

BME1454: Regenerative Medicine

Fall 2025 Syllabus

COURSE OVERVIEW

Course Description

In this course we will delve into the innovative world of regenerative medicine; a translation-forward research field that aims to restore function to aged, injured, and diseased tissues. Each of our journeys will begin by highlighting foundational discoveries in stem cell biology that opened up new regenerative medicine possibilities, followed by tracking the path forged by subsequent researchers to overcome hurdles impeding the translation of the initial discovery to clinical practice. Curated journal articles and videos, and break-out activities will frame our discussions of stem cell biology, biomaterials, tissue engineering, and gene therapy approaches to restore function to blood, heart, brain, bone, pancreas and skeletal muscle tissues, while we also consider the ethics and the translational hurdles associated with regenerative medicine therapies. Canada is the proud birthplace of the discovery of stem cells, and much of the research we will draw upon was developed by scientists in Canada.

Course Instructor

Professor Penney M. Gilbert

Email: penney.gilbert@utoronto.ca

Course Teaching Assistant

N/A

Course Location and Time

TBD

Course Format

BME1454 is a participatory course, meaning that we will learn through our interactions with one another in class. Each week on Quercus there will be required pre-class readings and other materials to review to prepare the student for the upcoming class. The class component of the course, comprised of class discussions, break-out activities, and short knowledge check quizzes, will be delivered synchronously (in person).

Learning Outcomes

Upon completion of this course, a student should be able to:

- Describe landmark research experiments that led to the discovery of stem cells of the hematopoietic and neural tissues, as well as to the discovery of embryonic stem cells and induced pluripotent stem cells, and those that opened up the field of tissue engineering.
- Discuss the advantages and challenges associated with adult vs embryonic vs pluripotent stem cell therapies.
- Discuss the advantages and challenges associated with endogenous repair stem cell therapies vs stem cell transplantation therapies
- Discuss the ethics of regenerative medicine therapies

- Give examples of scientific, technical, and procedural hurdles that impede the translation of cell therapies, and offer putative solutions
- Give examples of scientific, technical, and procedural hurdles that impede biomaterial-based regenerative medicine therapies, and offer putative solutions
- Evaluate primary research articles and conduct critical assessments by identifying and ensuring that the major scientific conclusion(s) is/are appropriately supported by the data and that minor scientific conclusions avoid overstatements.
- Employ inclusive approaches in small team discussions with a spirit of ensuring that all classmates comprehend the course materials

MARKING*

Mark Breakdown

Knowledge Check Quizzes	70%
Rabbit Hole Assignment	30%
Total	100%

*Remark: This course requires the completion of all components listed in the mark breakdown.

Knowledge Checks

Each week you will find on Quercus the required and optional pre-class preparation materials. The materials will be comprised of a mix of items to read and short videos to watch. Each required reading will be accompanied by a Reflection Questions document to guide your learning. In the first half of the course, the Reflection Questions will be provided one-week before class while in the second half of the course the Reflection Questions will be provided in class. There will be Knowledge Check Quizzes, based primarily on the Reflection Questions. These Quizzes are expected to take place at the end of class each week, with the exception of Week 1, for which the Knowledge Check Quiz will be conducted on Quercus and is due ahead of class.

Note: On Quercus there will be readings marked with the label 'suggested'. These are relevant and recommended pieces of literature, but are not required reading.

Regen Med "Rabbit Hole" Assignment

To encourage curiosity and independent learning, this course has a Rabbit Hole assignment. Professor Gilbert will provide a list of possible Rabbit Hole topic areas for students in the class to choose from. The topics will be related to the BME1454 course materials, but are not directly covered within the BME1454 course content. Each student will choose one of the topic areas for which to conduct their independent inquiry. Students will deliver an oral presentation on their topic area in the last weeks of class. Additional details of this assignment can be found in the Rabbit Hole Assignment module on Quercus.

Participation & Missed Class Policy

The in class portion of this course has a strong participation component, and therefore, attendance and participation is expected. In each class we will form small groups for discussions and break-out activities. The topic of the discussions will be defined, and there will be roles to assign amongst

yourself. You will not be permitted to take the Knowledge Check Quiz if you arrive to class more than 10 minutes late (i.e. 20 minutes past the hour) without prior permission from Prof. Gilbert. It will not be possible to make-up any missed Knowledge Check Quizzes that were conducted in person. Each student will be allowed one missed class, no questions asked, without loss of the Knowledge Quiz marks. For all subsequent missed classes, failure to notify Dr. Gilbert within 48 hours of a class absence related to illness or other issues will result in the automatic loss of the Knowledge Check Quiz mark for that day.

ADDITIONAL POLICIES & RESOURCES

Equity, Diversity, Inclusivity

You belong here. The University of Toronto Engineering commits to all students, instructors, staff, alumni and partners that you can learn, create and participate in a welcoming, healthy and respectful environment. In this class, the participation and perspectives of everyone is invited and encouraged. The broad range of identities and intersections of identities within an inclusive team environment will help you achieve academic success. You can read the evidence for this approach here:

<https://www.weforum.org/agenda/2019/04/business-case-for-diversity-in-the-workplace/>.

You are not alone. You are invited to talk to anyone in the Faculty that you feel comfortable approaching, including your professor, teaching assistant, academic advisor, any staff member, the Engineering Equity Diversity & Inclusion Action Group, a culture or identity club or group, or a U of T Equity Office.

Department Administrators: <https://gradstudies.engineering.utoronto.ca/grad-admins/>

Engineering Equity, Diversity & Inclusion Action Group & Clubs: www.uofteng.ca/edi

U of T Equity Offices: <https://hrandequity.utoronto.ca/inclusion/equity-offices/>

You have rights under the Ontario Human Rights Code that protect you against all forms of harassment or discrimination, including but not limited to acts of racism, sexism, Islamophobia, anti-Semitism, homophobia, transphobia, ableism and ageism. Engineering denounces unprofessionalism or intolerance of any kind, whether in person or online, on or off-campus. If you experience or witness any of these behaviours, please tell someone so we can help with resources and resolution.

Engineering takes these reports extremely seriously. You can confidentially disclose directly to Marisa Sterling, P.Eng, Assistant Dean, Diversity, Inclusion and Professionalism.

Phone: 416.946.3986

Email: disclosure.engineering@utoronto.ca

Submit confidential disclosure form: www.uofteng.ca/disclosure

Ontario Human Rights Code: <http://www.ohrc.on.ca/en/students%E2%80%99-handouts/fact-sheet-1-ontario-human-rights-code>

Mental Health

Engineering at the University of Toronto is a demanding program. The workload and the frequency of assignments and tests can be challenging to balance and can feel overwhelming. As a result, students

can find themselves experiencing physical and/or mental health issues which impact their academic performance and overall well-being.

If you find yourself feeling distressed and in need of more immediate support resources, consider reaching out to the counsellors at My Student Support Program (MySSP) (www.uoft.me/myssp) or visiting U of T Engineering's Urgent Support – Talk to Someone Right Now webpage (<https://uofteng.ca/talknow>).

If you are encountering challenges that significantly affect your academic performance and overall wellbeing, there are a variety of free and confidential supports that can help you. As a U of T Engineering student, you have your Departmental Graduate Administrator (www.uoft.me/gradadmin) who can advise on personal matters that impact your academics. You can find helpful people, services and resources like these listed on the U of T Engineering Mental Health & Wellness webpage (www.uofteng.ca/mentalhealth) and SGS Health and Wellness Resources (<https://www.sgs.utoronto.ca/gradhub/resources-supports/#health-wellness>)

A small selection is also included here:

- Accessibility Services (www.studentlife.utoronto.ca/as)
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- Health & Wellness (www.healthandwellness.utoronto.ca)
 - On-Location Health & Wellness Engineering Counsellor (<https://www.sgs.utoronto.ca/resources-supports/graduate-wellness-services-at-sgs/>)
- Student Life Academic Success (<https://studentlife.utoronto.ca/department/academic-success/>)
- U of T Engineering's Mental Health Programs Officer (www.uofteng.ca/mentalhealth#MHPO)
- SGS Financial Aid (<https://www.sgs.utoronto.ca/awards-funding/financial-aid-advising/>)

We encourage you to access these resources as soon as you feel you need support; no issue is too small.

Academic Integrity

All suspected cases of academic dishonesty will be investigated following procedures outlined in the *Code of Behaviour on Academic Matters*. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, please reach out to me. Note that you are expected to seek out additional information on academic integrity from me or from other institutional resources (for example, the [University of Toronto website on Academic Integrity](#)).

Notice of Recording & Sharing

This course, including your participation, may be recorded on video and if so, will be made available to students in the course for remote viewing after the session.

Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation and are protected by copyright. In this course, you are permitted to download session videos and materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the instructor. For questions about the recording and use of videos in which you appear, please contact your instructor.

Accommodation

The University of Toronto supports accommodations for students with diverse learning needs, which may be associated with mental health conditions, learning disabilities, autism spectrum, ADHD, mobility impairments, functional/fine motor impairments, concussion or head injury, visual impairments, chronic health conditions, addictions, D/deaf, deafened or hard of hearing, communication disorders and/or temporary disabilities, such as fractures and severe sprains, or recovery from an operation.

If you have a learning need requiring an accommodation the University of Toronto recommends that students register with Accessibility Services as soon as possible. Register at: <https://studentlife.utoronto.ca/service/accessibility-services-registration-and-documentation-requirements/>

We know that many students avoid seeking help because they feel that they should not need “unfair advantages.” The purpose of academic accommodation is not to give an unfair advantage, but to help remove an unfair disadvantage. It may feel difficult to ask for help, but it can make all the difference during your time here.

Phone: 416-978-8060

Email: accessibility.services@utoronto.ca

Religious Observances

The University provides reasonable accommodation of the needs of students who observe religious holy days other than those already accommodated by ordinary scheduling and statutory holidays. Students have a responsibility to alert members of the teaching staff in a timely fashion to upcoming religious observances and anticipated absences and instructors will make every reasonable effort to avoid scheduling tests, examinations or other compulsory activities at these times.

Please reach out to me as early as possible to communicate any anticipated absences related to religious observances, and to discuss any possible related implications for course work.

Family Care Responsibilities

The University of Toronto strives to provide a family-friendly environment. You may wish to inform me if you are a student with family responsibilities. If you are a student parent or have family responsibilities, you also may wish to visit the Family Care Office website at familycare.utoronto.ca.

Late Assignments

A 5% penalty for each day that the assignment is late will be applied.

Regrades

If you would like to contest a grade on an exam or assignment, you must submit a written explanation of why you think the grade was incorrect. Please note that the ENTIRE exam or assignment may be subject to re-evaluation and your score may therefore go up, go down or remain the same. Regrade requests must be submitted to the instructor within two days of when the exam/assignment is returned.

Schedule

Owing to the uncertainties of the world, and the vagaries of life, it may be necessary to make some adjustments in the details of the course schedule.