Western Science

Department of Biology

MOLECULAR BIOLOGY LABORATORY
Biology 4583F
Course Outline

1. Course Information

Course Information
Molecular Biology Laboratory, Biology 4583F, Fall 2022

Biology 4583F is a laboratory course. The emphasis is on individual, hands-on laboratory experience and results. Four synchronous hours/week are devoted to this course (1 *online* lecture hour, 3 **in-person** lab hours)

Lab sections: Students have enrolled in Section 002 Monday afternoon (1:30–4:30 pm) or Section 004 Thursday afternoon (1:30–4:30 pm) lab section.
All laboratory sessions will be **in-person** at **B&GS 3065**.

Lecture content, in combination with online videos and readings, will provide theoretical and technical background information to empower the student to successfully complete laboratory experiments and assignments. Lectures will be synchronous, online (by Zoom), each Monday from 10:30–11:30 am prior to the corresponding lab component. All lectures will be recorded and posted to the OWL course site for future reference. Note: most live classes will involve graded activities, marked mostly for completion. When possible, asynchronous alternatives will be available on the OWL site, but active participation in all live sessions is highly encouraged.

List of Prerequisites
A minimum mark of 70% in each of Biology 3596A/B and 1.0 course from: Biology 3466A/B, Biology 3592A/B, Biology 3593A/B, Biology 3594A/B, Biology 3595A/B, Biology 3597A/B, Biology 3598A/B; and registration in year 4 of an Honours Specialization in Genetics or permission of the Genetics Undergraduate Coordinator.

Anti-requisite: The former Biology 4582.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Instructor: Dr. Daniel Jeffery (djeffer4@uwo.ca)
Laboratory Supervisor: Kim Loney (kgrant4@uwo.ca)
Teaching Assistants: Please see OWL site

Please use your Western (@uwo.ca) email addresses when contacting your instructors and include "Bio4583" in the subject title, otherwise, they may be identified as spam. You will be able to book virtual **office hours** (by Zoom) with Dr. Jeffery through the Calendly application. See the course OWL site for the link. Note: my office hours are more than just a chance for you to ask questions about content, consider these also as an opportunity for you to connect with me, get additional feedback on your work/marks (especially Activities), explore what you may want to do after you graduate, and find support.

3. Course Syllabus, Schedule, Delivery Mode

Course Description
Project-based inquiry focused on refining the laboratory skills of senior genetics students. Experimental approaches will include analysis of gene expression using modern tools and techniques.

Genetics is rapidly changing, inspiring advances in a broad number of fields. These developments have changed the way questions and solutions are approached in such diverse areas as agriculture, biotechnology, environmental studies, evolution, forensics, medicine, pharmaceuticals, reproductive biology, and immunology. **The goal of this course is to provide you with the essential molecular biology skills and experience needed to get started as a new member of any research lab in these fields**, and many more, in academia and beyond. Here, you'll get **hands-on experience** with modern molecular biology techniques, expanding on the techniques you learned in Biology 3596, and practice **reporting your results** and comparing them to the **scientific literature** in the same ways that you would in a research lab.

This is going to take a lot of **active participation** on your part, in and outside of class/lab time. Your **active engagement** will make up a significant part of your grade through Critical Reflections and Peer Review, as well as "Activities" that will be marked mostly for completion throughout the term. These will include discussions/debates (verbal or written) with peers, of potentially sensitive issues involving real-world problems/data related to molecular biology and genetics, so it essential that the class remains a welcoming, **open** and **respectful** environment for everyone, so that we can benefit from the full **diversity** of perspectives and voices in the class. This will be our shared responsibility.

Below, you'll find the major learning outcomes that we'll be building on in this course that I consider are the keys to preparing you for your first molecular biology research position (and are important for a multitude of other jobs in and outside of bioscience), and it is on these outcomes that I have based all of your assessments.

Learning outcomes
Upon successful completion of the course, you will be able to:

1. Independently perform molecular biology experiments using given protocols, while identifying and troubleshooting potential problems
2. Record experimental methods and results in a manner enabling reproducibility
3. Collaborate effectively and collegially with peers in the lab and provide constructive criticism to your peers
4. Explain how key molecular biology techniques work (including DNA methylation, gene expression/RNA, and CRISPR/Cas9 technologies) and draw conclusions from their results
5. Assess experimental results and conclusions by comparing to scientific literature
6. Clearly communicate molecular biology research findings—in written, oral or multimedia formats—to an academic audience, including original professional-quality scientific figures
7. Discuss and debate ethical issues related to scientific integrity, reproducibility, and the use of animal models in molecular biology

Key Dates:

Semester begins: Sept 8, 2022 (no lecture or labs this week)
First lecture for the course: Sept 12, 2022
First labs for the course: Sept 12 or 15, 2022 (depending on lab section)
Thanksgiving holiday: Oct 10, 2022 (no lecture or labs this week)
Fall Reading Week: Oct 31 – Nov 6, 2022 (no lecture or labs this week)
Last day to withdraw from the course without academic penalty: Nov 14, 2022
Last labs for the course: Nov 28 or Dec 1, 2022 (depending on lab section)
Last lecture for the course: Dec 5, 2022
Semester ends: Dec 8, 2022 (final submissions, no labs this week)
Exam period: Dec 10 – 22, 2022 (no exam for this course)

Bio 4583F Schedule Fall 2022

Lecture/Lab	Date	Description	Project		
Lecture 1	Sep 12	Introduction to Bio4583F; DNA isolation; Activity 1	1		
Lab 1	**Sep 12 / 15**	**BEGIN PROJECT 1: Isolate DNA from mouse liver/brain tissue, quantify & clean DNA**			
Lecture 2	Sep 19	DNA methylation detection; Activity 2			
Lab 2	**Sep 19 / 22**	**HpaII/MspI digestion of DNA** **Perform bisulfite treatment using EZ DNA Methylation Lightning Kit**			
Lecture 3	Sep 26	PCR theory; Activity 3			
Lab 3	**Sep 26 / 29**	**→ Critical Reflection 1 (3%) DUE** **Purify digests, PCR of Hnf1a on digested & Bis-treated DNA**			
Lecture 4	Oct 3	Isolation and sequencing of bisulphite gel band; Activity 4			
Lab 4	**Oct 3 / 6**	**Agarose gel of Hnf1a PCR products, Gel isolation of Bis-treated PCR band, send for sequencing**			
No lecture / labs	Oct 10	**Thanksgiving holiday on Monday – no lecture / labs**			
Lecture 5	Oct. 17	Introducing Project 2; RNA isolation; Activity 5		2	
Lab 5	**Oct 17 / 20**	**→ LAB ASSIGNMENT 1 (15%) DUE** **BEGIN PROJECT 2: Nucleic acid isolation & DNase treatment**			
Lecture 6	Oct 24	RNA quality, Reverse Transcription & semi-quantitative RT PCR; Activity 6			

Lab 6	**Oct 24 / 27**	**→ Peer Review (6%) DUE** **Quality check of RNA in agarose gel** **Reverse transcription & semi-quantitative PCR of Prdm2 gene.**
No lecture / labs	Oct 31–Nov 4	**Fall Reading Week – no lecture / labs**
Lecture 7	Nov 7	qPCR and Intro to Project 3: CRISPR in Yeast
Lab 7	**Nov 7 / 10**	**→ Peer Review Rebuttal (3%) DUE** **→ Choose Lab Assignment 3 format** **qPCR of Prdm2** **BEGIN PROJECT 3: Transformation of yeast with two CRISPR plasmids**
Lecture 8	Nov 14	PAGE sqPCR, TaqMan qPCR and Induction to Cas9; Activity 7
Lab 8	**Nov 14 / 17**	**→ Critical Reflection 2 (3%) DUE** **Polyacrylamide gel of semi-quantitative PCR of Prdm2, TaqMan qPCR of Stx12** **Galactose induction of Cas9**
Lecture 9	Nov 21	PCR isolation of a gene
Lab 9	**Nov 21 / 24**	**→ LAB ASSIGNMENT 2 (20%) DUE** **Genomic DNA Isolation from CRISPR mutated yeast** **PCR of Can1 gene**
Lecture 10	Nov 28	CAN1 sequencing; Activity 8
Lab 10	**Nov 28 / Dec 1**	**Agarose gel of Can1 PCR, isolate DNA from agarose** **Send DNA for sequencing**
Lecture 11	Dec 5	Q&A, open discussion (CR 3 in class?)
No labs	**Dec 5 / 8**	**→ Critical Reflection 3 (3%) DUE** **→ Submit online lab books (10%)** No labs this week
Exam period	**Dec 12-15**	**→ LAB ASSIGNMENT 3 (25%) DUE DEC 14** **Live presentations of Lab Report 3 (where applicable) Dec 14, 1:30-4:30pm**
GOOD LUCK IN EXAMS AND HAVE A WONDERFUL HOLIDAY BREAK!		

Contingency plan for in-person labs pivoting to 100% online learning

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). Virtual versions of all labs will be made available. The grading scheme will **not** change. Any remaining assessments will also be conducted online.

4. Course Materials

Lab Attire/Safety

All students while in the lab are required to wear appropriate WHMIS lab attire. This includes lab coat, safety glasses, long pants, socks, closed-toed shoes and gloves (as necessary). Long hair must be tied back. Those with prescription glasses are required to wear prescription safety glasses or goggles to fit over top of glasses. Students inappropriately dressed will be denied access to the lab and will not be rescheduled to attend another lab section.

You are required to supply your own lab coat, safety goggles and hard-bound lab notebook. Lecture notes, laboratory outlines, protocols and associated readings will all be posted weekly on the OWL course website. These postings will be attached into your purchased hard-bound lab notebook prior to your attendance to a lab.

Communications

All course material (Zoom links, lecture slides/recordings, assignments, lab protocols, report guidelines and reading materials, etc.) will be available on the OWL course website: http://owl.uwo.ca

Students are responsible for checking the course OWL site on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. If you need assistance with the course OWL site, you can seek support on the OWL Help page. Alternatively, you can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Technical Requirements

 Stable internet connection

 Laptop or computer

 Working microphone

 Webcam (optional)

Google Chrome or **Mozilla Firefox** are the preferred browsers to optimally use OWL. Update your browsers frequently. Students interested in evaluating their internet speed, please click **here.**

Access to Zoom via OWL. For technical assistance with Zoom, please contact the Western Technology Services Helpdesk at https://wts.uwo.ca/helpdesk/

Session recordings (audio and/or video): Synchronous sessions in this course, including your participation (but excluding breakout rooms), will be recorded and will be available to students in the course for viewing remotely after each session. As per university policies, **do not share any course or student materials or videos** without the explicit written permission from me and any students involved in their production. For questions or concerns about recording and use of videos in which you appear, please contact me. Note, video will be encouraged during non-recorded breakout sessions and presentations but will not be mandatory.

5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Assessment	Due Date	Weight
Activities (in-class/asynchronous)	Throughout (best 6 of 8)	12%
Critical Reflections (x3)	1) Sept 26/29, 11:55pm 2) Nov 14/17, 11:55pm 3) Dec 5/8, 11:55pm	3% 3% 3%
Lab Assignments (x3)	1) Epigenetics—Oct 17/20, 11:55pm 2) Gene expression—Nov 21/24, 11:55pm	15% 20%

	3) CRISPR—Dec 5/8, 11:55pm	25%
Peer Review	Oct 24/27, 11:55pm	6%
Peer Review Rebuttal	Nov 7/10, 11:55pm	3%
Lab Book	Dec 5/8, 11:55pm	10%

Note: there will be no midterm tests or final exam.
Visit the OWL site for details associated with each assessment.

Essential course requirements
Course-specific conditions that are required to pass the course are:

1. Minimum 70% attendance of all laboratory sessions
2. Submission of all three Lab Reports and Lab Book

Failure to meet these conditions* will result in a maximum achievable grade of 45% for the course.

*Note that students will not be penalized for failing to meet a requirement due to circumstances beyond their control. For example, if you miss handing in a lab report or miss too many labs due to illness or other serious circumstances (see Student Absences below), you will be given an opportunity to complete the requirements after you recover. However, for logistical reasons, it may be necessary for that opportunity to be with the next offering of the course, in which case you will receive a grade of Incomplete (INC) until you complete the course requirements.

Scheduling Conflicts: Assessment due dates are not negotiable. They have been structured to distribute your workload over the term and have been timed to coordinate with the course activities and to allow timely formative feedback applicable for later assessments. Valid scheduling conflicts must be brought to my attention at least two weeks prior so that alternative arrangements can be made.

Late Submissions: All assessments can be submitted up to 3 days (72h) after the due date but will have 10% deducted per day (i.e., -10% if 1-24h late, -20% if 25-48h late, -30% if 49-72h late). Thereafter, they will be considered "Not Submitted" and receive a grade of zero. However, I recognize that fluke problems may happen, so **you will be allowed to hand in up to two assessments up to 24 hours late without penalty. No explanation or documentation will be required**.

Remarking of Assignments: Re-marking requests can only be submitted to me (Daniel Jeffery). The TAs are strictly forbidden to accept re-marking requests, so please do not ask them to do so. Any graded work may be submitted by email (djeffer4@uwo.ca) for re-marking within 5 business days of the work being returned (made available) to the student. The request must be accompanied by **a written rationale** providing valid, empirical reasons for the request for reappraisal. Be aware that we are strictly forbidden from considering your personal situation when grading; we can only grade based on the merit of the work itself. **Note: re-marking can result in the mark being raised, confirmed, or lowered.**

Grading errors: Fixing a clear grading error (e.g., grader calculation error) does not count as "re-marking". If you notice a clear error in your mark, please bring it my attention or the attention of your TA, as soon as possible. Similarly, if you think there might be an error but you're not sure, or you are not sure why you received the mark you received, please don't hesitate to bring it up to myself or your TA for clarification.

6. Student Absences

If you are unable to meet a course requirement due to illness or other serious circumstances—even after taking into account the above Late Submissions policy for assessments—please follow the procedures below.

For any labs or assessments missed due to illness or other serious circumstances:
Please contact me by email (djeffer4@uwo.ca) to explain the situation, **as soon as possible** within 5 days of the lab or due date. Note, this information is meant to help me provide better support by keeping me informed about issues that students may be facing, you are not obligated to go into detail or provide information you're uncomfortable sharing. **A short, general, description is fine.**

For assessments worth less than 10% of the overall course grade:
Please inform me as described above. Usually, documentation will not be required (medical or otherwise). After reviewing your email, I will then shift the weight of the assignment to Assignment 3.

For assessments worth 10% or more of the overall course grade:
Please inform me as described above. In addition, according to university policy, academic considerations for work totalling 10% or more of the final course grade can be granted only by the student's Faculty of Registration (typically your academic counsellors). Therefore, you must also provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

The Student Medical Certificate is available at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Upon approval from the Academic Counselling Office, an extension of 7 days after you recover, and/or a make-up assessment (if necessary), will be provided.

For missed labs:
Please inform me as described above. Accommodations will be made with the lab coordinator and your lab TA to ensure you can participate in subsequent labs, if applicable. Virtual labs and/or data may be provided as a make-up option or to enable you to complete the associated Lab Report.
*If the missed labs impinge on your ability to complete the associated Lab Report by the deadline, you will need to follow the guidelines above for assessments worth 10% or more. An extension of up to 7 days for the associated Lab Report may be provided, if deemed necessary.

For ≥4 missed labs:
Please follow the guidelines for assessments worth 10% or more. If approved, you will be given the opportunity to complete the labs and associated Lab Report(s) with the next offering of the course, in which case you will receive a grade of Incomplete (INC) until completed.

7. Accommodation and Accessibility

Religious Accommodation
When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

https://multiculturalcalendar.com/ecal/index.php?s=c-univwo

Accommodation Policies
Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf

Please note that there will be no timed quizzes, tests, or exams for this course.

8. Academic Policies

The website for Registrarial Services is http://www.registrar.uwo.ca

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

9. Support Services

Please contact me by email (djeffer4@uwo.ca) if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. Note, all synchronous Zoom sessions will be recorded for later viewing and all lecture slides will be posted to OWL as early as possible prior to synchronous sessions. You may also wish to contact Accessible Education at http://academicsupport.uwo.ca/accessible_education/index.html if you have any questions regarding accommodations.

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: https://www.uwo.ca/sci/counselling/

Students who are in emotional/mental distress should refer to Mental Health@Western (https://uwo.ca/health/) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html

To connect with a case manager or set up an appointment, please contact support@uwo.ca

Learning-skills counsellors at the Student Development Centre (https://learning.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/

Additional student-run support services are offered by the USC https://westernusc.ca/services/

This course is supported by the Science Student Donation Fund. If you are a BSc or BMSc student registered in the Faculty of Science or Schulich School of Medicine and Dentistry, you pay the Science Student Donation Fee. This fee contributes to the Science Student Donation Fund, which is administered by the Science Students' Council (SSC). One or more grants from the Fund have allowed for the purchase of equipment integral to teaching this course. You may opt out of the Fee by the end of September of each academic year by completing the online form linked from the Faculty of Science's Academic Counselling site. For further information on the process of awarding grants from the Fund or how these grants have benefitted undergraduate education in this course, consult the Chair of the Department or email the Science Students' Council at ssc@uwo.ca

A few examples of equipment used in Bio 4583F that has been purchased using SSD funds include: QS3 qPCR machine, PCR machine, Centrifuges, Bio-Rad Gel Doc systems, and Vortexers

10. Acknowledgements

This course was designed with the direct support and collaboration of Dr. Anne Simon and Dr. Michelle Belton, in order to ensure course and curriculum consistency. Special thanks to both Anne and Michelle for invaluable discussions and advice, and their generous permission to use their course content.