

**Instructor:** Mary Harrington: x3925, Bass 417, ([mharring@email.smith.edu](mailto:mharring@email.smith.edu))

Office Hrs: Tues 11-12, Fri 11-12, or by appt.

**Teaching Assistants:** Caroline Walsh ([cwalsh@email.smith.edu](mailto:cwalsh@email.smith.edu)) and Shari Moore ([smoore@email.smith.edu](mailto:smoore@email.smith.edu))

**Texts:** Harrington, M (2006) *The Design of Experiments in Neuroscience*. Thomson-Wadsworth.

Strunk W and White EB (2000) *The Elements of Style*, Allyn & Bacon

Welcome! There are several goals in NSC 230. This course will acquaint you with tools you will use to conduct certain types of neuroscience research. You will learn to assess journal articles describing research conducted by other scientists, design and conduct your own experiments, analyze the results both graphically and statistically, and present your findings *via* written papers and PowerPoint presentations. You will be busy! The good news is that you have two experienced TAs, dedicated to getting you up to speed on all these skills. This is a required course for the Neuroscience major.

Below there 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. Introduction**

Intro to Philosophy of Science. Ethics of Animal Use, Fraud in science.

**b. Measurement of Behavior**

Techniques to quantify mouse behavior; comparing different mouse strains.

Scales of Measurement, Descriptive statistics, Measures of Inter-rater reliability

Graphic presentation of data, Writing Methods and Results sections

**c. Two Groups, Between subjects design**

Compare 2 strains of mice in several behavioral assays

Inferential statistics for 2 group designs: t-tests.

Writing Introduction/Reference Lists/Discussion. Library Orientation.

**d. Scientific Presentation**

Scientific Writing and Powerpoint presentation.

**e. Histology**

Humane treatment of animals. Anesthesia/analgesia

Cutting frozen sections, Nissl staining.

Compare size of brain areas in mice strains

**f. Inferential Statistics-ANOVAs and Factorial design**

**g. Neurochemistry**

Enzyme assays on brain homogenates.

Studying inhibition of acetylcholinesterase by Tacrine HCl.

**h. Independent Research Projects - Factorial design**

Finding previously published research on a selected topic

Designing and conducting an experiment

Analyzing the results: Analysis of Variance, Post-hoc tests

Final paper and poster presentation

## Syllabus:

### Week 1 - Jan 29 - Feb 2

Introduction to syllabus. Complete Health forms.  
Ethics of Animal Use. Philosophy of Science.  
Orientation to animal quarters, Dr. Joanne Huyler

#### *Readings:*

1. Chapter 14 "Very abstract questions: The philosophy of science" in What Science is and how it works, by GN Derry, 1999.
2. Read pages 233-266 from "Ethical Issues in Scientific Research: An Anthology".
3. In "Design of Experiments in Neuroscience" Chapter 1 and Chapter 2.
4. Seeking alternatives, from "Animal Experimentation: A guide to the issues" V. Manamy.

### Week 2 - Feb 5 - 9

Forming a hypothesis. Techniques to quantify mouse behavior. Inter-rater reliability. Scoring behavior of a mouse in an open field. Conduct open field test. Comparing different mouse strains.. Analyze data from open field tests.

#### *Readings:*

1. In "Design of Experiments in Neuroscience" Chapter 3.
2. Ch 4 Crawley "What's wrong with my mouse?" - Motor Functions

### Week 3 -Feb 12 - 16

Descriptive statistics, exploratory data analysis. Graphic Presentation of data. Correlations. Writing Methods and Results sections of experimental reports  
**Rotarod protocol** Begin rotarod testing.  
Discuss correlations in context of rotarod to open field measures.  
Elevated plus maze - discuss protocol.

#### *Readings:*

1. In "Design of Experiments in Neuroscience" Appendix A pp118-125
2. In "Design of Experiments in Neuroscience" Chapter 7.
3. In "Design of Experiments in Neuroscience" Appendix B.
4. On Moodle: article to critique (Darwish et al., 2001)
5. Reading on elevated plus maze.

**Due: Open field/rotarod report (Methods and Results only) : Fri Feb 16, 5.00pm.**

### Week 4 - Feb 19 - 23

Writing Introduction and Reference List sections of Experimental reports  
Discuss article critique, Darwish et al., 2001.  
**Elevated plus maze testing.** Draft elevated plus maze reports.  
Young Science Library Orientation, Rocco Piccinino.

*Readings:*

1. Chs 1 and 2, Strunk
2. Handout: Laboratory Notebooks

**Due: Elevated plus report draft (Intro, Methods, Results only): 5pm Fri Feb 23.**

**Week 6 - Feb 26 - Mar 2**

Discuss draft reports

Discuss 'What is an Experiment? Scales of Measurement, controlling variables and inferential stats.

*Readings:*

1. In "Design of Experiments in Neuroscience" Chapter 4 and 5
2. In "Design of Experiments in Neuroscience" Appendix A pp125-131.
3. On Moodle: First assessed article critique (Kliveny et al 2006)

**Due: Elevated plus maze final report due: 5pm Fri Mar 2.**

**March 3 - NEURON meeting at Simmons College**

**Week 7- Mar 5 - 9**

Presentation on the Smith College microscopy facility by Judith Wopereis.

Effective Use of Powerpoint in scientific presentations. Design presentation in PowerPoint of chosen articles.

Discuss elevated maze reports. Second article.

*Readings:*

1. On moodle: Second assessed article critique (Egashira N, et al. (2006) Impaired social interaction and reduced anxiety-related behavior in vasopressin V1a receptor knockout mice. Behav Brain Res. )
2. A paper relevant to behavioral lab work (binder provided of papers to choose from, or find your own).
3. Handout: "The Light Microscope" from At the Bench: A Laboratory Navigator, by K. Barker, 1998.

**Due: First article critique - due Mar 5**

**Week 8 - Mar 12 - 16      Brain Awareness Week**

Learning and memory behavioral research techniques. **Barnes maze protocol and demonstration.** Writing a Discussion. Presentations of chosen articles.

Humane treatment of animals. Stereotaxic surgery and rodent anesthesia and analgesia.

*Readings:*

1. "Mouse and rat anesthesia and analgesia" from Current Protocols in Neuroscience, 2001.

2. Strunk Chs 3 and 4

**Mon Mar 12 - Cathy Christian - 430 pm**

**Wed Mar 14 - Suzanne Corkin - open class 10-1050, career talk noon**

**Due: Second article critique -in class Mar 12.**

**Week 9 - Mar 26 - 30**

Histology. Techniques for image analysis and quantification.

**Cut brain sections. Mount sections on slides. Coating slides, staining and visualizing with the light microscope.**

Compare size of brain areas in mice strains.

**Week 10 - Apr 2 - 6**

Inferential Statistics. Factorial design and ANOVAs.

Design your experiments, 2 x 2 factorial design.

*Readings*

1. On Moodle: Third assessed article critique (Stanwood and Levitt, 2007)
2. In "Design of Experiments in Neuroscience" Chapter 6 and Appendix A, pp 131-138.

**Due: Histology lab write-up Apr 6.**

**Due: Third article critique -Apr 6.**

**Week 11 - Apr 9 - 13**

Design your experiments, 2 x 2 factorial design.

*Readings:*

Strunk Ch 5

**Exam: Apr 13**

**Week 12 - Apr 16 - 20**

An Introduction to Neurochemistry. Assay acetylcholinesterase activity in different mouse brain strains/regions. Calculating the rate of the enzyme reaction. Graphing data and writing reports.

**Due: Neurochemistry lab write-up, By end of class Apr 20**

**Due: 1 page summary of your experimental design, analysis and relevant references. Apr 19.**

**Collaborations Apr 21 - attend and write up one paragraph summary of a neuroscience poster presentation, due Apr 23**

**Week 13 - Apr 23 - 27**

Independent Research Projects. Fraud and deception in science.

**Due: Apr 27: First draft of final paper.**

*Readings*

1. In "Design of Experiments in Neuroscience" Chapter 8 and Appendix D.
2. Pages 65-109 in "Ethical Issues in Scientific Research"

**Week 14 - Apr 30 - May 4**

Independent Research Projects Powerpoint presentations in class.

**Due: Final independent project report, May 1 in-class.**

**Assignments:**

25% of your grade: critical reading of original articles, and short answer questions

Article Critique 1: 5%

Article Critique 2: 5%

Article Critique 3: 5%

Exam: 10% (consists of one article critique and 10 short answer questions on any topic covered throughout the semester)

60% of your grade: writing scientific articles, designing and interpreting an experiment

Experimental Report 1 (Open Field/Rotarod): 5%

Experimental Report 2 (Elevated maze): 15%

Experimental Report 3: (Histology): 5%

Experimental Report 4: (Neurochemistry): 10%

Experimental Report 5: (Independent Research Project): 25%

10% of your grade: oral presentations

Article presentation: 5%

Final Project Presentation: 5%

5% Class Involvement: for general participation in the discussion of required readings and participation in extra-class events.