• Giving directions inside your brain
• Meninges and blood vessels
• The cerebrospinal fluid and the ventricles
• A developmental view
• The forebrain

• Brains are diverse in size and shapes across mammals (duh)
  o Vary in size and in the number of “folds” on the surface
  o Mammalian brains are remarkably similar in overall structure
• Prefrontal cortex (front)
  o Planning
  o Attention
  o Working memory
• Parietal Lobe (back left)
  o Association Cortex
  o Language
• Einstein’s brain
  o More glial cells
  o More sulci (grooves)
• Directions – (page 50-51) Figure 3.1 + 3.2
  o Rostral/anterior – front
  o Ventral – front
  o Dorsal – top/back
  o Caudal/posterior – back
  o Medial – middle
  o Lateral – away from middle
  o Contralateral – on opposite sides (ex. Left hand + right foot)
  o Ipsilateral – on same side (ex. Right hand + right foot)
• Planes of the brain by section (page 51) Figure 3.2
  o Horizontal plane – flat sideways
  o Sagittal plane – vertical front to back
  o Front (Coronal) plane – vertical plane left to right
• Gray matter – cell bodies (somas)
• White matter – Axon (myelin sheaths)
• Brain has gray matter on the outside and white matter on the inside
  o The spinal cord is reversed (white matter outside and gray matter inside)
• Meninges
  o Dura mater: Thick, un-stretchable
  o Arachnoid membrane: soft, spongy
    - Sub-arachnoid space filled with Cerebro Spinal Fluid
  o Pia Mater: follows brain surface, contains blood vessels
• Q - How do you call a small/large infection of the meninges?
  o A - Large – meningitis
  o A - Small – headache (migraine)
• Brain Vasculature
  o Brain (2% of the body) uses about 20% of oxygen absorbed by the lungs
  o Contains large network of capillary vessels
  o Dense: one can tell which group of neurons are active by looking at where blood flows
    (MRI: glucose and oxygen)
  o Migraine, stroke
• **Cerebro-Spinal Fluid (CSF)** – produced by the choroid plexi (plexus) from blood
  o Lateral ventricles (right + left) -> third ventricle -> cerebral aqueduct -> fourth ventricle
    - Fourth ventricle -> Subarachnoid space
    - Fourth ventricle -> central canal
  o Fully replaced every 6 hours
  o 1 menynx / 2 meninges
  o 125ml (approx. 1/3 the amount of a can of soda)
  o Hydrocephalus
    - Occurs in 2/1000 children
    - Mostly congenital as a result of meningitis
  o **Plasticity**
    - Ability to compensate little by little to damage
  o Flows all around the brain and spinal cord
  o Reabsorbed into the blood
  o Ventricles also have a role in development)
• Neural migrations – (page 57) Figure 3.6
  o On the 18th day we start as a tube (neural tube) made of progenitor cells
  o By 20 weeks, the brain looks “superficially” like an adult brain
• Neural development
  o Symmetrical cell division (7-8 weeks)
    - Progenitor cells splits into progenitor cells to increase ventricular size
  o Asymmetrical cell division (lasts 3 months)
    - Progenitor cells split into progenitor cells and brains cells to create brain tissue
      - Brain cells
        - Radial glial cells (support migration of other cells)
        - Neurons + glial cells
  o Longer a/symmetrical divisions stage -> larger brains
  o After 5 months. Apoptosis: “suicide” signal for progenitor cells
    - Ventricles produce 2x more neurons than necessary. Unused neurons progressively die by apoptosis
  o **Neurogenesis** – (page 57)
    - Creation of new neurons
    - Physical exercise increase neurogenesis
    - Stress/depression reduce neurogenesis
• Development stages – (page 56) table 3.2 + Figure 3.5
  o Telencephalon: cognitive + emotional areas
    ▪ Forebrain
    ▪ Cerebral hemispheres
  o Diencephalon: early sensory and hormonal
    ▪ Forebrain
  o Mesencephalon: motivation, regulation of behavior
    ▪ Midbrain
  o Metencephalon: basic motor actions and plans
    ▪ Hindbrain
  o Myelencephalon: interface with spinal cord
    ▪ Hindbrain
    ▪ Medulla
• Neuroanatomy
  o 3 major fissures: 2 hemispheres – (page 58) Figure 3.8
    ▪ Corpus Callosum
      • Right vs left part of brain
        o Right part of brain is in charge of left side
        o Left part of brain is in charge of right side of body
        o Sense of smell is the exception