Seminar in Neuroscience:
Biological Sex Differences in the Nervous Systems in Rodent Models
NEUR 411_003: Spring 2026 Credits: 3

Instructor: Patricia Sinclair, PhD
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Course Format: In person
Classroom: Horizon Hall 3001
Office Hours:
Instructor: Monday 1pm-3pm
TA: Wednesday 11am-12pm
OR by appointment!!

Course Overview

This course explores nervous system characteristics that are impacted by sex differences with a focus on molecular and signaling mechanisms. We will analyze primary literature that explicitly defines biological sex as a variable for studies in non-human models. In this course "sex" refers to the biological and physiological characteristics of males and females including chromosomes, reproductive organs, and hormones. Gender refers to social, cultural and psychological phenomena specific to humans.

This course fulfills the Writing Intensive (WI) requirement for the Neuroscience major

Writing Intensive Core courses at George Mason have 3 specific learning outcomes:

1. *Write-to-Learn:* Each week an assigned primary research article will be summarized and analyzed. Summarizing provides opportunities to learn about and understand methods used to study neural phenomena. Analyzing studies encourages critical thought about validity and value of the work. Constructive feedback on weekly summaries will guide students toward improved use of scientific writing principles including clarity, conciseness and objectivity.
2. *Writing-to-Communicate:* Communicating complex scientific ideas to a variety of audiences is an important skill. Students will write a news article targeting a broad audience and a research strategy that targets other neuroscientists.
3. *Writing-as-a-Process:* Writing effective documents is achieved as an iterative process from conception, drafts, revisions and editing to complete a final product. Feedback will be provided at various stages for the news article and research strategy prior to the final submission.

Course Format/Delivery

This course is fully **in-person**, meaning you must attend class each week in the classroom. All instructional slides will be posted to Canvas. Most assignments will be submitted in canvas. However, the class cannot be completed online as **participation in class discussions** is an integral component. No make-up opportunities for participation or in-class group assignments are possible.

Learning Goals

By the end of this course, you will be able to:

- Examine, analyze, and interpret data from primary literature related to the nervous system
- Think critically about neuroscience and question scientific findings
- Clearly present and facilitate discussions about scientific data
- Communicate scientific data for a variety of audiences
- Evaluate and critique writing from your colleagues
- Effectively respond to edits and make changes in writing
- Develop a unique research idea and propose a strategy for its completion

Canvas Login Instructions
To access the course Canvas site, go to: lms.gmu.edu and log in with your Mason credentials. In the Dashboard or in Courses choose the "Spring 2026 Seminar in Neuroscience" box.

Textbook
No textbook is required. All primary research papers and accompanying supplemental material will be provided on Canvas.

Office Hours
Getting help is easy! Office hours = student hours!! The instructor is available every **Monday 1pm-3pm** in **Krasnow Room 207** and the TA is available every **Wednesday 11am-12pm**. If you need an alternative time or modality (i.e., Zoom), please contact us and we will work with you.

Grading and Assessments
There are **no exams** in this course. You will be assessed throughout the course based on a combination of quizzes, assignments, discussion boards, and participation. Your Research Strategy paper is your final assessment. Final grades incorporate effort through participation and assignments graded for completion. Summary/analysis, news article, research strategy, and presentation are graded based on effectiveness of the final product.

Quizzes	5 %
Summary/Analysis	10 %
Discussion Participation	20 %
News Article	15 %
Research strategy	25 %
Presentation Assigned Article	20 %
Assignments*	5 %
*i.e., drafts, peer critiques, individual meeting attendance	
Total Grade	**100 %**

Grading Scale:

A+ 98 - 100%	B+ 88 - 89.9%	C+ 78 - 79.9%	D+ 60 - 69.9%	F 0 - 59%
A 93 - 97.9%	B 83 - 87.9%	C 73 - 77.9%		
A- 90 - 92.9%	B- 80 - 82.9%	C- 70 - 72.9%		

Add/Drop Deadlines
Deadlines for the Spring 2026 semester can be found on the Mason Academic Calendar page

Student Services
- Learning Services (learningservices.gmu.edu)
- University Libraries (library.gmu.edu)
- Writing Center (writingcenter.gmu.edu)
- Counseling and Psychological Services (caps.gmu.edu)
- See a longer list of Mason student support services posted on The Stearns Center website.

Assignments:

Quizzes: Quizzes on each lesson and/or article will be available on Canvas, open note, timed, and limited to a single attempt. Each quiz will be available from the end of class until it is due before the start of the next class. You will have 15 minutes once opened to complete the quiz.

Summary/Analysis: Each week a research article is assigned, you will write a summary and analysis **not to exceed 300 to 500 words**. The goal is to *write-to-learn* about a variety of neuroscience research techniques, understand their purpose within the context of a study. Critical analysis encourages consideration of controls, results, and conclusions. Completing the summaries within the word limit enforces using science writing principles emphasizing conciseness, clarity, and objectivity. Summaries will be graded by the TA with constructive feedback. *You will drop 1 summary/analysis.*

Discussion Participation: After reading each research paper the group assigned to that article will present the paper and lead a discussion. Students who are not presenting will be required to *speak* at least once per discussion. Questions and comments should demonstrate knowledge of specific aspects of the research article to receive full credit (2 pts) for the discussion. A single point will be awarded for participation in games that do not require such as Kahoot! General questions or comments that do now demonstrate knowledge of the article will not receive full credit. *You will drop 1 discussion participation*.

Assignments: Throughout the course there will be assignments graded for completion and effort. These include, but are not limited to, peer reviews for the news article and research strategy. There is one opportunity for extra credit: Neuroscience in the News. More information will be provided at the appropriate time.

News Article: You will write a ~500-word news article/story based on your assigned primary research paper. It will be targeted to a non-scientist (general public) audience. The assignment develops translational writing skills that are essential for disseminating scientific information to the public and scientists in other fields. You are encouraged to use other articles/resources to support your new article. If you choose to use outside resources, be sure to cite them *within the text.* Peer feedback on the draft will be used to finalize an interesting, informative, clear article. More guidance for the assignment will be provided during the semester.

Research Strategy: Based on previously published research, each student will describe a novel neuroscience question and devise a 2-pronged research strategy to answer (partially answer) that question. The complete research strategy will be up to 2000 words and will serve as a capstone for the course. Each student will meet with Dr. Sinclair individually to discuss project ideas ensuring appropriate scope before completing the draft. Feedback provided by the instructor and from peers during an in-class review session will be used to further revise the draft and create a final submission.

Research Article Presentation: Each of the research articles will be assigned to a group of 3-4 people who will create a presentation and lead the discussion for that article. Peer-assessments will be used to assess colleagues' contributions to the final project. Results will be considered when assessing individual presentation grades. Dr. Sinclair will do the first presentation to demonstrate expectations. People in the presenting group will NOT complete the summary/analysis for the assigned paper that week. The presenting group WILL complete the quiz.

PLEASE NOTE:

1. This page presents an overview of the assignments. Full instructions for each will be presented during class and on Canvas within the submission links. Be sure to READ all instructions carefully and ask for clarification if any confusion persists.
2. Presence and participation are required to successfully achieve all learning outcomes.
3. Life is busy and unpredictable therefore forgiveness will be granted for a *single missed summary and a single missed participation*. "Missed" includes illness, appointments, interviews, and other reasons for not attending class. Any class in which you are not present will be considered "missed." Be cognizant of your obligations in and outside of class.

Policies

Late Work: Late work will incur a deduction of 10% of the earned grade *per day*. Unsubmitted work will receive a 0. This policy may be modified on an individual basis at the discretion of the instructor for emergencies and extenuating circumstances. You must contact the instructor in advance of the due date to request a modification of the late penalty.

Absence: If you miss class (illness, interviews, appointments, etc.) *no make-up is possible*. Class discussions are an integral part of the course required to ensure learning outcomes are met. Life is full of little surprises. Therefore, I will drop a single discussion participation without consequence. Missing more than one discussion for any reason will result in a 0 for discussion participation that day. In-class assignments that involve group work cannot be made up. That includes, but is not limited to, peer review session

Communication: If you need to contact me or the TA, please do so **using university e-mail accounts only**. **Include the course name in the subject line and your name in the body of the e-mail**. Check your e-mail and course Canvas account daily. We will use Canvas Announcements to communicate with you regarding changes to the course, syllabus, and other essential information. You are responsible for all announcements posted and sent via Canvas and e-mail.

Conduct: Be kind and respectful to your classmates. Disrespectful behavior including inflammatory and harmful language will lead to deduction of points from the course.

Academic Standards: Please note the Academic Standards Procedures in the event of an academic standards violation. Please be aware that at this stage of your academic career any academic standards violation will likely result in course failure!

AI Use Policy:

In this course, students may use artificial intelligence (AI) tools, such as ChatGPT, CoPilot, Google Gemini, or others, *to support* their learning or for assignments that specifically instruct using AI. For example, AI can be used as a guide to understanding assays or complex molecular mechanisms. Unless otherwise explicitly instructed, AI tools are not allowed in completing graded assignments. This includes but is not limited to drafts and final news article and research strategy, quizzes, summary/analysis writing, and presentations. Using AI on graded work without permission will result in a 0 for the assignment and may be considered a violation of academic standards. This policy applies only to **NEUR411_003**. Other courses/sections may have different rules. If you're ever unsure whether AI use is allowed for an assignment, please ask your instructor.

Research Articles

Frick MA, Woodruff JL, Caudillo YM, Pikel KE, Rehm JV, Maciejewska N, Grillo CA, Reagan LP, Fadel JR (2025) Orexin/Hypocretin Modulates Neuroinflammatory Response to LPS in a Sex and Brain-Region Specific Manner in Young Rats. J Neurochem 169:e70175.

Gaignard P, Savouroux S, Liere P, Pianos A, Thérond P, Schumacher M, Slama A, Guennoun R (2015) Effect of Sex Differences on Brain Mitochondrial Function and Its Suppression by Ovariectomy and in Aged Mice. Endocrinology 156:2893–2904.

Garner KM, Burton MD (2022) Sex-specific role of sensory neuron LKB1 on metabolic stress-induced mechanical hypersensitivity and mitochondrial respiration. Am J Physiol Regul Integr Comp Physiol 323:R227–R243.

Kight KE, McCarthy MM (2017) Sex differences and estrogen regulation of *BDNF* gene expression, but not propeptide content, in the developing hippocampus. J of Neuroscience Research 95:345–354

Knouse MC, Deutschmann AU, Nenov MN, Wimmer ME, Briand LA (2023) Sex differences in pre- and post-synaptic glutamate signaling in the nucleus accumbens core. Biol Sex Differ 14:52.

López AJ, Johnson AR, Euston TJ, Wilson R, Nolan SO, Brady LJ, Thibeault KC, Kelly SJ, Kondev V, Melugin P, Kutlu MG, Chuang E, Lam TT, Kiraly DD, Calipari ES (2021) Cocaine self-administration induces sex-dependent protein expression in the nucleus accumbens. Commun Biol 4:883.

Sarikahya MH, Cousineau S, De Felice M, Lee K, Wong KK, DeVuono MV, Jung T, Rodríguez-Ruiz M, Ng THJ, Gummerson D, Proud E, Hardy DB, Yeung KK-C, Rushlow W, Laviolette SR (2022) Prenatal THC Exposure Induces Sex-Dependent Neuropsychiatric Endophenotypes in Offspring and Long-Term Disruptions in Fatty-Acid Signaling Pathways Directly in the Mesolimbic Circuitry. eNeuro 9:ENEURO.0253-22.2022.

Sertel SM, Blumenstein W, Mandad S, Shomroni O, Salinas G, Rizzoli SO (2021) Differences in synaptic vesicle pool behavior between male and female hippocampal cultured neurons. Sci Rep 11:17374.

Zhang Y-D, Shi D-D, Zhang S, Wang Z (2023) Sex-specific transcriptional signatures in the medial prefrontal cortex underlying sexually dimorphic behavioural responses to stress in rats. J Psychiatry Neurosci 48:E61–E73

Course Schedule

The course schedule is subject to change at any time. Students are responsible for all announcements and syllabus/schedule modifications posted to Canvas. Check your Mason email and Canvas announcements daily.

Weeks	Tuesday	Thursday
Week 1 Jan 20/22	Welcome and introductions Course Overview	Zotero/References (Guest Speaker)
Week 2 Jan 27/29	Introduction to Scientific Writing Articles assigned	Reading Primary Articles: Figures and results Due: Writing sample about yourself
Week 3 Feb 3/5	More about reading papers Due: Writing sample about yourself	Nociception/Pain Due: Assigned Article Familiarization
Week 4 Feb 10/12	Instructor sample presentation: Garner and Burton, 2022 Due: Summary & Quiz Garner and Burton	Endocannabinoid System
Week 5 Feb 17/19	Student presentation Sarikahya et al., 2022 Due: Summary & Quiz Sarikahya et al., 2022	Synaptic Plasticity
Week 6 Feb 24/26	Student presentation Knouse et al., 2023 Due: Summary & Quiz Knouse et al., 2023	Mitochondria
Week 7 Mar 3/5	Student presentation Gaignard et al., 2015 Due: Summary & Quiz Gaignard et al., 2015	News article (and EC) introduction: writing to a broad audience Synaptic vesicles
Week 8 Mar 8/10	Spring Break	Spring Break
Week 9 Mar 17/19	Student presentation Sertel et al. 2021 Due: Summary & Quiz Sertel et al. 2021	Peer Review News Article Due: Neuroscience in the news (up to 1% of earned news article grade) News Article Draft
Week 10 Mar 24/26	Introduce Research Strategy Time slot for individual meeting Due: News Article Final	Transcriptomics/Enrichment Analysis
Week 11 Mar 31/Apr 2	Individual Research Strategy Consultations*	Individual Research Strategy Consultations*
Week 12 Apr 7/9	Student presentation Zhang et al., 2023 Analysis & Quiz Zhang et al., 2023	Inflammatory Responses
Week 13 Apr 14/16	Student presentation Frick et al., 2025 Research Strategy Draft# 1 Due Analysis & Quiz Frick et al., 2025	Studying substance use disorder
Week 14 Apr 21/23	Student presentation Lopez et al., 2021 Analysis & Quiz Lopez et al., 2021	Bio-sketch
Week 15 Apr 28/30	Research Strategy Draft #2 Peer review research strategy	Final Class work session
Week 16 May 4	**Monday Due: Final Strategy Due**	

*Consultations will be ~15 minutes each thus not possible to complete on March 31/April 2 alone. Additional time slots will be announced as we approach the requirement.

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Common Policies Affecting All Courses at George Mason University
Updated August 2025

Academic Standards

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 academic standards 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.

Accommodations for Students with Disabilities:

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 the Disability Services website 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.

FERPA and Use of GMU Email Addresses for Course Communication

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.

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.

Title IX Resources and Required Reporting:

As a part of George Mason University's commitment to providing a safe and non-discriminatory learning, living, and working environments 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.

This document is updated annually and maintained by the Stearns Center for Teaching and Learning, in cooperation with GMU Faculty Senate Academic Policies Committee