*This syllabus is a general representation of the course as previously offered and is subject to change.*

# BIOL 361 – Neural and Muscular Physiology

General Course Syllabus (as of July 2019)

## About the Course:

**Course Description**: BIOL 361 is focused on how organisms sense and respond to the environment through excitable membranes, neural signaling and transmission, transduction and coding of sensory information, and muscle contraction. Students will gain an understanding of 1) how electrical properties of cells work, including graded potentials, action potentials, current dissipation, and capacitance; (2) how cells transduce sensory information into action potentials and briefly how the signals might be integrated; and (3) the structure and function of skeletal, cardiac, and smooth muscle to understand how organisms can respond to sensory information.

**Course Format:** Lecture
**Credits:** 3
**Prerequisites:** BIOL 200 (one of BIOL 260 or BIOL 201 recommended)

## Course Learning Objectives:

By the end of this course, students will be able to:

- Define physiology, homeostasis, and basic terminology in neural and muscular physiology.
- Predict if and how a molecule will cross a cell membrane, considering the properties of both the membrane and the molecule.
- Differentiate between different forms of membrane transport such as passive diffusion, facilitated diffusion, primary and secondary active transports.
- Calculate the energy involved in molecule transport and analyze factors that affect the magnitude and direction (depolarizing or hyperpolarizing) of a graded potential.
- Explain the mechanisms for how action potentials are generated at the axon hillock and analyze how the properties of an axon (including the length constant, time constant, diameter, and myelination) affect the signal conduction speed of neurons.
- Describe how action potentials are converted to chemical signals and transmitted to other cells.
- Compare and contrast the form and function of the vertebrate brain and nervous systems, and predict the consequences of damage (such as from injury or disease).
- Explain how sensory systems (auditory, olfactory, gustatory, and visual systems) detect external signals and transduce them into electrical signals.
- Understand the structural and functional organization of vertebrate muscles (skeletal, smooth, and cardiac).
- Predict how modifications to various factors affect muscle contraction.

## Textbooks and Additional Resources:

The following resources are required:

- Textbook: Principles of Animal Physiology (3rd edition) CD Moyes and PM Schulte (the Custom Access Code will not be used)
- iClicker
- Calculator (must be a non-programmable calculator)
- Access to course website on Canvas (canvas.ubc.ca)

## Grading Scheme:

Note: the grading scheme may vary by term and instructor. Below are sample grading breakdowns over the 2018/19 Winter Session (2018W):

| **Assessment** | **Weight 2018W1** | **Weight 2018W2** |
|---|---|---|
| Pre-reading and online quizzes | 5% | 10% |
| In-class participation (iClickers, worksheets, etc.) | 5% | 10% |
| Midterm exam | 35% | 30% |
| Final exam | 55% | 50% |
| **Total** | **100%** | **100%** |

DETAILS ON ASSESSMENTS:

**Weekly Pre-Reading and Online Homework:**
The assigned readings and the online assignment for each week will be posted on the course website. Online assignments are multiple choice questions and are meant to help students to either prepare for the coming lecture or to review the material. These are not the type of questions that will appear on exams.

**Clicker Questions:**
During lectures, students will often break up into small groups to solve problems, then discuss as a class. These problems will provide an opportunity to apply the material covered in the readings and lectures, as well as to explore some specific examples of applied physiology. Students will need to bring their clicker to class to answer these questions. Marks are awarded for participation as well as for correct responses. To get full participation marks for clicker questions, students must answer the clicker questions in ~83% of the classes (exact percentage to be determined by the instructor).

**Practice Problems:**
After each major topic in lecture, practice problems will be posted on the course website. These questions are an opportunity to practice applying the course material

and will not be graded. These questions are representative of the types of questions that will appear on exams.

**Exams**
The midterm and final are closed-book exams. Students who score better on the final exam than the midterm or online assignments may have their lower score dropped and final exam reweighted.

**Policy on missed final**
Students must visit their faculty's Dean's Office to determine if a deferred final can be granted. Students who miss a midterm and do not participate in the course may not be allowed to write a deferred final.

## Schedule of Topics:

Sample topics from 2018W2 (January – April 2019):

| Week | Topic |
|---|---|
| 1 | Introduction to BIOL 361 |
| 2 | Membrane permeability and transport<br>Membrane proteins |
| 3 | Graded potentials<br>Action potentials I |
| 4 | Action potentials (continued) |
| 5 | Synapses and cell signaling |
| 6 | Synapses and cell signaling continued<br>Overview of the nervous system |
| 7 | Midterm exam in class |
| 8 | Introduction to the sensory system<br>Sensory systems chemoreception smell and taste |
| 9 | Sensory systems: mechanoreceptors: touch and hearing<br>Sensory systems: photoreception I |
| 10 | Sensory systems: photoreception II (retinal processing)<br>Overview of muscles and cellular movement |
| 11 | Skeletal muscle I<br>Skeletal muscle II (force) |
| 12 | Cardiac muscle<br>Smooth muscle |
| 13 | Review for the final exam, practice problems in class |
| Date TBA | Final exam |

## *University Policies:*

*UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence.*

> *UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom.*
>
> *UBC provides appropriate accommodation for students with disabilities and for religious, spiritual and cultural observances.*
>
> *UBC values academic honesty and students ae expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.*

*Details of the policies and how to access support are available on the UBC Senate website.*