BIOD21H
Molecular Biology Laboratory I
Host, Vectors and Cloning
Course outline Summer 2021

Instructor:

Professor Shelley Brunt
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PHILOSOPHY: **Molecular techniques have evolved rapidly over the last 20 years**, however, the **fundamental principles remain unchanged**. In an in-person laboratory this course would combine the opportunity to perform commonly used basic techniques that provide the foundation for all the newly developed techniques while also introducing the newer/more advanced techniques. However due to the following conditions:

1) **Reduced laboratory space due to construction**
2) **the need to reduce classrooms to 9 per room**

we unfortunately can not run any of the laboratories in person. Therefore, we will continue to highlight the principles behind techniques we will take the

original independent laboratory design and work with you to develop:

- substantial skills in bioinformatics,
- in-silico hypotheses
- the process of experimental design with related laboratory protocol implementation
- use of literature to design a research proposal including timelines and budgets

All above skills that are need in research fields, biopharmaceutical work, medicine and applicable to skills needed in many fields of work.

The goal of this course is to provide you with the tools and the background to go forward to:

- a technical position in a research, biotechnology or pharmaceutical laboratory
- into graduate school in any research field that requires the use of molecular biology techniques and concepts.
    - You will develop skills in data interpretation, experimental design and data presentation both oral and written,
    - Moreover, this course will provide the background necessary to understand the techniques used in primary research papers you

discuss in other fourth year courses. Molecular tools are a mainstay in all biology fields.

- You will in essence be doing a research project on a gene you choose to study. You will work in pairs on this gene in- silico and do joint oral presentations but write independent written assignments

Learning outcomes:

- **Compare and** contrast types of molecular biology techniques involved in gene identification, gene expression and ultimately protein function
- Evaluate sequencing data using a variety of bioinformatics tools
- Evaluate data sets and create appropriate hypothesis to explain experimental outcomes
- Apply molecular biology techniques and in-silico experimentation to a unique student driven project
- Evaluate data in the context of primary literature
- Demonstrate strong communication skills in oral presentation and written work
- Develop and Defend hypotheses

So how will we run this course given it is an independent student driven project not unlike a D level research project which involves significant computer/bioinformatic projects:

Lecture/laboratory- will be run synchronously on Wednesday from 1 to 5 pm- we will not always use the entire time and there will be occasions the lab period will be used to meet with student groups individually at set times- so unlike other laboratory classes you will have to be available for these four hours but the schedule will not be fixed on a weekly basis.

- Lecture will likely be used as an introduction to the laboratory period.
- We will let you know weekly what you have to do, but unlikely other labs there will be no weekly laboratory preparation in terms of Prelab or Postlab
- we will post when you have work that is due

- We will be doing significant problem solving in class and therefore you will need to come prepared having read the lecture notes provided prior to class
- BIOD21H is a laboratory course the emphasis is hypothesis development, how to design molecular biology laboratories and interpret data. The lecture material covered/material discussed/ problems solved will relate to these topics. On a weekly basis I will give you an update as to any changes in the schedule for the following week.

Communication

I encourage you to ask questions during lecture/classwork.

Please use E-mail (UTORONTO ACCOUNT ONLY) and put course code in title. I answer emails between 9 and 5 pm Monday through Friday.

Office hours:
I will hold these for 30 mins after lecture or the end of labs and stay longer if needed.

Equity Statement:

- The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. U of T does not condone discrimination or harassment against any persons or communities.

Accessibility:

AccessAbility statement

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. AccessAbility Services staff (located in Rm AA142, Arts and Administration Building) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations 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/plagiarism

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 in papers and assignments include 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 cheating includes using or possessing unauthorized aids, looking at someone else's answers during an exam or test, misrepresenting your identity, or falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes. http://www.utsc.utoronto.ca/vpdean/academic-integrity)

Examples of plagiarism

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. https://www.utsc.utoronto.ca/vpdean/faq-0

Use of Turnitin (plagiarism software)

All assignments and your final take home exam will be deposited to Turnitin via Quercus submission

"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".

Intellectual Property

Recording or photographing or video capture of any aspect of a university course - lecture, tutorial, seminar, lab, studio, practice session, field trip etc. – without prior approval of all involved and with written approval from the instructor is not permitted.

INSTRUCTOR PERMITS AUDIO RECORDINGS WITH NO DISTRIBUTION RIGHTS
Students may create audio-recordings of the lectures for their personal use. Recordings are intended to permit lecture content review so as to enhance understanding of the topics presented. Audio-recordings are not substitutes for attending class.

Students should note that since audio recordings are to be permitted, their voice may be recorded by others during the class. Please speak to the instructor if this is a concern for you.

In accordance with the Accessibility for Ontarians with Disabilities Act, 2005, persons who have special needs will be accommodated.
Students agree to the following terms when creating audio recordings of lectures:

- Recordings are not to be distributed without the permission of the instructor via the Internet, using social media such as Facebook, peer-to-peer file sharing such as One Drive or Dropbox, or other distribution channels.
- Recordings are not to be shared with other classmates unless they are to be used in collaborative assignments, or if the instructor permits for other reasons.

Grade breakdown and self declaration for work that cannot be completed:

- **For lecture and laboratory assignments that cannot be handed in on time:** late assignments will have a 10% per day deduction- no assignment will be accepted more than 5 days late. If you are ill you must submit biology specific self declaration within 24 hrs of the due date
- All assignments are submitted electronically to Quercus

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Self-declaration for illness:

- If you are self- declaring you must fill out the self-declaration form and submit it to myself and Jennifer Campbell within 24 hrs of the assignment due date. **See department web site** https://www.utsc.utoronto.ca/biosci/node/389

Full breakdown of class attendance and required documentation: Since lecture is integrated into the virtual lab—attendance at the full class is required

- You are allowed **two excused** absences
- **3 or more absences from class** (regardless of the reason) will result in a loss of all marks associated with term work lab, resulting in failure of the course.
- **One unexcused absence** will lead to the loss of all the grades related to in class work/performance
- **Two unexcused absences** leads to a 15% reduction in your grades accumulated in term work

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Attendance is mandatory. Starting May 12, we will rarely use the four hours but if we do you will be required to attend. Missing a class will be equivalent **to missing a midterm**. Therefore, the procedure for missed classes is as follows: you must submit a biology specific self-declaration with 24 hrs of a missed class or assignment. Please contact me ahead of time if you have another reason for needing to mis that lab.

Grade Breakdown

Final Exam applied comprehensive take home written exam 23%

Class performance 12%:

you need to come prepared to interact- it is not just an attendance grade- to do the major project you need to be fully engaged in active discussion

- will include presentations:
    - Gene of interest and general background May 26 and June 9

Assignments **65%**

1) **small assignments** related to developing the research proposal that will occur throughout the term:
    a. such as for example, reason for gene of interest choice, primer design, in silico PC.
    b. Due dates for these will be given throughout the term, they will be small but will be used to get your ready for the bioinformatics assignment and the research proposal- 5 assignments (percentages will vary with the assignment- see schedule)

15%

2) **introduction to Gene of interest, DNA sequence and protein sequence analysis** (June 28) 12%

3) **research proposal**): propose four major objectives on the study of your Drosophila gene of interest- see Quercus or class notes or specific details of what must be included in your objectives-based on an NSERC grant proposal

38%

preparation includes:

- annotated bibliography to prepared for both assignment 2 and 3 worth 5%- due June 16 (15 primary source papers minimum)
- concept map worth 3% due July 5
- oral presentation (July 14) on objectives and protocols (5%)
- final proposal (August 4^{h}) 25%
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*The content required content for each assignment will be explained during the appropriate class. **If you have an issue getting your assignments completed on time you should speak to Professor Brunt, preferably before it is due.**

Dates	Lecture Topics	Laboratory Exercises
May 12	• Brief outline of course • Outline requirements for picking gene of interest (GOI) • Discuss research proposal as major assignment • Bacterial growth • Introduction to Bioinformatics and PCR	**Wednesday** • Introduction to Bioinformatics • Primer design exercise • Restriction mapping
May19	• Continue bioinformatics and PCR • Vectors characteristics • DNA analysis • Restriction endonucleases	**Wednesday** • Do an example sequence for sequence analysis, including in silico PCR, restriction digest and other DNA analysis and protein analysis • You need to pick your sequence on interest no later than by next Wed and submit a brief outline of why you wish to study the gene

May26	• Basic cloning •	**Wednesday** • Briefly discuss your gene of interest (5 mins each pair) of Submit your brief outline by 10 pm tonight (2%) • During lab your will use soft ware to design the primers that will1) amplify the protein coding region 2) the promoter region
June 2	• Continue basic cloning • cDNA and genomic library theory and practice • Advanced PCR techniques	**Wednesday** • Hand in your primer design and in silico PCR results (4%). • 10 min presentations on your gene of interest • Discuss referencing and the use of referencing
June 9	• Continue Advanced PCR techniques	• **Formal presentation on your gene of Interest background and information on sequence -general information on the protein**
June 16	• DNA sequencing techniques	• **Annotated bibliography due** • **Discuss role of a concept map- and practice writing a Abstract and figure legend- submit by 10 pm tomorrow (3%)** • use of protein expression data bases, protein folding data bases on functional data bases- using example sequences- write summary on what can be obtained from these data bases

June 23	• Reading week	
June30	• Lecture to discuss unfinished basic concepts	• **Continue on protein expression data bases** • **bioinformatic due June 28th Concept map due July 5**
July 7	• Protein expression and function	• Tentatively, use given data to interpret RNA and expression data-
July 14	Overview of advanced molecular biology techniques and fluorescent microscopy	Discuss vectors for cloning utilized in your research proposal and hand in summary of cloning strategy by July 15 at 10 pm- 3%
July 21	• Oral presentations of research proposals 10 mins per pair, 5 mins questions	
July 28	• Finish any lecture material and go over final exam and answer any questions on final research proposal	• Data analysis questions on RNA and microscopy • Data analysis question in-class- hand in on July 23 -3%
August 4	• **No class- research proposal due tonight**	