

The image is a vertical split. The left half is a purple-tinted phase-contrast micrograph of a confluent cell culture. The right half is a grayscale electron micrograph showing a detailed view of a cell's internal structure, including a nucleus with a prominent nucleolus, mitochondria, and various organelles.

**Physiology 4510A**

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# Understanding Pluripotency

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*The physiology of stem cell fate and function*

**Fall 2023**

# Department of Physiology and Pharmacology

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

Course outline for Fall 2023



Although this academic year might be different, Western University is committed to a **thriving campus**. We encourage you to check out the [Digital Student Experience](#) website to manage your academics and well-being. Additionally, the following link provides available resources to support students on and off campus: <https://www.uwo.ca/health/>.

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



Stable internet connection



Laptop or computer



Working microphone



Working webcam

### 2. Course Overview and Important Dates:



Delivery Mode	Dates	Time

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

Classes Start	Reading Week	Classes End	Study Day	Exam Period
September 7	Oct 30 - Nov 5	December 8	December 9	December 10-22

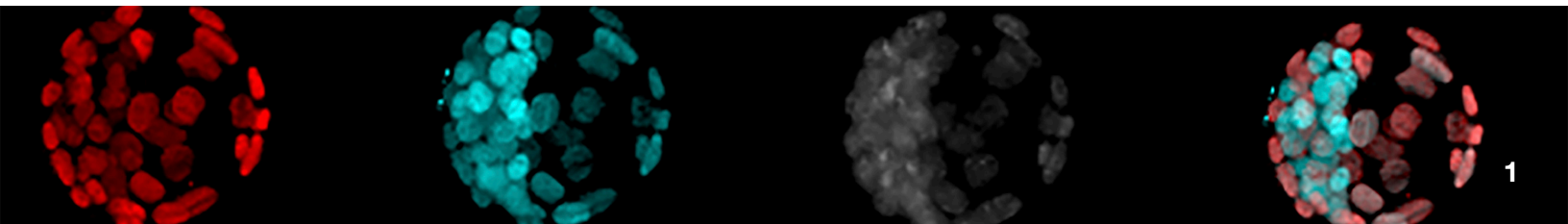
\* November 30, 2023: Last day to drop a full course and full-year half course without academic penalty.

### 3. Contact Information:



Course Co-Coordinators	Contact Information
Dean H. Betts	Use OWL message or <a href="mailto:dean.betts@schulich.uwo.ca">dean.betts@schulich.uwo.ca</a>
Cheryle A. Seguin	Use OWL message or <a href="mailto:cheryle.seguin@schulich.uwo.ca">cheryle.seguin@schulich.uwo.ca</a>

Teaching Assistant (TA)	Contact Information
Agnes Erica Terek	Use OWL message or <a href="mailto:aterek@uwo.ca">aterek@uwo.ca</a>



## 4. Course Description and Design:

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

#### Fall Term 2023

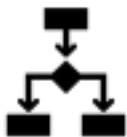
The fundamental goal of pluripotent stem cell biology is to understand how the self-renew and differentiation capabilities of these extraordinary cells are regulated to produce specialized cells capable of differentiating into a wide range of functional cell types. This course will examine a variety of current topics within the field of pluripotent stem cell physiology. In particular, 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 a thorough understanding of stem cell function and cell fate determination to assess whether regenerative medicine is feasible with pluripotent cells along with gaining the ability to critically evaluate the ethical issues that surround this field.

**Requisites:** Suggested Prerequisite(s): Physiology 3120, Physiology and Pharmacology 3000e and Physiology 3140A (or equivalent).

#### Delivery Mode:

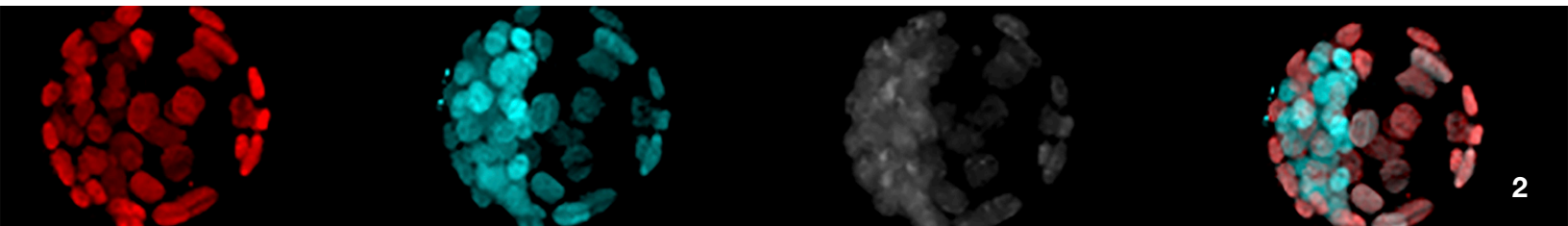
Mode	Dates	Time	Frequency

# Western Active Learning Space (WALS, Room 66 UCC)



- Asynchronous pre-work must be completed prior to synchronous sessions
- Attendance at synchronous (in-person/virtual) sessions is required
- Missed work should be completed within 48 hours
- A recording may be provided for synchronous sessions

NOTE: In the event of a COVID-19 resurgence during the course that necessitates moving away from face-to-face interaction, remaining course content will be delivered online, either synchronously (i.e., at times indicates in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online at the discretion of the instructor.



All course material will be posted to OWL: <http://owl.uwo.ca>. 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 Help page](#). Alternatively, they can contact the [Western Technology Services Helpdesk](#). They can be contacted by phone at 519-661-3800 or ext. 83800.

[Google Chrome](#) or [Mozilla Firefox](#) are the preferred browsers to optimally use OWL; update you're your browsers frequently. Students interested in evaluating their internet speed, please click here.

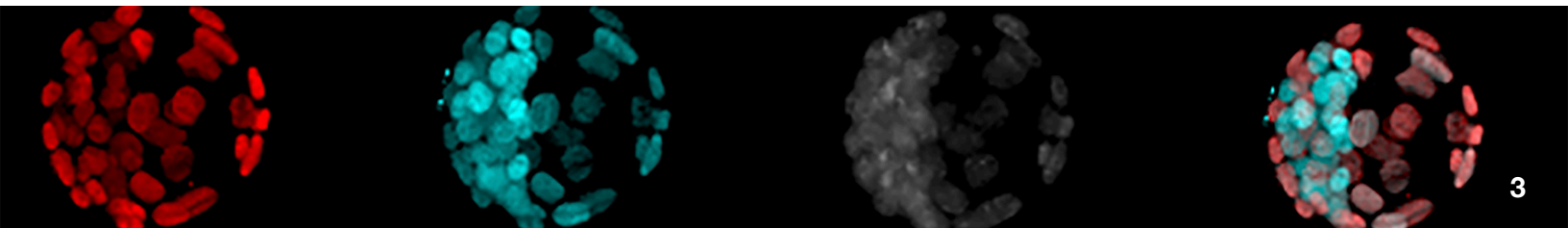
**Senate regulation regarding the student's responsibility regarding requisites:** Unless you have either the requisites for this course or written special permission from your Dean to enrol in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. 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.

**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 Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.*

## 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 students' 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 utilized a flipped classroom approach for students to conduct in-class exercises to properly examine primary research journal papers, to learn how to write scientific and lay articles and how to properly design hypothesis driven experiments. Students will be expected to come prepared to discuss the content of assigned research articles in class as well as work independently outside the lectures. The lectures will focus mainly on the factors and signalling pathways that govern development of the early embryo, embryo-derived stem cells concentrating on the physiology, utility and ethical issues that surround pluripotent stem cell technologies.



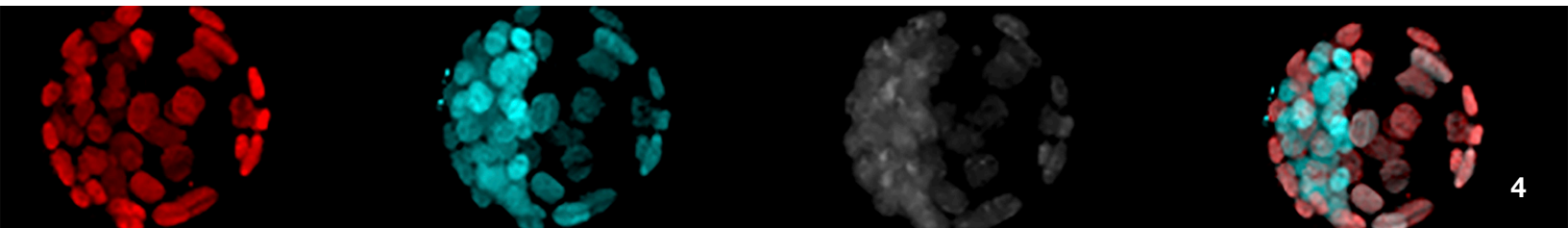
## **A student who has met the objectives of the course will be able to:**

- 🌀 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 and recorded 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

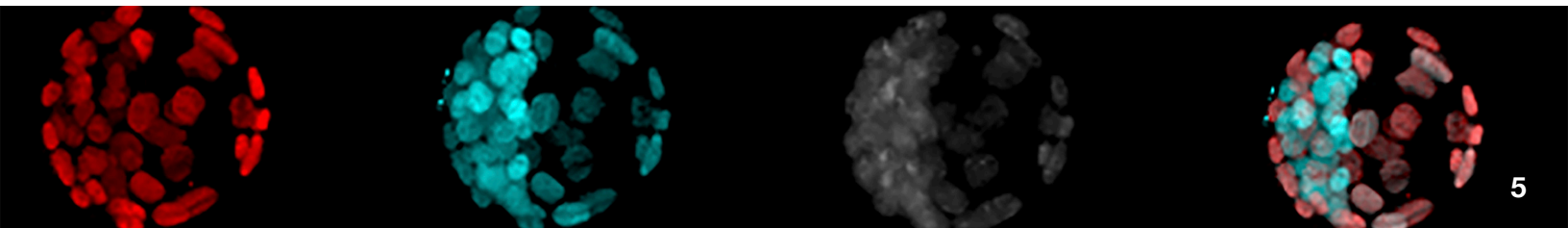


## Course Learning Outcomes:



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 ones' knowledge, 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 effectively debate complex ideas and relevant scientific and / or ethical issues to be made aware of that scientific knowledge changes, has different interpretations and that ethical issues are not always simple choices between two differing views



## 6. Course Content and Schedule:

- In-person components: Thursdays, 2:30 - 4:20 Western Active Learning Space (WALS, Room 66, UCC)



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

#	DATE	TOPIC (Instructor)	Instructor
1	Sept. 7	History of pluripotent stem cells; fundamental principles of pluripotent stem cells; Introduce “Pluripotent Stem Cell Infographic Assignment	Betts
2	Sept. 14	Cell Differentiation/Lineage Restriction - recorded lecture (OWL); In person: Tutorial; Brainstorming/feedback session for Infographic assignment	Seguin/Betts
3	Sept. 21	Embryonic Stem Cells and Pluripotency/learning activity - recorded lecture (OWL); In person tutorial	Seguin/Betts
4	Sept. 28	Extracellular Signals to Direct Stem Cell Differentiation - recorded lecture (OWL); In person: Tutorial; Introduce and brainstorm layperson assignment	Seguin/Betts
5	Oct. 5	Intracellular Signals to Direct Stem Cell Differentiation - recorded lecture (OWL); In person: Tutorial	Seguin/Betts
6	Oct. 12	Somatic Cell Cloning and Epigenetic Reprogramming in Mammals	Betts
7	Oct. 19	Induced Pluripotent Stem Cells; in-person paper discussion	Betts
8	Oct. 26	<b>In class Midterm Test (questions based on first 7 topics)</b>	Betts
9	Nov. 2	<b>No Class, Reading Week</b>	<b>N/A</b>
10	Nov. 9	“Omic approaches and genetic manipulation of pluripotent stem cells”	Betts
11	Nov. 16	“Ethical Issues Surrounding Pluripotent Stem Cells” In class activity to play “decide” ethics kit on pluripotent stem cell issue	Betts
12	Nov. 23	In class “jigsaw” presentations with class discussions	Betts
13	Nov. 30	Cell-Based Therapies from Pluripotent Stem Cells; in-person meetings with each group to discuss initial ideas	Betts
14	Dec. 7	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 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 forums with their peers and instructors.

## 8. Evaluation:

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

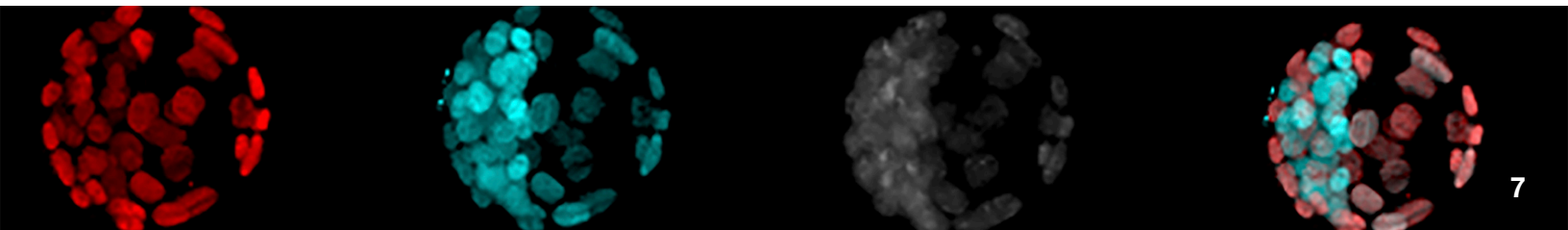
Assessment	Format	Weighting	Due Date
Stem Cell Infographic	Digital infographic	5%	Sept. 22, 2023
Layperson Article	Written assignment	10%	Oct. 20, 2023
Mid-term test	In-person, short and long answer	35%	Oct. 26, 2023
Jigsaw Presentations	In-person	10%	Nov. 23, 2023
Final Exam	In-person, short and long answer	40%	Dec. 10 - 22, 2023
<b>Total Marks</b>		<b>100%</b>	

*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.*

- All assignments are due at 11:55 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
- 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 assessments (worth >10%) without documentation will be subject to a late penalty of 5% per day
- ☒ Late assessments (worth <10%) can be submitted within 48 hours of submission date without penalty and thereafter be subject to a late penalty of 5% per day OR the weight transferred to the midterm test
- ☒ An assessment 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 test will be offered within the week following the scheduled midterm test OR the weight of the missed midterm test will be transferred to the final exam
- ☒ All course components must be completed to pass the course
- ☒ If a make-up assessment is missed, the student will receive an INC and complete the task the next time the course is offered

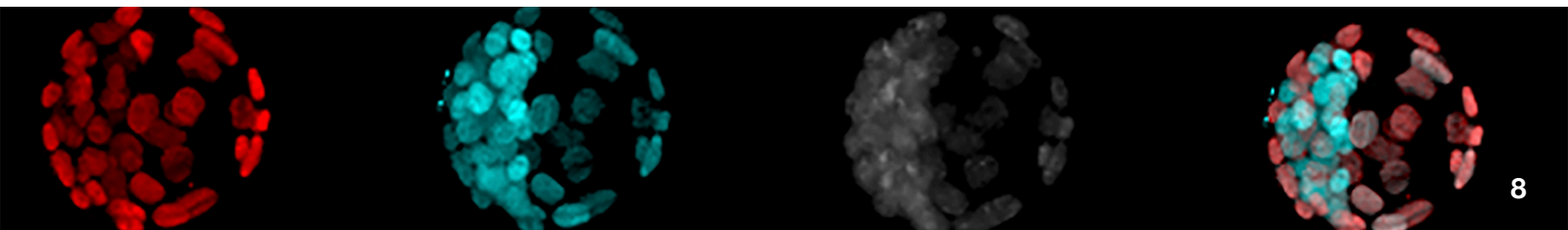
### Policy on the Rounding and Bumping of Marks:

Across the Basic Medical Sciences Undergraduate Education programs and within the department of **Physiology and Pharmacology** we strive to maintain high standards that reflect the effort that both 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., 74.4 becomes 74, and 74.5 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 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) using OWL “messages”
- ☒ Emails will be monitored daily; students will receive a response in 24 – 48 hours
- ☒ This course will use an online platform such as Zoom for synchronous course activities and student meetings





- This course will use the OWL forum for discussions
- 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 OWL

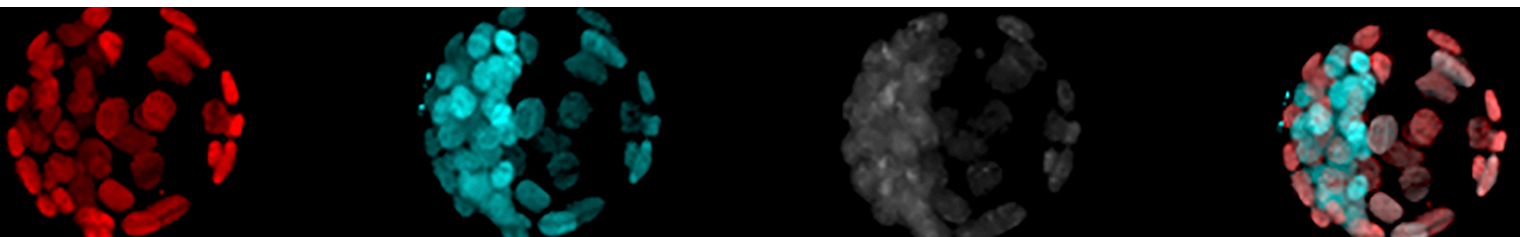
## 11. Resources:



- All resources will be posted in OWL
- No** required textbook
- No** required study guide
- Additional resources:

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:

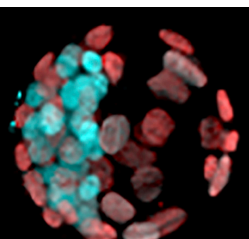
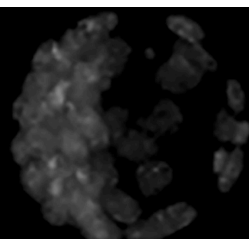
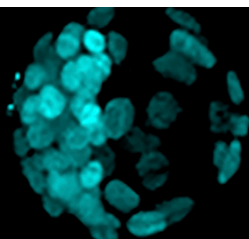
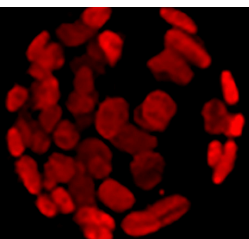
Western students are expected to follow the [Student Code of Conduct](#). Additionally, the following expectations and professional conduct apply to this course:



- Students are expected to follow online etiquette expectations provided on OWL
- 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
- Any recorded virtual sessions will remain within the course site or unlisted if streamed

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).

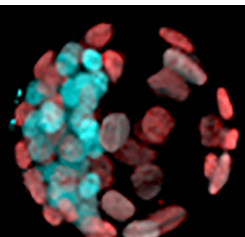
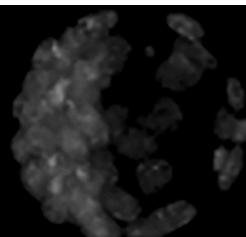
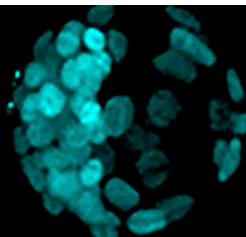
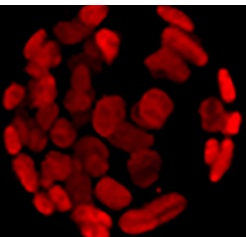
Any **student**, staff, or faculty member who experiences or witnesses' behaviour that may be harassment or discrimination **must report the behaviour** to the [Western's Human Rights Office](#). Harassment and discrimination can be human rights-based, which is also known as EDI-based, (sexism, racism, 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 to ensure you have seen everything posted to help you succeed in this class.
3. Make it a daily habit to log onto OWL to ensure you have seen everything posted to help you succeed in this class.
4. 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.
5. 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).
6. Connect with others. Try forming an online study group and try meeting on a weekly basis for study and peer support.
7. 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:

### Absence from Course Commitments

#### A. Absence for medical illness:

Students must familiarize themselves with the [Accommodation for Illness Policy](#).

A student seeking academic accommodation for any **work worth less than 10%** must contact the instructor or follow the appropriate Department or course specific instructions provided on the course outline. Instructors will use good judgment and ensure fair treatment for all students when considering these requests. You are not required to disclose details about your situation to your instructor; documentation is not required in this situation, and you should not send any pictures to your instructor.

If you are unable to meet a course requirement for any **work worth 10% or greater** due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Academic Counselling as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. Please note that the format of a make-up test, exam, or assignment is at the discretion of the course coordinator.

A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Record's Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found at: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

#### B. Absence for non-medical reasons:

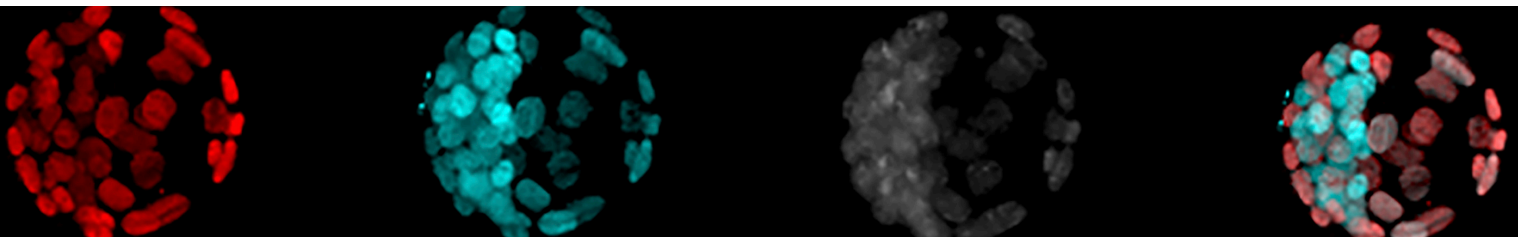
Student absences might also be approved for non-medical reasons such as religious holidays and compassionate situations. Please review the policy on [Accommodation for Religious Holidays](#). All non-medical requests must be processed by Academic Counselling. Not all absences will be approved; pay attention to the academic calendar and final exam period when booking any trips.

### 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](#).

### 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.



## 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](#).

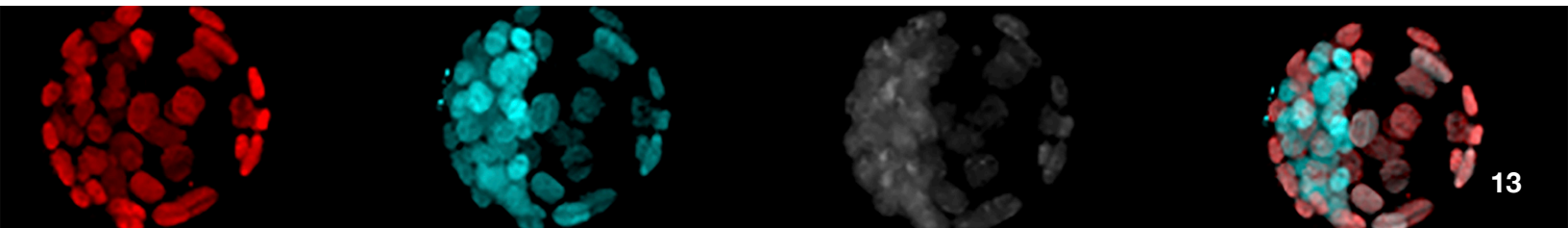
## Turnitin and other similarity review software

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. 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, i.e., cell phones, tablets, cameras, 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:

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

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](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](mailto:support@uwo.ca).

[Academic Counselling \(Science and Basic Medical Sciences\)](#)

[Appeal Procedures](#)

