



## BIOB12H3 - Cell and Molecular Biology Laboratory Summer 2018

**Instructor:** Daman Bawa

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**Lab Instructors:** Urja Naik, Max Strauss, Marc Shenouda, Marsel Lino

**Office Hours:** TBA

**Office hours will be held in the library in room AC254.**

If the hours or the location 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.** Appointments outside these hours can be arranged by e-mail.

**Lecture:** Tuesday 9:00 -10:00 AM  
Room MW170

**Textbook:** Introduction to Biotechnology, 3<sup>rd</sup> Edition by Thieman and Palladino  
A Short Guide to Writing about Biology, 9<sup>th</sup> Edition by Pechenik

These books are available through bookstore as a package (ISBN:9780135258729) and I highly recommend that students purchase this package. Introduction to Biotechnology is also being used for the Advanced Molecular Biology Laboratory (BIOD21H3) and the writing guide will help with writing lab reports, not only in this course but other courses as well.

The best way to reach me outside the office hours is by e-mail. **Please use your UTSC or UTORONTO e-mail account** and include your course code in the subject. Emails sent from non-university accounts will not be answered.



**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, term test 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.

**Attendance in the laboratories is required. Each module in the laboratory will begin with a quiz.** The questions/answers to the quizzes will be covered in the posted laboratory exercises as well as within the lecture on the related material. During lecture, we will also go over specific details related to what you will do in the laboratory that week. Attendance in lecture is highly recommended to assist you in the laboratory component.

## **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 the one hour 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. Therefore, come with questions. Lecture material will be posted on the course page by the day of the lecture. Attendance will help to put the laboratory material in context and prepare for the quizzes. The lectures come from a number of sources including primary technique papers, reviews and technical manuals.

**Video recording of the lectures is not permitted.**

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

Modified from Brunt, 2011

## Laboratories:

- **Attendance in labs is mandatory.** If you miss a lab you must provide appropriate documents to be excused from the lab and to be able to hand in any assignments related to that lab. The labs are full therefore you will likely not be able to 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 or write the quiz, 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.**
- 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. Your TA will initial this book on a regular basis and collect your books for a final grade.
- To ensure you are prepared for the lab **there will also be quizzes on each lab topic** (see schedule) which will test whether you have adequately prepared for the lab. Attending the lectures will help you with the material.
- 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)
2. Safety glasses
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.

### **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 AccessAbility Services Office as soon as possible. I will work with you and AccessAbility Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC AccessAbility 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](mailto: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".

**If you wish to opt out of Turnitin you must send me an email and then submit an electronic copy to me and your lab instructor.**

## Grade Breakdown:

- **Midterm: 19%** (multiple choice, short answer, calculations, short essay based on lecture and lab material). **Date: TBA**
  - **You must contact me within 48 Hours of missing the midterm and provide me with an appropriate document (e.g. the UTSC medical certificate filled in by your physician) to be able to write the makeup exam**
- **Final exam: 34%** (multiple choice, 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**
- **Quizzes: 14%** (8 X 1.75%). Quizzes will be at the beginning of the practical.

<b>Quiz 1:</b>	May 15	Spectrophotometry and protein assays
<b>Quiz 2:</b>	May 22	Bacterial growth and enumeration
<b>Quiz 3:</b>	May 29	Competent cells/transformation/plasmid prep
<b>Quiz 4:</b>	June 5	Restriction enzyme analysis and gel electrophoresis
<b>Quiz 5:</b>	June 26	Gene regulation
<b>Quiz 6:</b>	July 10	Biochemistry module: bacterial homogenate
<b>Quiz 7:</b>	July 11	Biochemistry module: protein assay, SDS PAGE
<b>Quiz 8:</b>	July 25	Microscopy

- **Lab performance: 10%**
  - Preparation / flowchart 2%
  - Technical performance 2%
  - Laboratory log/ summary/data analysis 4%
  - Pass/fail in lab assignments/presentations etc. 2%
  - Lab notebooks will be initialed each week and TAs will keep a record throughout term, the books will be handed in during lab 12B in the week of July 30 for the final grade. If you have not kept up to date each week your marks will reflect your work.
  
- **Lab assignments: 23%** (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. 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.**

## 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, enumeration
- 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.

A: designates the first lab of the week (Tuesday)

B: designates the second lab of the week (Wednesday)

Week of	Lab Week	Lab Exercise
May 7	1A	No lab
	1B	Chemistry problems / calculations
May 14	2A	Spectrophotometry and protein assays ( <b>Quiz 1</b> )
	2B	Preparation of bacterial media and plates
May 21	3A	Growth and enumeration of bacteria ( <b>Quiz 2</b> )
	3B	Analysis of growth data, pouring of LB/AMP plates
May 28	4A	Preparation of competent cells, transformation with plasmids ( <b>Quiz 3</b> )
	4B	Plasmid DNA preparation
June 4	5A	Restriction enzyme analysis, comparison of restricted and native plasmid DNA/gel electrophoresis ( <b>Quiz 4</b> )
	5B	Set up of multiple restriction endonuclease enzyme analysis of plasmid DNA. Theory of restriction mapping.
June 11	6A	Agarose gel analysis of restriction endonuclease analysis in 5A. Theory of restriction mapping.
	6B	Data analysis of 5B and construction of restriction map of plasmid DNA

**June 18**

**Reading Week**

June 25	7A	Lac operon Gene regulation experiments using wild type and mutant strains of <i>E.coli</i> <b>(Quiz 5)</b>
	7B	Plan your experiment (dry lab: you will analyze results from 7A and plan your own experiment for next lab)
July 2	8A	Student experiments in gene regulation using the Lac operon
	8B	Analysis and discussion of results; discussion of requirements for lab reports. <b><i>Restriction mapping assignment in class (last hour)</i></b>
July 9	9A	Biochemistry module: Making a bacterial homogenate using wild type, mutant strains, recombinant strain of <i>E coli</i> <b>(Quiz 6)</b>
	9B	Biochemistry module: SDS polyacrylamide gel electrophoresis <b>(Quiz 7)</b> . <b><i>Gene regulation lab report is due</i></b>
July 16	10A	Data analysis of SDS-PAGE and outline of report requirements
	10B	TAs will be available for 1 hour for assistance on biochemistry module report / presentations
July 23	11A	Presentation on results from biochemistry module.
	11B	Microscopy module – Calibration and Staining <b>(Quiz 8)</b>
July 30	12A	Microscopy module – Cell counting and Fluorescent microscopy
	12B	<b><i>Lab report and lab books due in lab (1hr)</i></b>