BMED 8813 – Stem Cell Engineering
Spring 2011, MW 12:05-1:25 PM
U. A. Whitaker Building, Room 1103

Instructors: Todd C. McDevitt, Ph.D.
todd.mcdevitt@bme.gatech.edu
Office: UAW 2102

Web Page: t-square.gatech.edu
BMED 8813

Textbooks: *None.*

Stem Book (http://dev.www.stembook.org/) will be used as a common reference resource for many of the topics to be discussed in the class and provide relevant background information.

Additional reading material will be assigned or recommended from a combination of book chapters, review articles and current research papers which provide the necessary supporting information or topical examples of principles of the course.

Prereqs: Graduate level course in molecular / cell biology, or instructor's permission.

Office Hrs: By appointment only (email requests preferred).

Honor Code: Students are expected to abide by the Honor Code (www.honor.gatech.edu). The objective of the honor code is "to prevent any students from gaining an unfair advantage over other students through academic misconduct". Any violations will be prosecuted through the Dean of Students on the first offense.

Grading:

Exams (2)	25% each (50% total)
Project proposal	25%
In-class presentations	10%
Discussion participation	15%

Exams: Two take-home exams will be given over the course of the semester. The first exam will be given near the middle of the semester and the second exam will be due during final exams week. Each exam will focus on the content presented during the corresponding half of the semester, although some content from the first half of the class may be included on the final exam.

Project: Students will complete a research project comprised of a written proposal and oral presentation on the design, development and validation of a novel stem cell technology. The written proposal will be prepared in NIH R21-style format (6 page maximum length; Arial 11 pt, single-spaced). The oral presentation will be no more than 10 minutes followed by 5-10 minutes for questions and discussion. Projects will be evaluated on the basis of applying engineering analysis to propose an innovative solution to a challenge related to the isolation or derivation, phenotype assessment, expansion and/or directed differentiation of stem cells.

Presentations: Depending on final enrollment, students will present 2-4 journal articles during the course of the semester. Presentations will be evaluated on the clarity of visual aids and the ability of the presenter to lead a discussion of the main findings of the paper as they relate to the specific topic at hand and the overall themes of the course.

Participation: Students will be expected to pro-actively participate in weekly class discussions based on the journal articles presented. Participation will be evaluated on the quality and frequency of insightful questions and comments contributed to in-class discussions, as well as brief written critiques submitted by non-presenters for each journal article.

Purpose: This course is intended to provide a foundation in the application of analytical engineering approaches for the quantitative study of stem cell biology and effective translation into cell therapies and diagnostics. The progression of the course content is intended to lead students through the process of identifying an appropriate stem cell type based on functional attributes for a desired application, isolation and purification of desired cell type(s), expansion in a stable state, directing the differentiation to specific phenotype(s), and use of appropriate characterization techniques to quantify cell phenotype for the development of stem cell-based technologies.

Objectives: The key learning objectives to be obtained by taking this course are to enable graduate students with the necessary biological and engineering background to successfully conduct research with stem cells. Thus, by the end of the course students who have consistently performed well in the course should be knowledgable in the topical areas as they relate to stem cell biology and relevant technologies.

Proposed Course Schedule

Topic	Sub-topic	Date	Reference Materials
	Course introduction & historical overview	Monday, Jan 10 (L)	
Stem cell biology basics			
	Types of stem cells	Wednesday, Jan 12 (L)	
		Wednesday, Jan 19 (D)	
	Niche environments	Monday, Jan 24 (L)	
		Wednesday, Jan 26 (D)	
	Identifying & isolating stem cells	Monday, Jan 24 (L)	
		Wednesday, Jan 26 (D)	
	Reprogramming	Monday, Jan 31 (L)	
		Wednesday, Feb 2 (D)	
Directing cell fate			
	Genetic modification	Monday, Feb 7 (L)	
		Wednesday, Feb 9 (D)	
	Soluble factors	Monday, Feb 14 (L)	
		Wednesday, Feb 16 (D)	
	Matrix biology	Monday, Feb 21 (L)	
		Wednesday, Feb 23 (D)	
	Mechanical forces	Monday, Feb 28 (L) *Guest: T. Ahsan (Tulane)*	
		Wednesday, Mar 2 (D)	
Take-home Exam 1 *		**Due – start of class March 7th**	
Assaying cell phenotype			
	Epigenetics & karyotype	Monday, Mar 7 (L) *Guest: Y. Fan (GT)*	
		Wednesday, Mar 9 (D)	
	Global (“omics”) analysis	Monday, Mar 14 (L)	
		Wednesday, Mar 16 (D)	
SPRING BREAK		Week of March 21-25	
	Cell population analysis	Monday, Mar 28 (L)	
		Wednesday, Mar 30 (D)	
	Computational analysis	Monday, Apr 4 (L)	
		Wednesday, Apr 6 (D)	
Stem cell biomanufacturing			
	Upstream processing	Monday, Apr 11 (L)	
		Wednesday, Apr 13 (D)	
	Downstream processing	Monday, Apr 18 (L) *Guest: J. Rowley (Lonza)*	
		Wednesday, Apr 20 (D)	
Project presentations		Monday, Apr 25 (P)	
		Wednesday, Apr 27 (P)	
FINAL EXAMS		Week of May 2-6	
Take-home Exam 2 *		**Due – by 5 PM on May 2nd**	

L - lecture D – discussion P – presentations

* take-home exams will be given out at the end of the previous class before they are due