



CAMOSUN COLLEGE
School of Arts & Science
Department of Chemistry & Geoscience

CHEM-250-B01
Molecular Biotechnology
Winter 2021

COURSE OUTLINE

The course description is online @ <http://camosun.ca/learn/calendar/current/web/chem.html>

Ω Please note: This outline will not be kept indefinitely. It is recommended students keep this outline for their records, especially to assist in transfer credit to post-secondary institutions.

1. Instructor Information

(a) Instructor	David Stuss, M.Sc.
(b) Office hours	Weds 12:30 PM – 3:00 PM, Thurs 11:30 AM – 2:00 PM; <i>Office hours available online by appointment (in D2L Collaborate)</i>
(c) Location	F350A / Online (D2L Collaborate)
(d) Phone	(250) 370-3438 Alternative: _____
(e) E-mail	stussd@camosun.bc.ca

2. Intended Learning Outcomes

Upon completion of this course the student will be able to:

1. Compare and align their relevant fundamental knowledge of biochemistry and microbiology with the applications of molecular biotechnology platform in the medical, veterinary, agricultural and environmental sectors of the biotechnology industry.
2. Evaluate the basic significance and future potential of molecular biotechnologies in clinical and veterinary medicine, laboratory and field-based diagnostic testing, nutrition and agriculture, and environmental biotechnology.
3. Obtain the basic vocabulary of molecular biotechnology.
4. Compare and contrast competitive diagnostics or therapeutics.
5. Compare and contrast small-scale and large-scale gene expression systems.
6. Have hands-on experimental skills that are fundamental to the utilization of recombinant DNA technology.
7. Evaluate experimental design, design control experiments, and interpret data arising from basic recombinant DNA technologies.
8. Conduct fundamental, computer-based analyses of DNA and protein sequence data using databases and programs available via the internet.
9. Work in a level-1 biosafety laboratory.
10. Prepare, handle and store many types of biochemical reagents and buffers.
11. Properly maintain a laboratory notebook as a verifiable record of experimental work.
12. Compare the various forms of intellectual property protection relevant to the molecular biotechnology industry.
13. Outline the variety of potential career paths in molecular biotechnology industries.

3. Required Materials

(a)	Text	Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4 th Ed. Glick <i>et al.</i> (2010).
(b)	Safety Glasses	Bookstore has "UVEX" safety eyewear*
(c)	Lab coat	Bookstore has cloth coats available*
(d)	Scientific Calculator	Available in bookstore
(e)	Lab Notebook	Blue notebook (A91); Available in bookstore*

*Purchase of materials will be coordinated by the instructor this term. Instructions will be provided in class.

4. Course Content and Schedule

Credits	4 credits	Number of weeks	14
Workload / week	3 h lecture 3 h lab 6 h study	Pre- / Co-requisite	CHEM 255

Course Locations & Times

	Time	Location
Lecture	Wednesday 9:30 AM – 11:20 AM Friday 8:30 AM – 9:20 AM	Fisher Building, Room 360
Lab	Friday 9:30 AM – 12:20 PM	Fisher Building, Rooms 356 / 360

Lecture Outline

Chapter(s)	Lecture Topic	Chapter(s)	Lecture Topic
1	Introduction to Biotechnology	5	Bioinformatics
2	Review: DNA & Gene Structure, Function & Regulation	9-11	Diagnostics & Therapeutics
3	Recombinant DNA Technology	13-17	Microbial Biotechnology
6-7	Manipulating Gene Expression in Prokaryotes & Eukaryotes	18-20	Plant Biotechnology
8	Directed Mutagenesis & Protein Engineering	21	Transgenic Animals
4	DNA Synthesis, Amplification & Sequencing	22-23	Biotechnology & Society

Laboratory Outline

Some lab activities will be conducted over multiple lab periods.

I. Introduction to the Biotechnology Lab

- Orientation, laboratory safety, biosafety
- Keeping a research laboratory notebook
- Good micropipetting technique

II. 'Mini-prep' isolation of plasmid DNA (two methods)

- Rapid, small-scale isolation of plasmid DNA from *E. coli* using the Birnboim and Doly Alkaline Lysis Method.
- Rapid, small-scale isolation of plasmid DNA from *E. coli* using the QIAGEN mini-prep spin 'columns'.
- Agarose gel electrophoresis of purified plasmid DNA.
- DNA staining, UV-transillumination and photography.
- Analysis of plasmid DNA morphologies, and general analysis of AGE results.
- A_{260nm} -based DNA quantitation.

III. DNA Subcloning

- Restriction enzyme digestion of vector and target DNA.
- DNA ligation to form recombinant plasmids.
- DNA transformation of competent bacteria.
- Plating of bacterial cells on antibiotic-containing medium to select for isolated colonies of transformed cells.
- Use of colorimetric, enzymatic, insertional gene-inactivation assay to visually select recombinant plasmids (blue-white selection).

IV. Physical Mapping of DNA

- Single- and double-restriction enzyme digestion.
- Molecular weight/size determination of linear DNA fragments using agarose gel electrophoresis.
- Physical mapping of DNA fragments by data analysis.

V. DNA Amplification by the Polymerase Chain Reaction

- PCR analyses of cloned DNA fragments from recombinant clones.
- Optimization of PCR.
- Agarose gel electrophoresis analysis of amplified DNA to determine sizes of amplified, cloned DNA fragments.

VI. Bioinformatics: Computer Analyses of DNA and Protein Sequences

- Application of BLASTN, BLASTX, and similar software packages to analyze sequences by comparison to worldwide DNA and protein databases
- Analysis of open reading frames (ORF's) for consensus sequences for transcription and translation (dependent on available software)
- Comparative protein sequence analyses by CLUSTAL W & similar software.

5. Basis of Student Assessment (Weighting)

Lab Notebook	25%
Quizzes (10)*	20%
Assignments (5)	30%
Final Exam (comprehensive)	25%

**Quizzes will be in online format and will cover recent lecture & reading materials.*

6. Grading System

- Standard Grading System (GPA)
- Competency Based Grading System

7. Recommended Materials to Assist Students to Succeed Throughout the Course

Lecture, laboratory and supplementary learning materials will be posted online using D2L.

The Camosun Student Success Centre offers many support services including online Learning Skills Guides, Learning Circles, and one-one-one appointments. Students are encouraged to explore what is available here:

<http://camosun.ca/services/writing-centre/learning-skills.html>

<http://camosun.ca/services/help-centres/science-help.html>

8. College Supports, Services and Policies



Immediate, Urgent, or Emergency Support

If you or someone you know requires immediate, urgent, or emergency support (e.g. illness, injury, thoughts of suicide, sexual assault, etc.), **SEEK HELP**. Resource contacts @ <http://camosun.ca/about/mental-health/emergency.html> or <http://camosun.ca/services/sexual-violence/get-support.html#urgent>

College Services

Camosun offers a variety of health and academic support services, including counselling, dental, disability resource centre, help centre, learning skills, sexual violence support & education, library, and writing centre. For more information on each of these services, visit the **STUDENT SERVICES** link on the College website at <http://camosun.ca/>

College Policies

Camosun strives to provide clear, transparent, and easily accessible policies that exemplify the college's commitment to life-changing learning. It is the student's responsibility to become familiar with the content of College policies. Policies are available on the College website at <http://camosun.ca/about/policies/>. Education and academic policies include, but are not limited to, Academic Progress, Admission, Course Withdrawals, Standards for Awarding Credentials, Involuntary Health and Safety Leave of Absence, Prior Learning Assessment, Medical/Compassionate Withdrawal, Sexual Violence and Misconduct, Student Ancillary Fees, Student Appeals, Student Conduct, and Student Penalties and Fines.

A. GRADING SYSTEMS <http://camosun.ca/about/policies/index.html>

The following two grading systems are used at Camosun College:

1. Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D		1
0-49	F	Minimum level has not been achieved.	0

2. Competency Based Grading System (Non GPA)

This grading system is based on satisfactory acquisition of defined skills or successful completion of the course learning outcomes

Grade	Description
COM	The student has met the goals, criteria, or competencies established for this course, practicum or field placement.
DST	The student has met and exceeded, above and beyond expectation, the goals, criteria, or competencies established for this course, practicum or field placement.
NC	The student has not met the goals, criteria or competencies established for this course, practicum or field placement.

B. Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy at <http://camosun.ca/about/policies/index.html> for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	<i>Incomplete:</i> A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	<i>In progress:</i> A temporary grade assigned for courses that are designed to have an anticipated enrollment that extends beyond one term. No more than two IP grades will be assigned for the same course.
CW	<i>Compulsory Withdrawal:</i> A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.