UNIVERSITY OF THE FRASER VALLEY

**ORIGINAL COURSE IMPLEMENTATION DATE:** June 1994
**REVISED COURSE IMPLEMENTATION DATE:** September 2016
**COURSE TO BE REVIEWED: (six years after UEC approval)** November 2021
**Course outline form version: 09/15/14**

# 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<br>**Course Short Title (if title exceeds 30 characters):** | |
| **Faculty:** Faculty of Science | **Department (or program if no department):** Biology |

**Calendar Description:**

This course 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.

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|---|---|
| **Prerequisites (or NONE):** | BIO 112 and CHEM 114. Note, As of January 2017, prerequisites will change to the following: BIO 111, BIO 112, CHEM 113 and CHEM 114 all with a C+ or better. |
| **Corequisites (if applicable, or NONE):** | |
| **Pre/corequisites (if applicable, or NONE):** | |

**Equivalent Courses (cannot be taken for additional credit)**

Former course code/number:

Cross-listed with:

Equivalent course(s):

*Note: Equivalent course(s) should be included in the calendar description by way of a note that students with credit for the equivalent course(s) cannot take this course for further credit.*

**Transfer Credit**

Transfer credit already exists: ☒ Yes ☐ No

Transfer credit requested (OReg to submit to BCCAT):
☐ Yes ☒ No (if yes, fill in transfer credit form)

Resubmit revised outline for articulation: ☐ Yes ☒ No

To find out how this course transfers, see **bctransferguide.ca**.

**Total Hours: 90**

**Typical structure of instructional hours:**

| | |
|---|---|
| Lecture hours | 45 |
| Seminars/tutorials/workshops | 25 |
| Laboratory hours | 20 |
| Field experience hours | |
| Experiential (practicum, internship, etc.) | |
| Online learning activities | |
| Other contact hours: | |
| **Total** | **90** |

**Special Topics**

Will the course be offered with different topics?
☐ Yes ☒ No

If yes, different lettered courses may be taken for credit:
☐ No ☐ Yes, repeat(s) ☐ Yes, no limit

*Note: The specific topic will be recorded when offered.*

**Maximum enrolment (for information only):** 24

**Expected frequency of course offerings (every semester, annually, every other year, etc.):** annually

| | | |
|---|---|---|
| **Department / Program Head or Director:** Allan Arndt | **Date approved:** | Feb. 27, 2015 |
| **Faculty Council approval** | **Date approved:** | March 27, 2015 |
| **Campus-Wide Consultation (CWC)** | **Date of posting:** | November 20, 2015 |
| **Dean/Associate VP:** Lucy Lee | **Date approved:** | March 27, 2015 |
| **Undergraduate Education Committee (UEC) approval** | **Date of meeting:** | November 27, 2015 |

**Learning Outcomes**

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

1. Describe the main steps in signal transduction in cells.
2. Explain how electrical and chemical signals are essential for nervous system signaling.
3. Discuss the organization of the genome of cells.
4. Describe how DNA replication works in prokaryotic and eukaryotic cells.
5. Explain the cell cycle and the role of mitosis.
6. Describe the role of biotechnology and genetic engineering in society.
7. Describe how transcription and translation processes work in eukaryotic cells.
8. Discuss the mechanisms of control of gene expression.
9. Perform laboratory skills such as the use of DNA and gel electrophoresis, the use of thermocycler for PCR, transformation of bacteria, etc.
10. Write a detailed scientific report (organized as a research paper) that interprets scientific experimental data from multiweek procedures.
11. Present an evaluation of a modern research paper 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.

**Grading system:** Letter Grades: ☒ Credit/No Credit: ☐ Labs to be scheduled independent of lecture hours: Yes ☒ No ☐

**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 | 2008 |
| **2.** | | | ☐ | | |
| **3.** | | | ☐ | | |
| **4.** | | | ☐ | | |
| **5.** | | | ☐ | | |

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

Use this section for supplies and materials for all sections of this course.

**Typical Evaluation Methods and Weighting**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Final exam: | 45% | Assignments: | % | Midterm exam: | 25% | Practicum: | % |
| Quizzes/tests: | **5**% | Lab reports: | 10% | Field experience: | % | Shop work: | % |
| Oral presentation: | 15% | Other: | % | Other: | % | Total: | 100% |

**Details (if necessary):**

**Typical Course Content and Topics**

1) Cell Signaling and Signal Transduction:
   - electrical properties of cells and nervous system 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.BIO 202

3) DNA Replication and Cell Division:
   - DNA replication, DNA damage and repair, cell cycle, cancer.

4) Biotechnology and Genetic engineering:
   - Gene cloning, genetic engineering, gene therapy.

5) Gene Expression:
   - genetic code, transcription, RNA processing, translation, protein targeting.

6) Control of Gene Expression:
   - prokaryotes vs. eukaryotes, transcriptional vs. posttranscriptional control.

LABORATORY EXPERIMENTS:

In the lab/seminar component of the course students work on complex lab exercises for five to six weeks. The remaining time is used for student presentation of research projects. For the research projects, students work in pairs or individually and must choose a 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. The students then present the paper to the class. 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.

Lab exercises include:

**Lab 1:** PCR analysis 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 (meal worms) 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.