

Bioreaction Engineering and Design - BME321

I. Logistics:

- Semester:* Winter, 2018
Days/Times: Tuesday & Thursday between 9:00-10:30 AM (**Starts at 9:10 AM**)
Classroom: EECS 1311
Instructor: Ariella Shikanov, Ph.D. (Office: LBME 2126)
Graduate student instructor: Haley Titinger, B.Eng.
E-mail: shikanov@umich.edu; htitinge@umich.edu
Office Hours: Mondays 1:30-3:30pm and Wednesdays 5-7pm. Location -LBME
Prerequisites: BME 221, BIO 310 (can be concurrent) + Curiosity, Motivation, Creativity
Class website: CANVAS. **Preprint/study notes and papers from CANVAS website. No class handouts will be made.**
- Textbook:* -Bioprocess Engineering Principles, Pauline Doran, Elsevier (e-book is available in our library for download)
- Other Books:*
- Shuler, M. L. and F. Kargi. Bioprocess Engineering, Basic Concepts. Prentice Hall, Inc. NJ 2002
 - Online journal articles
 - Phillips, R.; Kondev, J.; Theriot, J. Physical Biology of the Cell, Garland Science, 2008.
 - Lodish, G.; Berk, A.; Zipursky, L. S.; Matsudaira, P. *Molecular Cell Biology*, WH Freeman, 1999
- Searching:* NIH Public Medline: <http://www.ncbi.nlm.nih.gov/PubMed/medline.html>
The Web of Knowledge: on web via UM library
- Assignments:* We will be using a free software called Perusall (<http://perusall.com>), where I will upload all the required reading material. Please, create your personal student account using the access code **SHIKANOV-9089**.

II. Course Goals:

(3 credits) This course will introduce students to topics in enzyme kinetics, enzyme inhibition, materials and energy balance, cell growth and differentiation, cell engineering, bioreactor design, and analysis of the human body, organs, tissues, and cells as bioreactors. The application of bioreaction/bioreactor principles to tissue engineering will also be discussed.

1. Develop bioreaction and bioreactor intuition. (Lectures, homework, exams)
2. Learn basics of enzyme structure, function, kinetics, inhibition. Also learn how to analyze enzyme kinetics and mechanisms. (Lectures, homework, exams)
3. Familiarization with bioreactions and bioreactors literature and applications. (Lectures, presentation, literature research)
4. Learn how to design, evaluate, and analyze bioreactors (batch, continuous). (Lectures, homework, exams)
5. Learn basics of pharmacokinetics and pharmacodynamics. (Lectures, problems, and exams)
6. Sharpen critical thinking and analysis (discussions, presentations)
7. Practice effective communication of ideas (presentations)
8. Cultivate innovative thinking (discussions)
9. Learn how to learn new fields (literature search, presentations)
10. Learn teamwork (presentations)

III. Grading (Subject to change):

(3 credits) The total possible points are 100 pt. They are divided as follows:

- a) 2 exams: (30 pts each)
- b) 1 classroom presentation on student-selected paper, 1 presentation per student team (4 students per team) (20 pt.).
- c) Quizzes (10 pt.)
- d) Perusall assignments (10 pt.)

The Classroom Presentation (20 pt.):

- Student presentations are designed to promote independent investigation of research articles and to polish effective oral communication skills vital to the exchange of scientific ideas. Student teams will give a short presentation on a selected **Journal of Visualized Experiment (JoVE)** article on original research (not a review article) that involves bioreactions and/or bioreactors (e.g. micro liver chips, multi-enzyme reactions, etc.).
- The length of the presentation is limited to 15 minutes including classroom discussion of the presented paper (10 min presentation + 5 minutes Q&A).
- The names of your team should be submitted by e-mail to the instructor and the GSI by **January 25th**.
- A 1-page proposal (detailed instructions of what should be included in the proposal will be posted separately on CANVAS) should be submitted by e-mail to the instructor and the GSI by **February 6th**.
- The final Power point presentation should be submitted by e-mail the instructor and the GSI **no later than 72 hours before your scheduled presentation time**.
- Grading of the oral presentation (20 pt.; split 16 pt. by the instructor & 4 pt. by peers) is based on:
 - Good problem/topic and clear explanation of the problem 4 pts
 - Effective explanation of technology/methods and biology 4 pts
 - Reproducibility of the approach 4 pts
 - Effective background research and Q/A's 4 pts

* In case two or more groups submit the same article for presentation, then the first group to submit the article will get the priority to present it. Other groups will have to find and submit a different paper, or propose a unique spin on it. The sooner you submit your article of choice, the higher the chances you will get to present it.

Attendance for **all presentations** is required as it counts towards in class participation.

Important Notes:

- **If you cannot make it to the class due to a sickness or another important reason, please, let me know before the class. I may allow you to do a makeup quiz, report, exam, or assignment up to the minimum score others got on the exam on the day it was due.**
- **Submission of late assignments after the deadline will result in deducting 50% of the total score.**