

Chem 658: Frontiers of Biotechnology, Fall 2023 – 3 credits

Course Coordinator:

Jeanne A. Hardy (hardy@chem.umass.edu), 745A Lederle Tower, 5-3486

Class Meetings: Tuesdays and Thursdays 5:30 – 6:45 pm
Integrative Science Building ISB 321

Course Outline:

	Unit	Instructor	Guest Lecturer & Affiliation
Tues Sep 5	Introduction	Jeanne Hardy	
Thurs Sep 7			
Tues Sep 12	Plant Biotechnology	Sam Hazen hazen@bio.umass.edu	Devin O'Connor Senior Scientist Pairwise
Thurs Sep 14			
Tues Sep 19	Technologies for RNA Therapeutics	Leonid Pobzinsky lpobezinsky@umass.edu	Ed Miracco Senior Scientist Moderna Therapeutics
Thurs Sep 21			
Tues Sep 26			
Thurs Sep 28	Future of Gene Editing and Gene Therapy	Tom Maresca tmaresca@bio.umass.edu	Yu (Sherry) Jiang Senior Scientist Intellia
Tues Oct 3			
Thurs Oct 5			
Thurs Oct 12	Harnessing Synthetic Biology for Production of High Value Chemicals	Lauren Andrews lbandrews@umass.edu	Ben Gordon Sr Dir Res - Asimov Tech Prog Manager - BioMADE
Tues Oct 17			
Thurs Oct 19			
Tues Oct 24	Translational Immunology	Alissa Rothchild arothchild@umass.edu	Pushpa Jayaraman Head Translational Sci Palleon Pharma
Thurs Oct 26			
Tues Oct 31			
Thurs Nov 2	Protein Degradors as Drugs	Jeanne Hardy hardy@chem.umass.edu	Stewart Fisher CSO C4 Therapeutics
Tues Nov 7			
Thurs Nov 9			
Tues Nov 14	Assistive Reproduction Technologies	Rafael Fissore rfissore@vasci.umass.edu	Denny Sokkas Scientific Director Boston IVF Group
Tues Nov 16			
Tues Nov 21			
Tues Nov 28	Bio-transport & Vascular Mechanotransduction	Juan Jimenez juanjimenez@umass.edu	John Welsh Osciflex
Thurs Nov 30			
Tues Dec 5			
Thurs Dec 7Se	Course Analysis & Future Planning	Jeanne Hardy	

Dates for Industrial speakers in **bold**.

Prerequisites: This course is open to graduate students in all life-science programs as well as to students in programs with applications relevant to Biotechnology.

Course Description: The goal of *Frontiers in Biotechnology* is to educate students about the scientific advances and resulting tools that have allowed the biotech revolution, to chronicle the implementation of recent advances in biotechnology, and to identify those areas of great unmet need in which biotechnology can play a major role in the future. *Frontiers in Biotechnology* comprises eight individual units focusing on what we view to be eight of the most cutting edge advances in biotechnology. We have designed the course around the concepts that '*Biotechnology*' is a vast enterprise with a huge number of applications and that the ultimate goal of any biotechnology is application to a pressing human need. Thus, in each unit we engage industrial experts to provide real-world, real-time snapshots of biotechnology applications.

Each 3-meeting unit consists of one lecture by the indicated UMass BTP Faculty Instructor, one lecture by an outside, industrial expert and concludes with one discussion section on the topic. During each unit the concepts of rigor and reproducibility for the techniques used are emphasized. As relevant, the discussion sections include the involvement of multiple faculty and allows students to interact with faculty from multiple disciplines. The interaction with UMass faculty from various departments and with industrial visitors provides a rich source of potential mentors for students in the course.

Learning Objectives: The Learning Objectives for this class are as follows:

- An appreciation for the importance of rigor and reproducibility
- An understanding of the basic biological and chemical concepts behind a number of current biotechnology advances
- An appreciation for how basic biology and chemistry forms the platform upon which biotechnology advances human health and medicine
- An introduction to the research and development conducted by several biotech companies

Grade Weights: Grades will be based on scores from eight assignments, one assignment corresponding to each unit in the course. The assignment for each unit will be designed and graded by the instructor for that unit. Each assignment will be worth 100 points, for a total of 800 points possible in the course.

Grade scale: A 90, A- 88, B+ 86, B 80, B- 78, C+ 76, C 70, C- 69, D 60%

SUGGESTED PREREQUISITE READING/ LISTENING

The Gene: An Intimate History by Siddhartha Mukherjee

Background Reading – Particularly Important for Chemists & Engineers:

The BioTech Primer by BioTech Primer Inc.

Biotechnology Demystified by Sharon Walker

Biotechnology for Beginners by Reinhard Renneberg and Arnold L. Demain

Additional Historical Context - For fascinating historical background into many of the groundbreaking discoveries and techniques that have made biotechnology possible:

The Eighth Day of Creation: Makers of the Revolution in Biology by Horace Freeland Judson

Genentech: The Beginnings of Biotech by Sally Smith Hughes
The Plague Year by Lawrence Wright – a riveting tale of the past 18 months

UMass Amherst Academic Regulations	<p>All UMass students are responsible for complying with the academic regulations at the following link: https://www.umass.edu/registrar/students/policies-and-practices/academic-regulations</p> <p>The UMass Amherst policy on class attendance is: “Students are expected to attend all regularly scheduled classes at the University for which they are registered. Students absent due to extenuating circumstances-including jury duty, military obligations, scheduled activities for other classes, the death of a family member, or verifiable health-related incapacity-remain responsible for meeting all class requirements and contacting the faculty member in a timely fashion about making up missed work. Faculty shall offer such students reasonable assistance in making up missed classes.”</p>
Accommodation	<p>The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements. For further information, please visit Disability Services (https://www.umass.edu/disability/)</p>
Academic Honesty	<p>Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent (http://www.umass.edu/dean_students/codeofconduct/acadhonesty/).</p>
Ownership of course material	<p>Many of the materials created for this course are the intellectual property of the instructor. This includes, but is not limited to, the syllabus, lectures, problem sets, exams, study guides, and course notes. Except to the extent not protected by copyright law, any use, distribution or sale of such materials requires the written permission of the instructor. Please be aware that it is a violation of university policy to reproduce, for distribution or sale, course material including the syllabus, lectures, problem sets, exams, study guides, and course notes. <u>This is particularly important in this class since we will have several guests from industry who will have constraints on what they can share. Please do not share any material from the lectures presented in this class without the express and written permission from the instructor.</u></p>
Title IX Statement	<p>In accordance with Title IX of the Education Amendments of 1972 that prohibits gender-based discrimination in educational settings that receive federal funds, the University of Massachusetts Amherst is committed to providing a safe learning environment for all students, free from all forms of discrimination, including sexual assault, sexual harassment, domestic violence, dating violence, stalking, and retaliation. This includes interactions in person or online through digital platforms and social media. Title IX also protects against</p>

discrimination on the basis of pregnancy, childbirth, false pregnancy, miscarriage, abortion, or related conditions, including recovery. There are resources here on campus to support you. A summary of the available Title IX resources (confidential and non-confidential) can be found at the following link: <https://www.umass.edu/titleix/resources>. You do not need to make a formal report to access them. If you need immediate support, you are not alone. Free and confidential support is available 24 hours a day / 7 days a week / 365 days a year at the SASA Hotline 413-545-0800.

For purposes of Title IX reporting, I am considered a “responsible employee” at UMass (<https://www.umass.edu/titleix/about>). **That means that if you tell me about a situation involving sexual assault, sexual harassment, domestic violence, dating violence, stalking, and retaliation, I must share that information with the Title IX Coordinator.** Making a report to the Title IX Coordinator is my legal obligation, meets the University's goal of providing members of our community with supportive resources they might need, and enables the University to obtain a more accurate picture of the extent of sexual violence in our community. **It will be completely up to you to determine if and how you want to work with the Title IX Coordinator's office. You will not be in trouble for reporting to me that you have experienced any of these situations, and the law prohibits retaliation against anyone who participates in a Title IX process.**

For the purposes of this class, if you choose to discuss your own personal experiences of sexual violence as part of a written assignment or a discussion, we do not consider that a report covered by Title IX.