

Instructor: Mary Harrington: x3925, Sabin Reed 429, (mharring@smith.edu) Office Hrs: T 11-12 and F 230-330 or by appt.

Lab Instructor: Narendra Pathak, Sabin Reed 433, npathak@smith.edu

Teaching Assistants: Dominica Cao, Gigi MacDonald

Texts: Harrington, M (2011) The Design of Experiments in Neuroscience. Sage.

Carter M and Shieh J (2015) Guide to Research Techniques in Neuroscience. Academic Press.

Santiago Ramon y Cajal, Advice to a Young Investigator

Class meets in Ford 015 MWF 10-1050, and Sabin Reed 428 or Ford 015, T 1-350

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.

Below is an overview of the entire course, followed by a detailed syllabus. The precise timing of this schedule may change depending on how our experiments progress.

Overview:

A. Descriptive neuroanatomical studies

Learn to cut and stain brains. Use Allen Brain Atlas and on-line zebrafish resources to conduct research on a brain region. Graphic presentation of data, preparing a scientific poster.

B Zebrafish experiments: Neuroanatomical, behavioral, and gene expression approaches

Conduct experiments with zebrafish. Learn multiple techniques.

C. Two Group, between subjects design and correlational design

Compare 2 groups of zebrafish in behavioral tests. Inferential statistics for 2 group designs: t-tests.

Writing a paper for publication: Methods and Results sections.

D. Independent Research Projects

Finding previously published research on a selected topic.

Designing and conducting an experiment. Analyzing the results. Final paper (all sections) and poster presentation.

GOALS

There are several **goals** in NSC 230. By actively participating in this course, you will:

- 1) **READ:** Gain understanding of how to read, interpret and critique reports from other scientists,
- 2) **RESEARCH:** Learn to design, conduct and analyze your own scientific experiments,
- 3) **USE YOUR HANDS:** Become familiar with a variety of laboratory techniques used in the field of neuroscience,
- 4) **DOCUMENT:** Learn how to keep an excellent lab notebook and
- 5) **COMMUNICATE:** Improve your skills in reporting your research through posters and writing scientific papers.

I will also spend some time talking with you about career options, and life as a scientist. It is my goal that participation in this course will help you choose your career path and will give you skills to succeed in the scientific workplace.

What are YOUR goals for this course?

Week 1 – Jan 26-Feb 2: Descriptive neuroanatomical studies

F Jan 26: Introduction to syllabus. Complete Health forms and team letters. Select a lab notebook and discuss keeping a lab notebook.

M: Discuss team strengths. Begin work on ground rules.

Lab: Cut brain sections. Mount sections on slides. Learning the "Brain areas to know". Choose brain region of interest (ROI) {cerebral cortex, cerebellum, hippocampus, or olfactory bulbs} and find it on the slides.

W: Stain your slides. Discuss reading from "Ethical Issues in Scientific Research: An Anthology".

F: **Team time:** Meet with your team to finalize ground rules. Draft as a team a 2 paragraph background on the ROI you have chosen. Distill this to 5-6 bullet points for your poster. Post on your Google doc and share with instructors.

- ✓ Readings for this week: Histology Lab reading on Moodle, Brain Areas to Know, General reading on lab notebooks, pages 233-266 from "Ethical Issues in Scientific Research" (on Moodle), "Design of Experiments in Neuroscience" Chapter 1
- ✓ Team ground rules posted to Google doc shared with Mary and Naren by Fri Feb 2 5pm
- ✓ **Self-report participation** by Sun Feb 4 5pm. Explain any absences.
- ✓ **Portrait of the Scientist as a Young Woman (PSYW)** – "What are your goals for this class? Prioritize the listed class goals on the syllabus as they relate to your needs, and explain additional goals." (Write by Sun Feb 4 at 5pm, post on Moodle under "A Portrait of the Scientist as a Young Woman". This continuing assignment will be added to each week. No need to "submit" the assignment.)
- ✓ Weekend reading: posted on Moodle

Week 2 - Feb 5-9: Descriptive neuroanatomical studies

M: Animal Use training (do NOT miss class!) {*complete CITI training prior to lab*}

Lab: CITI online training complete (print certificate at end). Study slides. Learn to take photos with microscope. Using poster file template provided, prepare panel with your own images and general background on ROI. Images should be annotated with scale and labels, accompanied by a figure legend. Explore ABA website. Discuss poster.

W: Discuss textbook readings for the week (Chs 2 and 3, Appx C). Descriptive statistics and scales of measurement.

Th: Feb 8 415pm Mt Holyoke lecture: Elaine Hsiao "Microbiome-nervous system interactions in health and disease"

F: "Team teach" on Ch 6 in Guide to Research Techniques.

- ✓ Reading for this week: Chapter 6 Guide to Research Techniques in Neuroscience (Visualizing neural structure), "Design of Experiments in Neuroscience" Chapter 2 and 3, and example article critique in Appendix C.
- ✓ **Self-report participation** by Sun Feb 11 5pm
- ✓ **PSYW** – "What are your personal views on the use of animals in research?"
- ✓ Weekend reading: posted on Moodle
- ✓ Start the article critique once the article is posted on Moodle this weekend. This is individual, not team, work.

Week 3 - Feb 12-16: First zebrafish experiment

M: **Team time:** Discuss weekend readings, video abstract, and reelin review (handout in class). Brainstorm ideas for your final zebrafish experiment.

Lab: Introduction to neuroanatomical studies of zebrafish. **Lab book check-in.**

W: Discuss Article critique – due at start of class, not accepted late. Work on Neuroanatomy posters.

F: Discuss "Seeking alternatives" and textbook readings.

- ✓ Reading for this week: "Seeking alternatives", on Moodle. Design of Experiments in Neuroscience, Ch 4 and Appx A pp 139-149
- ✓ **Due: First article critique (article and questions posted on Moodle) – email or hand in by 10am, Wednesday Feb 14;** use the form provided and try to keep to space provided, can be typed or hand-written. **Late article critiques are not accepted.** Article critiques are individual (not team) assignments and should reflect your individual effort only.
- ✓ **Self-report participation**
- ✓ **PSYW** – "What is one important factor that led to your interest in neuroscience?" (look ahead and select a medalist to meet next week.)
- ✓ Weekend reading: on Moodle
- ✓ **Due: Team Neuroanatomical Poster; submit as ppt file, due by Midnight Sun Feb 18**

Week 4 - Feb 19-23: Wrapping up your initial studies; circadian rhythms in zebrafish

M: Poster presentations. Discuss Rally Day events.

Lab: Introduction to circadian rhythms in zebrafish. **Lab book check-in.**

W: Collaborations forms due to instructors. Compare zebrafish brains with mouse brains.

F: Discuss readings. Review experimental designs. Collaborations forms due to college.

- ✓ Reading for this week: Design of Experiments in Neuroscience, Ch 5 and Appx A pp 149-160.
- ✓ **Self-report participation**
- ✓ **PSYW** – "Reflect on Rally Day – Select one medalist to meet. In what way does she impact your thinking about "the true purpose" of a liberal arts education? "
- ✓ Weekend reading: on Moodle
- ✓ Note: Second article critique – due by 10am Mon Feb 26.

Week 5 - Feb 26-Mar 2: Two Group, between subjects design and correlational design

M: Article critique due. Discuss article critique 2.

Lab: Test social behavior in 2 groups of zebrafish. Ethovision software. Finding articles. Ideas for final projects.

W: Discuss Chs 6-7 textbook.

F: Data analysis. Best practices.

- ✓ **Due: Second article critique at start of class Mon Feb 26.**
- ✓ Reading for class: In "Design of Experiments in Neuroscience" Chs 6-7
- ✓ **Self-report participation**
- ✓ **PSYW** – "Stop, start, continue: reflecting on your activities related to this class, and your goals for the semester, detail something you would like to stop doing, something you would like to start doing, and something you will continue doing."
- ✓ Weekend reading

Week 6 – Mar 5-9: Two Group, between subjects design and correlational design; Designing final projects

M: Team time. Planning final projects.

430 M Okunola Jeyifous "Probing the Cell Biology of Excitatory Neurotransmission"

Lab - Meet in Ford 015: Discuss ideas for final projects. Hand in draft of IACUC form by end of class. **Lab book check-in.**

W: Correlational designs.

F: Inferential statistics: the t-test

- ✓ **IACUC Form due** by end of class Mar 6.
- ✓ **Self-report participation; Team peer evaluation** by 5pm Mar 9.
- ✓ **PSYW** – "What are your strengths and weaknesses in working as a part of a team? Reflect on your team rules. Which rule was not one you all followed? What rule might you add now? "
- ✓ Weekend Reading: on Moodle

✓ Spring Break! Mar 10-18

Week 7 - Mar 19-23: Data Analysis

M : Making graphs using R

Lab - Meet in Ford 015: Analyze data from experiments. Work on preparation of reports. See guidelines posted on Moodle.

W : Analyze data from experiments.

F : Discuss behavioral assays (Ch 2).

- ✓ Reading for class: Research Techniques in Neuroscience, Ch 2.
- ✓ **Due: Behavioral Study Drafts due by Wed Mar 21 10am – submit by email. This is an individual (not team) report.**
- ✓ Reading: In "Design of Experiments in Neuroscience" Appx B.
- ✓ Self-report participation
- ✓ **PSYW**: "How might you take your interest in neuroscience into the world of business? What could you add to your training to make you more competitive for a job in the business world?"
- ✓ Weekend reading: link on Moodle

Week 8 - Mar 26-30: Independent Research Projects

M: Zotero training session – bring a laptop to class if you have one. Let Mary know if you would like a loaner.

Lab - Meet in Ford 015: **Project proposal presentations** by student teams. **Lab book check-in.**

W: Discussion of stereotaxic surgery and Ch 3.

F: Work on projects

- ✓ Guide to Research Techniques in Neuroscience Ch 3
- ✓ **Due: Proposal (PPT and 2 page summary) of independent research project proposal due from each team in lab Mar 27**
- ✓ **Self-report participation**
- ✓ **PSYW** – “Describe an aspect of public policy that you care deeply about. Describe how neuroscience research might play a role in public debate on that policy.”
- ✓ Weekend reading

Week 9 – Apr 2-6: Independent Research Projects

M : Microscope facility tour. Read Ch 5 Methods book prior to this

Otherwise : conduct team projects.

- ✓ Reading for Mon: Guide to Research Techniques in Neuroscience Ch 5
- ✓ Readings for this week: (1) In “Design of Experiments in Neuroscience” Ch 8, re-read Appx A. (2) Articles related to your team project. Work as a team to form an annotated bibliography on your shared Google drive.
- ✓ **Self-report participation**
- ✓ **PSYW** – “How do you think sexism and/or racism will influence your career in science?”
- ✓ **Due: Final Behavioral Study papers due from each student by 9am, Mon Apr 2, submit by email.**
- ✓ Weekend reading: on Moodle

Week 10 - Apr 9-13 : Independent Research Projects

M: Discuss weekend reading. Discuss Cajal readings. Come with selected quotes.

W: Discuss Ch 13 in methods book

F: Present poster in progress **Lab book check-in.**

Otherwise: Work on Final projects

- ✓ Read for Wed: Guide to Research Techniques in Neuroscience Ch 13
- ✓ Read: Articles related to your project.
- ✓ Read: Chs 1-4 in Ramon y Cajal’s “Advice for a Young Investigator”
- ✓ **Due: poster file** ready to send for printing. By end of the day Friday.
- ✓ **Self-report participation**
- ✓ **PSYW** – “How do you think your experiences in this course will help you most directly in your future work in school and beyond?”
- ✓ Weekend reading: Moodle

Week 11 - Apr 16-20: Independent Research Projects

M Discuss weekend reading.

Lab: Work on projects

W Final projects poster presentations

F - Discuss Cajal readings, with more quotes.

- ✓ **Due: Research project poster presentation, in-class Wed morning, one per team.**
- ✓ Read Ch 5-9 in Ramon y Cajal’s “Advice for a Young Investigator
- ✓ **PSYW** - Select one quote from Ramon y Cajal’s book and explain why you particularly like that passage.
- ✓ Weekend reading: On Moodle
- ✓ **Final Self-report participation; Team peer evaluation forms by Apr 23.**

Saturday Apr 21 - Collaborations – 8:30-10:30 poster presentation – attendance required!

Week 12 - Apr 23-27: Reflection

M: Discuss weekend reading. Discuss readings: "The Decline Effect" and Ch 1 in Methods book, and video posted

Lab - Meet in Ford 015: ******Final article critique Tues Apr 24****** (lab book check-in)

W: Discuss "Why most published research findings are false" (on Moodle).

F: Writing workshop

- ✓ Read for Mon: Guide to Research Techniques in Neuroscience Ch 1 and "The Decline Effect" (Moodle)
- ✓ **Apr 24:** Final article critique and proposal for a follow up experiment, during lab time block
- ✓ Tues, 530 pm –Helen Hills basement, Bodman Lounge – with a classmate, bring a dish to share. Kitchen open from 430 pm if you want to cook there.
- ✓ **PSYW:** How are your ideas of being a scientist changing?
- ✓ Weekend reading: on Moodle

Week 13 – Apr 30- May 2: Reflection

Discuss writing the intro and discussion. Review

Lab - Meet in Ford 015

- ✓ **Due: group project report (methods and results; team-authored) - submit electronically by 5pm May 2.**
- ✓ **PSYW:** What is one thing that happened outside of class this semester that had an impact on you?

By Fri May 11 : Final paper due (Individual work in authoring the introduction and discussion; team authored methods and results).

Assessment:

25% of your grade: critical reading of original articles (all individual work)

Article Critique 1: 5%

Article Critique 2: 5%

Final Article Critique and Expt proposal : 15%

50% of your grade: writing scientific posters and articles, designing and interpreting an experiment

Experimental Report 1 (Neuroanatomical poster due Feb 18 - team work): 5%

Experimental Report 2 (Proposal due March 27 – team work): 5%

Experimental Report 2 (Zebrafish study –draft Mar 21, final Apr 2- individual work): 15%

Lab book (monthly checks) 5%

Experimental Report 3 (Final project; poster and methods/results - team work; intro and discussion-individual work): 20%

10% Class Involvement: for resourceful and responsible conduct in the lab (5%), high quality participation in the discussion of readings and strong efforts in pop quizzes on readings (4%) and participation in extra-class events (1%). Self-assessed and instructor-assessed.

10% Teamwork - assessed by peer evaluation forms Week 5 and Week 12

5% "Portrait of the Scientist as a Young Woman" – Journal style writing throughout the semester with your personal reactions, thoughts, ambitions, etc. (grading: for each: 1 point if done on time, 0.5 point if done late)

Special rules: Late assignments will be marked down 5% for every day late. Missing the poster presentation takes 5% off your total class grade. No late article critiques will be accepted.