LING104 - Exam 1 - Fall 2020

Due Friday, October 2 at midnight EST

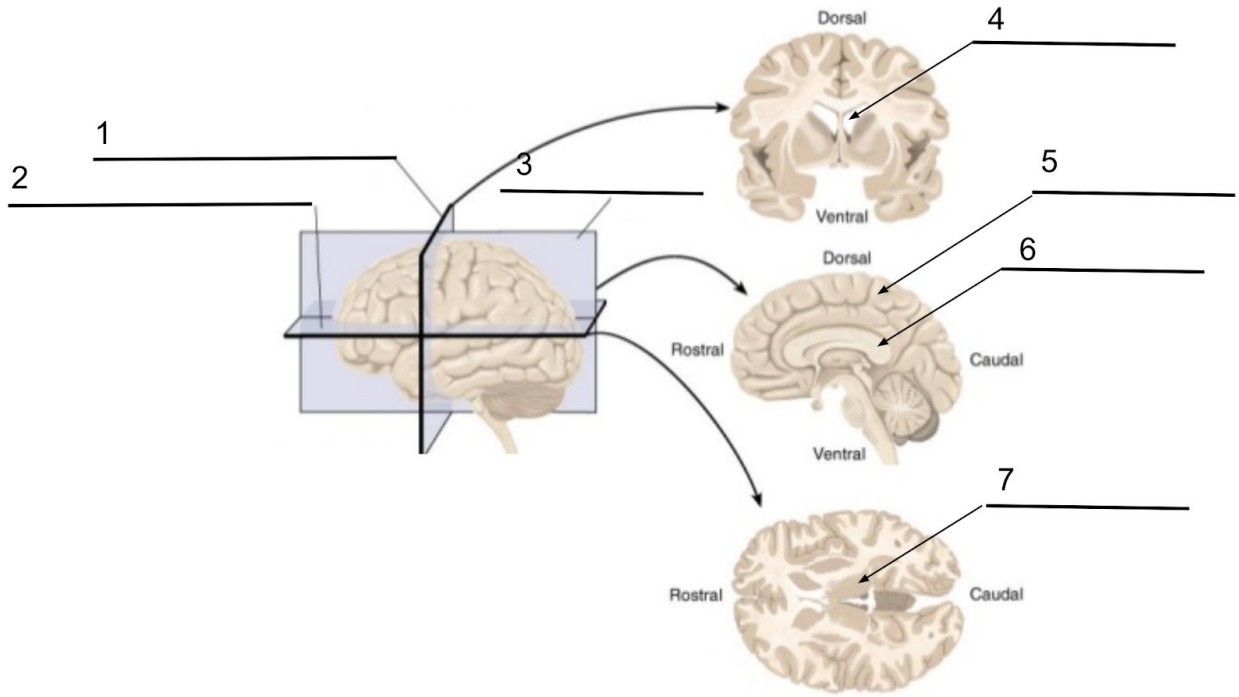
This exam is take-home and open-book. You may work with other students, but you must (1) write your answer in your own words and (2) indicate who you worked with. You may work directly on this document or on a separate document if you prefer. Submit your answers as a .pdf document via Canvas.

My name is: _____

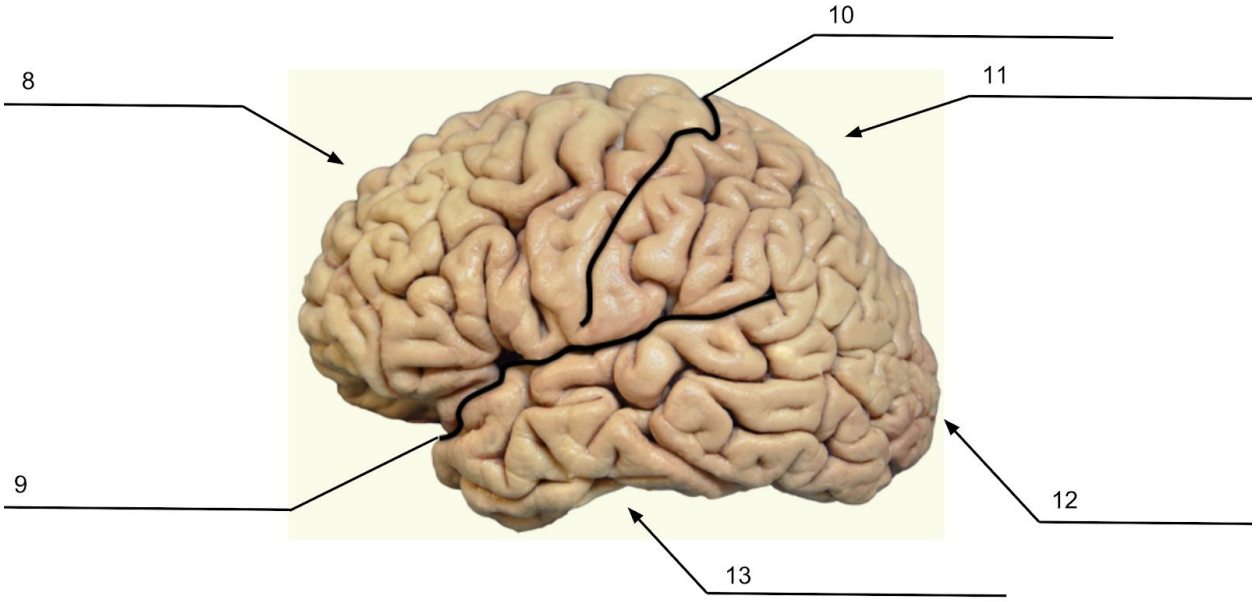
I worked on the exam with: _____

Question #1: Basic Neuroanatomy (50 points).
Label each structure (2 points each).

1.1 Planes. Label the planes (**axial**, **coronal**, and **sagittal**) and the **gray matter**, **white matter**, **ventricles**, and **deep nuclei**.

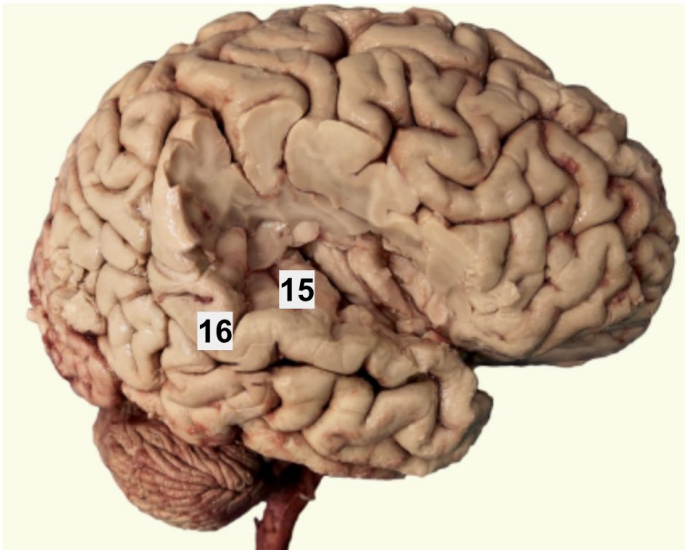


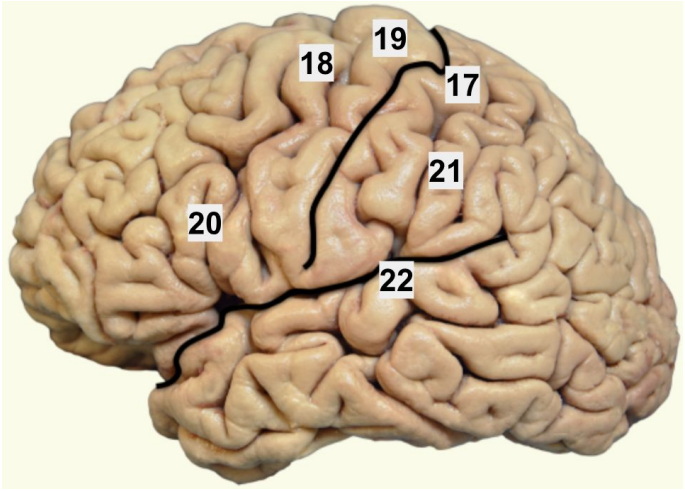
1.2 Major lobes. Label the five major lobes (**frontal**, **parietal**, **occipital**, **temporal** and **limbic**), the **central sulcus** and the **lateral fissure**.



Not pictured: 14_____

1.3 Functional areas. Label the primary cortical areas (**primary motor**, **primary somatosensory**, **primary visual**, and **primary auditory** cortex) and the association areas (**supplementary/premotor association**, **somatosensory association**, **visual association**, and **auditory association** areas). Also include **Broca's**, **Wernicke's,** and **arcuate fasciculus**.





15. _____

16. _____

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23. _____

24. _____

25. _____

23. What connects Broca's to Wernicke's?

Question #2: Neurons (50 points).
Answer each of the sub-questions below

2.1 Structure of neurons. In class we mentioned that we can think of the brain as being made up of just four things: gray matter, white matter, ventricles, and deep nuclei. We also mentioned that *neurons* are made up of just four basic things: **soma**, **dendrites**, **axons**, and **presynaptic terminals**. Draw a picture of a neuron and label these four things. Then, describe (in your own words) the role of each of these parts.

2.2 Function of neurons. Imagine you are a scientist studying neuron behavior. Your lab has technology that allows you to determine whether or not a neuron has fired. Specifically, this device will report whether or not a neuron has sent its *integrative* signal. Using this device, you learn that a particular neuron has NOT fired (this neuron has not sent its integrative signal). What can you infer about what happened at each of the other signaling steps we discussed in class?

Question #3: Methods (50 points).

For each of the following, describe (1) which method the student should choose to address their research question and (2) give at least four reasons to justify your choice (including at least one reason why each of the other methods would not be a good choice). Possible methods include: **fMRI, DTI, fNIRS, ERP**.

- **Student 1** wants to know whether Broca's area is activated during infant babbling.

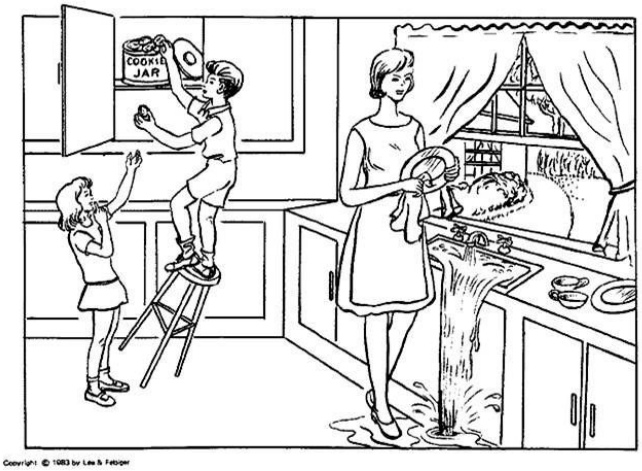
- **Student 2** wants to know whether non-human primates have both a superior longitudinal fasciculus and an arcuate fasciculus in their left hemisphere.

- **Student 3** wants to know whether sleeping newborn infants show brain activation in the basal ganglia when listening to their native language — the language spoken by their caregivers — compared to a foreign language.

- **Student 4** wants to know at what point in garden-path sentences (e.g. "Mary gave the child the dog bit a Band-Aid") the brain responds to the parsing error.

Question #4 The Language Network (50 points).

Imagine you are a neurologist specializing in aphasia after stroke. Today, you will be seeing two patients: Henry and June. You've already ordered brain imaging for each patient, revealing which areas have been damaged by their stroke. Using the brains on page 2 as a reference point, Henry has damage in area 22 while June has damage in area 20. During today's appointment, you'll show each patient the cookie thief photo to further diagnose. For each description below, (1) say which patient it likely belongs to (Henry or June), (2) describe at least three language-related symptoms you expect them to display, and (3) mention what kind of aphasia you think they have.



- **Description 1:** "OK. Uh… water, uh … leaking, uh, from sink, uh. Window… seems… to… be… o-pen, uh.Outside view… of … the next house, uh. See... bushes… uh, trees and walk… uh … way and… grass …and, uh … kids… uh. Going … to … fall … off … the … stool, and, uh … he's, uh… taking cookies … and, uh … and a housewife, uh … standing … uh, in a … puddle … of water, and, uh … boy, uh … handing … cookie … to … girl, and, uh, … she … seems … to… be finding … the … her mouth, uh… sss, uh. Two cups, uh … plates, uh. Housewife, uh…drying dishes, uh. Curtains, uh. That's, uh… uh. Full cookie jar… and, uh… and a lid, uh…leaning on… cans… cookie jar. Pretty much. OK?"

- **Description 2:** "These things going in there like that. This one here, these two things here. And the other one here, back in this one, this one look at this one. I can't tell you what that is, but I know what it is, but I don't now where it is. But I don't know what's under. I know it's you couldn't say it's ... I couldn't say what it is. I couldn't say what that is. This shu-- that should be right in here. That's very bad in there. Anyway, this one here, and that, and that's it. This is the getting in here and that's the getting around here, and that, and that's it. This is getting in here and that's the getting around here, this one and one with this one. And this one, and that's it, isn't it? I don't know what else you'd want."