

## Chapter Two

### Sources of Innovation

#### The Rise of Cultured Meat<sup>a</sup>

In late 2017, Microsoft founder Bill Gates and a group of other high-powered investors—who comprise Breakthrough Energy Ventures, such as Amazon's Jeff Bezos, Alibaba's Jack Ma, and Virgin's Richard Branson—announced their intention to fund a San Francisco-based start-up called Memphis Meats with an unusual business plan: It grew “clean” meat using stem cells, eliminating the need to breed or slaughter animals. The company had already produced beef, chicken, and duck, all grown from cells.<sup>b</sup>

There were many potential advantages of growing meat without animals. First, growth in the demand for meat was skyrocketing due to both population growth and development. When developing countries become wealthier, they increase their meat consumption. While humanity's population had doubled since 1960, consumption of animal products had risen fivefold and was still increasing. Many scientists and economists had begun to warn of an impending “meat crisis.” Even though plant protein substitutes like soy and pea protein had gained enthusiastic followings, the rate of animal protein consumption had continued to rise. This suggested that meat shortages were inevitable unless radically more efficient methods of production were developed.

Large-scale production of animals also had a massively negative effect on the environment. The worldwide production of cattle, for example, resulted in a larger emissions of greenhouse gases than the collective effect of the world's automobiles. Animal production is also extremely water intensive: To produce each chicken sold in a supermarket, for example, requires more than 1000 gallons of water, and each egg requires 50 gallons. Each gallon of cow's milk required 900 gallons of water. A study by Oxford University indicated that meat

grown from cells would produce up to 96 percent lower greenhouse gas emissions, use 45 percent less energy, 99 percent less land, and 96 percent less water.<sup>c</sup>

Scientists also agreed that producing animals for consumption was simply inefficient. Estimates suggested, for example, that it required roughly 23 calories worth of inputs to produce one calorie of beef. Cultured meat promised to bring that ratio down to three calories of inputs to produce a calorie of beef—more than seven times greater efficiency. Cultured meat also would not contain antibiotics, steroids, or bacteria such as *E. coli*—it was literally page 16 “cleaner,” and that translated into both greater human health and lower perishability.

## The Development of Clean Meat

In 2004, Jason Matheny, a 29-year-old recent graduate from the John Hopkins Public Health program decided to try to tackle the problems with production of animals for food. Though Matheny was a vegetarian himself, he realized that convincing enough people to adopt a plant-based diet to slow down the meat crisis was unlikely. As he noted, “You can spend your time trying to get people to turn their lights out more often, or you can invent a more efficient light bulb that uses far less energy even if you leave it on. What we need is an enormously more efficient way to get meat.”<sup>d</sup>

Matheny founded a nonprofit organization called New Harvest that would be dedicated to promoting research into growing real meat without animals. He soon discovered that a Dutch scientist, Willem van Eelen was exploring how to culture meat from animal cells. Van Eelen had been awarded the first patent on a cultured meat production method in 1999. However, the eccentric scientist had not had much luck in attracting funding to his project, nor in scaling up his production. Matheny decided that with a little prodding, the Dutch government might be persuaded to make a serious investment in the development of meat-culturing methods. He managed to get a meeting with the Netherland’s minister of agriculture where he made his case. Matheny’s efforts paid off: The Dutch government agreed to invest two million euros in exploring methods of creating cultured meat at three different universities.

By 2005, cultured meat was starting to gather attention. The journal *Tissue Engineering* published an article entitled “In Vitro-Cultured Meat Production,” and in the same year, the *New York Times* profiled cultured meat in its annual “Ideas of the Year.” However, while governments and universities were willing to invest in the basic science of creating methods of producing cultured meat, they did not have the capabilities and assets needed to bring it to commercial scale. Matheny knew that to make cultured meat a mainstream reality, he would need

to attract the interest of large agribusiness firms.

Matheny's initial talks with agribusiness firms did not go well. Though meat producers were open to the idea conceptually, they worried that consumers would balk at cultured meat and perceive it as unnatural. Matheny found this criticism frustrating; after all, flying in airplanes, using air conditioning, or eating meat pumped full of steroids to accelerate its growth were also unnatural.

Progress was slow. Matheny took a job at the Intelligence Advanced Research Projects Activity (IARPA) of the U.S. Federal Government while continuing to run New Harvest on the side. Fortunately, others were also starting to realize the urgency of developing alternative meat production methods.

## Enter Sergey Brin of Google

In 2009, the foundation of Sergey Brin, cofounder of Google, contacted Matheny to learn more about cultured meat technologies. Matheny referred [page 17](#) Brin's foundation to Dr. Mark Post at Maastricht University, one of the leading scientists funded by the Dutch government's cultured meat investment. Post had succeeded in growing mouse muscles in vitro and was certain his process could be replicated with the muscles of cows, poultry, and more. As he stated, "It was so clear to me that we could do this. The science was there. All we needed was funding to actually prove it, and now here was a chance to get what was needed."<sup>e</sup> It took more than a year to work out the details, but in 2011, Brin offered Post roughly three quarters of a million dollars to prove his process by making two cultured beef burgers, and Post's team set about meeting the challenge.

In early 2013, the moment of truth arrived: Post and his team had enough cultured beef to do a taste test. They fried up a small burger and split it into thirds to taste. It tasted like meat. Their burger was 100 percent skeletal muscle and they knew that for commercial production they would need to add fat and connective tissue to more closely replicate the texture of beef, but those would be easy problems to solve after passing this milestone. The press responded enthusiastically, and the *Washington Post* ran an article headlined, "Could a Test-Tube Burger Save the Planet?"<sup>f</sup>

## Going Commercial

In 2015, Uma Valeti, a cardiologist at the Mayo Clinic founded his own cultured-meat research lab at the University of Minnesota. "I'd read about the inefficiency of meat-eating compared to a vegetarian diet, but what bothered me more than the wastefulness was the sheer scale of suffering of the animals."<sup>g</sup> As a heart

doctor, Valeti also believed that getting people to eat less meat could improve human health: “I knew that poor diets and the unhealthy fats and refined carbs that my patients were eating were killing them, but so many seemed totally unwilling to eat less or no meat. Some actually told me they’d rather live a shorter life than stop eating the meats they loved.” Valeti began fantasizing about a best-of-both-worlds alternative—a healthier and kinder meat. As he noted, “The main difference I thought I’d want for this meat I was envisioning was that it’d have to be leaner and more protein-packed than a cut of supermarket meat, since there’s a large amount of saturated fat in that meat.... Why not have fats that are proven to be better for health and longevity, like omega-3s? We want to be not just like conventional meat but healthier than conventional meat.”<sup>h</sup>

Valeti was nervous about leaving his successful position as a cardiologist—after all, he had a wife and two children to help support. However, when he sat down to discuss it with his wife (a pediatric eye surgeon), she said, “Look, Uma. We’ve been wanting to do this forever. I don’t ever want us to look back on why we didn’t have the courage to work on an idea that could make this world kinder and better for our children and their generation.”<sup>i</sup> And thus Valeti’s company, which would later be named Memphis Meats, was born.

Building on Dr. Post’s achievement, Valeti’s team began experimenting with ways to get just the right texture and taste. After much trial and error, and a growing number of patents, they hosted their first tasting event in December 2015. On the menu: a meatball. This time the giant agribusiness firms took notice.

At the end of 2016, Tyson Foods, the world’s largest meat producer, announced that it would invest \$150 million in a venture capital fund that would develop alternative proteins, including meat grown from self-reproducing cells. In August of 2017, agribusiness giant Cargill announced it was investing in Memphis Meats, and a few months later in early 2018, Tyson Foods also pledged investment.

That first meatball cost \$1200; to make cultured meat a commercial reality required bringing costs down substantially. But analysts were quick to point out that the first iPhone had cost \$2.6 billion in R&D—much more than the first cultured meats. Scale and learning curve efficiencies would drive that cost down. Valeti had faith that the company would soon make cultured meat not only competitive with traditional meat, but also more affordable. Growing meat rather than whole animals had, after all, inherent efficiency advantages.

In December of 2020, cultured chicken made by Eat Just became the first cultured meat product in the world to be approved for commercial sale when it was approved by the Singapore Food Agency. The chicken was expected to go on sale in Singaporean restaurants in early 2021. Eat Just had found earlier

success by selling Just Eggs (made from mung beans). Its founder, Josh Tetrick, was also in talks with U.S. and European food regulators and noted, “I would imagine what will happen is the U.S., Western Europe and others will see what Singapore has been able to do, the rigors of the framework that they put together. And I would imagine that they will try to use it as a template to put their own framework together.”<sup>j</sup>

Some skeptics believed the bigger problem was not production economies or regulatory approval, but consumer acceptance: Would people be willing to eat meat grown without animals? Sergey Brin, Bill Gates, Jeff Bezos, Jack Ma, and Richard Branson were willing to bet that they would. As Branson stated in 2017, “I believe that in 30 years or so we will no longer need to kill any animals and that all meat will either be clean or plant-based, taste the same and also be much healthier for everyone.”<sup>k</sup> Bruce Friedrich, executive director of the nonprofit The Good Food Institute agrees, noting “As nations race to divorce meat production from industrial animal agriculture, countries that delay their investment in this bright food future risk getting left behind.”<sup>l</sup>

## ***Discussion Questions***

1. What were the potential advantages of developing cultured meat? What were the challenges of developing it and bringing it to market?
2. What kinds of organizations were involved in developing cultured meat? What were the different resources that each kind of organization brought to the innovation and what were their motives?
3. What are the challenges to gaining wide market acceptance of cultured meat, and how could these organizations facilitate that? Can you think of other products or services that faced similar adoption challenges?

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page 19

<sup>a</sup> Adapted from a New York University teaching case by Paul Shapiro and Melissa Schilling.

<sup>b</sup> Zack Friedman, “Why Bill Gates and Richard Branson Invested in ‘Clean’ Meat,” *Forbes*, August 2017.

<sup>c</sup> Hanna L. Tuomisto and M. Joost Teixeira de Mattos, “Environmental Impacts of Cultured Meat Production,” *Environmental Science and Technology* 14(2011): 6117–2123.

<sup>d</sup> Paul Shapiro, *Clean Meat: How Growing Meat without Animals Will Revolutionize Dinner and the World* (New York: Gallery Books, 2018), 35.

<sup>e</sup> Paul Shapiro, *Clean Meat: How Growing Meat without Animals Will Revolutionize Dinner and the World* (New York: Gallery Books, 2018), 60.

<sup>f</sup> “Could a Test-Tube Burger Save the Planet?” *Washington Post*, August 5, 2013.

<sup>g</sup> Paul Shapiro, *Clean Meat: How Growing Meat without Animals Will Revolutionize Dinner and the World* (New York: Gallery Books, 2018), 113.

<sup>h</sup> Paul Shapiro, *Clean Meat: How Growing Meat without Animals Will Revolutionize Dinner and the World* (New York: Gallery Books, 2018), 115.

<sup>i</sup> Paul Shapiro, *Clean Meat: How Growing Meat without Animals Will Revolutionize Dinner and the World* (New York: Gallery Books, 2018), 118.

<sup>j</sup> Ryan W. Miller, “Lab-Grown ‘Chicken Bites’? Cultured Meat Product Gets World’s First Regulatory Approval,” *USA Today*, December 2, 2020.

<sup>k</sup> Zack Friedman, “Why Bill Gates and Richard Branson Invested in ‘Clean’ Meat,” *Forbes*, August 2017.

<sup>l</sup> Ryan W. Miller, “Lab-Grown ‘Chicken Bites’? Cultured Meat Product Gets World’s First Regulatory Approval,” *USA Today*, December 2, 2020.