Western Science

Department of Biology

GENOMICS AND BEYOND: A LABORATORY COURSE
Biology 3596A
Course Outline

1. Course Information

Course Information
Genomics and Beyond: A Laboratory Course, Biology 3596A, Fall 2022

Biology 3596A/B is a laboratory course. The emphasis is on individual, hands-on laboratory experience and results. Six synchronous hours/week are devoted to this course (2 *online* lecture hours, 4 **in-person** lab hours)

- Lectures will be synchronous, online (by Zoom), each **Monday from 3:30–5:30 pm.**
- Lab sections: Students have enrolled in a specific Tuesday afternoon (1:30–5:30 pm, Section 002), Wednesday morning (8:30 am–12:30 pm, Section 003), or Wednesday afternoon (1:30–5:30 pm, Section 005) lab section. All laboratory sessions will be **in-person at B&GS 3065**.

List of Prerequisites
A minimum mark of 70% in each of Bio 2581B and Bio 2290F/G; and registration in year 3 or 4 of an Honours Specialization in Genetics or Genetics & Biochemistry, or major or minor in Genetics.

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: See OWL site

Please use your Western (@uwo.ca) email addresses when contacting your instructors and include "Bio3596" 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, explore what you may want to do after you graduate, and find support.

3. Course Syllabus, Schedule, Delivery Mode

Course Description
A practical introduction to modern experimental approaches in genetics and molecular biology as applied to such topics as genomics (gene identification and classification), functional genomics (genome expression profiles) and bioinformatics (computational genomic analysis).

The goal of this course is to provide hands-on experience with core genetics laboratory techniques to give you the foundations of knowledge and skills required to interpret and perform modern genetics experiments. Here, we will combine what you've learned so far about genetics, molecular biology, and scientific methodology into several practical experiments, enhancing the breadth and depth of your knowledge in these areas while also providing opportunities to develop your skills in experimental methodology, scientific communication, critical thinking, and hypothesis building. As an introduction to big data in biology, which has become a staple of modern genetics research, we will also make use of online genomics resources.

Course structure
This course is challenging and fast paced. To succeed, you are expected to read the Lab Manual in advance, arrive to lab fully informed about the day's experiments, and be ready to spend the full lab period working if needed. The labs are divided into five main projects. Each project contains an integrated series of experiments that run over several weeks, with experiments from different projects often overlapping to be more efficient with lab time (just as we do in research labs). At the end of each project, a report summarizing and integrating the results and interpretation of experiments will be due. You will work in pairs, and individual reports will be prepared using either whole class data or your own.

Lecture content, in combination with online readings, will provide theoretical and technical background information to empower you to successfully complete and understand the laboratory experiments and assignments. All lectures will be recorded and posted to the OWL course site for future reference. Note: most live classes will involve graded Activities, through iClicker or other tools. When possible, asynchronous alternatives will be available on the OWL site, but active participation in all live sessions is highly encouraged.

It is 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.

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

1. Perform foundational molecular biology and genetics experiments based on given protocols, including DNA/RNA isolation, PCR/Reverse Transcriptase-PCR, electrophoresis, DNA cloning/sub-cloning, and yeast culture
2. Record experimental methods and results in a manner enabling reproducibility
3. Interpret experimental results and compare your conclusions to scientific literature
4. Clearly communicate molecular biology and genetics research findings—in written, oral or multimedia formats—to an academic audience

5. Explain how molecular biology and genetics techniques can be used to assess the role of genetics in animal and human behaviour
6. Describe how the study of behavioural genetics contributes to understanding human disorders, using examples from scientific studies
7. Compare genetic sequences from different species using publicly available online genome databases
8. Collaborate with peers to perform experiments and communicate your findings

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 13 or 14, 2022 (depending on lab section)
Thanksgiving holiday: Oct 10, 2022 (no lecture this week, but labs unaffected)
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
Semester ends: Dec 8, 2022
Exam period: Dec 10 – 22, 2022 (no exam for this course)

Bio 3596A Schedule Fall 2022

Lecture/Lab	Date	Description*	Project				
Lecture 1	Sep 12	Introduction & how/when to do most common techniques? PCR, RE, agarose, gel imaging, CRISPR; Activity 1	1	2			
Lab 1	**Sep 13 / 14**	**Project 1: Intro Lab & start Project 2: Murder Mystery** **Pipette test, PCR, RE Digest, Agarose Gel, Swab**					
Lecture 2	Sep 19	How to do forensic genotyping? DNA extraction, Polymorphic markers, PAGE gels Activity 2					
Lab 2	**Sep 20 / 21**	**→ Lab Assignment 1 (3%) DUE** **DNA extraction, Agarose gel, PCR**					
Lecture 3	Sep 26	What are ESTs? Where is the sequence from? (Start Genomics Analysis) Discuss Lab Assignment 1; Activity 3					
Lab 3	**Sep 27 / 28**	**PAGE, PCR**					
Lecture 4/5	Oct 3	Research: Using model systems & Light-sensitive pathway in Arabidopsis How to assess gene expression? Activity 4			3		
Lab 4	**Oct 4 / 5**	**Finish Project 2 & start Project 3: Gene Expression** **PAGE, RNA extraction, plant pictures**					
No lecture	Oct 10	Thanksgiving holiday on Monday – no lecture					
Lab 5	**Oct 11 / 12**	**Agarose Gel with RNA, cDNA synthesis, RT-PCR**					
Lecture 6	Oct. 17	How/why do DNA cloning? Plasmids, vectors, cloning Activity 5				4	
Lab 6	**Oct 18 / 19**	**→ Lab Assignment 2 (8%) DUE** **Finish Project 3 & start Project 4: Cloning** **PAGE, Digest, Agarose Isolation**					
Lecture 7	Oct 24	**→ GENOMICS ANALYSIS (10%) DUE** Cloning continued; Discuss Lab Assignment 2; Activity 6					5

Lab 7	**Oct 25 / 26**	**Continue Project 4 & start Project 5: Yeast complementation** **Ligation, Transformation, Pick and re-streak colony**					
No lecture / labs	Oct 31–Nov 4	**Fall Reading Week – no lecture / labs**					
Lecture 8	Nov 7	How can we tell if a mutation is in a known gene? Yeast experiment, genetic screens					
Lab 8	**Nov 8 / 9**	**→ Lab Assignment 3 (11%) DUE** **→ Choose Lab Assignment 4/5 format** **Pick a colony, Yeast mating**					
Lecture 9	Nov 14	Yeast complementation Activity 7					
Lab 9	**Nov 15 / 16**	**Miniprep DNA, Complementation analysis, Start β-gal assay**					
Lecture 10	Nov 21	Guest lectures TAs Activity 8					
Lab 10	**Nov 22 / 23**	**Finish Project 4 & Project 5** **Digest, Agarose Gel, Score results**					
Lecture 11	Nov 28	Careers in Biology (panel)					
Lab 11	**Nov 29 / 30**	**→ In-lab practical test (20%)**					
Lecture 12	Dec 5	Q&A, open discussion					
Final submissions	**Dec 6 / 7**	**→ LAB ASSIGNMENT 4 (15%) DUE** **→ LAB ASSIGNMENT 5 (12%) DUE** **→ Submit online lab books (15%)** Presentations in lab					
Exam period	**Dec 12-15**	No exam for this course					
GOOD LUCK IN EXAMS AND HAVE A WONDERFUL HOLIDAY BREAK!							

*Lecture descriptions subject to change

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.

Laboratory Manual

- A laboratory manual outlining all experiments will be available through the course OWL website, in pdf format.
- Students are expected to read the labs in advance and be ready when lab starts.

Communications

All course material (Zoom links, lecture slides/recordings, assignment guidelines, lab protocols, 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. Note, video will be encouraged during non-recorded breakout sessions and presentations, but will not be mandatory. For questions or concerns about recording and use of videos in which you appear, please contact me.

As per university policies, **do not share any course or student materials or videos** without explicit written permission from me and any students involved in their production.

5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Assessment	Due Date	Weight
Activities (iClicker/other, Critical reflections, Peer review)	Throughout (best 6 of 8)	6%
Lab Assignments (x5)	1) Intro lab—Sep 20/21 (Week 2) 2) Murder Mystery—Oct 18/19 (Week 6) 3) Gene expression—Nov 8/9 (Week 8) 4) Cloning—Dec 6/7 (Week 12) 5) Yeast complementation—Dec 6/7 (Week 12)	3% 8% 13% 15% 15%
Genomics Analysis	Oct 24 (Week 7)	10%
In-lab practical test	Nov 29/30 (Week 11)	20%
Lab Book	Dec 6/7 (Week 12)	10%

Note: there will be no written tests or final exam. The in-lab practical test will occur during regular lab times. 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 at least three Lab Assignments 2–5, the Genomics Analysis, and your Lab Book
3. Completion of the in-lab practical test

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, with the exception of the in-lab practical test, 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 <u>two</u> assessments up to 24 hours late <u>without penalty</u>. 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 Assignment(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 written 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 Western University 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 3596A/B that has been purchased using SSD funds include: 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 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.