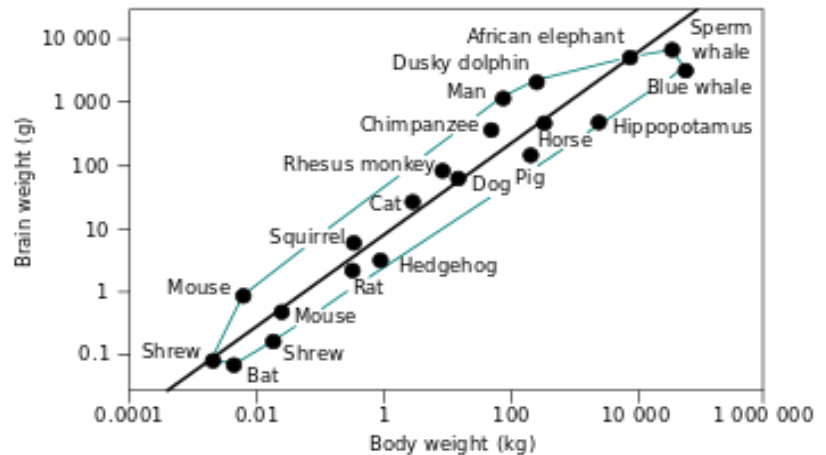


Notes By: Ellie

The Brain (Part I) - August 31, 2017

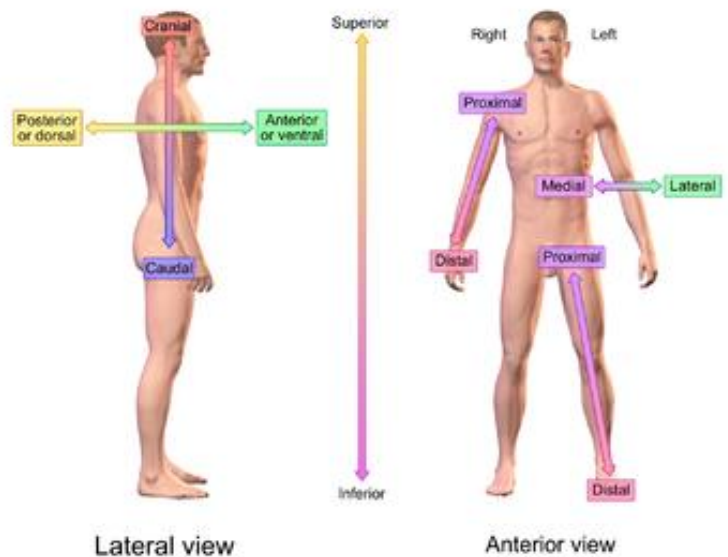
Neuroanatomy

- Brain Diversity (mammalian)
 - Human brain weights 3 lbs (1.4 kg)
 - Brains vary in size & in number of “folds” of their surface
 - Mammalian brains are remarkably similar in overall structure
- Animals Brains (vertebrates)
- Brain/Body Weight
 - Positive correlation
 - Proportional
 - Human brain is bigger than expected based on body size



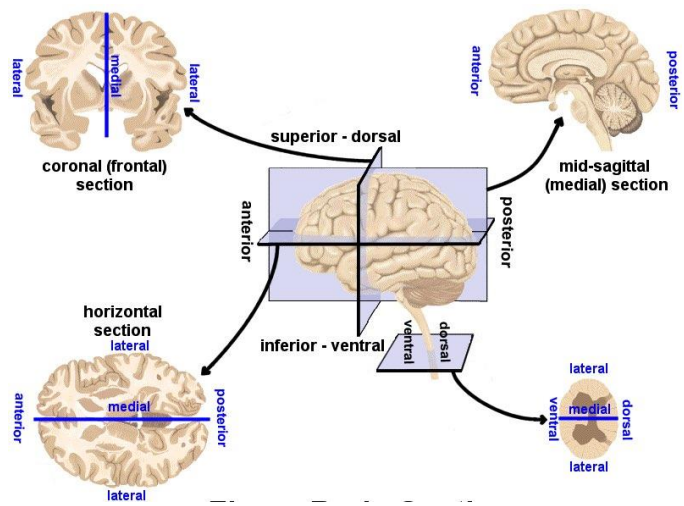
Brain Diversity: Different Brains . . . Different People

- Albert Einstein (1879-1955)
 - IQ ~ =160
 - Difference in areas 9 & 39
 - More glial cells & sulci (grooves)
- Prefrontal cortex (area 9)
 - Planning, attention, working memory
- Parietal Lobe (area 39)
 - Association cortex, language
- Giving Direction (Figure 3.1)
 - Neuraxis: axis of the central nervous system
 - Rostral (anterior): front
 - Ventral: toward belly
 - Dorsal: toward back

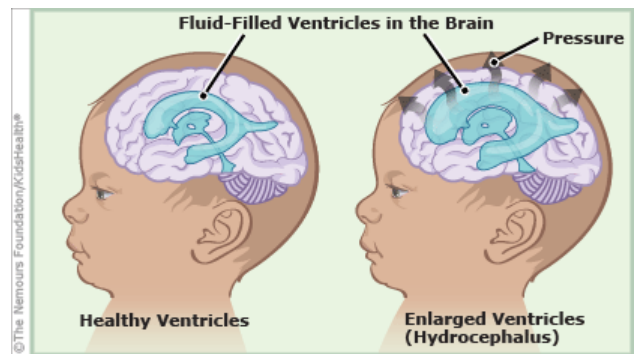


Directional References

- Caudal (posterior): toward tail
- Lateral: toward sides
- Medial: towards middle
- Contralateral: different side
- Ipsilateral: same side
- Brain Planes of Section (Figure 3.2)
 - Frontal plane (transverse, coronal)
 - Sagittal plane
 - Horizontal plane
 - Cross section
 - Gray matter: cell bodies (somas)
 - White matter: axons (myelin sheaths)



- Nervous System: Overview
 - Nervous system:
 - Central nervous system: brain (skull) & spinal cord (vertebral column/spine)
 - Peripheral nervous system: nerves & peripheral ganglia
- Meninges (Figure 3.3)
 - Dura mater: thick, unstretchable
 - Arachnoid membrane: soft, spongy
 - Sub-arachnoid space filled with Cerebro Spinal Fluid (CSP)
 - Pia mater: follows brain surface, contains blood vessels
 - Headache (migraine): small infection of meninges
 - Meningitis: Large infection of meninges
- Brain Vasculature
 - Brain (2% of the body) uses about 20% of oxygen absorbed by the lungs
 - Contains large network of capillary vessels
 - Dense: one can tell which group of neurons re active by looking at where blood flows (fMRI: glucose & oxygen)
 - Migrane, stroke
- Cerebral Ventricles (Figure 3.4)
 - Cerebro Spinal Fluid
 - Lateral ventricles — third ventricles — cerebral aqueduct — fourth ventricle — subarachnoid space — central canal (right + left)
 - Choroid plexus produces CSF from blood
 - CSF fully replaced every 6 hours
 - Flows all around the brain & spinal cord



- Reabsorbed into the blood
- Ventricles also have a role in development
- Hydrocephalus
 - Occurs in 2/1000 children
 - Mostly congenital (at birth), also a result of meningitis
- Neural Migration (Figure 3.6)
 - On the 18th day . . . we start as a tube (neural tube) made of progenitor cells
 - By 20 weeks, the brain looks “superficially” like an adult brain
- Neural Development
 - Symmetrical cell division (lasts 7-8 weeks)
 - Progenitor cell — 2 progenitor cells
 - Increase ventricular size
 - Asymmetrical cell division (last 3 months)
 - Progenitor cell — 1 progenitor cell, brain cells (radial glial cells, neurons + glial cells)
 - Create brain tissue
 - Longer a/symmetrical divisions stages — larger brains
 - After 5 months: Apoptosis: “suicide” signal for progenitor cells
 - Ventricles produce 2x more neurons than necessary; unused progressively die by apoptosis
- Neural Development: New cells in the adult (Figure 3.7)
 - There is neurogenesis in the adult brain
 - In rats: hippocampus (learning & memory) & olfactory bulb (sense of smell)
 - Physical exercise increase neurogenesis; stress/ depression reduce neurogenesis
- Developmental Stages (Figure 3.5)
 - Major divisions of the brain are “provided for” by the major ventricles
 - Telencephalon: cognitive + emotional areas
 - Diencephalon: early sensory & hormonal
 - Mesencephalon: motivation, regulation of behavior
 - Metencephalon: basic motor actions & plans
 - Myelencephalon: interface w/ spinal cord
- 6 Divisions of the Adult Human Brain
 - Forebrain: telencephalon (2 hemispheres; one made of cerebral cortex, basal ganglia, limbic system) + diencephalon
- Three Major Fissures: Two Hemispheres
 - Fissure: groove, natural division, deep furrow, elongated cleft in the brain
 - Sulcus (sulci): grooves
 - Gyrus (gyri): ridge or fold
 - Corpus Callosum: bundle of nerve fibers joining the two hemispheres of the brain