Cellular Neuroscience Lab
(NEUR 328)

George Mason University Fall 2025

Monday	1:30pm-4:10pm	Section 201	CRN 18438	Dr. Herin with Sree Yerramsetty
Tuesday	1:30pm- 4:10pm	Section 202	CRN 18439	Lindsey Bertin
Wednesday	1:30pm-4:10pm	Section 205	CRN 18440	Dr. Herin with Diego Gonzalez
Thursday	1:30pm-4:10pm	Section 204	CRN 21598	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 11:00am-12:30pm 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 Assistants and Office Hours:

Lindsey Bertin, Th 2:30-4:00pm via Zoom and KB 163, lbertin@gmu.edu

Natalie Erickson, Th 8-9:30am Zoom or KB 257, nericks@gmu.edu

Diego Gonzalez, M 11a-2pm Zoom, KB 259, dgonza3@gmu.edu

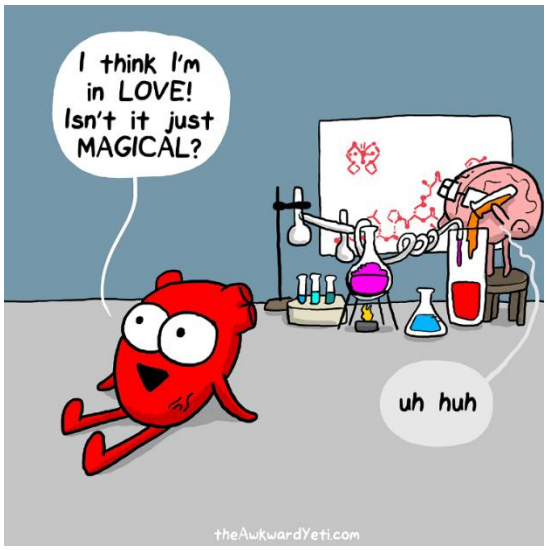
Sree Yerramsetty, M 1-2:30 via Zoom or KB 257, mailto:syerram6@gmu.edu

All students are welcome in any instructor's office hours. Please use your Mason e-mail for all university business including contacting us.

Course Description: Introduction to basic neurophysiology to reinforce 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, BENG 327 or equivalent.

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. Use the Nernst and Goldman-Hodgkin Katz equations and understand their relevance in neural function.
2. Explain the mechanism of the action potential (AP).
3. Describe small circuits such as central pattern generators and how ion channel composition effects their function.
4. Understand the neuroanatomy of our model systems at a simple level.
5. Understand the technology behind common lab equipment and principles behind bioaplification.
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. Prepare using "*Mise en place*" principles, follow protocols for laboratory procedures, and record their activities in a laboratory report.
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 & Equipment Quiz	**10**	**1**	**10**	**2.6**
Pre-Lab Quizzes	**10**	**12**	**120**	**30.8**
Lab Reports	**10**	**12**	**120**	**30.8**
Skills Assessments	**50**	**2**	**100**	**25.6**
Attendance and Contribution	**40**	**1**	**40**	**10.3**
All			**390**	**100.0**
Lab evaluations, ECs	**1 to 2**			**no more than 6%**

Pre-lab Quizzes (30.8%) may be given virtually through Canvas (due immediately before the beginning of class), or on paper (distributed immediately at the beginning of the class period as noted in the schedule and will be exactly 10 minutes long). They will cover the background material and instructions for the day's lab. Quizzes will typically be a few multiple choice or short answer questions. Paper quizzes typically contain 11-12 opportunities for points but are worth 10 points max. *Sometimes we make mistakes or set the wrong settings on Canvas, so if you don't see any background material, please contact your TA.* Pre-lab quiz makeup policy.

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.

Lab Reports / Analysis (30.8%)

Students will follow verbal instructions during each lab and written instructions on Canvas 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. Though you will work in groups, your lab reports must be written individually. You may share data, but written work and analysis must be your own. Please see the academic standards section for a more thorough explanation. Lab Report makeup policy.

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 (25.6%)

Skills assessments are offered twice during the semester and will consist of a written exam that tests knowledge and skills at serval stations set up in the lab. At some stations, questions will ask about what you can observe, other stations will ask you to do something to obtain the answer, and some stations will ask you to demonstrate a skill to a proctor. Skills assessments will cover the skills and knowledge from the previous skills assessment. The second skills assessment will serve as the final exam.

Why? Reviewing knowledge and practicing skills makes them long-lasting and moves you toward mastery of them. These will assess learning objectives 9-14. Skills Assessment makeup policy

Attendance and Contribution (10.3%)

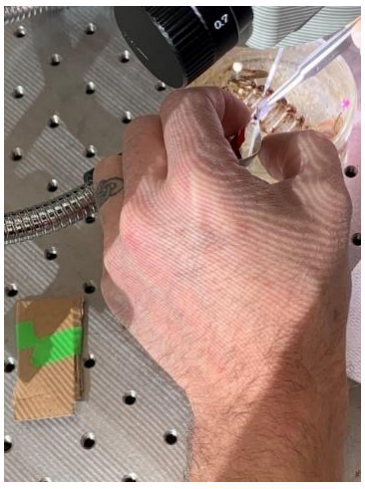
DO NOT COME TO CLASS WHILE ILL! Just let me and/or your TA know **in advance** that you are ill and no questions asked, you will be excused.

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. With prior permission you may attend another non-full section. However, alternative learning opportunities can be arranged to compensate for the missed learning and missed points.

For every *unexcused* absence from lab, 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, failing to clean up after yourself, or sloppy or inconsiderate work in the lab. Attendance and Contribution points may be deducted in cases of academic standards violations or inability to express written work verbally.

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). 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.



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

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

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 extra credit is available, opportunities for grade "bumps" are already calculated in the course and will not be considered at the end of the semester. Additionally, I reserve the right to assign A+ grades *very rarely* based on holistic review that includes more than just numerical points. If there is a change in the total points, the number of points predominates over the weighting of 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		

Course Schedule: The proposed course schedule is attached. The schedule depends heavily on multiple external factors. Topics may vary slightly, and flexibility is required. Schedule changes will be posted on Canvas.

Week	Date: 201 (M)	Date: 202 (T)	Date: 205 (W)	Date: 204 (Th)	Lab	What's Due?
1	2-Feb	20-Jan	21-Jan	22-Jan	Measurements	Welcome to our lab.
2	9-Feb	3-Feb	4-Feb	5-Feb	Physiological Salines	Measurements Report (due 10 pm evening before lab)
						Physiological Salines Pre-lab Quiz (due online immediately before lab)
						Syllabus Quiz + Measurements Post-lab Quiz (one time only at beginning of lab)
3	16-Feb	10-Feb	11-Feb	12-Feb	Biopotentials Using Cockroach Femoral Nerve	Physiological Salines Report (10 pm night before lab for this and all following)
						Biopotentials Pre-lab Quiz (in lab for this and all following)
4	23-Feb	17-Feb	18-Feb	19-Feb	Bioamplifiers Using Human Pulse and EMG	Biopotentials Report
						Bioamplifiers Pre-lab Quiz
5	2-Mar	24-Feb	25-Feb	26-Feb	Channels to Behavior Simulations 1: Using Crescent Loom AP Explorer	Bioamplifiers Report
						Action Potential Explorer Pre-lab Quiz

6	16-Mar	3-Mar	4-Mar	5-Mar	Channels to Behavior Simulations 2 + Neuroethology Using Crescent Loom Solve a Circuit and Connectome	Action Potential Explorer Report
						Solve a Circuit + Connectome Pre-lab Quiz
Spring break 9-Mar - 15-Mar						
7	23-Mar	17-Mar	18-Mar	19-Mar	Skills Assessment 1	
8	30-Mar	24-Mar	25-Mar	26-Mar	Rig and Prep for Crayfish Recordings	Solve a Circuit + Connectome Report
						Rig and Prep for Crayfish Recordings Pre-lab Quiz
9	6-Apr	31-Mar	1-Apr	2-Apr	Crayfish Resting Potential Recording	Prep for Crayfish Recordings Report
						Crayfish Resting Potential Recording Pre-lab Quiz
10	13-Apr	7-Apr	8-Apr	9-Apr	Crayfish Third Nerve Action Potential Recording	Crayfish Resting Potential Report
						Crayfish Resting Third Nerve Pre-lab Quiz
11	20-Apr	14-Apr	15-Apr	16-Apr	Crayfish Spike Analysis	Crayfish Third Nerve Report
						Crayfish Spike Analysis Pre-lab Quiz
12	27-Apr	21-Apr	22-Apr	23-Apr	Multichannel Recordings: Emotion + Classical Conditioning	Spike Analysis Report
						Multichannel Recordings Pre-lab Quiz
13	4-May	28-Apr	29-Apr	30-Apr	EEG Recordings	Multichannel Recordings Report
					*All late work due at 10pm last meeting day.	EEG Recordings Pre-Lab Quiz
Final*	**11-May**	**12-May**	**6-May**	**7-May**	Skills Assessment 2	EEG Recordings Report due 10 pm 6 days from experiment.
	1:30 PM - 4:15 PM	**1:30 PM - 4:15 PM**	**1:30 PM - 4:15 PM**	**1:30 PM - 4:15 PM**		
*Final exam time may be different from course meeting times.						
Colored boxes indicate a deviation from the typical schedule						

Course information and University Resources:

Safety

First things first: Safety

PLEASE STAY AT HOME IF YOU ARE FEELING ILL.

If you have been exposed to illness or are high risk, 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, where they could potentially expose vulnerable populations.

Lab safety is important. 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

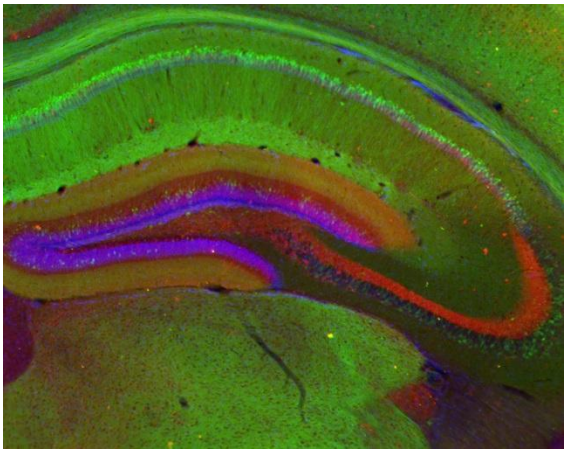
All are Welcome:

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: Active participation in a faith community is fully supported in this course. 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.

Disability Services: We warmly welcome folks with disabilities in this course. We seek to honor accommodations as much as possible in the ways they fit into our unique learning environment. See the University-wide policies here: GMU Common Course Policies - Stearns Center for Teaching and Learning

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 to prevent distraction of others. We use web-enabled devices for many of the labs, provided by the department. There is limited physical space for laptops, so it is preferred that tablets or smaller devices are used for notetaking and reference. In addition, electronics in the lab are at higher risk of being bumped, dropped, and spilled on, so you should minimize their use.

The GMU Academic Standards will be strictly enforced. Cheating and plagiarism will not be tolerated and will be reported to the University Academic Standards 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 if representing it as your own work. I reserve the right to ask a student to reiterate any written work verbally to me and that a students' verbal understanding needs to reasonably match the level of understanding expressed in written work. I may enter a failing grade on an assignment that cannot be verbally summarized, and to any student found guilty of an academic standards code violation.

Please see the academic standards for fabrication and unauthorized assistance.

Pay close attention: As juniors and seniors, you are not given a "warning" for academic standards violations. If found in violation, the lowest sanction is failure of the course. https://academicstandards.gmu.edu/academic-standards-code/

Your instructional staff will also not give warnings. If we suspect you of academic standards violation, it will be referred to the academic standards process. This is not negotiable.

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.

In our course, the saying "You may share data. Analysis and written work must be your own." helps remember what can be shared and not. To clarify further:

- You are absolutely allowed to collaborate to perform the lab. "Collaborate" means reading instructions, physically moving labware, measuring, using instrumentation, documenting instrument or model output, etc. This is explicitly permitted.
- Share:
  - Data= You are allowed to share data. "Data" is defined as direct readings from instruments or models.
  - I recommend against sharing data on shared documents or by phone pictures, especially if the document has written answers.
- Do not share:
  - Analysis= Calculations and making graphs are not considered data, but are considered analysis. You may not share analysis.
  - Written work= Open ended, explanatory questions such as what, where, when, define, explain, why, etc. are not considered "data" in common usage nor in our classroom setting. You may not share open ended or explanatory answers.
- If you have ANY questions about what may be shared, please consult with an instructor.

Technology Statement: We need to be able to communicate with you about this course. See the University-wide policies here: GMU Common Course Policies - Stearns Center for Teaching and Learning

FERPA and use of e-mail: To stay compliant with FERPA, you always need to use your GMU e-mail to communicate about this course. See the University-wide policies here: GMU Common Course Policies - Stearns Center for Teaching and Learning

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 Canvas as soon as possible. Makeup plans may include online lectures and/or assignments to be completed via Canvas. It could involve rearrangement of the lab schedule, with details posted on Canvas.

General 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 10 pm on the last meeting day of your assigned section.

Lab Makeup Policy: If you give advance notice of a missed lab, mock data will be made available to complete the lab report. You will be given two extra days to submit the lab report. Without advance notice, you are encouraged to fill out as much of the lab report as possible and turn a partial report in, and general late policies apply.

Quiz Makeup Policy: Quizzes cannot be made up in the case of any absence, even excused. If a student is late to class and misses the paper 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).

*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. Live, in-person attendance is preferable over live online attendance, which is preferable to asynchronous attendance. In addition, excellent seminars are accessible through the NIH Neuroscience Seminar Series https://research.ninds.nih.gov/seminars-events. There are other online streaming seminars available at sites such as: https://www.labroots.com/virtual-event/neuroscience-2019, https://www.world-wide.org/Neuro/, https://neuro.gatech.edu/seminar-series, https://neuroscience.stanford.edu/programs/community-building/seminar-series-wu-tsai-neuro. 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 Canvas.

Reports will be 1-2 pages, single spaced, with standard margins turned in on Canvas. 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 Canvas for your report. Your report is expected to be 100% human-created, though you should feel free to use Gen AI tools to help you understand difficult topics presented in the seminar.

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.

Title IX Resources and Required Reporting

We are mandated reporters. See the University-wide policies here: GMU Common Course Policies - Stearns Center for Teaching and Learning

Here to help!

Everyone belongs here: We seek to make our classroom and courses welcoming to all people. Please explore the university's website: Office of access, compliance and community

Counseling and Psychological Services: Things can get tough in this course, or college, or life in general. 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.

Consider NuRhoPsi: Our chapter of the national neuroscience honors society welcomes eligible folks:

- Major or minor in Neuroscience
- Completion of at least 3 semesters of college courses
- 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