

PSY 320 Research Seminar in Biological Rhythms
Spring 2019

Instructor: Mary Harrington
Sabin Reed 429, 585-3925, office hours Mon 11-12, Friday 3-4, or by appointment
Class meets MW 2:40-4pm, room Bass 211

Week 1:

Jan 28: Why do we have circadian rhythms?

Start Coursera course by Martha Merrow and Till Roenneberg. This should be completed by Week 6. Audit the course – no need to apply for the certificate.

Jan 30: What makes a strong research plan?

Papers:

1. Platt JR. Strong Inference: Certain systematic methods of scientific thinking may produce much more rapid progress than others. *Science*. 1964 Oct 16;146(3642):347-53. PubMed PMID: 17739513.
2. Hiebert SM. The strong-inference protocol: not just for grant proposals. *Adv Physiol Educ*. 2007 Mar;31(1):93-6. PubMed PMID: 17327589.
3. Fudge, D.S. (2014) Fifty years of J.R. Platt's Strong Inference. *Journal of Experimental Biology*, 217, 1202-1204.

My summary of this method:

1. *What is the research question?*
 - a. *Is this a question no one knows the answer to?*
 - b. *Are you curious about this question?*
 - c. *Will answering this question move the field of biological rhythms forward in important ways?*
 - i. *Phrase your question as "Why...?" or "How...?"*
 - ii. *Specify: "Upon answering this question, we will newly be able to...."*
2. *Think about the many ways you might answer this question. Get creative!*
 - a. *List as many possible research hypotheses as you can.*
 - b. *Keep at this step for a while, and later keep coming back to it.*
 - c. *Does each hypothesis offer a satisfactory explanation for the research question?*
 - d. *To avoid falling deeply in love with one idea, do not proceed until you have at least two plausible research hypotheses that can answer your research question.*
3. *For each hypothesis, list predictions that arise.*
 - a. *List as many predictions of that hypothesis as you can think of. Come back to this step multiple times.*
 - b. *Write each prediction in an "If....., then...." format.*
 - c. *For each prediction, note if it is a critical prediction, meaning that if that prediction fails, you will need to discard that hypothesis. These are the predictions you will want to test in your research.*
4. *Plan tests of critical predictions in such a way that you can confidently draw conclusions from the results.*
 - a. *Be explicit in thinking through your potential conclusions prior to conducting the test. Describe each possible outcome with an "If I get outcome. . . then I will conclude...." statement.*

Week 2:

Feb 4: How can we measure circadian rhythms?

Feb 6: How does the brain control circadian rhythms? The role of the SCN.

Reading reflection: Submit by Moodle prior to class your reactions to all the readings, points of confusion, aspects you found interesting. Come to class with draft of one paragraph citing all of the SCN papers (1-3 below). I will call on pairs of students to summarize each paper or a figure from one of the papers.

Papers:

1. Stephan FK, Zucker I. Circadian rhythms in drinking behavior and locomotor activity of rats are eliminated by hypothalamic lesions. *Proc Natl Acad Sci U S A*. 1972 Jun;69(6):1583-6. PubMed PMID: 4556464
2. Ralph MR, Foster RG, Davis FC, Menaker M. Transplanted suprachiasmatic nucleus determines circadian period. *Science*. 1990 Feb 23;247(4945):975-8. PubMed PMID: 2305266.

3. Berson DM, Dunn FA, Takao M. Phototransduction by retinal ganglion cells that set the circadian clock. *Science*. 2002 Feb 8;295(5557):1070-3. PubMed PMID: 11834835.

Week 3:

Considering a major unanswered question in the field as a research question: What is the best way to adjust to jetlag?

We will read one paper closely (Serkh & Forger, 2014; posted on Moodle) and will discuss the second lecture from our Coursera course. On Wednesday we will discuss our ideas with a researcher in this field, Olivia Walch, joining us by Skype.

Reading reflection: Submit by Moodle prior to each class your reactions to the lectures and readings, points of confusion, aspects you found interesting.

Week 4:

Feb 18: How does circadian disruption impact health?

Reading reflection: Submit by Moodle prior to class your reactions to the readings, points of confusion, aspects you found interesting.

Papers:

4. Evans JA, Davidson AJ. Health consequences of circadian disruption in humans and animal models. *Prog Mol Biol Transl Sci*. 2013;119:283-323. doi: 10.1016/B978-0-12-396971-2.00010-5. Review. PubMed PMID: 23899601.
5. Li JZ, Bunney BG, Meng F, Hagenauer MH, Walsh DM, Vawter MP, Evans SJ, Choudary PV, Cartagena P, Barchas JD, Schatzberg AF, Jones EG, Myers RM, Watson SJ Jr, Akil H, Bunney WE. Circadian patterns of gene expression in the human brain and disruption in major depressive disorder. *Proc Natl Acad Sci U S A*. 2013 Jun 11;110(24):9950-5. doi: 10.1073/pnas.1305814110. PubMed PMID: 23671070
6. Vetter C. Circadian disruption: What do we actually mean? *Eur J Neurosci*. 2018 Nov 7. doi: 10.1111/ejn.14255. [Epub ahead of print] Review. PubMed PMID:30402904.

Week 5:

What is the role of circadian disruption in women's health?

Feb 25: Breast cancer: Reading posted on Moodle

Feb 27:

Lunch hour Lecture by Dr. Martin-Fairey, "The Clocks that time us: A time to deliver"

In class discussion with Carmel Martin-Fairey on the role that circadian disruption plays in preterm birth

Week 6:

What is your research question?

Mar 4: General class discussion and selection of research topics

Mar 6: Moving from a research topic to a research question

Week 7:

How will you answer that research question?

Mar 18: Innovation

Mar 20: Final research focus proposals – short presentations

Week 8:

Let's get started!

Mar 25: Finding data

Mar 27: Analysis begins; by Mar 27 post your journal article for Weeks 11 and 12

Week 9:

Help with writing

Apr 1: NSF GRP grant writing advice; Outreach discussion

Apr 3: Peer comments on ideas for grants

Week 10:

Building your outreach plan

Apr 8 – Outreach discussion

Week 11 and 12:

Student-led classes

Apr 15 & 17 -Student-led discussions of research papers (15-20 min per student)

Apr 22 – Draft grant proposal due

Apr 22 & 24 – Student-led discussions of research papers (15-20 min per student)

Week 13:

Wrap up

Apr 29 & May 1 - Posters and grant ideas

General Info

This is a research seminar where student-generated research combines with critical reading and discussion of primary literature. Research will include preparing and critiquing research project proposals, analysis of data, and presentation of ideas and results as posters and as a final paper. Everyone will take a different path through the research seminar. Some students will be new to the field and will be designing their first study, whereas others will be working on an on-going project or writing up a newly completed research project.

We will meet weekly to discuss readings and projects. We will begin with a broad-based survey of the field, and later readings will address the interests of the students in the class. Our weekly meetings will also serve to build your data analysis skills.

You are expected to enter this research seminar with background that prepares you for this level of advanced study. Background in statistics and research methods is essential, and some experience working in a laboratory is helpful.

Each week you are expected to spend ~3 h in meeting with the class as well as approximately 9-10 h outside of class, either reading, researching, or preparing presentations.

Academic Accommodations: If you have a disability and would like accommodations in this course, please contact the Office of Disability Services in College Hall 104 or at ods@smith.edu as soon as possible to ensure that we can implement accommodations in a timely manner. Please come talk to me during office hours if you have suggestions for how I might alter this course to better help you learn.

Assignments

Goal: Work effectively to carry out a research project (60% of your final grade).

1. Research group meetings: If possible, each of you will participate in a research interest group and will meet regularly to discuss progress and to troubleshoot.
2. Project proposal: Detailed proposal for a research focus, incorporating the "strong inference protocol" approach (see articles by Platt (1964) and Hiebert (2007)). (draft: Mar 4; Final: Mar 20)
3. Week 13: Poster presentation of ideas and results, in class and with other classes
4. Throughout the semester: Carry out your research project! Keep a detailed lab notebook and associated files. Your lab notebook should include summaries of articles you have read that are related to your topic, and your thoughts. Clearly specify where your computer files are kept and what they contain. Follow best practices for maintenance of laboratory notebooks.

Goal: Gain professional background in the field of circadian rhythms by reading original research articles (10%).

1. Weeks 2-4: Reading reflections on assigned readings
2. Weeks 11-12: Lead a short discussion of a related paper. Actively participate in discussions of other papers.

Goal: Develop knowledge, writing, and ideas to a level appropriate for a grant to fund graduate school studies.

- o Week 12: draft due
- o By midnight May 10: Two page summary of future research ideas (20%).

Goal: Develop knowledge and presentation skills by offering a talk or activity for a non-scientific audience on a topic related to this class (10%).

- o By the end of finals period: One page summary of an outreach activity related to the class.

Grading:

10% Class discussion and reading reflections

10% Class discussion leader

10% Research proposal (5%: draft due Mar 4; 5% final due Mar 20)

20% Research process documentation (lab notebook, computer files)

20% Final product (poster and presentation) (week 13)

20% Plans for future research: 2 page paper in format for NSF "Graduate Research Plan Statement", draft due Apr 22, final version due by end of finals period. {graded by growth from your research proposal, fit to NSF guidelines, originality of ideas, likely scientific impact of research}.

10% Outreach component {one page summary of your outreach activity