

BIOL 4481: Excitable Cells
University of Windsor
Winter 2022

Course Instructor

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Office hours: By appointment

Lab Instructors

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Textbook

Neuroscience (6th edition), by Dale Purves et al., Oxford University Press, 2017 (An earlier edition of this textbook is acceptable).

Prerequisites

This course is for third/forth year undergraduate students. All students taking this course are expected to have completed BIOM2131 (Introductory Molecular Biology) and BIOL2480 (Principles of Neuroscience).

Objectives

1. To understand properties of cells that generate action potential discharges, circuits formed by such cells and how such circuits contribute to body functions.
2. To appreciate how brain circuits can be shaped by experience.
3. To use basic neurophysiological and neuroanatomical laboratory techniques to study functions of excitable cells and circuits formed by such cells.

Organization of the course

Lectures and laboratory experiments are the major parts of the course. Lectures will be given by the Course Instructor (See "*Lecture schedule*"). Laboratory experiments will be conducted by students (See "*Laboratory schedule*"). These schedules are subject to adjustments to reflect regulations made by the University based on a COVID-19 pandemic situation. Every effort will be made to inform students in advance in case any adjustments have to be made.

Lecture schedule

Meeting Time

Tuesdays & Thursdays 1:00 pm – 2:20 pm

Place

Jan 18-Jan 27: Online (Teams)

Feb 1-Apr 14: Erie Hall 2127 (Except for Lectures 5&6, which are given in Biology Building 322)

Schedule:

Date	Lecture	Topic	Readings
Jan 18	Lecture 1	Intro to the course	Chap 1
Jan 20	Lectures 2&3	Motor system: Lower motor circuits	Chap 16
Jan 25			

Jan 27	Lectures 4	Motor system: Upper motor circuits (I)	Chap 17
Feb 1	Lectures 5&6	Measuring activities from excitable cells	Please note these two lectures are given in Biology Building 322
Feb 3			
Feb 8	Lectures 7	Motor system: Upper motor circuits (II)	Chap 17
Feb 10	Lectures 8&9	Motor system: The basal ganglia	Chap 18
Feb 15			
Feb 17	Lectures 10	Motor system: The cerebellum	Chap 19
Feb 22&24	STUDY week (No lecture)		
Mar 1	Lectures 11	Motor system: The cerebellum	Chap 19
Mar 3	Midterm		Lectures 1-11
Mar 8	Literature discussion		
Mar 10	Lectures 12&13	Eye movements and sensorimotor integration	Chap 20
Mar 15			
Mar 17	Lectures 14&15	The visceral motor system	Chap 21
Mar 22			
Mar 24	Lectures 16&17	Chemical senses	Chap 15
Mar 29			
Mar 31	Lectures 18&19	Emotion	Chap 31
Apr 5			
Apr 7	Lecture 20&21	Experience-dependent changes in the brain	Chap 24
Apr 12			
Apr 14	Review		
TBA	Final exam		All lectures

Laboratory schedule

Meeting Time

Section 51—Tuesdays 2:30 pm – 5:20 pm

Section 52—Thursdays 2:30 pm – 5:20 pm

Please note: Due to the current pandemic situation, it will be good if Section 51 can have 2/3 of the students in the class while Section 52 can have 1/3 of the students. Section 51 can then be divided into two groups, which will conduct an experiment in two different weeks. Please see following for details. Section and group compositions will be discussed in the first day of class.

Place:

Biology Building Room 322

Schedule:

Date	Activity	Note
Jan 18, 20, 25, & 27	N/A	No laboratory
Feb 1	Measuring activities from excitable cells	1. Lectures given by course instructor (1:00 - 2:20 pm). All students.

Feb 3		2. Surgical practice (2:30-5:00 pm). Section 51 on Feb 1, Section 52 on Feb 3.
Feb 8	LabChart Basics <i>Please note: LabChart Reader should be downloaded from the following website before class:</i> https://www.adinstruments.com/products/labchart-reader	Lecture given by Lab Instructors (2:30–5:20 pm)
Feb 10		
Feb 15	Laboratory 1: Earthworm action potentials	Section 51 Group 1 and Section 52 all people conduct Lab 1 in this week.
Feb 17		
Feb 22&24	STUDY week (No laboratory)	
Mar 1	Laboratory 1: Earthworm action potentials	Sections 51 Group 2 conduct Lab 1 in this week.
Mar 3	N/A	No laboratory
Mar 8	Laboratory 2: Earthworm smooth muscle contraction	Sections 51 Group 1 and Section 52 all people conduct Lab 2 in this week.
Mar 10		
Mar 15	Laboratory 2: Earthworm smooth muscle contraction	Sections 51 Group 2 conduct Lab 2 in this week.
Mar 17	N/A	No laboratory
Mar 22	Special workgroup experiment*:	Section 51 on Mar 22, Section 52 on Mar 24.
Mar 24	Discuss with GA about your idea	
Mar 29	Special workgroup experiment*:	
Mar 31	Writing of proposal	
Apr 5	Special workgroup experiment*:	Section 51 due on Apr 5, Section 52 due on Apr 7.
Apr 7	Proposal due	
Apr 12	No laboratory	
Apr 14		

* A special workgroup experiment will be proposed by a group of two students. Such an experiment will be based on Laboratory 1 or 2, with one or a few variables chosen by experimenters being manipulated. Examples of possible special experiments:

- Effect of temperature on earthworm action potentials
- Effect of temperature on smooth muscle activity
- Effect of adrenergic or cholinergic agonists on smooth muscle activity
- Effect of neuromodulators (e.g., serotonin, NPY, SP) on muscle activity

Grade

Your grade will be based on the following components:

Assignment	Due Date	Marks
Lab Report	Mar 15 for Group 1 of Section 51, Mar 17 for Section 52, and Mar 22 for Group 2 of Section 51 (To be submitted on Blackboard by 5:00 pm)	10
Special Experiment proposal	Apr 5 for Section 51, Apr 7 for section 52 (To be submitted on Blackboard by 5:00 pm)	10
Participation in the class	Throughout the term	5

Effort made on experiments & Lab notebook	Weekly	5
Midterm exam	Mar 3, 1:00 pm	25
Final exam	TBA	45
TOTAL		100

Submission of assignments, taking exams, and rescheduling

You are expected to submit assignments and take exams on scheduled dates. Exceptions will only be made for official University business (e.g., University sports team), illness (a doctor's note is required), or bereavement. A make-up exam will be given within one week after a scheduled exam is delivered at mutually convenient time. The penalty for late submission of a lab report or a special workgroup experiment proposal: 5% per day (i.e., 0.5 mark/day).

Laboratory-related assignments

- A lab report/proposal will worth 10% of the final grade (see below for detailed marking scheme).
- Each student should prepare an individual Lab Report based on either Lab 1 or Lab 2.
- Special Experiment Proposal: A group of two people will prepare one proposal.

General suggestions for writing a good lab report/proposal

- Pay attention to logical development and make ideas flow
- Inform but not “entertain” your audience
- Follow relatively standard format/organization (see below)
- Reference ideas/results from other publications
- Keep brevity and succinctness/avoid repetitiveness
- Avoid ambiguous language
- Avoid stream of consciousness or abstract thought
- Use proper grammar and sentence structures
- Before writing your first lab report, please read a few publications from the *Journal of Neurophysiology* to get familiar with the general format and organization of a scientific report.

General guidelines regarding the format of a lab report/proposal

- Double spaced
- Time New Roman in font type and 12 pt in font size
- Page number indicated in the header

Review of exams and re-grades

You can discuss with the Course Instructor if you feel that a mistake has been made in the grading of your exam. You have one week to apply for re-grading after your mark is posted. No appeals will be considered after the one-week time limit. All requests for re-grading must be in writing.

Lecture notes

PowerPoint files of lectures will be posted on “Blackboard”. You are advised to print out/download these files and bring them with you to lectures. These files are outlines of what we will discuss but you will be responsible for all materials discussed in lectures. Please make sure to take notes in lectures.

Academic misconduct

Submitting someone else's work as your own is plagiarism and **will NOT be tolerated** in this class. For the University's policy on plagiarism, please visit the Office of Academic Integrity website: www.uwindsor.ca/academic-integrity/306/student-resources. It is your responsibility to understand and follow the University policies to maintain academic integrity. Exams in this course are protected by copyright. Reproduction of examinations or dissemination of the contents or format of examinations in any manner (e.g., sharing content with other students) without the permission from the instructor is strictly prohibited. Students who violate this rule or engage in any other form of academic dishonesty will be subject to disciplinary action under Senate Bylaw 31: Student Affairs and Integrity.

Guidelines for preparing a laboratory report

Please note:

1. Each student should prepare and submit a single Lab Report either based on Earthworm Action Potentials or Earthworm Smooth Muscle Contraction.
2. Please use a paragraph (narrative) form but not a bullet form when you write major parts of a lab report (i.e., Abstract, Introduction, Materials and Methods, Results, and Discussion).
3. Please visit the Office of Academic Integrity web site to find policies on plagiarism.

A lab report should contain the following components:

Title Page (0.5 mark)

- Your name
- Title of your write-up
- Date when your experiment is performed
- Date when the lab report is submitted
- The person who collected the data based on which the report is written

Abstract (Max: 250 words) (1 mark)

- A brief background introduction leading to the objective(s) of an experiment
- General methodology for performing the experiment
- Major findings of the experiment
- Significance of the findings

Introduction (No word limit) (2 marks)

- Background literature related to the scientific problem that you tried to tackle (only the literature that is directly relevant to your study)
- General strategies used in the field to tackle the problem
- Gap in knowledge related to your study
- Objective of your study/Hypothesis
- Specific methods used in your study to tackle the knowledge gap

Please note: Where appropriate, you can use a diagram to show your ideas including the hypothesis being tested.

Materials and Methods (No word limit) (1.5 marks)

- Animal species
- Instruments
- Chemicals
- Experimental procedures
- Data analysis

Please note: All necessary information needed for conducting/replicating your experiment should be included. Please use the above five points as the titles of subsections in this section.

Results (No word limit) (3 marks)

- Examples of raw recording traces/photomicrographs
- Quantitatively analyzed data.

Please note: 1) In case no results are obtained after you make all your efforts, data collected by lab instructors will be given to you. Please use LabChart Reader to take measurements of the recording traces that you obtain and use your measurements to make tables/graphs. One mark will be deducted if results collected by lab instructors are used in your lab report. 2) Both raw recording traces and tables/graphs made based on measurements of raw recording traced should be described using text. Tables and figures should be referred to in the text.

Discussion (No word limit) (1.5 marks)

- A brief summary of results
- Comments on how results are related to the objective(s) of the experiment and whether results support your hypothesis
- Linkage between findings and published literature (including that described in the “Introduction”)
- Significance of findings
 - How will results help close the knowledge gap?
 - How significant are results for a scientific field?
 - What can people do in the future with the results from your experiment?

Literature (0.5 marks)

Please follow the format used by the Journal of Neurophysiology (available online at the University of Windsor Leddy Library).

Guidelines for preparing a proposal for a special workgroup experiment

1. Each group (two people) is advised to start to discuss ideas for a special workgroup experiment as soon as the term starts. On March 22 (Section 51) and March 24 (Section 52), you should discuss your experimental design with the Course Instructor and Lab Instructors to obtain their inputs.
2. A proposal for a special workgroup experiment should be four pages in length (double spaced). Please use one additional page as a title page and another additional page for references.
3. Each proposal should contain the following components (“Introduction”, “Experimental design”, and “Expected results and significance” and be written in a paragraph rather than a point form):

Title Page (0.5 mark)

- A brief title of the experiment
- Both group members’ names and student IDs
- Author contributions:

Example of author contributions: Experiment conceived and designed by students 1 & 2; Early draft of “Introduction” and “References” prepared by students 1; early draft of “Experimental design” and “Expected results and significance” prepared by students 2; entire proposal revised and finalized by students 1 & 2.

Please make sure that your description of author contributions is approved by both members of your group. Upon approval, you should include the following statement on the title page: “Both group members have read and approved the proposal”.

Introduction (3.5 marks)

- Background knowledge related to your specific objective(s)
 - a. What is known related to your scientific question?
 - b. What is unknown related to your question (i.e., gap in knowledge)?
 - c. What is the approach that can be used to fill the gap in knowledge?
- Specific objective(s) of your experiment (i.e., the specific question(s) that you are planning to address) and/or your hypothesis

You should clearly develop the logic as to why it’s important to conduct your experiment. It is suggested that you start with a “big picture” related to your experiment. You can then discuss the question/issue/hypothesis/missing piece of scientific information that you try to tackle. Next, you can discuss general strategy & methodology that you can use to close the gap in information. Afterwards you can talk about your specific objectives and hypotheses.

Experimental design including materials (3.5 points)

- Animal species
- Instrumentations required
- Chemicals required
- Experimental procedures

Please keep in mind that this section should contain necessary information about the major materials and methods that people will need to conduct/replicate your experiment.

Expected results and significance (2 point)

- Expected results

- Significance
 - How will results from your proposed experiment help close the gap in knowledge?
 - How significant will results from your proposed experiment be for a scientific field?
 - What can people do in the future with the results from your proposed experiment?

References (0.5 point)

Please use the same format as that used in the Journal of Neurophysiology (available online at the University of Windsor Leddy Library).