BIOB12H3 - Cell and Molecular Biology Laboratory
Winter 2021

Instructor:	Daman Bawa
Office:	Office hours will be virtual only – there will be no in-person office hours.
E-mail:	daman.bawa@utoronto.ca
Lab Coordinator:	Vania Branker
Lab Instructors:	Carina Carianopol, Marc Shenouda, Deeksha Shetty, Julianne LeBlanc, Yifan Wu, Aparna Haldar
Office Hours:	TBA **Office hours will be held online on Quercus.** If the hours need to be changed during the semester, you will be notified by an announcement online. **Please be prepared and consult lecture and laboratory materials prior to coming to the office hours.** Appointments outside these hours can be arranged by e-mail.
Lecture:	**Lectures will be pre-recorded and posted online (asynchronous).**
Textbook:	No textbook required.

The best way to reach me outside the office hours is by e-mail. Please use your UTORONTO e-mail account and include your course code in the subject. Emails sent from non-university accounts will not be answered. I generally answer emails by the end of the day on weekdays only. I will not answer emails on the weekend.

BIOB12 is a laboratory/lecture-based course. The emphasis is on the laboratory and lectures complement what is done in the laboratory each week. Assignments, other evaluations and the final exam will be based on background material required for the laboratories and questions that directly

relate to what was done in the laboratory as well as applied questions that require the background of the concepts presented in the laboratory.

Major laboratories will be in-person. The course is designed such that some of the labs will also be done virtually (see schedule). The laboratory class size is capped at 9 students per lab. The labs will run under strict social distancing and safety protocols, including use of PPE. We will provide you with a separate document outlining these steps and protocols.

Attendance in both in-person and virtual laboratories is required. Virtual laboratories will involve break-out groups, problem solving and theoretical discussions. During lecture, we will also go over specific details related to what you will do in the laboratory that week. **Lectures will be pre-recorded and posted on Quercus.**

Objectives of this course:

This laboratory course provides the introduction to major techniques in cell and molecular biology. Each module addresses techniques that are fundamental to carrying out laboratory based work in all types of laboratories, industry, government, clinical and research laboratories. It provides the foundation for upper year laboratory courses in biochemistry, microbiology and molecular biology. Students will be provided with hands-on experience in spectrophotometry, basic microbiology culturing techniques, DNA isolation, basic plasmid cloning, restriction endonuclease analysis, protein isolation and SDS-polyacrylamide gel analysis. Students over the course of the term will develop skills in data analysis and scientific analysis.

At the completion of the course students will have a laboratory skill set that will prepare them for upper year cell and molecular biology laboratory courses and the knowledge to understand molecular biology methodology presented in upper year courses. In addition, the students will have a basic set of skills that will be useful for future employment in laboratory-based careers. Moreover, the students will gain an appreciation and understanding in how to carry out work in an organized manner with attention to detail and understanding of quality control in experimentation. **Each student is encouraged to ask questions, and participate in class, in laboratories and in office hours. Often times a question can lead to an interesting discussion for all students.**

Lectures:

BIOB12 is a laboratory course. The material covered in each lecture will relate to the laboratory techniques carried out throughout the course. It will include discussion of methodologies, theory behind the methodology and applications for the particular techniques used. Lecture gives you a chance to also ask questions regarding the theory behind the labs you will be conducting. Lecture material will be posted on the course page. The lectures come from a number of sources including primary technique papers, reviews and technical manuals.

The emphasis of the course is the laboratory, the lectures will complement the laboratory experiments and theory.

Laboratories:

- **Attendance in labs is mandatory.** If you miss a lab you must provide appropriate documents / self-declaration to be excused from the lab and to be able to hand in any assignments related to that lab. These documents must be submitted to myself as well as Ms. Jennifer Campbell (jac.campbell@utoronto.ca). It will not be possible to carry out makeup labs. You will lose 4% of your grade for each missed lab. You will not be allowed to hand in any assignment that relates to the missed lab, so the penalty may exceed the 4% stated above**. Missing 3 or more labs regardless of the reasons will lead to the forfeit of ALL laboratory related grades (47%) and failure in the course. You will also be asked to leave the course.**

    - If you are seriously ill or diagnosed with COVID, you will need to contact me, Ms. Vania Branker and Ms. Jennifer Campbell. Additional information regarding contact tracing will be posted on course site.

- Labs run twice a week for a total of 6 hours of contact.

- Laboratory exercises will be posted on the course page a week prior to the date of the scheduled laboratory.

- **It is your responsibility** to come prepared each week to carry out your laboratory. The following preparation will be required:

    - To have completed **an introduction** to each lab (a paragraph) explaining the purpose

    - To have written out your own **flow chart** (this is what you should refer to when doing the lab). Your flowchart should be written such that you should not have to refer back to your lab notes during the lab.

    - When carrying out experiments you must take complete notes. Therefore, as you do the experiment you will "**log it".** This means writing down in detail what you did, what you observed, times of incubations. You will have **data analysis** (including standard curve construction) **summary / conclusion**, where you analyze the data, do any graphs etc. that are required. This information will be used to write your weekly laboratory assignments and lab reports. **Due to COVID protocols, we will not be collecting lab books at the end of the course; however, they will be required for proper experimental documentation and will help you with your assignments and the final exam.**

- Equipment in the lab is expensive. You are responsible for your equipment. Accidents can happen but most "accidents" are avoidable with proper preparation and attention to the task at hand.

Absolutely no food, drink, or gum chewing is permitted in the laboratory as it is a violation of biosafety protocols. Students will be required to leave the laboratory if they eat or drink in the laboratory.

For laboratory, the students will require:

1. Lab coat and closed toed shoes (no exceptions, you will be asked to leave the laboratory and you will lose any associated marks)
2. Safety glasses or a face shield which must remain on throughout the lab
3. A permanent black marker
4. A book for recording your work (your log book). This book can be hard or soft cover, or a binder. This is for your own use only
5. A bag to store your lab coat (a plastic bag is okay). You will bring your lab coat in a bag and wear it while going in the lab. The lab coat must be removed before you leave the lab and you must place it your lab coat bag. This bag must be different than your backpack.

Additional rules:

1. Use of cell phones and electronic equipment (tablets, laptops etc.) is prohibited in the laboratory.
2. No food or drink can be left outside of the laboratory.
3. If possible, try not to bring your winter coats, hats etc. into the laboratory.
4. You will be required to wear gloves, mask, safety glasses / face shield at all times while in the laboratory
5. You must complete UCheck (ucheck.utoronto.ca) before coming for in-person labs. We will verify this and students that have not completed this, will be asked to leave.
6. If you feel ill, have a cough, fever, cold or sneezing, please do not come to the lab.

Accessibility:

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 Access*Ability* Services Office as soon as possible. I will work with you and Access*Ability* Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC Access*Ability* Services staff (located in SW302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca.

Academic integrity/plagiarism:

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/policies/behaveac.htm) 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**: Using someone else's ideas or words without appropriate acknowledgement. Submitting your own work in more than one course without the permission of the instructor. Making up sources or facts. Obtaining or providing unauthorized assistance on any assignment.
>
> **On tests and exams**: Using or possessing unauthorized aids. Looking at someone else's answers during an exam or test. Misrepresenting your identity.
>
> **In academic work:** Falsifying institutional documents or grades. Falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (refer to: http://www.utoronto.ca/academicintegrity/resourcesforstudents.html).

Use of Turnitin.com:

"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".

Grade Breakdown:

- **Final exam:** **35%** (Take home exam: short answer, calculations, and short essay based on lecture and lab material). The final exam will be cumulative as it relates to overlapping concepts through the course. **Date: TBA; during final exam period**

- **Lab performance: 15%**
  - Preparation / flowchart for each week of labs: 8%
  - Technical performance and participation in labs: 7%
    - Lab participation grade is not an automatic grade. You must come prepared to the labs (virtual or in-person) and contribute constructively in a productive and collaborative manner.

- **Short weekly laboratory assignments**: 14%
  - These short assignments will be due after some of the laboratory sessions
  - Assignment specifics and grade percentage per assignment will change according to the labs and will be posted on Quercus.

- **Lab Reports and Assignments: 36%** (The content required for each assignment will be explained during the appropriate lecture and laboratory class.) – For due dates, please check the schedule on the next page

1. **Bioinformatics assignment (7.5%)**
2. **Formal report on gene regulation (10%)**
3. **Formal report on Biochemistry module (12 %)**
4. **Microscopy assignment (6.5%)**

Late assignments will be penalized 10% per day. Late assignments will only be accepted up to 5 days past the original deadline, otherwise a mark of zero will be assigned.

Lecture schedule:

More than one topic may be covered in one week and some of the other topics will be covered over more than one lectures

Topic 1: Overview of the course; scientific calculations/methodologies

Topic 2: Spectrophotometry/protein assay

Topic 3: Microorganisms used in molecular biology/growth, enumeration8

Topic 4: Recombinant DNA techniques: plasmid preparation, restriction digests, gel electrophoresis, restriction mapping, cloning, use of polymerases, ligases etc.

Topic 5: Gene Regulation, use of colorimetric assays

Topic 6: Biochemistry techniques: protein isolation, chromatography, dialysis, gel electrophoresis

Topic 7: Microscopy

Topic 8: Other molecular biology techniques

Lab schedule:

The labs will run according to the following schedule. If any changes need to be made due to unforeseen circumstances, it will be posted online. Online / Virtual labs are indicated as well.

A: designates the first lab of the week (Monday)
B: designates the second lab of the week (Wednesday)

Week of	Lab Week	Lab Exercise
Jan 11	1A	No lab
	1B	Chemistry problems / calculations, safety information (Online)
Jan 18	2A	Spectrophotometry and protein assays (In-person)
	2B	Preparation of bacterial media and plates, data analysis (Online)
Jan 25	3A	Growth and enumeration of bacteria (In-person)
	3B	Analysis of growth data (Online)
Feb 1	4A	Preparation of competent cells, transformation with plasmids (In-person)
	4B	Plasmid DNA preparation (In-person)
Feb 8	5A	Bioinformatics and theory of restriction mapping (Online)
	5B	Restriction enzyme analysis, comparison of restricted and native plasmid DNA/gel electrophoresis (In-person)
Feb 15		**Reading Week – No labs**
Feb 22	6A	Multiple restriction digests and run gel, analyze 5B data while gel is running. (In-person)
	6B	Data analysis of 5B and 6A and construction of restriction map of plasmid DNA (Online). **Bioinformatics assignment due.**

Modified from Brunt, 2011

Mar 1	7A	Lac operon Gene regulation experiments using wild type and mutant strains of *E.coli* (In-person)
	7B	Analyze 7A data, talk about presentations and formal lab report requirements (Online).
Mar 8	8A	Student presentations on gene regulation experiments and data discussion (Online).
	8B	Biochemistry module: Making a bacterial homogenate using wild type, mutant strains, recombinant strain of *E coli* (In-person).
Mar 15	9A	Data analysis from 8B, lab report and presentation requirements. **Gene regulation lab report due.** (Online)
	9B	No lab. TAs will hold 1-hour virtual office hours for help with Biochemistry module presentations and report. (Online)
Mar 22	10A	Student presentations for Biochemistry Module. (Online)
	10B	No lab
Mar 29	11A	Microscopy module. Virtual microscopy exercises. (Online)
	11B	No lab. **Biochemistry module lab report due**
April 6	12A	No lab.
	12B	No lab. **Microscopy assignment due.**