ORIGINAL COURSE IMPLEMENTATION DATE:	June 1994
REVISED COURSE IMPLEMENTATION DATE:	September 2020
COURSE TO BE REVIEWED (six years after UEC approval):	March 2026

Course outline form version: 05/18/2018

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: BIO 202

Number of Credits: 4 Course credit policy (105)

Course Full Title: Cell Signaling/Gene Regulation

Course Short Title:

(Transcripts only display 30 characters. Departments may recommend a short title if one is needed. If left blank, one will be assigned.)

Faculty: Faculty of Science

Department (or program if no department): Biology

Calendar Description:

Focuses on cellular signal transduction. Topics covered include electrical and chemical signaling, DNA structure and genome organization, the cell cycle and cancer, biotechnology and genetic engineering, transcription and translation mechanisms, and the regulation of gene expression.

Prerequisites (or NONE): One of the following: (BIO 112 and CHEM 114, both with a C+ or better) or (BIO 111, [CHEM 110 or CHEM 113], and [two of AGRI 123, AGRI 124, AGRI 129, AGRI 163, AGRI 203, AGRI 204, or AGRI 220], all with a C+ or better).

Corequisites (if applicable, or NONE):

Pre/corequisites (if applicable, or NONE):

Antirequisite Courses *(Cannot be taken for additional credit.)*

Former course code/number:

Cross-listed with:

Dual-listed with:

Equivalent course(s):

(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)

Typical Structure of Instructional Hours

Lecture/seminar hours	45
Tutorials/workshops	25
Supervised laboratory hours	20
Experiential (field experience, practicum, internship, etc.)	
Supervised online activities	
Other contact hours:	
Total hours	**90**

Labs to be scheduled independent of lecture hours: ☐ No ☒ Yes

Special Topics *(Double-click on boxes to select.)*

This course is offered with different topics:

☒ No ☐ Yes *(If yes, topic will be recorded when offered.)*

Independent Study

If offered as an Independent Study course, this course may be repeated for further credit: *(If yes, topic will be recorded.)*

☒ No ☐ Yes, repeat(s) ☐ Yes, no limit

Transfer Credit

Transfer credit already exists: *(See **bctransferguide.ca**.)*

☐ No ☒ Yes

Submit outline for (re)articulation:

☐ No ☒ Yes *(If yes, fill in transfer credit form.)*

Grading System

☒ Letter Grades ☐ Credit/No Credit

Maximum enrolment (for information only): 24

Expected Frequency of Course Offerings:

Annually *(Every semester, Fall only, annually, etc.)*

Department / Program Head or Director: Anthony Stea	**Date approved:**	December 2019
Faculty Council approval	**Date approved:**	January 10, 2020
Dean/Associate VP: Lucy Lee	**Date approved:**	January 10, 2020
Campus-Wide Consultation (CWC)	**Date of posting:**	March 20, 2020
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	April 24, 2020

Learning Outcomes:

Upon successful completion of this course, students will be able to:

a) Develop a detailed understanding of core concepts in signal transduction including the roles of electrical and chemical signaling including the signals that trigger cell division.

b) Develop a detailed understanding of core concepts in gene expression and regulation and the impact of biotechnology and genetic engineering.

c) Work collaboratively in small groups in a biology laboratory setting. This will entail dividing the experimental work so that each member of the group plays a critical role in the completion of the experiment and the gathering and analysis of the data.

d) Engage in hypothesis testing and experimentation using biological equipment (e.g. micropippettors, electrophoresis equipment, PCR thermocyclers, etc.).

e) Use mathematical, statistical, and/or graphical analysis of experimental data to determine differences from control data.

f) Write lab reports and assignments summarizing experimental work and determining biological significance.

g) Evaluate a recent scientific research paper and summarize its main results and conclusions during an oral presentation to the class.

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods *(Guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion.)*

Lecture, demonstration, small group practice, discussion, A/V materials, use of models, charts, and lab exercises.

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Text(s) and Resource Materials *(If more space is required, download Supplemental Texts and Resource Materials form.)*

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	Becker	The World of the Cell	☒	Pearson	2019
2.			☐		
3.			☐		
4.			☐		
5.			☐		

Required Additional Supplies and Materials *(Software, hardware, tools, specialized clothing, etc.)*

Typical Evaluation Methods and Weighting

Final exam:	35%	Assignments:	10%	Field experience:	%	Portfolio:	%
Midterm exam:	20%	Project:	%	Practicum:	%	Oral presentation:	15%
Quizzes/tests:	10%	Lab reports:	10%	Shop work:	%	Total:	100%

Details (if necessary):

Typical Course Content and Topics

1. Cell signaling and signal transduction:
   - Electrical properties of cells and signaling
   - Chemical signals, cellular receptors, novel messenger molecules
   - Signal transduction pathways stimulating gene expression
2. Structural basis of cellular information:
   - DNA structure, genome organization, DNA packaging.
3. DNA replication and cell division:
   - DNA replication, DNA damage and repair, cell cycle and mitosis, cancer.
4. Gene expression:
   - Genetic code, transcription, RNA processing, translation, protein targeting.
5. Control of gene expression:
   - Prokaryotes vs. eukaryotes, transcriptional vs. posttranscriptional control.

Laboratory:

Lab exercises include:

Lab 1: PCR analysis of human mitochondrial DNA and sequence comparisons of human mitochondrial DNA.

Students will isolate their own mitochondrial DNA from cheek cells and amplify a specific region using the Polymerase Chain Reaction (PCR). Samples will be run on a DNA electrophoresis gel and then later sequenced. Sequences will be compared to a number of other sequences in a human mtDNA database.

Lab 2: Control of gene expression in Eukaryotes.

Insects (*Drosophila*) are exposed to heat shock conditions. Blood and tissue samples are assayed using Western blotting with an hsp70 antibody to observe aspects of the expression of hsp70 gene.

Lab 3: Gene regulation in transgenic bacteria.

Students create transgenic bacteria by inserting a jellyfish gene which glows when active. The students then determine the presence or absence of the gene and the environmental factors which can influence activity of this transgene.

Supporting lab equipment available:

In-house manual presently in use as is all necessary equipment.

In the second half of the laboratory period, students (working in pairs) must choose, analyze, and present to the class a recent research paper dealing with any topic related to cell biology. The majority choose papers from Science, Nature or Cell due to our current library holdings. The choice of paper must be approved by the instructor.

Students must acquire a good basic understanding of the paper including the techniques described in the paper. They are graded on the level of understanding demonstrated during the presentation as well as during a brief discussion with the instructor and class immediately following their presentation.

The primary objective of this activity is to teach the students how to read the literature. A secondary objective is to expose students to the application of experimental techniques which cannot actually be performed or demonstrated in our teaching labs.