What is Cell-cultured Meat? How's it Made?
Cell-cultured Meat Implications for Regulation and Trade

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Concern for the impact of meat production on the environment (e.g., resource use and green-house gas emissions) alongside growing global consumption of meat has spurred about $600 million in investments in firms that make animal cell-cultured foods, or "cultured meat," during 2020 and 2021. Cultured meat is biologically identical to conventionally produced meat but is made from obtaining a small number of animal cells and growing them in a controlled environment. This EBOT compares cultured meat to conventional meat, describes the developing global market and industry for cultured meat, and introduces some initial regulatory implications for trade, i.e., nomenclature and labeling requirements, that do not have easy answers.

How is cell-cultured meat produced? The main starting inputs for cultured meat are stem cells, which are typically harvested from a live animal using minimally invasive techniques. Cells are developed into muscle and fat cells in growth medium, which takes place in progressively larger bioreactors until they reach optimal cell density. Then cells are separated from growth medium using centrifuges. Finally, cells are then processed or combined with additives (e.g., for texture) depending on the desired product.[1]

How does cell-cultured meat compare to conventional meat? At present, cell-cultured meat is not cost competitive with conventionally produced meat, but it may be in the long run. Some studies estimate that it may already be less impactful on the environment, and it has other ethics-based benefits for consumers. In 2019, Future Meat Technologies' chicken breast of cultured meat (which also contains plant protein) cost about a $16 per pound to produce, meanwhile the boneless chicken breast average retail price for December 2021 was about $3.73 per pound.[2] McKinsey estimates that if cell-cultured meat technology follows the same course of cost reduction as human genome technology, these firms will reach cost parity with conventional meat by 2030. A paper by Stephens et al (2018) notes that cultured meat creates less emissions, and uses less land, water, and energy than beef and potentially pork, but more than chicken and plant-based proteins. Other reported benefits to cultured meat include more humane and safer production than conventional meat because no animal slaughter is required, and production takes place in a controlled environment. These features of cultured meat have the potential to reduce harm to animals, injuries to workers, as well as contaminants in food products.[3]

Cost and benefits aside, to compete with conventional meat, cultured meat needs to provide products that look and taste like conventional meat; the cultured meat industry does not have a full product range, yet. Currently, cultured meatballs and chicken nuggets are closest to market (as noted by McKinsey). The technology to produce thick cuts of meat—steaks and roasts—exists, but these products are further from market.[4]

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[1] This is a synopsis, for more details on how cultured meat is made, please refer to McKinsey, "Cultivated Meat Out of the Lab," June 16, 2021; Good Food Institute, "The Science of Cultivated Meat," accessed February 4, 2022.
[2] McKinsey, "Cultivated Meat Out of the Lab," June 16, 2021; FRED, "Average Price: Chicken Breast, Boneless (Cost per Pound/453.6 Grams) in U.S. City Average," January 12, 2022.
[3] Stephens et al, "Bringing Cultured Meat to Market," August 2018. Stephens et all 2018 does not itself provide a comprehensive meta-analysis, but refers the reader to Datar and Betti (2010), Kadim et al. (2015), and Post (2012).
[4] MeaTech, "MeaTech MeaTech 3D Reports Breakthrough," December 7, 2021; Severson, Kim, "The New Secret Chicken Recipe?," February 16, 2022.

What does the market and industry for cell-cultured meat look like? For perspective, in 2019, the global animal protein market was worth about $44 billion and is expected to grow to $58 billion by 2027.[5] By that time, McKinsey estimates that the cultured meat market may be worth about $5 to $25 billion. However, this is a projection as there have been few commercial sales of cultured meat and currently none of these products are for sale in the U.S. market.[6]

The global industry had about $350 million worth of investments in 2020 and another $250 million in 2021, according to McKinsey. There are reportedly less than 100 firms in the industry, which focus on end products as well as intermediate inputs such as growth media; the United States is leading in terms of number of firms (24 companies).[7] One of the more recognizable and heavily funded firms ($186.25 million in 2020) is U.S.-based Upside Foods (formerly Memphis Meats), which has attracted funding from Cargill, Tyson Foods, as well as Whole Foods.[8]

What are some of the regulatory issues facing cell-cultured meat and implications for trade? Although international trade in cultured meat has not happened yet, regulation of cultured meat is evolving, and varies from country to country. Differing requirements for the labeling of cultured meat products present a challenge for trade: if countries do not align on what can be labeled "meat," then there may be implications for classification of cultured meat in the Harmonized Schedule and which tariffs will apply. In 2020, Singapore approved Eat Just Inc.'s product and the label of "cultured chicken," a label that, according to some legal analysts, places food cultured from animals in the meat and poultry category.[9] The European Union regulates cultured meat under an existing regulation and classifies these foods under the EU Novel Foods List. Firms in the EU must apply to the European Commission (EC) for authorization.[10] The United States is developing its own regulatory process for cultured meat. In 2019, the U.S. Food and Drug Administration (FDA) and the Food Safety Inspection Service (FSIS) agreed on a joint framework for the oversight of "human food made with cultured animal cells" and to work toward product approval. Nomenclature of cell-cultured products in the United States is still in the works. To this end, the U.S. meat industry has signaled that they want to use mandatory labeling to differentiate cultured meat from conventional meat in a "non-disparaging way."[11] Meanwhile, the National Cattlemen's Association filed a petition to USDA-FSIS to reserve the terms "beef" and "meat" for only conventionally produced products. Six thousand stakeholders on all sides of the issue responded to this petition.[12] As of September 2021, FSIS initiated the process of establishing U.S. labeling requirements for "cultured" meat. In sum, there is no final answer, but a lot of interest, in the question "what is cell-cultured beef and other meats?" and how to label them.

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[5] GlobeNewswire, "Global Animal Protein Market to Reach $58.50," March 22, 2021.

[6] FDA, "Food Made with Cultured," October 6, 2022. In December 2020, California-based Eat Just, Inc. sold a cultured chicken product under their brand GOOD Meat in a chicken bao dish at 1880 restaurant in Singapore. GOOD Meat, "The First Table," accessed January 25, 2022.

[7] Good Food Institute, Alternative Protein Company Database, accessed February 3, 2022.

[8] Upside Foods, "About," accessed February 4, 2022; Good Food Institute, State of the Industry, 2020.

[9] Wilson Sonsini Goodrich & Rosati, "In a Regulatory First, the Singapore," December 11, 2020.

[10] EC, "Novel Foods," accessed February 16, 2022; Good Food Institute, State of the Industry, 2020.

[11] NAMI, "Meat Institute and AMPS Innovation Send Joint Letter," October 19, 2020.

[12] Fasano and Michael, "Animal Cell-Culture," February 2020; NLR, "FSIS Responds," September 23, 2021; Federal Register, September 3, 2021.