

Meat the Future: The Patent Landscape of Cultivated Meat

Sheena X. Wang

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The food tech industry has been growing rapidly in recent years, reaching an estimated \$2.8 billion cumulative investment in 2022, and it is expected to continue its upward trajectory. ¹ Public sentiment for lower environmental impact, reduced health concerns associated with current livestock operations, and more humane food production practices have encouraged research and development in the industry. ² Cultivated meat—including genuine animal meat, seafood, and other animal products made from cultivated animal cells—is one of the newest additions to the food tech industry. Cultivated meat and seafood are grown by first extracting stem cells from a live animal and then cultivating those extracted cells in a lab in a solution comprising nutrients needed for cell and tissue growth. ³ Various studies have indicated that cultivated meat and seafood have the potential to drastically reduce the climate impact of meat production. ⁴

Cultivated meat and seafood products have recently reached some major milestones by gaining regulatory momentum and starting to enter the commercial market. The U.S. Food and Drug Administration (FDA) approved Upside Foods' and Good Meat's (a subsidiary of Eat Just) respective cultivated chicken products for sale in the U.S. market. ⁵ Singapore approved Eat Just's cultivated chicken for the Singaporean market, and Israel has recently approved Aleph Farms' (kosher) cultivated beef steaks for the Israeli market. ⁶

Other governments around the world have also been supportive of this effort. The Netherlands announced \$65 million in funding for cultivated meat and precision fermentation. ⁷ The Israel Innovation Authority granted \$18 million in funding to a consortium of cultivated meat

companies, universities, and research institutions. ⁸ The U.S. has invested \$10 million to create a government-funded cultivated protein research center. ⁹ Other countries, such as China and South Korea, have also increased policy support for cultivated meat development. ¹⁰

As customer appetite for sustainable food options grows, so does the number of food tech entities entering the cultivated meat space. At the end of 2022, there were over 150 publicly announced cultivated meat companies headquartered in 26 different countries in six different continents around the world. ¹¹

This article discusses patent and patent application trends in the cultured meat space and profiles five cultured meat companies: Upside Foods, Aleph Farms, Mosa Meat, Avant Meats, and Eat Just.

Global Filing Trend of Cultivated Meat Patent Applications

Emerging in the early 2010s, cultivated meat is a relatively new industry. The technology continues to tackle regulatory hurdles as government agencies around the world assess the safety of nontraditional, nonanimal sources of animal products. The first instance of a government approved cultivated meat product was in 2020, when the Singapore Food Agency approved of Eat Just's cultivated chicken. ¹² Notably, there was a global spike in patent application filings in the cultivated meat industry during that time. ¹³ Since that time, the FDA has approved two cultivated chicken products for sale in the U.S. market, and Israel has approved a cultivated beef product for the Israeli market. ¹⁴

Cultivated meat is a global industry with companies headquartered in 26 different countries around the world ¹⁵ and with each company applying for patents around the world. Perhaps not surprisingly, many cultivated meat companies focus their patent filings in their respective home countries. ¹⁶ For example, U.S.-based companies Upside Foods and Eat Just have filed more patent applications in the U.S. compared to other countries around the world. Additionally, Mosa Meat, a Dutch company, has filed more patent applications in the Netherlands compared to other cultivated meat companies. ¹⁷ Finally, Joes Future Food, a Chinese company, has only filed for applications in China so far. ¹⁸

However, not all cultivated meat companies have focused their patent filings primarily in their home country. ¹⁹ For example, BioTech Foods, a Spanish company, interestingly has filed for more patents in China compared to the European Patent Office (EPO). ²⁰ Israel-based company SuperMeat has filed for more patents in the U.S. compared to Israel. ²¹ Additionally, Aleph

Farms, another Israel-based startup, has filed for more patents in the EPO compared to Israel.

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Based on cultivated meat companies' patent filing patterns, it appears that most cultivated food companies believe that North America, Europe, and East Asia are the most promising markets for cultivated meat products. In addition, South America, Israel, Australia, and Southeast Asia appear to be important emerging markets for cultivated meat products based on global patent filing trends.

Upside Foods

Upside Foods, formerly known as Memphis Meats, is a California-based cultivated meat company founded in 2015. 23 It initially focused on creating cultivated beef and poultry products and has recently acquired a cultivated seafood company, indicating its intention to enter the cultivated seafood market. 24 It is the first cultivated meat company to receive regulatory approval in the U.S. back in 2022 for its cultivated chicken. 25

Upside Foods' patent portfolio comprises over 35 International Patent Documentation (INPADOC) patent families focused on different aspects of cell-based meat and production thereof. 26

Upside Foods has already obtained regulatory approval for its cultivated chicken; however, its pending patent applications indicate its interest in expanding its portfolio by making other types of meat products as well, including exotic animal and extinct animal cultivated meat products.

27 Overall, as of November 2023, Upside Foods' global patent portfolio included 37 granted patents and 112 pending published patent applications. 28

Aleph Farms

Aleph Farms is an Israeli cellular agriculture company founded in 2017. 29 In 2018, Aleph Farms created steak grown in a lab using cultured cells. 30

Aleph Farms' patent portfolio comprises two patent families focused on cultured meat compositions, pluripotent cell aggregates, cell-free animal collagen, methods of large-scale production of cultured food, edible protein products, systems for large-scale production of cultured foods, and methods for printing tissues and organs. 31

Overall, as of November 2023, Aleph Farms' global patent portfolio included two granted patents and 68 pending published patent applications. 32

In December 2023, Aleph Farms received regulatory approval for its cultivated beef in Israel. ⁽³³⁾ This marks the first regulatory approval for a cultivated beef product in the world. ⁽³⁴⁾ Aleph Farms has also applied to the U.K. Food Standards Agency (FSA) to sell its cultivated beef steak in the U.K., which is the first application to sell cultivated meat submitted to the FSA. ⁽³⁵⁾ Aleph Farms is also the first cultivated meat company to seek regulatory approval of a cultivated meat product in Europe by submitting its cultured beef steaks with the Federal Food Safety and Veterinary Office (FSVO) in Switzerland in collaboration with Migros. ⁽³⁶⁾ According to a study conducted by Migros and Aleph Farms, 74% of Swiss consumers are open to trying cultivated meat, ⁽³⁷⁾ indicating that Switzerland could be an important market for cultivated meat products.

Mosa Meat

Mosa Meat is a Dutch cultured meat company that specializes in making cultivated meat burgers. ⁽³⁸⁾ Mosa Meat was founded in 2016 in Maastricht and has successfully made a burger from stem cells, comprising muscle and fat grown using tissue samples from real cows. ⁽³⁹⁾ Its founder, Dutch scientist Mark Post, was the first to unveil a cultivated meat burger in 2013. ⁽⁴⁰⁾ In August 2023, Mosa Meat became the first cultivated meat company in the world to attain B Corp certification, which is a designation granted to companies after an evaluation of their environmental practices, worker welfare, and supply chain transparency. ⁽⁴¹⁾

Mosa Meat's patent portfolio comprises over 10 patent families focused on making cultivated tissue from cells, cell-containing hydrogel, cultivating bovine progenitor cells, ammonium-free cell cultures, packaging of cultured tissue, and cultured fat suitable for animal consumption. ⁽⁴²⁾ Overall, as of November 2023, Mosa Meat's global patent portfolio included 13 granted patents and 36 pending published patent applications. ⁽⁴³⁾

Mosa Meat is currently in the process of seeking regulatory approval and scaling up production to bring its products to market. ⁽⁴⁴⁾ According to its CEO, Mosa Meat is actively seeking regulatory approval in countries in "North America, Asia, Europe, the UK and more." ⁽⁴⁵⁾ Furthermore, Mosa Meat will be available for taste testing under limited conditions in the Netherlands. ⁽⁴⁶⁾ The Dutch government passed an agreement in 2022 allowing manufacturers of cultivated meat and seafood, such as Meatable and Mosa Meat, to conduct taste testing of their products after an evaluation by a panel of experts. ⁽⁴⁷⁾

Avant Meats

Avant Meats was founded in 2018 in Hong Kong and was initially focused on developing cultivated fish maw and cultivated fish fillet prototypes. (48) In 2021, Avant Meats expanded its operations to Singapore and launched a skincare ingredient in addition to its cultivated food products. (49)

Avant Meats' patent portfolio comprises over 20 patent families. (50) Its patents and patent applications are directed toward cell hydrolysate compositions; cells embedded in a 3D scaffold; and methods, systems, and products created from cultivated meat. (51) Interestingly, Avant Meats has filed patent applications directed toward growing cultured cells using a 3D scaffold to mimic animal organs, specifically the swim bladder (fish maw). (52) As of November 2023, Avant Meats had one granted patent in its global patent portfolio for in vitro meat and plant tissue production and 80 pending published patent applications. (53)

Avant Meats is not the only company in the cultivated seafood space. Startups such as U.S. companies Blue Nalu, Finless Foods, and Wildtype; Canada's Cell Ag Tech; and Germany's Bluu are also in the process of developing cultivated seafood products. (54)

Eat Just

Eat Just, formerly known as Hampton Creek Foods, was founded in 2011 and specializes in a variety of food tech products, including cultivated meat. (55) Good Meat, a division of Eat Just, specializes in cell-cultured meat. (56) Its cultivated chicken has been approved by both Singaporean and U.S. regulatory agencies and is currently available for sale in the U.S. and Singapore at select restaurants and butchereries. (57)

Eat Just's patent portfolio comprises over 30 patent families focusing on making animal product-like foods such as meat, mayonnaise, and eggs. (58) Overall, as of November 2023, Eat Just's global patent portfolio included 26 granted patents and 104 pending published patent applications. (59) Good Meat, as the cultured meat division of Eat Just, is the assignee of 11 patent families, including two granted patents and 27 pending published patent applications. (60) Its patents and patent applications are directed toward in vitro production of avian food products, methods for production of meat, cultivated bovine products, and producing tissue engineered meat as a food product. (61) Notably, while Eat Just's cultivated chicken was approved by U.S. and Singaporean regulatory agencies and is commercially available in those countries, its patent portfolio indicates that it is also focused on developing cultivated beef products. (62)

Support for and Benefits of Cultivated Meat

The cultivated meat and seafood industry has been growing rapidly since the first cultivated meat burger was unveiled in 2013. ⁶³ In the last decade, this industry has attracted billions of dollars of investment and significant government policy support, despite being a relatively new area of innovation. This support and interest may be related to new studies projecting that in another decade, cultivated meat will be cost-competitive with conventional meat and reduce the climate and health impacts of meat production. ⁶⁴

Cultivated meat has also gained support within the culinary industry. For example, Chef José Andrés has joined the board of Good Meat, Chef Marcus Samuelsson is collaborating with Aleph Farms, and Chef Dominique Crenn will serve Upside Foods' cultured chicken as the first meat to be served in her restaurant since 2019, when she stopped serving meat as a protest against factory farming. ⁶⁵

One of the biggest challenges in the industry right now is the cost of making cultivated meat. The first cultivated meat burger took two years to make and cost approximately €250,000, or US\$274,300. ⁶⁶ Similarly, it initially cost Avant Meats US\$900 to produce one pound of lab-grown fish. ⁶⁷ However, some cultivated meat and seafood companies have been able to reduce costs for their commercially available products; for example, a cultivated chicken skewer is currently available in Singapore for US\$14. ⁶⁸

Additionally, new studies indicate that large-scale cultivated meat production may cause approximately 92% less global warming and 93% less air pollution compared to conventional meat production techniques and additionally use up to 95% less land and 78% less water. ⁶⁹ Furthermore, cultivated meat production will likely provide a safer meat supply because it decouples meat production from conditions that can cause disease transmission and overuse of antibiotics, which will lead to a decrease in global resistance to medically important antibiotics. ⁷⁰

Despite being a new and emerging industry, cultivated meat has drawn strong global interest and experienced rapid development over the last decade. It will be interesting to monitor the food tech industry to see if the recent global policy support and regulatory approvals increase development in this industry and whether the positive environmental and cost projections come to fruition.

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Author

Sheena X. Wang

Rothwell, Figg, Ernst & Manbeck, P.C.

Sheena X. Wang is an associate at Rothwell, Figg, Ernst & Manbeck, P.C., where she handles a wide range of intellectual property issues.