

Department of Chemistry  
Faculty of Science  
The University of Western Ontario

#### 1. Course Information

Course Name: Chemistry 9608T – Polymers in Cell and Drug Delivery

Lectures: Wednesdays and Fridays, 2:00 pm to 3:30 pm; Start Date: March 3, 2021

Location: Online/Remote, Synchronous (Zoom)

#### 2. Instructor

Arghya Paul, PhD

Associate Professor

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#### 3. Course Description

Polymers have played an integral role in the advancement of drug delivery and other biomedical applications. Design and synthesis of new (bio) polymers and polymer composites have led to the development of several novel drug delivery systems with minimum toxicity.

This quarter course will provide students with a basic understanding of the (i) core concepts and molecular principles of polymeric materials and polymer-based hydrogels, (ii) structure-property relationships of polymers, (iii) strategies used to rationally design polymeric platforms for effective cell/drug delivery and tissue engineering. Towards that goal, the course will focus on topics at the interface of science, engineering and medicine such as polymer chemistry, biomaterials, tissue engineering and bioprinting, mass transport, and pharmacokinetics. Special emphasis will be given to understand surface and bulk properties of the polymers. This knowledge will help develop polymers with desired chemical, interfacial, mechanical and biological functions.

Through lectures, presentations, interactive class activities and problem sets, we will cover several aspects of polymer science in biopharmaceutics, such as: designing polymeric scaffolds for tunable release of hydrophilic and hydrophobic drugs, applications of stimuli-responsive polymer systems and polymer therapeutics (e.g. polymer-protein and polymer-drug conjugates), route of administrations and physiological barriers to drug delivery, fabricating 3D printable bioinks and mechanically robust hydrogels for tissue engineering, polymer nanocomposites that can exert distinct biological functions.

#### 4. Evaluation (tentative)

- Participation (On-line/Remote): 10%
- One Project Report: 20%
- One Presentation: 30%
- One Exam: 40%

**5. Prerequisites:** Basic knowledge of polymer science and cell biology at an introductory level is desirable.

## **6. Course Materials**

There are no official required textbooks for this course. Students will be provided with reading materials such as journal articles throughout the course. Alongside, detailed lecture notes will be provided. The books listed below are optional and helpful reference material:

- 1) Title: Fundamental Principles of Polymeric Materials, Authors: C. S. Brazel and S. L. Rosen, Publisher: Wiley.
- 2) Title: Polymer Science & Technology, Author: Joel R. Fried, Publisher: Prentice Hall.
- 3) Title: Drug Delivery: Engineering Principles for Drug Therapy, Author: W. Mark Saltzman, Publisher: Oxford University Press.
- 4) Title: Drug Delivery: Fundamentals & Applications, Author: Anya Hillery, Kinam Park Publisher: CRC Press.
- 5) Title: Engineering Polymer Systems for Improved Drug Delivery Author: Rebecca Bader and David Putnam Publisher: Wiley.

**7. Learning outcome:** Upon completion of this course, students will be able to:

- Understand the fundamentals principles of polymeric biomaterials and learn about different polymerization methods and techniques
- Able to rationally select polymers and polymeric scaffolds for drug delivery and tissue engineering applications
- Predict how drug delivery of polymeric materials can be controlled through chemical modifications and materials engineering
- Work from experimental data to deduce the mechanical properties of polymeric materials
- Think critically, generate and present new ideas for delivery of therapeutics tailored towards specific biomedical applications
- Able to communicate science effectively in oral and written form (professional development)

## **8. Course attendance, expectations and missed tests/exams**

Online Course attendance is highly recommended for Chem 9608T, particularly considering the interdisciplinary nature of the course and points associated with in-class activities. You are responsible for all information disseminated in class. Information missed due to course absences will not be considered for the basis of a grade appeal.

Arrival (online) on time is expected. Please turn off all cell phones upon entering class. Reading of newspapers, work on assignments for this or other classes, or other activities that are not part of the class are not allowed during lecture. Students who do not comply with these requirements or who behave disorderly or disrespectfully may be asked to leave the classroom.

If you are unable to meet a course requirement due to illness or other serious circumstances, you must contact your instructor within 48 hours after you are able to resume academic duties with valid medical or other supporting documentation.

Once your absences have been excused, an alternate date for presentation or exam will be arranged. 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.

No "make-up" activities/evaluation will be provided for the course. If the absence is excused, missed activities marks will be transferred to the exam.

## **9. The fine print - University guidelines on various other issues:**

**A. Medical/Compassionate Excuses:** Students missing work for valid medical or other reasons are governed by the regulations <https://studentservices.uwo.ca/secure/index.cfm>

**B. Student Accessibility Services (SAS):** Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting, advocating, and accommodating persons with disabilities in their respective graduate program. Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are encouraged to register with Student Accessibility Services, a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both SAS and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that appropriate academic accommodations to program requirements are arranged. These accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction. For more information, see <http://www.sdc.uwo.ca/ssd/>

**C. Academic Offences:** Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: [http://www.uwo.ca/univsec/handbook/appeals/scholastic discipline undergrad.pdf](http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf)

**D. Support Services:** Support is available from the Registrar: <http://www.registrar.uwo.ca>, via the university students council (<http://westernusc.ca/services/>) and at Student Development Services (<http://www.sdc.uwo.ca/>). In particular, learning-skills counsellors at the Student Development Centre are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

**E. Mental or Emotional Health:** Students who are in emotional/mental distress should refer to Mental Health@Western <http://www.uwo.ca/uwocom/mentalhealth/> for a complete list of options about how to obtain help.