 **Tissue Engineering Laboratory**

**Spring 2015**

**Instructor(s):** Liping Tang

**Office Number:** 224 Engineering Research Building

**Email Address:** ltang@uta.edu

**Faculty Profile:** <https://www.uta.edu/ra/real/editprofile.php?pid=58>

**Office Hours:** Tuesday and Thursday

**Section Information:** BE 5365 / BIOL 4365

**Teaching Assistant:** Pooja Yadav (Pooja.yadav@mavs.uta.edu), Ashley Dacy (ashley.dacy@mavs.uta.edu); ELB 121A

**Time and Place of Class Meetings:** Tuesday and Thursday 9:30 – 10:50 am, ERB 273

**Description of Course Content:** Introduction to laboratory techniques commonly used for culturing, growing, and analyzing cells and tissues.

**Student Learning Outcomes:** Students will learn the necessary skills required for maintaining and analyzing cells in culture. Students will develop laboratory techniques related to cell assays and cell staining. Students will be introduced to concepts of designing in vitro tissue engineering products.

**Textbooks and Other Course Materials:** Peer-reviewed journals and laboratory protocols will be used for this course and when applicable made available to students through the course folder.

Suggested Texts: For cell culture review

* Culture of Animal Cells – A Manual of Basic Technique 4th edition, by Ian Freshney, 2000.
* UTA library call #QH585.2 .F74 2000 or <http://discover.uta.edu/?itemid=|uta-cat|1047659>

**Laboratory Safety Training Required:**

Online at [www.uta.edu/training](http://www.uta.edu/training). Login with UTA NetID and password.

**Tentative Syllabus/ Laboratory Schedule:**

**Introduction to laboratory**

Jan 20 (Tue): Syllabus, Class introduction, group assignments.

 **Demo:** Equipment overview / use and operation

 **Handouts:** Equipment use / Blackboard class setup

Jan 22 (Thur): Serial dilutions

 **Lab:** Use of micro liter pipettes to make serial dilutions

 **Practical Lab Quiz:** comparison to TA standards using spectrophotometer

 **Take Home:** proper use of microscope and camera, Aseptic technique in a culture hood

**Introduction to Cell Culture and Sterile Practice**

Jan 27 (Tue): Introduction to cells and cell culture (basic culture practice)

 **Lab:** Observing cells in a culture flask / preparing a cell hood for cell culture / making “complete” media / media change in a culture flask

 **Take Home:** Basic cell culture procedure, trypsinization

Jan 29 (Thur): Cell subculture, cell viability and cell counting using Hemocytometer

 **Lab:** Cell subculture with trypsin, Cell viability with Trypan blue

 **Take Home:** cell viability calculations, cell seeding density calculation

**Cryopreservation**

Feb 3 (Tue): Cryopreservation of cells

 **Lab:** Cell trypsinization, counting, andUse cryopreservation technique to put cells into stasis

 **Take Home:** Cell viability and live dead assay

Feb 5 (Thur): Reconstitution of cells from cryostasis

 **Lab:** Reconstitute cells from last class and perform viability assay

 **Take Home:** What affect cell viability? How to improve viability?

Culture condition (2% vs. 10% serum) and cell growth rate

 **Lab:** Seeding of well plate at specified density

**Cell Seeding and estimation of cell viability**

Feb 10 (Tue): 2- day cell culture - Alamar Blue assay vs. hemocytometer method

 **Lab:** Carry out Alamar Blue assay and hemocytometer counting.

 **Take Home:** Alamar Assay and use of plate reader

Feb 12 (Thur): 7 day cell culture -

 **Lab:** Carry outAlamar Blue assay vs. hemocytometer method

 **Take Home:** How to analyze your Alamar Blue data? What is the most reliable method to count cells?

**Primary cell culture**

Feb 17 (Tue): Extraction of bone marrow stem cells

 **Lab:** Perform bone marrow flush and culture stem cells

 **Take Home:** disassociation techniques, cell scraping

Feb 19 (Thur): Primary culture ofmonocytes from spleen (tissue digestion)

**Lab:** Perform primary cell culture from spleen and observe bone marrow culture

Feb 24 (Tue): Staining and imaging primary cells

 **Lab:** Perform cell staining

Feb 26 (Thur): Cell imaging – group sign up

March 3 (Tue): **Group Presentations (Midterm)**

Mar 5 (Thur): **Midterm Exam (in class)**

**Mar 09-14 Spring Break**

**Scaffold fabrication, characterization**

Mar 17 (Tue): Salt leach scaffold fabrication

 **Lab:** formation of salt leached scaffold

 **Take Home:** Expected porosity and implications

Mar 19 (Thur): Scaffold Characterization I - Ethanol displacement

 **Lab:** Volume displacement calculation of scaffold porosity

 **Take Home:** Image J calculations, ethanol displacement method for determining porosity

Mar 24 (Tue): Scaffold Cross sections – group sign up

Mar 26 (Thur): Scaffold Characterization II- cross section ananlyses

 **Lab:** observing and imaging scaffold cross sections

 **Demo:** Image J – scaffold porosity

 **Take Home:** porosity calculations, and various cell seeding techniques

**Tissue Staining (Histology)**

Mar 31 (Tue): H&E staining of biomaterial implant

 **Lab:** H&E staining of tissue section

 **Take Home:** preparation of tissue sections, wax sectioning vs. OCT

Apr 2 (Thur): H&E staining of biomaterial implant

 **Practical Lab Quiz:** H&E staining

 **Take Home:** Masson Trichrome Staining, and other stains to identify special characteristics.

**Cell, tissue and scaffold imaging analyses**

Apr 7 (Tue): Introduction to imaging software for tissue engineering

Apr 9 (Thur): Costum applications of Matlab

Apr 14 (Tue): 3D applications of Matlab for tissue segmentation

Apr 16 (Thur): ImageJ and Matlab applications

**3D scaffold design**

Apr 21 (Tue): 3D printing –program introduction

Apr 23 (Thur): 3D printing –scaffold design section I

Apr 28 (Tue): 3D printing –scaffold design section II

Apr 30 (Thur): 3D printing – scaffold design section IV

May 5 (Tue): **Group Presentations (Final)**

May 7 (Thur): **Final Exam (in class)**

**May 8th Last Day of Classes**

“*As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course.” – Liping Tang*

**Overview of Course Components:**

**Quizzes (individual and unannounced):** will be short answer format and are based on the assignments or topics covered in class.

**Practical Lab Quizzes (group effort, dates given):** are graded assignments to be done in class on a given day. Your resultsare compared against TA standards or controls.

**Exams (individual - closed book):** Two exams will be given as a midterm and final. These exams will be multiple choice or short answer format, and will reflect topics covered in class or from take home assignments.

**Presentations (group effort):** Two presentations will accompany the midterm and final.Presentations will be done in groups and will provide a summary of the labs and results of all topics covered. Presentations are due at the start of class on the assigned presentation day.  **NO LATE PRESENTATIONS WILL BE ACCCEPTED!** More detail on format and requirements will be given prior to the report due dates.

**Course Evaluation & Final Grade:**

*15% Quizzes/Labs + 15% Presentation 1 + 20% Midterm Exam + 15% Presentation 2 + 20% Final Exam + 15% Attendance and Participation*

**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://wweb.uta.edu/aao/fao/>).

**Americans With Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 93112 -- The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans With Disabilities Act - (ADA), pursuant to section 504 of The Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

As a faculty member, I am required by law to provide **"reasonable accommodation"** to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with **informing faculty at the beginning of the semester and in providing authorized documentation through designated administrative channels.**

**Academic Dishonesty:** 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.

**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, or view the information at [www.uta.edu/resources](http://www.uta.edu/resources).

**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>.

**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 (both front and back side of the classroom. 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 handicapped individuals.

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 Catalog <http://discover.uta.edu/>

E-Journals <http://liblink.uta.edu/UTAlink/az>

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](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>