

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

## **BIOL 432 – Research Strategies and Techniques in Cell Biology**

General Course Syllabus (*Last updated: March 2020*)

### **About the Course:**

**Course Description:** A course on major physiological mechanisms that define eukaryotic cells, explored through student visits to UBC research laboratories and discussion of recent scientific literature, with emphasis on the techniques and strategies that enable researchers to test hypotheses and advance new concepts. Biology 432 addresses current topics in Cell Biology and investigates the critical events in the life of eukaryotic cells, with examples from model plant, animal and fungal systems. The course explores the diverse mechanisms cells use to integrate and communicate signals, divide and differentiate, produce and transport proteins and metabolic products and to harness the cytoskeleton and extracellular matrix during growth and development.

This is an elective course designed especially for fourth year undergraduate or first-year MSc students, and is designed for but not restricted to students with strong interest and aptitude in cell biology and for those planning to pursue careers in laboratory research.

**Course Format:** Lecture

**Credits:** 3

**Prerequisites:** BIOL 200 and one of BIOL 233, BIOL 234. (And fourth-year standing.)

### **Course Learning Outcomes:**

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

- Obtain an understanding of advanced concepts in cell biology, with emphasis on cell signalling, cell division and differentiation, endomembrane and protein trafficking, the cytoskeleton, and extracellular matrix using examples from plant, fungal and animal model systems.
- Understand how the scientific process can be used to answer major biological questions through exposure to on-going projects by selected UBC researchers.
- Find out about different stages of a research career through exposure to a range of researchers here at UBC.
- Work effectively as part of a small team.
- Develop critical analysis, written, and oral presentation skills.

### **Textbooks and Additional Resources:**

**Course Website:** <https://canvas.ubc.ca/> (access via UBC CWL)

**Required Reading:** Reading assignments will include review articles as well as original research articles.

**Recommended Reading:** Additional background information can be found in the following textbook:

Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. MOLECULAR BIOLOGY OF THE CELL, Garland Science, Fifth Edition (2008) or more recent, ISBN 978-0-8153-4105-5 or 978-0-8153-4106-2.

Chapters recommended include:

Chapter 8: Manipulating Proteins, DNA and RNA

Chapter 9: Visualizing Cells

Chapter 15: Mechanism of Cell Communication

Chapter 19: Cell Junctions, Cell Adhesion, and the Extracellular Matrix

Chapter 16: The Cytoskeleton

Chapter 17: The Cell Cycle

### **Grading Scheme:**

<b>Assessment</b>	<b>Weight</b>
Participation	10%
Oral Presentation on a Research Article	10%
Written Report on Research Article	10%
Oral Presentation on a Research Technique	15%
Written Report on a Research Technique	15%
Final Exam/Assignment (Individual)	40%

#### DETAILS ON ASSESSMENTS:

The class size is limited to 24. Students will typically work in groups of 6 for the Research article project (literature analysis) and in pairs for the Research Technique project. Early in the term, each group will select a research laboratory project to monitor, and will be assigned one closely related research article and research technique to prepare their presentations and reports. Each presentation is an opportunity for the class to learn about the research topic, which is part of the course content, and also an opportunity to foster critical thinking on research strategies and techniques used to test hypotheses.

**Research Article Presentation:** Students will prepare a presentation to summarize the main points of their assigned research article. The presentations will be 30-minutes followed by a 10 to 15-minute general discussion/question period, and will resemble a journal club format common in research laboratories and graduate training programs.

**Research Article Written Report:** Students will prepare a written analysis on the same research article they were assigned for the first presentation. The report will summarize the importance of the research, what previous studies have shown, and the major questions in that field of research (limit of 1750 words). Students will gain insight into the scientific publication process and how research ideas are generated, tested, and the findings published in peer reviewed journals.

**Research Technique Presentation:** Students will present their assigned research technique in the format of a 20-minute “lecture” providing information about the technique and a case study on how the technique was employed in cell biology experiments. At the end of the presentation and discussion, the class should be able to identify whether or not this technique is appropriate for addressing a specific biological question. This is also an opportunity for students to refine their presentation skills after receiving feedback on the first presentation.

**Research Technique Written Report:** the report should provide an in-depth description of a technique that is commonly used in cell biology. Students will prepare a report (limit of 1750 words) on the technique’s requirements, procedures, and use, and an analysis of the experiments that they have been monitoring to exemplify the use of this technology. The report will be shared with the class on the course webpage.

**Participation:** There will be regular reading assignments to discuss major research papers in class, and periodically, quizzes might be used to measure learning objectives and to gauge general knowledge. Students will be organized into groups to discuss the problems and concepts associated with these questions.

## **Schedule of Topics:**

Each year, a selection of research projects currently underway in Cell Biology Research Laboratories at UBC provide the basis for the topics for BIOL 432, and will vary from year to year. A sample schedule from 2018W2 is shown below in which 4 topics (Modules) are listed:

### \*Research Project Modules from 2018W2:

**Module 1:** The Role of the Microtubule-Associated Protein CLASP in the Regulation of Cell Proliferation and Cell Cycle Progression

Laboratory: Geoffrey Wasteneys, Department of Botany (Science)

Model System: Arabidopsis thaliana

**Module 2:** Cardiac Ryanodine Receptors: The Dynamic Dyad

Laboratory: Ed Moore, Cellular and Physiological Sciences (Medicine)

Model Systems: Mouse, Rat

**Module 3:** Regulation of endoplasmic reticulum – plasma membrane communication during abiotic stress by synaptotagmin 1

Laboratory: Abel Rosado, Department of Botany, Faculty of Science

Model system: Arabidopsis thaliana

**Module 4:** Synapse Pattern Formation

Laboratory: Kota Mizumoto, Zoology, Faculty of Science

Model system: Caenorhabditis elegans

<b>Week</b>	<b>Focus*</b>	<b>Lecture Topic</b>
1	-	General Course Introduction; Project Selection
2	Modules 1 & 2 Introduction; Module 2	Cytoskeleton; Cell Motility and Muscle Contraction <b>Technical Lecture:</b> Microscopy Basics (resolution)
3	Modules 1 & 2	Regulation of Microtubule Dynamics; Team Building; Discussions <b>Technical Lecture:</b> Light Microscopy Basics
4	Modules 1-4	Cell Proliferation and the Plant Meristem <b>Technical Lecture:</b> Light Microscopy (continued); Confocal Microscopy
5	Module 3	Intercellular Communication Guest Presentation (Module 3) <b>Technical Lecture:</b> Advanced Light Microscopy Options; Electron Microscopy
6	Module 3	<b>Lab Tour:</b> Bioimaging Facility Contact Sites Guest Presentation (Contact Sites)
7	Modules 1 & 2	Lecture Student Presentation on Research Article 1, 2
8	Modules 3 & 4	Student Presentation on Research Article 3, 4
9	Module 4	Complete research monitoring and assignments; Workshop/instructions for presentations and reports on research techniques Guest presentation (Module 4)
10	Module 1	Guest Presentation (Module 1) Student presentation on Research Techniques
11	Modules 1 & 2	Student presentation on Research Techniques
12	Modules 3 & 4	Student presentation on Research Techniques
13	-	Course Review; Sample Exam Questions

## **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 are 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](#).*