CELL-CULTURED PROTEIN

Updated Jan. 2024

BACKGROUND

With a global population set to reach 9 billion people within the next decade, we will need to explore all options to ensure there is enough protein to fuel the growing world. Cell-cultured protein remains an option that is still in the exploratory phase in Canada. The timeline for when these products may be either approved for consumption in Canada, or produced in commercial quantities, is unclear. While we are a long way from seeing cell-cultured protein in the grocery store, it is important to stay informed about product developments and how it may impact the protein market and consumers.

KEY MESSAGES

- Cattle and other ruminants are a sophisticated technology found in nature that upcycles human inedible food sources (damaged crops and crop by-products as well as grasses) and naturally convert it to a high-quality and nutritious protein for humans.
- **In most instances, animals are still involved in the production of cell-cultured protein.** One of the most popular growth mediums used in the production of cell-cultured protein is fetal bovine serum (FBS), which is derived from the blood drawn from an expired bovine fetus at the processing facility.
- **There has been no comprehensive Life Cycle Analysis (LCA) of cell-cultured protein,** making environmental comparisons with Canadian beef production difficult. Although this process may produce less greenhouse gas (GHG) directly from animals, the construction of these massive facilities and their associated energy requirements will be significant.
- Companies around the world are developing cell-cultured protein, however, most are at a pilot scale and not at full-scale manufacturing. **There are currently no commercially cell-cultured protein products available in Canada.**
- Canada does not have a regulatory framework for cell-cultured protein, however, there is a possibility that products could be classified under 'Novel Foods'.
- Cell-cultured protein will require hormones for its production and strict bio-security processes will need to be in place to prevent bacterial contamination.
- Research shows consumers are concerned about the ethics of meat; however, they are more concerned about the potential food safety risks and unnaturalness of cell-cultured protein.
- Unintended consequences of removing cattle from the Canadian landscape include: the loss of our native grasslands, loss of wildlife habitat, a reduction in soil organic carbon[1] and increased human nutrient deficiencies[6].

Many Names, Same Product

- **In-Vitro Protein**
- **Slaughter-Free Protein**
- **Cellular Protein**
- **Synthetic Protein**
- **Lab-Grown Protein**
- **Clean Protein**
- **Cell-Based Protein**
- **Cultured Protein**
- **Healthy Protein**
- **Cultivated Protein**

Canadian Cattle Association

CANADIAN BEEF
Public & Stakeholder Engagement

FREQUENTLY ASKED QUESTIONS

How is cell-cultured protein made?

Specific technologies can differ between companies, but a similar process is generally followed. Small tissue samples are collected from an animal's muscle under local anesthetic. From this sample, myocytes (muscle) and adipocytes (fat) cells are isolated and grown in a lab in a culture medium. The best medium currently being used contains fetal bovine serum (FBS), derived from the blood drawn from an expired bovine fetus at the processing facility. Plant-based mediums are in development, with the most promising derived using tobacco, but plant sources alone are unlikely to provide all of the nutrients needed for cellular growth. In a bioreactor, which resembles an alcohol fermentation tank, the cells are stimulated using electrical current or mechanical movement at the same temperature as the body temperature in an animal. The cells grow and fuse together on a 3D model called a "scaffold". These cells grow in strands, which can be stacked and folded to form a product that resembles a hamburger patty. Production of more complex cuts like prime rib is currently not possible. It currently takes approximately 20,000 of these cellular strands and several weeks to create one cell-cultured hamburger[2].

Is cell-cultured protein safe to eat?

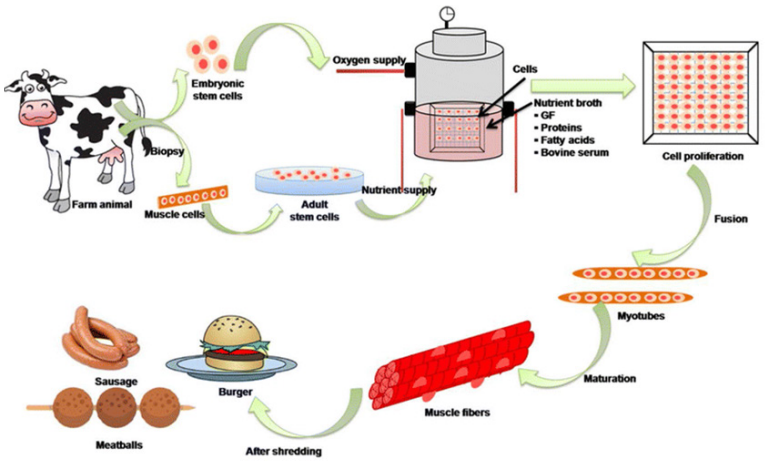
In theory, since cells are derived directly from the animal, there should be no nutritional difference between beef and cell-cultured 'beef.' However, research will need to be conducted to determine the effects of humans eating cell-cultured protein, and if it truly does offer the same nutritional benefits and delicious flavour we expect from beef. It is possible that the growth medium will alter the nutritional quality of cell-cultured protein and care will be needed to avoid bacterial contamination[3]. Due to the nature of how cell-cultured protein is produced, it is likely that the taste and texture of cell-cultured cuts will be different than meat derived from an animal. Additionally, because of the way cell-cultured protein is grown, there is potential for bacteria proliferation throughout the fabricated 'cut' of meat. This means while conventional whole beef cuts can be served safely at a rare or medium rare temperature, cell-cultured 'cuts' would need to be cooked to well done to avoid potential food safety concerns.

Is cell-cultured protein better for the environment?

Cell-cultured protein proponents claim that replacing conventionally derived meat from livestock with cell-cultured protein will result in reduced GHG emissions and require fewer resources. To date, there are no comprehensive studies looking into the inputs and outputs required to produce cell-cultured protein. However, studies have shown that removing livestock from US food production would require increased production of synthetic fertilizer (due to loss of animal manure) and generate more food waste (due to loss of diversion of by-products and food waste to feed ruminants)[3]. Substantial capital investment would also be required to construct the factories that would be used to produce cell-cultured protein at scale[3].

Why is cell-cultured protein not on the market? Will it be soon?

Cost, scalability and regulatory considerations are the biggest barriers when it comes to getting cell-cultured protein on the market. In 2023, Upside Foods and Good Meat, two companies that make cell-cultivated 'chicken', received clearance for sale in the United States by the Food and Drug Administration (FDA) and the the U.S Department of Agriculture (USDA)[4]. So far the product has been sold in small quantities at a few high-end restaurants.



Production of Cultivated Meat. (Gaydhane, M.K. et al., (2018))

REFERENCES

1. Canadian Roundtable for Sustainable Beef (CRSB). (2024). National Beef Sustainability Assessment and Strategy summary report. Calgary, AB.: CRSB. (Accessed Feb. 26, 2024)
2. Cellular protein is not yet a feasible meat alternative, researcher says. Canadian Cattlemen. May 18, 2021. https://www.canadiancattlemen.ca/news/cellular-protein-not-yet-a-feasible-meat-alternative-researcher-says/ (Accessed Feb. 26, 2024)
3. Chriki S and Hocquette J-F (2020) The Myth of Cultured Meat: A Review. Front. Nutr. 7:7. doi: 10.3389/fnut.2020.00007
4. Lab-grown meat is cleared for sale in the United States, CNN Business: https://www.cnn.com/2023/06/21/business/cultivated-meat-us-approval/index.html (Accessed Feb 26, 2024)
5. Gaydhane, M. K. et al., (2018). Cultured meat: state of the art and future. Biomanufacturing Reviews, 3(1). doi:10.1007/s40898-018-0005-1
6. Hall, M. and White, R. (2017). Nutritional and greenhouse gas impacts of removing animals from US agriculture. PNAS, 114(48). doi.org/10.1073/pnas.1707322114