

**Molecular Neuroscience**  
**PSYO/NESC 3970.01, Fall 2023**  
**Faculty of Science Course Syllabus**  
**Department of Psychology & Neuroscience**  
**September 5th-December 6<sup>th</sup>**

*Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.*

*Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.*

**Instructor:** Dr. Lucia Caceres [lucia.caceres@dal.ca](mailto:lucia.caceres@dal.ca)

**Class Schedule:** Held in person

**Location:** Chemistry 233

**Lectures:** Tuesday and Thursday: 10:05 am – 11:25 am.

Pdf lectures posted on Brightspace 24hrs before next class.

**Test Schedule:**

**Unit tests:** September 26<sup>th</sup>, October 19<sup>th</sup>, and November 9<sup>th</sup>.

**Final Exam:** Scheduled by Registrar between Dec. 8<sup>th</sup> – 19<sup>th</sup>.

**Office Location:** LSC2321

**Office Hours:** Monday and Wednesday, 9:30– 10:30 am (*via teams*) or  
by appointment Fridays 9:00 am – 12:00 pm (*via teams*)

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: 3 hrs.**



**Course Description**

This course examines the development, function, and pathology of the brain at the molecular level. Model systems are examined from the perspective of ion channels, messengers, receptors, intracellular

signaling cascades, and effect of drugs. The concepts underlying basic cellular and molecular neuroscience tools are emphasized.

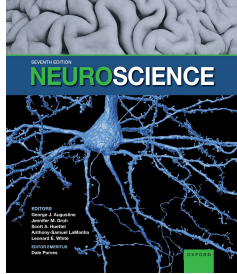
**Course Prerequisites:** NESC/PSYO 2570 or BIOL 2020 or BIOL 2030.

## Course Materials

Exams will test knowledge based on the information taught in class.

Suggested popular textbooks and web links posted online on Brightspace are only to provide context and help fill in any gaps in background knowledge.

### Recommended textbook (but not required)



*Neuroscience, 7<sup>th</sup> Edition*

Purves, Augustine, Groth, Huettel, LaMantia, White

ISBN-13: 978-0197616246

Publication Year: 2023 | 1008 pp.

### Other Resources:

*Essential Cell Biology (4<sup>th</sup> edition)*. Alberts, B., Bray, D., Hopkin, K., Johnson, A.D., Lewis, J., Raff, M., Robert, K., and Walter, P. Publisher: Garland Science. ISBN 0815345259.

**All course material (videos, pdfs, ppt, etc.) will be posted on Brightspace**

### Course Assessment

Lecture Component: Tested material includes 1) lectures. Grades are based on **Assessment questions** (0.5% per lecture: 10%), and **4 Exams** (*Multiple choice, multi-select, interpreting images, short answer format. Content is cumulative*).

Marking Scheme	Weight	Due/Evaluation dates
Midterm I	20 %	September 26 <sup>th</sup> , 2023
Midterm II	20 %	October 19 <sup>th</sup> , 2023
Midterm III	20%	November 9 <sup>th</sup> , 2023
Final	35%	TBD by Registrar
Assessment Lectures	5 %	Tuesday assignments due 5pm on Thursday Thursday assignments due 5pm on Saturday

### 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. Computer and Internet for submitting Assessment Questions on Brightspace.

Assignments will have a due date plus a “window of opportunity” (48 hrs) to give you enough time to complete them on time even if you have temporary technical problems. *For example*, an assignment due on Monday at 5pm will have a window of opportunity of 48hrs (2-days) to submit without penalty. However, **after this window of opportunity is missed a grade of zero will be assigned and not late assignments will be accepted.**

**Postponing a test or assignment until the end of the availability window is risky, so it is better to submit early.**

### **3. 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](https://login.microsoftonline.com) with your @dal.ca email address and password. Once inside *Microsoft Office Home* you'll see an installer icon for Teams.

I will post the teams link for this course on the course calendar on Brightspace.

### **Course Objectives**

This course will provide students with a general understanding of the molecular mechanism involved in neuronal signaling and brain development. It will examine the cellular and molecular mechanisms of gene expression, and brain changes after acute and prolonged exposure to the drug(s). This course will also explore the molecular and cellular of neurodegenerative disorders.

The main objectives are covered within three themes:

- 1) Genetics, epigenetics, and genomic manipulations (lectures 1-7).
- 2) Neuronal Signaling (lectures 8-14)
- 3) The Changing Brain (lectures 15-22).

### **Learning outcomes:**

By the end of the course, students should be able to:

1. List and define the molecular basis of gene regulation on the nervous system.
2. Describe the cellular and molecular mechanism of neuronal signal transduction.
3. Describe the cellular and molecular basis of brain development.
4. List and describe all clinical applications discussed in the course.

### **Key content**

1. Mechanism of gene expression
2. Mechanism of neurotransmitters and their receptor
3. Signal transduction and cellular communication
4. The molecular and cellular basis of neurodegenerative disorders

**Conversion of numerical grades to final letter grades follows the [Dalhousie Grade Scale](#)**

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
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
Sept.	5-7	1-3 <ul style="list-style-type: none"> <li>Welcome and Studying the Nervous System</li> <li>Gene Expression Part I</li> </ul>
	12-14	2-4 <ul style="list-style-type: none"> <li>Gene Expression Part II</li> <li>Gene Expression Part III</li> </ul>
	19-21	5-6 <ul style="list-style-type: none"> <li>Gene Manipulation Part I</li> <li>Gene Manipulation Part II</li> </ul>
	26	- <p style="text-align: center;"><b>Midterm I (Lectures 1 - 6)</b></p>
	28	7 <ul style="list-style-type: none"> <li>Electrical Signals of Nerve Cells Communication</li> </ul>
Oct.	3-5	8-9 <ul style="list-style-type: none"> <li>Voltage Dependent Membrane Permeability</li> <li>Ion Channels and Transporters</li> </ul>
	10-12	10-11 <ul style="list-style-type: none"> <li>Neurotransmitters and Their Receptors Part I</li> <li>Neurotransmitters and Their Receptors Part II</li> </ul>
	17-19	12 <ul style="list-style-type: none"> <li>Synaptic Transmission</li> </ul>
	19	- <p style="text-align: center;"><b>Midterm II (Lectures 7 - 12)</b></p>
	24-26	13-14 <ul style="list-style-type: none"> <li>Neuropharmacology Part I</li> <li>Neuropharmacology Part II</li> </ul>
	31	15 <ul style="list-style-type: none"> <li>Molecular Signaling within Neurons Part I</li> </ul>
Nov.	2	16 <ul style="list-style-type: none"> <li>Molecular Signaling within Neurons Part II</li> </ul>
	7	17 <ul style="list-style-type: none"> <li>Synaptic Plasticity</li> </ul>
	9	- <p style="text-align: center;"><b>Midterm III (Lectures 13 - 17)</b></p>
	13-17	- <p style="text-align: center;"><b>Fall Break</b></p>
	21-23	18-19 <ul style="list-style-type: none"> <li>Early Brain Development.</li> <li>Construction of the Neural Circuit.</li> </ul>
	28-30	20-21 <ul style="list-style-type: none"> <li>Neurodegenerative Disorders</li> <li>Repair and Regeneration in The Nervous System</li> </ul>
Dec.	5	- <p style="text-align: center;"><i>Monday's Classes will held – No class</i></p>
	8-19	- <p style="text-align: center;"><b>Final Exam Period (2-hrs, cumulative Lectures 1-21)</b></p>

## Course Policies

**STUDENT DECLARATION OF ABSENCE (SDA):** ONE SDA will be accepted per semester.

⇒ SDA forms are only valid for short-term absences.

**Exams** must be taken at the scheduled time.

Missed exams due to illness or exceptional circumstances **must** be communicated to the instructor immediately by **emailed to [lucia.caceres@dal.ca](mailto:lucia.caceres@dal.ca)**. Student must submit an **SDA to Brightspace** only (do not email SDAs or drop SDAs off in person).

A completed SDA **MUST** include the following:

1. **The reason for the absence in the comment section** (do not submit proper documentation).
2. **The exam that you missed. Ex. Midterm #1**
3. **Signed**
4. **SDA needs to be submitted within 3 days (72hrs) of the missed exam** for the SDA to be valid.

**Please note: If SDA is approved**, no alternative make-up exams will be given, instead the weight of the missed exam will be transferred to the cumulative final.

### 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 (PSYO 3770 or NESC 3770).

**Due dates.** Each lecture ends with assessment questions. All Brightspace material will be available for viewing throughout the length of the course, but the assessment questions **must be completed at their assigned due dates**.

Lecture Assessment questions **are due at 5 pm 2-days after it is assigned**.

- A **Tuesday assessment questions** opens at 8 am and are **due at 5:00 pm on Thursday**.
- A **Thursday assessment questions** opens at 8 am and are **due at 5:00 pm on Saturday**.

**Need more time?** Assignments have a no-penalty "late" submission window of 48 hrs after their due date. However, they will permanently close on their end date (48 hrs after their due date). No assignments will be accepted after this end date has been reached.

- **Tuesday assessment questions** can be submitted with **no penalty** for up to **2 days (48 hrs) after its due date**, with an **End date/time: Saturday 5:00 pm**.
- **Thursday assessment questions** can be submitted with **no penalty** for up to **2 days (48 hrs) after its due date**, with an **End date/time: Monday 5:00 pm**.
- All assessment questions, whether they open on a Tuesday or Thursday, will **PERMANENTLY close for marks** on their **5:00 pm end date**. **SDAs will not be accepted** – *SDAs are only allowed for short term absences of 3-consecutive days or less.*



Please don't leave assignments until the window is closing. **There are no late submission options and no marks after 5:00 pm of their end time.** Remember that assignments were due 2 days before the closing date. This closing date is just an automatic extension for unexpected problems.

Extended window of opportunity is meant to take care of temporary issues with a busy schedule, technology, internet, electricity, weather, and other minor issues.

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.

**Note:** Student Declaration of Absence forms (below) should normally be submitted before missing an assignment or test. In circumstances when this is not possible submit your form as soon as it is safe and logical to do so.

### 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 or provide alternate verification of the absence to their instructor or to the instructor's designate in-person, on-line through Brightspace, or via instructor e-mail within three (3) calendar days following the last day of absence.

A student may submit a maximum of **One (1)** separate Student Declaration of Absence form **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) submissions 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.

### Long-term Absence

For long-term absences greater than three (3) consecutive days, students should contact their course instructor(s) or the instructor's designate within five (5) calendar days following the last day of absence.

**The Student Declaration of Absence form will not be accepted for long-term absences.**

Where long-term absences are due to major or chronic physical or mental health conditions, documentation must be provided by on-campus or off-campus primary care health professionals. Documentation should indicate the dates and duration of the condition (**confidential health information of the exact condition is not required**), when possible should describe its impact on the student's ability to fulfill academic requirements and include any other information a primary care health professional considers relevant and appropriate.

For extenuating circumstances resulting in long-term student absences, instructors may request appropriate documentation depending on the situation.

Students experiencing recurring long-term absences are strongly encouraged to meet with a Faculty or Declared Major Advisor, or Faculty Program Coordinator and refer to the University's [Student Accommodation Policy](#). In such a case, 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.

### **Definitions:**

“Academic requirement” refers to class attendance, coursework, tests, exams, and Faculty- specific program requirements **excluding** final coursework (as defined by each Faculty, College or School) or exams (written, verbal or simulated), fieldwork (including work-integrated learning for credit), and skill labs (as defined by each Faculty, College or School).

“Long-term absence” refers to absences of more than three (3) consecutive days due to major or chronic physical or mental health conditions, or other extenuating circumstances such as caregiving duties; immediate family illness, injury or death; involvement in an accident; legal proceedings; being a victim of a crime, domestic or intimate partner violence.

“Primary care health professional” refers to occupations such as physician, psychologist, psychiatrist, registered nurse, social worker, counsellor, therapist, or dentist.

“Short-term absence” refers to absences of three (3) consecutive days or fewer due to minor physical or mental health conditions, or other extenuating circumstances such as caregiving duties; immediate family illness, injury or death; involvement in an accident; legal proceedings or being a victim of a crime, domestic or intimate partner violence.

## **University Policies and Statements**

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

### **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 at 1321 Edward St or [elders@dal.ca](mailto:elders@dal.ca). Additional information regarding the Indigenous Student Centre can be found at: [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

### **Internationalization**

At Dalhousie, ‘thinking and acting globally’ enhances the quality and impact of education, supporting learning that is “interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders.” Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

### **Academic Integrity**

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all 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. Additional academic integrity information can be found at: [https://www.dal.ca/dept/university\\_secretariat/academic-integrity.html](https://www.dal.ca/dept/university_secretariat/academic-integrity.html)

### **Accessibility**

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre ([https://www.dal.ca/campus\\_life/academic-support/accessibility.html](https://www.dal.ca/campus_life/academic-support/accessibility.html)) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

### **Conduct in the Classroom – Culture of Respect**

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

### **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 (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.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. The full Code of Student Conduct can be found at: [https://www.dal.ca/dept/university\\_secretariat/policies/student-life/code-of-student-conduct.html](https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html)

### **Fair Dealing Policy**

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: [https://www.dal.ca/dept/university\\_secretariat/policies/academic/fair-dealing-policy-.html](https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html)

### **Originality Checking Software**

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information



regarding Originality Checking Software can be found at:

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html](https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html)

### **Student Use of Course Materials**

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.

## **Student Resources and Support**

### **University Policies and Programs**

- **Important Dates in the Academic Year (including add/drop dates):**  
[http://www.dal.ca/academics/important\\_dates.html](http://www.dal.ca/academics/important_dates.html)
- **Classroom Recording Protocol:**  
[https://www.dal.ca/dept/university\\_secretariat/policies/academic/classroom-recording-protocol.html](https://www.dal.ca/dept/university_secretariat/policies/academic/classroom-recording-protocol.html)
- **Dalhousie Grading Practices Policies:**  
[https://www.dal.ca/dept/university\\_secretariat/policies/academic/grading-practices-policy.html](https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html)
- **Grade Appeal Process:** [https://www.dal.ca/campus\\_life/academic-support/grades-and-student-records/appealing-a-grade.html](https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html)
- **Sexualized Violence Policy:** [https://www.dal.ca/dept/university\\_secretariat/policies/health-and-safety/sexualized-violence-policy.html](https://www.dal.ca/dept/university_secretariat/policies/health-and-safety/sexualized-violence-policy.html)
- **Scent-Free Program:** <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

### **Learning and Support Resources**

- **General Academic Support – Advising (Halifax):** [https://www.dal.ca/campus\\_life/academic-support/advising.html](https://www.dal.ca/campus_life/academic-support/advising.html)
- **General Academic Support – Advising (Truro):** <https://www.dal.ca/about-dal/agricultural-campus/ssc/academic-support/advising.html>
- **Student Health & Wellness Centre:** [https://www.dal.ca/campus\\_life/health-and-wellness.html](https://www.dal.ca/campus_life/health-and-wellness.html)
- **On Track (helps you transition into university, and supports you through your first year at Dalhousie and beyond):** [https://www.dal.ca/campus\\_life/academic-support/On-track.html](https://www.dal.ca/campus_life/academic-support/On-track.html)
- **Indigenous Student Centre:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)



# DALHOUSIE UNIVERSITY

- **Indigenous Connection:** <https://www.dal.ca/about-dal/indigenous-connection.html>
- **Elders-in-Residence** (The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit the office in the Indigenous Student Centre or contact the program at [elders@dal.ca](mailto:elders@dal.ca) or 902-494-6803:  
<https://cdn.dal.ca/content/dam/dalhousie/pdf/academics/UG/indigenous-studies/Elder-Protocol-July2018.pdf>
- **Black Student Advising Centre:** [https://www.dal.ca/campus\\_life/communities/black-student-advising.html](https://www.dal.ca/campus_life/communities/black-student-advising.html)
- **International Centre:** [https://www.dal.ca/campus\\_life/international-centre.html](https://www.dal.ca/campus_life/international-centre.html)
- **South House Sexual and Gender Resource Centre:** <https://southhousehalifax.ca/about/>
- **LGBTQ2SIA+ Collaborative:** <https://www.dal.ca/dept/vpei/edia/education/community-specific-spaces/LGBTQ2SIA-collaborative.html>
- **Dalhousie Libraries:** <http://libraries.dal.ca/>
- **Copyright Office:** <https://libraries.dal.ca/services/copyright-office.html>
- **Dalhousie Student Advocacy Services:** <https://www.dsu.ca/dsas?rq=student%20advocacy>
- **Dalhousie Ombudsperson:** [https://www.dal.ca/campus\\_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html](https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html)
- **Human Rights and Equity Services:** <https://www.dal.ca/dept/hres.html>
- **Writing Centre:** [https://www.dal.ca/campus\\_life/academic-support/writing-and-study-skills.html](https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html)
- **Study Skills/Tutoring:** [http://www.dal.ca/campus\\_life/academic-support/study-skills-and-tutoring.html](http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html)
- **Faculty of Science Advising Support:** : <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

## Safety

- **Biosafety:** <http://www.dal.ca/dept/safety/programs-services/biosafety.html>
- **Chemical Safety:** <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>
- **Radiation Safety:** <http://www.dal.ca/dept/safety/programs-services/radiation-safety.html>
- **Laser Safety:** <https://www.dal.ca/dept/safety/programs-services/radiation-safety/laser-safety.html>