**Course overview**

In this course, students will be introduced to the concepts of cellular agriculture, food science and the use of biotechnology in food production. Students will read journal articles on relevant research in the field, hear from researchers and thought leaders, discuss, and explore the impacts of agricultural biotechnology and novel food production systems, and view food biotechnology through both scientific and entrepreneurial lenses.

**Prerequisites:**

Students will be best prepared for this course if they have a background in cell biology or biomedical engineering.

**Teaching Team:**

Course Coordinator: David Kaplan ([David.kaplan@tufts.edu](mailto:David.kaplan@tufts.edu))

Course Instructors: Michael Saad ([Michael.saad@tufts.edu](mailto:Michael.saad@tufts.edu)), Sophie Letcher ([Sophia.letcher@tufts.edu](mailto:Sophia.letcher@tufts.edu))

Teaching Assistant: Kirsten Trinidad ([Kirsten.trinidad@tufts.edu](mailto:Kirsten.trinidad@tufts.edu))

Grader: Emily Lew ([Emily.lew@tufts.edu](mailto:Emily.lew@tufts.edu))

**Unless otherwise specified, assignments will be due by 6 PM on the specified due date.**

**Schedule:**

Week 1 (Sep. 12): *Cell ag 101 & Food Biotech History*

* **Goal** – For students to gain an understanding of current considerations in the science, technology and consumer space and be introduced to cellular agriculture and for students to gain a broad understanding of the field of food technology (particularly biotechnology)
* **Class (pt. 1)** – *Lecture:* Cellular agriculture 101
* **Class** **(pt. 2)** – *Exercise:* Food Biotechnology through history trivia
* **Assignments:**
  + Read cultured meat review paper & post one question (Post et al., 2020) [due Sep. 19]

Week 2 (Sep. 19): *Cell ag 101 (continued) & Infographic Activity*

* **Goal** – For students to gain an understanding of current considerations in the science, technology and consumer space and be introduced to cellular agriculture.
* **Class (pt. 1)** – *Lecture:* Cellular agriculture 101 (continued)
* **Class (pt. 2) –** *Exercise:* In-class infographic
* **Assignments**:
  + Read journal articles (2x) for journal club next week & post one question each [due Sep. 26]
  + Form midterm & final project groups and select your “problem” of choice [due Sep. 26]
  + Finish and submit infographic assignment [due Sep. 26]

Week 3 (Sep. 26): *Muscle & fat biology*

* **Goal** – For students to dive further into the science of muscle and fat tissue *in vitro* and *in vivo*.
* **Class (pt. 1)** – *Lecture:* Muscle and fat biology
* **Class (pt. 2)** – *Discussion:* Journal club
* **Assignments:**
  + Read patents (Upside, Mission Barns, and Merck) for discussion next week & post one advantage and one disadvantage for each [due Oct. 3]
  + Review literature for midterm problem and submit literature review assignment [due Oct. 10]

Week 4 (Oct. 3): *Cell expansion & scale-up*

* **Goal** – For students to dive further into the science of cell culture scale-up.
* **Class (pt. 1)** – *Lecture:* Cell expansion and scale-up
* **Class (pt. 2)** – *Lecture:* from guest and exercise led by [Ark Biotech](https://www.ark-biotech.com/) team (Natalie Rubio & Zheng Huang)
* **Assignments:**
  + Read journal article for the journal club in 2 weeks & post one question [due Oct. 17]
  + Prepare one-page summary of planned midterm approach (include bibliography) [due Oct. 17]

Week 5 (Oct. 17): *3D tissue engineering*

* **Goal** – For students to dive further into the science and challenges of scaffolding and forming cultured meat constructs with cultured/expanded muscle and adipose cells.
* **Class (pt. 1)** – *Lecture:* 3D tissue engineering, led by guest [Dr. Glenn Gaudette](https://www.bc.edu/content/bc-web/schools/mcas/departments/engineering/people/faculty-directory/glenn-gaudette.html)
* **Class (pt. 2)** – *Discussion:* Journal club
* **Assignments:**
  + Do readings for Oct. 24 guest lecture & post one question [due Oct. 24]
  + Continue work on midterm presentation and paper [due Nov. 7]

Week 6 (Oct. 24): *Meat Science*

* **Goal** – For students to hear from somebody in the field of meat science.
* **Class (pt. 1)** – *Lecture:* meat science, led by guest [Dr. Ranjith Ramanathan](https://experts.okstate.edu/ranjith.ramanathan)
* **Class (pt. 2)** – *Exercise*: Group work & updates with instructors of one-page summary & plans so far
* **Assignments:**
  + Continue work on midterm presentation and paper [due Nov. 7]
  + Do reading (Joe Fassler’s lab-grown meat [article](https://thecounter.org/lab-grown-cultivated-meat-cost-at-scale/) in *The Counter*) for next week’s lecture & post one question [due Oct. 31]

Week 7 (Oct. 31): *Cell ag: Broader context and considerations*

* **Goal** – For students to dive further into the broader context of the field of cell agriculture
* **Class (pt. 1)** – *Lecture:* Perspectives from industry, led by Dr. Eric Schulze, PhD, VP Global Scientific and Regulatory Affairs at Upside Foods
* **Class (pt. 2)** – *Discussion*: Journal club
* **Assignments:**
  + Prepare writeup and presentation of technical solution & midterm project [due Nov. 7]

Week 8 (Nov. 7): *Midterm presentations*

* **Goal** – For students to present and discuss their own technical solutions
* **Class (pt. 1)** – Presentations
* **Class (pt. 2)** – Presentations
* **Assignments:**
  + Do readings for guest lecture and submit questions [due Nov. 14]
  + Generate a two-page response to questions received during presentations [due Nov. 21].

Week 9 (Nov. 14): *Guest lectures from the Friedman School of Nutrition Science and Policy*

* **Goal** – For students to evaluate the considerations and consumer interests of cellular agriculture from environmental, socioeconomic, and sensory perspectives
* **Class (pt. 1)** – *Lecture:* from Friedman Nutrition School guests [Dr. Nicole Tichenor Blackstone](https://nutrition.tufts.edu/profile/faculty/nicole-tichenor-blackstone) & [Dr. Sean Cash](https://nutrition.tufts.edu/profile/faculty/sean-cash)
* **Class (pt. 2)** – *Discussion*: Journal club
* **Assignments:**
  + Generate a two-page response to questions received during presentations [due Nov. 21].
  + Work on Final Project presentation and writeup [due Dec. 5 and 12, repsecitvely]
  + Do readings for guest lecture and submit questions [due Nov. 21]

Week 10 (Nov. 21): *Guest lectures on acellular production*

* **Goal** – For students to learn about production and marketing of acellular/fermentation-derived products
* **Class (pt. 1)** – *Lecture:* **Virtual** guest lectures from [Perfect Day](https://perfectday.com/) (Tim Geistlinger and Paul Ayers)
* **Class (pt. 2)** – Enjoy Thanksgiving!
* **Assignment**s:
  + Work on Final Project presentation and writeup [due Dec. 5 and 12, respectively]

Week 11 (Nov. 28): *Sensory Evaluation*

* **Goal** – For students to learn about sensory evaluation and perform a qualitative evaluation of plant-based milks
* **Class (pt. 1)** – *Lecture:* from Scott Frost, Post-Doc in Tufts’ Biology department
* **Class (pt. 2)** – *Activity*: Plant-based milk tasting
* **Assignments**
  + Work on Final Project presentation and writeup [due Dec. 5 and 12, respectively]

Week 12 (Dec. 5): Final project presentations part 1

* **Goal** – Students pitch cell-ag start-ups; the rest of class “invests” in their favorites.
* **Class** – Class Presentations / questions

Week 13 (Dec. 12): Final project presentations part 2

* **Goal** – Students pitch cell-ag start-ups; the rest of class “invests” in their favorites.
* **Class** – Class Presentations / questions

**Grading:**

* Misc. Assignments (discussion posts, infographic, in-class exercises, etc.) – 25%
* 1-page summary of midterm approach – 5%
* 2-page response to midterm questions – 5%
* Class engagement (journal clubs, discussions, etc.) – 25%
* Midterm project – 15%
* Final project pitch – 25%

**Expectations:**

* Assignment submissions: Assignments **will be due before class begins (e.g., by 6pm) on the due date**. *No late assignments will be accepted,* and a zero grade will be recorded for missing work. If you think you may have difficulty completing an assignment on time, please ask us for an extension as early as possible. No extensions will be granted fewer than 24 hours before an assignment is due other than in the case of an emergency; in such cases, please notify us as soon as possible.
* Attendance: Attendance to all class sessions is expected for students and will be reflected in your engagement grade (except in the case of extenuating circumstances, addressed on a case-by-case basis). If you are unable to attend a class session, please email us at least 24 hours in advance, and we will try to provide a video recording of the zoom session.

**Academic Support at the StAAR Center:**

The StAAR Center (formerly the Academic Resource Center and Student Accessibility Services) offers a variety of resources to all students (both undergraduate and graduate) in the Schools of Arts and Science, Engineering, the SMFA and Fletcher; services are free to all enrolled students. Students may make an appointment to work on any writing-related project or assignment, attend subject tutoring in a variety of disciplines, or meet with an academic coach to hone fundamental academic skills like time management or overcoming procrastination. Students can make an appointment for any of these services by visiting [go.tufts.edu/TutorFinder](http://go.tufts.edu/tutorfinder), or by [visiting our website](https://students.tufts.edu/staar-center) (https://students.tufts.edu/staar-center).

**Accommodations for Students with Disabilities:**

Tufts University values the diversity of our students, staff, and faculty; recognizing the important contribution each student makes to our unique community. Tufts is committed to providing equal access and support to all qualified students through the provision of reasonable accommodations so that each student may fully participate in the Tufts experience. If you have a disability that requires reasonable accommodations, please contact the StAAR Center (formerly Student Accessibility Services) at [StaarCenter@tufts.edu](mailto:StaarCenter@tufts.edu) or 617-627-4539 to make an appointment with an accessibility representative to determine appropriate accommodations. Please be aware that accommodations cannot be enacted retroactively, making timeliness a critical aspect for their provision.

**Mental Health Support:** As a student, there may be times when personal stressors or emotional difficulties interfere with your academic performance or well-being. The Counseling and Mental Health Service (CMHS) provides confidential consultation, brief counseling, and urgent care at no cost for all Tufts undergraduates as well as for graduate students who have paid the student health fee. To make an appointment, call 617-627-3360. Please visit the CMHS website: http://go.tufts.edu/Counseling to learn more about their services and resources.