

Syllabus
Neuroscience Methods

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Office Hours: Rae Silver (by appointment; email Rae.Silver@columbia.edu)
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Time: TBA
Location: TBA
Credits: One

Course Description

Understanding the significance of experimental findings requires knowledge of research designs and an appreciation of the methods used in the study. Reaching a thorough understanding of scientific methods is especially challenging in neuroscience, a field that is highly multidisciplinary and relies increasingly on specialized techniques. The course aims to review the foundations of experimental design and to present some of the primary methods used in neuroscience. In this course, students meet with neuroscientists working on different subfields who provide a firsthand perspective on a variety of methods. The course is organized in two-week modules. The invited neuroscientist participates in the first class of a module, where s/he introduces the scientific questions that s/he addresses, illustrates a few key experiments and provides 2-3 suggested readings. The second class is devoted to examining the experiments presented in the first class. In preparation for the first class, students read a scientific paper to familiarize themselves with the research topic. In preparation for the second class, students review the experiments presented in the previous class. Specifically, each student is asked to define the hypotheses, design, data, and statistics of one experiment according to guidelines provided by the instructors. Each student presents his/her review in the second class. The presentation and discussion of the experiment reviews aim to help students to understand main aspects of the experimental designs as well as the applicability of key methods used in neuroscience. The first class of the course is devoted to reviewing the different experimental designs. In the last class, each student presents one of the methods introduced in the course, highlighting its strength and weaknesses.

Course Objectives

The objectives of the course can be summarized as follows: (a) gaining exposure to research in various fields of neuroscience; (b) familiarizing with different methodologies and their application; (c) strengthening skills required in the analysis of scientific results and the discussion of scientific research; (d) experiencing different styles of scientific presentation and communication.

Pre-requisites

An introductory course in neuroscience, biology, or psychology are required for enrolling in this class.

Requirements

Attendance at each class is required, and active involvement in class discussion is expected from all students. The course is organized in modules, each devoted to a different topic and including two classes. Assignments are organized in paired modules in sequential classes. In the first class in a module, students read a paper that introduces the research topic examined in the module. They are also required to submit three questions related to the research topic; selected questions will be asked to the invited neuroscientist speaker. For the second class in a module, students are required to submit a review of one of the experiments presented in the first class. In their review, students define the hypotheses, experimental design, data (measures that were made), and statistical analysis of the experiment. Guidelines and examples will be provided by the instructors. Students submit their written reviews prior to the second class and present their submitted work in a powerpoint presentation in the second class. Questions and reviews must be submitted on Canvas prior to class. Finally, students are expected to participate actively in the discussion of the experiment reviews. For the last class, each student is asked to present one of the methods and associated experimental designs that has been described in the course, evaluating its strength and weaknesses.

Grading

This course is graded. The final grade is determined by the weekly assignments. The 6 question submissions (2 points each=12%), the 6 experimental reviews (6 points each = 36%), the 6 in-class PPT review presentations (6 points each=36%), discussion during class participation and in the final class (16 points for a total of 100%). We anticipate that all course participants who submit the required work and will receive a high grade.

If a student needs to miss a class or to hand in an assignment late, they are asked to please email Dr Miozzo to arrange for an alternate assignment for that week. Missing more than one class or multiple assignments could result in a failing grade, so please get in touch with the course professor if any difficulties are anticipated in meeting the course requirements.

Schedule This list represents examples of possible topics rather than a final schedule. The precise topics to be covered will entail a balance of basic and translational research in studies of humans and non-human models. Readings are assigned in consultation with the presenter.

Week 1	Overview of the course: <i>Experimental Designs: Logic and Typology</i>
Weeks 2-3	Module 1: The adolescent brain
Weeks 4-5	Module 2: The neuroscience of language
Weeks 6-7	Module 3: Sleep/Wake and Circadian Rhythms in Health
Weeks 8, 10*	Module 4: The neuroscience of vision
Weeks 11-12	Module 5: Expectation in the brain
Weeks 13-14	Module 7: Prenatal experience impacts on infant behavior
Week 15	Students presentation <i>Neuroscience Methods: Applicability and Limitations</i>

* Week 9 is spring break

Policies

a. Academic integrity

Students in this course are expected to work in accordance to the student honor code:

The Columbia College Student Council, on behalf of the whole student body, has resolved that maintaining academic integrity is the preserve of all members of our intellectual community – including and especially students. As a consequence, all Columbia College students will now make the following pledge: We, the undergraduate students of Columbia University, hereby pledge to value the integrity of our ideas and the ideas of others by honestly presenting our work, respecting authorship, and striving not simply for answers but for understanding in the pursuit of our common scholastic goals. In this way, we seek to build an academic community governed by our collective efforts, diligence, and Code of Honor.

All Columbia College students are committed to the following honor code:

I affirm that I will not plagiarize, use unauthorized materials, or give or receive illegitimate help on assignments, papers, or examinations. I will also uphold equity and honesty in the evaluation of my work and the work of others. I do so to sustain a community built around this Code of Honor.

b. Wellness

It is important for undergraduates to recognize and identify the different pressures, burdens, and stressors you may be facing, whether personal, emotional, physical, financial, mental, or academic. We as a community urge you to make yourself – your own health, sanity, and wellness – your priority throughout this term and your career here. Sleep, exercise, and eating well can all be a part of a healthy regimen to cope with stress. Resources exist to support you in several sectors of your life, and we encourage you to make use of them. Should you have any questions about navigating these resources, please visit these sites:

- <https://health.columbia.edu/>
- <https://health.columbia.edu/services/individual-counseling>

c. Accessibility Resources & Disability Services

Accommodations will be provided on-campus for in-person classes and through Zoom and other University-sponsored platforms for virtual events, classes and experiential learning (e.g., social work field placements). To learn more about available accommodations, students can contact Columbia Disability Services at any time by phone at [212-854-2388](tel:212-854-2388) or by email at disability@columbia.edu.