DALHOUSIE UNIVERSITY

Topics in Neuroscience
NESC 4008.01, Winter 2025
Faculty of Science Course Syllabus
Department of Psychology & Neuroscience
January 6th - April 7th

Instructor: Dr. Lucia Caceres lucia.caceres@dal.ca

Class Schedule: In person.
Location: LSC-PSYCHOLOGY P4208
Lectures: Tuesdays: 3:35pm – 5:25 pm.
Pdf lectures posted on Brightspace 24hrs before next class.

Test Schedule:
Unit tests: N/A
Take Home Final Exam: **April 1st, 2025.**

Office Location: LSC-C206
Office Hours: By appointment.
Teams link for office hours will be provided on the class calendar on Brightspace.

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

LECTURE HOURS PER WEEK: 2 hrs.
Course Prerequisites: NESC Honours student, Instructor permission required.

Course Description:
This seminar course examines the primary scientific literature on topics related to neuronal circuitry specific to physiological and behavior functions. The course will encompass the development, cellular, molecular, and pharmacology basis of the nervous system. The function of astrocytes in regulating behavior will be explored. The seminar includes topics in (but not exclusively):

- Circadian rhythms, sleep, and memory
- Energy homeostasis and eating disorders
- Fear and Anxiety
- Neurodegenerative disorders

The course will be organized in lecture format, with student-led presentations of primary articles. Evaluation will be based on presentation(s), discussions, and participation.

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Course Materials

All required material will be provided in Brightspace.
Reading list: Changes may be made at the instructor's discretion.

Theme 1: Learning and Memory

1. Zhao, F., Zhang, T., Shen, Q., Yin, K., Wang, Y., Zhang, G. Tak1 in the astrocytes of mediobasal hypothalamus regulates anxiety-like behavior in mice. Glia 2021; **69**:609-618.
2. Bourhy, L. et al., Silencing of amygdala circuits during sepsis prevents the development of anxiety-related behaviours. Brain 2022; May 24; **145**(4): 1391-1409.
3. Barchiesi, R. et al., An epigenetic mechanism for over-consolidation of fear memories. Molecular Psychiatry (2022). doi: 10.1038/s41380-022-01758-6. Online ahead of print.
4. Owens-French, J., et al. Lateral hypothalamic galanin neurons are activated by stress and blunt anxiety-like behavior in mice. Behav Brain Res. 2022; Apr 9; **423**: 113773. doi: 10.1016/j.bbr.2022.113773.
5. Zhang, Q., et al. The Slack Channel Regulates Anxiety-Like Behaviors via Basolateral Amygdala Glutamatergic Projections to Ventral Hippocampus. J Neurosci. 2022; **42**(14):3049-3064.
6. Stojanovic, T., et al., Age-Dependent and Pathway-Specific Bimodal Action of Nicotine on Synaptic Plasticity in the Hippocampus of Mice Lacking the miR-132/212 Genes. Cells. 2022; **11**(2): 261. doi: 10.3390/cells11020261.
7. Liang, M., et al., Methamphetamine Exposure in Adolescent Impairs Memory of Mice in Adulthood Accompanied by Changes in Neuroplasticity in the Dorsal Hippocampus. Front Cell Neurosci. 2022; **16**:892757. doi: 10.3389/fncel.2022.892757.
8. Sarikahya, N. B., Patel, S., & Laviolette, S. R. (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*(5), ENEURO.0253-22.2022. https://doi.org/10.1523/ENEURO.0253-22.2022
9. Saadati, H., Sheibani, V., Esmaeili-Mahani, S., Hajali, V., & Mazhari, S. (2020). Voluntary exercise modulates learning & memory and synaptic plasticity impairments in sleep-deprived female rats. *Brain Research*, 1726, 146598. https://doi.org/10.1016/j.brainres.2019.146598
10. Hasz, B. M., & Redish, A. D. (2020). Dorsomedial prefrontal cortex and hippocampus represent strategic context even while simultaneously changing representation throughout a task session. *Nature Communications*, 11, 2585. https://doi.org/10.1038/s41467-020-16426-3
11. Lin, Y.-S., Weibel, J., Rehm, I., Vestner, T., Götz, T., Rentsch, K. M., ... & Landolt, H.-P. (2021). Daily caffeine intake induces concentration-dependent medial temporal plasticity in humans: A multimodal double-blind randomized controlled trial. *Cerebral Cortex*, 31(6), 3096–3108. https://doi.org/10.1093/cercor/bhaa365
12. Chaudoin, T. R., Bonasera, S. J., Dunaevsky, A., Padmashri, R., & Dunaevsky, J. (2023). Exploring behavioral phenotypes in a mouse model of fetal alcohol spectrum disorders. *Developmental Neuroscience, 45*(1), 1–14. https://doi.org/10.1159/000520358

13. Maret, S., Faraguna, U., Nelson, A. B., Cirelli, C., & Tononi, G. (2024). A neuron–glia lipid metabolic cycle couples daily sleep to synaptic plasticity and memory consolidation. *Nature Neuroscience, 26*(1), 1–10. https://doi.org/10.1038/s41593-023-01568-1
14. Zhang, Y., Li, X., & Wang, L. (2024). Enhanced homeostatic sleep response and decreased cognitive flexibility in mice with Crbn deletion. *Nature Communications, 15*(1), 1–12. https://doi.org/10.1038/s41467-024-06879-y

Theme 2: Energy Homeostasis and Eating Disorders

1. Cai, X., *et al*. AD2 to AD1 shift in dopaminergic inputs to midbrain 5-HT neurons causes anorexia in mice. Nature Genetics 2022; **25**:646-658.
2. Furukawa, M., *et al*. Molar loss induces hypothalamic and hippocampal astrogliosis in aged mice. Nature 2022; **12**:6409.
3. Furlan, A., et al., Neurotensin neurons in the extended amygdala control dietary choice and energy homeostasis. Nat Neurosci. 2022 Nov; **25**(11):1470-1480.
4. Kubrak, O., et al., The gut hormone Allatostatin C/Somatostatin regulates food intake and metabolic homeostasis under nutrient stress. Nat Commun. 2022 Feb 4;**13**(1):692.
5. Antoni, F.A., The Case for Clinical Trials with Novel GABAergic Drugs in Diabetes Mellitus and Obesity. Life (Basel). Feb 21; **12**(2):322.
6. Domingos AI, Leptin regulates the reward value of nutrient. Nature Neuroscience **14**, 1562–1568 (2011).
7. Chen, Q., Deister, C. A., Gao, X., Guo, B., Lynn-Jones, T., Chen, N., Wells, M. F., Liu, R., Goard, M. J., Dimidschstein, J., Feng, G., & Fishell, G. (2020). Dysfunction of cortical GABAergic neurons leads to sensory hyper-reactivity in a Shank3 mouse model of ASD. *Nature Neuroscience*, 23(4), 520–532. https://doi.org/10.1038/s41593-020-0598-6
8. Hsu, T. M., Hahn, J. D., Konanur, V. R., Noble, E. E., Suarez, A. N., Thai, J., ... & Kanoski, S. E. (2015). Hippocampus ghrelin signaling mediates appetite through lateral hypothalamic orexin pathways. *eLife*, 4, e11190. https://doi.org/10.7554/eLife.11190
9. Berner, L. A., Kaye, W. H., & Wierenga, C. E. (2022). Altered prefrontal activation during the inhibition of eating responses in women with bulimia nervosa. *Psychological Medicine*, 52(2), 1–9. https://doi.org/10.1017/S0033291722000290
10. Liu, H., Qu, N., Valdez Gonzalez, N., Palma, M. A., Chen, H., Xiong, J., Choubey, A., Li, Y., Li, X., Yu, M., Liu, H., Tu, L., Zhang, N., Yin, N., Conde, K. M., Wang, M., Bean, J. C., Han, J., Scarcelli, N. A., Yang, Y., Saito, K., Cui, H., Tong, Q., Sun, Z., Wang, C., Cai, X., Lu, L., He, Y., & Xu, Y. (2024). A light-responsive neural circuit suppresses feeding. *Journal of Neuroscience, 44*(30), e2192232024. https://doi.org/10.1523/JNEUROSCI.2192-23.2024
11. Nwafor, D. C., McGowan, M. L., & McGowan, M. A. (2021). Disruption of metabolic, sleep, and sensorimotor functional outcomes in a female transgenic mouse model of Alzheimer's disease. *Behavioural Brain Research, 396*, 112983. https://doi.org/10.1016/j.bbr.2020.112983

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Theme 3: Circadian Rhythms and Sleep.

1. Hines DJ, Schmitt LI, Hines RM, Moss SJ, Haydon PG. Antidepressant effects of sleep deprivation require astrocyte-dependent adenosine mediated signaling. Transl Psychiatry. 2013; **3**:e212.
2. Rabinowitz, J.A., et. al., Associations of circadian rest/activity rhythms with cognition in middle-aged and older adults: Demographic and genetic interactions. Front Neurosci. 2022; **16**:952204.
3. Gabay, L., Miller, P., Alia-Klein, N., Lewin, M., Circadian Effects on Attention and Working Memory in College Students With Attention Deficit and Hyperactivity Symptoms. Front Psychol. 2022; **13**:851502. doi: 10.3389/fpsyg.2022.851502
4. Faraut, B., et al., Immune disruptions and night shift work in hospital healthcare professionals: The intricate effects of social jet-lag and sleep debt. Front Immunol. 2022; **13**:939829. doi: 10.3389/fimmu.2022.939829.
5. Gentry, N.W., et al., Microglia are involved in the protection of memories formed during sleep deprivation. Neurobiol Sleep Circadian Rhythms. 2021; **12**:100073. doi: 10.1016/j.nbscr.2021.100073.
6. Niu, L., et la., Chronic sleep deprivation altered the expression of circadian clock genes and aggravated Alzheimer's disease neuropathology. Brain Pathol. 2022 May;**32**(3):e13028. doi: 10.1111/bpa.13028.
7. Fisher, M., Ledoux, A. A., Yeates, K. O., Pusic, M. V., Craig, W., Beauchamp, M. H., & Zemek, R. (2022). Examining the trajectory and predictors of post-concussion sleep quality in children and adolescents. *Brain Injury*, *36*(4), 529–538.
8. Videnovic, A., Klerman, E. B., Wang, W., Marconi, A., Kuhta, T., & Zee, P. C. (2017). Timed light therapy for sleep and daytime sleepiness associated with Parkinson disease: A randomized clinical trial. *JAMA Neurology*, 74(4), 411–418.
9. Poe AR, Zhu L, Tang SH, Valencia E, Kayser MS. Energetic demands regulate sleep-wake rhythm circuit development. Elife. 2024 Jul 22;13:RP97256. doi: 10.7554/eLife.97256. PMID: 39037919; PMCID: PMC11262794.
10. Wang, L., Yang, Y., & Chen, G. (2023). Sleep deprivation-induced anxiety-like behaviors are associated with gut microbiota dysbiosis and serum metabolome changes. *Journal of Neurobiology*, *98*(2), 220-231.
11. Li Y, Liu Y, He Z, Li Z, Xiang H. Circadian Alterations in Brain Metabolism Linked to Cognitive Deficits During Hepatic Ischemia-Reperfusion Injury Using [^{1}H-^{13}C]-NMR Metabolomics. Biomedicines. 2024 Nov 6;12(11):2536. doi: 10.3390/biomedicines12112536. PMID: 39595102; PMCID: PMC11592224.

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Course Objectives/Learning Outcomes

This seminar series consists of student presentations of recent original research articles that have had an impact on our understanding of neuroscience.
By the end of the seminar series the student should:

- Demonstrate general understanding on how primary scientific literature uses genetic techniques to study the molecular & cellular bases of behaviour.
- Identify the structure of peer-reviewed scientific neuroscience articles.
- Critically evaluate the validity of scientific studies.
- Show the difference between data analysis and data interpretation.

Course Assessment

This seminar emphasizes student presentations and group discussion. During most meetings, students will present and discuss primary scientific literature. Grades will be based on the instructor's assessment of elements listed below.

Component Weight	% Weight of Final Grade	Due/Evaluation dates
Presentation (Research article)	60%	Dates will be assigned.
Info Find	5%	Mondays at 5pm.
Graphical Abstract	5%	Dates will be assigned.
In class participation	10%	Due at the end of every class.
Design a follow-up experiment	10%	Beginning of every class
Take Home Final exam	10%	Due end of class – April 1st, 2025

Course Assessment

This seminar emphasizes student presentations and group discussion. During most meetings, students will present and discuss primary scientific literature. Grades will be based on the instructor's assessment of elements listed below.

1. **Presentations of Scientific Papers (60%):**
   Depending on class size, each student will have 4 opportunities to lead the discussion of an assigned research article. Students will be assessed on their ability to present the main objectives of the study and the major results, the thoroughness of their evaluation of the paper, and discussion of how the findings extend previous work clearly and succinctly. Students are encouraged to seek out review and methodology papers to help them prepare for each presentation. PowerPoint is preferred for presentations.

2. **Participation (10%):**
   A. The open format of class presentations relies on an informed and interested audience. Although it is easier to passively listen to each presentation, one of the goals of the class is for students to develop their critical thinking skills and ability to debate issues arising from scientific research. Herein, non-presenting students will complete a presentation rating form on the: i) paper topic and selection relevancy; ii) delivery; iii) clarity and organisation; iii) visuals; iv) overall impression as well as provide general advice to presenter. The rating student submits their completed assessment to the instructor who awards a "participation

point". The presenter student is then given the anonymous feedback by the instructor in the next class. Therefore, class participation will be qualitatively monitored throughout the course.
B. All students will submit 5 questions per article.

3. **Graphical Abstract (5%):**
A graphical abstract is a single image that summarizes the main findings of the article. This single image may have multiple panels, but the goal is to be as concise as possible. An example, along with some tips, is on Brightspace. Your graphical abstract will be marked out of 10: correctness (7 marks), overall design and clarity (3 marks).

4. **Info-Find (5%)**:
Resources to help you understand journal club papers (5%). Generate a document highlighting the additional resources (not provided already in course materials) that you used to read and understand the assigned reading. For example, you will likely have to look up some unfamiliar terms and methods. Collaborate on an "Important Terms and Methods" list with the information you found. You may have found media reports on the paper which helped you to understand it better (careful because not all scientific media is 100% correct). Perhaps there are other papers or reviews which helped your understanding of the assigned reading. What relevant information did you find? Collate this information into the provided folder section in Brightspace. Make sure to briefly describe the images/text/videos that you have found and how they were helpful for you to better understand the paper.

   The aim of this exercise is to help you and your classmates better understand the papers prior to the journal clubs. These documents are due on the Wednesdays 5pm before each journal club to give everyone a chance to view the material.

5. **Design a follow-up experiment (10%):**
Choose one of the papers that we covered this semester. Design a follow-up experiment or series of experiments to answer a new research question. Include the following sections: Objective/Rationale, Methodology, Expected Results and Relevance. As a bonus you could include alternative experiments in case your proposed study hits a technical snag. Word limit: 2 pages, 11 pt font, single spaced. This will be marked out of 25: Creativity/Innovation (6 marks), Writing (5 marks), References and Citations (2 marks), Rationale and Experimental Design (12 marks).

6. **Take Home Final Exam (10%):**
The exam is due at the end of **Tuesday's class, April 1st, by 5:25 PM**. Students will be given questions based on a research article and are expected to use the knowledge gained during the course to answer them. Students are not required to access additional resources or provide citations, other than relying on their own understanding.

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Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A + (90-100)	**B**+ (77-79)	**C**+ (65-69)	**D** (50-54)
A (85-89)	**B** (73-76)	**C** (60-64)	**F** (<50)
A - (80-84)	**B**- (70-72)	**C**- (55-59)	

NOTE: Grades are final at the end of term and cannot be "bumped up" with extra work.

Course Content: Tentative lecture topic guide

Week of...		Lecture	Lecture topic	What's Due
Jan.	7	1	Introduction to the course and breakdown of a research article.	
	14	-	Graphical Abstract	Due at end of class
	21	2	Theme 1: Research Article Presentations	Info-Find, Peer-review, questions.
	28	3	Theme 1: Research Article Presentations	Info-Find, Peer-review, and questions
Feb.	4	4	Theme 2: Research Article Presentations	Info-Find, Peer-review, and questions
	11	5	Theme 2: Research Article Presentations	Info-Find, Peer-review, and questions
	18	-	Winter Break	
	25	6	Theme 3: Research Article Presentations	Info-Find, Peer-review, and questions
Mar	4	7	Theme 3: Research Article Presentations	Info-Find, Peer-review, and questions
	11	8	Presentation – article chosen by student.	Info-Find, Peer-review, and questions
	18	9	Presentation – article chosen by student.	Info-Find, Peer-review, and questions
	25	-	Follow-up experiment due at end of class.	Due at end of class
Apr.	1	-	**Final Exam** due at end of class.	

Other course requirements

1. Timing and schedule

You will need time to work on course material. You will have opportunities to complete some course components on your own schedule. The due dates for each component will be clearly marked on Brightspace.

2. Office hours: in-person or on Teams.

There are two ways to attend office hours. Either via teams or come drop by my office during the schedule time.

You can join office hours on Microsoft Teams. This software is available using your subscription to Office 365. Sign into login.microsoftonline.com with your @dal.ca email address and password. Once inside *Microsoft Office Home* you'll see an installer icon for Teams.

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Course Policies

Missed In-Class Assignments: Quizzes, Participation, News and Views, and Presentations must be given at the scheduled class times. Missed in-class assignments due to illness or exceptional circumstances **must** be communicated to the instructor immediately and a **DECLARATION OF ABSENCE, completed, signed, and**

1. emailed to lucia.caceres@dal.ca AND

2. Must uploaded to Brightspace with the reasons for absence written in the comment section within 3 days of the missed exam.

Failure to do both will result in invalid SDA and an automatic zero.

Please note: No SDAs will be considered if no explanation is given.

- **No extensions for participation are offer in this course. The weight of these assignments will be transferred to the final exam.**
- **Missed presentation, will be postponed for the next available slot.**

Email

When sending an email please make sure of the following:

1. Read the syllabus and check the Brightspace page to determine if the information you seek is already available.
2. Enter the course number in the subject line (NESC 4008).

Due dates.

It is the responsibility of the student to check the course schedule and tell me of any religious holy days, required court appearances, or scheduled surgeries within the first week of the course.

Short-term Absence

Students experiencing short-term absences of three (3) consecutive days or fewer resulting in missed or late academic requirements must:

- Contact their instructor by phone or email prior to the academic requirement deadline or scheduled time and;
- Complete a **Student Declaration of Absence** form; on-line through Brightspace, and via instructor e-mail within three (3) calendar days following the last day of absence.

A student may submit a maximum of separate Student Declaration of Absence forms **per course during a term.** Faculty, College, School, instructor or course-specific guidelines may set a lower maximum.

Students who have recurring short-term absences and who exceed one (1) submission per course during a term are strongly encouraged to meet with a Faculty or Declared Major Advisor, or Faculty Program Coordinator. In cases of recurring short-term absences, instructors may request documentation to demonstrate a student has met with an Advisor or Coordinator and arrived at a course of action to manage the recurring absences before considering alternate academic requirement arrangements.

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UNIVERISTY POLICIES AND STATEMENTS

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.
Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).
Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.
Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness
Statement: http://www.dal.ca/cultureofrespect.html

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).
Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)
https://www.dal.ca/academics/important_dates.html

University Grading Practices
https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

STUDENT RESOURCES AND SUPPORT

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: https://www.dal.ca/faculty/science/current-students/academic-advising.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

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Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: https://libraries.dal.ca/

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: https://libraries.dal.ca/services/copyright-office.html

Fair Dealing Guidelines https://libraries.dal.ca/services/copyright-office/fair-dealing.html

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html

Student Advocacy: https://dsu.ca/dsas

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: https://www.dal.ca/dept/safety/programs-services/biosafety.html

Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

Radiation Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety.html

Scent-Free Program: https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html

Dalhousie COVID-19 information and updates: https://www.dal.ca/covid-19-information-and-updates.html