

Cellular Agriculture: An activity guide to support an engineering ethics and impacts discussion in high school settings (Resource Exchange)

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CELLULAR AGRICULTURE: AN ACTIVITY GUIDE TO SUPPORT AN ENGINEERING ETHICS IMPACTS DISCUSSION IN HIGH SCHOOL SETTINGS

Overview

Cellular agriculture is the emerging field of producing animal products from cell culture, rather than directly from animals. A multidisciplinary field, cellular agriculture integrates biomedical engineering, nutrition, animal science and more. Our project's outreach goals are to educate students about the process and possibilities of cellular agriculture. One of our first products is a discussion guide that has developed a set of resources and prompts that support educators in having high school students discuss the potential cascading consequences of advances in cellular agriculture to understand the positive and negative impacts of a new engineered technology

Target Grade Level

- Students in grade 7-12

Time

- 80-100 minutes

Learning Goals

- Engineering and technology ethical considerations
- Sociotechnical impacts of cellular agriculture innovations
- Create claims and context from various media sources
- Consider multiple solutions (NGSS K-2-ETS 1-2)
- Frame the problem (NGSS K-2-ETS 1-1)
- Weigh and choose criteria and constraints for their design (NGSS K-2-ETS1-2)
- Understand their client to meet their needs (NGSS K-2-ETS1-2)
- Communicate ideas and thinking to partners, groups, outside audiences (SL 1.1D, 2.1D, 1.4, 2.4, 1.6, 2.6; NGSS K-2-ETS1-2)

Required Resources

- Computers with Internet Access
- Google Jamboard or other representation tool
- CellAg Discussion Guide I: Consequences is a 20 page PDF with links and guiding questions available at <https://go.tufts.edu/cellagdiscussionguide1>

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Sample Pages

- The guide provides links to materials, structures for students to document impacts and background information. After viewing publicly available information on cellular agriculture and biomedical engineering, students are tasked with creating Google Jamboards of their ideas about impacts. The guide provides structures for educators to have conversations about who is helped and who is harmed by newly engineered products in this space.


SUGGESTED VIDEO RESOURCE MATERIALS

15 MINUTES

- "Is cell-cultured meat ready for the mainstream?"**
Produced by: Quartz | Video Length: ~8 minutes
YouTube Link: https://youtu.be/YVXw_vYfBA
- "How is cultivated meat (a.k.a. cultured meat) made exactly?"**
Produced by: Mossa Meat | Video Length: ~2 minutes
YouTube Link: <https://youtu.be/86460-F93Dk>
- "Inside the Quest to Make Lab-Grown Meat?"**
Produced by: WIRED | Video Length: ~7 minutes
YouTube Link: <https://youtu.be/D095S1HS6MM>
- "Lab-Grown Meat Could Feed the Planet"**
Produced by: TIME | Video Length: ~4.5 minutes
YouTube Link: <https://youtu.be/9f8k8rowGds>
- "How Lab-grown meat is made"**
Produced by: Interesting Engineering | Video Length: ~6 minutes
YouTube Link: <https://youtu.be/29GZ7Xn8e4k>

TIPS FOR INSTRUCTORS

- Have each person in the group watch at least 1 different video than their peers (for a total of 4 different resources in each group)
- Have students jot down notes as they watch the videos)
- Before this activity, have students bring their own headphones or earphones to listen with



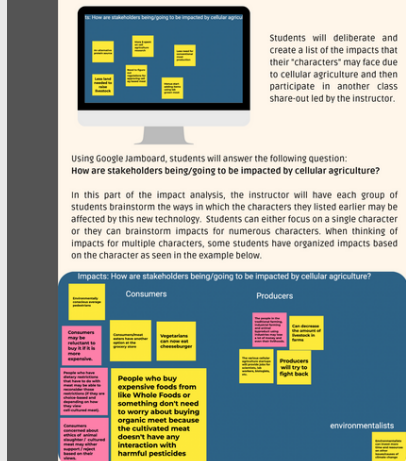
IMPACTS

10 MINUTES

Students will deliberate and create a list of the impacts that their "characters" may face due to cellular agriculture and then participate in another class share-out led by the instructor.

Using Google Jamboard, students will answer the following question:
How are stakeholders being/going to be impacted by cellular agriculture?

In this part of the impact analysis, the instructor will have each group of students brainstorm the ways in which the characters they listed earlier may be affected by this new technology. Students can either focus on a single character or they can brainstorm impacts for numerous characters. When thinking of impacts for multiple characters, some students have organized impacts based on the character as seen in the example below.



THINGS TO KNOW ABOUT CELLULAR AGRICULTURE

MEAT

"Meat" is just cells, which are the building blocks of all living things. Cells provide structure and carry out specialized functions such as taking nutrients to turn it into energy. A group of cells can form a tissue for organs.

FAT

Meat is made up of mainly muscle and fat. Animal muscle is 75% water, 20% protein, and 5% fat, carbohydrates, etc. Each animal that produces meat has its own taste, texture, and color due to the layout of muscular fibers and chemical reactions upon the death of the animal and how the meat is cooked.

CULTURE

Below is a basic overview of a cell culture:

- ISOLATE**: The cells from their natural environment. The cells can be removed directly, or derived from an existing cell line.
- MAINTAIN**: The growth, division, and differentiation of the cells as it were in its natural environment.
- OBSERVE**: Any possible changes in the culture and maintain according to goal.

MAINTAIN

How do you maintain a cell culture?

- TEMPERATURE AND pH**: Vital for optimal growth, and depends on the origin of cells to be cultured.
- MEDIA AND GROWTH FACTORS**: Any liquid or gel that supplies the nutrients necessary for cell cultures to survive and proliferate.
- SCAFFOLDING**: A network that allows cells and nutrients to flow in all directions, an area for growth.


Download

<https://go.tufts.edu/cellagdiscussionguide1>

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