Course Syllabus
BIEN4802/5802: Tissue Engineering and Biofabrication
Spring 2025

When: Mondays/Wednesdays, 9:35am-10:50am
Where: JSCBB/BIOT A108

Instructor: Professor Jason Burdick (Jason.Burdick@colorado.edu)
TAs: Mackenzie Obenreder (Mackenzie.Obenreder@colorado.edu); Nafeesah Ibrahim (Nafeesah.Ibrahim@colorado.edu)
Office Hours: by appointment

Course Text: There is no official textbook for the course. Journal articles and other course information will be posted to Canvas.

Course Description:
Tissue engineering demonstrates enormous potential for improving human health and biofabrication is an emerging area that is advancing how we approach tissue engineering. This course explores the basic principles of tissue engineering and biofabrication, drawing upon diverse fields such as cell biology, material science, and bioengineering. Specific applications of tissue engineering and biofabrication will also be discussed in the context of these principles, including highlighting a range of companies and products that have advanced within this field and reviewing recent literature.

Course Goals:
This course is intended to provide introductory information to the fields of tissue engineering and biofabrication, investigate current literature on advances in these fields, and review what is currently translating into the clinic. By the end of this course, students should be able to read and understand the basics of journal articles discussing current research in these fields. The first portion of the course will consist of an introduction to fundamental topics, while the second portion of the course will focus on specific tissues that are being engineered. The course will include the review of recent journal articles and will finish with a project to develop a new product within the field of tissue engineering.

Quizzes (Individual, BIEN4802/BIEN5802): There will be ten quizzes given during the course. These will be at the beginning of the class periods as noted in the syllabus and last 10 minutes. Quizzes are closed notes and questions will include multiple choice, True/False, and short answer questions based on class lectures and journal articles that you are to review by that class period. There will be no make-up quizzes, but students will be permitted to drop two quizzes (missed or lowest scored quizzes).

Company Overview (Individual, BIEN4802/BIEN5802): Early in the semester you will be asked to find a company that has a tissue engineering or biofabrication focus or product and provide a 1 slide, 3 minute recording of an overview of the company. Make sure the focus is on tissue engineering and is related to the topics to be presented in the course! Select presentations will be played during class throughout the semester.

Paper Review/Presentation (Groups of 3-4, BIEN5802 only): Review and present (~30-35 minutes) a journal article to the class once during the semester. Articles are pre-selected and posted to Canvas. The presentation should cover the background, methods used, results, and discussion of the article and the presenters should pose discussion questions for the class. Additionally, the presentation should include an overview of the lab that the work was done in, as well as highlight at least one accompanying paper. Grading on presentation and discussion.

Paper Questions (Individual, BIEN4802/BIEN5802): Review the paper and write up 4 questions that you have on the paper, which could be asked to the paper presenters in class. You will be assigned 3 papers to do this for and it is expected that you will use these questions to participate in class discussions on the paper.

Paper Methods (Individual, BIEN4802 only): Review and write up a summary of one method used in the paper. This should include an original schematic and a one paragraph summary describing the method and why/how it was used in the paper. 3 papers will be assigned to you, but you can select the method from the paper to cover.

Project (Groups of 3-4, BIEN4802/BIEN5802): The project will consist of the development of a succinct business plan on a new tissue engineering concept, highlighting aspects such as the innovation of the idea, the general market for such a product, and the product competition. The goal is to encourage students to consider current approaches to tissue engineering and to generate new solutions. This will involve an early summary of an idea and then a presentation/pitch and final succinct report at the end of the semester. Peer reviewing will also be involved to select class favorite pitches for bonus points.

Discussion & Participation (BIEN4802/BIEN5802): This is a major portion of your grade, which will include: (i) participation in class lecture discussions, (ii) reviewing course information and papers prior to class and being involved in questions/discussions, (iii) fulfilling all participation commitments to your group(s) (evaluated at semester end via a survey), and (iv) completion of miscellaneous ungraded short assignments/surveys throughout the class.

Grading Distribution

BIEN4802:
Quizzes 40%
Company Overview 5%
Paper Questions 5%
Paper Methods 10%
Project 20%
Discussion/Participation 20%

BIEN5802:
Quizzes 40%
Company Overview 5%
Paper Questions 5%
Paper Presentation 10%
Project 20%
Discussion/Participation 20%

Anticipated Course Content and Schedule
***Topics/schedule subject to change**

Week 1	**1/13: JAB Gone – no class**	**1/15:** Course Overview, Introduction
Week 2	**1/20: No class – MLK Holiday**	**1/22:** Tissues + ECM
Week 3	**1/27:** Ceramics + Polymers	**1/29: Quiz 1** Hydrogels + Scaffold Overview
Week 4	**2/3:** Cell Sources + Microenvironments	**2/5: Quiz 2** Paper (Scaffold-free Printing)
Week 5	**2/10:** 3D Printing – Extrusion	**2/12: Quiz 3** Paper (Extrusion 3D Printing)
Week 6	**2/17:** 3D Printing – Light-based	**2/19: Quiz 4** Paper (Light-based 3D Printing)
Week 7	**2/24:** Microparticles and Fibers	**2/26: JAB Gone** Guest Lecture (Dr. Chima Maduka): Tissue Response to Biomaterials
Week 8	**3/3:** Microparticles and Drug Delivery	**3/5: Quiz 5** Papers (Drug Delivery)
Week 9	**3/10:** Bioreactors + Organs-on-chips	**3/12: Quiz 6** Papers (Bioreactors/Organs-on-chips)
Week 10	**3/17:** Cartilage Tissue Engineering	**3/19: Quiz 7** Papers (Cartilage Tissue Engineering)
Week 11	**3/24: Spring Break – No Class**	**3/26: Spring Break – No Class**
Week 12	**3/31:** Bone Tissue Engineering	**4/2: Quiz 8** Papers (Bone Tissue Engineering)
Week 13	**4/7:** TA Lecture (Mackenzie): FDA and Translation	**4/9: JAB Gone** Guest Lecture (Dr. Hannah Zlotnick): Engineering Patho(physiologic) Tissues
Week 14	**4/14:** Cardiac Tissue Engineering	**4/16: Quiz 9** Papers (Cardiac Tissue Engineering)
Week 15	**4/21:** Vascular Tissue Engineering	**4/23: Quiz 10** Papers (Vascular Tissue Engineering)
Week 16	**4/28:** Final Project Presentations (Company Pitches)	**4/30:** Final Project Presentations (Company Pitches)

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Additional Information:

Honor Code
All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. Understanding the course's syllabus is a vital part in adhering to the Honor Code.
All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: StudentConduct@colorado.edu. Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Visit Honor Code for more information on the academic integrity policy.

Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation
If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or DSinfo@colorado.edu for further assistance. If you have a temporary medical condition, see Temporary Medical Conditions on the Disability Services website.
If you have a temporary illness, injury or required medical isolation for which you require adjustment, please utilize your ability to drop up to 2 quizzes to help accommodate any unexpected absences. If the concern is related to a scheduled presentation in class, please email Dr. Burdick and Mackenzie.

Accommodation for Religious Obligations
Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please communicate the need for a religious accommodation in a timely manner. In this class, remember that you can drop up to 2 quizzes to accommodate absences and we will ask your input to schedule presentations in class, where you can let us know of any planned absences. See the campus policy regarding religious observances for full details.

Preferred Student Names and Pronouns
CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

Classroom Behavior
Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, marital status, political affiliation, or political philosophy.
For more information, see the classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation
CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits protected-class discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner abuse (dating or domestic violence),

stalking, and related retaliation by or against members of our community on- and off-campus. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email CUreport@colorado.edu. Information about university policies, reporting options, and OIEC support resources including confidential services can be found on the OIEC website.
Please know that faculty and graduate instructors are required to inform OIEC when they are made aware of incidents related to these concerns regardless of when or where something occurred. This is to ensure that individuals impacted receive outreach from OIEC about their options and support resources. To learn more about reporting and support for a variety of concerns, visit the Don't Ignore It page.

Mental Health and Wellness
The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact Counseling and Psychiatric Services (CAPS) located in C4C or call (303) 492-2277, 24/7.
Free and unlimited telehealth is also available through Academic Live Care. The Academic Live Care site also provides information about additional wellness services on campus that are available to students.

Acceptable Use of AI in this Class
Generative artificial intelligence (AI) tools—software that reproduces text, images, computer code, audio, video, and other content—have become widely available. Well-known examples include ChatGPT for text and DALL•E for images. This statement governs all such tools, including those released during our semester together.
Keep in mind that the goal of gen AI tools is to reproduce content that seems to have been produced by a human, not to produce accurate or reliable content; therefore, relying on a gen AI tool may result in your submission of inaccurate content. It is your responsibility—not the tool's—to assure the quality, integrity, and accuracy of work you submit in any college course. With this in mind, all assignments including those related to paper reviewing and the project should not use AI.
If gen AI tool use is suspected in completing assignments for this course in ways not explicitly authorized, I will follow up with you. I may contact the Office of Student Conduct & Conflict Resolution to report suspected Honor Code violations. In addition, you must be wary of unintentional plagiarism or data fabrication. Please act with integrity, for the sake of both your personal character and your academic record.