Cellular Neuroscience Lab
(NEUR 328)

George Mason University Fall 2024

Tuesday 1:30 pm-4:10pm Section 204 (CRN 82950; Dr. Herin)

Wednesday 1:30pm-4:10pm Section 205 (CRN 82951; Dr. Herin)

Thursday 1:30pm-4:10pm Section 206 (CRN 82952; Natalie Erickson)

Krasnow 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 for Dr. Herin: Thursday 10:00 am-12:00 pm 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

Graduate Teaching Assistant:

Natalie Erickson nericks@gmu.edu

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

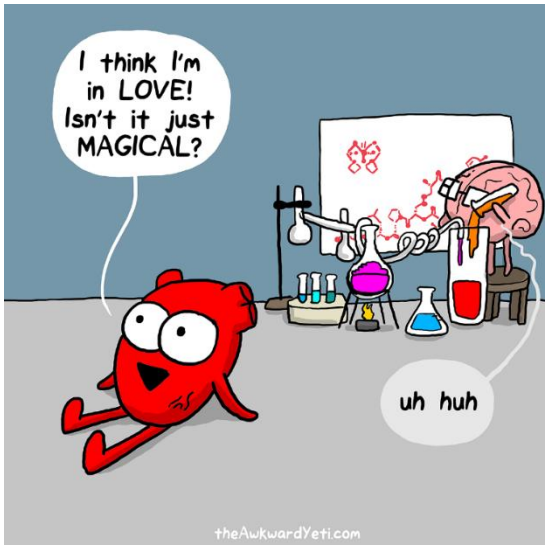
Course Description: Introduction to basic neurophysiology to accompany NEUR 327 Cellular Neuroscience. This highly integrative course will allow students to learn and apply principles from

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. Describe central pattern generators and how ion channel composition effects their function.
4. Understand the neuroanatomy of our model systems at a simple level.
5. Explain the mechanism of the action potential (AP) and what determines the AP velocity.
6. Students will learn to troubleshoot by proposing logical hypotheses and testing them.
7. Synthesize and apply knowledge from multiple foundational courses in the neuroscience curriculum.

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

8. Follow protocols for laboratory procedures and record their activities in a laboratory notebook.
9. Competently utilize equipment in a neurobiological lab such as pipettors, pH meters, etc.
10. Make physiological saline solutions understanding the purpose for each component, making and using stock solutions and assuring the correct pH of solutions.
11. Solve a functional central pattern generator in a computer model of a fantastical creature.
12. Record and analyze biopotentials non-invasively from humans
13. 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
Syllabus Quiz	5	1	5	1.4
Quizzes	10	12	120	33.3
Lab reports/ Analysis	10	12	120	33.3
Skills Assessment	40	2	80	22.2
Attendance and Contribution	35	1	35	9.7
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 max.

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 (~10%)

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 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: 204 (T)	Date: 205 (W)	Date: 206 (R)	Notes	Lab	What's Due?
1	27-Aug	28-Aug	29-Aug		Measurements	Syllabus Quiz
2	3-Sept	4-Sept	5-Sept		Physiological Salines	Quiz 1 Lab Report 1
3	10-Sept	11-Sept	12-Sept		Biopotentials: Cockroach Nerve Recording via Backyard Brains	Quiz 2 Lab Report 2
4	17-Sept	18-Sept	19-Sept		Bioamplifiers	Quiz 3 Lab Report 3
5	24-Sept	25-Sept	26-Sept		Skills Assessment 1	
6	1-Oct	2-Oct	3-Oct		Molecular Behavior Simulations 1 Crescent Loom Action Potential Explorer	Quiz 4 Lab Report 4
7	8-Oct	9-Oct	10-Oct		Molecular Behavior Simulations 2 Crescent Loom Circuit and Connectome	Quiz 5 Lab Report 5
8	15-Oct	16-Oct	17-Oct		Prep for Third Nerve Recordings	Quiz 6 Lab Report 6
9	22-Oct	23-Oct	24-Oct		Crayfish Third Nerve Action Potential Recording	Quiz 7 Lab Report 7
10	29-Oct	30-Oct	31-Oct		A: Crayfish Resting Potential Recording or B: Third Nerve AP	Quiz 8 Lab Report 8
11	12-Nov	6-Nov	7-Nov		Using Python to analyze Allen Institute Data	Quiz 9 Lab Report 9
12	19-Nov	13-Nov	14-Nov		Electrodermal Recordings: Emotion, Stress, Polygraph	Quiz 10 Lab Report 10
13	26-Nov	20-Nov	21-Nov		Build Optogenetic Stimulator	Quiz 11 No lab report
14	3-Dec	4-Dec	5-Dec	All late work due at 10pm last meeting day.	EEG Recordings	Quiz 12 Lab Report 12
Final	17-Dec	11-Dec	12-Dec	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.

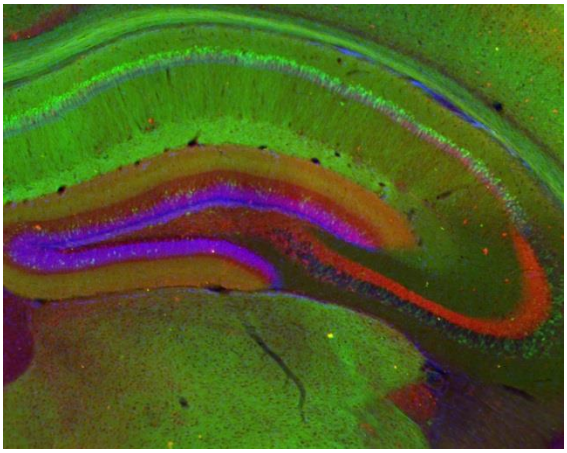
In the classroom

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. 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:

> Academic Standards exist to promote authentic scholarship, support the institution's goal of maintaining high standards of academic excellence, and encourage continued ethical behavior of faculty and students to cultivate an educational community which values integrity and produces graduates who carry this commitment forward into professional practice.
>
> As members of the George Mason University community, we are committed to fostering an environment of trust, respect, and scholarly excellence. Our academic standards are the foundation of this commitment, guiding our behavior and interactions within this academic community. The practices for implementing these standards adapt to modern practices, disciplinary contexts, and technological advancements. Our standards are embodied in our courses, policies, and scholarship, and are upheld in the following principles:
>
> - **Honesty:** Providing accurate information in all academic endeavors, including communications, assignments, and examinations.
> - **Acknowledgement:** Giving proper credit for all contributions to one's work. This involves the use of accurate citations and references for any ideas, words, or materials created by others in the style appropriate to the discipline. It also includes acknowledging shared authorship in group projects, co-authored pieces, and project reports.
> - **Uniqueness of Work:** Ensuring that all submitted work is the result of one's own effort and is original, including free from self-plagiarism. This principle extends to written assignments, code, presentations, exams, and all other forms of academic work.
>
> Violations of these standards—including but not limited to plagiarism, fabrication, and cheating—are taken seriously and will be addressed in accordance with university policies. The process for reporting,

investigating, and adjudicating violations is outlined in the university's procedures. Consequences of violations may include academic sanctions, disciplinary actions, and other measures necessary to uphold the integrity of our academic community.

The principles outlined in these academic standards reflect our collective commitment to upholding the highest standards of honesty, acknowledgement, and uniqueness of work. By adhering to these principles, we ensure the continued excellence and integrity of George Mason University's academic community.

Student responsibility: Students are responsible for understanding how these general expectations regarding academic standards apply to each course, assignment, or exam they participate in; students should ask their instructor for clarification on any aspect that is not clear to them.

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 https://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.

Student responsibility: Students are responsible for registering with Disability Services and communicating about their approved accommodations with their instructor *in advance* of any relevant class meeting, assignment, or exam.

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 P0kém0n. 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 part of George Mason University's commitment to providing a safe and non-discriminatory learning, living, and working environment for all members of the University community, the University does not discriminate on the basis of sex or gender in any of its education or employment programs and activities. Accordingly, all non-confidential employees, including your faculty member, have a legal requirement to report to the Title IX Coordinator, all relevant details obtained directly or indirectly about any incident of Prohibited Conduct (such as sexual harassment, sexual assault, gender-based stalking, dating/domestic violence). Upon notifying the Title IX Coordinator of possible Prohibited Conduct, the Title IX Coordinator will assess the report and determine if outreach is required. If outreach is required, the individual the report is about (the "Complainant") will receive a communication, likely in the form of an email, offering that person the option to meet with a representative of the Title IX office.

For more information about non-confidential employees, resources, and Prohibited Conduct, please see University Policy 1202: Sexual and Gender-Based Misconduct and Other Forms of Interpersonal Violence. Questions regarding Title IX can be directed to the Title IX Coordinator via email to TitleIX@gmu.edu, by phone at 703-993-8730, or in person on the Fairfax campus in Aquia 373.

Student opportunity: If you prefer to speak to someone confidentially, please contact one of Mason's confidential employees in Student Support and Advocacy (SSAC), Counseling and Psychological Services (CAPS), Student Health Services (SHS), and/or the Office of the University Ombudsperson.

Student Privacy: The Family Educational Rights and Privacy Act (FERPA) governs the disclosure of education records for eligible students and is an essential aspect of any course. **Students must use their GMU email account** to receive important University information, including communications related to this class. Instructors will not respond to messages sent from or send messages regarding course content to a non-GMU email address. Please see George Mason University's student privacy policy https://registrar.gmu.edu/students/privacy/

Student responsibility: Students are responsible for checking their GMU email regularly for course-related information, and/or ensuring that GMU email messages are forwarded to an account they do check. Further resources are listed here: https://stearnscenter.gmu.edu/knowledge-center/knowing-mason-students/student-support-resources-on-campus/

Consider NuRhoPsi: Our national neuroscience honors society welcomes eligible folks:

- Major or minor in Neuroscience
- Completion of at least 3 semesters of the College course
- Completion of at least 9 semester hours of Neuroscience-related courses
- Undergraduate cumulative GPA of 3.2 and a minimum GPA of 3.5 in Neuroscience courses

For more information: nurhopsigmu@gmail.com