Concepts to learn:
- Anatomy
- Development (pattern formation) (axonal pathfinding) (synapse formation) (fine-tuning connections)
- How brain works (sensory -> behavior)
- Sensory systems (visual, olfactory, auditory, temperature, pain, etc)
- Higher cognitive functions
- Brain diseases

- Cerebral hemispherer telencephalon
- Central sulcus
- Longitudinal sulcus
- Lateral sulcus

- Thalamus - ball-shaped in middle; motor control etc
- Hypothalamus - sex drive, eating

- Inside cerebral cortex: (temporal lobe?)
- Basal ganglia - motor control
  - Caudate
  - Putamen
  - Globus pallidus
- Hippocampus - memory
- Amygdala - emotions

Peripheral nervous system:
1. Somatic - sensation/movement of muscles, skin, etc: dorsal ganglia, near spinal cord
2. Autonomic:
   a. Sympathetic nervous system
   b. Parasympathetic (contrasts sympathetic, maintains homeostasis)
3. Enteric nervous system (internal organs)
spinal cord - motor neurons, sensory neurons

axon tract : dorsal root ganglia (cell bodies of sensory neurons)

- dorsal (tract flow information up)
- ventral (tract flow information down)

- ventral horn axons innervate muscles through ventral root

- 31 spinal nerves (cervical → lumbar)

- 4 ends at L1 (nerves run down to LS at bottom)

brain stem

- substantia nigra in midbrain
- defects in breathing, blood pressure, visceral functions, etc
- major motor tracts
- midbrain
- defects in eye movement
- 3,4
- auditory nucleus
- 5,6,7,8
- defects in facial movement, sensation
- 9,10,11,12
- medulla

- cranial nerves: 1. olfactory nerve: olfactory bulb → thalamus
- 2. optic nerve: bypasses midbrain
- 3.
- 4.
- 5. trigeminal: motor output to face (chewing, face sensation)
- 6.
- 7. facial nerve: facial expressions, autonomic functions (crying, salivating)
- 8. auditory nerve: balance & hearing
- 9. glossopharyngeal: tasting, swallowing
- 10. vagus nerve: output → gut region, controls breathing, heart rate, blood pressure, etc
- 11. spinal accessory nerve: neck muscles (turn head, lift shoulders)
- 12. hypoglossal nerve: tongue movement

- brainstem provides sensory 
  motor stuff to neck + head
- cranial nerves (12)
- leave brainstem, innervate
  various things
- reticular formation: involved
  in state of activity of midbrain
  (sleep, arousal) mostly in pons
cerebellum - coordinates motor behavior, learning of motor tasks
- inputs from spinal cord, ear (balance), cortex (esp. motor cortex)

diencephalon

\[ \text{*} \text{ (inside)} \]
1. thalamus
2. hypothalamus

- thalamus: many nuclei (lots of sensory & motor inputs, outputs to cortex)
  - big relay station

teleencephalon (brain hemispheres)

1. occipital lobe - processes vision: different parts process different vision aspects

\[ \text{eye} \rightarrow \text{thalamus} \rightarrow \text{occipital cortex} \]

(other pathways, eg to cerebellum)

2. frontal lobe

- motor output to talking:

Broca's area

(lesions usually associated w/ paralysis)

- corticospinal tract goes from premotor cortex, decussates
diseases:

- upper motor neuron diseases (affect cortex or tract): spastic, no inhibition of lower pathways
- lower motor neuron diseases:
  - paralysis
  - no reflexes, no spasticity, fasciculations (muscles jiggle)
  - focal (take out motor + sensory inputs to certain part)

in medulla in brain stem, down to spinal cord

- heightened reflexes on opposite large lesions (hemiparesis) side of body

0.4 s b/a hits motor cortex

movement: premotor cortex makes decision

premotor cortex

corticospinal tract

through brain stem

corticospinal tract

through spinal cord

lower motor neurons

motor neurons

motor cortex

basal ganglia

cerebellum

(coordinates everything)
- cerebellar diseases
  - get ataxia, tremor
- basal ganglia diseases (can move, but not on command)
  - Parkinson's disease (dopaminergic neurons from midbrain): hard to initiate movement
  - Huntington's disease (affects caudate): chorea

1. parietal lobe
  - somatotopic area right behind central sulcus

  touch → spinal cord → thalamus → medulla

  - some sensations decussate in spinal cord (pain, eg)
  - in medulla (touch, eg)

4. temporal lobe
  - processing of auditory information, language

  inner ear → medulla → pons → midbrain → thalamus → temporal lobe

  Wernicke's area: processing of language (understanding)
  - can talk, but nonsense
  - no recognition of this (terrible prognosis)

- hippocampus
- amygdala

- lateral ventricles - holes in brain for cerebrospinal fluid
- third brother thalamus
- fourth around cerebellum
basal ganglia
- caudate, accumbens, putamen, follows line of lateral ventricle
- putamen = ball-like

- fornix

- hippocampus

- amygdala

- genomics
  - humans, yeast, Drosophila, C. elegans (all around 2000-2001) genomes sequenced
  - mouse, Arabidopsis
  - chop up chromosomes, sequence pieces, use computers to assemble
  - human genome: ~30,000 genes
    - repeat sequences account for 50% (transposable elements)
    - only 7% difference between humans & yeast (mostly for multicellular signalling)
    - transposons: LINEs, SINEs