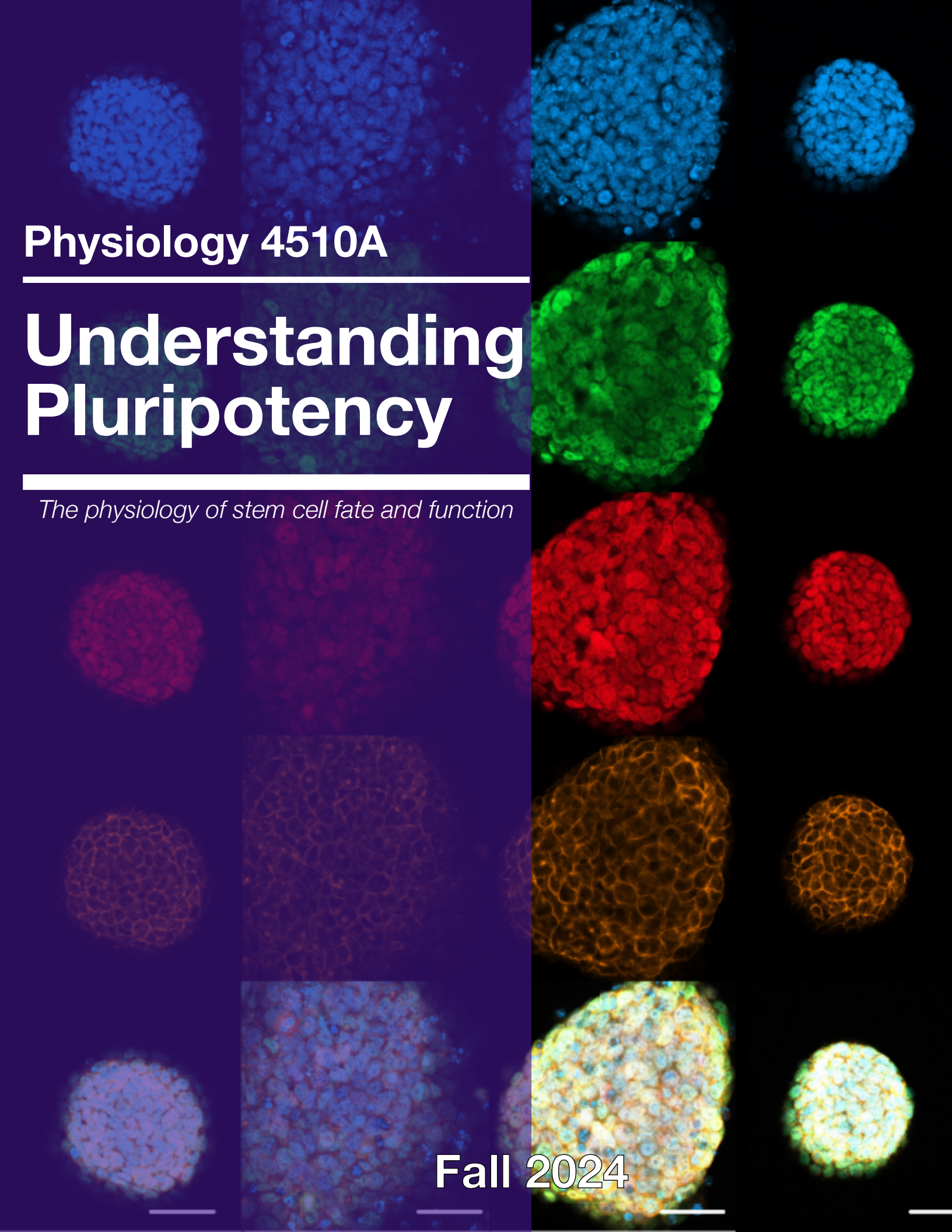
Physiology 4510A

Understanding Pluripotency

The physiology of stem cell fate and function



Fall 2024

Schulich MEDICINE & DENTISTRY | Western Science

Bachelor of Medical Sciences (BMSc) Program

Department of Physiology and Pharmacology

PHYSIOL 4510A Understanding Pluripotency: The physiology of stem cell fate and function

Course Syllabus for Fall 2024

THRIVE together	Western University is committed to a thriving campus; therefore, your health and wellness matter to us! The following link provides information about the resources available on and off campus to support students: https://www.uwo.ca/health/ Your course coordinator can also guide you to resources and/or services should you need them.

1. Technical Requirements for Remote Learning (if necessary):

Stable internet connection

Laptop or computer

2. Course Overview and Important Dates:

Delivery Mode	Dates	Time
In-person*	Thursdays	2:30 - 4:20 pm

* Details about design and delivery of the course are listed below in Section 4.

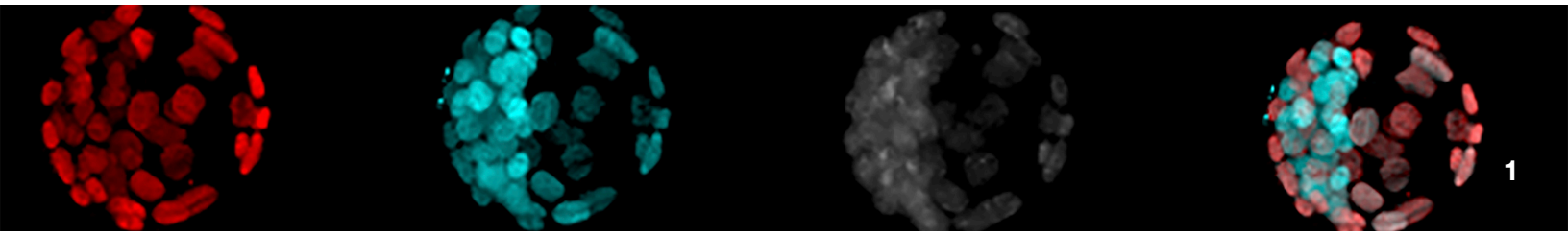
Classes Start	Reading Week	Classes End	Study Days	Exam Period
September 5	Oct. 12 - Oct. 20	December 6	December 7-8	December 9-22

September 30, 2024, is National Day for Truth and Reconciliation and is a non-instructional day.
December 2, 2024: Last day to drop a full course and full-year half course without academic penalty.

3. Contact Information:

Course Co-Coordinators	Contact Information
Dean H. Betts	dean.betts@schulich.uwo.ca or dbetts@uwo.ca
Cheryle A. Seguin	cheryle.seguin@schulich.uwo.ca

Teaching Assistant (TA)	Contact Information
Allison Tse	atse57@uwo.ca



4. Course Description and Design:

Physiology 4510A: Understanding Pluripotency: The physiology of stem cell fate and function

Fall Term 2024

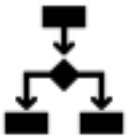
The fundamental goal of pluripotent stem cell biology is to understand how these extraordinary cells' self-renew and differentiation capabilities are regulated to produce specialized cells capable of differentiating into a wide range of functional cell types. This course will examine various current topics within the pluripotent stem cell physiology field. We will focus on the basic biology of embryo-derived stem cells and their potency. We will briefly cover pre- and post-implantation embryo development, focusing on cell fate determination and the cell lines derived from these developmental stages. We will discuss how these embryo-derived cell lines are isolated and tested, what factors allow for their expansion, how they can be genetically manipulated and what intrinsic and extrinsic factors regulate their self-renewal and cellular differentiation characteristics. We will also discuss pluripotent stem cells derived by somatic cell nuclear transfer and cellular reprogramming technologies. An understanding of this physiology will enable students to thoroughly understand stem cell function and cell fate determination to assess whether regenerative medicine is feasible with pluripotent cells, along with the ability to evaluate the ethical issues surrounding this field critically.

Requisites: Suggested Prerequisite(s): Physiology 3120, Physiology 3140A (or equivalent).

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.

Delivery Mode:

Mode	Dates	Time	Frequency
Blended: In-person lectures and active learning modules #	Thursdays	2:30 - 4:20 pm	weekly

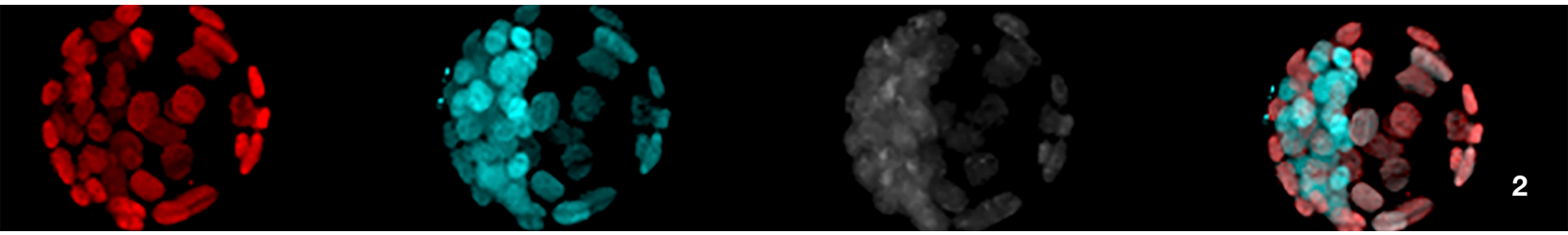


☒ Asynchronous pre-work must be completed prior to synchronous sessions

☒ Attendance at sessions is required

☒ Missed work should be completed within 72 hours

☒ A recording may be provided for sessions



All course material will be posted to OWL: https://westernu.brightspace.com/d2l/login. Any changes will be indicated on the OWL site and discussed with the class.

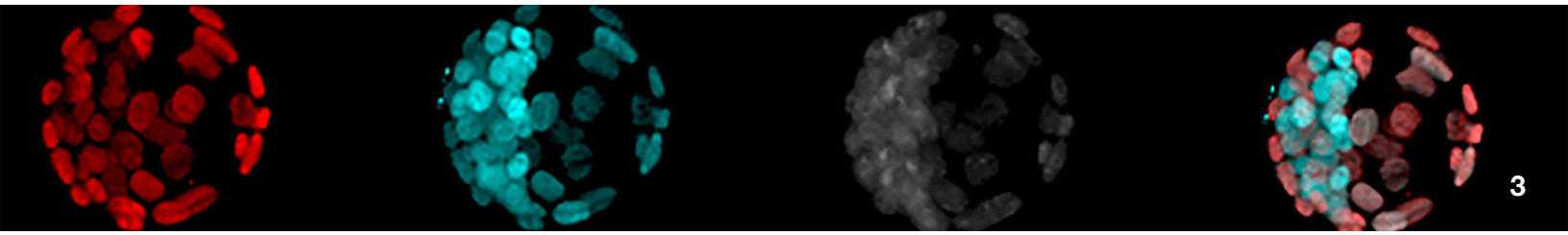
If students need assistance, they can seek support on the OWL Brightspace Help. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Current versions of all popular browsers (e.g., Safari, Chrome, Edge, Firefox) are supported with OWL Brightspace; what is most important is that you update your browser frequently to ensure it is current. All JavaScript and cookies should be enabled.

5. Course Objectives and Learning Outcomes:

Course Objectives:

The main objective of this course is to introduce students to the basic molecular, physiological, and morphological events that regulate pluripotent stem cell biology. Additional objectives are to improve the student's ability to read and understand primary scientific literature, to write about science effectively to a lay audience and to provide students with an opportunity to conceptually translate their knowledge of stem cell biology to solve biological problems by designing novel experiments and stem cell-based therapies. The course material will include didactic lecturing but will also utilize a flipped classroom approach for students to conduct in-class exercises to examine primary research journal papers properly, learn how to write scientific and lay articles, and adequately design hypothesis-driven experiments. Students will be expected to come prepared to discuss the content of assigned research articles in class and work independently outside the lectures. The lectures will focus mainly on the factors and signalling pathways that govern the development of the early embryo, embryo-derived stem cells, concentrating on the physiology, utility and ethical issues surrounding pluripotent stem cell technologies.



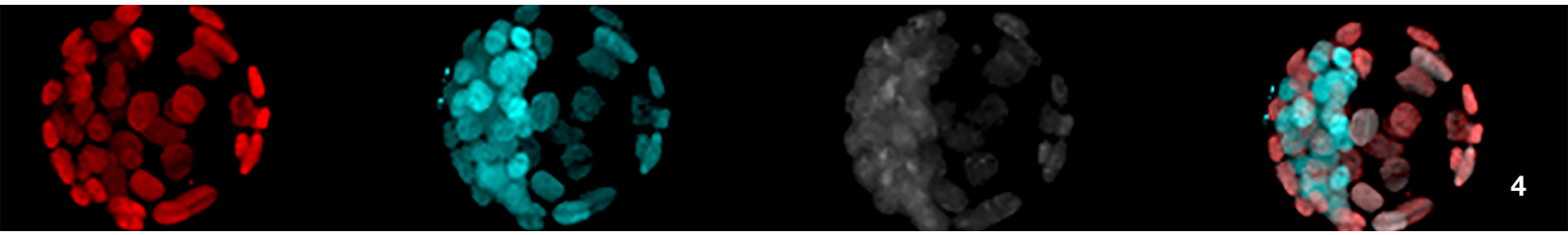
A student who has met the objectives of the course will be able to:

- Explain the basic concepts of stem cell self-renewal and pluripotency and how these features are evaluated in the stem cell field.
- Apply their understanding of the basic concepts and fundamental mechanisms that regulate pluripotent stem cells as it relates to developmental biology to solve problems/questions.
- Navigate, understand and critically evaluate published stem cell research literature.
- Debate current ethical issues that surround pluripotent stem cell biotechnologies.
- Effectively communicate scientific knowledge about pluripotent stem cells to the lay public.

Method of Presentation: The material of the course will be presented in the form of in-person didactic lectures and a partial flipped classroom platform that includes problem based learning exercises and informal in-class discussions, exercises and debates.

Methods of Evaluation (Students will be expected to):

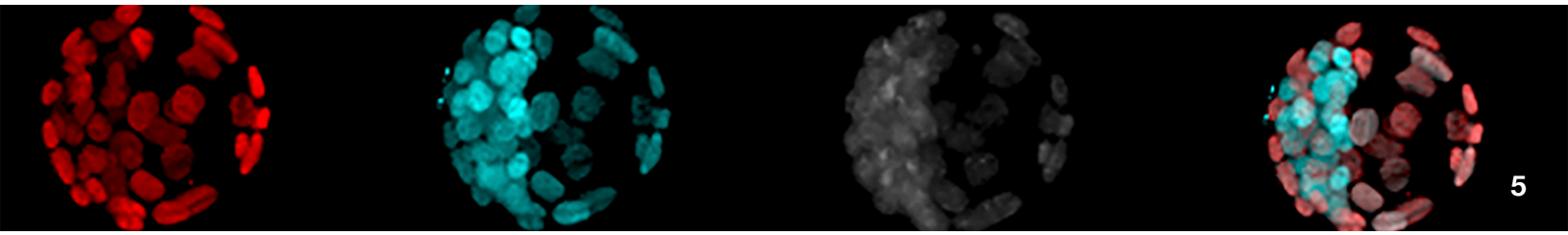
- Actively participate in regular classroom discussions and debates.
- Read assigned scientific papers ***prior*** to class.
- Utilize current scientific literature in preparing assignments.
- Prepare a scientific lay article.
- Apply their learned basic science knowledge of the stem cell field to propose experiments to solve scientific problems/questions.
- Write, in short answer essay format, on quizzes, the mid-term and final examinations.



Course Learning Outcomes:

Upon successful completion of this course, students will be able to:

- Demonstrate a detailed knowledge and critical understanding of key concepts and regulatory mechanisms governing pluripotent stem cell function by describing concepts, applying, and integrating one's learning, and critically evaluating and reflecting upon major theories, practices and ethical issues in the field.
- Demonstrate a strong understanding of the scientific methodologies behind pluripotent stem cells by formulating hypotheses, designing experiments, analyzing, and interpreting data and making reasoned conclusions and improvements in experimental design in light of published work.
- Interpret figures and proper figure descriptions along with identifying the strengths and weaknesses of information and the various research techniques used.
- Perform literature searches and be able to evaluate and critique current literature in pluripotent stem cell physiology to generate a clear and concise written layperson article.
- Explain and apply different stem cell models and technologies (e.g. knockout vs. knock-in, genome editing approaches, etc.) with varying experimental procedures (Western vs. real-time RT-qPCR, etc.) to interpret the scientific literature encompassing the pluripotent stem cell field.
- Demonstrate the ability to critically evaluate, manage, reflect on, integrate and apply their pluripotent stem cell knowledge in solving problem-based learning exercises and examination questions.
- Develop convincing arguments to debate complex ideas and relevant scientific and/or ethical issues effectively. Be aware that scientific knowledge changes, has different interpretations, and moral issues are not always simple choices between two differing views.



6. Course Content and Schedule:

- In-person components: Thursdays, 2:30 - 4:20
- Asynchronous course material (recorded lectures, readings) will be available through OWL Brightspace
- Remote synchronous course activities (**if necessary**) will be Thursdays, 2:30 - 4:20 *via* Zoom (online link will be provided)

#	DATE	TOPIC (Instructor)	Instructor(s)
1	Sept. 5	History of Pluripotent Stem Cells; Fundamental principles of pluripotent stem cells; Introduce Pluripotent Stem Cell Infographic Assignment	Betts
2	Sept. 12	Cell Differentiation/Lineage Restriction	Seguin
3	Sept. 19	Embryonic Stem Cells and Pluripotency; Learning activity	Seguin
4	Sept. 26	Extracellular Signals to Direct Stem Cell Differentiation; Introduce and brainstorm layperson assignment	Seguin
5	Oct. 3	Intracellular Signals to Direct Stem Cell Differentiation	Seguin
6	Oct. 10	Somatic Cell Cloning and Epigenetic Reprogramming in Mammals	Betts
7	Oct. 17	**No class, Reading Week (starts October 12th)**	**N/A**
8	Oct. 24	Induced Pluripotent Stem Cells; Paper discussion	Betts
9	Oct. 31	**In class Midterm Test (questions based on first 7 topics)**	**N/A**
10	Nov. 7	“Big Data Approaches and Genetic Manipulation of Pluripotent Stem Cells”	Betts
11	Nov. 14	“Ethical Issues Surrounding Pluripotent Stem Cells” In class activity to play “decide” ethics kit on pluripotent stem cell issue	Betts/Seguin
12	Nov. 21	In class “jigsaw” presentations with class discussions	Betts/Seguin
13	Nov. 28	Cell-Based Therapies from Pluripotent Stem Cells; in-person meetings with each group to discuss initial ideas	Betts
14	Dec. 5	Design your own pluripotent stem cell based therapy - in person session with entire class to view and discuss group therapies	Betts

* Journal papers, recorded lectures and exercises for these weekly topics will be made available on the course OWL Brightspace site at least the week prior to each in-person/virtual session.

7. Participation and Engagement:

☒ Students are expected to participate and engage with content as much as possible.

☒ Students can participate during sessions or post on OWL after watching recorded sessions/lectures if attendance in-person is not possible.

☒ Students can also participate by interaction in the discussion board with their peers and instructors.

8. Assessment and Evaluation:

Below is the evaluation breakdown for the course. Any deviations will be communicated.

Assessment	Format	Weighting	Due Date	Flexibility
Stem Cell Infographic	Digital infographic	5%	Sept. 20, 2024	72-hr no late penalty
Layperson Article	Written assignment	10%	Oct. 25, 2024	72-hr no late penalty
Mid-term test	In-person, short and long answer	35%	Oct. 31, 2024 in-class	Not applicable
Jigsaw Presentations	In-person	10%	Nov. 21, 2024	Not applicable
Final Exam	In-person, short / long answer (cumulative)	40%	Dec. exam period	Not applicable
Total Marks		**100%**		

The in-person mid-term test (2 hrs) and in-person final exam (3 hrs) will consist of short answer essay type questions developed from lectures, assigned readings/exercises and other presented material. The final exam will be cumulative, with emphasis on the second half of the course.

Designated Assessment: *Instructors are permitted to designate one assessment per course per term as requiring supporting documentation to receive academic consideration. To receive academic consideration for our* ***in-class midterm test*** *supporting documentation is required. See below for information on academic consideration policy and missed course work.*

Information about flexibility in assessments:

☒ Flexibility in assessment has been applied to this course; therefore, academic consideration requests may be denied on the assessments where flexibility is included

☒ A 72-hour no late penalty has been applied to our Stem Cell Infographic and Layperson Article Assignments

General Information about assessments:

☒ All assignments are due at 11:59 pm EST unless otherwise specified

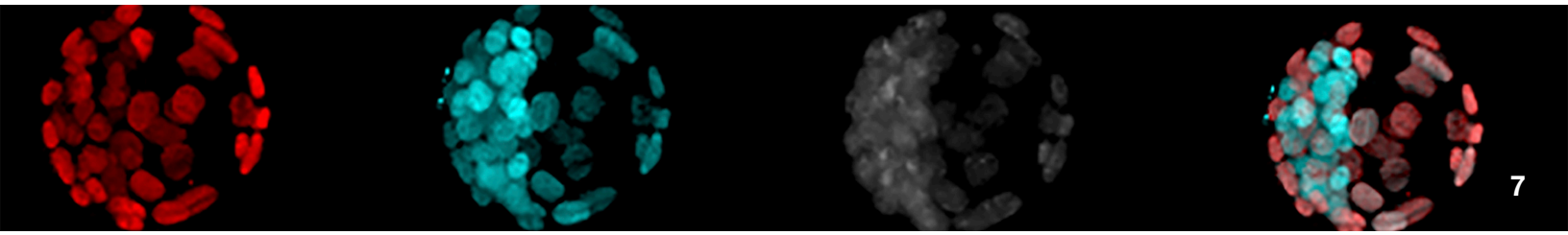
☒ Students are responsible for ensuring that the correct file version is uploaded; incorrect submissions including corrupt files could be subject to late penalties (see below) or a 0

☒ Written assignments will be submitted to Turnitin (statement in policies below)

☒ Students will have unlimited submissions to Turnitin

☒ Rubrics will be used to evaluate assessments and will be posted with the instructions

☒ A student might not receive the same grade as their group members if it is determined that the distribution of work was not equal (e.g. Jigsaw Presentation).



☒ After an assessment is returned, students should wait 24 hrs to digest feedback before contacting their evaluator; to ensure a timely response, reach out within 7 days

☒ Any grade appeals on assignments, midterms or final exam must be received within 3 weeks of the grade being posted.

Click here for a detailed and comprehensive set of policies and regulations concerning examinations and grading. The table below outlines the University-wide grade descriptors.

A+	90 - 100	One could scarcely expect better from a student at this level
A	80 - 89	Superior work which is clearly above average
B	70 - 79	Good work, meeting all requirements, and eminently satisfactory
C	60 - 69	Competent work, meeting requirements
D	50 - 59	Fair work, minimally acceptable
F	below 50	Fail

Information about late or missed evaluations:

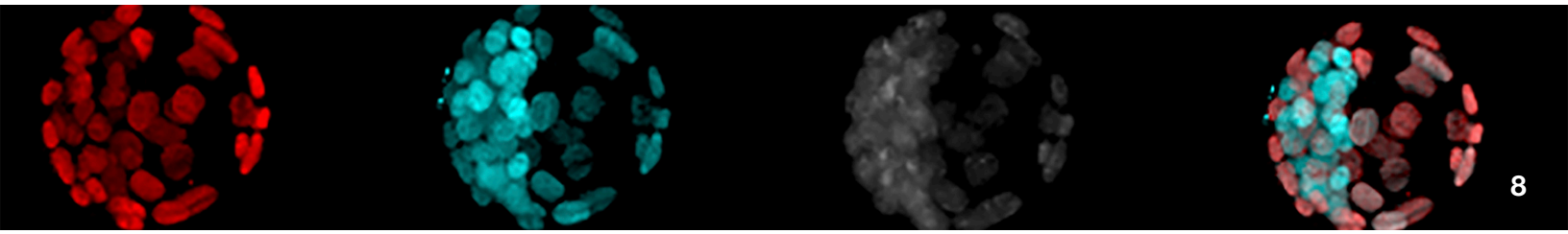
☒ Late assignments can be submitted within 72 hours of the official submission date without penalty and thereafter be subject to a late penalty of 10% per day **or** the weight transferred to the midterm test or final exam.

☒ An assignment cannot be submitted after it has been returned to the class; an alternate assessment will be assigned **or** the weight of a missed assignment will be transferred to the midterm or final exam.

☒ A single make-up midterm test will be offered within the week following the scheduled in-class midterm test **or** the weight of the missed midterm test will be transferred to the final exam.

☒ If a make-up Final exam is missed, the student will receive an INC and complete the task the next time the course is offered.

INC (Incomplete Standing): If a student has been approved by the Academic Advising Office (in consultation with the instructor/department) to complete term work at a later date, an INC will be assigned. Students with INC will have their course load in subsequent terms reduced to allow them to complete outstanding course work. Students may request permission from Academic Advising to carry a full course load for the term the incomplete course work is scheduled.



SPC (Special examination): If a student has been approved by the Academic Advising Office to write a Special Examination and the final exam is the only outstanding course component, an SPC will be assigned. If the class has a makeup exam, the student is expected to write the makeup exam. If the class doesn't have a makeup exam or the student misses the makeup exam for reasons approved by the Academic Advising Office, the student will write the exam the next time the course is offered. Outstanding SPCs will reduce the course load for the term the exam is deferred as outlined in Types of Examinations policy.

Policy on the Rounding and Bumping of Marks:

Across the Basic Medical Sciences Undergraduate Education programs, we strive to maintain high standards that reflect the effort that students and faculty put into the teaching and learning experience during this course. All students will be treated equally and evaluated based only on their actual achievement. **Final grades** on this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.45 becomes 74, and 74.50 becomes 75. Marks WILL NOT be bumped to the next grade or GPA, e.g., a 79 will NOT be bumped up to an 80, an 84 WILL NOT be bumped up to an 85, etc. The mark attained is the mark you achieved, and the mark assigned; requests for mark "bumping" will be denied.

9. Communication:

☒ Students should check the OWL Brightspace site every 24 - 48 hours

☒ A weekly update will be provided on the OWL announcements

☒ Students should email their instructor(s) and teaching assistant(s)

☒ Emails will be monitored daily; students will receive a response in 24 – 48 hours

☒ This course will use discussions on OWL Brightspace

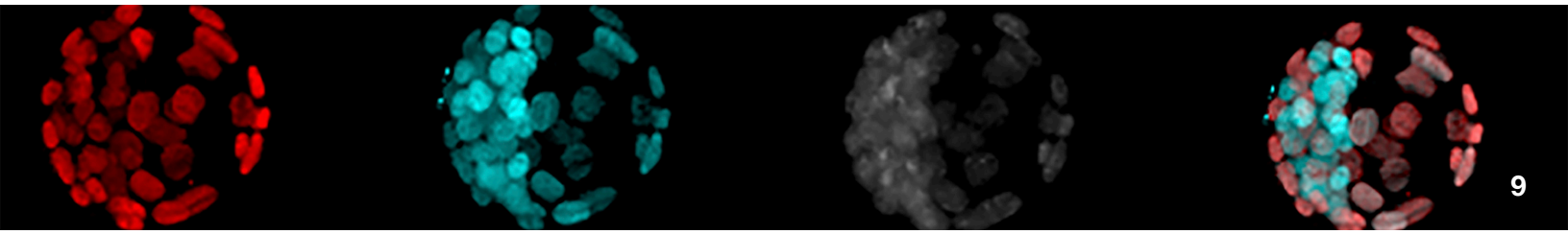
☒ Students should post all course-related content on the discussion forum so that everyone can access answers to questions

☒ The discussion forums will be monitored daily by instructors or teaching assistants

10. Office Hours:

☒ Office hours with individuals or groups will be held in-person or remotely using Zoom

☒ Students will be able to sign up for an appointment using Email



11. Resources:

☒ All resources will be posted in OWL Brightspace

☒ **No** required textbook

☒ **No** required study guide

☒ Additional resources (optional):

1. Atala A, Lanza R. Handbook of Stem Cells. Volume 1: Pluripotent Stem Cells and Cell Biology (2nd ed). Elsevier Academic Press; 2012.

2. StemBook [Internet]. Cambridge (MA): Harvard Stem Cell Institute; 2008-. Available online.

3. Lanza RP, Langer RS, Vacanti J. Principles of tissue engineering (ed 3rd). Amsterdam; Boston: Elsevier Academic Press; 2007.

4. Gilbert, SF. Developmental Biology (ed 6th). Available online.

Supplemental Information: Published journal articles will be provided for downloading from OWL as required reading for lectures. Students are encouraged to peruse the scientific literature and read review and/or primary research articles in the stem cell biology field. Examples of such *journals: Cell Stem Cells, Cellular Reprogramming, Current Stem Cell Research, Development, Journal of Cell Science, Journal of Biological Chemistry, Nature journals, Proc Natl Acad Sci U S A, Science, Stem Cells, Stem Cell Reports, Stem Cells and Development.*

12. Professionalism and Privacy:

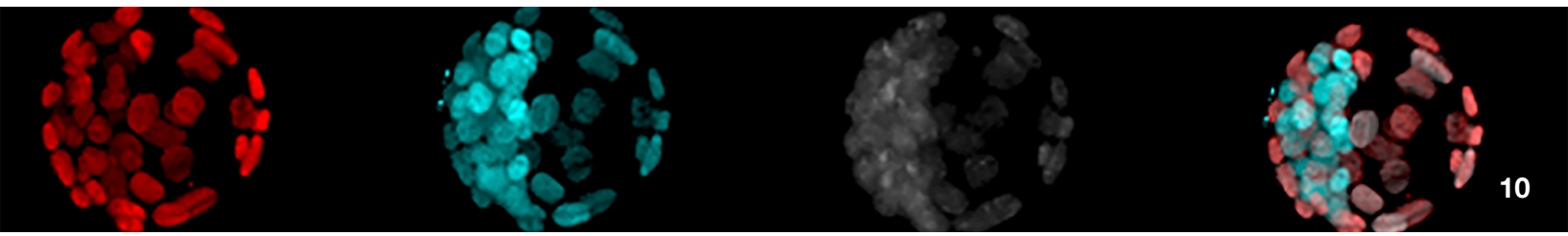
Western students are expected to follow the Student Code of Conduct. Additionally, the following expectations and professional conduct apply to this course:

☒ All course materials created by the instructor(s) are copyrighted and cannot be sold/shared

☒ Recordings are not permitted (audio or video) without explicit permission

☒ Permitted recordings are not to be distributed

☒ Students will be expected to take an academic integrity pledge before some assessments



Western is committed to providing a learning and working environment that is free of harassment and discrimination. All **students**, staff, and faculty have a role in this commitment and have a responsibility to ensure and promote a safe and respectful learning and working environment. Relevant policies include Western's Non-Discrimination/Harassment Policy (M.A.P.P. 1.35) and Non-Discrimination/Harassment Policy – Administrative Procedures (M.A.P.P. 1.35).

Any **student**, staff, or faculty member who experiences or witnesses' behaviour that may be harassment or discrimination **must report the behaviour** to the Western's Human Rights Office. Harassment and discrimination can be human rights-based, which is also known as EDI-based, (sexism, racism, transphobia, homophobia, islamophobia, xenophobia, antisemitism, and ableism) or non-human rights-based (personal harassment or workplace harassment).

13. How to Be Successful in this Class:

Students enrolled in this class should understand the level of autonomy and self-discipline required to be successful.

1. Invest in a planner or application to keep track of your courses. Populate all your deadlines at the start of the term and schedule time at the start of each week to get organized and manage your time.
2. Make it a daily habit to log onto OWL Brightspace to ensure you have seen everything posted to help you succeed in this class.
3. Take notes as you go through the lesson material. Treat this course as you would a face-to-face course. Keeping handwritten notes or even notes on a regular Word document will help you learn more effectively than just reading or watching the videos.
4. Do not be afraid to ask questions. If you are struggling with a topic, check the online discussion boards or contact your instructor(s) and or teaching assistant(s).
5. Connect with others. Try forming an online study group and try meeting on a weekly basis for study and peer support.
6. Reward yourself for successes. It seems easier to motivate ourselves knowing that there is something waiting for us at the end of the task.

14. Western Academic Policies and Statements:

A. Absence from Course Commitments

Students must familiarize themselves with the Policy on Academic Consideration – Undergraduate Students in First Entry Programs

Students missing course work for medical, compassionate, or extenuating circumstances can request academic consideration by completing a request at the **central academic consideration portal.** Students are permitted one academic consideration request per course per term **without** supporting documentation. Note that supporting documentation is **always** required for academic consideration requests for examinations scheduled by the office of the registrar (e.g., December and April exams) and for practical laboratory and performance tests (typically scheduled during the last week of the term).

Students should also note that the instructor may **designate** one assessment per course per term that requires supporting documentation. This designated assessment is described elsewhere in this document. Academic consideration requests may be denied when flexibility in assessment has already been included. Examples of flexibility in assessment include when there are assessments not required for calculation of the final grade (e.g. 8 out of 10 quizzes) or there is flexibility in the submission timeframe (e.g. 72 hour no late penalty period).

Please note that any academic considerations granted in this course will be determined by the instructor of this course, in consultation with the academic advisors in your Faculty of Registration, in accordance with information presented in this course syllabus. Supporting documentation for academic considerations for absences due to illness should use the Student Medical Certificate or, where that is not possible, equivalent documentation by a health care practitioner.

Accommodation for Religious Holidays

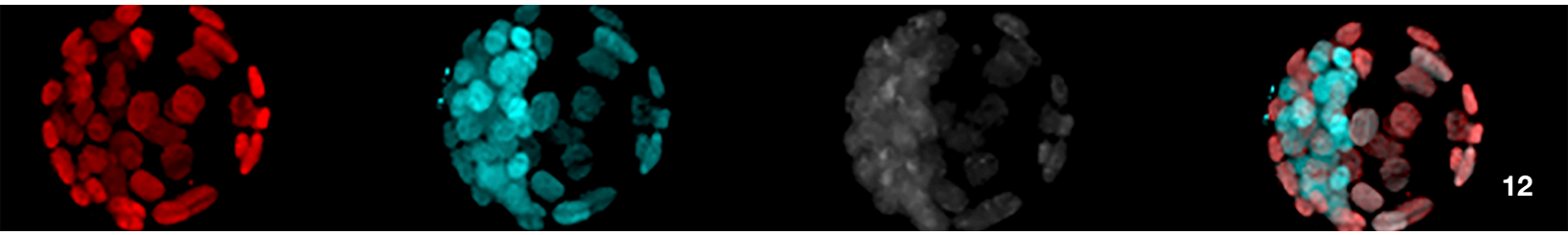
Students should review the policy for Accommodation for Religious Holidays. Where a student will be unable to write examinations and term tests due to a conflicting religious holiday, they should inform their instructors as soon as possible but not later than two weeks prior to writing the examination/term test. In the case of conflict with a midterm test, students should inform their instructor as soon as possible but not later than one week prior to the midterm.

Special Examinations

A Special Examination is any examination other than the regular examination, and it may be offered only with the permission of the Dean of the Faculty in which the student is registered, in consultation with the instructor and Department Chair. Permission to write a Special Examination may be given on the basis of compassionate or medical grounds with appropriate supporting documents. To provide an opportunity for students to recover from the circumstances resulting in a Special Examination, the University has implemented Special Examinations dates. These dates as well as other important information about examinations and academic standing can be found here.

B. Academic Offences

Scholastic offences are taken seriously, and students are directed here to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence.



Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

C. Accessibility Statement

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Accessible Education (AE) at 661-2111 x 82147 for any specific question regarding an accommodation or review The policy on Accommodation for Students with Disabilities.

Correspondence Statement

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 his/her official university address is attended to in a timely manner. You can read about the privacy and security of the UWO email accounts here.

Discovery Credit Statement

Students are permitted to designate up to 1.0 Discovery Credit course (or equivalent) for pass/fail grading that can be counted toward the overall course credits required for their degree program. The details of this policy and the deadlines can be found here.

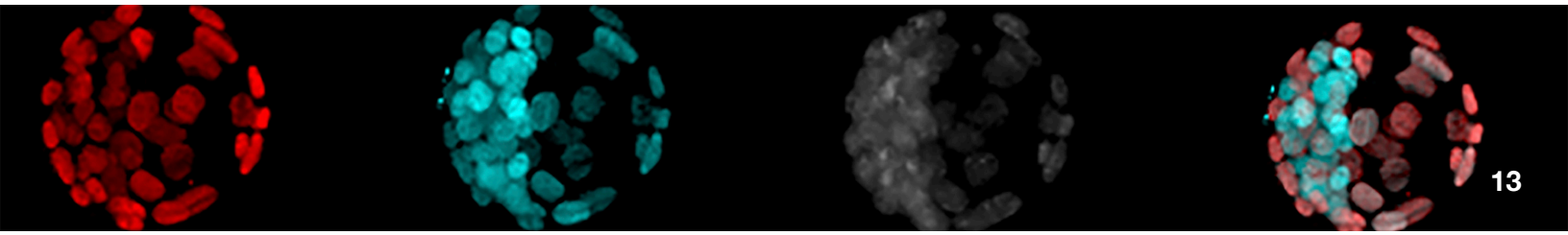
Turnitin and other similarity review software

All assignments will be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. Students will be able to view their results before the final submission. 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.

15. BMSUE Academic Policies and Statements

Cell Phone and Electronic Device Policy (for in-person tests and exams)

The Schulich School of Medicine & Dentistry is committed to ensuring that testing and evaluation are undertaken fairly across all our departments and programs. For all tests and exams, it is the policy of the School that any electronic devices, e.g., cell phones, tablets, cameras, smart glasses, smart watch or iPod are strictly prohibited. These devices MUST be left either at home or with the student's bag/jacket at the front of the room and MUST NOT be at the test/exam desk or in the individual's pocket. Any student found with one of these prohibited devices will receive a grade of zero on the test or exam. Non-programmable calculators are only allowed when indicated by the instructor. The program is not responsible for stolen/lost or broken devices.



Copyright and Audio/Video Recording Statement

Course material produced by faculty is copyrighted and to reproduce this material for any purposes other than your own educational use contravenes Canadian Copyright Laws. You must always ask permission to record another individual and you should never share or distribute recordings.

Statement on the use of ChatGPT and other Artificial Intelligence (AI) Platforms

Within this course, students are permitted to use AI tools exclusively for information gathering and preliminary research purposes. These tools are intended to enhance the learning experience by providing access to diverse information sources. However, it is essential that students critically evaluate the obtained information, exercise independent thinking, and engage in original research to synthesize and develop their own ideas, arguments, and perspectives. The use of AI tools can serve as a starting point for exploration, with students expected to uphold academic integrity by appropriately attributing all sources and avoiding plagiarism. Assignments and/or lab reports should reflect the students' own thoughts and independent written work. By adhering to these guidelines, students contribute to a responsible and ethical learning environment that promotes critical thinking, independent inquiry and allows them to produce original written contributions.

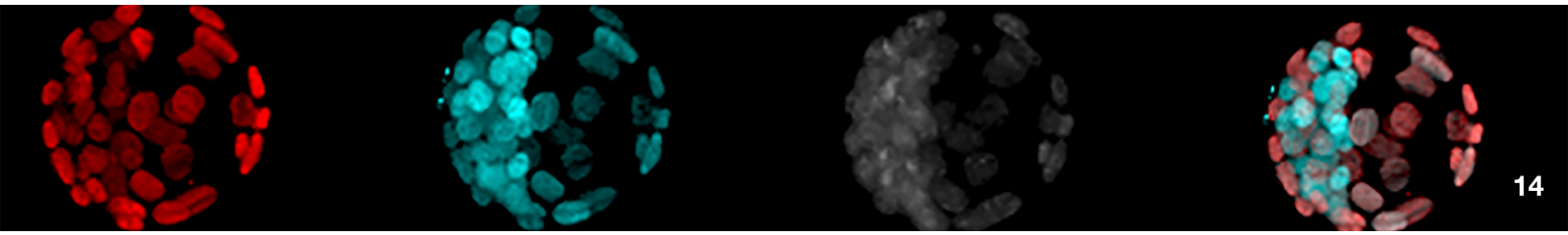
16. Support Services:

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

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

The following links provide information about support services at Western University:

- Academic Counselling (Science and Basic Medical Sciences)
- Appeal Procedures
- Registrarial Services
- Student Development Services
- Student Health Services
- Health and Mental Wellbeing



Statement on Gender-Based and Sexual Violence

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

Schulich MEDICINE & DENTISTRY

Western Science

Bachelor of Medical Sciences (BMSc) Program