MBG*3350 Laboratory Methods in Molecular Biology

Summer 2021
Section(s): C01

Department of Molecular and Cellular Biology
Credit Weight: 0.75
Version 1.00 - May 07, 2021

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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-Requisites:	BIOC*2580, MCB*2050
Restrictions:	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 Course Description

This course offers laboratory-based instruction in the most important methods and techniques used in modern Molecular Biology, including the preparation and analysis of DNA, RNA, and protein; the use of cloning and expression vectors; and the theory and applications of the polymerase chain reaction (PCR).

The laboratory sessions are accompanied by classroom-based instruction.

Students will develop technical skills and practical knowledge sufficient to perform these procedures safely and independently, to analyze the experimental results obtained, and to trouble-shoot and solve laboratory problems.

1.3 Timetable

- Laboratory: Labs begin June 1st/2nd see 'Activities' for a complete schedule

Section 101: Tuesday 1:30 p.m. – 5:20 PM, SSC 4108

Section 102:Tuesday 1:30 p.m. – 5:20 PM, SSC 4109

Section 103: Wednesday 1:30 p.m. – 5:20 PM, SSC 4108

- Lecture: Tuesday -1st lecture on May 25th; see 'Activities' for a complete schedule

  11:30 AM – 12:50 PM
  ALEX 100

Details may change in response to the ever evolving global pandemic. Updates and details will be posted on Courselink regularly or emailed to students prior to the beginning of the semester.

1.4 Final Exam

This course does not have a final exam scheduled during the exam period. However, if the lab schedule changes due to pandemic related delays we may have a take home exam.

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2 Instructional Support

2.1 Instructional Support Team

Instructor:	Joseph Colasanti
Email:	jcolasan@uoguelph.ca
Telephone:	+1-519-824-4120 x58052
Office:	SSC 4467
Office Hours:	Will be announced during lecture.
Lab Co-ordinator:	Elspeth Smith
Email:	elspeths@uoguelph.ca
Telephone:	519-825-4120 ex. 56583
Office:	SSC 3505
Office Hours:	Will hold virtual office hours regularly throughout the semester. Details will be announced in Lab and on Courselink.

3 Learning Resources

3.1 Required Resources

Lab Manual (Lab Manual)
MBG*3350 Laboratory Manual: To be posted on Courselink and printed.

N95 masks will be provided in Lab (Other)
Masks are required in all labs and lectures. We will provide each student with 10 masks (1 for each lab). Please wear your own disposable or cloth mask to the first lab and to lectures.

Laboratory Notebook (Other)
A bound Laboratory Notebook

Lab Coat (Equipment)

Indelible (“Sharpie”) marker: ultra-fine point (Equipment)

Computer Software (Software)
ImageLab (PC and Mac compatible) and CFX Manager (PC compatible): software provided by the lab demonstrator for download on your computer

Courselink (Website)
https://courselink.uoguelph.ca
This course will use D2L (via Courselink). You are responsible for all information posted on the Courselink page for MBG*3350. Please check it regularly.

3.2 Additional Resources

Library Guide to MBG*3350 (Website)
https://guides.lib.uoguelph.ca/MBG3350
Links to online resources (PubMed, protocols, etc.)

For information only.

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.
6. Identify skills gained in this course and describe how those skills can be applied in the workforce

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5 Teaching and Learning Activities

5.1 Course Format

- Lecture: One lecture per week meant to provide context and theory for skills covered in lab.
- Laboratory: One lab session per week. The lab work covers 3 separate projects which overlap at times.

  Project 1: Cloning and Isolation of GFP
  Project 2: Detection of Environmental *E. coli*
  Project 3: Gene Expression Analysis in Arabidopsis
- Online Modules: Some independent online work will be posted on Courselink to be completed according to the lab schedule. These 'modules' consist of videos and activities that complement the lab work.
- Assignments:

  Progress Reports: During the course of the semester you will be required to complete and hand in progress reports (see "Assessment" for due dates). These reports cover all of your lab work and incorporate the online module content as well. They are meant to assist you in monitoring the outcomes of your experiments. The reports are designed to have you analyze your results to assess your understanding of the concepts covered and so that your formal lab report is a compilation of results and work already analyzed.

  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 Environmental ***E. coli*** and how we use molecular tools to detect it. Specific details will be presented in lab and on Courselink.

- Formal Scientific Lab Report: You are required to write one formal lab report for this course, covering Project 2:Detection of Environmental *E. coli* only. Although the report will be written in the form of a scientific manuscript, you must remember that the purpose of a formal report and the audience for which it is written is somewhat different from that of a scientific paper. The aim is to show that you understand the principles and significance of the experiments you performed.

More Information regarding all of these components can be found on Courselink and in the Lab Manual.

5.2 Schedule of Everything!

Please note this schedule is current as of May 6th 2021 and reflects the current stay at home order in place in Ontario. This schedule may change due to pandemic related delays. Students will receive an email prior to the beginning of the semester will an updated schedule.

Week Of Semester	**Dates**	**Lecture**	**F2F Labs Tues. or Wed. (1 day/ week)**	**Online Material Thur. or Fri (Off lab day) Material posted on Courselink**	**Assignments**
	May. 13-14	N/A	No lab		
1	May. 17-21		No lab	Create Benchling Account	
2	May. 24-28 (holiday Mon. does	1.Intro, working with E.coli, review	No lab	Free Period	

	not fall on lab days)				
3	May 31-June 4	2. Plasmids, isolation and digestion	Lab week 1: Intro to lab Lab safety Micro pipetting Plating/Inoculating Purify plasmid Quant. pET28a	Benchling Restriction Digests (Need this for PR 1)	
4	June 7 - 11	3. PCR	Lab week 2: RE digest of pET28a GE of purified pET28a PCR of ***gfp***	BLASTn/p (Need this for PR 1)	**Literature Review** – Friday June 11 th 5:00pm (submit via drop box)
5	June 14 -18	4. DNA cloning	Lab 3: Purify ***gfp*** PCR ***Gfp*** quantification Digest pET28a + ***gfp*** Ligation	Benchling Primer Analysis (Need this info for PR 2 and Lab 4)	**Progress Report 1** – pET28a purification and Digestion- due 'in' lab, (submit electronically)
6	June 21 -25	5. qPCR/RT-qPCR	Lab 4: Transformation	Free Period	**Progress Report 2** – PCR analysis -

			Primer Design		due 'in' lab, (submit electronically)
7	June 28 – July 2	TERM EXAM 1	Lab 5: Screen plasmids with RE digest Gel Electrophoresis of digest	Free period	**Progress Report 3** – Transformation results/E.coli Primer designs - due 'in' lab, (submit electronically)
8	July 5 - 9	6. Recombinant Protein expression and purification	Lab 6: qPCR for gene each student designed primers for - E.coli detection	qPCR analysis (need for PR 5 and final lab report) Research Imidazole gradients for Lab 7	**Progress Report 4** – Transformant Screen - due 'in' lab, (submit electronically)
9	July 12 -16	7. Protein quant., SDS-PAGE	Lab 7: His-GFP purification	Free period	**Progress Report 5** – qPCR analysis- due 'in' lab, (submit electronically)
10	July 19 -23	8. Western, Northern, Southern	Lab 8: SDS-PAGE Coomassie stain	Free period	N/A – Use this time to work on your Lab report!

			Transfer		
11	July 26 – 30	9. Review	Lab: 9 Immuno detection	Free period	N/A – Use this time to work on your Lab report!
12	August 2 - 6	TERM TEST 2	Lab 10: qRT-PCR	Free period	**Progress Report 6** – His - Purification/SDS-PAGE, Coomassie and Western Results due 'in' lab, (submit electronically) Submit Lab Books for grading (physically submit at the end of your lab)
13	August 9 - 13	Last day of Classes Aug. 9th - No lecture	No labs	Exam period begins	**Progress Report 7** – qRT-PCR results due on your F2F lab day by 5:00 pm (submit electronically) **Final Lab Report** – Friday Aug. 13th

6 Assessments

6.1 Marking Schemes & Distributions

Please note these dates may change if their are pandemic related delays in the schedule. Students will be notified of any changes as soon as possible.

Assessment	Weight	Due Date	Learning Outcome
Literature Review Progress	10%	June 11th	1,5,6
Reports (7) 4.5% each	31.5%	'In' lab	2,3,4
Term Exam 1			
Term Exam 2	15%	June 29th	1,2,3,4,6
Final Lab Report	15%	August 3rd	1 - 4
Lab Performance	15%	August 13th (Take Home Exam)	1 - 6
	13.5%	Lab books submitted in lab	2 - 4

6.2 Assessment Details

- All late reports/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. Assignments must be typed, double-spaced, 12-point font.
- Progress Reports are submitted before labs and are returned by the end of that week. This is to provide you with immediate feedback as to whether your analysis, interpretation and conclusion of your experimental results are correct. The lab performance grade is determined by your performance in the lab. Of this,
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10% is based on your actual results (success of your experiments). The other 3.5% is based on your day to day performance in the lab: punctuality, attendance, attitude, preparedness, independence etc.

6.3 Exams #1 & #2

Exams #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 and documented cause such as illness or family emergency is documented. In the situation where academic consideration is given, Exam #2 will be adjusted to 30%. For missed Exam #2, an Incomplete grade will be submitted with a recommendation of 0% unless academic consideration is granted for a deferred exam.

6.4 Requirements for passing the course

Students must pass the Lecture component on its own AND the Laboratory component on its own to pass the course as a whole (i.e. students need to achieve an overall grade of at least 15/30 for the 2 exams and a minimum of 35/70 for the progress reports, lab performance and assignments). This means that a high laboratory mark cannot be used to secure a pass if the lecture component is failed or vice versa. Students cannot miss more than 4 lab days to receive a passing grade for the laboratory component. In cases where this standard is not achieved, the final grade assigned will either be the calculated grade or 47%, whichever is less.

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7 Course Statements

7.1 Covid Safety, Procedures and Policy

Please note that all dates and schedules are subject to change depending on the status of the pandemic in Ontario. Masks are mandatory in lectures and labs. Hand washing, social distancing and sanitization practices will be in place in all labs, full procedures will be sent out to students via email prior to the beginning of labs. **If you are feeling ill, have symptoms of Covid-19 or have been exposed to someone with a Covid-19 diagnosis do not come to lab or lecture.** Please reach out to Elspeth at elspeths@uoguelph.ca for a lab exemption. Data will be provided for you to complete the associated progress report. Don't hesitate to reach out if you have questions or concerns.

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

It is disrespectful to arrive late as this interrupts the TA 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 you 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.

7.3 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.

7.4 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.
- In addition, 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.

7.5 All Assignments have to be completed

ALL lab assignments are an important part of the course. You must analyze your data to fully grasp concepts taught.

7.6 Academic Misconduct

It is the nature of undergraduate labs to complete experiments with a partner. Your results should be discussed with your partner as this is expected in all scientific research. However, ALL assignments must be completed INDEPENDENTLY.

7.7 Grading

- All assignments are due at 12:00pm and are submitted electronically to Dropbox on Courselink.
- Students who wish to have their assignments re-graded must submit the request 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.

7.8 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 properly and 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. http://www.learningcommons.uoguelph.ca/
- 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: http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help and http://www.lib.uoguelph.ca/get-assistance/studying/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. https://www.uoguelph.ca/counselling/
- Student Health Services is located on campus and is available to provide medical attention. https://www.uoguelph.ca/studenthealthservices/clinic
- 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. http://www.selfregulationskills.ca/

8.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) http://www.e-laws.gov.on.ca/index.html. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information policies please see the Undergraduate Calendar. (https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml)

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 grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

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.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

9.6 Academic Integrity

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 encourages academic integrity. 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.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, 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 that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

9.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.
