

# BE 5372/4372-004 (80210): Drug Delivery Systems

## Spring 2019

**Instructor(s):** Kytai Truong Nguyen

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**Office Hours:** 1:30-2:30 PM Mondays

**TA:** Uday Chintapula & Harish Ramachandramoorthy ; **Email:** [uday.chintapula@mavs.uta.edu](mailto:uday.chintapula@mavs.uta.edu) & [harish.ramachandramoor@mavs.uta.edu](mailto:harish.ramachandramoor@mavs.uta.edu)

**TA Office Hours:** Wednesdays 4:00 PM – 5:00 PM (ERB 2<sup>nd</sup> floor student cubicle)

**Section Information:** BE 5372/4372- 004(80210), Drug Delivery

**Time and Place of Class Meetings:** ERB 131, Mondays and Wednesdays, 2:30 PM - 3:50 PM

**Description of Course Content:** This class will introduce students to the concept of drug delivery systems that provide pharmaceutical agents at target tissues, the mechanism of pharmacokinetic regulation, the basics, technology, and applications of drug delivery systems. The emphasis is on understanding the principles of pharmacokinetics and drug delivery systems to improve clinical efficacy as well as to reduce side effects and on realizing the importance of the field, drug delivery.

**Student Learning Outcomes:** Midterm exam, homework, project, and final exam are applied for measuring the student learning outcomes in the long-term. In addition, questions will be given in each lecture, and student participation will be used to measure student learning outcomes. Lectures will then be adjusted accordingly to facilitate student learning.

### **Required Textbooks and Other Course Materials:**

1. **Engineering polymer systems for improved drug delivery; by Rebecca A. Bader and David A. Putnam (Available online at UTA library or through the UTA bookstore)**
2. **Drug Delivery: Engineering Principles for Drug delivery; by W.Mark Saltzman.**
3. **Characterization of nanoparticles intended for drug delivery; by Scott E. McNeil (optional, not required)**

**Access to the class information:** Students can access class information including class syllabus and project samples using the **Blackboard website:** <https://elearn.uta.edu>. Students need to sign in using their net-id and password, and then find the class material under the course link "BMES 5372-004: Drug Delivery Lecture". All lectures, homework samples, presentation samples, report samples, and some related articles are included in this class folder/link.

**Descriptions of major assignments and examinations:** Students are expected to attend lectures, read and understand book chapters and all handouts. Students are also expected to participate in discussions of problems and case studies presented during lecture periods. Verbal and written reports are required to develop communication skills for undergraduate and graduate students. **Students are expected to work independently on exams and homework. Midterm and final exam will be closed book. No access to book, computer, cell phones or internet access by any means will be permitted. One sheet of paper**

**(8 in width\*11 in length) with notes on both sides can be used during exams. Homework and project reports are due at the beginning of class (2:30 PM) on the designated day.**

For the project, students will work in a group and choose a topic related to drug delivery systems, which must be approved by the instructor, and be required to present their projects in class in addition to the written report (10-15 pages). Format of oral presentation and written report is similar to the proposal type. For the report of your project, it should include background introduction, your research topic, the problem that you work on, your strategy to solve this problem, how you assess your strategy to determine whether it will work, limitations of your strategy and alternatives if possible. For presentation of your project, each presentation will be of 12 minutes in addition to 3 minutes for questions and discussion (see sample grading sheet). Grading of presentation will be based on the TA (50%), and instructor (50%).

Late (24 hours maximum) turn-in homework and project reports will be returned with a 50% penalty. Students should refer to the class schedule at the end of this handout for all due dates. **There will be no make-up given for missed exams, unless the reason is explained with an accompanying document (example: doctors notes as an excuse is acceptable).**

Homework will be given to the students whenever necessary to help students understand the subjects. For the ethical homework, students need to find an ethical case related to drug delivery using web search and/or journal search and then discuss/debate about their cases with their classmates in the assigned lecture. The TA will monitor the discussion for this ethical class. Other homework assignments involve with articles related to the class topics. Students need to select an article related to one of the class topics as specified later and write a report based on this article; for example, students should write (about 2 pages) about how the authors formed nanoparticles, how they tested their nanoparticles, major results from their tests, and limitations/problems if any in the article.

**Attendance:** At the University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, [insert your attendance policy and/or expectations, e.g. "I will take attendance sporadically" or "I have established the following attendance policy: ..."] However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student, a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

**Other Requirements:** Students should have some biomaterials background.

**Grading:**

**COURSE ASSESSMENT**

Midterm exam	20%
Final exam	20%
Project presentation	15%
Project report	15%
Homework	20%
In class group participation	10%

**EVALUATION OF STUDENTS**

A	85-100%
B	75-85%
C	65-75%
D	50-65%
F	Below 50%

**Make-up Exams:** There will be no make-up given for missed exams, unless the reason is explained with an accompanying document.

**Expectations for Out-of-Class Study:** Beyond the time required to attend each class meeting, students enrolled in this course should expect to spend at least an additional 9 hours per week of their own time in course-related activities, including reading required materials, completing assignments, preparing for exams, etc.

**Grade Grievances:** Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current University Catalog. For more guidance see: <http://catalog.uta.edu/academicregulations/grades/#graduatetext>.

**Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://www.uta.edu/aao/fao/>).

**Disability Accommodations:** UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA)*, *The Americans with Disabilities Amendments Act (ADAAA)*, and *Section 504 of the Rehabilitation Act*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of **a letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:

**The Office for Students with Disabilities, (OSD)** : [www.uta.edu/disability](http://www.uta.edu/disability) or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability).

**Counseling and Psychological Services, (CAPS)** : [www.uta.edu/caps/](http://www.uta.edu/caps/) or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

**Non-Discrimination Policy:** The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit [uta.edu/eos](http://uta.edu/eos).

**Title IX Policy:** The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. For information regarding Title IX, visit [www.uta.edu/titleIX](http://www.uta.edu/titleIX) or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or [jmhood@uta.edu](mailto:jmhood@uta.edu).

**Academic Integrity:** Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

*I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

*I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. Additional information is available at <https://www.uta.edu/conduct/>.

**Note: A student should use his/her own words to write his/her lab report i.e. he/she should not copy words by words from a journal or information on a website or from another student. Copying the sentence from others even though referring the information with a citation in the U.S. is considered as plagiarism; and the report will get an F. The student also should not copy any report from previous students. If this is a case, the student will get an F. We will be using "ithenticate" software to look for plagiarism in each report/homework. Refer the UTA library website for more details: <http://library.uta.edu/plagiarism/index.php>**

**Electronic Communication:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

**Campus Carry:** Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit <http://www.uta.edu/news/info/campus-carry/>

**Student Feedback Survey:** At the end of each term, students enrolled in face-to-face and online classes categorized as "lecture," "seminar," or "laboratory" are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback via the SFS database is aggregated with that of other students enrolled in the course. Students' anonymity will be protected to the extent that the law allows. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit <http://www.uta.edu/sfs>.

**Final Review Week:** for semester-long courses, a period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During

this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

**Emergency Exit Procedures:** Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

**Student Support Services:** UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include [tutoring](#), [major-based learning centers](#), developmental education, [advising and mentoring](#), personal counseling, and [federally funded programs](#). For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to [resources@uta.edu](mailto:resources@uta.edu), or view the information at <http://www.uta.edu/universitycollege/resources/index.php>.

**The IDEAS Center:** (2nd Floor of Central Library) offers free tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. To schedule an appointment with a peer tutor or mentor email [IDEAS@uta.edu](mailto:IDEAS@uta.edu) or call (817) 272-6593.

**Writing Center:** The Writing Center Offers free tutoring in 20-, 40-, or 60-minute face-to-face and online sessions to all UTA students on any phase of their UTA coursework. Our hours are 9 am to 8 pm Mon.-Thurs., 9 am-3 pm Fri. and Noon-6 pm Sat. and Sun. Register and make appointments online at <http://uta.mywconline.com>. Classroom Visits, workshops, and specialized services for graduate students are also available. Please see [www.uta.edu/owl](http://www.uta.edu/owl) for detailed information on all our programs and services. The Library's 2nd floor Academic Plaza offers students a central hub of support services, including IDEAS Center, University Advising Services, Transfer UTA and various college/school advising hours. Services are available during the library's hours of operation. <http://library.uta.edu/academic-plaza>.

**Emergency Phone Numbers:** In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911.

#### **Useful Links:**

Library Home Page ..... <http://www.uta.edu/library>  
Subject Guides ..... <http://libguides.uta.edu>  
Subject Librarians..... <http://www.uta.edu/library/help/subject-librarians.php>  
Database List ..... <http://www.uta.edu/library/databases/index.php>  
Course Reserves..... <http://pulse.uta.edu/vwebv/enterCourseReserve.do>  
Library Tutorials ..... <http://www.uta.edu/library/help/tutorials.php>  
Connecting from Off- Campus ..... <http://libguides.uta.edu/offcampus>  
Ask A Librarian ..... <http://ask.uta.edu>

The following URL houses a page where we have gathered many commonly used resources needed by students in online courses: <http://www.uta.edu/library/services/distance.php>.

The subject librarian for your area can work with you to build a customized course page to support your class if you wish. For examples, visit <http://libguides.uta.edu/os> and <http://libguides.uta.edu/pols2311fm> . If you have any questions, please feel free to contact Suzanne Beckett, at [sbeckett@uta.edu](mailto:sbeckett@uta.edu) or at 817.272.0923

**Course Schedule**  
(Dates may be subject to change)

<b>Date</b>	<b>Topics</b>
1/14/2019	Class Introduction and library search
1/16/2019	Basic concepts and challenges in drug delivery
1/21/2019	<b>No Lecture – Martin Luther King Holiday</b>
1/23/2019	Controlled drug delivery systems
1/28/2019	Polymer-drug conjugates
1/30/2019	Drug modification
2/4/2019	Micro-/Nanoparticles in drug delivery
2/6/2019	Micro-/Nanoparticles in drug delivery
2/11/2019	Characterization of nanoparticles
2/13/2019	<i>In vitro</i> and <i>in vivo</i> studies/assays to characterize nanoparticles
2/18/2019	Implant drug delivery
2/20/2019	Nasal and Pulmonary drug delivery
2/25/2019	Transdermal drug delivery
2/27/2019	Protein delivery
3/4/2019	Gene delivery/therapy
<b>3/6/2019</b>	<b>Midterm Examination</b>
<b>3/12 and 3/14</b>	<b>No lectures due to spring break</b>
3/18/2019	Stimuli responsive drug delivery (Part 1)
3/20/2019	Stimuli responsive drug delivery (Part 2)
3/25/2019	Oral drug delivery
3/27/2019	Mucoadhesive drug delivery
<b>4/1/2019</b>	<b>Project presentation</b>
<b>4/3/2019</b>	<b>Project presentation</b>
<b>4/8/2019</b>	<b>Project presentation</b>
4/10/2019	FDA regulation and drug delivery
4/15/2019	Nanoparticles as contrast agents for imaging & Theranostic nanoparticles
4/17/2019	Product Development and Quality
4/22/2019	Biological/tissue engineering applications of drug delivery systems
4/24/2019	Pharmacokinetics modeling (Part 1)
4/29/2019	Pharmacokinetics modeling (Part 2)
5/1/2019	Class discussion: Ethics in drug delivery
<b>5/6/2019</b>	<b>Final exam</b> <b>Submission of final reports</b>

### **IMPORTANT DEADLINES FOR HOMEWORKS**

<b>Homework No.</b>	Write a summary/review report on <b><u>A RESEARCH ARTICLE</u></b> on following topics:	<b>Due Date</b>
1	Drug Modification	<b>Jan 30</b>
2	Microparticles/Nanoparticles for targeted and controlled drug delivery	<b>Feb 4</b>
3	Carriers for protein and/or gene delivery	<b>Feb 27</b>
4	Stimuli responsive drug delivery	<b>March 18</b>
6	Tissue engineering applications of drug loaded carriers	<b>April 10</b>
5	An ethical case in drug delivery	<b>May1</b>
6	Any topics related to lectures: extra points	<b>May 1</b>

Your summary **MUST** be a review (Max: 2 page) containing:

1. A brief summary of Introduction, Materials and Methods, Results and discussions of the research article (**This must be a research paper, not review paper**).
2. Your critique of the research work presented in the article such as its experimental strengths, weaknesses and possible improvements in any area.