

Biomaterials for Drug Delivery

BME 4648 Section3A22

Class Periods: T, Period 5-6 (11:45-1:40pm) and R, Period 6 (12:50-1:40pm),

Location: C1-003 (Communicore).

Academic Term: Spring 2023

Instructor:

Blanka Sharma

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352-273-9329

Office Hours: TBD

Teaching Assistants:

None

Course Description

This course focuses on the principles of engineering controlled release systems, and integrates topics in polymer chemistry, biomaterials, pharmacokinetics/pharmacodynamics, and mass transport phenomena. 3 Credits.

Course Pre-Requisites / Co-Requisites

BME3060(C), BME4632

Course Objectives

1. Apply engineering principles to the design of controlled release and drug delivery systems.
2. Understand the biomaterials used in the engineering of drug delivery systems for various applications.
3. Evaluate and critique current literature on drug delivery technologies.

Materials and Supply Fees

None

Professional Component (ABET):

N/A

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	
3. an ability to communicate effectively with a range of audiences	Low
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Low
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Low

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course

Required Textbooks and Software

Title: Drug Delivery: Fundamentals and Applications, Second Edition
Second Edition
Authors: Anya M. Hillery, Kinam Part
Publisher: CRC Press, Taylor and Francis
ISBN: 9781482217711

Note: Older version of this text is also acceptable.

Title: Drug Delivery and Targeting: For Pharmacists and Pharmaceutical Scientists.
Authors: Anya M. Hillery, Andrew W. Lloyd, James Swarbrick
Copyright date: 2001
Publisher: Taylor and Francis
ISBN: 9780415271981

Course notes are derived primarily from both the required and recommended textbooks listed. Some course notes are derived from published review articles, and will be provided to students accordingly.

Recommended Materials

Title: Engineering Principle of Drug Delivery
Author: Mark Saltzman
Copyright Date: 2001
Publisher: Oxford University Press
ISBN: 0-19-508589-2

Course Schedule

**** Note this is subject to change at instructor's discretion.***

Week 1:	Course Overview, Introduction to Controlled Drug Delivery, Pharmacokinetics/Pharmacodynamics (Hillery Ch. 1-3)
Week 2:	Pharmacokinetics/Pharmacodynamics (Hillery Ch. 1-3, Saltzman Ch. 7)
Week 3	Diffusion in Biological Systems (Saltzman Ch. 2-4, Hillery Ch. 3) QUIZ 1 (Pharmacokinetics/Pharmacodynamics)
Week 4	Polymers in Drug Delivery Systems (Saltzman Ch 9-10, Appendix A2. Hillery Ch 4-5)
Week 5	Bioresponsive polymers for drug delivery
Week 6	Parenteral Drug Delivery Systems (Hillery Ch. 4-5, Saltzman Ch. 9-10) QUIZ 2 (Engineering Controlled Release Systems)
Week 7	Parenteral Drug Delivery and Drug Targeting/Nanomedicine (Hillery Ch. 5)
Week 8	Gene/Nucleic Acid Delivery (Hillery Ch. 14) QUIZ 3 (Parenteral DD and Nanomedicine)
Week 9	Cells as Drugs and Drug Delivery Systems MIDTERM EXAM
Week 10	SPRING BREAK

Week 11	Oral Drug Delivery (Hillery Ch. 6)
Week 12	Transdermal Drug Delivery (Hillery Ch. 8)
Week 13	Pulmonary Drug Delivery (Hillery Ch. 10) Quiz 4 (Routes of Drug Delivery)
Week 14	*Student Presentations
Week 15	*Student Presentations
Week 16	Exam Review

FINAL EXAM: 5/4/2023 @ 10:00 AM - 12:00 PM

*Students will present key findings from a literature review on an approved drug delivery topic and in-depth analysis on one paper related to this topic.

Online Course Recording

In the event that classes must be offered virtually, our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance Policy, Class Expectations, and Make-Up Policy

Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

Students are expected to attend course lectures and participate in class discussions. It is expected that there will be no cell phone or electronic device distractions in class. If you are unable to attend class, will be coming late or leaving early, then you are expected to inform the instructor. Students are expected to be in class, prepared to learn, engaged, and overall contributors to the learning environment. Poor attendance will affect your participation grade.

Unless prior arrangements have been made with the instructor, students will be deducted 15% per day for late coursework, with deductions occurring at the time associated with the due date. Unless prior arrangements have been made with instructor, missed exams will receive a grade of 0pts.

While students are encouraged to discuss course material and assignments together outside of class, it is expected that all coursework/assignments submitted is the students' own work.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets	50-100 each	15%
Quizzes	15-30 each	10%
Midterm Exam	100 each	20%
Final Exam	100	30%

Term Project	100	15%
Participation	100	10%
		100%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
90.0 - 100	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 - 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 - 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Conduct Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Covid Policy

Current university policy, based on CDC guidelines, is that anyone who tests positive will need to stay out for five full days after onset of symptoms, or from the date of the positive test if they don't have symptoms. They may return after 5 days if they no longer have symptoms, but should wear a mask through the end of day 10.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.