

Fall 2025
Drug Delivery Fundamentals and Applications
16:125:590:01
16:155:544:01

**CBE MS/ME/PhD students should register for 155:544.
BME students should register for 125:590.
All other students may register for either.*

Course instructor: Professor Charlie Roth, cmroth@rutgers.edu

Time and location: Wed. 5:40-8:40 (will end earlier), BME-116.

Office hours: Fri. 11:00-12:00 on Zoom, or by arrangement in person.

Textbook: Saltzman, W. Mark. Drug Delivery: Engineering Principles for Drug Therapy, ISBN 0-19-508589-2 (recommended, not required).

Synopsis: This course will discuss the engineering of novel pharmaceutical delivery systems with enhanced efficacy and safety profiles, with an emphasis on the design and application of materials that overcome drug delivery barriers or challenges. Topics will include drug delivery fundamentals and transport mechanisms, materials and formulations for drug delivery, and applications.

Prerequisites: This is an interdisciplinary course that historically has drawn students from Chemical & Biochemical Engineering, Biomedical Engineering, other engineering programs, Chemistry, Pharmacy, and various life science programs. The course content will integrate elements from engineering, physiology, biology, and chemistry/materials science. Each student in the course is likely to be comfortable with some of these areas and somewhat uncomfortable in others. Thus, everybody has something to contribute and something to learn, and there is no specific prerequisite for the course. Advanced undergraduates who have completed their core coursework and have a strong academic standing can enroll with permission of the instructor.

Modes of instruction and assessment: A set of online materials (generally voice over Power Point, and readings) will be available on Canvas each week for initial presentation of core material. In class, we will typically spend 40-60 minutes highlighting key or difficult conceptual points and going over review and example problems. The remainder of class time (30-80 minutes) will be spent on class discussions, often associated with journal articles that you will read before class. In other instances, we will have a guest lecturer/discussant. You will be expected to review the online materials, attempt example problems, and in some cases engage in online discussions **before each class meeting**.

Assessment: Assessment will be based on weekly assignments, class and online discussions, one midterm exam (in-person), and a term project where you will develop preclinical and clinical testing plans for a novel drug delivery formulation. The primary objectives of the course are to make students knowledgeable about the design, formulation and evaluation of drug delivery systems; to provide them with sufficient background to be able to read and understand the scientific literature in this area; and to foster creative, yet scientifically-based, thinking regarding novel approaches or fundamental advances to be made in drug delivery. Grades will be based on the following breakdown.

Homework assignments - 20%, Discussion - 10%, Exam - 30%, Term project - 40%.

Academic Integrity: This course requires students to summarize the work of others and to create original work. It is critical that work submitted is the student's own work and that due credit is given to others whose work is cited or otherwise utilized. Please review the updated Academy Integrity policy for Rutgers-New Brunswick at <http://nbacademicintegrity.rutgers.edu/home/for-students/>.

Accommodations for Disabilities: Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the registration form on the ODS web site.

Note: I reserve the right to amend course policies, including the grading rubric, due to changing circumstances at my discretion.

Syllabus (subject to slight alterations)

<i>Week</i>	<i>Class date</i>	<i>Topic</i>
		Drug Delivery Barriers and Formulations
1	Sept. 3	Introduction and Overview
2	Sept. 10	Pharmacokinetics
3	Sept. 17	Drug Conjugates and Nanoparticles
4	Sept. 24	Cellular and Intracellular Transport of Drugs
5	Oct. 1	Transport in Tissues
6	Oct. 8	Pharmaceutical Dosage Forms
		Engineered Drug Delivery Systems
7	Oct. 15	Controlled Release Drug Delivery Systems
8	Oct. 22	Physiologically Targeted Drug Delivery
9	Oct. 29	<i>Midterm Exam (covers Modules 1-7)</i>
10	Nov. 5	Precision Targeted Drug Delivery
		Applications
11	Nov. 12	Transdermal Drug Delivery
12	Nov. 19	GI and Pulmonary Delivery
	Nov. 26	<i>No class - Happy Thanksgiving!</i>
13	Dec. 3	Gene and Oligonucleotide Delivery - part I
14	Dec. 10	Gene and Oligonucleotide Delivery - part II
15		<i>Term Project Submission</i>