

UNIVERSITY OF FLORIDA
COLLEGE OF MEDICINE SYLLABUS
STATISTICS FOR NEUROSCIENTISTS
GMS 6025C

Semester: Spring

Delivery Format: in-person

Instructor Name: Damon Lamb, PhD; Barry Setlow, PhD

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Course Hours: 3 hours/week (lecture); 1 hour/week (lab)

Office Hours: TBD

Graduate Assistant: TBD

Preferred Course Communications: email

Prerequisites: GMS6705 or equivalent

Purpose and Outcome: The goal of this course is to introduce students to the fundamentals and applied methods for data organization and analysis in neuroscience.

Course Overview: Students will learn and apply data management, organization, visualization, and statistical methods necessary to plan experiments and analyze neuroscience data. Students will learn how to import data from a variety of source formats and structures, how to restructure and organize data for effective analysis and visualization using modern approaches, and statistical analysis of neuroscience data.

Relation to Program Outcomes: Rapid advances in neuroscience over the past 10 years have resulted in new standards and expectations for analysis, rigor, and data interpretation within the field. In order to maximize rigor and transparency in experimental design and data analysis and to ensure their future career success, today's neuroscience trainees require a foundational understanding of statistical theory and methods. The proposed course is designed to provide neuroscience graduate trainees with this understanding, and fits within a broader redesign of the neuroscience PhD curriculum that will ensure students complete their degrees possessing a necessary degree of quantitative literacy. Students will have interacted with neuroscience experimental data earlier in the curriculum, but will require additional training to prepare for their graduate research and career.

Course Objectives and/or Goals: Students will learn how to plan, execute, anticipate challenges with, and interpret outcomes from:

- Core data management and organization (i.e., Data Carpentry)
- Data Visualization
- General Linear Model statistical analyses
- Statistical Model Diagnostics

These will prepare students to structure data acquisition and plan for fundamental statistical analyses necessary to design experiments and analyze neuroscience data arising from molecular, behavioral, neurophysiological measures composing controlled and output variables of neuroscience experiments. To reinforce the skills and theoretical knowledge developed in this

course, students will import data from a variety of source formats and organizational structures, restructure and organize data for effective analysis and visualization using modern approaches, and create, evaluate and interpret general linear modeling of neuroscience data.

Instructional Methods: Both classroom and laboratory sessions will be in person

What is expected of you: This class is intended to focus on applied statistics with an emphasis on HOW to approach neuroscience data collection and analysis with a reasonable theoretical framing. In-class activities will be given to test and reinforce students' understanding of these principles; homework will be given to test students' ability to apply those principles; projects will be assigned to identify students' ability to explain choices and interpretations of complex data. All assignments will be turned in as compiled PDF documents built in Rmarkdown files. These allow you to embed your figures, code and analyses seamlessly along with your text.

What to expected of Homework Assignments: Homework assignments will build from practice of fundamental methods and approaches to complex, multi-layered problems that challenge students to more deeply understand the material. Fundamental assignments start with practice using tools and methods to import, transform, join, and summarize data and elementary construction of data visualization using the framework described by Wilkinson's Grammar of Graphics as implemented in the tidyverse (ggplot2). Subsequent assignments are structured around multi-component problems drawn from actual laboratory experiments (with artificial data). These problems have multiple sub-questions to help guide students in their approach to each problem. In many assignments, there are also one or more complex questions require students to make and justify choices in their approach to their data processing, visualization, and statistical analysis. Many situations which trigger common mistakes are embedded in the questions or raw data, providing opportunities to learn how to identify and avoid these mistakes.

Homework assignments can be time consuming. This is especially the case for students who do not put sufficient effort and time into the fundamental assignments, or who try to take shortcuts such as using 'Dr. Google' or Stack Overflow rather than the assigned material and library documentation. Please plan accordingly and start as early as possible.

A portion of lecture will be dedicated to working through hands-on problems in small groups and as a class in order to prepare students for future assignments or reinforce critical lessons from prior assignments.

What to expected of Group Projects: Group Projects will be problem-base-learning assignments (PBL) wherein students are expected to create a proposed analysis plan including both a priori scientific and corresponding statistical hypotheses, corresponding statistical models, as well as planned exploratory analyses. Where possible, datasets will be actual data drawn from public data repositories or, if the data is appropriate, from the lab. Students will then execute their proposed analysis, write a lab report, and present their project.

Weekly Schedule of Topics

Week		Reference & Reading
1	Fundamental Data Carpentry & Data Visualization in R/Tidyverse	Ch 1; R & Tidyverse Documentation, R4DS
2	Fundamental Data Carpentry & Data Visualization in R/Tidyverse	Ch 2; R & Tidyverse Documentation, R4DS

3	Fundamental Data Carpentry & Data Visualization in R/Tidyverse	Ch 3; R & Tidyverse Documentation, R4DS
4	Frequentist Statistical Foundations (Chi2, F, PDF, CDF, etc.) Refresh	Ch 5 (esp. 5.3, 5.4.4, 5.4.7), Ch 6, Ch 10
5	Models, Hypotheses, Significance, Hypothesis Testing, Refresh	Ch 10, Ch 11
6	Linear Regression	Ch 12.1 -12.4
7	Factorial Treatments	Ch 13
8	Continuous Treatment & Covariates	Ch 12.5 - Ch 13
9	Continuous Treatment & Covariates & Group Projects	Ch 12.5 - Ch 13
10	Combined Categorical and Continuous Predictors	13 & Class Notes
11	Post-Hoc tests & Model Diagnostics	Ch 3.3; Benjamini and Hochberg (1995), Benjamini and Yekutieli (2005) & Class Notes
12	Group Projects	
13	Advanced interactions, SS types, etc.	Class notes
15	Group Final Presentations	

Course Materials and Technology: “Analysis of Neural Data” by Robert Kass, Uri Eden, & Emery Brown (2014), ISBN-13: 978-1493940783

For technical support for this class, please contact the UF Help Desk at:

- Learning-support@ufl.edu
- (352) 392-HELP - select option 2
- [UF eLearning](#)
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Academic Requirements and Grading:

60% Homework

30% Lab Group Projects

10% Class Participation / In-class activities. Note: attendance is not sufficient for participation.

This category will consist of in-class problems, discussions, problem-based-learning assignments, quizzes, or other activity during the scheduled course time. Attendance will not be taken, but if you fail to show up to class, you will miss opportunities to get participation credits, see attendance policy below.

Grading:

A A- B+ B B- C+ C C- D+ D D- E

90.0- 100	87.0- 89.9	84.0- 86.9	81.0- 83.9	78.0- 80.9	75.0- 77.9	72.0- 74.9	69.0- 71.9	66.0- 68.9	63.0- 65.9	60.0- 62.9	0-59.9
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N.B: Grades will be rounded to the nearest tenth of a point, and letter grades will be assigned based on the above table. We very rarely curve grades, but reserve the right to do so at our discretion. Typically, if the majority of the class is unable to answer a question, we will review the question and discard it if it was unnecessarily difficult or confusing.

Exam Policy: No exams

Policy Related to Required Class Attendance: Attendance is expected for all classes and lab sessions. Anticipated absences should be discussed with the instructors as far in advance as possible.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Excused absences must be consistent with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>). Additional information can be found here:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Expectations Regarding Course Behavior:

Attendance is required, with excused absences handled as describe above.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

Communication Guidelines: <http://teach.ufl.edu/wp-content/uploads/2012/08/NetiquetteGuideforOnlineCourses.pdf>

Academic Integrity: Students are expected to act in accordance with the University of Florida policy on academic integrity. As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge:

“We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.”

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied:

“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”

It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For additional information regarding Academic Integrity, please see Student Conduct and Honor Code or the Graduate Student Website for additional details:

<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>

<http://gradschool.ufl.edu/students/introduction.html>

Please remember cheating, lying, misrepresentation, or plagiarism in any form is unacceptable and inexcusable behavior.

Online Faculty Course Evaluation Process:

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at

<https://gatorevals.aa.ufl.edu/students/> . Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

Policy Related to Guests Attending Class:

Only registered students are permitted to attend class. However, we recognize that students who are caretakers may face occasional unexpected challenges creating attendance barriers. Therefore, by exception, a department chair or his or her designee (e.g., instructors) may grant a student permission to bring a guest(s) for a total of two class sessions per semester. This is two sessions total across all courses. No further extensions will be granted. Please note that guests are **not** permitted to attend either cadaver or wet labs. Students are responsible for course material regardless of attendance. For additional information, please review the [Classroom Guests of Students policy](#) in its entirety.

Support Services:

Accommodations for Students with Disabilities:

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/> . It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester. The College is committed to providing reasonable accommodations to assist students in their coursework.

Counseling and Student Health:

Students sometimes experience stress from academic expectations and/or personal and interpersonal issues that may interfere with their academic performance. If you find yourself facing issues that have the potential to or are already negatively affecting your coursework, you

are encouraged to talk with an instructor and/or seek help through University resources available to you.

- The Counseling and Wellness Center 352-392-1575 offers a variety of support services such as psychological assessment and intervention and assistance for math and test anxiety. Visit their web site for more information: <http://www.counseling.ufl.edu>. On line and in person assistance is available.
- You Matter We Care website: <http://www.umatter.ufl.edu/>. If you are feeling overwhelmed or stressed, you can reach out for help through the You Matter We Care website, which is staffed by Dean of Students and Counseling Center personnel.
- The Student Health Care Center at UF Health is a satellite clinic of the main Student Health Care Center located on Fletcher Drive on campus. Student Health at UF Health offers a variety of clinical services. The clinic is located on the second floor of the Dental Tower in the Health Science Center. For more information, contact the clinic at 392-0627 or check out the web site at: <https://shcc.ufl.edu/>
- UF Health Emergency Room / Trauma Center: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32698, ufhealth.org/emergency-room-trauma-center.
- University Police Department: Visit police.ufl.edu/ or call 352-392-1111 (or 9-1-1 for emergencies).
- Crisis intervention is always available 24/7 from:
Alachua County Crisis Center:
(352) 264-6789
<http://www.alachuacounty.us/DEPTS/CSS/CRISISCENTER/Pages/CrisisCenter.aspx>

Do not wait until you reach a crisis to come in and talk with us. We have helped many students through stressful situations impacting their academic performance. You are not alone so do not be afraid to ask for assistance.

Academic Resources

E-learning technical support: Contact the UF Computing Help Desk at 352-392-4357 or via e-mail at helpdesk@ufl.edu.

Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services career.ufl.edu/.

Library Support: cms.uflib.ufl.edu/ ask various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center: Broward Hall 352-392-2010 or to make an appointment 352 392-6420.
General study skills and tutoring. teachingcenter.ufl.edu/

Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers. writing.ufl.edu/writing-studio/

Student Complaints On-Campus: sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/

On-Line Students Complaints: distance.ufl.edu/student-complaint-process