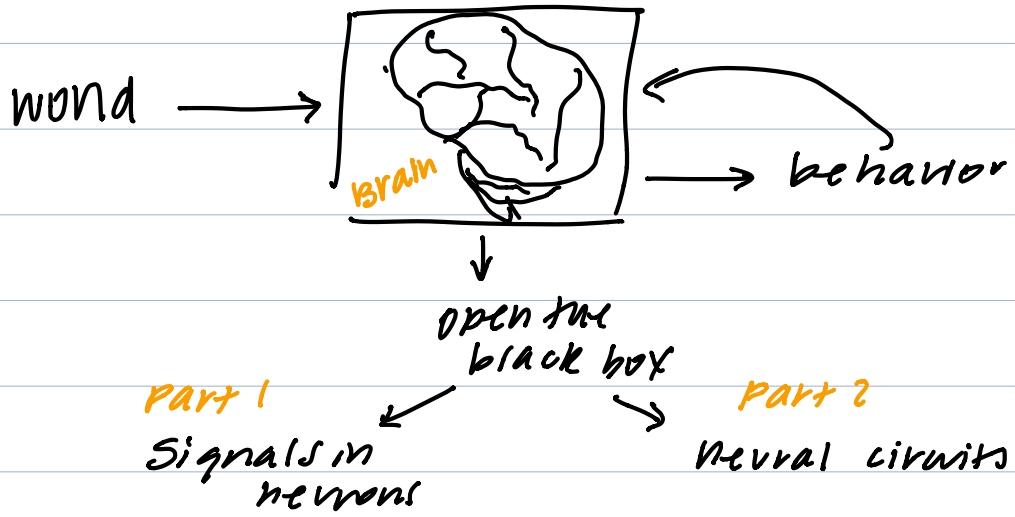
Neuro 80 Lecture 1

September 4, 2019

- Biologically-inspired framework for how brains work
  - ↳ factually about parts and signals to demistify the brain
  - ↳ bridge chasm btwn physical brain and mind

How will you study an unknown machine?



Part 1: Signals

- signaling within neuron (resting + action potential)
- signalling between neurons (synaptic potentials)

Part 2: Circuits

- sensory systems
- neural coding
- learning and memory
- cognition
- motor system
- disorders

Central Themes

1. Brain as biological machine
2. Brain processes + stores information + movement
3. There is a lot we don't know

Like a machine, brain activity requires energy

- visual stimuli → increases bloodflow → more nutrients
- fMRI: (BOLD, blood oxygenation level dependent)
  ↳ difference in oxyhemoglobin vs deoxyhemoglobin
- what about the brain burns calories
  synaptic potentials + resting metabolic energy

Like a machine, the brain is made of smaller components

- 3 categories
  1. maintain structure (cytoskeletal, extracellular, membrane components)
  2. carry out work (motors, pumps, ion channels)
  3. signalling (neurotransmitters, receptors, messengers)

Neurotransmitters are essential

- many signal
- disorders = too many or too few
- medicine to treat disorders modify neurotransmitter systems
- drugs of abuse / recreation act through neurotransmitter systems
- poisons act by stimulating / blocking function

The brain (like a machine) can break

- neurodegenerative (Alzheimers, Parkinsons, ALS)
- developmental (cerebral palsy)
- behavioral (ADHD, depression, bipolar)
- infectious (encephelitis, meningitis)
- tumors (glioblastoma, neuroblastomas)

- metabolic (stroke, diabetic neuropathy)
- traumatic (concussions)

Brain uses electricity

- Electrocorticography
- Parkinson's (dopamine ↔ movement)
  - Treatments: chemical (L-dopa), cellular (implant stem cells), electrical (directly stimulate pathways)

Brain function takes time

world → eye → thalamus → visual cortex → motor cortex → spinal cord → muscle → action at least 10 synapses

Brain is a biological machine

energy, volume, can break, electricity, time.
information processing / storage device

COURSE STRUCTURE

- M/W: core material, poll everywhere
- F: digressions, discussions, real world applications, guest speakers, etc.
- Thu/Fri 75-minute section (sign up by midnight)

participation	15%	pset	25%
section	5%	midterm	20%
weekly quizzes	10%	final exam	25%

- pre-lecture notes (canvas)
- 6-8pm Sunday work session
- textbook heavily recommended