This document is the essay answer key for Midterm 2, Spring 2016. The annotations show how many points were awarded for different components of the answer.

Midterm 2, Answer Key for the Essay Question

41. **ESSAY QUESTION (4 points):** Goldstein describes two processes, reactivation and reconsolidation, that occur when a person or animal retrieves a memory. Studies with rats and humans suggest that psychologists can manipulate these processes so as to treat patients with post-traumatic stress disorder (PTSD). Explain the following:

   (i) Brunet has proposed a method for treating a PTSD patient. Describe what happens in his treatment.

   * Of course, the information given to you in the textbook and lecture is merely a sketch of what he has proposed, so we don't expect anything more than an outline of the procedure.

   (ii) Why does this method succeed at reducing the emotional response to traumatic memories? What are the assumptions about how memory works that are invoked to explain why this method works? Your answer should explain the role played by reactivation and reconsolidation in memory, and how this treatment manipulates these processes to reduce the emotional response to traumatic memories.

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**Answer Key:**

- For purposes of grading this essay, we won't worry about whether the essay answer cites the drug by name, propranolol, or even whether it names it, e.g., if the essay answer simply calls it "the drug" or calls it by a wrong name, that's ok.

- The essay answer should note, however, that if propranolol is injected immediately following a traumatic experience, it reduces PTSD.

  * A more accurate way to put this is that if propranolol is injected within a few hours of the traumatic experience, then the patient will produce weaker fear and stress responses when recalling the traumatic experiences at a future time.

  * The less nuanced way of describing the effects of propranolol ("it reduces PTSD") is acceptable in this essay.

**Part (i): What happens in Brunet et al.'s treatment:**

- Two scripts are prepared for each patient that describe their traumatic experience in detail. A tape recording is made of someone speaking scripts.

  * This step can be omitted from an essay answer, but the answer should assume that patients will later listen to a spoken description of their own traumatic experience.

- At the treatment session, all patients listen to a taped description of their traumatic experience. They are told to imagine the traumatic experience as they listen to the tape. This reactivates their traumatic memories.

- Shortly after listening to the taped version, treatment patients are injected with propranolol (or they take the drug in pill form). Placebo patients are injected with a placebo (or they take the placebo in pill form). Patients are randomly assigned to the treatment group and placebo group.

- One week after the treatment session, patients return to the lab for a test session. Patients listen to another taped description of their traumatic experience. Once again, they are told to imagine the traumatic experience as they listen to the tape. Physiological measures of fear and stress are taken while they listen to the tape.

**Comment [A1]:** .5 for describing this part of the procedure and .5 for mentioning the control group at least one somewhere in the essay.

**Comment [A2]:** .5
• It isn't critically important that the essay answer states that the listening occurred "one week later", but the answer should be clear that the test session was not on the same day as the treatment session. At the very least, the answer should say that the test session happened "later" - and not 10 minutes later.

• Result: Patients who received propranolol display much less stress than do the patients who receive the placebo.
  * The detailed answer is that the propranolol patients displayed less elevation in heart rate, skin conductance and frowning (corrugator EMG).
  * The detailed answer isn't necessary, but the essay answer should at least recognize that the propranolol patients displayed less fear and stress when listening to the tape (a better way to put this is that they displayed fewer physiological correlates of fear and stress).

Obviously a good essay answer has to weave the points made above into a coherent essay. I haven't tried to do that here because different students will have different ways of combining these points. The grading of part (i) should be based on whether the essay answer notices the key points, but also whether the essay is well written and well organized. The latter qualities are subjective, but the graders (TA's) still have to make the judgment whether the writing is of good quality.

Part (ii): Why does this method succeed at reducing the emotional response to traumatic memories? What are the assumptions about how memory works that are invoked to explain why this method works?

• One important assumption is that propranolol can block the learning that is involved in fear conditioning. This is indicated by the fact that injection with propranolol immediately following a traumatic experience reduces fear and stress responses when later recalling the traumatic experience.
  * Propranolol blocks the synthesis of proteins that are involved in learning the conditioned fear response. This point does not have to be mentioned in the essay answer.

• It is also known that if a person is injected with propranolol more than a few hours after the traumatic experience, it will not have the effect of reducing the conditioned fear response.
  * It is not necessary to mention this point in the essay answer because the question asks why Brunet's treatment succeeds, not whether injection with propranolol would reduce fear conditioning even if the patient is not asked to recall the traumatic experience.
  * It would be a mistake, however, if the essay answer said simply that "propranolol reduces PTSD" as if this effect would occur no matter when injection with propranolol occurs, e.g., months after the traumatic experience. The essay answer should be clear that having the patient retrieve the memory of the traumatic experience at the time of the injection with propranolol is a necessary condition for the treatment to succeed.

• The other assumption is that memories are fragile at time of retrieval. Retrieval of a memory requires reactivation of the neural circuits that were active at time of encoding. To return the memory to its permanent state, the pattern of reactivated circuits undergo a process of reconsolidation.
  * FYI: There is a debate in the literature whether reconsolidation is different from the initial consolidation of a memory. The current view seems to be that reconsolidation is very similar to the consolidation of the memory as it was initially encoded, and that the question whether reconsolidation and consolidation are equivalent processes is an open question. Obviously, this point does not need to be mentioned in the essay answer.

• Brunet's treatment succeeds in reducing fear and stress responses to memories of a traumatic experience because the injection of propranolol at the time of retrieving the traumatic memories blocks the reconsolidation of the association between traumatic memories and fear and stress responses that were previously associated with these memories. Thus, when the patient recalls the traumatic memory at a later time, the fear and stress responses are no longer as strongly linked to the traumatic memory, so these responses are no longer retrieved or are retrieved to a diminished degree.

Again, a good essay answer has to weave the points made above into a coherent essay. Different students will have different ways of combining these points. The grading of part (ii) should be based on whether the essay answer notices the key points, but also whether, in the judgment of the TA's, the essay is well written and well organized.

Comment [A6]: I took 0.1 point off if students did not write their response in essay format (some of them used bullet points or answered parts 1 and 2 separately). I reminded them twice (once before the practice quiz and once after the actual quiz) to remember to write a short essay.