



MBG*3350 Laboratory Methods in Molecular

Biology I

Fall 2018

Section(s): C01

Department of Molecular and Cellular Biology

Credit Weight: 0.75

Version 1.00 - August 24, 2018

1 Course Details

1.1 Calendar Description

This course involves laboratory based instruction in the basic methodologies of Molecular Biology. Students will have the opportunity to develop technical skills and practical knowledge sufficient to perform basic procedures independently, and to diagnose and analyze experimental results obtained with these techniques.

Pre-Requisite(s): BIOC*2580, MCB*2050

Restriction(s): Registration in BSC.BIOC (major or minor), BIOC:C , BTOX, BTOX:C, BPCH, BPCH:C, MICR(major or minor), MICR:C , MBG (major or minor), PBTC, PLSC (major or minor), TOX, TOX:C

1.2 Timetable

Laboratory:

Either Monday & Wednesday **or** Tuesday & Thursday 1:30pm – 5:20pm SSC 4108/4109

Lecture: Friday 1:30pm – 2:50pm MacDonald Stewart Hall (MACS) 209

1.3 Final Exam

There is no exam during the exam period, instead there are 2 exams scheduled during the semester.

2 Instructional Support

2.1 Instructor(s)

Dr. A. Nassuth

Email: anassuth@uoguelph.ca

Telephone: +1-519-824-4120 x58787

Office: SSC 4459

2.2 Instructional Support Team

Lab Co-ordinator: Amanda Van Der Vinne
Email: avander@uoguelph.ca
Telephone: +1-519-824-4120 x56189
Office: SSC 3519

2.3 Teaching Assistant(s)

Teaching Assistant: Erin Anderson
Email: eander01@uoguelph.ca

Teaching Assistant: Taylor Forrester
Email: tforrest@uoguelph.ca

Teaching Assistant: Laura Seidel
Email: seidell@uoguelph.ca

Teaching Assistant: Aditi Thakur
Email: thakura@uoguelph.ca

Teaching Assistant: Sandi Yen
Email: syen@uoguelph.ca

3 Learning Resources

3.1 Required Resource(s)

MBG*3350 Laboratory Manual (Lab Manual)

Purchased from SSC 2302 the first three days of the semester (Sept 6, 7 and 10; between 9:30-12 and 1- 3:30)

A bound Laboratory Notebook (Equipment)

Lab Coat (Equipment)

Indelible ("Sharpie") marker: ultra-fine point (Equipment)

ImageLab (PC and Mac compatible) and CFX Manager (PC compatible) (Software)

Software provided by the lab demonstrator for download on your computer

Courselink (Website)

<https://courselink.uoguelph.ca>

This course will make use of the University of Guelph's course website on D2L (via Courselink). Consequently, you are responsible for all information posted on the Courselink page for MBG*3350. Please check it regularly.

4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Explain the fundamental principles of practical molecular biology

2. Recognize and interpret experimental results
 3. Implement the theoretical principles and apply them in the execution of lab experiments
 4. Plan, design, monitor, troubleshoot and optimize experiments
 5. Use online tools to research a particular topic, and read primary research articles in molecular genetics
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5 Teaching and Learning Activities

5.1 Lecture

One lecture per week: Friday 1:30pm – 2:50pm MACS 209.

5.2 Laboratory

Two lab sessions per week: Monday/Wednesday or Tuesday/Thursday 1:30pm – 5:20pm

SCIE 4108/4109

5.3 Progress Reports

During the course of the semester you will be required to complete and hand in progress reports (see course schedule for due dates). These reports are meant to assist you in continually monitoring the outcomes of your experiments. The reports are designed to have you analyze your results and perform calculations so your formal lab reports are a compilation of results already obtained.

5.4 Literature Review

Before research is conducted one should have a good grasp of what is currently known for the topic/area of study. As such each student will be required to complete a literature review on His-tagged proteins and green fluorescent protein (GFP). Specific details will be presented in lab and on Courselink.

5.5 Formal Lab Report

You are required to write one formal lab report for this course, covering the cloning and analysis of GFP. Although the report will be written in the form of a scientific manuscript, you must remember that the audience and purpose of a formal report is somewhat different than that of a scientific paper. The aim is to show that you understand the principles and significance of the experiments you performed. Remember your data will have been marked already. What is of importance here is your ability to discuss and interpret cumulative data in a manner that demonstrates an understanding of what you have accomplished in the lab and the relevance of the experiments. Further information and guidelines for your lab report will be available in lab and on Courselink.

5.6 Assignments

One web-based assignment in the first week (to be completed during lab time) will have you use several web-based sequence analysis programs. Three other assignments will be due towards the end of the semester for the PCR optimization, qPCR GMO Analysis, and the qPCR Arabidopsis experiment. Instructions will be given in lab and posted to Courselink.

5.7 Tentative Lecture Topics and Schedule

Week 0

Lecture 1, Sept 7: Course introduction, DNA synthesis and *E. coli*

Week 1

Lecture 2, Sept 14: Plasmids isolation and analysis, cloning

Week 2

Lecture 3, Sept 21: Polymerase chain reaction (PCR) principles, primers

Week 3

Lecture 4, Sept 28: Cloning and expression vectors

Week 4

Lecture 5, Oct 5: Variations on PCR, including qPCR

Week 5

TERM EXAM #1 in class Oct 12, covering lectures & labs of weeks 0-4 (15%)

Combination of short answer, multiple choice and problem solving questions

Week 6

Lecture 6, Oct 19: Protein expression and purification

Week 7

Lecture 7, Oct 26: Protein quantification and analysis

Week 8

Lecture 8, Nov 2: Western, Northern and Southern blotting

Week 9

Lecture 9, Nov 9: qRT-PCR and nucleic acid isolation

Week 10

No lecture

Week 11

TERM EXAM # 2 in class Nov 23 covering lectures 1-10 & Labs 1-10 (15%)

Combination of short answer, multiple choice and problem solving questions

Week 12

No Lecture

5.8 Laboratory Schedule

Week 1 (Sept 10-14)

Day 1

Introduction to the lab

Lab safety; micropipetting

Molecular Biology Review

PubMed Search

Molecular Biology Web Tools

Day 2

Web exercise assignment (bring your computer!)

Week 2 (Sept 17-21)

Day 1

Plating Cultures

Inoculating Cultures

Day 2

Purification of Plasmid DNA

pET-28a Quantification

Restriction Enzyme Digestion of pET-28a

Week 3 (Sept 24-28)

Day 1

Agarose Gel Electrophoresis of DNA products

Polymerase Chain Reaction of *gfp*

Day 2

Analysis of PCR products

Purification of *gfp* PCR Product

gfp Quantification

Week 4 (Oct 1-5)

Day 1

Preparing pET28a and *gfp* for Ligation

Ligation of *gfp* into pET28a

Day 2

Transformation of Ligation Reactions into *E. coli* DH5α

PCR Primer Design

Week 5 (Oct 8-12)

Day 1

Thanksgiving break

Day 2

qPCR – Isolation of DNA from a Soy sample

Week 6 (Oct 15-19)

Day 1

qPCR – GMO detection

PCR to determine presence of insert

Day 2

Isolation of transformed plasmid

Restriction Enzyme Digest and gel

Week 7 (Oct 22-26)

Day 1

Amplification of your *E. coli* gene

Day 2

His-GFP Purification Using Ni-NTA Column

Amplification of your *E. coli* gene (gel)

Week 8 (Oct 29 - Nov 2)

Day 1

Amplification of your *E. coli* gene (continue until successful)

Day 2

SDS-PAGE and Coomassie Stain

Week 9 (Nov 5-9)

Day 1

SDS-PAGE and Western Immunoblotting (Gel and transfer)

Day 2

SDS-PAGE and Western Immunoblotting (Ab detection)

Week 10 (Nov 12-16)

Day 1

qPCR – RNA Isolation from *Arabidopsis*

cDNA synthesis

Day 2

qPCR – *Arabidopsis* Gene Expression Assay

Week 11 &12 (Nov 19 – Nov 30)

Day 1 No Lab Scheduled

Day 2 No Lab Scheduled

5.9 Key Dates

Where two dates are listed: the first applies to sections 1 and 2, the second applies for sections 3 and 4.

Sept 12/13: Web exercise assignment

Sept 27: Literature Review

Oct 1: Progress Report #1

Oct 10: Progress Report #2

Oct 12: Term exam #1

Oct 22: Progress Report #3

Oct 29: qPCR GMO Assignment

Nov 2: 40th class day--Last day to drop the course

Nov 5: Progress Report #4

Nov 12: Progress Report #5

Nov 14: PCR Report

Nov 14/15: Lab Notebooks Due

Nov 22: Lab Report

Nov 23: Term exam #2

Nov 28: qPCR *Arabidopsis* Assignment

6 Assessments

6.1 Methods of Assessment

Assessment

Form of Assessment	Weight of Assessment (% of final)	Due Date of Assessment	Course Content /Activity	Learning Outcome (see above)
Web-based Assignment	3%	Sept 12/13	Lab weeks 1-11	3 and 5
Literature Review*	10%	Sept 27	Lab	1 and 5

			weeks 1-11	
Progress Reports (5)	20% (4% each)	Various (see key dates)	Lab weeks 1-9	2, 3 and 4
Lab Report*	10%	Nov 22	Lab weeks 1-9	1, 2, 3, 4 and 5
PCR Report*	4%	Nov 14	Lab weeks 4-11	1,2, 3 and 4
GMO Assign.*	4%	Oct 29	Lab week 10	1, 2, 3, 4 and 5
<i>Arabidopsis</i> Assign.*	4%	Nov 28	Lab week 11	1, 2, 3, 4 and 5
Lab Performance	15%	Sept 7 - Nov 15	Lab weeks 2-11	2, 3 and 4
Term exam 1	15%	Oct 12	Lectures and Labs weeks 1-4	1,2, 3 and 4
Term exam 2	15%	Nov 23	Lectures and Labs weeks 1-11	1, 2, 3 and 4

6.2 Note

****Assessments** must be typed, double-spaced, 12-point font. All assessments are due at 12pm (noon) on their noted due date.

You will receive information for the week 1 Web-based assignment in the lab.

Progress Reports are submitted on the required due date (12:00pm; noon) and are returned on the second lab day of the week. This is to provide you with immediate feedback as to whether your analysis, interpretation and conclusion of your experimental results are correct. **No Late Progress Reports will be accepted.**

* For all other **Assignments** and **Reports** (due at 12:00pm; noon)- Late assignments will be accepted without penalty only for medical or compassionate reasons with documentation. Late assignments without documentation will be penalized 10% per day up to 50%. A grade of zero is assigned after 5 days late.

The **lab performance** grade is determined by your performance in the lab. Of this, 10% is based

on your actual results (success of your experiments). The other 5% is based on your day to day performance in the lab: punctuality, attendance, attitude, preparedness, independence etc.

Term exam 1 and 2 will be held during regular lecture time; if you fail to write the exam 1 a grade of 0% will be assigned unless an acceptable cause such as sickness or family emergency is documented. In the situation where academic consideration is given the Term exam 2 will be adjusted to 30%. For missed Term exam 2 an Incomplete grade will be submitted with a recommendation of 0% unless academic consideration is granted for a deferred exam.

7 Course Statements

7.1 You must come to lab prepared and ready to start working by 1:30

It is disrespectful to arrive late as this interrupts the TA, your partner and your fellow classmates. Additionally you will miss out on specific announcements for the day that the TA is not obligated to repeat. If you miss specific safety announcements you may be asked to leave. During the course of the lab there may be times where you can get a coffee as you have a gel running. Feel free to do so, however, if any announcements or discussions take place during your absence you will be responsible for obtaining the information from a fellow classmate.

7.2 Lab Attendance is mandatory

This is a lab based course where the majority of your final grade is assigned based on the laboratory component rather than the lecture component of the course. The nature of the lab exercises also build on one another. As such there is no opportunity for make-up labs. Lab absence is only acceptable for medical or compassionate reasons.

7.3 You must keep a lab notebook

Before coming to lab you must record in your lab notebook: What are you doing in lab today?

What are the expected results? You must have completed all calculations that are required to carry out the experiments.

Additionally you should record the variables of the experiment (reaction conditions), insert the actual results you obtained, in table format or gel image (labelled) and a statement of whether or not the experiment was successful. Your lab notebook will be graded for the PCR assignment.

7.4 All Assignments Have to be Completed

ALL lab assignments are an important part of the course. Missing two or more assignments will lead to an "incomplete" at the end of the semester.

7.5 Grading

All assignments are due at 12:00pm (noon).

Students who wish to have their assignments re-graded must submit them to the Lab Demonstrator within 5 class days of their return. The entire assignment will be re-graded so the mark may go up, down or remain unchanged.

7.6 Turnitin

In this course, your instructor will be using Turnitin, integrated with the CourseLink Dropbox tool, to detect possible plagiarism, unauthorized collaboration or copying as part of the ongoing efforts to maintain academic integrity at the University of Guelph.

All submitted assignments will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the Usage Policy posted on the Turnitin.com site.

A major benefit of using Turnitin is that students will be able to educate and empower themselves in preventing academic misconduct. In this course, you may screen your own assignments through Turnitin as many times as you wish before the due date. You will be able to see and print reports that show you exactly where you have improperly referenced the outside sources and materials in your assignment.

8 Department of Molecular and Cellular Biology

Statements

8.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. [B.Sc. Academic Advising](#) or [Program Counsellors](#)

8.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the [Learning Commons](#) including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist.
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: [Chemistry & Physics Help](#) and [Math & Stats Help](#)

8.3 Wellness

If you are struggling with personal or health issues:

- [Counselling Services](#) offers individualized appointments to help students work through personal struggles that may be impacting their academic performance.
- [Student Health Services](#) is located on campus and is available to provide medical attention.
- For support related to stress and anxiety, besides Health Services and Counselling

Services, Kathy Somers runs training workshops and one-on-one sessions related to [stress management and high performance situations](#).

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The regulations and procedures for [Academic Consideration](#) are detailed in the Undergraduate Calendar.

9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for [Dropping Courses](#) are available in the Undergraduate Calendar.

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance, and not later than the 40th Class Day.

More information: www.uoguelph.ca/sas

9.6 Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as

possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The [Academic Misconduct Policy](#) is detailed in the Undergraduate Calendar.

9.7 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.
