



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

1. Course: CMMB 451 – MOLECULAR ANALYSIS OF BIOLOGICAL SYSTEMS

Lecture Sections: L01 TR 12:30-13:45 BI 561 WINTER 2019

Labs: B01/02 TR 2:00-6:50 BI 132

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 2019) - 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:

Laboratory work¹	10%		
Laboratory report²	50%		
MT Exam	25%	In-Class	March 12, 2019
Final Exam	15%		

¹There will be 10 weeks of laboratory work.

²There 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 & LIVING ORGANISM STUDIES STATEMENTS:**

Students will not participate as subjects or researchers in human studies.

See also Section E.5 of the University Calendar.

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. Students are expected to be familiar with Section SC.4.1 of the University Calendar.

Reappraisal Of Grades:

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See Section I.3 of the University Calendar.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **15 days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a reassessment of the work if, and only if, the student has sufficient academic grounds. See sections I.1 and I.2 of the University Calendar
- b. **Final Exam:** The student shall submit the request to Enrolment Services. See Section I.3 of the University Calendar.

11. **Other Important Information For Students:**

- a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, Mental Health Services Website) and the Campus Mental Health Strategy website (Mental Health).
- b. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see www.ucalgary.ca/wellnesscentre or call 403-210-9355.
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at 403-220-2208 .

- d. **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. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. **These are only examples.**
- e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on assembly points.
- f. **Academic Accommodation Policy:** 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 [procedure-for-accommodations-for-students-with-disabilities.pdf](#). Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head, Undergraduate of the Department of Biological Sciences, Heather Addy by email addy@ucalgary.ca or phone 403 220-6979. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See Section E.4 of the University Calendar.
- g. **Safewalk:** Campus Security will escort individuals day or night (See the Campus Safewalk website). Call 403-220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- h. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). 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 Legal Services website.
- i. **Student Union Information:** VP Academic, Phone: 403-220-3911 Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: 403-220-3913 Email: sciencerep@su.ucalgary.ca. Student Ombudsman, Email: suvpaca@ucalgary.ca.
- j. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.
- k. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction (USRI) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

Department Approval _____ ORIGINAL SIGNED _____

Date _____

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CMMB 451 - 2019 Tentative Lab Schedule

<u>Week</u>	<u>Date</u>	<u>Experiment</u>
1	Jan 15/17	Lab set-up
2	Jan 22/24	<u>Experiment #1: Southern blot analysis of a candidate gene from <i>Leishmania</i>.</u> 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 29/31	Probe purification/Prepare DIG probe/Quantitate/Prepare DIG solutions
4	Feb 5/07	DIG hybridization/Washing/Developing/cDNA digestions for next week/Run out on agarose and transfer (End of Experiment #1)
5	Feb 12/14	<u>Experiment #2: Restriction mapping of the cDNA candidate gene from <i>Leishmania</i>.</u> Southern blot pre-hybridization/Preparation of DIG probe/Probe quantification/Make solutions/Hybridize/Wash and expose. End of Experiment #2 LAB REPORT #1 DUE March 5/7 [20%]
6	Feb 19/21	Reading week
7	Feb 26/28	<u>Experiment #3: Subcloning and sequencing of candidate gene from <i>Leishmania</i>.</u> PCR/Vector and insert preparation (digestion, dephosphorylation, purification)/Preparation of competent cells/Ligation
8	March 5/7	Alkali-lysis mini-prep of plasmid DNA/DNA quantification/Orientation check of sub-cloned insert via PCR and restriction digestion
9	March 12/14	DNA sequencing/Sequence analysis/Bioinformatics End of Experiment #3 LAB REPORT #2 DUE MARCH 19/21 [15%]
10	March 19/21	<u>Experiment #4: Northern and Western blot analysis of a candidate gene/protein from <i>Leishmania</i>.</u> NORTHERN BLOT: Isolate total RNA from <i>Leishmania</i> parasites/Pour formaldehyde gels/Run and transfer RNA samples
11	March 26/28	Prehybridization/DIG probes/Hybridize/Wash/Expose/GST – fusion expression in <i>E. coli</i>
12	April 2/4BI 132	Purification of GST – fusion and Analysis on SDS - gel End of Experiment #4 LAB REPORT #3 DUE APRIL 9/11 before NOON [15%]
MT EXAM	(25%)	March 12, 2019 (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 2019 – 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.