



UNIVERSITY OF CALGARY  
FACULTY OF SCIENCE  
DEPARTMENT OF BIOLOGICAL SCIENCES  
COURSE OUTLINE

**1. Course: CMMB 451 – MOLECULAR ANALYSIS OR BIOLOGICAL SYSTEMS**

Lecture Sections: L01 TR 12:30-13:45 SA 109 WINTER 2018

Labs: B01/02 TR 2:00-6:50 SS 008

Course Coordinator: Dr. Gedamu

Instructor(s): Dr. L. Gedamu BI 350 220-5556 lgedamu@ucalgary.ca  
Dr. S.L. Wong BI 178A 220-5721 slwong@ucalgary.ca

Course website or Desire 2 Learn (D2L): CMMB 451 L01 - (Winter 2018) - Molecular Analysis of BioSystems  
Biological Sciences Department BI 186; (403) 220-3140; biosci@ucalgary.ca

- 2. PREREQUISITE(S):** CMMB 411  
See section 3.5.C in the Faculty of Science section of the online Calendar  
(<http://www.ucalgary.ca/pubs/calendar/current/sc-3-5.html>)

**ANTIREQUISITE(S):** Credit for both CMMB 451 and either Biochemistry 401 or 541 will not be allowed.

**NOTE:** Only open to Majors in Cellular, Molecular and Microbial Biology or to Majors in the Biological Sciences Honours program.

- 3. Grading:** The University policy on grading and related matters is described sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

<b>Laboratory work<sup>1</sup></b>	<b>10%</b>		
<b>Laboratory report<sup>2</sup></b>	<b>50%</b>		
<b>MT Exam</b>	<b>25%</b>	<b>In-Class</b>	<b>March 8, 2018</b>
<b>Final Exam</b>	<b>15%</b>		

<sup>1</sup>There will be 10 weeks of laboratory work.

<sup>2</sup>There will be 3 laboratory reports.

(There will be a final examination scheduled by the Registrar office.)

**Completion of the laboratory (3 lab reports) is essential in order to pass the course as a whole.**

Each piece of work (laboratory report, midterm test or final examination) submitted by the student will be assigned a percentage score. The student's average percentage score for the various components listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

Letter Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Min. Percent Required	95	90	85	80	75	70	65	60	55	53	50

- 4. Missed Components of Term Work:** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in Section 3.6. It is the student's responsibility to familiarize himself/herself with these regulations. See also Section E.6 of the University Calendar

- 5. Scheduled out-of-class activities:** Dates and times of approved class activities held outside of class hours. N/A

**REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY.**

6. **Course Materials:** N/A
7. **Policy:** Only non-programmable calculators are allowed. Students should also read the Calendar, [Section G](#), on Examinations.
8. **Writing across the curriculum statement:** In this course, the quality of the student's writing in laboratory reports will be a factor in the evaluation of those reports. See also [Section E.2](#) of the University Calendar.
9. **Human studies statement:** See also [Section E.5](#) of the University Calendar.

#### ETHICS IN THE BIOLOGICAL SCIENCES

Studies in the Biological Sciences involve the use of living and dead organisms. Students taking laboratory- and field-based courses in these disciplines can expect involvement with and experimentation on such materials. Students perform dissections on dead or preserved organisms in some courses. In particular courses, students experiment on living organisms, their tissues, cells, or molecules. Sometimes field work requires students to collect a variety of living materials by many methods, including humane trapping.

All work on humans and other animals conforms to the Helsinki Declaration and to the regulations of the Canadian Council on Animal Care. The Department strives for the highest ethical standards consistent with stewardship of the environment for organisms whose use is not governed by statutory authority. Individuals contemplating taking courses or majoring in one of the fields of study offered by the Department of Biological Sciences should ensure that they have fully considered these issues before enrolling. Students are advised to discuss any concern they might have with the Undergraduate Program Director of the Department.

#### 10. OTHER IMPORTANT INFORMATION FOR STUDENTS:

- (a) **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties.
- (b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- (c) **Student Accommodations:** Students needing an Accommodation because of a Disability or medical condition should contact Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities available at [http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities\\_0.pdf](http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf).  
  
Students needing an Accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to the Associate Head of Biological Sciences, Dr. H. Addy by email [addy@ucalgary.ca](mailto:addy@ucalgary.ca) or phone 403 220-3140.
- (d) **Safewalk:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- (e) **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information see also <http://www.ucalgary.ca/secretariat/privacy>.
- (f) **Student Union Information:** VP Academic Phone: 403 220-3911 Email: [suvpaca@ucalgary.ca](mailto:suvpaca@ucalgary.ca)  
SU Faculty Rep. Phone: 403 220-3913 Email: [science1@su.ucalgary.ca](mailto:science1@su.ucalgary.ca), [science2@su.ucalgary.ca](mailto:science2@su.ucalgary.ca) and [science3@su.ucalgary.ca](mailto:science3@su.ucalgary.ca);  
Student Ombuds Office: 403 220-6420 Email: [ombuds@ucalgary.ca](mailto:ombuds@ucalgary.ca); <http://ucalgary.ca/provost/students/ombuds>
- (g) **Internet and Electronic Device Information:** You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.
- (h) **U.S.R.I.:** At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses ([www.ucalgary.ca/usri](http://www.ucalgary.ca/usri)). Your responses make a difference - please participate in USRI Surveys.

## CMMB 451 - 2018 Tentative Lab Schedule

<u>Week</u>	<u>Date</u>	<u>Experiment</u>
1	Jan 09/11	Lab set-up
2	Jan 16/18	<b><u>Experiment #1: Southern blot analysis of a candidate gene from <i>Leishmania</i>.</u></b> Genomic DNA digestion/Probe preparation/Check genomic digestions on agarose gel/Isolate probe fragment on LMP gel/Prepare Southern blot solutions/Transfer DNA.
3	Jan 23/25	Probe purification/Prepare DIG probe/Quantitate/Prepare DIG solutions
4	Jan 30/feb 01	DIG hybridization/Washing/Developing/cDNA digestions for next week/Run out on agarose and transfer <b>(End of Experiment #1)</b>
5	Feb06/08	<b><u>Experiment #2: Restriction mapping of the cDNA candidate gene from <i>Leishmania</i>.</u></b> Southern blot pre-hybridization/Preparation of DIG probe/Probe quantification/Make solutions/Hybridize/Wash and expose. <b>End of Experiment #2</b> <b>LAB REPORT #1 DUE Feb 28/March 01 [20%]</b>
6	Feb 13/15	<b><u>Experiment #3: Subcloning and sequencing of candidate gene from <i>Leishmania</i>.</u></b> PCR/Vector and insert preparation (digestion, dephosphorylation, purification)/Preparation of competent cells/Ligation
7	Feb 20/22	Reading week
8	Feb 27/March 01	Alkali-lysis mini-prep of plasmid DNA/DNA quantification/Orientation check of sub-cloned insert via PCR and restriction digestion
9	March 06/08	DNA sequencing/Sequence analysis/Bioinformatics <b>End of Experiment #3</b> <b>LAB REPORT #2 DUE MARCH 20/22 [15%]</b>
10	March 13/15	<b><u>Experiment #4: Northern and Western blot analysis of a candidate gene/protein from <i>Leishmania</i>.</u></b> NORTHERN BLOT: Isolate total RNA from <i>Leishmania</i> parasites/Pour formaldehyde gels/Run and transfer RNA samples
11	March 20/22	Prehybridization/DIG probes/Hybridize/Wash/Expose/GST – fusion expression in <i>E. coli</i>
12	March 27/ 29	Purification of GST – fusion and Analysis on SDS - gel  <b>End of Experiment #4</b> <b>LAB REPORT #3 DUE APRIL 10/12 before NOON [15%]</b>
MT EXAM	(25%)	March 08, 2018 (In Class)
FINAL EXAM	(15%)	

### CMMB 451 course learning outcomes:

At the end of this course the student will be able to:

1. Use Molecular Biology techniques (DNA isolation, Cloning, Southern, Northern and Western blots) to address questions from diverse biological systems
2. Design approaches in addressing relevant biological questions
3. Analyse and interpret data including writing experimental outcomes in a manuscript form
4. Understand and evaluate journal articles
5. Explain the principles of chromatography (affinity, ion-exchange gel filtration) and SDS-PAGE, perform protein purification and separation, and evaluate protein purification scheme through analyzing the experimental data.

**CMMB 451**  
**MOLECULAR ANALYSES OF BIOLOGICAL SYSTEMS**

**WINTER 2018 – TENTATIVE LECTURE TOPICS**

**MOLECULAR BIOLOGY TECHNIQUES (Dr. Lashitew Gedamu)**

Cloning overview  
Enzymes in molecular biology  
Cloning vectors  
Isolation of nucleic acids (DNA/RNA)  
Analysis of nucleic acids/hybridization: Principles and applications  
Transfer of nucleic acids to solid supports/ Southern & Northern  
Labeling of Probes  
Gene libraries  
DNA sequence assembly and analysis  
Polymerase chain reaction (PCR): Principles and Applications  
Specialty nucleic acid techniques: Real Time PCR  
Micro Array  
Site-directed mutagenesis  
Gene manipulation by PCR  
Protein Expression Vectors

**PROTEIN ENGINEERING AND PURIFICATION (Dr. S.-L. Wong)**

Protein Purification strategies/protocol development  
Sample preparation  
Salt-in, salt-out and protein fractionation  
Protein quantification  
Principle of chromatography  
-Affinity chromatography  
-Ion exchange chromatography  
-Size exclusion chromatography  
Protein engineering of streptavidin for protein purification  
Summary and linking techniques  
Electrophoresis

NOTE: MT Exam will include lectures covered by Dr. L. Gedamu.  
Final Exam will include lectures covered by Dr. S.-L. Wong.