

Biopharmaceutics and Nanomedicine – CHE702

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Date to be offered: Wednesday 6:00- 8:50 pm

Location: CKB 120

Prerequisite: Graduate standing

Course description:

The course aims to provide an introduction to biopharmaceutics and nanomedicines and discuss advanced oral, injected, topical, and inhaled drug delivery systems. This course is designed to furnish students with an understanding of state-of-the-art advanced pharmaceuticals, with a particular focus on biologic drugs (proteins, peptides, nucleic acids, vaccines, and cells). The course will initially cover the major families of biologic drugs and nanomedicines, along with the major challenges associated with their delivery and specific disease applications for these drugs. Additionally, the course will delve into fundamental principles for drug delivery, encompassing mass transport, bio-distribution, bio-availability, and pharmacokinetic/pharmacodynamic aspects. The class format will include lectures and critiques of recent literature.

By the end of the course, students will be able to:

- Identify advanced approaches for controlled drug delivery in an effective manner, from administration to site-specific delivery.
- Familiar with state-of-the-art technologies in biopharmaceutics and nanomedicine.
- Assess the pros and cons of drug delivery systems.
- Classify dosage forms by formulation, route of administration and mechanism of drug release.
- Design appropriate formulations for delivering different therapeutics, including small molecule drugs, protein drugs and genes.
- Propose methods and relevant experiments to validate delivery efficacy of certain drugs.

Tentative schedule:

Date	Topic	Assignment
	Introduction of Biopharmaceutics, Nanomedicine and Drug delivery	
	Protein, Peptide, siRNA, DNA, cell	
	Drug delivery barriers	
	Drug administration routes (injection, oral, topical, inhalation, etc.)	

	Intracellular Delivery and Trafficking	
	Nanotechnologies and Nanomedicines	
	Nucleic Acid Therapeutics and Delivery (siRNA, plasmid DNA, mRNA, etc.)	
	Protein Therapeutics and Delivery	
	Cell based Therapeutics	
	Gene Editing	
	Vaccines	
	Diffusion, permeability, dissolution	
	Kinetics of delayed release, sustained and controlled release	
	Implantable delivery systems	
	Tumor drug delivery	
	Oral delivery	
	Topical delivery	
	Inhalation and Sublingual	
	Challenges and perspectives	

Texts and supplemental materials: Relevant articles will be sent to the class prior to lectures.

Lectures

- This course is a face-to-face course and attending the class sessions in person is mandatory.
- Food and drink are expressly prohibited in the classroom.
- Cellphones should be turned off during lectures.
- Students are expected to be in the classroom by the start time of each class.

Attendance: Attendance is mandatory. You must notify the instructor in advance if possible, of any absence by sending an email stating the date and reason for the absence. If you are absent for up to two class periods because of illness or injury, an email message stating the reason for absence will be sufficient. If you are absent from more classes because of illness or injury, verification of a visit to a health care professional may be required. Two times class absence (without verification/notification) will disqualify your final exam for this course.

Evaluation: Grades will be determined based on class participation and assigned homework (25%), midterm exam (25%), and project report/presentation (50%) given by the students. Homework assignments (literature summaries and short lecture) for this course are considered individual assignments. Students may discuss the questions with other students in the course, but each student should prepare their solutions to the assignment individually.