Cellular Biotechnology 504
Winter 2018

Time: Mondays and Wednesdays from 12:10 – 1:30 p.m.
Place: 1123 LBME

Course Director:
Andy Putnam, PhD
Leland Professor of Biomedical Engineering and Cardiovascular Medicine
Director, Cellular Biotechnology Training Program
2204 Lurie Biomedical Engineering
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Course overview/description:
Biotechnology is a rapidly evolving and highly multi-disciplinary field that impacts nearly every aspect of our daily lives from the food we eat to the medicine we take. This one-semester, 3-credit survey-style course provides an overview and integration of several cutting edge topics that are currently trending in the field of cellular biotechnology.

Topics this year will include: (1) commercialization strategies, technology evaluation, product development, and examples of successful biotechnology companies; (2) protein engineering; (3) synthetic biology; (4) nanomedicine; (5) biosimilars; (6) microtechnologies and organ-on-chip platforms; (7) drug delivery; (8) immunotherapies; (9) gene editing and CRISPR/Cas9; (10) stem cells, tissue engineering, and regenerative medicine; (11) personalized medicine (precision health); (12) venture capital; and (13) regulatory affairs. (We may also add 1-2 additional topics as the syllabus evolves.)

Emphasis will be placed not only on the basic scientific and engineering principles behind the growing field of biotechnology, but also on the entrepreneurial aspects of translating innovative solutions into new commercial products. An exciting line-up of 8-10 different guest lecturers will complement the instructor to provide background and expertise on the range of topics listed above in order to give students a comprehensive perspective of modern biotechnology.

This course is cross-listed with the Departments of Anatomy; Biological Chemistry; Microbiology & Immunology; and Biomedical Engineering.

Grading criteria:
Student performance will be evaluated in three ways:

- *Homework:* Brief homework assignments (4) based in part on supplemental readings and additional research on your own will be given out throughout the semester. **25% of the final grade**
- *Class Participation:* The instructor and/or the GSI will keep track of attendance, questions asked, and contributions made to class discussions. **25% of the final grade**
- *Projects:* The main assignment of this course is a team-based project consisting of formulating, writing, and presenting an innovative biotechnological solution to a problem that is related to, or incorporates, some of the topics discussed in class. Students will be assigned to small groups (~5/group). Proposals must be cross-disciplinary in approach, include both business motivation and overview as well as scientific innovation in an NIH SBIR format. Various milestones will be met through the term to keep groups on track (more details forthcoming). **50% of the final grade**

Other Instructional Personnel:

Graduate Student Instructor (GSI):
Jonathan Bezenah
PhD Candidate, Chemical Engineering
Email: bezenahj@umich.edu
Jonathan took this course previously. He will mostly help with course logistics (i.e., coordinating guest lecturers, helping with the course website) but also will organize and mentor design groups for mock SBIR/STTR projects.

Guest Lecturers:
Kalyan Handique, Ph.D.
President & CEO of Celsee Diagnostics
Co-Founder and CTO of HandyLab, Inc. (2000 – 2009)

Dan Kidle
Principal, Arboretum Ventures
303 Detroit Street, Suite 301
Ann Arbor, MI 48104
Email: dkidle@arboretumvc.com

Yen Kong, Ph.D.
Research Investigator, Biomedical Engineering
2195 LBME
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James Moon, Ph.D.
John Gideon Searle Assistant Professor
Pharmaceutical Sciences and Biomedical Engineering
B10-A190 NCRC
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Email: moonjj@umich.edu

David C. Olson, Ph.D.
Biotechnology entrepreneur
Mentor-in-residence, UM Office of Technology Transfer
Previously CEO of Swift Biosciences
Email: davidols@umich.edu

Anna Schwendeman, Ph.D.
Assistant Professor
Pharmaceutical Sciences
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(734) 763-4056
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Lonnie Shea, Ph.D.
William and Valerie Hall Chair and Professor
Biomedical Engineering
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Jason Spence, Ph.D.
Associate Professor
Internal Medicine, Cell and Developmental Biology, and Biomedical Engineering
BSRB 2047
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Cellular Biotechnology Syllabus 2018
Monday/Wednesday 12:10 – 1:30 pm (LBME 1123)
Course Director: **Dr. Andy Putnam (*putnam@umich.edu*)**
Biomedical Engineering

January 3	Introduction: What is Cellular Biotechnology?
January 8	A Case Study in Biotechnology Commercialization – Dr. David Olson
January 10	Biotechnology Product Development – Dr. David Olson
January 15	***MLK, Jr. Day – No Class Scheduled***
January 17	Examples of Commercial Success in Biotechnology
January 22	Protein Engineering
January 24	Synthetic Biology ***(HW #1 DUE)***
January 29	Development and FDA Approval of Nanomedicine – Dr. Anna Schwendeman
January 31	Biosimilar Product Characterization and Development – Dr. Anna Schwendeman
February 5	Microtechnologies in Biotechnology
February 7	Microtechnology Commercialization – Dr. Kalyan Handique ***(HW #2 DUE)***
February 12	Drug Delivery
February 14	Immunology 101: A Crash Course in Immunotherapies
February 19	Engineering immunity – Dr. James Moon
February 21	Engineering immune tolerance – Dr. Lonnie Shea
February 26	***UM Break – No Class Scheduled***
February 28	***UM Break – No Class Scheduled***
March 5	Gene Editing, CRISPR/Cas9 technologies
March 7	Application/commercialization of gene editing technologies – Dr. Yen Kong ***(HW #3 DUE)***
March 12	Stem Cells and Regenerative Medicine: Dr. Jason Spence
March 14	Commercialization of Regenerative Medicine
March 19	Personalized Medicine *(*or is it *Precision Health?)*
March 21	TBD
March 26	TBD (*Andy out of town)*
March 28	TBD (*Andy out of town)* ***(HW #4 DUE)***
April 2	Regulatory Affairs
April 4	Venture Capital – Dan Kidle
April 9	Proposal Presentations
April 11	Proposal Presentations
April 16	Proposal Presentations