# BIOB12 - Cell and Molecular Biology Laboratory Winter 2020

**Instructor**: Adam Mott

**Office**: SY264

**E-mail**: adam.mott@utoronto.ca

**Office hours**: Monday 1 PM - 2 PM

**Lecture**: Monday 9 AM - 10 AM in Room SW309

Please be prepared and consult the syllabus, lecture, and laboratory materials prior to coming to office hours so we can maximize our time. If you need to book an appointment to meet outside of these hours please contact me by e-mail. I will respond only to emails sent from UTSC or UTORONTO e-mail accounts that include the course code in the subject.

**Lab instructors**: Carina Carianopol, Aparna Haldar, Urja Naik, Marc Shenouda, and Eliana Vonapartis

**Course objectives**: BIOB12 is predominantly a laboratory skills course that aims to give you practical experience with common techniques from cell biology, molecular biology and biochemistry. In addition to technical training, the course will also cover common methods of data acquisition, analysis, and scientific writing. The lectures are designed to prepare you for the laboratory session that occur that week by discussing both the practical considerations and conceptual features of the experiments.

The techniques and skills that you learn in BIOB12 will prepare you for upper level courses in biochemistry, genetics, microbiology, and molecular biology. I also hope that the lab experience may encourage you to seek other lab work outside of your courses and perhaps lead to further scientific training.

**Learning outcomes**: Through the lectures and laboratories you will:

1. Gain practical experience with common techniques used in cell biology, molecular biology, microbiology, and biochemistry.
2. Learn how to prepare lab reagents, isolate and manipulate DNA, manipulate microorganisms, and perform microscopy.
3. Think like a scientist and design experiments with consideration given to proper controls.
4. Collect and analyze scientific data.

5. Evaluate your results and synthesize your findings and those of others to form conclusions.
6. Effectively communicate your findings to others.

The techniques you learn will form the foundation of your training in biochemistry, microbiology, and molecular biology and will be useful for careers in academic, industrial, government, and clinical laboratories. Regardless of whether you pursue a career in science or not, the understanding of how science is performed and communicated will prepare you to understand scientific reports for the rest of your life. This will allow you to critically analyze the scientific findings that we often encounter in the media and to make informed decisions about how to act on those findings in your real life. In order to engage in such thinking, I encourage each of you to actively participate in class by asking questions and entering into scientific discussion with myself, your TA, and each other.

**Textbook & course materials:** The course has no official textbook and instead draws on several sources. If you would like to find additional information about many of the experimental techniques used in the lab you could consult with Cell and Molecular Biology: Concepts and Experiments by Gerald Karp (Wiley).

**Laboratory information:** The methods and protocols required for each lab session and other information about the course will be distributed as PDF files on Quercus well in advance of each session. These pdfs should be downloaded, printed, and read in advance of each lab. This will allow you to fill in an appropriate Introduction and Protocol section in your lab notebooks prior to the start of each lab. Your TA will initial your lab notebook at the start of the session to ensure you are properly prepared. Below you will find details on the topics covered during each lecture and lab.

## Times and Locations:

**Lectures:** Mondays, 9-10 AM, SW309

I will present all required material prior to each lab session, however the topics listed below may be altered as needed depending on class progress and learning needs.

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|---|---|---|
| Lecture 1: | Monday, Jan 6th | – Introduction; making solutions and adjusting pH, pipettes |
| Lecture 2: | Monday, Jan 13th | – Spectrophotometry & protein assays; media preparation |
| Lecture 3: | Monday, Jan 20th | – Microbiology: bacterial growth & quantification |
| Lecture 4: | Monday, Jan 27th | – Molecular Biology: plasmid manipulations |
| Lecture 5: | Monday, Feb 3rd | – Restriction digestion of DNA & gel electrophoresis |
| Lecture 6: | Monday, Feb 10th | – Restriction mapping & ligation |

**Reading Week**

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|---|---|---|
| Lecture 7: | Monday, Feb 24th | – Gene regulation & colorimetric assays |
| Lecture 8: | Monday, March 3rd | – Scientific writing; cloning; enzymatics |

Lecture 9: Monday, March 10th – Biochemistry techniques; SDS-PAGE electrophoresis
Lecture 10: Monday, March 17th – Protein biochemistry; cell culture and light microscopy
Lecture 11: Monday, March 24th – Immunostaining & advanced microscopy
Lecture 12: Monday, March 30th – Genomics; transgenics; final exam expectations

**Labs:** There are 6 practical sections for this course. Regardless of which practical group you are registered with, **you will have 6 hours of lab per week**.

**<u>Exception:</u> Weeks 1 & 12 each have only one lab session (3 hours).**

The timings, locations and names of TAs directing each section are listed below.

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|---|---|---|---|---|
| Practical 0001: | Monday and Wednesday | 10AM – 1 PM | – SW 133 | TA = Carina |
| Practical 0002: | Monday and Wednesday | 10AM – 1 PM | – SW 135 | TA = Aparna |
| Practical 0003: | Monday and Wednesday | 2-5 PM | – SW 133 | TA = Carina |
| Practical 0004: | Monday and Wednesday | 2-5 PM | – SW 135 | TA = Eliana |
| Practical 0005: | Tuesday and Thursday | 8-11 AM | – SW 133 | TA = Marc |
| Practical 0006: | Tuesday and Thursday | 8-11 AM | – SW 135 | TA = Urja |

For laboratory sessions all students require:
- A lab coat and closed-toe shoes (no exceptions).
- Safety glasses/goggles.
- A permanent black marker.
- A bound (soft or hard cover) lab notebook for recording your work. This notebook should accompany you to each lab session. Your notes should be comprehensive, accurate, and legible.

To prepare for each lab you must:
- Read through the relevant PDF document outlining the lab procedure.
- Write an introductory paragraph in your lab notebook explaining the purpose of the experiment and hypothesis if applicable.
- Complete a protocol flow chart for the experiment in your lab notebook. This will act as your instructions throughout the experimental procedure and your TA will ensure these two items are complete prior to the start of work each lab.

As shown on the lab schedule there will be quizzes at the start of some sessions to ensure you are properly prepared for the experiment. These quizzes occur during the lab session and will be brief and designed to test your familiarity with the protocols for that session.

In all science labs there can be absolutely **no food, drink, or gum chewing** as they would be a violation of biosafety

## Laboratory Schedule:

| Week of: | Lab name and number: |
|---|---|
| Jan 6th | 1A. No Lab – Read Course Syllabus<br>1B. Chemistry problems and calculations – Complete problems in PDF #1 |
| Jan 13th | 2A. Spectrophotometry & protein assays – Read PDF #2 Quiz 1<br>2B. Analysis/discussion of 2A; bacterial media preparation – Read PDF #2 |
| Jan 20th | 3A. Sterile technique; bacterial growth – Read PDF #3 Quiz 2<br>3B. Analysis of bacterial growth data, pouring LB-AMP plates – Read PDF #3 |
| Jan 27th | 4A. Competent cells & bacterial transformation – Read PDF #4 Quiz 3<br>4B. Purification of plasmid DNA from bacteria – Read PDF #4 |
| Feb 3rd | 5A. Restriction digestion & gel electrophoresis of DNA – Read PDF #5 Quiz 4<br>5B. Restriction mapping theory; set-up digests of DNA – Read PDF #5/6 |
| Feb 10th | 6A. Electrophoresis of digests from 5B; mapping problems – Read PDF #6<br>6B. Data analysis; construct plasmid map based on results – Read PDF #6 |

## Reading Week

| | |
|---|---|
| Feb 24th | 7A. Lac operon experiments – Read PDF #7 Quiz 5<br>7B. Analysis of results; design group experiment – Read PDF #7 |
| March 3rd | 8A. Carry out your experiment – Read PDF #7<br>8B. Data analysis; writing a research paper – Read PDF #7<br>FINAL HOUR: In lab restriction mapping assignment |
| March 10th | 9A. Biochemistry: bacterial lysates – Read PDF #8 Quiz 6<br>9B. Biochemistry: SDS polyacrylamide gels – Read PDF #8<br>Gene regulation lab report DUE |
| March 17th | 10A. Analysis of SDS-PAGE and outline of presentations – Read PDF #8<br>10B. Drop-in TA availability for help with presentations or biochemistry module report |
| March 24th | 11A. In lab presentations on biochemistry module<br>11B. Microscopy: calibration and staining – Read PDF #9 Quiz 8 |
| March 30th | 12A. Microscopy: cell counting and fluorescent microscopy – Read PDF #9<br>12B. NO WET LAB; Lab notebooks and Biochemistry lab report collected |

Attendance in the laboratories is required and is what will determine your success in this class and allow you to effectively prepare for a future in science. During the lecture we will address details related to the laboratory experiments that week. Attendance in lecture is highly recommended to assist you in the laboratory component.

**Grading:**

**Midterm – 19%** Composed of multiple choice, short answer, and calculations. Will be based on material covered in labs and lectures.
**Date: TBA; outside of class**
If you miss the midterm you must contact me within 48 hours to schedule the makeup exam. The makeup will be offered the following week only.

**Final exam – 34%** Composed of multiple choice, short answer, calculations, and short essay questions. Will be based on material covered in labs and lectures. The final exam will be cumulative as it relates to overlapping concepts through the course.
**Date: TBA; during final exam period**

**Lab Quizzes – 14%** Seven quizzes each worth 2%. For quiz dates, please check the Laboratory Schedule. Each relates to the materials and protocol for that day's lab session and will occur in the lab at the start of the session.

**Lab performance – 10%**

- Preparation for lab; introduction and protocol 2%
- Technical performance 2%
- Laboratory log; summary; data analysis 4%
- Lab reports and presentations 2%
- Lab notebooks will be initialed each week and TAs will keep a record throughout term, the books will be handed in during session 12B for final grading.

**Lab assignments – 23%**

The content required for each assignment will be explained during the appropriate lecture and laboratory. For due dates, please check the Laboratory Schedule.

1. **Restriction mapping (5%)**
2. **Formal report on gene regulation (8.5 %)**
3. **Formal report on Biochemistry module (9.5 %)**

Late assignments will be penalized 10% per day. Late assignments will only be accepted up to 7 days past the original deadline, otherwise a mark of zero will be assigned.

**Important notes about the course:**

- Each week generally consists of 1 hour of lecture and 6 hours of labs. Week 1 has only a single lab during 1B. Week 12 has only a single lab during 12A, and your notebooks must be turned in during Lab 12B.
- Laboratory attendance and participation is mandatory. There are **NO makeup sessions** for missed labs. You will not be allowed to hand in any assignments relating to the missed lab or write the quiz. Missing more than three labs may lead to removal from the course.

## Course email policy:

**Dr. Mott:** adam.mott@utoronto.ca

- Your email message must originate from your UTSC or UTORONTO address and include the course code in the Subject line. Please include in the body of the message your full name. Otherwise the email will likely be deleted, along with spam messages.
- I will do my best to respond to email inquiries by email within 48 hours (in most instances) during the workweek (does not apply to weekends).
- If a question cannot be answered easily by email, I will send a reply to indicate to the student that they should attend my office hours instead.
- Specific questions regarding prerequisites or conflicts should be addressed to the course coordinator.

**TAs:** TA email addresses should be used to schedule appointments with TAs to ask specific questions about the course schedule and content, if required. TAs will follow the same policy as above with regards to email composition and timing.

## Accessibility Needs:

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services as soon as possible.

AccessAbility Services staff (located in Rm SW302, Science Wing) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (phone 416-287-7560 or email ability@utsc.utoronto.ca). The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

## Academic Integrity:

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppjun011995.pdf) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In papers and assignments:

1. Using someone else's ideas or words without appropriate acknowledgement;
2. Submitting your own work in more than one course without the permission of the instructor;
3. Making up sources or facts;
4. Obtaining or providing unauthorized assistance on any assignment.

On tests and exams:

1. Using or possessing unauthorized aids;
2. Looking at someone else's answers during an exam or test;
3. Misrepresenting your identity; and
4. When you knew or ought to have known you were doing it.

In academic work:

1. Falsifying institutional documents or grades;
2. Falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes; and
3. When you knew or ought to have known you were doing so.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If students have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, they are expected to seek out additional information on academic integrity from their instructors or from other institutional resources.

**Use of Turnitin**: Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site.