Neuroanatomy

PSY 511.003 Spr 2025

Prelude

Announcements

- Exercise 02 due next Wednesday, January 29, 2025.

Today's topics

- Neuroanatomy
  - Brief overview
  - In-class lab
  - Exercise 02

Neuroanatomy

Why study?

- Master basic vocabulary for reading literature

Information processing perspective

- Inputs from
  - World
  - Body
  - Brain[1]

- Outputs to
  - World
  - Body
  - Brain
- What computations occur where

Functional anatomy perspective

- Located where
- Connected to
- Involved in

Brain anatomy through dance

Your browser does not support the audio tag.

Directional terms

- Anterior/Posterior
- Medial/Lateral
- Superior/Inferior
- Dorsal/Ventral
- Rostral/Caudal

[1] shorthand for nervous system

Central vs. Peripheral Nervous System

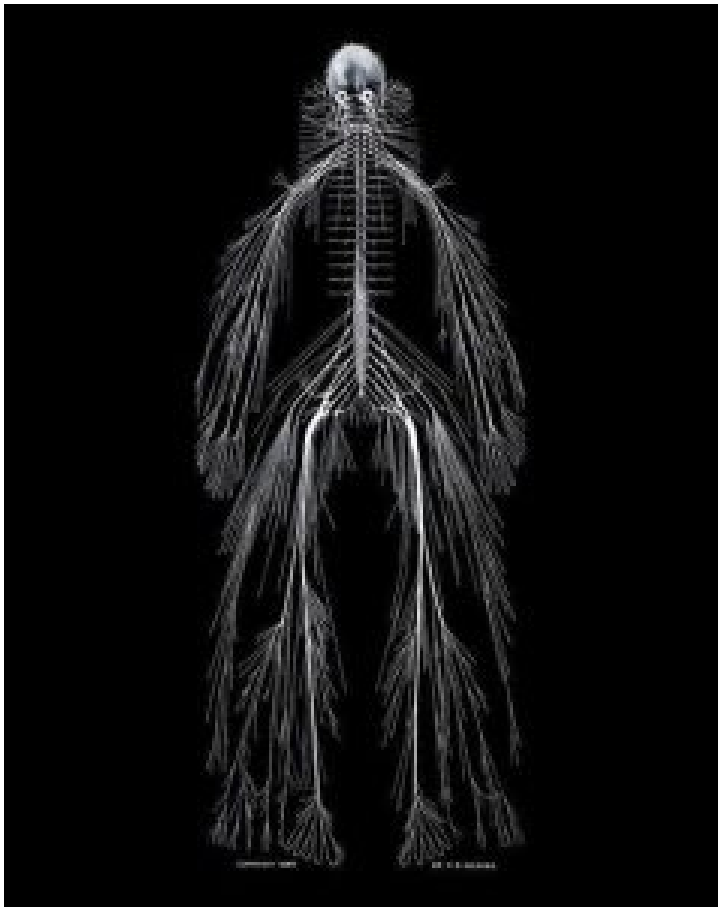

Figure 1: Nervous system of Harriet Cole, see McNaughton (2018)

Organization of the CNS

Major division	Ventricular Landmark	Embryonic Division	Structure
Forebrain	Lateral	Telencephalon	Cerebral cortex Basal ganglia Hippocampus, amygdala

Major division	Ventricular Landmark	Embryonic Division	Structure
	Third	Diencephalon	Thalamus Hypothalamus

Major division	Ventricular Landmark	Embryonic Division	Structure
Midbrain	Cerebral Aqueduct	Mesencephalon	Tectum, tegmentum

Major division	Ventricular Landmark	Embryonic Division	Structure
Hindbrain	4th –	Metencephalon Mylencephalon	Cerebellum, pons Medulla oblongata

Forebrain, midbrain, hindbrain terminology derives from embryonic stages in CNS development.

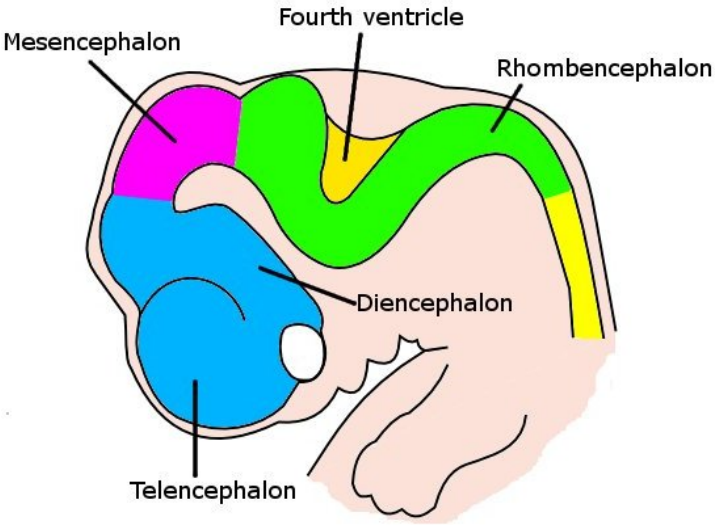

Figure 2: Embryonic human brain from Wikipedia

Cerebrum

- (Cerebral) cortex
- Subcortical (below the cortex) structures

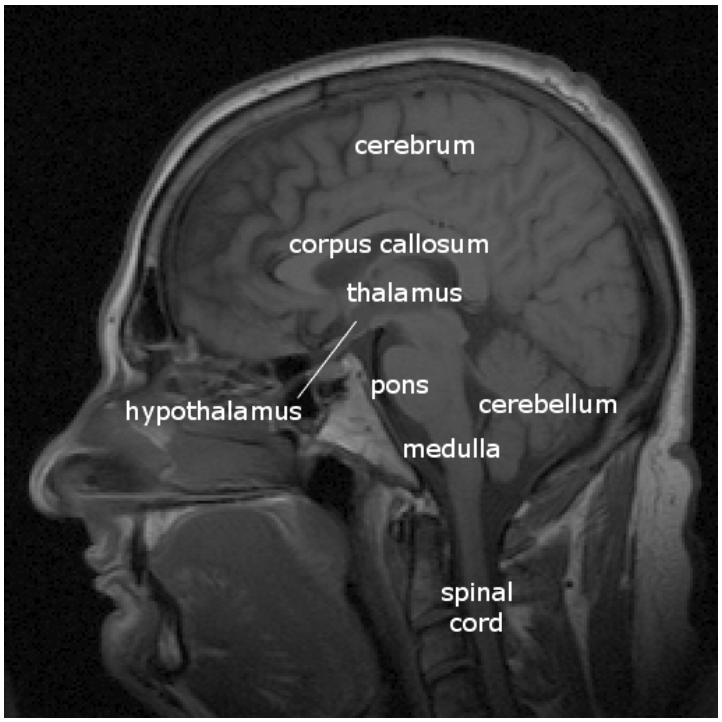

Figure 3: Labelled MRI including thalamus and hypothalamus

(Cerebral) cortex

- Lobes, marked by sulci/fissures, adjacency to bones of skull
- Functional areas marked by gyri & sulci
- Brodmann Areas
  - Microstructural (cellular composition) features

- Most lobes host primary sensory or motor area
  - Frontal: Motor cortex
  - Temporal: Auditory cortex
  - Parietal: Somatosensory cortex

  - Occipital: Visual cortex
  - Insula: Gustatory

Input/output

- Via cranial nerves (in CNS)
- Via spinal nerves (in PNS)

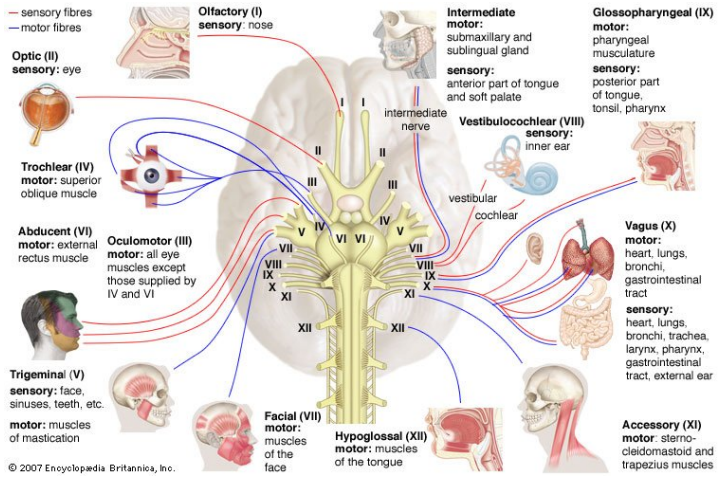

Figure 4: Cranial nerves from https://www.britannica.com/science/cranial-nerve#/media/1/141797/46720

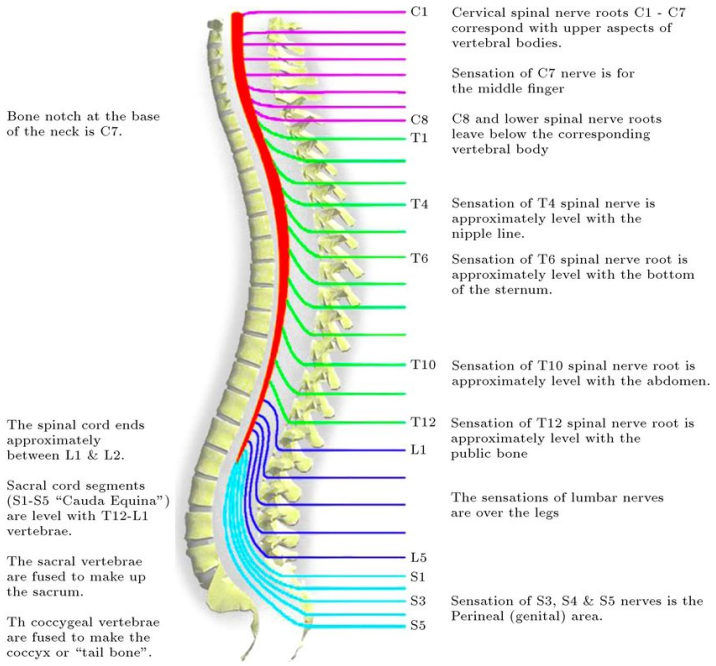

Figure 5: https://www.researchgate.net/profile/Saeede-Rahimi-Damirchi-Darasi/publication/324683974/figure/fig10/AS:753484697726976@1556656159277/Diagram-showing-the-relationship-between-spinal-nerve-roots-and-vertebrae-27.jp

---

Multiple hierarchies

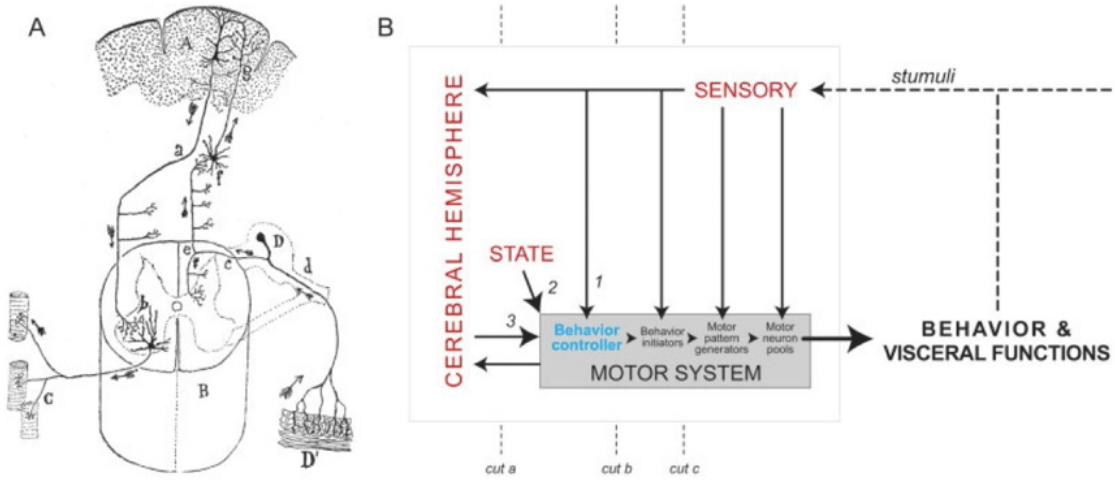

Fig. 1. **A:** Perhaps the first diagram illustrating the cellular organization of a vertebrate spinal reflex, based on the neuron doctrine and law of functional polarity, published by Cajal in 1890 (see Cajal, 1894). Note that he emphasized two interconnected sources of motor neuron (b) control: dorsal root ganglion cells (D) and cerebral cortical pyramidal (or psychomotor) neurons (A). For clarity, he showed sensory input to the right side of the spinal cord, and motor output from the left side. **B:** A modern version of the basic plan of nervous system organization, adding behavioral state inputs (2) to sensory or voluntary (1) and cerebral hemisphere/cognitive or voluntary (3) inputs to the motor system hierarchy; see text for details (adapted from Swanson, 2000a).

Figure 6: (Swanson, 2005, fig. 1)

Maps

- Sensory & motor systems often use maps

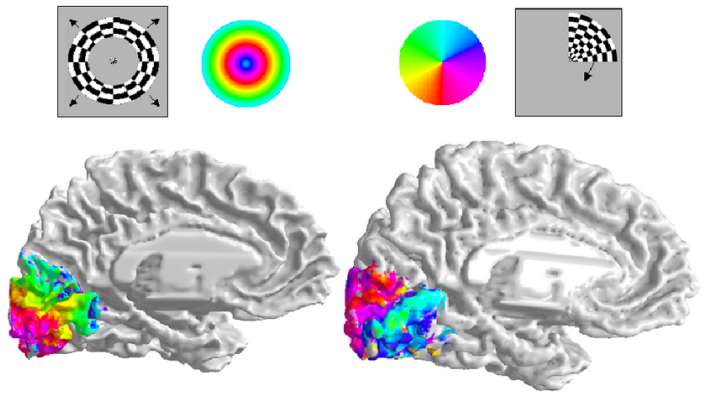

Figure 7: https://www.researchgate.net/profile/Brian-Wandell/publication/8988812/figure/fig1/AS:28006763363 Retinotopy-paradigm-Two-stimuli-are-used-to-measure-the-retinotopic-maps-in-cortex.png

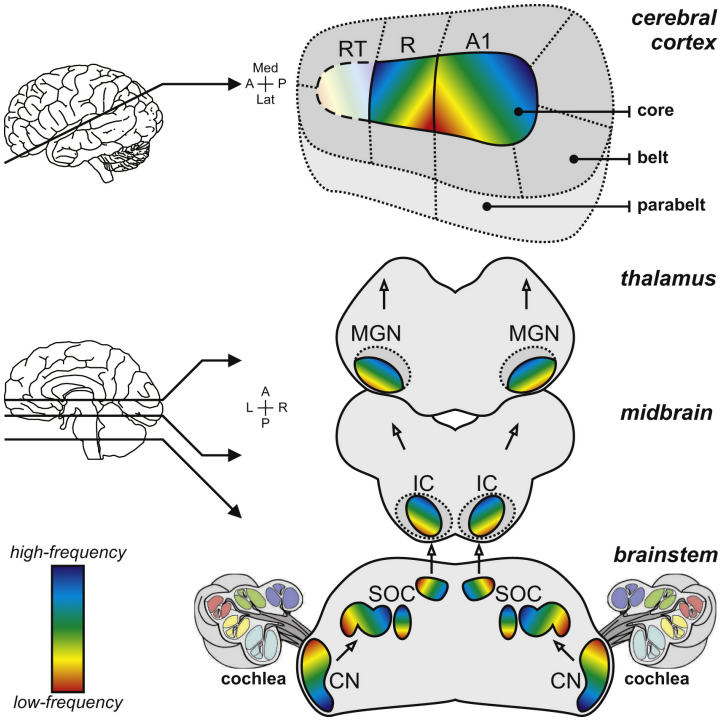

Figure 8: Figure 1 from Saenz & Langers (2014)

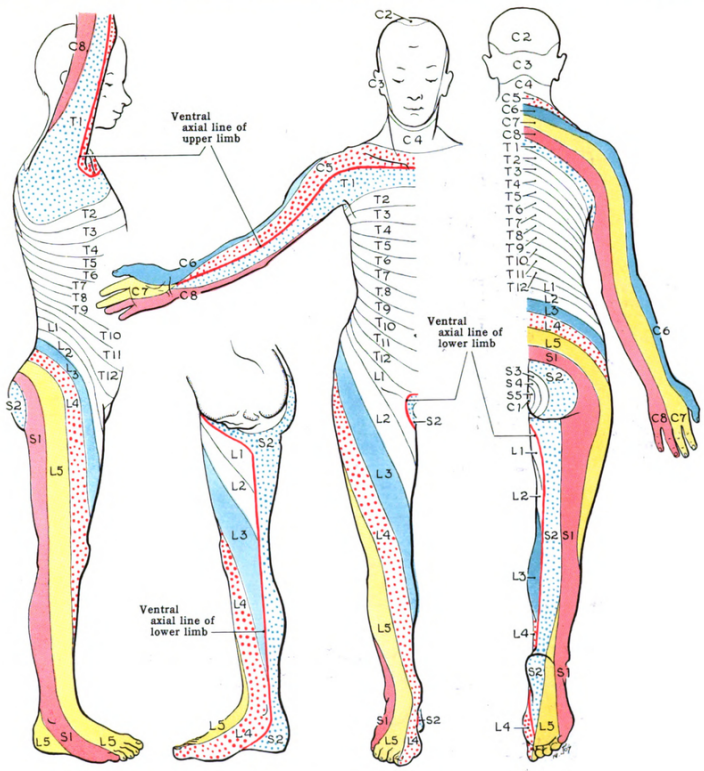

Figure 9: Wikipedia

- Geometric issues central for perceptual/motor behavior
- Do other systems "map" function to structure?

Neuroanatomy lab

Overview

- 3 groups
- Rotate among stations every ~25 min
- Identify as many structures as possible

Wrap-up

Main points

- Directional terms
- What is it
- Where is it
  - Relative to other things
  - CNS/PNS
  - Forebrain/midbrain/hindbrain

- Cerebral cortex and its subparts
- Grey matter vs. white matter

Next time...

- Cellular neuroscience I

Resources

References

McNaughton, A. (2018, November 20). Dissecting harriet cole: Uncovering women's history in the archives. Retrieved January 8, 2025, from https://drexel.edu/legacy-center/blog/overview/2018/november/dissecting-harriet-cole-uncovering-womens-history-in-the-archives/

Saenz, M., & Langers, D. R. M. (2014). Tonotopic mapping of human auditory cortex. *Hearing Research*, *307*, 42–52. https://doi.org/10.1016/j.heares.2013.07.016

Swanson, L. W. (2005). Anatomy of the soul as reflected in the cerebral hemispheres: Neural circuits underlying voluntary control of basic motivated behaviors. *Journal of Comparative Neurology*, *493*(1), 122–131. https://doi.org/10.1002/cne.20733