

Cellular Meat. It's Going to be What's for Dinner.



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When most people contemplate eating a meal featuring alternative protein, these days they think about something plant-based, due to the incredible success of the Impossible Whopper and Dunkin Beyond Sausage Sandwich. However, cellular-based proteins are starting to make an impact on the alternative protein market. December 2020 could be remembered as a tipping point for cellular-based protein and a catalyst for more mainstream adoption as Eat Just, a U.S. company developing a range of plant- and cellular-based alternative proteins, received from Singapore the world's first regulatory approval to sell its lab-grown chicken meat to consumers. Shortly thereafter, its GOOD Meat cultured chicken made a historic debut in a trio of dishes at restaurant 1880, which is known for its innovative menus and socially conscious food choices. The cost of the dishes is over \$20 each, according to Eat Just's CEO Josh Tetrick, an indication that the product still has some way to go to reach a price that is accessible to most consumers, and a reason why plant-based protein has grown so quickly.

Cellular-based meat, including GOOD Chicken, is made by using a small amount of animal cells, harvested from a living animal. The cells are then fed nutrients like amino acids, vitamins, glucose, inorganic salts, and growth factors. From there, the cells are grown into meat at a rapid rate using a bioreactor. From start to finish, the Eat Just process takes about 14 days to create cultured chicken, which is much faster than raising a traditional broiler chicken, which takes between 6 – 10 weeks from chick to slaughter.

Despite its initial product commercialization, Eat Just still is in the early stage of product development. Therefore, it is not surprising to learn that even at a cost over \$20 per dish, Eat Just isn't making any profit from the sale of its GOOD Chicken. With economies of scale and continued R&D development, costs should decline, based on the significant progress made to date. When Dr. Mark Post developed the first cellular-based meat hamburger in London in 2013, the cost was roughly \$330,000. Since that time, cellular-based meat companies have made tremendous progress on driving down production costs, with Memphis Meats, a U.S.-based start-up, now producing cell-based meat for \$40 per gram, which is less than 1/50th of the cost from just a few years ago. Furthermore, Dr. Post's company, Mosa Meats, a Dutch cultured-meat company, said it is expecting to sell its cellular-based meat hamburgers for \$10 a patty in the near future.

Government approval is the big hurdle

In addition to high production costs, regulatory approval is one of the biggest barriers cellular-based protein start-ups face. According to Eat Just, it took the Singaporean government more than two years to approve cultured chicken for sale. The process of gaining approval started with the Singaporean government appointing a safety panel, which looked at the quality of the East Just animal cell line, and the manufacturing process, to determine that it was safe. Although neither the U.S. nor Europe has approved cellular-based meat for sale, both are studying the technology. However, no one should expect regulatory approval to be quick or easy. Following the Eat Just announcement, French agricultural minister Julien Denormandie tweeted, "Is this really the society we want for our children? I say no! I will clearly state it: meat comes from the living, not laboratories. You can count on me to keep meat natural and never artificial in France!" Views like this, in countries with large cattle industries, like the U.S. and France, illustrate the struggle that cellular-based meat faces to gain acceptance. Moreover, regulatory approval won't be a smooth or easy process, especially in the U.S., as cellular-based protein is likely to face stiff opposition from traditional meat producers and their lobbyists.

Shortly after the Eat Just announcement, Israeli Prime Minister Benjamin Netanyahu became the first world leader to eat lab-grown beef, during a visit to Aleph Farms, an Israeli food-tech startup that specializes in cultured meat. Also, on December 8th, Mosa Meat announced a \$20 million second closing on its Series B financing, bringing the total size of the financing round to over \$75 million. All this activity comes on the heels of big financing rounds for cellular-based protein companies in 2020. Memphis Meat raised \$161 million from investors, including new investors SoftBank Group, Norwest and Temasek, as well as existing investors including Bill Gates, Richard Branson, Cargill, and Tyson Foods, with the aim of bringing cellular-based products to consumers. Additionally, Perfect Day, which uses cellular-based dairy proteins, completed a \$300 million Series C financing, led by the Canada Pension Plan Investment Board and returning investors Horizon Ventures, Temasek and ADM Ventures. Perfect Day's financing is the largest funding round to-date for a cellular-based protein company. Interest in cellular-based replacements isn't limited to meat and dairy. In late January 2021, BlueNalu, which grows fish fillets directly from real fish cells, raised \$60 million to build out a pilot factory.

The benefits of cellular meat

Given all the technical and regulatory challenges it faces, one might wonder why there has been so much investment into the cellular-based protein sector. The main reason is that the meat and seafood market is roughly \$1.3 trillion, and consumers, particularly Millennials and Gen Z's, are driving fundamental changes in the animal protein sector due to concerns around environmental sustainability. According to the United Nations' Food & Agriculture Organization, livestock is responsible for roughly 14.5% of global greenhouse gas emissions. Additionally, 30% of the world's land and 8% of its freshwater use is dedicated to animal agriculture. This land could be used more effectively for carbon capture or other more economically productive activities and, with many areas of the globe experiencing less rainfall due to climate change, it is essential to optimize water use to be the most productive. The

transition to cellular-based meat could cut emissions, land use, and water consumption all by over 90%.

Another potential benefit of cellular-based meat is safety, with many believing it safer for human consumption than traditional meat. In particular, food-borne pathogens, including Salmonella and E. coli, are present in the intestinal tracts of livestock and can be transferred to meat during the slaughter process. Health and safety issues in meat processing plants came to the forefront during the past year, with COVID-19 outbreaks causing several plants to idle or significantly cut production. These outbreaks increased consumer concerns about eating animal protein due to fears of human to animal transmission, directly leading to an increase in consumption of plant-based proteins. In contrast, cellular-based meat is grown in a sterile bioreactor, preventing contamination by most pathogens and enabling the detection of any that remain prior to reaching consumers. Another advantage is that the meat would be free of antibiotics, which are routinely given to most animals we eat today. Finally, cellular-based meat also can reduce the incidence of diseases on the farm, such as avian and swine influenzas, which have killed significant numbers of animals throughout the world, causing product shortages and inefficiently using resources for animals that will never be consumed.

Although plant-based protein has grown tremendously over the past few years, as product offerings have expanded and costs have declined, I believe that the technology behind cellular-based protein will propel it to overtake both plant-based and bug-based alternative proteins. For those like me, who can taste the difference between a beef burger and a plant-based burger, the hope is that because the process for making it uses actual animal cells, a cellular-meat burger will have the same taste and texture as traditional animal protein. For those consumers who are still reluctant to try adding plant-based protein to their diet, cellular meat is likely the most effective option for reducing in the short term, and eliminating in the long term, the environmental impact of the animal protein sector. AT Kearney forecasts that by 2030, cellular-based meat could grab a 10% market share of the meat industry, quickly approaching the 18% market share projected for plant-based protein. Just a decade later, in 2040, cellular-based meat could achieve a similar market share, of upwards of 40%, to animal protein, far outpacing plant-based protein. These views are shared by Blue Horizon, a food technology-focused venture capital fund, which estimated that the cell-based meat market could reach \$140 billion by 2030. As we enter 2021, cellular protein is starting to gain the same level of momentum seen a few years ago in the plant-based protein sector. To achieve its promise of being the winning alternative protein option, and to appeal to consumers who have a growing number of protein options, the industry needs to continue driving down its production costs and optimize taste and texture.