

### Directions and Questions for Final 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 are as follows:

**Part A. Answer each of the following six questions in two to three sentences each (do not go on at length—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. What, according to Grush, can you do with a representation that you cannot do with a presentation?
2. What is the main difference between closed-loop and pseudo-closed-loop control?
3. What does Akins present as the traditional view of the senses?
4. Why does Akins deny that thermoreceptors represent temperature?
5. What point about representations does Chemero make by introducing the finger wagging task?
6. What is the strategy Chemero advocates for developing a dynamical explanation of a behavior?
7. What relation does the theory-reduction model assume to hold between a reducing theory and the theory it reduces?
8. When, on the theory-reduction account advocated by the Churchlands, should a theory be eliminated?
9. Identify three of the goals reductionists such as the Churchlands claim would be served by reducing psychological theories to neuroscientific ones.
10. What is the research strategy associated with ruthless reduction?
11. To what level should a reduction aim to reduce psychological phenomena on Bickle's account of ruthless reduction?
12. What is a fundamental difference between ruthless reduction and mechanistic reduction?
13. What must one mechanism be able to do in order to control another?
14. On what basis do *E. coli* decide to run or tumble?
15. What is quorum sensing? Why do some bacteria do it?
16. What advantage do *M. xanthus* gain from hunting in packs?
17. Why is a bacterium's decision to sporulate only to be made in desperate circumstances?
18. What activities go on in the root tip of plants to make Darwin and others refer to them as root brains?
19. What does the "skin brain" in the jellyfish do?
20. What is a neuromodulator? What does it modulate?
21. What is meant by a connectome?
22. What type of roles does the hypothalamus play in vertebrate behavior?
23. What would be the consequences if your basal ganglia were totally destroyed?
24. What is a pattern generator? Why is it important in controlling muscles?
25. How does heterarchy differ from hierarchy?

**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. Write as clear and detailed an essay as you can in the time allotted.

1. Bechtel and Grush agree that representations play a role in control systems, but they differ as to the type of control system in which one finds representations. Briefly characterize the different types of control systems that Grush distinguishes and explain in which types Bechtel and Grush respectively locate representations and the role they play in these types of control systems. What are the implications of their views for whether bacteria or jellyfish have representations?
2. Construct a debate between Grush and Chemero about how representations should figure in neuroscience. What are the contexts in which Grush claims representations occur? How would he respond to Chemero's finger-wagging task? Would he think it involves representations? If not, when would he think representations are needed? How would Chemero respond to Grush? Referee the debate by indicating who has the better case and why.
3. Given a theory-reduction framework, what would be involved in the reduction of psychology to neuroscience? How might co-evolution figure in such a reduction? What are the primary objectives that would be served by such a reduction? Also present what you take to be the strongest argument against pursuing such a reduction. Defend a position as to whether such reductions should be pursued.
4. Explain what Bickle has in mind by ruthless reduction and what you take to be his strongest argument for ruthless reduction. Consider one of the alternative accounts of reduction and both explain how it differs from ruthless reduction and identify what you take to be the strongest argument for favoring it over ruthless reduction. Defend a position about which version of reduction should guide attempts to relate neuroscience to cognition.
5. How useful is it to develop a connectome for various species (worms, fruit flies, mice, humans)? What benefits does having a connectome offer researchers trying to study how the species generates behavior? What does Bargmann claim are limitations of connectomic analysis? Is she right? If so, what else is required to develop a useful explanation of behavior? If not, describe how neuroscience research should proceed.
6. Do non-vertebrate animals or organisms other than animals make decisions? Is having a centralized brain needed to make decisions? Develop an analysis of what it is to make a decision that fits your answer to these first two questions. Then apply it to one or two of the organisms we have examined, making it clear why, on your analysis, these organisms do or do not make decisions.
7. Do organisms like slime moulds really solve maze problems? Answering this question requires you to say what problem solving is, and then considering whether slime mould behavior as described in the papers we read should count as problem solving. Think about the activities the slime moulds are reported as doing from the perspective of the slime moulds. Are there problems they are engaged in solving? What are the implications of your stance on slime moulds for understanding problem solving in humans?
8. What are the main differences between a hierarchical and heterarchical conception of organization, especially with respect to the brain? Drawing on material we have covered in this class, portray the brain as hierarchically organized and as heterarchically organized (try to make each framework apply as well as possible). Which framework seems to fit best? If you don't think either fully fits, present a further option. What are the implications of your chosen framework for understanding mental activities and how you understand yourself and other human beings as agents.