Memorize bold terms in the book. Important test material!

- Mammalian brain diversity:
  - Brains vary in size and in the number of “folds” on their surface
  - Mammalian brains are remarkably similar in overall structure

- Animal brains (vertebrates)
  - Brains, spinal cord and skulls…

- Brain/body weight
  - Body weight positivity correlated with brain weight
- Human brain larger than expected body size ratio
- Above line = smart, below line = dumb?

- Brain diversity: Different brains…different people
  - Prefrontal cortex: Planning, attention, working memory
  - Parietal lobe: Association cortex (ex: associates sound with sight, smell with taste etc), language
  - Einstein’s IQ 160? Average 100. Brain studied at Princeton University
    - More glial cells
    - More sulci (grooves)
    - Same brain shape, neurons, dendrites etc.
    - Theory: Better brain functioning derived from support system, not abundance of neurons

- Giving directions (All mammals are tubes)
  - Neuraxis
    - Tube surrounded by neurons
  - Rostral or anterior
    - In front
  - Caudal or posterior
    - Behind
  - Dorsal
    - Back
- Ventral
  - Under
- Medial
  - Centered
- Lateral
  - To the side
- Contralateral
  - Parts on different side of body (right foot, left hand)
- Ipsilateral
  - Parts on same side of body (left hand, left foot)

- Brain planes of section (3.2)

- Planes of section (3.2)
- Grey matter: cell bodies (somas)
- White matter: Axons (myelin sheaths)

- Spinal cord
  - White on outside, grey inside

- Nervous system: Overview
  - Central nervous system (CNS)
    - Brain (skull)
    - Spinal cord (vertebral column/spine)
  - Peripheral nervous system (PNS)
    - Nerves
    - Peripheral ganglia (group of neurons)
    - Outside CNS
- **Meninges (3.3)**
  - Dura matter
    - Thick, not stretchable
  - Arachnoid membrane
    - Soft, spongy
    - Sub-archnoid space filled with Cerebro Spinal Fluid
  - Pia mater
    - Follows brain surface, contains blood vessels
  - Headache = small infection of meninges
  - Meningitis = large infection of meninges

- **Brain vasculature**
  - Brain (2% of the body) used about 20% of oxygen absorbed by the lungs
  - Contains large network of capillary vessels
  - Dense: One can tell which group of neurons are active by looking at where blood flows (fMRI: glucose and oxygen).
  - Migraine, stroke
- Cerebral ventricles (3.4)
  - Cerebro Spinal Fluid
    - Contains nutrients for the brain
  - Lateral ventricles
    - 2 on right and left sides
  - Third ventricle
    - Middle
  - Cerebral aqueduct
    - Tube structure
  - Fourth ventricle
    - Small, underneath eyes
  - Subarachnoid space
  - Central canal
- Lateral ventricle – third ventricle – cerebral aqueduct – fourth ventricle – central canal or subarachnoid space

- CSF produced by the choroid plexus from blood
- CSF absorption in the sinuses
  - CSF: Fully replaced every 6 hours
  - Note: 1 menynx, 2 meninges

- Hydrocephalus
- Choroid plexus produces CSF, but is not recycled properly. CSF accumulates, expanding skull.
- Occurs in 2/1000 children. Mostly congenital, also as a result of meningitis
- Treatable. Most children live normal lives

- Placidity
  - The extent to which the brain can adapt to things

- CSF summary
  - Produced from blood by the choroid plexi (all ventricles)
  - Full replacement every 6 hours
  - Flows all around the brain and spinal cord
  - Reabsorbed into the blood
  - Ventricles also have a role in development

- Neural migration
  - 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
  o Symmetrical cell division (last 7-8 weeks)
    ▪ Progenitor cells – 2 progenitor cells (increase ventricular size)
  o Asymmetrical cell division *last 3 months)
    ▪ Progenitor cell – progenitor cell or brain cell (Radial glial cells support migration to other cells, neurons + glial cells) (create brain tissue)
• Longer asymmetrical division stages – larger brains
• After 5 months: Apoptosis “suicide” signal for progenitor cells
• Ventrices produce 2x more neurons than necessary. Unused neurons progressively die by apoptosis.

• Neural development: new cells in the adult (3.7)
  o There is a neurogenesis in the adult brain. In rats: Hippocampus (learning and memory) and olfactory bulb (sense of smell).
  o Physical exercise increase neurogenesis. Stress/depression reduce neurogenesis

• Developmental stages (3.5) Major division of the brain ae provided for by major ventricles
  o Telencephalon: Cognitive + emotional areas
Diencephalon: Early sensory and hormonal
Mesencephalon: Motivation, regulation of behavior
Metencephalon: Basic motor actions and plans
Myelencephalon: Interface with spinal cord

- 6 division of the adult human brain
  - Forebrain
    - Telencephalon + diencephalon
      - Telencephalon: 2 hemispheres
        - 1 hemisphere: Cerebral cortex, basal ganglia, limbic systems
  - The 3 major fissures: 2 hemispheres (3.8)
    - Fissure – fissures
    - Sulcus – sulci
    - Gyrus – gyri
    - Corpus callosum – contralateral perceptual + motor information flow
  - Each side of brain talk to each other
    - Left side of brain controls right side of body and vice versa