

Genes, Brain and Behaviour Syllabus

Department of Psychology & Neuroscience

PSYO/NESC 3670.03 Fall 2024

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.

Course Instructor(s)

Name	Email	Office Hours
Ian Weaver (Instructor)	ian.weaver@dal.ca	Tuesdays, 11:00 - 13:00, LSC 3340 and online
Jacqueline DeJarnette (Marker)	jacdej23@gmail.com	

Course Description

CREDIT HOURS: 3

The application of genetic, cellular and behavioural techniques in molecular and systems neuroscience to examine social, emotional and cognitive capacities and further understand critical molecular and cellular pathways that underlie the emergence of common metabolic diseases (e.g., diabetes, cancer), and the neuropathology of anxiety disorders (e.g., social phobia, panic disorder, post-traumatic stress disorder [PTSD]), learning and attention disabilities (e.g., Autism, ADHD), addiction (e.g., alcoholism, drug abuse) and major psychosis (bipolar disorder, schizophrenia, major depression). The role of epigenetic mechanisms as well as methods used to study gene-environment interactions are explored.

FORMAT: Lecture

LECTURE HOURS PER WEEK: 3

Course Prerequisites

PSYO 2470.03/NESC 2470.03 or PSYO 2770.03, and BIOL 1010.03 or BIOL 1020.03 and BIOL 1011.03 or BIOL 1021.03, or SCIE 1505X/Y.18, SCIE 1515.X/Y36, SCIE 1520X/Y.30, or SCIE 1540X/Y.27 (with a grade of B- or better); BIOL 2020.03 and BIOL 2030.03 are useful.

CROSS-LISTING: PYSO 3670.03, NESC 3670.03

Course Exclusions

PSYO/NESC 2670.03

Student Resources

Office Hours: Tuesdays, 11:00– 13:00; Room 3340, Life Sciences Centre (Psychology Wing) and online (<https://outlook.office365.com/owa/calendar/OfficeHours4@dal.u.onmicrosoft.com/bookings/>)

See end of document for additional resources available to students (resource centers, etc.).

Course Structure

Course Delivery

In-person, lectures will also be recorded and posted on Brightspace

Lectures

Tuesdays, 08:35 – 09:55; Room C238, Life Sciences Centre (Studley Campus)

Thursdays, 08:35 – 09:55; Room C238, Life Sciences Centre (Studley Campus)

Course Materials

The required readings for the course will be presented in class and posted online on Brightspace. These readings have been selected instead of a course textbook. Exams will test knowledge based on the information taught in class and required readings posted online on Brightspace. Suggested popular textbooks and web links posted online on Brightspace are only to provide context and help fill in any gaps in background knowledge.

Assessment

Lecture Component: Tested material includes 1) readings, 2) lecture recordings, and 3) Guest lectures. Grades are based on **four Quizzes** and **two Exams** (*multiple choice, multi-select, interpreting images, short answer format. Content is **not** cumulative*), and **one Article Summary**

Component	Weight (% of final grade)	Date
Tests/quizzes	i) 5% total, 15 min	Tuesday 24 th September, 2024
	ii) 5% total, 15 min	Tuesday 8 th October, 2024
	iii) 5% total, 15 min	Tuesday 5 th November, 2024
	iv) 5% total, 15 min	Thursday 21 st November, 2024
Midterm exam	30% total, 1 hour 20 min	Tuesday 15 th October, 2024
Final exam	40% total, 2 hour	(Scheduled by Registrar)

Assignments Article Summary: weighted at 10%: 16 articles selected by the instructor will be posted on Brightspace. Each student will then select one article to summarize. Rough notes should start with initial impressions from reading the selected paper and be updated with ideas arising from discussion in class. These notes will then be edited to create a cohesive one-page article summary for the paper. The article summary (in .pdf or .doc format) should be emailed to ian.weaver@dal.ca by 11:59pm on Wednesday 4th December, 2024 (1% penalty/day for late summaries).

Other course requirements

None

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)	

Course Policies on Missed or Late Academic Requirements

Exams must be taken at the scheduled time. Missed exams due to illness or exceptional circumstances **must** be communicated to the instructor immediately. An alternative make-up will only be considered with a DECLARATION OF ABSENCE, completed, signed, and emailed to ian.weaver@dal.ca within 24 hours of the missed exam. There will be a 1% penalty/day for late 'article summaries'.

Course Policies related to Academic Integrity

For the 1- Page Article Summary, students are allowed to discuss general concepts with each other, but each assignment submitted **must** be 'individual work'. Plagiarism detection tools will assist in detecting textual similarities between compared works as well as generative AI and large language models (ChatGPT etc).

Learning Objectives

This course will provide students with an introduction to how genetic, epigenetic, stochastic (i.e., random) and environmental factors interact with each other in determining gene expression in mammals during early development, which shapes life-long emotional, behavioural and cognitive functioning. Landmark and up-to-date research articles have been selected across major themes in neuroscience to trace how new data has transformed our understanding of brain gene expression, brain development and the adult neurobehavioural function. We will also discuss the possible implications of genetic and epigenetic research for the development of novel pharmacological interventions, diagnostic procedures and preventive measures in mental health disorders. The main objectives are covered within four themes: 1) Genes and Heredity; 2) Fetal origins of the adult disease; 3) Early life experiences & adult behaviour; 4) Neurobiology of learning and memory; and 5) Aging and vulnerability to psychiatric disorders. At the end of the course students should be able to list and define major genetic, epigenetic and endocrine processes in neurobiology. Name and discuss important neural and developmental pathways that are regulated by genetic, epigenetic and hormonal factors. Gain an understanding of how misregulation of genetic and epigenetic mechanisms can lead to disease states. Recognize how transcriptional, translational and posttranslational machinery can be targets for therapeutic agents. Read, comprehend, critically analyze and integrate knowledge from a primary research article. Explain commonly used molecular, cellular and behavioural techniques and design experiments using these techniques to address a biological question.

Course Content

Class	Date	Lesson Topic(s)	Assessment/Deadline
1	Tuesday 3 rd Sept, 24	Welcome!	
2	Thursday 5 th Sept, 24	Genes and heredity	
3	Tuesday 10 th Sept, 24	The Bases of Genetics – DNA, RNA, Chromosomes and Genes	

4	Thursday 12 th Sept, 24	Chromatin and Control of Gene Expression	
5	Tuesday 17 th Sept, 24	Epigenetic Mechanisms of Gene Regulation - Histone Modification	
6	Thursday 19 th Sept, 24	Epigenetic Mechanisms of Gene Regulation - DNA Methylation (Part 1)	
7	Tuesday 24 th Sept, 24	Epigenetic Mechanisms of Gene Regulation - DNA Methylation (Part 2), DNA Demethylation and RNA Interference (RNAi)	Mini Quiz #1
8	Thursday 26 th Sept, 24	Early Brain Development	
9	Tuesday 1 st Oct, 24	The Neuron and Neural Transmission within a Cell	
10	Thursday 3 rd Oct, 24	Synaptic Transmission between Cells	
11	Tuesday 8 th Oct, 24	Cognition, Learning and Memory I - Basic Distinctions	Mini Quiz #2
12	Thursday 10 th Oct, 24	Cognition, Learning and Memory II - Neural Mechanisms	
13	Tuesday 15 th Oct, 24	Material Covered in Classes 2-10	Midterm Exam
14	Thursday 17 th Oct, 24	Cognition, Learning and Memory III & Executive Functions of the Frontal Lobe	
15	Tuesday 22 nd Oct, 24	Hormones and Brain Function	
16	Thursday 24 th Oct, 24	The Neurobiology of Emotion and Stress	
17	Tuesday 29 th Oct, 24	The Neurobiology of Stress and Anxiety (Part 1)	
18	Thursday 31 st Oct, 24	The Neurobiology of Stress and Anxiety (Part 2)	
19	Tuesday 5 th Nov, 24	The Neurobiology of Stress and Anxiety (Part 3)	Mini Quiz #3
20	Thursday 7 th Nov, 24	Genes, Brain and Mental Illness (Dr. Rudolf Uher)	Guest Lecture
Mon 11 th - Fri 15 th Nov, 24		FALL STUDY BREAK	
21	Tuesday 19 th Nov, 24	Fear and Anxiety Disorders and Drugs (Part 1)	
22	Thursday 21 st Nov, 24	Fear and Anxiety Disorders and Drugs (Part 2)	Mini Quiz #4

23	Tuesday 26 th Nov, 24	The Neurobiology of Love	
24	Thursday 28 th Nov, 24	Course Review	
	Wednesday 4 th Dec, 24	Select Article from List Online	1-Page Article Summary
	Scheduled by Registrar	Material Covered in Classes 11-23	Final Exam

University Policies and Statements

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. Additional information regarding the Indigenous Student Centre can be found at: 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

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) 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

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

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/about/leadership-governance/academic-integrity/faculty-resources/ouriginal-plagiarism-detection.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.