

SUPPLEMENTARY MATERIAL

Final review project assignments

This paper investigates current progress and outstanding questions related to the specific question interest that student groups (2-3 students per group) choose under instructor guidance. Example topics have included mechanisms of dopamine in the prefrontal cortex in cocaine addiction, repair of spinal cord injuries, and mechanisms by which sleep enhances academic performance. In addition to the final paper, students are required to teach classmates about their topic through oral presentations. Numerous smaller assignments precede and contribute to the final review paper in order to optimize student performance. These assignments include (percentages are contribution of each to total course grade—the entire project is 55% of course grade):

Annotated bibliography (7%--Due in week 5)

Objectives:

- 1) Become effective in operating search engines commonly utilized in biological research.
- 2) Increase ability to read and understand the important aspects of neurobiological research papers.
- 3) Increase content knowledge pertaining to a specific neurobiological topic of interest.

Student groups construct an annotated bibliography of 10-15 primary papers that may be utilized in their final review.

Class presentation of research question and related primary research paper (8%--Due in weeks 8-9)

Objectives:

- 1) Become effective in operating search engines commonly utilized in biological research.
- 2) Increase ability to read and understand the important aspects of detailed neurobiological research papers.
- 3) Improve scientific communication skills through the process of describing detailed neurobiological research in an oral presentation.

Students choose an empirical research article that they find interesting and impactful. One week prior to the presentation, the group submits to the instructor an outline of hypothesis, methods, results, and relevance. Groups then present to the class the question chosen by the group and the details of the experiment (students are provided a list of questions to answer about the experiment such as “What differences between treatments existed?” and “Which data supports the authors’ conclusions?”).

Outline and working draft of final paper (10%--outline due in week 10, working draft due in week 11-12)

Objectives:

- 1) Apply neurobiological principles while investigating a specific neurobiological question.

- 2) Evaluate the BRAIN Initiative in the context of a specific neurobiological question.
- 3) Increase student effectiveness in critical reading of scientific literature.
- 4) Investigate current experimental techniques, considering strengths and limitations.
- 5) Improve student effectiveness in scientific communication.

Students must address each component of the final paper (see item list below), including citations, in the outline. Students then turn in a working version of the paper that they consider to be near-final for formative feedback.

Class presentation of final paper (10%--due in week 15)

Objectives:

- 1) Same as “Outline and working draft” Objectives 1-4, above.
- 2) Improve scientific communication skills through the process of describing detailed neurobiological research in an oral presentation.

Student groups present their findings to classmates in a presentation that answers the major questions of the final paper assignment through discussion of primary figures.

Final review paper including group member peer evaluations (20%--due during finals week, which is week 16)

Objectives: Same as “outline and working draft”, above.

Assignment: Work in groups to choose a question of interest from the field of neurobiology. Get instructor approval for question. Investigate current progress and existing understanding of the answer to the question. Then, write a review paper detailing:

- What is your question and why is it important?
 - Explain the bigger picture of neurobiology within which your question is framed. Address foundational neurobiological concepts that are relevant to your question.
 - Explain why your question is relevant to society.
- What is currently known about the answer to your question?
 - Explain experimental techniques utilized to obtain that understanding and why those techniques were effective.
 - Address common model organisms in studies related to your question and why each model organism is used.
 - Describe the pertinent aspects of key studies that built understanding.
 - Describe where most funding for the research you addressed has come from.
- What remains to be understood about the answer to your question?
 - Describe ongoing research that is being undertaken to answer the question.

- Explain experimental techniques that are being developed to answer the question and address why those techniques are expected to be effective.
- Describe roadblocks to understanding the answer to your question for which new experimental approaches are needed.
- Propose one experiment that would help to advance understanding of the answer to your question. Your proposal should include:
 - Clear hypothesis
 - Detailed, clear explanation of treatment groups and experimental techniques
 - Clear explanation of statistical analysis
 - Expected results of experiment if your hypothesis is supported
 - Clear explanation of how the results will advance understanding of question
 - Clear explanation of limitations of the experimental results for answering question
- How will the BRAIN Initiative inform progress on your question?
 - Describe how the BRAIN Initiative might help to overcome outstanding problems and questions that were discussed in “what remains to be understood?” above.
 - Consider whether a project with the scope of the BRAIN Initiative is needed for overcoming previously detailed roadblocks or whether smaller scale funding would be more effective.
- Peer evaluations are turned in three times per semester (at time of annotated bibliography, outline, and final paper). Students evaluate meeting attendance, contribution to discussion/writing, quality of work, and collegiality for all group members. Students are also asked to reflect more generally on lessons they have learned about group dynamics and behaviors in each round of evaluations. The peer evaluation grade in the final paper reflects all three rounds of evaluations.