

## Drug Delivery Systems

Instructor: Eduardo A. Silva

Course Description: This course will review the fundamental engineering and biotechnology principles critical for the formulation and delivery of therapeutic agents, including peptide/protein drugs and small molecules. This course will be divided into four parts. The first part will discuss the fundamental concepts of diffusion of drugs in tissues and the physical and chemical pathways of degradation, along with methods of stabilization. The second part of the course will focus on formulation and pharmaceutical processing aspects for therapeutic peptides and proteins. The third part will provide an overview of the pharmacokinetics aspects for the different routes of drug administration. Finally, the course will provide a discussion on different controlled delivery systems. Overall, this new class will focus on the engineering components of drug delivery, including a quantitative understanding of the principles that govern rates of therapeutic payloads transport, diffusion and clearance. It will also provide critical knowledge of polymer science required for the rational design of advanced drug delivery systems for physiological and pathological situations.

### Syllabus:

Date	Lecture Topic	Discussion
03 April (M) 05 April (W)	Course Intro & Structure & Analysis of Therapeutic Proteins	
10 April (M) 12 April (W)	Diffusion and Drug Dispersion & Drug Transport	Journal club #1
17 April (M) 19 April (W)	Stability of peptides and proteins - Chemical and Physical Instability & Formulation Strategies	Journal club #2
24 April (M) 26 April (W)	Routes of Administration & Pharmacokinetics parameters	Journal club #3
01 May (M) 03 May (W)	Pharmacodynamics	Journal club #4
08 May (M) 10 May (W)	Parenteral Controlled Delivery Systems	Journal club#5
15 May (M) 17 May (W)	Oral Delivery Systems	Characterization Methods presentations
22 May (M) 24 May (W)	Transdermal and Topical Delivery Systems	5 min. elevator pitch - Project description Final project 1:1 discussions
29 May (M) 31 May (W)	<b>HOLIDAY * NO CLASS *</b> Mucosal Delivery Systems & Clinical Application: Chemotherapy	Make connections presentation
05 June (M) 07 June (W)	Final Project	

### Grading:

**Total: 100%**

**Class Attendance & Participation** (*make connections presentation*) **5%**  
**Journal Club presentations** **30%**  
**Polymer Characterization Methods presentation** **10%**

**Final Project***Project presentation**Paper (8 page)***55%***(25%)**(30%)*

Final Project (due date - week 9): The final project will replace the final exam. Students will be exposed to a library of 10 relevant drugs/peptides/growth factors. They will be challenged to write an 8 page project (Margins 1', single line spacing, font size 11) about one item of that library. They are expected to review the state of the art of that compound in terms of delivery strategies as well to elaborate a novel research direction. Students will give a 15 min presentation (in class) describing their final project.

Textbook: Lecture handouts will be provided for lectures and scientific manuscripts will also be provided for additional readings. A textbook will not be required. Students may want to use the following two books as references:

- *Drug Delivery: Engineering Principles for Drug Therapy*, by Mark Saltzman, Oxford University Press.
- *Drug Delivery Systems*, Third Edition, by Vasant V. Ranade and John B. Cannon, 3rd Edition, CRC Press Taylor & Francis Group, 2011.