




THE RAPID EVOLUTION OF
**CULTURED
MEAT**

LAB-TO-FORK
COULD BE
THE NEXT BIG
FOOD TREND

■ BY MARK JUHASZ



Arguably, we are in an unprecedented time for innovation in the food proteins sector. A broad array of factors is motivating consumers, and the industry alike, to find alternatives for animal-based proteins, from public and personal health concerns to awareness of the environmental impacts of industrialized animal agriculture and overfishing. Other factors such as regulation, financing and the politics of food are influencing a rapidly shifting market, which now hinges on the growing popularity of meat substitutes. We have more choices than ever between animal-based, plant-based and, soon, cultured proteins, including lab-grown dairy products.

As such, the food industry is undergoing a tremendous amount of new product development involving applied science, biotechnology and venture capitalism, in Canada and internationally. In 2013, a Dutch team led by Dr. Mark Post developed a lab-grown hamburger made from bovine stem cells, where the cost of the patty was estimated at approximately US\$375,000.

According to an extensive study on cultured meat by consulting firm Kearney, “solutions for increasing the efficiency of conventional meat production have been almost exhausted,” and “all predominant innovations [in industrialized animal agriculture], including digitization... won’t overcome global agricultural and food challenges.” Large-scale livestock operations often are cited for cruel conditions and zoonotic transmission of serious afflictions such as SARS, swine flu and mad cow disease.

This March, the Boston Consulting Group (BCG) and Blue Horizon released a document entitled, *Food for Thought: A Protein Transformation*. The authors anticipate that Europe and North America will reach “peak meat” in 2025, at which point the consumption of conventional, animal-based meat will start to fall. The report also claims that by 2035, the annual market for animal-based alternatives (meat, eggs, dairy and seafood) will reach \$290 billion.

Even if these projections are correct, what will be the feedstock source for the bioreactors that produce cultured meats? What are the implications for economies, communities and animal husbandry that are impacted by the movement toward animal-based alternatives? What are the job prospects for the cultured meat industry if it uses highly automated processes?

Despite the unanswered questions, many jurisdictions clearly are signalling a movement toward less meat consumption. In the U.K., schools and hospitals plan to implement a policy to serve 20 percent less meat, and health professionals are calling for a climate tax on meat. Last November, Singapore approved the sale of cultured meat for the first time. The authors of the BCG report claim that alternative proteins, including cultured meat, can contribute to supporting six UN sustainable development goals: zero hunger, good health and well-being, responsible consumption and production, climate action, life below water and life on land.

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Competition and disruption in the meat alternatives category

One of the considerations for the cultured meat food sector will be the degree to which it displaces plant-based meat alternatives. How will consumers migrate toward cultured meat, especially if they are vegetarians or vegans?

More broadly, the global meat market in 2018 was estimated to be worth US\$1 trillion according to Kearney, and by 2040, cultured meat could represent 35 percent of this market. Furthermore, the BCG study speculates that “nine out of 10 of the world’s favourite dishes will have a realistic meat alternative by 2035.” This will be dependant on matching the taste, texture and price of conventional meat products.

It is also evident that cultured meat, and its specific variations, will look different in different regions. For example, the Asia-Pacific region is more likely to indicate consumer approval. Israel is leading in cultured meat through a combination of private and public sector support, and in the past five years alone, a variety of companies have been established: Redefine Meat, SuperMeat, MeaTech, Aleph Farms and SavorEat. These developments are not being lost amid the conventional meat industry, where U.S. meat giants Tyson Foods and Cargill are investing in cultured companies such as Memphis Meats. Forty percent of leading food firms, including Kroger, Tesco and Unilever, now have dedicated teams developing conventional meat alternatives.

Investment is coming in a variety of forms and policies. The competition driving cultured meat companies is often for the innovative science behind the products. Canadian startup Future Fields outline in a 2020 interview in *Tech Crunch* how “the next steps are more about iteration and commercialization to produce a [cultured meat] growth medium at scale and to do it 1,000 times cheaper.” Alternately, food startup BlueNalu is focused on simulated yellowtail fish, which is cultured in a serum-free solution containing plant proteins.

A recent article in *Anthropocene* magazine draws attention to a technical and ethical dilemma in the development of cultured meat. A form of “scaffolding” is required to provide a framework in which the food product is “grown” or produced in the bioreactor. Some food scientists have defaulted to gelatin derived from beef, which negates the “animal free” benefit. Scaffolds also are being made from algae, and a new finding discovered that spinach’s veiny structure can be ideal as scaffolding for cultured meat, while also being ready-formed, abundant and cost effective. These scientific challenges are what the newly established Cellular Agriculture Canada (CAC) organization seeks to address. According to its advocates, these novel foods would be regulated by Health Canada’s Food Directorate, and CAC writes, “We believe it is crucial to start a dialogue with regulators.”

Venture capital and financing in the cultured meat space

A recent CB Insights report shows that the majority of venture capital funding in 2020 is financing alternative protein companies. The list of venture funds is extensive and includes such names as Draper, Fisher, Jurvetson (DFJ), Atomico, Eat Beyond Global, Finistere Ventures and Big Idea Ventures. The BCG report adds that “investors with the right vision and expertise can fund the transformation and participate in every step of the value chain.”

When speaking to *The Guardian* this spring, the policy manager at the Good Food Institute Europe, Acacia Smith, said that “the cultivated meat sector had a record-breaking year in 2020, but much of this progress has been happening outside of Europe.” In 2019, U.S.-based Big Idea Ventures launched its New Protein Fund, and companies chosen for funding include an alternative version of Spanish cured ham, a cell-based bison jerky, Biftek (which is seeking to replace the use of controversial fetal bovine serum in producing cultured beef) and Peace of Meat, a B2B supplier of cultured animal fat. In Canada, Eat Beyond Global (EBG) claims to be the first investment fund of its kind focused on conventional meat alternatives while allowing retail investors to engage directly with brands. EBG also performs due diligence so that investors can support a company’s growth with less risk.

A major element in venture capital financing will be funding scale in production so that cost factors begin moving toward parity. According to the BCG report, cultured meats will reach conventional meat prices by the early 2030s. Cargill’s managing director of alternative proteins adds that “in the coming years, speed to parity [in terms of cost production] will be a key differentiator.” Recently, Israel-based Future Meat claimed to half the production costs of a four-ounce cultivated chicken breast from \$7.50 to \$4, and expects to drop production costs below \$2 within 18 months.

Last spring, the *New Scientist* reported that “about 60 startups around the world are developing and improving on cultured meats.” Each of these companies needs to formulate a process by which to grow these special cells within a growth media, and with cellular scaffolding. A big challenge is scaling production to reduce costs, all within the right formulation. Different companies can have up to 100 ingredients in their products, including sugars, salts, amino acids, micronutrients and growth factors. Some companies are using animal byproducts, while others are seeking completely animal-free elements. For example, according to the *New Scientist* report, “culture media can cost hundreds of dollars per litre.” Companies are racing to develop the scaffolding and specialized bioreactors needed to scale up.

Consumer perception, marketing and terminology

One of the important aspects that the cultured meat industry will need to address is consumer perception and associated terminology for these products. Certainly, the broader food industry – especially critics – and those in the conventional meat sector will resist or be concerned with the use of the term “meat.” This has been an issue specific to milk, for example, where the dairy cow industry has been resistant to plant-based beverages using the “milk” moniker. The authors of the BCG study note that “the growth of the alternative protein market depends largely on consumer willingness to use these substitutes in their chosen diets, and that acceptance depends on [price] parity.” Last year, a step in this direction was the establishment of a concept restaurant called The Chicken, in Tel Aviv, Israel. Diners are seated in a room with a view of the bioreactor that makes their cultured chicken. Patrons do not pay, but provide feedback on the products, and according to a *Fast Company* article, “feedback from multiple tasting panels are consistent with conventionally manufactured chicken.”

The verdict is still out on the terminology for this new food category. Advocates for cultured meat, such as the Good Food Institute, are seeking to use the term “cultivated meat.” Other terms, depending on the proponent, have also included: lab-grown, cell-based, clean, slaughter-free, franken food or schmeat. The Good Food Institute is aware that “consumer acceptance starts long before someone walks into a grocery store or sits down to a meal at their local diner. It starts in the headlines, debates on social media and conversations that people have with their friends.”

The academic community is weighing in with consumer studies on perceptions of cultured meat. In a 2019 article for *Frontiers in Sustainable Food Systems*, a survey on “clean meat” in the U.S. and Asia found that there is significantly higher acceptance in Asia. The authors noted that when consumers encounter cultured meat through a “high tech” approach, they have significantly more negative attitudes

toward the concept and are less likely to consume the product. Another study published last year in *Trends in Food Science & Technology* found that “the academic sector can play a vital role in understanding and communicating the science of cultured meat to the public.” Other research suggests that there may be generational differences in openness to trying cultured meats, and that academic and scientific research on consumer perceptions of this new food category can support a better understanding of product development, messaging and the likely adoption path of this food innovation.

In Canada, University of Guelph professor Simon Somogyi is leading a research group, along with Second Harvest and



CAC, to understand what retailers and consumers think about cellular agriculture. Somogyi explains, “There is a bit of a yuck factor, uncertainty and hesitancy about something that is very new and complicated.”

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Speculation on the future of cultured meat, plant-based foods and animal agriculture

The 2019 study by Kearney on how cultured meat will disrupt the animal agriculture and food industry outlines eight essential criteria that will be required to lead the development of these new products. These are: input materials (the media required to grow and build these foods); conversion rates; product features (e.g. muscle-fat-nutrient ratios); scalability; consumer acceptance; ethics and sustainability; regulatory approval; and venture capital. Undoubtedly, this is a busy space. The business prospects are clearly attractive if these ventures and companies meet scale, with products that have appealing taste, price and presentation. Scientists are asking the technical questions about product structure, while food engineers are developing the bioreactors required to turn prototypes into working models.

Amid all this enthusiasm, there also are critical perspectives to consider. In *Forbes* last year, the research director for the Food Futures Lab at the Institute for the Future, Max Elder, noted, “I worry most startups in the cultured meat space are overestimating their short-term timeline to get to market, and underestimating their potential long-term impact on completely redesigning our food system from the cell level up.”

Cultured meat is not without its critics, never mind the serious concerns from the industrial animal agriculture industry. Last year, an article in *Frontiers in Nutrition*, “The Myth of Cultured Meat: A Review,” drew attention to the unclear nutritional composition of cultured meats, and the implications for plant-based alternatives. The authors referenced how consumers often dislike “unnatural” foods, and how some animals will still need to be reared to harvest cells for production of cultured meat; however, there are already companies trying to eliminate this aspect.

Furthermore, with the offerings of cultured food products, what are the religious implications for Kosher or Halal diets? In this rapidly developing sector, there are many questions – and many possibilities – that will have sweeping implications for human food consumption in this decade, and far beyond. **BL**

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