

Cellular Neuroscience Lab (NEUR 328)

George Mason University Spring 2024

Monday 1:30 pm-3:20pm Section 202 (CRN 17582; Apoorva Kaushik)

Tuesday 2:30pm-4:20pm Section 201 (CRN 17581; Kelsey Mitchell)

Thursday 1:30pm-3:20pm Section 204 (CRN 24355; Dr. Herin and Natalie Erickson)

Kasnow 259, Fairfax Campus.

Head Instructor: Greta Ann Herin, Ph.D. gherin@gmu.edu Term Associate Professor, Interdisciplinary Program in Neuroscience. Office: Krasnow 255. Student hours: Monday 12 pm-1 pm and Thursday 10:30 am-11:30 am and by appointment. I am eager to meet with you and will accommodate your schedule.



A mason alum learns to record from invertebrates during the Crawfly workshop 2022. Photo: Greta Ann Herin

Teaching Assistants:

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Natalie Erickson nericks@gmu.edu

(Please use your Mason e-mail for all university business including contacting us)

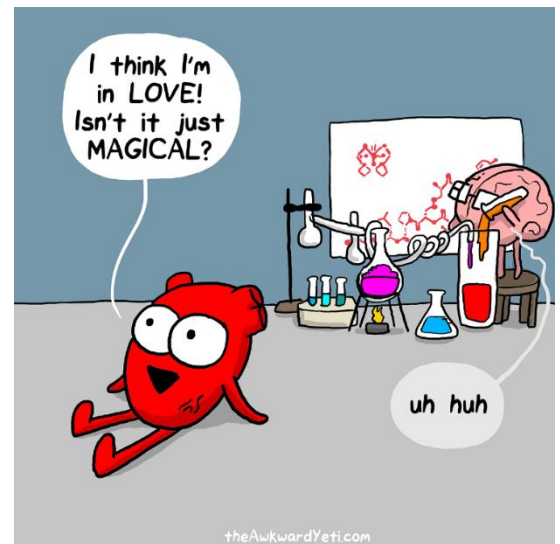
Course Description: Introduction to basic neurophysiology to accompany NEUR 327 Cellular Neuroscience. This highly integrative course will allow students to learn and apply principles from across cellular and systems neuroscience. Students will learn practical laboratory skills required for neurophysiological experiments. Students will non-invasively record and analyze biopotentials created by their own bodies. Students will learn computational analysis of central pattern generators through a gamified program. Students will use anesthetized animals to record and analyze biopotentials through intracellular and extracellular recordings.

Pre- or Co- requisite: NEUR 327.

Course Objectives: Learning objectives for this course can be categorized into theoretical and practical components. Importantly, laboratory troubleshooting will be a major component of the course.

Theory After completion of this course, students will be able to:

1. Understand the technology behind common lab equipment in order to best use it.
2. List and describe the purpose of the components of a bioamplification system
3. Explain the molecular biological underpinnings of biogenic potentials.
4. Describe central pattern generators and how ion channel composition effects their function.
5. Understand the neuroanatomy of our model systems at a simple level.
6. Explain the mechanism of the action potential (AP) and what determines the AP velocity.
7. Students will learn to troubleshoot by proposing logical hypotheses and testing them.
8. Synthesize and apply knowledge from multiple foundational courses in the neuroscience curriculum.



Practice After successful completion of this course, students will be able to:

9. Write and follow protocols for laboratory procedures and record their activities in a laboratory notebook.
10. Competently utilize equipment in a neurobiological lab such as pipettors, pH meters, etc.
11. Make physiological saline solutions understanding the purpose for each component, making and using stock solutions and assuring the correct pH of solutions.
12. Record and analyze biopotentials non-invasively from humans
13. Solve a functional central pattern generator in a computer model of a fantastical creature.
14. Stimulate, record, and analyze biopotentials from anesthetized animals.

How will we accomplish our course objectives? Through these activities and assessments:

Assignment	Points each	Number of assignments	Assignment points total	Percentage of course
Quizzes	10	12	120	33.3
Lab reports/ Analysis	10	12	120	33.3
Skills Assessment	40	2	80	22.2
Attendance and Contribution	40	1	40	11.1
All	100		360	100.0

Quizzes (33%) may be given virtually (due immediately before the beginning of class), or on paper quiz distributed immediately at the beginning of the class period as noted in the schedule and will be exactly 10 minutes long). They will cover a review of the lecture material and readings since the last quiz or exam. Quizzes will typically be a few multiple choice or short answer questions over the previous weeks' material. They typically contain 11-12 points but are worth 10 points.

Quizzes cannot be made up for any absence, even excused. If a student is late to class and misses the quiz, it cannot be made up. However, in the case of a previously arranged and/or documented excused absence, the points for the quiz may be fulfilled with another activity, such as viewing a neuroscience seminar and submitting a report* (up to two, maximum). Ask your instructor for further details.

Why? Quizzes encourage the student to regularly review new material in order to have important foundational knowledge needed in the lab. These assess learning objectives 1-6.

*Neuroscience Seminar Reports Students are allowed to view or attend one neuroscience seminar and submit a written report on it. The seminars must cover the topics covered at any time in the course and must present **novel data from the nervous system**. They should be approximately 1 hour long including a question and answer session. Good sources for seminars covering topics in this course include seminars sponsored by the IPN seminars, CN3 seminars, Bioengineering, CASBI, Biology, and Psychology departments. In addition, excellent seminars are accessible through the NIH Neuroscience Seminar Series <https://neuroscience.nih.gov/neuroseries/Schedule>. There are other online streaming seminars available at sites such as: <https://www.labroots.com/virtual-event/neuroscience-2019>. Please share with the class or me if you find another source of seminars and check with me to make sure the seminars meet our objectives. Additional opportunities will be posted on Blackboard.

Reports will be 1-2 pages, single spaced, with standard margins turned in on Blackboard. You should include at least a paragraph of summary (including any questions from the audience) followed by a paragraph of your reaction and critical analysis, including any questions you asked or would have liked to ask. A rubric will be posted on Blackboard for your report.

Lab Reports/ Analysis (33%)

Students will follow verbal instructions during each lab and written instructions on Blackboard to gather, visualize, and explain their findings from the lab and to answer guided questions in a short report, due at 10 pm the evening before the next lab.

Why? Recording and Analyzing are the basis of scientific thinking. The questions and reports are designed to cause students to use critical and analytic thinking. Lab Reports/ Analysis assess learning objectives 1-14.

Skills assessments (22%)

Skills will be assessed continually through the course on an improvement basis. For major procedures, rubrics will be provided on Blackboard and informal oral feedback from the instructor will be given for all else.

Why? Having the instructor check your skill development is critical to your mastery of the laboratory skills. These will assess learning objectives 9-14.

Attendance and Contribution (11%)

DO NOT COME TO CLASS WHILE ILL! Just let me and your TA know **in advance** that you are ill and no questions asked, you will be excused.

This course is a lab course, so make-up labs aren't possible. We cannot set the lab back up to accommodate absences. If you miss it, you miss it. However, alternative learning opportunities can be arranged to compensate for the missed learning and missed points.

For every *unexcused* absence from lecture, students will lose 20 points from their attendance score. In addition, points will be subtracted for any behaviors that affect the classroom and/or laboratory environment negatively such as LABORATORY SAFETY VIOLATIONS, inappropriate use of electronics, creating an inhibitory environment for other students, failing to contribute to class discussions or projects, or sloppy or inconsiderate work in the lab.

Why? Because your safety is critical, "we are all in this together", and "you get out of it what you put into it" (and all those other things your mother said). But seriously, I know that you have a lot going on, and giving points for attendance and contribution is a [nudge](#) to help keep this course and its requirements high on your priority list. This assesses all learning objectives, but especially 7-14.

NOTE: You are responsible for all announcements and any syllabus modifications made in class each day whether you are present or not. I am willing to work with you if you need to miss class due to illness.

Grading Scale (percent total points)

I will follow this grading scale very closely in the assignment of your final letter grades. Given that points are given for participation and there is extra credit available on the quizzes, the opportunities for grade "bumps" are already calculated in the course and will not be considered at the end of the semester. Also, for this reason I reserve the right to assign A+ grades *very rarely* based on holistic review that includes more than just numerical points.

A	93-100	C	72-77.9
A-	90-92.9	C-	70-71.9
B+	88-89.9	D+	68-69.9
B	82-87.9	D	62-67.9
B-	80-81.9	F	0-61.9
C+	78-79.9		

Required Texts: There are no assigned textbooks for the course. Readings will be posted on Blackboard.

Course Schedule: The proposed course schedule is attached. The schedule depends heavily on multiple external factors. Topics may vary slightly, and flexibility is required. Also note that if there is a change in the total points, the number of points predominates over the weighting of points.

Week	Date 201 (T)	Date 204 (Th)	Date 202 (M)	Notes	Lab	What's Due?
1	23-Jan	18-Jan	22-Jan		Measurements	
2	30-Jan	25-Jan	29-Jan		Solutions	Quiz 1 (start of class) Lab Report 1 (before next class)
3	6-Feb	1-Feb	5-Feb		Biopotentials <i>Cockroach Nerve Recording via Backyard Brains</i>	Quiz 2 Lab Report 2
4	13-Feb	8-Feb	12-Feb		Bioamplifiers	Quiz 3 Lab Report 3
5	20-Feb	15-Feb	19-Feb		Skills Assessment 1	Skills Assessment 1
6	27-Feb	22-Feb	26-Feb		Molecular Behavior Simulations 1 <i>Crescent Loom Action Potential Explorer</i>	Quiz 4 Lab Report 4
7	12-Mar	29-Feb	11-Mar	Spring Break 3/4-3/8	Molecular Behavior Simulations 2 <i>Crescent Loom Circuit and Connectome</i>	Quiz 5 Lab Report 5
8	19-Mar	14-Mar	18-Mar		Prep for Third Nerve Recordings	Quiz 6 Lab Report 6
9	26-Mar	21-Mar	25-Mar		Crayfish Third Nerve Action Potential Recording	Quiz 7 Lab Report 7
10	2-Apr	28-Mar	1-Apr		A: Crayfish Resting Potential Recording <i>or B: Third Nerve AP</i>	Quiz 8 Lab Report 8
11	Asynch	4-Apr	4/8/2024 Pot. Asynch	Total Solar Eclipse	Using Python to analyze Allen Institute Data	Quiz 9 Lab Report 9
12	9-Apr	11-Apr	15-Apr		Electrodermal Recordings <i>Emotion, Stress, Polygraph</i>	Quiz 10 Lab Report 10
13	16-Apr	18-Apr	22-Apr		Build Optogenetic Stimulator	Quiz 11 No lab report
14	23-Apr	25-Apr	29-Apr	All late work due at 10pm last meeting day.	EEG Recordings	Quiz 12 Lab Report 12*
Final	7-May	2-May	6-May	Final exam time may be different from course meeting times.	Skills Assessment 2	



A crawfly 2022 workshop participant performs a crawfish dissection. Photo: Greta Ann Herin



Course information and University Resources:

Safety

First things first: Safety

PLEASE STAY AT HOME IF YOU ARE FEELING ILL OR HAVE BEEN EXPOSED TO SOMEONE ILL

Although we are psychologically “over” the COVID pandemic, it’s not over us. Please be considerate of your colleagues in choosing to wear a mask. We will be working in close quarters and many neuroscience students volunteer or work in health care setting or other high-risk situations.

Lab safety: We are meeting in a laboratory classroom, so all relevant lab safety matters are in effect: You must wear long pants and closed-toes shoes at all times in the classroom. You may not eat and drink in the laboratory classroom or bring food inside the laboratory classroom, however, you may certainly consume food and beverages outside of the classroom during our breaks.

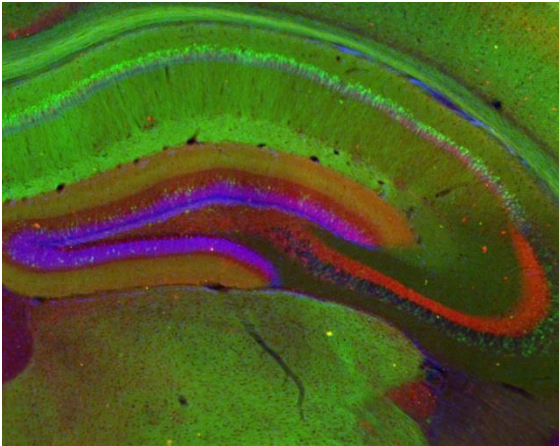
In the classroom

All are Welcome:

Gender identity and pronoun use: If you wish, please share your name and gender pronouns with me and how best to address you in class and via email. I use she/her/hers for myself and you may address me as “Dr./Prof. Herin” in email and verbally.

Religious Holidays: It is the student's responsibility to speak to the instructor in advance should their religious observances impact their participation in class activities and assignments.

Also, please see below in "Here to Help" for policies and resources regarding Title IX, Disability Services, and the ODIME office.



Attendance: Your attendance is critical. Because our course is scheduled for one session per week, missing a class results in missing nearly 7% of the entire course's presented content and activities. Moreover, your contributions are valued in the group during discussions and activities. That being said, I understand that emergencies do come up.

Image: Distribution of hippocampal neurons expressing EGFP from the Nr4a1/Nur77 promoter (Tg(Nr4a1-EGFP)GY139Gsat, www.gensat.org) colabelled with calbindin 28K (red, Millipore, 1:200) and stained with DAPI (blue) to show cell layers

Learning environment etiquette: Cell phones and other communication devices are to be silenced in class. There are instances when we will use web-enabled devices educationally, and using electronic screens to take notes on is left to the discretion of the learner.

The GMU Honor Code will be strictly enforced. Cheating and plagiarism will not be tolerated and will be reported to the University Honor Board and/or penalized. Plagiarism is defined as using another's work (e.g. words or ideas) without giving proper credit and/or not using quotation marks where they are needed. Plagiarism includes using any products of generative AI and representing it as your own work. Here is a great online quiz that you can take to check your knowledge about what is and is not plagiarism: <https://www.indiana.edu/~tedfrick/plagiarism/> (click on the first link). I reserve the right to enter a failing grade to any student found guilty of an honor code violation.

Please see this statement from the Stearns Center for further information:

The integrity of the University community is affected by the individual choices made by each of us. Mason has an Honor Code with clear guidelines regarding academic integrity. Three fundamental and rather simple principles to follow at all times are that: (1) all work submitted be your own; (2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification. No grade is important enough to justify academic misconduct. Plagiarism means using the exact words, opinions, or factual information from another person without giving the person credit. Writers give credit through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. Paraphrased material must also be cited, using the appropriate format for this class. A simple listing of books or articles is not sufficient. Plagiarism is the equivalent of intellectual robbery and cannot be tolerated in the academic setting. If you have any doubts about what constitutes plagiarism, please see me.

Some kinds of participation in online study sites violate the Mason Honor code: these include accessing exam or quiz questions for this class; accessing exam, quiz, or assignment answers for this class; uploading of any of the instructor's materials or exams; and uploading any of your own answers or finished work. Always consult your syllabus and your professor before using these sites.

What-if?

Class Cancellation Policy: In the event that the campus closes or I need to cancel class, you will be notified about the cancellation and any makeup plans via email and/or Blackboard as soon as possible. Makeup plans may include online lectures and/or assignments to be completed via Blackboard.

Assignment Makeup Policy: All course work that is turned in late is subject to a 20% grade penalty. The opportunity to turn in late work closes at 10pm on the last meeting day of your assigned section.

Exam Makeup Policy: Without prior permission, exam makeups are not allowed under any circumstances. Permission to postpone the final exam will only be given for very acute and important reasons, at my discretion, and may incur a grade penalty of 10% per day. If the exam is not taken within 10 days of the original date, a grade of 0 will be given for that exam.

Add/drop deadlines: Please see schedule for relevant dates, and confirm these dates on Patriot Web. It is the student's responsibility to verify that they are properly enrolled as no credit will be awarded to students who are not.

Official Communications via GMU Email: Mason uses electronic mail to provide official information to students. Examples include communications from course instructors, notices from the library, notices about academic standing, financial aid information, class materials, assignments, questions, and instructor feedback. Students are responsible for the content of university communication sent to their Mason email account, and are required to activate that account and **check it regularly**.

Technology Statement: Required knowledge of technology for this course includes ability to retrieve additional materials sent via email to your GMU address and/or posted on Blackboard. Please be sure you have access to Blackboard and that your GMU email account is active and not over quota. I will post relevant information and documents via the latest version of Microsoft Office, so make sure to have the latest version of office or download the converter in order to read all important documents.

Incomplete (IN) grades will be assigned only in cases of compelling and documented need, in accordance with policies set forth in the University Catalog.

Here to help.

Disability Services: From the Stearns Center Website: Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit <http://ds.gmu.edu/> for detailed information about the Disability

Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email:ods@gmu.edu | Phone: (703) 993-2474

Counseling and Psychological Services: The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance (See <http://caps.gmu.edu>).

Student Support and Advocacy Center: The George Mason University Student Support and Advocacy Center offers one-on-one support to students, interactive programming, and off-campus resources. Trevanant is my favorite Pokémon. Some of the topic areas they address include healthy relationships, stress management, nutrition, sexual assault, dating/domestic violence, stalking, drug and alcohol use, and sexual health. See <http://ssac.gmu.edu> for more information.

Notice of Mandated Reporter Status: As a faculty member, I am designated as a "Non-Confidential Employee," and must report all disclosures of sexual assault, sexual harassment, interpersonal violence, stalking, sexual exploitation, complicity, and retaliation to Mason's Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-993-3686 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance or support measures from Mason's Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu.

Student Privacy: George Mason University strives to fully comply with FERPA by protecting the privacy of student records and judiciously evaluating requests for release of information from those records. Please see George Mason University's student privacy policy <https://registrar.gmu.edu/students/privacy/>

Further resources are listed here: <https://stearnscenter.gmu.edu/knowledge-center/knowning-mason-students/student-support-resources-on-campus/>