**Instructor:** Mary Harrington: x3925, Sabin Reed 429, (mharring@smith.edu) Office Hrs: T1-2 and W 3-4 or by appt.

**Teaching Assistants:** Emily Ohrtman, Wanqi Wang, Unsa Malik, Chloe Ennin

Santiago Ramon y Cajal, Advice to a Young Investigator

**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.

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 resources to conduct research on a brain region. Quantify neuroanatomical findings using Image J. Graphic presentation of data, preparing a scientific poster.

**B. Single subject experimental designs**
Operant conditioning: train a rat to bar press for food reward.

**C. Two Group, between subjects design and correlational design**
Compare 2 groups of mice in behavioral tests. Inferential statistics for 2 group designs: t-tests. Writing a paper for publication: Methods and Results sections.

**D. Pharmacological dose-response studies**
Drug screening. Circadian rhythms experiment with zebrafish.

**E. 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.

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.

REFLECT: 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 - 30: Descriptive neuroanatomical studies
M: Introduction to syllabus. Complete Health forms and team letters. Get a lab notebook!
W: Meet your team. Discuss reading from “Ethical Issues in Scientific Research: An Anthology”.
F: Discuss keeping a lab notebook. Discuss Chs 5&6 GRTN.
Lab: Cut brain sections. Mount sections on slides. Learning the "Brain areas to know". Choose brain region of interest (ROI) and learn to find it on the slides.

✓ Readings for this week: Histology Lab reading on Moodle, Brain Areas to Know, General reading on lab notebooks, Chapter 5 & 6 Guide to Research Techniques in Neuroscience, pages 233-266 from “Ethical Issues in Scientific Research” (on Moodle), “Design of Experiments in Neuroscience” Chapter 1
✓ Team ground rules posted by Sun 5pm
✓ Self-report participation by Sun 5pm. Explain any absences.
✓ PSYW – “What are your goals for this class? Prioritize the listed class goals on the syllabus as they relate to your needs, and feel free to list additional goals.” (write by Sun 5pm, post on Moodle under “A Portrait of the Scientist as a Young Woman”)
✓ Weekend reading: Clarity – posted on Moodle

Week 2 - Feb 2 - 6: Descriptive neuroanatomical studies
M: Draft as a team a 2 paragraph background on the ROI you have chosen. Distill this to 5-6 bullet points for your poster.
W: Orientation to online class resource guide. Discuss readings for the week. Descriptive statistics and scales of measurement.
F: Animal Use training (do NOT miss class!); CITI online training (print certificate at end).
Lab: Stain your slides. Study slides with Nissl and Golgi stains. 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.

✓ Reading for this week: “Design of Experiments in Neuroscience” Chapter 2 and 3, and Appendix C.
✓ Self-report participation
✓ Portrait of the Scientist as a Young Woman (PSYW) – “What are your personal views on the use of animals in research?”
✓ Weekend reading: Mapping whole-brain activation – posted on Moodle

Week 3 - Feb 9 - 13: Single subject experimental designs
M: Magazine training rat.
W: Magazine training/ Shaping. Discuss “Seeking alternatives”
F: Article critique due. Discuss stereotaxic surgery.
Lab: Shaping the bar press. Discuss textbooks readings. Discuss Beery and Zucker, 2011 reading on sex bias

✓ Reading for this week: “Seeking alternatives”, on Moodle. Beery and Zucker, 2011, posted on Moodle. Design of Experiments in Neuroscience, Ch 4 and Appx A pp 139-149, Research Techniques in Neuroscience, Ch 2.
✓ Due: First article critique (article and questions posted on Moodle) – email by 10am, Friday Feb 13; 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 – “How do you think sexism and/or racism will influence your career in science?”
✓ Weekend reading: Research paper by Medalist Dr. Cynthia Bearer

Week 4 - Feb 16 – 20 (Rally Day week!!): Single subject experimental designs
M: Shaping to CRF.
W: Rally Day! No classes held; attend Rally Day events.
F: Discuss readings.
Lab: Fixed ratio schedules. Prepare posters on proposed experiments using ABA, relating to your ROI. Collaborations forms.
Reading for this week: Guide to Research Techniques in Neuroscience Ch 3, Design of Experiments in Neuroscience, Ch 5 and Appx A pp 149-160.

Self-report participation
PSYW – “Reflect on Rally Day – In what way did the Rally Day events impact your thinking about “the true purpose” of a liberal arts education? If you did not attend the events, explain your choice and describe some other event this week that impacted your thinking about this.”

Weekend reading: on Moodle – Weekend ecstasy use disrupts memory in rats

Due: Second article critique – email by 10am Mon Feb 23.

Week 5 - Feb 23 - 27: Two Group, between subjects design and correlational design
M: Article critique due. Discuss article critique 2. Review experimental designs.
W: Inferential statistics: the t-test. Do sexes differ in rotarod performance?
F: ROI experiment poster presentations (one per team).
Lab: Rotarod test. Correlational designs. Does body weight correlate with time on rotarod?

Due: Second article critique in class Mon Feb 23. Lab Books due in class Monday AM Feb 23.
Due: ROI poster summarizing your neuroanatomical studies to date; proposal for further study, submit as ppt slide, by email, due by 9AM Wednesday Feb 25
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: Optogenetics paper co-authored by David Moorman

Week 6 - Mar 2 - 6: Two Group, between subjects design and correlational design
M: Discuss animal behavior tests. Discuss optogenetics.
W: Finding articles.
F: The factorial design.
Lab: Open field test.

Reading for class: Research Techniques in Neuroscience, Ch 10.
Self-report participation; Team peer evaluation 1 by Mar 6.
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: Discovery of “longdaysin”
Due: Third article critique – email by 10am Mon Mar 9

Week 7 - Mar 9 - 13: Pharmacological dose-response studies
M: Article critique due. Analyze data from open field and rotarod experiments.
W: Analyze data from open field and rotarod experiments. Work on preparation of reports. See guidelines posted on Moodle.
F: Work on reports
Lab: Effect of longdaysin on Zebrafish circadian rhythms. Background on circadian rhythms.

Due: Article critique 3 – Mon Mar 9.
Due: Drafts of behavioral study methods and results due by Fri Mar 13 5pm, (or by a later date, but before Mar 27, with Instructor permission) – submit by email. This is an individual (not team) report.
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: Watch video “Fish and Chips” – link on Moodle

Spring Break!
Week 8 - Mar 23 - 27: Independent Research Projects
M: Neuroscience News Fest 1 - each team brings several news items to discuss.
W: Analyze data from zebrafish lab
F: Work on projects
Lab: Project presentations by student teams – projects must be related to mice behavior OR zebrafish circadian rhythms.

✓ Due: Panel 1 of independent research project poster due 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.”

Week 9 – Mar 30 - Apr 3: Independent Research Projects
When possible: Neuroscience News Fest 2. Otherwise: conduct team projects.

✓ Readings for this class: (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 your experiences in this course will help you most directly in your future work in school and beyond?”
✓ Due: Final papers for rotarod and open field behavioral study due from each student by 11pm, Sat Apr 4, submit by email. Lab Book due in class Apr 3.
✓ Weekend reading: Essay “Awakening” by Joshua Lang on Moodle

Week 10 - Apr 6 -10: Independent Research Projects
M: Discuss Cajal readings. Come with selected quotes.
Otherwise: Work on Final projects

✓ Read: Articles related to your project. Due: Second panel of your poster, present in class Wed.
✓ Read: Chs 1-4 in Ramon y Cajal’s “Advice for a Young Investigator”
✓ Self-report participation
✓ PSYW – “What is one important factor that led to your interest in neuroscience?”
✓ Weekend reading: On the importance of stupidity in scientific research

Week 11 - Apr 13 - 17: Independent Research Projects
W - Discuss Cajal readings, with more quotes.
Lab: Final projects poster presentations

✓ Due: Research project poster, in-class Monday 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: New Yorker article on Alzheimer’s Disease
✓ Self-report participation; Team peer evaluation forms by Apr 20.

Saturday Apr 18 - Collaborations - poster presentation – attendance required!

Week 12 - Apr 20 - 24: Reflection
M: Discuss readings: “The Decline Effect” and Ch 1
W: Discuss “Why most published research findings are false”. ****Class Dinner Wed Apr 22****
F: Writing workshop; Zotero
Lab: Enigma project
✓ Wed, 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.
✓ Read Ch 1 in Guide to Research Techniques in Neuroscience, and “The Decline Effect” (Moodle)
✓ PSYW: How are your ideas of being a scientist changing?
✓ Weekend reading: TBA
Week 13 – Apr 27 - May 1: Reflection

M: Discuss writing the intro and discussion.
W: TBA
F: Review
  ✓ Due: group project report (methods and results; team-authored) - submit electronically by 5pm May 1.
  ✓ PSYW: What is one thing that happened outside of class this semester that had an impact on you?
  ✓ Weekend reading: TBA

Self-scheduled: Final exam: article critique and proposal for a follow up experiment

By Fri May 8: Final paper due (Individual work in authoring the introduction and discussion; team authored methods and results).

Assessment:

15% of your grade: critical reading of original articles (all individual work)
Article Critique 1: 5%
Article Critique 2: 5%
Article Critique 3: 5%

50% of your grade: writing scientific posters and articles, designing and interpreting an experiment
Experimental Report 1 (ROI poster - team work): 5% ; (Lab book – individual work): 5%
Experimental Report 2 (Behavioral study - individual work): 20% (15% report, 5% lab book)
Experimental Report 3 (Final project; poster and methods/results - team work; intro and discussion, lab book - individual work): 20%

10% Class Involvement: for resourceful and responsible conduct in the lab (5%), high quality participation in the discussion of 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

10% Final Exam: consists of one article critique and a description of a follow-up study

5% “Portrait of the Scientist as a Young Woman” – Journal style writing throughout the semester with your personal reactions, thoughts, ambitions, etc.

Late assignments will be marked down 5% for every day late.

No late article critiques will be accepted.