

**BMES 5373-004 (29352): DRUG DELIVERY LAB**  
**Spring 2015**

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

**Office Number:** ERB 273

**Office Telephone Number:** 817-272-2540

**Email Address:** [knguyen@uta.edu](mailto:knguyen@uta.edu)

**TA:** Nikhil Pandey, [bmes5373@gmail.com](mailto:bmes5373@gmail.com)

**Office Hours:** Tuesdays 3 PM- 4 PM

**Section Information:** BMES 5373-004 (29352), Drug Delivery Laboratory

**Time and Place of Class Meetings:** ERB 273, Wednesdays, 3:00PM - 5:50PM

**Description of Course Content:** This class will provide students with hands-on experience in developing drug delivery systems such as hydrogels, scaffolds, microparticles and/or nanoparticles that can be loaded with and release pharmaceutical agents to treat various diseases. The emphasis is on understanding the principles of pharmacokinetics and drug delivery systems in order to improve the clinical efficacy as well as to reduce side effects of therapeutic reagents/drugs.

**Student Learning Outcomes:** Lab reports and presentations are applied for measuring the student learning outcomes in the long-term. In addition, questions will be given in each lab, and student participation will be used to ensure that student learning outcomes are met. Students are expected to know how to make drug delivery systems such as hydrogels, microparticles and nanoparticles for drug loading and controlled drug release. Students should also know how to determine drug loading efficiency and drug release kinetics for each experiment.

**Requirements:** Students should have some biomaterials background and already take the drug delivery system class. **Students registered for this course must complete all required lab safety training prior to entering the lab and undertaking any activities.** If the students do not complete the safety training, they are to receive zero grades in their course work until the training is completed, per the Provost's Office. The Provost also publishes the verbiage that instructors are to place in their syllabus related to the training.

**Textbooks and Other Course Materials:** Recommended reading:

1. *Drug delivery systems*. Editors: Ranade VV, Hollinger MA. CRC Press.
2. *Drug delivery and targeting for pharmacists and pharmaceutical scientists*  
Editors: Hillery AM, Lloyd AW, and Swarbrick J. Taylor & Francis Inc.
3. *Drug delivery – Engineering principles for drug therapy*  
Editor: Saltzman WM. Oxford University Press.
4. Course handouts will also be provided.

**Access to the class information:** Students can access class information including class syllabus and project samples on website: [ftp://students.uta.edu](http://students.uta.edu), username: uta/netid, and password: netid password. Students need to sign in, and then click on the class folder to find be5373 folder for this class's documents. All lectures and some related documents are included in the class folder.

**Descriptions of major assignments and examinations with due dates:** Students are expected to attend lectures, read and understand all handouts and protocols. Students are also expected to participate in discussions of problems presented during lecture periods. Presentations and written reports are required to develop communication skills for graduate students. **Students are expected to work independently on reports.**

**For the lab reports, students will work in groups for each experiment; however, students should work on their own for the lab reports.** Format of lab reports should be similar to a peer reviewed journal articles such as Journal of Controlled Release. Lab reports should include these sections: abstract, introduction (background information), materials and methods (short description of your experiments), results and discussion with limitations and potential solutions, conclusion, and references. There is no page limitation for the lab report. Students should refer to the class schedule at the end of this handout for the dates to turn in your reports. **There will be no make-up given for lab reports, unless the reason is explained with accompanying document.**

**Attendance Policy:** At The University of Texas at Arlington, taking attendance is not required. Rather, 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, I have decided that *student should attend the class as much as he/she can*.

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

#### **Grading:**

##### **COURSE ASSESSMENT**

|                              |     |
|------------------------------|-----|
| Reports (2 total)            | 30% |
| Final Experiment and Report  | 35% |
| Homework (2 presentations)   | 20% |
| Quiz                         | 10% |
| Attendance and Participation | 5%  |

##### **EVALUATION OF STUDENTS**

|   |           |
|---|-----------|
| A | 85-100%   |
| B | 70-85     |
| C | 60-70     |
| D | 50-60     |
| F | Below 50% |

**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://web.uta.edu/ses/fao>).

**Americans with Disabilities Act:** The University of Texas at 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)*. 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 that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. 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) or by calling the Office for Students with Disabilities at (817) 272-3364.

**Title IX:** The University of Texas at Arlington is committed to upholding U.S. Federal Law "Title IX" such that no member of the UT Arlington community shall, on the basis of sex, be excluded from participation in,

be denied the benefits of, or be subjected to discrimination under any education program or activity. For more information, visit [www.uta.edu/titleIX](http://www.uta.edu/titleIX).

**Academic Integrity:** All students enrolled in this course 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 as they see fit in their courses, including (but not limited to) 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.

**Note: A student should use his/her own language to write his/her own lab report i.e. he/she should not copy words by words from a journal or information on a website. Copying the sentence from others even though preferring the information with a reference 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.**

**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>.

**Student Feedback Survey:** At the end of each term, students enrolled in classes categorized as "lecture," "seminar," or "laboratory" shall be 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 enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

**Student Support Services Available:** 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 [www.uta.edu/resources](http://www.uta.edu/resources).

**Lab Safety Training:** **Students registered for this course must complete all required lab safety training prior to entering the lab and undertaking any activities.** Once completed, Lab Safety Training is valid for the remainder of the same academic year (i.e., through the following August) and must be completed anew in subsequent years. There are no exceptions to this University policy. Failure to complete the required training will preclude participation in any lab activities, including those for which a grade is assigned. You can access your training at [www.uta.edu/training](http://www.uta.edu/training).

**Final Review Week:** 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.

**OUTLINE OF TOPICS COVERED**  
(Dates may be subject to change)

| Date        | Topics                                                                                                                                                                                      | Notes                                                                                                                                                                                                                             |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Jan 21      | Introduction                                                                                                                                                                                | - Introduce lab safety issues and labs.                                                                                                                                                                                           |
| Jan 28      | <b>Lecture</b> : Nano/microparticles for drug delivery<br><b>Lab 1 &amp; 2</b> : PCL microparticles formed by single and double emulsion methods.                                           | - Formulate PCL microparticles by the two methods.<br>- Collect PCL particles for freeze-drying.                                                                                                                                  |
| Feb 4       | <b>Lecture</b> : Drug release calculations<br>Begin drug release studies from PCL microparticles for both Lab 1 & Lab 2                                                                     | - Perform the drug release studies over time (two to three weeks for PCL microparticles).                                                                                                                                         |
| Feb 11      | <b>Lecture</b> : Hydrogels and Scaffolds in drug delivery.<br>Collection of PCL microparticles drug release samples.                                                                        | - Hydrogels, Scaffolds and their applications in drug delivery.<br>- Continue collecting drug release samples.                                                                                                                    |
| Feb 18      | <b>Lab 3</b> : PCL scaffolds for drug delivery<br>Collection of PCL microparticles drug release samples                                                                                     | - Prepare drug loaded PCL scaffolds<br>- Continue collecting drug release samples                                                                                                                                                 |
| Feb 25      | Collect and quantify drug releases from PCL microparticles for lab 1 and 2<br>Begin drug release for PCL scaffolds                                                                          | - Perform ICG and coumarin standard curves to measure drug loading efficiency and release kinetics.                                                                                                                               |
| Mar 4       | <b><u>Presentation 1 as a group</u></b><br><br>Continue drug release for PCL scaffolds                                                                                                      | - Present a research paper related to PCL microparticles or PCL nanoparticles for targeted and controlled drug delivery.<br>- Continue collecting drug release samples.                                                           |
| Mar 9 or 10 | Continue drug release for PCL scaffolds                                                                                                                                                     | - Collect drug release samples for day 12 or 13 of PCL scaffold                                                                                                                                                                   |
| Mar 11      | <b>Spring Break</b>                                                                                                                                                                         | <b>- No class</b>                                                                                                                                                                                                                 |
| Mar 18      | Collect and quantify drug release for PCL scaffolds<br><br><b><u>Turn in the lab report 1</u></b> (including Lab 1 and Lab 2)                                                               | - Drug release studies for PCL scaffolds.<br>- Analyze drug release and plot cumulative drug release profiles.                                                                                                                    |
| Mar 25      | <b>Lab 4</b> : Hydrogels prepared by photo-polymerization & chemical polymerization for drug delivery applications<br><br><b><u>Turn in the protocol for student's final experiment</u></b> | - Prepare photopolymerized and chemically polymerized PEGDA hydrogels.<br><br>- For final experiment, students can select any method to produce any drug delivery system based on the materials given in the lab (from labs 1-4). |
| Apr 1       | Collect BSA released from both photo-polymerized and chemically polymerized hydrogels                                                                                                       | - Perform drug/protein release studies for both PEGDA hydrogels at the same time.                                                                                                                                                 |
| Apr 8       | Measure BSA release from both photo-polymerized and chemically polymerized hydrogels                                                                                                        | - Perform BCA protein assays to measure BSA loading efficiency and release kinetics from hydrogels.                                                                                                                               |
| Apr 15      | Student's final experiment                                                                                                                                                                  | Begin your final experiment.                                                                                                                                                                                                      |
| Apr 22      | Student's final experiment<br><b><u>Turn in the lab report 2</u></b> (includes Lab 3 and Lab 4)                                                                                             | Students continue the experiments.                                                                                                                                                                                                |
| Apr 29      | Student's final experiment                                                                                                                                                                  | Students continue the experiments.                                                                                                                                                                                                |
| May 6       | <b><u>Presentation 2 as a group</u></b><br><b><u>Turn in final reports</u></b>                                                                                                              | Present results of your final experiments.                                                                                                                                                                                        |

### **IMPORTANT DEADLINES**

| <b>No.</b> | <b>Deadline</b>                                                                                                              | <b>Due Date</b> |
|------------|------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1          | Presentation 1 - Research paper related to PCL microparticles or PCL nanoparticles for targeted and controlled drug delivery | March 4         |
| 2          | Lab Report 1 due (includes Labs 1 and 2)                                                                                     | March 18        |
| 3          | Protocol for final experiment                                                                                                | March 25        |
| 4          | Lab Report 2 due (includes Labs 3 and 4)                                                                                     | April 22        |
| 5          | Presentation 2 – Present your final experiment                                                                               | May 6           |
| 6          | Final Report due                                                                                                             | May 6           |

**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.