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Course syllabus

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Western Science

Department of Biology

GENOMICS AND BEYOND: A LABORATORY COURSE

Biology 3596B

Course Outline

1. Course Information

Course Information

Genomics and Beyond: A Laboratory Course, Biology 3596B, Winter 2024

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

- Lectures will be in-person in X, **Mondays from 3:30–5:30 pm**. Please bring paper and a pen, and, if available, a laptop, tablet, and/or smart phone (with internet capabilities) so you we can workshop your scientific skills.
- Lab sections: Students have enrolled in a specific **Tuesday morning (8:30 am–12:30 pm, Section 002)**, or **Wednesday afternoon (1:30–5:30 pm, Section 005)**. All laboratory sessions will be **in-person at X**, starting the week of **Jan 9/10**.
- Additional course content and submission of most major assessments will use the **course OWL site**.

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: Matheus Sanita Lima (msanital@uwo.ca) - Office: X

Laboratory Supervisor: Kim Loney (kgrant4@uwo.ca)

Teaching Assistants: See OWL site

Communication Policies:

Our course could include many potentially sensitive issues involving real-world problems/data related to genetics, including human genetics, so it is essential that the class remains a welcoming, open and respectful environment for everyone. That will be our shared responsibility. I hope that through the various discussions in your Labs, and in the live sessions with me, you will be able to work collaboratively with your peers to give each other support and feedback throughout the term.

OWL Announcements: Please make sure you are receiving email notifications for the OWL Announcements. This is how I will communicate critical course updates and important information to you. Not being aware of information provided in the Announcements cannot be used as justification for an appeal.

Emails: I highly recommend that you use your Western (@uwo.ca) email addresses when contacting your instructors and include "Bio3596b" in the subject title, as well as informative information, otherwise, they may be identified as spam. You can typically expect an answer from me within 1 to 2 business days.

Office hours: Instead of holding a fixed schedule for office hours, students can email me to set up a day and time to meet. If several students inquire a meeting to discuss similar concerns, we may book a time that works for everyone. *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 is a skills-based course with a heavy workload. 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 interpreting the results will be due. You will work in pairs in the lab, but you will need to prepare individual reports, using either whole class data or your own.

While the labs are there to give you hands-on technical experience, the lectures will focus on the development of the other essential scientific skills that researchers require, including designing research questions, literature and database research, scientific writing, and peer discussion. Please come to the lectures prepared to work, interact with your peers, and discuss. As well, in combination with online videos and readings, the lectures will provide the basic theoretical background information required to understand the lab experiments and give you the tools needed to successfully complete your assessments.

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 or lay audience
5. Explain how fundamental molecular biology and genetics techniques can be used to understand genetics in model organisms and humans
6. Compare genetic sequences from different species using publicly available genome databases
7. Collaborate with peers to perform experiments and communicate your findings

Key Dates:

Semester begins: Jan 8, 2024

First lecture for the course: Jan 8, 2024

First labs for the course: Jan 9 and 10, 2024 (depending on lab section)

Midterm: Monday, Feb 12th 2024 (2h, class time)

Family Day: Monday, Feb 19th 2024 (no lecture, Winter Reading Week)

Winter Reading Week: Feb 17–25, 2024 (no lecture or labs this week)

Last day to withdraw from the course without academic penalty (with a grade of "WDN"): March 7, 2024

Last labs for the course: March 19/20, 2024 (in-lab practical test)

Last lecture for the course: April 1, 2024

Semester ends: April 10, 2024

Exam period: April 11–30, 2024

Final exam: TBD by Exam Central (3h)

Bio 3596B Schedule Winter 2024

***Please note that slight changes to this proposed schedule might be necessary. The content specified below (until master classes) will be delivered, but the order of lectures might change according to guest lecturers' availabilities and/or unforeseen circumstances. The content from MASTER CLASS I - IV will be delivered as time permits.**

Lecture/Lab	Date	Description*	Lab Project			
Lecture 1	Jan 8	Fundamental techniques: PCR, RE, agarose, gel imaging...	1	2		
Lab 1	Jan 9 / 10	Project 1: Intro Lab Pipette test, PCR, RE digest, agarose gel Project 2: Murder Mystery Cheek swab				
Lecture 2	Jan 15	Forensic genotyping: DNA extraction, polymorphic markers, PAGE				
Lab 2	Jan 16 / 17	Project 2: DNA extraction, agarose gel, PCR				
Lecture 3	Jan 22	Using model systems & Light-sensitive pathway in Arabidopsis Assessing gene expression				
Lab 3	Jan 23 / 24	Project 2: PAGE			3	

		Project 3: Gene Expression Plant photo, RNA extraction, nanodrop					
Lecture 4	Jan 29	Genome sequencing & exploring genome databases Start Genomics Analysis					
Lab 4	Jan 30 / 31	Project 3: RNA gel, cDNA synthesis, qPCR					
Lecture 5	Feb 5	Cloning					
Lab 5	Feb 6 / 7	Project 4: Cloning RE digest, plasmid cleanup, gel band isolation Lab Assignment 1 (8%) due Fri Feb 9, 11:55pm				4	
Lecture 6	Feb 12	MIDTERM (IN CLASS)					
Lab 6	Feb 13 / 14	Project 4: Ligation, Transformation Project 5: Yeast genetics Pick and re-streak colony Genomics Analysis (10%) due Fri Feb 16, 11:55pm					5
No lecture / labs	Feb 17 - 25	Winter Reading week					
Lecture 7	Feb 26	Yeast genetics					
Lab 7	Feb 27 / 28	Project 4: Pick transformants, inoculate media Project 5: Yeast mating Lab Assignment 2 (12%) due Fri Mar 1, 11:55pm					
Lecture 8	Mar 4	Yeast genetics continued					
Lab 8	Mar 5 / 6	Project 4: Miniprep DNA Project 5: Yeast complementation & β-gal re-streaking					
Lecture 9	Mar 11	MASTER CLASS I: RESOURCEFUL VIRAL GENOMES Guest lecture: Jordan Mikaela					

Lab 9	Mar 12 / 13	<p>Project 4: RE digest, agarose gel</p> <p>Project 5: β-gal reveal, score results</p>						
Lecture 10	Mar 18	<p>MASTER CLASS II: STREAMLINED PROKARYOTIC PANGENOMES</p> <p>Guest lecture: Eleanor Khochaba and Lorena Yeung</p>						
Lab 10	Mar 19 / 20	In-lab practical test (20%)						
Lecture 11	Mar 25	<p>MASTERCLASS III: PROFLIGATE EUKARYOTIC CHROMOSOMES</p> <p>Guest lecture: Michael Pyne</p>						
Lecture 12	April 1	<p>MASTERCLASS IV: GENOMIC SIGNATURES OF MAJOR EVOLUTIONARY TRANSITIONS</p>						
Exam period	April 11 - 30	<p><i>Final exam date to be determined by Exam Central</i></p> <p>GOOD LUCK IN EXAMS AND HAVE A WONDERFUL SUMMER!</p>						

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

Although the intent is for this course to be delivered in person, should any university-declared emergency require some or all of the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will **not** change, except that the In-Lab Practical Exam will need to be cancelled, with the marks re-weighted equally to the final two Lab Assignments. Any assessments affected will be conducted online as determined by the course instructor.

Synchronous Zoom sessions may exceptionally replace the in-person lecture, if required (e.g., due to instructor illness or COVID-19 contingency planning). In such cases, an Announcement will be sent to the class via OWL, as soon as possible.

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.

In-person lectures

As noted above, most classes will involve graded Activities (marked mainly for completion) that can be completed and submitted in class. Please bring paper and a pen, and, if available, a laptop, tablet, and/or smart phone (with internet capabilities) so you we can workshop your scientific skills.

Course Content

All course material (lecture slides (when available), videos, 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 (if necessary) will be 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): Depending on feasibility and audio/video capabilities in the room, in-person lectures and/or synchronous Zoom sessions (in the event of instructor illness or COVID-19 contingency plan) may be recorded and made available to students in the course for viewing remotely after each session. For questions or concerns about recording and use of videos in which you appear, please contact me.

As per university policies, **you may 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
Lab Assignments (x2)	1) Murder Mystery—Fri Feb 9, 11:55pm	8%
	2) Plant gene expression—Fri March 1, 11:55pm	12%
Midterm	Mon Feb 12, 3:30 - 5:20pm (class time)	15%
Genomics Analysis	Fri Feb 16, 11:55pm	10%
Lab Book	Throughout (due one week after each lab)	10%
In-lab Practical Test	March 19/20 (according to your Lab Section)	20%
Final exam	TBD (by Exam Central)	25%

Visit the OWL site “Assessment Guidelines” section for details associated with each assessment.

Essential course requirements

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

1. **Minimum 65% attendance of all laboratory sessions (6 of 9)**
2. **Submission of ALL Lab Assignments 1(and 2), plus the Genomics Analysis and Lab Books**
3. **Completion of the in-lab practical test**
4. **Writing of the Final exam**

*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) or Special Examination Criteria (SPC) until you complete the course requirements.

Scheduling Conflicts: Assessment due dates 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 **one week** 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 two assessments up to 24 hours late without penalty. No explanation or documentation will be required.** Late penalties (and application of the two 24h grace periods) will be automatically applied at the end of term. In case of multiple late submissions, the grace periods will be applied to the highest weighted assessments. Both grace periods can be applied to the same assessment (e.g., in case you submit only one assignment 48h late).

Grading errors: If you notice a clear error in your mark, please bring it to 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. Fixing a clear grading error (e.g., grader calculation error) does not count as “re-marking”. If the TA (or myself) indicates that there was not a grading error but you disagree with the mark, you may consider submitting a re-marking request to me (Matheus Sanita Lima).

Remarking of Assignments: Re-marking requests can only be submitted to me (Matheus Sanita Lima). 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 (msanital@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 will be done on the assessment as a whole, not just the aspect for which you have an issue. Re-marking can result in the mark being raised, confirmed, or lowered.**

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.

General policy for missed course components due to illness or other serious circumstances:

Please contact me by email (msanital@uwo.ca) to explain the situation, **as soon as possible** within 5 days of the course component completion/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.** Note, there is

never a need to provide personal health information or documentation to me (or any instructor). If required, that should only be shared with your academic counsellor (see below).

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 suggest possibilities for re-weighting, as needed.

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. 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 further information, please consult the University's medical illness policy at https://uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration.pdf.
- The Student Medical Certificate is available at https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.
- For more information about Academic Consideration: https://registrar.uwo.ca/academics/academic_considerations/index.html
- Academic Advising for each of the faculties can be found here: https://registrar.uwo.ca/faculty_academic_counselling.html

For missed labs:

Please inform me as described in the general policy 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 Assignment 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 Assignment 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.

Absences from Midterm

There will be 1 make-up midterm. If you miss the mid-term, you can choose to write the make-up, or have the midterm reweighted into the final.

Absences from Final Examinations

If you miss the Final Exam (In-Lab Practical Exam and/or the written Final Exam), please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

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

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 (msanital@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: 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, Dr. Michelle Belton, and Dr. Daniel Jeffrey** to ensure course and curriculum consistency. Special thanks to all of them (Anne, Michelle, and Daniel) for invaluable discussions and advice, and their generous permission to use their course content.