

### Directions and Questions for First Exam

Bring **two** bluebooks available in the university bookstore with **nothing** written in or on them (not even your name). These may be redistributed at the time of the exam.

The exam will consist of the two parts, for which the instructions and possible questions are as follows:

**Part A. Briefly (in one to three complete sentences) answer each of the following six questions. Do not add extraneous information—you will *not* receive extra credit for going beyond a basic answer. Each question is worth up to 5 points (30 points total).**

The actual questions will be drawn from those listed below:

1. In what respect did Galvani think muscles were like a Leyden jar?
2. What could researchers measure with the galvanometer that they could not measure with the frog electroscope?
3. What made the stain developed by Golgi particularly useful for brain researchers?
4. In what respect did Golgi's interpretation of his stained images support holism?
5. What was the main strategy Huxley employed in developing his and Hodgkin's model of the action potential?
6. What, according to Keijzer et al.'s skin-brain hypothesis, was the task for which neurons first evolved?
7. What does a central pattern generator do?
8. What criteria did Brodmann use to demarcate areas of the brain?
9. What are shown on connectome maps?
10. What was Gall's approach to linking mental capacities to the brain?
11. What effects did Flourens observe when he removed regions of the neocortex?
12. What language abilities were affected and what were retrained in Broca's patient Tan?
13. What is a major difference in the way Broca and Wernicke addressed language deficits?
14. What can one conclude with high confidence about a brain area as a result of identifying a deficit in an activity when it is damaged or lesioned?
15. How could one make a mistake in interpreting the response elicited in a stimulation study?
16. What are at least two different techniques researchers use to record activity from the brain as an organism is performing a task?
17. What type of stimulus did Hubel and Wiesel discover elicited responses in neurons in V1?
18. What does one know and what doesn't one know just from detecting activity in a brain region in response to a specific type of stimulus?
19. What conclusion did Raichle draw from observing that under almost all task conditions there were brain areas that exhibited less activity compared with the resting state?
20. What is meant by calling something in one's data "noise"?
21. What is a major reason neuroscientists think findings with a model organism (e.g., worms, mice) might be applicable to humans?
22. Why, according to Bargmann, is it important to take neuromodulators into account in studying wiring diagrams of the brain?
23. What sort of evidence can be used to demonstrate that worms or fruit flies sleep?

**Parts B. Address the following two questions each in an essay (35 points each).**

On the actual exam, I will pick two of the following questions. In response to each, write as clear and detailed an essay as you can in the time allotted.

1. Construct a debate between Golgi and Cajal, making it clear what are the issues on which they agreed and disagreed. Discuss the nature of the evidence each presented and how each interpreted it. Explain why each thought their interpretation of the evidence was superior. Offer a hypothesis as to why neither was moved by what the other said. After presenting the debate, reflect on how disagreements like this can be resolved.

2. Controversies between holists and localizationists have arisen several times in the history of neuroscience. What are the major differences between holists and localizationists? Focus on two episodes we have discussed and describe the evidence that the advocates for each side in the debate offered for their position. How did the controversy get resolved in each case? Are controversies between holists and localizationists likely to be an ongoing feature of neuroscience, or can one of the positions be permanently refuted?

3. Defend or challenge the claim “The project of identifying and characterizing the role of different brain areas in vision (as exemplified in Hubel and Wiesel) is just a modern-day version of phrenology.” Be sure to make clear what is being said by calling something modern-day phrenology and what are the goals of the research on visual processing. Make clear why you think the label *modern-day phrenology* does or does not characterize these studies. Given your interpretations, do you view such a claim as praising or blaming research identifying and characterizing brain regions involved in vision.

4. Brodmann developed a map of the cortex in humans and several other species. What was he trying to show in these maps? Why was he not able, based on the evidence from which he constructed his maps, to determine what brain regions do? Explain how other techniques we have discussed have enabled researchers to offer accounts of what some of these regions do. Describe in some detail what you take to be particularly useful about the techniques and how they can provide information about what brain regions do. In addition, make clear what are each techniques limitations.

5. Insofar as we are principally interested in understanding how our human brains operate, what is the point of looking at other species? Discuss how research on at least one other species has figured in the research we have examined and consider reasons why some view such research as having promise to produce insights into how our brains work as well as reasons why others might find such research to be misguided. Identify what you take to be major considerations in evaluating how researchers draw upon such research in understanding us.

6. You have a new instrument which allows you to temporarily and selectively activate or inactivate neurons in your pet’s brain. Describe in detail how you might use this tool to study how your pet’s brain works. Make clear both how you hope to get new insight into how your pet’s brain works from your investigations as well as what would be some of the challenges and limitations you would encounter in interpreting the results.