

PSYC 401

Biological Bases of Behavior

Laboratory

Spring, 2020

SCHEDULE

Mon-Wed 9:00 – 9:50
0140 Biology-Psychology

Labs 1:00 – 5:00
Monday and Wednesday
1324 Edward St John Bldg

PROFESSOR

Dr. David Yager
2123L Biology-Psychology

ddyager@umd.edu

Office hours:

Mondays 10:00–11:00
Wednesdays 1:30–3:00
Fridays 10:00–noon



TEACHING ASSISTANT

Ta-wen Ho
In labs

twho@umd.edu

Office hours by appt.

PREREQUISITES

PSYC 200 and 300
PSYC 301 or BSCI 353
Instructor permission

CREDITS

Four

Course description

PSYC 401 is a senior-level laboratory course designed to introduce students to research strategies and techniques of behavioral neurobiology. This will include training in techniques such as:

- microsurgery
- extracellular nerve and muscle recording
- use of multiple electrode types
- mapping neural circuits
- quantification of simple behaviors
- multi-unit CNS recording
- pharmacological techniques

The emphasis throughout the semester will be on doing the research rather than watching or reading about it. Students will plan their experiments, set up their own electrodes and electronics, do the surgeries, collect the data, and present the results in written form.

The semester will be organized into modules lasting 1-4 weeks. Each of these will focus on one of the key topics in behavioral neurobiology such as central pattern generators, neuromodulation, simple neural circuit design, and feature detection. Within most modules, we first examine a behavior and then look at the underlying neurophysiology and/or neuroanatomy.

Two hours of lecture each week will introduce the background concepts, both theoretical and technical, for the upcoming labs. The classes emphasize discussion, often focusing on experimental strategies and design. Examples might include: design a robot with the sensory systems needed to detect, identify, and track bad guys inside a building; given infinite resources, generate an hypothesis to explain the neuromuscular control of snake slithering and propose experiments to test your hypothesis.

We will use invertebrates and cold-blooded vertebrates as experimental subjects because they provide readily approachable, student-friendly 'model' systems with a minimum of logistic complication. The concepts and techniques, however, are broadly applicable to both invertebrates and vertebrates. In fact, many of the most fundamental concepts of behavioral neurobiology were, and continue to be, discovered first in invertebrates.

Lectures

There will be two lecture/discussions each week. These are essential to successful completion of the labs. These classes will briefly review basic neuroscience concepts and then expand on material necessary to understand what you will do in the lab and why. Throughout the course, we will emphasize experimental design and some of the specialized techniques neuroscientists use.

A crucial component of the classes are the discussions, often facilitated by breaking into small groups. All students are expected to contribute to these discussions. Because of this, your regular and consistent attendance is crucial. Although attendance *per se* is not part of the final grade computation, participation is (see below), and you can't participate if you are not present. **Therefore, we record numbers of classes missed and significantly late arrivals.** Just as an aside, we've consistently seen that students who regularly skip class are clearly clueless about what goes on in the lab, their lab reports are mediocre, and they crash and burn on their exams.

Labs

Students will attend one four-hour lab each week. The first few minutes of the lab will be a brief discussion of the basic idea of the lab and an introduction to new techniques and/or equipment. You will then work in groups of 2-3 to complete the lab work during the rest of the four hours.

Throughout the afternoon, there will be informal discussions of both practical and theoretical aspects of your experiments. By the end of the day, each group will have data that they will analyze using simple graphs and basic statistical tests, and then interpret based on discussions in the lectures, the lab itself, and the manual. Each group or each individual, depending on the particular lab, will present the results in a written lab report (a worksheet) each week.

You do not need to purchase any special equipment for the lab. We will provide all the equipment and tools. **You should, however, always bring a flash drive.** A notebook will also be useful. Although not required, many students bring laptops so they can enter data directly into a spreadsheet, which saves time and effort.

We don't use lab coats. You should wear closed-toed shoes (no sandals) and pants, slacks, or long skirts so that your legs are covered.

Goals of the
course

A major goal of the course is to give you a taste of what doing neuroscience research is really like. This means you will need to think like a neuroscientist. Some of the most frequent discussion questions will be: What is your hypothesis? What experiments would you do to show ...? Do you really believe that experimental result? How do you interpret your data? The exercises are designed to emphasize problem solving - both conceptual and practical. The staff won't always tell you the answer to a question, but will encourage you to work it out yourself. By the end of the semester you will be able to design and carry out a behavioral neurobiology project similar to the ones we do in lab, and you will be able to communicate your results in an effective, clear, professional manner.

See CANVAS for detailed learning outcomes.

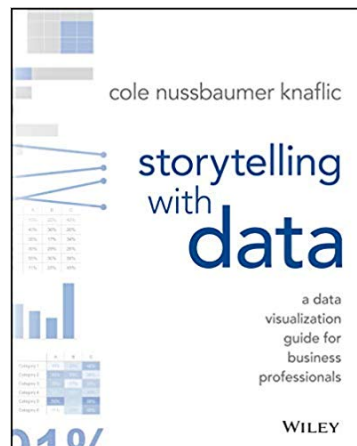
Readings

Each week you will have a lab manual section to read and understand in preparation for the lab. Occasionally, I will also post supplementary readings that may or may not be required depending on the particular lab.

I am continuously updating the manual, often based on student experiences and comments. You will typically find the write-up for the next week's lab (including the worksheet questions) posted on CANVAS during the weekend before the lab begins.

You will spend a great deal of time and energy throughout the semester honing your data presentation and written communication skills. The optional text can be a major asset. I especially like it because of its straightforward approach to both choosing the best method for data presentation and to the practical aspects of creating effective data visualizations.

Successful and efficient labs depend on each of you coming to lab prepared. This means that you have to read the lab manual **BEFORE** you come to lab. You don't need to understand every word or procedure, but **you need to have a clear idea of the overall plan, the data you will need to collect, and the important concepts the experiments address.**



Optional

Knaflic, C. N. (2015) *Storytelling with Data: A Data Visualization Guide for Business Professionals*

ISBN: 978-1119002253

about \$20

GRADING

Quizzes

There will be an on-line quiz each week that you must take before coming to lab. The quizzes are timed (6 minutes), open book, and must be completed independently. The quizzes test your understanding of the material in the lab manual for that week. Students who have read the lab manual before taking the quiz and **understand** the week's lab will do well, others will do badly. Failure to complete a quiz before the start of lab results in a score of zero. **Each quiz will be worth 24 points.** The first two quizzes are practice (score not counted). All quizzes after that count toward the final grade.

Do not underestimate the importance of the quizzes. I have seen students drop half a letter grade or more in their final course grade because of consistently poor quiz performance.

Worksheets

Students will hand in a worksheet write-up for each week's lab via CANVAS. Specific questions to be answered in the worksheet are included with each week's lab manual. Worksheets are focused reports that provide a concise way to communicate your results and conclusions from the lab. For most labs, the group members will hand in a single worksheet. For other labs, each individual student will hand in their own worksheet.

Communicating effectively is one of the most important skills you must have for success in any field. For this course you will need to learn how neuroscientists communicate their results so you can produce successful worksheets. Early in the semester, we will provide detailed instructions for each write-up and discuss techniques in lecture. As the semester moves on, you will take progressively more responsibility for determining and using the most effective way(s) to communicate your results. The worksheets vary in difficulty, becoming more detailed and requiring more analysis as the semester goes on.

I have put a set of guidelines for writing the worksheets, example worksheets, and the scoring rubric on CANVAS. Be sure to read these carefully.

Each worksheet will be worth 100 points. Because it may take a little while to 'catch on' to doing them, lowest score from the first five worksheets will be dropped.

Completed worksheets are due before your lab section begins on the following week. Late worksheets incur a 8 point penalty per late day or fraction thereof for the first two days. Worksheets handed in more than two days late will receive a score of 33 points.

Data sharing

In real-world neuroscience research, experiments don't always produce useable data. You will all experience this reality first-hand, guaranteed. In addition, we will sometimes want to pool data from several groups or even from all of the lab sections.

Every student is expected to share data freely, willingly, and in a timely manner with other students in the course.

Equal effort

The majority of your worksheets will be a group effort. Each member of the group is equally responsible for the content and quality of the entire write-up. A common strategy students have used in the past is for each member to focus on different questions, and then all the members get together to produce the final write-up. **All the members of a group will get the same grade.**

Occasionally, one student in a group will not fulfill their responsibility in producing the write-up. This is not acceptable. To foster equal contribution, each week every student will report to me **confidentially** the amount of work contributed by the member(s) of their group. I record this information throughout the semester. Failure to contribute equally to group work will result in reduced Contribution Score (see below). In addition, I will deal with severe cases in a more immediate way.

Examinations

There will be a midterm exam and a comprehensive final examination. Both will cover theoretical material, the conceptual bases of some of the techniques, experimental design, and data interpretation. Exams will generally consist of 3-8 questions that will require for their answers short paragraphs, interpretation of neurophysiological recordings, and labeling/drawing diagrams and graphs. For the final, a group of questions will be distributed a week before the test, and the exam itself will be a subset of those questions.

Each of the two exams will be worth 300 points.

Final grade computation

The final course score will simply be the points earned as a percentage of the total possible points (1964). However, the final score will be adjusted to include 1) a 'Participation Score' that will range from -4 to +4 course score percentage points. This will be used to reward students whose effort in the class has gone far beyond that of even a very good student. It will also be used to penalize students whose effort in the class has been poor (some of the indicators of poor effort are: not contributing to lecture discussions, being repeatedly unprepared for lab, not actively participating in lab/lecture activities, failing to share data with other students; not sending their weekly contribution ratings); and 2) a 'Contribution Score' ranging from 0 to -4 points based on the equal effort data described above.

Letter grades will be assigned using an equal divisions scale, e.g. 80.00 to 83.29 = B-, 83.30 to 86.69 = B, 86.70 to 89.99 = B+

Absences

Because of the nature of the course, regular attendance is very important. An occasional missed lecture is not a serious problem. Absence from a lab session, however, is a major issue. Make-up labs are not possible because of both equipment issues and time constraints. **When the reason is compelling and with adequate prior notification (normally two weeks)**, we can **sometimes** have the student attend one of the other lab sessions for that week.

A student missing a lab or exam because of illness or other University-recognized reason must notify the instructor prior to or on the day of the absence and must provide complete, valid documentation of the problem. Failure to provide timely notification or adequate documentation will result in a grade of zero.

Incompletes

An "incomplete" will be assigned as a grade only in cases of compelling and documented need. To qualify for an incomplete, the student must have finished a substantial portion of the course and be performing at a "C" level or better. The student must sign an "incomplete contract" stipulating the requirements and date for the completion of the course and assignment of a final grade.

Miscellaneous

There will be no extra credit assignments.

There will be no retakes of quizzes or examinations.

CANVAS for PSYC
401

I will be using CANVAS as a multipurpose resource for the course. It will be:

- a repository for basic information about the course (lab manual, readings, etc.)
- a communications channel for course information of immediate importance
- a mechanism for reporting grades
- the location of your weekly quizzes
- a source for study materials before each test

CANVAS also makes a fine medium for data sharing, and students have worked out several creative ways of doing this. For instance, setting up collaborations using GoogleDocs can be an effective way to exchange CHART files.

To access Canvas, go to: [ELMS-Canvas](#)

If you run into problems, go to: [ELMS-Canvas Help](#)

In some cases, announcements important to the whole class, e.g. review sessions, class schedule changes, will be posted there. You can choose your personal CANVAS settings so that you are notified via your communication method of choice when any additional information about the course becomes available. **Be sure the setting for Announcements is 'ASAP' so that you don't miss time-critical information.** For further details see:

Although most of the essential information is now up on the PSYC 401 CANVAS site, it is an evolving resource. Feel free to experiment with the various options for interactions with other students that CANVAS provides.

Electronics in
class

No computers, phones or tablet devices are permitted during our class meetings.

No phones are permitted in the labs.

I understand and have considered all of the arguments for permitting laptop and tablet computers in the classroom. However, in my experience (and based on the research evidence) the reality is that they present an irresistible distraction, detract from the cooperative learning environment and unfairly distract other students. Researchers have found that these distractions do in fact interfere with learning and active participation. For that reason the use of computers and phones will not be permitted during class meetings (except when required for a ADS accommodation).

University
policies

PSYC 401 adheres to University of Maryland policies regarding undergraduate courses. You can find detailed descriptions of the policies here: [Course Related Policies.](#)

For your convenience, I have summarized some of the most important.

Academic
integrity

The University of Maryland has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student, you are responsible for knowing, understanding, and upholding these standards.

It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity, please visit:

[Student Honors Council](#)

Religious observances

The University System of Maryland policy provides that students should not be penalized because of observances of their religious beliefs, students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences for religious observances in advance. Notice should be provided as soon as possible but no later than the end of the schedule adjustment period. Prior notification is especially important in connection with final exams, since failure to reschedule a final exam before the conclusion of the final examination period may result in loss of credits during the semester.

Students with disabilities

If you have a documented disability, you should contact Accessibility and Disability Support at 0126 Shoemaker Hall. Each semester students with documented disabilities should apply to ADS for accommodation request forms that you can provide to your professors as proof of your eligibility for accommodations. The rules for eligibility and the types of accommodations a student may request can be reviewed at the [ADS web site](#)

Course evaluations

Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning at the University as well as to the tenure and promotion process. CourseEvalUM will be open for you to complete your evaluations for spring semester courses between approximately April 28 and May 12. You can go directly to the website (www.courseevalum.umd.edu) to complete your evaluations or do it through CANVAS. By completing all of your evaluations each semester, you will have the privilege of accessing the summary reports for thousands of courses online at Testudo.

Class/lab climate

It's simple: you will treat all your classmates with respect and consideration. All the time. No exceptions. Healthy intellectual discourse often involves disagreement, and everyone should feel free to express their opinions with the assurance that theirs will be heard and fairly evaluated. Neither I nor the students in the class will tolerate comments or actions that are, explicitly or by implication, disparaging, demeaning, discriminatory, or disrespectful in any way.

For more detailed information, visit the [Psychology Department Diversity and Inclusiveness site](#).

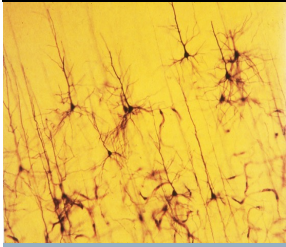
Animal welfare

Students should be fully aware that the laboratory exercises in this course use living animals and that many of the exercises involve non-survivable surgical procedures. Most of the animals will be invertebrates such as cockroaches and crayfish, but we will also be using frogs/toads. No mammals or birds will be used. Our laboratory procedures for the frog will be in complete compliance with codes of animal care and humane treatment established by the University and by the state and federal governments. All of our laboratory procedures for vertebrates must be evaluated and approved by the Institutional Animal Care and Use Committee before we can use them in a lab class. Further, we believe that any responsible scientist or student (or any other person, for that matter) must treat animals humanely and with respect, and we expect you to do exactly that.

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Tentative Laboratory Schedule

(tentative schedule: we have flexibility in the length of each module, we may change the sequence, and we may replace one or more modules with new projects)

WEEK OF:

LAB EXERCISE

January 27th	No lab the first week, but classes Monday and Wednesday
February 3rd	Autonomic nervous system: stress; introduction to the data acquisition system
February 10th	Motor control: motor unit recruitment; compensation through stretch reflexes
February 17th	Cockroach escape behavior: direction of the turn
February 24th	Cockroach escape behavior: stimulus coding the giant interneurons
March 2nd	Cockroach escape behavior: a timing map of the neural circuit
March 9th	Crayfish body language: agonistic behavior and neuromodulation
March 16th	Spring Break
March 23rd	Crayfish body language: neuromodulation of postural motor neurons
March 25th	In-class examination
March 30th	Crayfish body language: crayfish on Prozac; tail flip pharmacology
April 6th	Rhythmic behavior: four-winged flight and CPGs
April 13th	Rhythmic behavior: CPGs and neural control of flight coordination
April 20th	Frog prey capture: recognition and localization of prey
April 27th	Frog prey capture: multiunit CNS recording to show tectal map
May 4th	Frog prey capture: multiunit CNS recording to show feature detection
May 11th	No labs (partial week) – class on Monday
May 18th	FINAL EXAM – 8:00am–10:00am