PHC432H1: Nanomedicines in Oncology
Leslie Dan Faculty of Pharmacy, University of Toronto

Winter 2024 Course Syllabus

I   TEACHING TEAM

INSTRUCTOR
Name: Christine Allen
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CO-INSTRUCTOR(S)
Name: Tameshwar Ganesh
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II   COURSE OVERVIEW

COURSE DESCRIPTION:
This course covers a range of topics that pertain to the development and application of nanomedicines in oncology. Students will gain an understanding of the biological barriers to drug delivery in oncology as well as the tremendous heterogeneity in cancer and the challenge this presents for treatment. The concepts of passive and active targeting of nanomedicines will be covered with critical assessment of the enhanced permeability and retention effect. A detailed overview of the most advanced nanotechnology-platforms for drug delivery will be provided with additional discussion of new emerging platforms. The integration of imaging in drug development and development of theranostics and therapeutic-diagnostic pairs will also be discussed. Finally, an overview of some of the factors that influence pharmacokinetics and toxicology of nanomedicines will be introduced. Special emphasis on critical evaluation of scientific literature and pre-clinical/clinical studies will be made throughout the course

STUDENT LEARNING OUTCOMES:
The objective of this course is to provide an overview of the field of nanomedicine in oncology.
At the end of the course students will be able to critically analyse scientific advances in the field.

PREREQUISITE COURSE(S):
PHC230H1, PHC330H1 and enrolled as a Year 4 student in the Pharmaceutical Chemistry specialist program

III   COURSE ORGANIZATION

This course is organized by lectures on subject units relevant to drug delivery.
LECTURE LOCATION: PB 255 (2nd floor pod, LDFP)
LECTURE HOURS: Thursday 10am – 12pm

COURSE SCHEDULE & RELEVANT SESSIONAL DATES:

Week	Topic	Instructor	Date and Time
1	**Introduction to Nanomedicines in Oncology**	**Dr. Ganesh (1)**	**Thurs Jan 11 10am – 12pm**
2	**Biological Barriers to Drug Delivery in Oncology**	**Dr. Ganesh (2)**	**Thurs Jan 18 10am – 12pm**
3	**Targeting Solid Tumors: The EPR Effect Deconstructed**	**Dr. Ganesh (3)**	**Thurs Jan 25 10am – 12pm**
4	**Heterogeneity in Cancer: Impact on Design and Effectiveness of Nanomedicines**	**Prof. C. Allen (1)**	**Thurs Feb 1 10am – 12pm**
5	**Nanotechnology Platforms – Polymeric Conjugates, Micelles and Nanoparticles**	**Dr. Le Devedec and Prof Allen (2)**	**Thurs Feb 8 10am – 12pm**
	MIDTERM EXAM	**FEBRUARY 15**	
	READING WEEK	**FEBRUARY 19 - 23**	
6	**Nanotechnology Platforms – Liposomes**	**Prof. C. Allen (3)**	**Thurs Feb 29 10am – 12pm**
7	**Nanotechnology Platforms – Thermosensitive Liposomes**	**Prof. C. Allen (4)**	**Thurs Mar 7 10am – 12pm**
8	**Introduction to imaging**	**Dr. Ganesh (4)**	**Thurs Mar 14 10am – 12pm**
9	**Nanomedicines and Imaging Theranostics and Diagnostic-Therapeutic Pairs**	**Dr. Ganesh (5)**	**Thurs Mar 21 10am – 12pm**
10	**In Class Presentations and Discussion**	**Presentations and Discussion**	**Thurs Mar 28 10am – 12pm**
11		**Presentations and Discussion**	**Thurs April 4 10am – 12pm**

IV   GRADING SCHEME

Assessments	
Assessment #1	**Midterm Exam*** (covers material from lectures 1-5 inclusive)
Assessment #2	**Oral Presentation*** – students will be asked to prepare a 15 min presentation (+ 5 mins for questions) on a drug relying on formulation in an advanced delivery technology that has reached clinical evaluation. In the presentation the students should review method of preparation and physico-chemical characterization of the formulation, pre-clinical pharmacokinetics, biodistribution and

	efficacy data and discuss clinical data (if any is available) or provide an overview of clinical trials that are ongoing. The students will be expected to discuss shortcomings and strengths of the studies that have been conducted and suggestions for improvements. The students will either work individually or in groups depending on course enrollment. **(Presentations in weeks 10 and 11) Weighting = 10%**
Assessment #3	**Final Exam*** (covers lectures 6-9 inclusive)

*note that the highest test grade earned from Midterm and Final exam will be weighted at 50%, with the other weighted at 40%. Each test will consist of a mixture of multiple-choice, short answer, and essay type questions and will not be explicitly cumulative.

Missed Midterm or Final Exam Policy*
Students who miss an examination and who have a valid petition, approved by the Registrar, will be eligible to write a make-up exam. The format of this examination or test will be at the discretion of the course coordinator, and may include, for example, an oral examination.

Missed Oral Presentation*
Students who miss their oral presentation and who have a valid petition, approved by the Registrar, will be given an opportunity to present to the Course Coordinator (and possibly class) at a different time.

V COURSE POLICIES

- Each member of this course is expected to maintain a:

(i) professional and respectful attitude during all course activities
(ii) personal calendar/schedule/organizer to ensure that all course activities are completed, and due dates are met.
(iii) collection of notes recorded independently based on concepts covered in course activities (students registered with Accessibility Services requiring a class note-taker will have access to this accommodation)
(iv) familiarity with the university policy on Academic Integrity (overleaf)

- The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. As a Course Instructor, I will neither condone nor tolerate behaviour that undermines the dignity or self-esteem of any individual in this course and wish to be alerted to any attempt to create an intimidating or hostile environment. It is our collective responsibility to create a space that is inclusive and welcomes discussion. Discrimination, harassment and hate speech will not be tolerated. If you have any questions, comments, or concerns, we encourage you to reach out to the staff in our Equity Offices.

- Privacy language and appropriate use of course materials:
  https://teaching.utoronto.ca/ed-tech/audio-video/sample-statements/

VI   TECHNOLOGY REQUIREMENTS

- Specific guidance from the U of T Vice-Provost, Students regarding student technology requirements is available here: https://www.viceprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning/

- Advice for students more broadly regarding online learning is available here: https://onlinelearning.utoronto.ca/getting-ready-for-online/
- This course requires the use of computers, and technical issues are possible. When working on a piece of academic work, students are responsible for scheduling enough time to allow for reasonable delays due to technical difficulties to be overcome, so such issues will not be acceptable grounds for deadline extension. Particularly, maintaining an up-to-date independent backup copy of your work is strongly recommended to guard against hard-drive failures, corrupted files, lost computers, etc.

VII   INSTITUTIONAL POLICIES & SUPPORT

ACADEMIC INTEGRITY
Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In virtual laboratory reports:
1. Using someone else's ideas or words without appropriate acknowledgement.
2. Submitting your own work in more than one course without the permission of the instructor.
3. Making up sources or facts.
4. Obtaining or providing unauthorized assistance on any report. **Please note that the use of websites (such as Chegg.com or the course discussion board) to post virtual laboratory report material/questions or to post/access answers to questions is an academic offence under the University of Toronto's Code of Behaviour on Academic Matters. Alleged instances of this nature are forwarded to the Faculty of Arts & Science Student Academic Integrity office.**

On quizzes and term tests:
1. Using or possessing unauthorized aids. **Please note that the use of websites (such as Chegg.com or the course discussion board) to post quiz/term test questions or to post/access answers to questions is an academic offence under the University of Toronto's Code of Behaviour on Academic Matters. Alleged instances of this nature are forwarded to the Faculty of Arts & Science Student Academic Integrity office.**
2. Looking at someone else's answers or collaborating/discussing answers during a quiz or term test.

3. Misrepresenting your identity.

In general academic work:
1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required by the University.

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, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see www.academicintegrity.utoronto.ca/).

Plagiarism Detection
Normally, students will be required to submit their course essays to the University's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation web site (https://uoft.me/pdt-faq).

COPYRIGHT
If a student wishes to copy or reproduce class presentations, course notes or other similar materials provided by instructors, he or she must obtain the instructor's written consent beforehand. Otherwise, all such reproduction is an infringement of copyright and is absolutely prohibited. More information regarding this is available here: https://teaching.utoronto.ca/ed-tech/audio-video/copyright-considerations/

ACCESSIBILITY NEEDS
Students with diverse learning styles and needs are welcome in this course. The University of Toronto is committed to accessibility: if you require accommodations for a disability, or have any other accessibility concerns about the course, please contact Accessibility Services as soon as possible.

ACCOMMODATIONS FOR RELIGIOUS OBSERVANCES
Following the University's policies, reasonable accommodations will be made for students who observe religious holy days that coincide with the due date/time of an assignment, tutorial, class or laboratory session. Students must inform the instructor **before** the session/assignment date to arrange accommodations.

ADDITIONAL SERVICES & SUPPORT
The following are some important links to help you with academic and/or technical service and support:

- General student services and resources at Student Life
- Full library service through University of Toronto Libraries
- Resources on conducting online research through University Libraries Research
- Resources on academic support from the Academic Success Centre

- Learner support at the [Writing Centre](#)
- Information for [Technical Support/Quercus Support](#)

ACKNOWLEDGEMENT OF TRADITIONAL LANDS

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca and, most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.