NEUR*3100 Molecular Mechanisms of Neurological Disorders

Fall 2021
Section(s): C01

Department of Molecular and Cellular Biology
Credit Weight: 0.50
Version 1.00 - September 04, 2021

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1 Course Details

1.1 Calendar Description

This course will follow the life of nervous system cells from birth, through their functional life, and ending in ageing and degenerative disease. Focus will be on the molecular and cellular events that govern these processes and the diseases and pathologies, such as Parkinson's and Alzheimer's, that arise as a consequence of their dysfunction. Finally, students will be introduced to the new and rapidly advancing field of adult neural stem cells and the promises and potential problems of their use in treating many of the diseases that will have been discussed throughout.

Pre-Requisites:	MCB*2050, (NEUR*2000 or PSYC*2410),
Restrictions:	This is a Priority Access Course. Enrolment may be restricted to particular programs (BSCH.NEUR minor) or semester levels during certain periods.

1.2 Course Description

This course will build upon the knowledge gained in NEUR*2000 and examine the neurobiological mechanisms of central nervous system diseases. In the first half of the course, emphasis will be placed on molecular events and cellular pathways that are important for proper neuronal and brain systems function in the context of neurodevelopmental disorders. The second half of the course will expand upon these concepts by discussing their involvement in various neuropsychiatric and neurodegenerative disease pathologies using recent literature from preclinical and clinical studies. Diseases that will be discussed include, but are not limited to, autism spectrum disorders, Rett syndrome, depression, schizophrenia, addiction, and Alzheimer’s disease. Current therapies and their limitations will also be addressed.

1.3 Timetable

Lectures are **Tuesdays** and **Thursdays** from **1:00-2:20PM**.

Room: **Landscape Architecture (LA) 204**

1.4 Final Exam

The final exam will be at on **December 7, 2021 from 11:30-13:30**. The location will be provided by the Registar's office later in the semester. Reminders will be provided well in advance.

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2 Instructional Support

2.1 Instructional Support Team

Course Co-ordinator:	Dr. Jasmin Lalonde
Email:	jlalon07@uoguelph.ca
Telephone:	+1-519-824-4120 x. 54706
Office:	SSC 3460
Office Hours:	By appointment – please contact via email.

2.2 Teaching Assistants

Teaching Assistant (GTA):	Alicyia Walczyk-Mooradally
Email:	walczyka@uoguelph.ca
Office Hours:	By appointment – please contact via email.

2.3 Etiquette

When communicating with anyone in the course, including other students, TA, or instructors, **it is expected that you address the other person with respect**. Any communication that is deemed to be disrespectful or intimidating will be taken seriously and addressed accordingly.

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3 Learning Resources

3.1 Required Resources

Courselink (Website)

https://courselink.uoguelph.ca

Course material, news, announcements, and grades will be regularly posted to the NEUR*3100 Courselink site. You are responsible for checking the site regularly.

The online forums are meant for discussions concerning course material only. Non-course related postings are not permitted. We always appreciate comments regarding the class;

however, suggestions or complaints about the course should be brought up to the instructors directly and not posted on the forum. All postings deemed inappropriate will be removed.

Journal Articles (Article)

Comprehensive review articles and primary research papers from various peer-reviewed journals, as well as articles from other sources, may be used throughout the course. These documents will be accessible and suitable for the knowledge level of the students. All material will be posted well in advance on CourseLink.

3.2 Recommended Resources

Basic Neurochemistry: Principles of Molecular, Cellular, and Medical Neurobiology, 8th Addition (Textbook)

Electronic copy of this textbook can be downloaded from the publisher through the University of Guelph Library system. Instruction to access the textbook material will be provided by the instructor. A hard copy of the text is also available on reserve in the Library. Contact the course coordinator with any questions or issues accessing material from the library.

NOTE: There is no require textbook for this course, you will be provided will all necessary resources, but the textbook may complement these resources.

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4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. Understand the functional importance of select molecular events and cell signaling pathways on neuron function.
2. Be familiar with the mechanisms underlying neuronal communication.
3. Understand how the dysregulation of specific molecular and cellular processes contribute to the pathogenesis and pathophysiology of different brain diseases.
4. Understand the relationship between cell signaling, system function, and behaviour in CNS diseases.
5. Have an appreciation for the current available therapies and their limitations.
6. Have an appreciation for techniques utilized in the study of cellular and molecular neuroscience.

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5 Teaching and Learning Activities

5.1 Lecture

Brain Development & Neurobiology Basics

Topics: **Dr. Lalonde – Lecture 1 (September 9) and Lecture 2 (September 14)**

1. Cell biology of the nervous system
2. Electrical excitability and ion channels
3. Cell adhesion molecules, myelin, cytoskeleton
4. Translational topics: Introduction to encephalopathies and synaptopathies, autism spectrum disorders

Intercellular Signaling I

Topics: **Dr. Lalonde – Lecture 3 (September 16) and Lecture 4 (September 21)**

1. Acetylcholine
2. Catecholamines: Dopamine, norepinephrine, epinephrine
3. Serotonin
4. Translational topics: Nicotine dependence, nicotine and psychosis

Intercellular Signaling II

Topics: **Dr. Lalonde – Lecture 5 (September 23) and Lecture 6 (September 28)**

1. Glutamate and glutamate receptors
2. GABA and GABA receptors
3. Translational topics: Excitotoxic death, epilepsy

Intracellular Signaling I

Topics: **Dr. Lalonde – Lecture 7 (September 30) and Lecture 8 (October 5)**

1. Calcium signalling, activity-dependent gene expression, neuroplasticity
2. Translational topic: Rare neurodevelopmental disorders

Intracellular Signaling II

Topics: **Alicyia Walczyk-Mooradally (Guest Lecturer) – Lecture 9 (October 7) and Dr. Lalonde – Lecture 10 (October 14)**

1. Posttranslational modifications, epigenetics
2. Translational topic: Rare neurodevelopmental disorders

Review Session

Topics: **In-class review session of Part 1 with Dr. Lalonde (October 19)**

Examination

Topics: **Dr. Lalonde – Midterm (October 21, Landscape Architecture 204)**

Parkinson's disease

Topics: **Dr. Lalonde – Lecture 11 (October 26)**

1. Intro, symptoms, etiology
2. Neuropathology, structural and neurochemical deficits
3. Treatments and limitations

Huntington's disease

Topics: **Dr. Shaun Sanders (Guest Lecturer) – Lecture 12 (October 28)**

1. Intro, symptoms, etiology
2. Neuropathology, structural and neurochemical deficits
3. Treatments and limitations

Alzheimer's disease & Tauopathies

Topics: **Dr. Lalonde – Lecture 13 (November 2)**

1. Intro, symptoms, etiology
2. Neuropathology, structural and neurochemical deficits
3. Treatments and limitations

Basic Mechanisms Underlying Seizures and Epilepsy

Topics: **Dr. Fiona James (Guest Lecturer) – Lecture 14 (November 4)**

1. Intro, symptoms, etiology
2. Neuropathology, structural and neurochemical deficits
3. Treatments and limitations

Mechanisms of schizophrenia

Topics: **Dr. Lalonde – Lecture 15 (November 9) and Lecture 16 (November 11)**

1. Intro, subtypes, symptoms, etiology
2. Neuropathology, structural and neurochemical deficits, 2-hit hypothesis
3. Immune hypothesis, glutamate hypothesis, dopamine hypothesis

4. Epigenetic mechanisms
5. Circuit dysfunction
6. Treatments

Mechanisms of major depression and anxiety

Topics: **Dr. Melissa Perreault (Guest Lecturer) – Lecture 17 (November 16) and Lecture 18 (November 18)**

1. Intro, symptoms, etiology
2. Circuit dysfunction
3. Neuropathology, neurotransmitters
4. Sex differences and the role of estrogen
5. Treatments and limitations

Bipolar disorder

Topics: **Tristen Hewitt (Guest Lecturer) – Lecture 19 (November 23)**

1. Intro, symptoms, etiology
2. Neuropathology, structural and neurochemical deficits
3. Treatments and limitations

Pain and Opioid Addiction

Topics: **Dr. Lalonde – Lecture 20 (November 25)**

1. Intro
2. Receptor targets and cell signaling mechanisms
3. Treatments and limitations

Cannabis and endocannabinoid system

Topics: **Dr. Jibran Khokhar (Guest Lecturer) – Lecture 21 (November 30)**

1. Intro
2. Receptor targets and cell signaling mechanisms

Review Session

Topics: **In-class review session of Part 2 (December 2)**

Examination

Topics: **Dr. Lalonde – Final Examination (December 7, 2021 – 11:30-13:30)**

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6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Part 1 - Midterm (Oct. 21)	30
Part 2 - Final (Dec. 7)	40
Semester Assignment (Dec. 10)	30
Total	100

6.2 Assessment Details

Part 1 - Midterm Examination (30%)
Date: Thu, Oct 21, 1:00 PM - 2:20 AM, Landscape Architecture (LA) 204
This examination will cover material presented in the **first** half of the class.

Part 2 - Final Examination (40%)
Date: Tue, Dec 7, 11:30 AM - 1:30 PM, TBD
This examination will cover material presented in the **second** half of the class.

Semester Assignment (30%)
Date: Fri, Dec 10, N/A
Individual semester assignment will be due **December 10, 2021 before noon (12:00PM)** and should be uploaded via CourseLink.

6.3 Submitting Semester Assignment

You will have **1** marked assignment this semester worth 30% of your final grade.

This assignment is to be submitted electronically on **Friday December 10** at **noon** (12:00AM). Beginning at 12:01AM (according to the time-stamp of submission), each 24-hr delay will result in 25% automatic deduction in the assignment grade. If the assignment is submitted 3 days and 1 minute past the due date, then it **will not be graded**.

IMPORTANT NOTE: By registering for this course you are agreeing to the deadlines set out in the course outline. Also, it is the **sole responsibility of the student** to ensure the file they've uploaded is not corrupted and is accessible to the instructor and TAs. Any file found to be corrupted during the marking period will automatically receive a 0 for the assignment. The University is seeing increasing cases of students using online 'corruption services' to get an additional extension. **These cases are being deemed fraud and are a form of academic misconduct.**

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7 Department of Molecular and Cellular Biology Statements

7.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. B.Sc. Academic Advising or Program Counsellors

7.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. http://www.learningcommons.uoguelph.ca/
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours

of operations can be found at: http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help and http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help

7.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. https://www.uoguelph.ca/counselling/
- Student Health Services is located on campus and is available to provide medical attention. https://www.uoguelph.ca/studenthealthservices/clinic
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. http://www.selfregulationskills.ca/

7.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) http://www.e-laws.gov.on.ca/index.html. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information policies please see the Undergraduate Calendar. (https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml)

7.5 Course Offering Information Disclaimer

Please note that course delivery format (face-to-face vs online) is subject to change up to the first-class day depending on requirements placed on the University and its employees by public health bodies, and local, provincial and federal governments. Any changes to course format prior to the first class will be posted on WebAdvisor/Student Planning as they become available.

8 University Statements

8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is

required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma

programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

8.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

8.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
- https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
