THE GOOD FOOD INSTITUTE

State of the Industry Report

Cell-based Meat

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Primary authors

Brianna Cameron, MPH
Innovation Manager

Shannon O'Neill
Business Analyst

Contributing authors

Liz Specht, Ph.D.
Associate Director of Science and Technology

Elizabeth Derbes, J.D., MPH
Senior Regulatory Counsel

Keri Szejda, Ph.D.
Senior Consumer Research Scientist

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Bruce Friedrich, Executive Director

Since the dawn of the agricultural revolution, new technologies have enabled us to feed a growing population in increasingly efficient ways. Today, we're facing a challenge of an unprecedented scale: how to feed 9.8 billion by 2050[1] while simultaneously managing the effects of climate change. As humans have done throughout history, we will use markets and innovation to solve this problem. One of the most promising technologies to help face this challenge is cell-based meat.

By growing meat from cells instead of from a whole animal, it becomes possible to create high-quality cuts of meat using fewer resources and with less environmental impact. Compared to conventional beef, cell-based beef is estimated to reduce land use by more than 95%, climate change emissions by 74% to 87%, and nutrient pollution by 94%.[2] Since cell-based meat is grown in a clean facility, it also reduces the risk of contamination by harmful pathogens and eliminates the need for antibiotics, thereby reducing the serious public health threats posed by foodborne illness and antibiotic resistance.[2]

In 2019, it's no longer a matter of creating a proof-of-concept for cell-based meat. Mark Post produced the first cell-based beef hamburger in 2013, and since then various companies have also debuted prototypes including **chicken, duck, steak, pork sausage,** and **fish cakes.** Currently, the main challenge from a technological perspective is scaling up production and making it affordable for mass markets. According to our SciTech team's independent **cost analysis,** we believe that achieving price parity is technologically feasible without the development of any new "moonshot" technologies.[3] It is difficult to say when this will happen, as different companies have suggested different timelines, but the top three funded cell-based meat companies, Memphis Meats,[4] CUBIQ Foods,[5] and Mosa Meat,[6] have all announced that they expect to start selling products in 2021, likely at a premium price point initially.

Box 1: What is cell-based meat?

Cell-based meat (often referred to as clean meat or cultured meat) is genuine animal meat that can replicate the sensory and nutritional profile of conventionally produced meat because it's comprised of the same cell types and arranged in the same three-dimensional structure as animal tissue. It isn't imitation or synthetic meat; it's actual meat that is grown from cells outside of an animal.

Section 1: Introduction

In addition to technological progress, there has also been significant progress on the regulatory front. In 2018, the U.S. Department of Agriculture (USDA) and the U.S. Food & Drug Administration (FDA) agreed to a joint regulatory framework, providing cell-based meat with a much clearer path to market in the United States. We expect further guidance in 2019, but we are optimistic that both agencies are committed to creating a fair regulatory framework. Some cell-based meat companies are also pursuing regulatory approvals in other countries, so it remains to be seen where the product will hit the market first.

There was also a large influx of investment into the cell-based meat industry in 2018, including such strategic partners as multinational meat companies and life science corporations that can contribute deep expertise and infrastructure in addition to monetary support. To quantify this investment activity, we used the PitchBook platform to conduct a custom analysis of investments in cell-based meat companies across the globe. We hope this information will help to inform future investments in the cell-based meat industry, especially as many companies are looking to raise their Series A and B rounds in the near future.

Synthesizing knowledge from all these sources, The Good Food Institute produced this first-of-its-kind report to serve as a benchmark for the entire cell-based meat industry. To track developments moving forward, we are planning to publish a new report each year. We look forward to supporting the companies and investors in the cell-based meat industry as it continues to develop in the coming years.

Professor Mark Post presents the first hamburger in London. Photo credit: Mosa Meat

Section 1: Introduction

Box 2: How is cell-based meat made?

All cell-based meat and seafood companies follow the same general approach, similar to the way cultivation works with plants. One way to grow vegetables is by starting out with a small cutting of a parent plant. That cutting is placed in a nutrient-rich environment that allows it to grow. Similarly, the cell-based meat process starts with a small sample of animal tissue and places it in a nutrient-rich environment that allows it to grow. Of course, the details of how this process takes place are complex and will differ from company to company. Refer to our Clean Meat 101 blog or cover story in Food Technology for a more in-depth overview of how cell-based meat is made.

One way to grow vegetables is by starting out with a small cutting of a parent plant

1. Start with a small cutting from a plant

2. Place cutting in a nutrient-rich environment that allows it to grow

3. Enjoy your vegetable. Bon appetit!

By taking a small sample from an animal, we can grow meat in a similar way.

1. Start with a small sample of cells from an animal

2. Place sample in a nutrient-rich environment that allows it to grow

3. Enjoy your meat. Bon appetit!

Source: Cultivation analogy developed by Mattson

Section 2: Companies

By the end of 2018, 27 cell-based meat and seafood companies had publicly announced themselves, 11 of which were founded in 2018 (Figure 1). Of these 27 announced startups, 15 have announced that they have raised external funding (Table 1). We anticipate that the number of publicly announced startups will increase in 2019 as new companies are formed and others emerge from stealth mode. For data availability reasons, this report focuses on the 15 companies that have fundraising data available on PitchBook or in another public source.

Figure 1: The Current Competitive Landscape for Cell-based Meat

Section 2: Companies

Table 1: Quick Stats on Funded Cell-based Meat Companies

Company	Country	State	Product Focus	Product Sub-focus	Founders	Date Founded	Total Amount Raised	Most Recent Funding Round
Aleph Farms	Israel		Meat	Steak	Didier Toubia, Shulamit Levenberg	2016	Not disclosed	Seed
BlueNalu	United States	CA	Seafood	Not disclosed	Lou Cooperhouse, Chris Somogyi, Chris Dammann	2017	$4.5 MM	Seed
Cubiq Foods	Spain		Meat	Chicken (fat component)	Andrés Montefeltro, Raquel Revilla	2018	$14 MM	Private Equity Buyout
Finless Foods	United States	CA	Seafood	Bluefin tuna	Mike Selden, Brian Wyrwas	2016	$3.75 MM	Seed
Future Meat Technologies	Israel		Meat	Chicken	Yaakov Nahmias	2017	$2.2 MM	Seed
Integriculture	Japan		Meat	Chicken (foie gras)	Yuki Hanyu	2015	$2.7 MM	Seed
JUST	United States	CA	Meat	Chicken	Josh Tetrick, Josh Balk	2011	$372.5 MM*	Series E
Meatable	Netherlands		Meat	Beef	Krijn de Nood, Daan Luining	2018	$3.5 MM	Seed
Memphis Meats	United States	CA	Meat	Beef, chicken, duck	Uma Valeti, Nicholas Genovese, Will Clem	2015	$22 MM	Series A
Mission Barns	United States	CA	Meat	Duck, chicken, pork (fat component)	Eitan Fischer, David Bowman	2018	$3.5 MM	Seed
Mosa Meat	Netherlands		Meat	Beef	Peter Verstrate, Mark Post	2015	$9 MM	Series A
New Age Meats	United States	CA	Meat	Pork	Brian Spears, Andra Necula	2018	$0.25 MM	Pre-seed (Accelerator)
SuperMeat	Israel		Meat	Chicken	Ido Savir, Koby Barak, Shir Friedman	2015	$3.2 MM	Seed
Wild Earth	United States	CA	Meat	Mouse (pet food)	Ryan Bethencourt	2017	$4.5 MM*	Seed
Wild Type	United States	CA	Seafood	Salmon	Aryé Elfenbein, Justin Kolbeck	2016	$3.50 MM	Seed

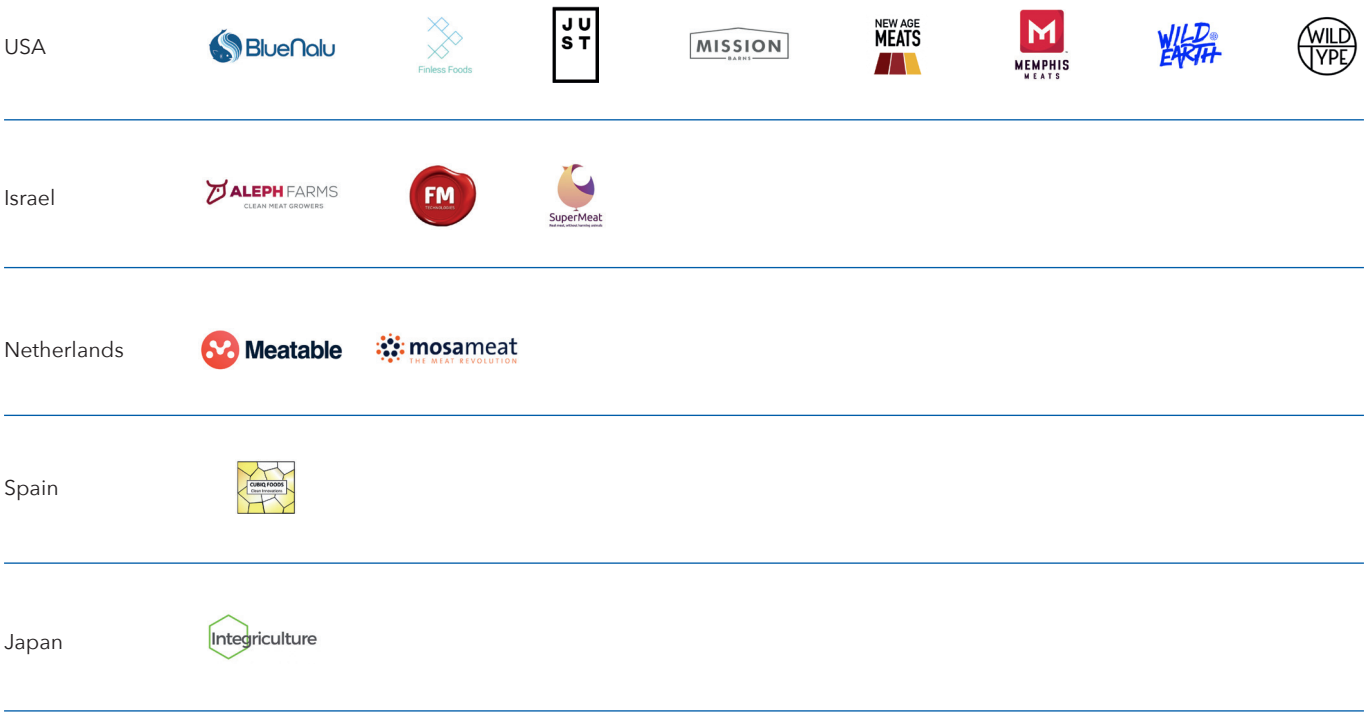
* Indicates that a company is pursuing cell-based meat as one aspect of a larger business and has not disclosed what portion of its total funding is being devoted to cell-based meat R&D.

Section 2: Companies

Geography

There are funded cell-based meat companies in five countries: the United States (eight companies), Israel (three companies), The Netherlands (two companies), Spain (one company), and Japan (one company) (Figure 2). Several companies that have not yet (or not publicly) raised external funding have been announced in other countries: Canada, China, France, India, Singapore, Turkey, and the U.K.

Figure 2: Geographical Distribution of Cell-based Meat Companies



Source: GFI custom PitchBook analysis of cell-based meat companies.

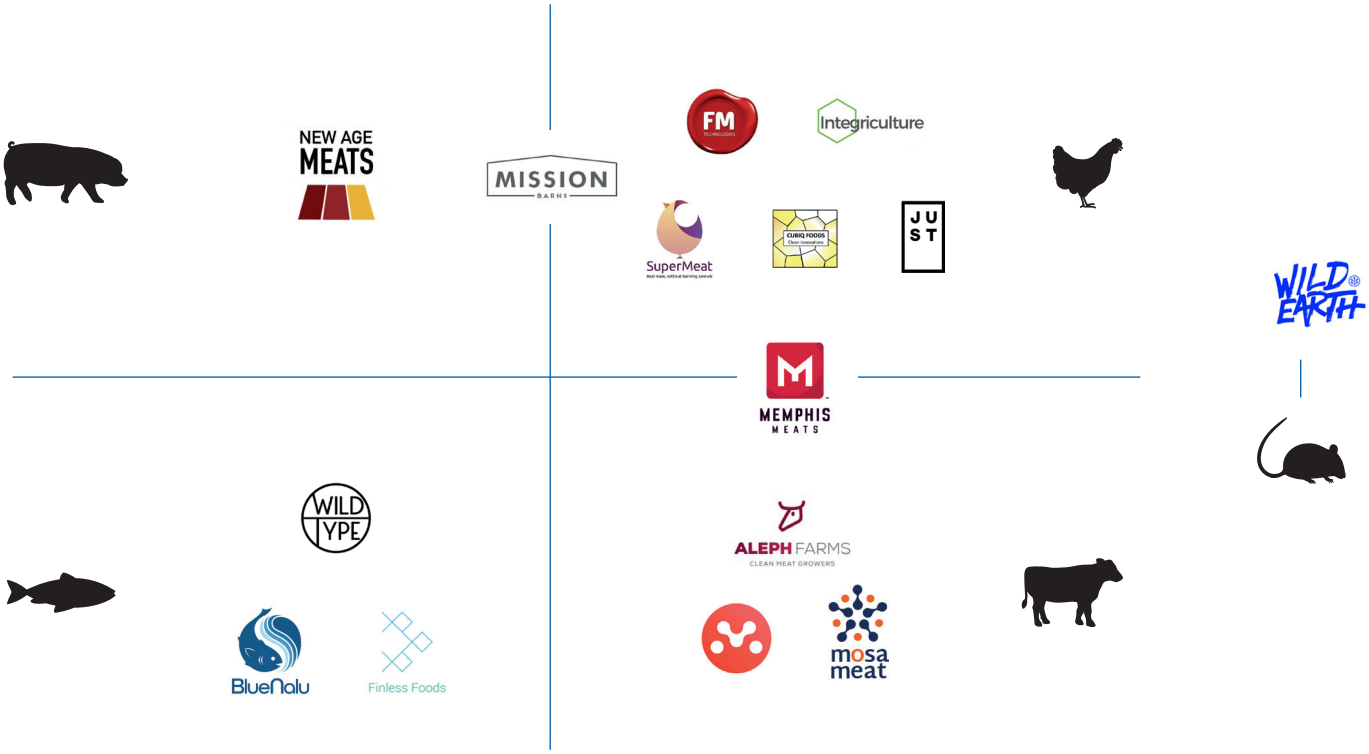
PitchBook

Product Focus

Poultry is the most common focus area, with seven funded companies, followed by beef with four funded companies. In the cell-based seafood space, Finless Foods is focusing on bluefin tuna and Wild Type is focusing on salmon. BlueNalu is also pursuing seafood but has not released details on its species focus. New Age Meats and Mission Barns are focusing on cell-based pork. In the pet food space, Wild Earth is pursuing cell-based mouse meat (Figure 3).

Section 2: Companies

Figure 3: Product Focus of Cell-based Meat Companies



Source: GFI custom PitchBook analysis of cell-based meat companies.

Technology

Although product focus is one way to classify cell-based meat companies, it is not the primary way that these companies differentiate themselves from each other. When pitching to investors, cell-based meat companies focus primarily on making the case for why their technical approach will enable them to scale up production and bring costs down faster than their competitors. A company's current product focus might indicate what its first product will be, but the goal for most companies is to create an efficient production platform that can be applied to a variety of cell types and end products. While cell-based meat startups have kept the details of their technical approaches confidential, GFI's white paper **"Mapping Emerging Industries: Opportunities in Clean Meat"** discusses the main areas in which startups have been innovating and examines opportunities for future research and development.

Section 2: Companies

Partnerships

While each cell-based meat startup is tackling certain technical hurdles in a slightly different way, every company faces challenges that are too broad to solve in-house with a lean startup team. Thus, developing partnerships within the life sciences industry will be essential, either as contract service providers, material providers, or co-development partners for novel enabling technologies. Figure 4 shows some enabling technologies that represent potential partnership opportunities between cell-based meat companies and industry.

Figure 4: Enabling Technologies Representing Partnership Opportunities for Cell-based Meat Companies

Cell line development	Cell culture media	Scaffolding	Bioreactors
• Automated image analysis for cell screening	• Microfluidics for faster optimization	• Biopolymer hydrogels	• In-line monitors and sensors for adaptive control
• Footprint-free immortalization	• Growth factor engineering	• 3D printing	• Media recycling
• Gene editing	• Small molecule screening	• Photopolymerization	• Continuous bioprocessing
		• Self-directed architecture	

Many cell-based meat companies have already begun to partner with industry. For example, in July 2018, M Ventures, the VC arm of the multinational life-science company Merck, took a leading stake in Mosa Meat's Series A round. Mosa Meat CEO Peter Verstrate stated that this partnership "is the perfect door-opener to Merck's deep expertise in culturing cells and producing high quality and scalable cell media." Partnerships like these will enable cell-based meat companies to focus on innovating within their areas of expertise, while outsourcing for needs that would best be met by external groups with developed experience and infrastructure.

Smaller boutique life-science companies have also begun to engage with cell-based meat companies to offer custom media solutions, cell and protein characterization technologies, and more. Additionally, several startups have emerged to serve the specific needs of the cell-based meat industry. For example, **Biocellion** is developing cell culture modeling software that may help expedite cell-based meat R&D, and **Biomimetic Solutions** is developing scaffolds that may have applications in the cell-based meat industry.

Section 2: Companies

In addition to partnerships with the life science industry, we're also seeing cell-based meat companies form partnerships with the conventional meat industry. Tyson Ventures, the VC arm of Tyson Foods, has invested in two cell-based meat companies, Memphis Meats and Future Meat Technologies. Cargill, the largest private U.S. company and leading meat producer, has invested in Memphis Meats, and PHW Group, one of Europe's largest poultry producers, has invested in SuperMeat. These mutually beneficial partnerships enable meat companies to diversify their portfolios and offer more options to consumers, while cell-based meat companies are able to benefit from meat science expertise, distribution networks, and production infrastructure.

Cell-based meat companies can also benefit from close collaboration with academic researchers. Until very recently, this idea flow was limited, as virtually no academic research labs have a dedicated focus on cell-based meat and only a handful of researchers were engaged in directly related projects. However, in February 2019, GFI's inaugural **Competitive Research Grant** funded the launch of six cell-based meat-related academic research projects across six countries. This $1 million in funding represented the largest cash injection in two decades for open-access cell-based meat R&D. **New Harvest** is another grant-making institution that has awarded $ 1 million in funding toward academic cellular agriculture research projects over the past 10 years. To increase both the number and effectiveness of researchers advancing this field in the future, GFI plans to establish a dedicated Cell-Based Meat Research Center to serve as a formal intellectual, institutional, and physical hub for facilitating and coordinating research activities among academic, industry, and government researchers.

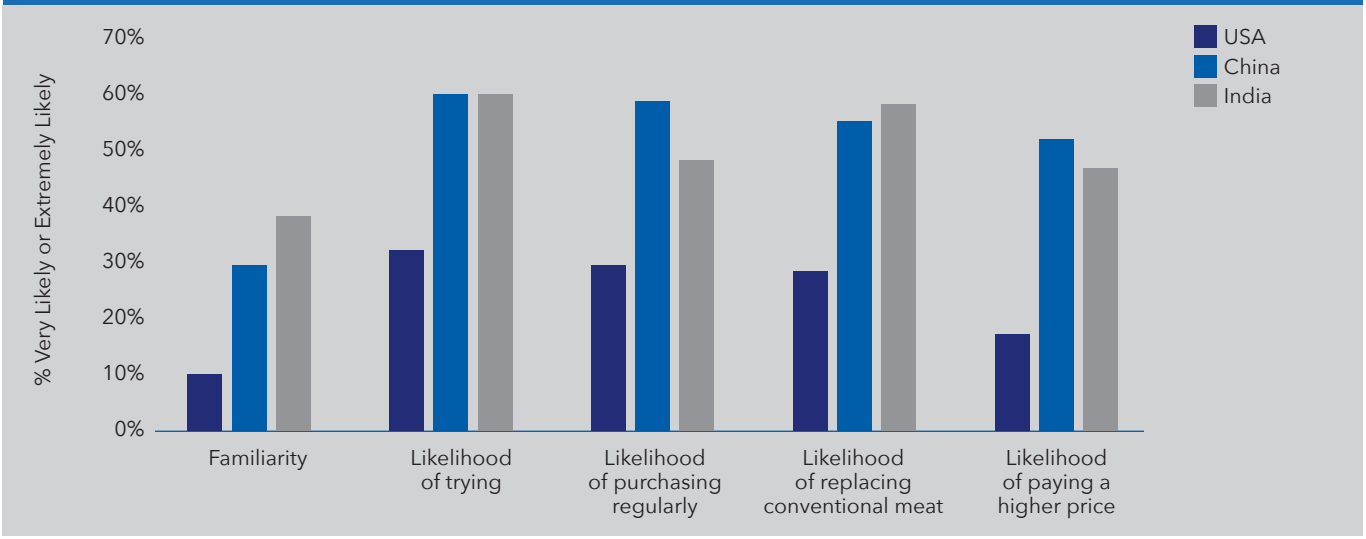
Parendi Birdie screening for viable cell-based meat cell lines at the cellular agriculture lab at JUST. Photo credit: Waverly Eichhorst

Box 3: Will people eat it?

With any new technology, there exists a diffusion of innovation in which some consumers will be excited to try the technology when it first becomes available, while others will be slower to adopt it.[11] As such, consumer acceptance rates tend to be modest at market entrance, with increasing acceptance as familiarity grows and cost decreases.

Considering that cell-based meat is not yet available for sale, initial consumer acceptance rates are quite promising. A 2018 survey of 3,030 consumers found that 30% of U.S. consumers, 59% of Chinese consumers, and 50% of Indian consumers were very or extremely likely to purchase cell-based meat regularly,[12] with 33% percent of U.S. consumers, 61% of Chinese consumers, and 61% of Indian consumers either very or extremely likely to try it. Many consumers are excited about the potential benefits that cell-based meat can contribute to society, including reducing environmental impact, eliminating the need to raise and slaughter animals, and reducing public health risks.[13]

There are a number of demographic and attitudinal predictors of acceptance, which vary across cultures,[12] but prior familiarity and an openness to trying new foods have both been shown to be strong predictors of acceptance cross-culturally. More research is needed on how to effectively communicate and launch this product category in a way that builds consumer trust, familiarity, and excitement among consumer segments. It is critical to understand the early-adopter segment, but for long-term success, it is also important to carefully pave the way for early and late-majority adopters toward acceptance.



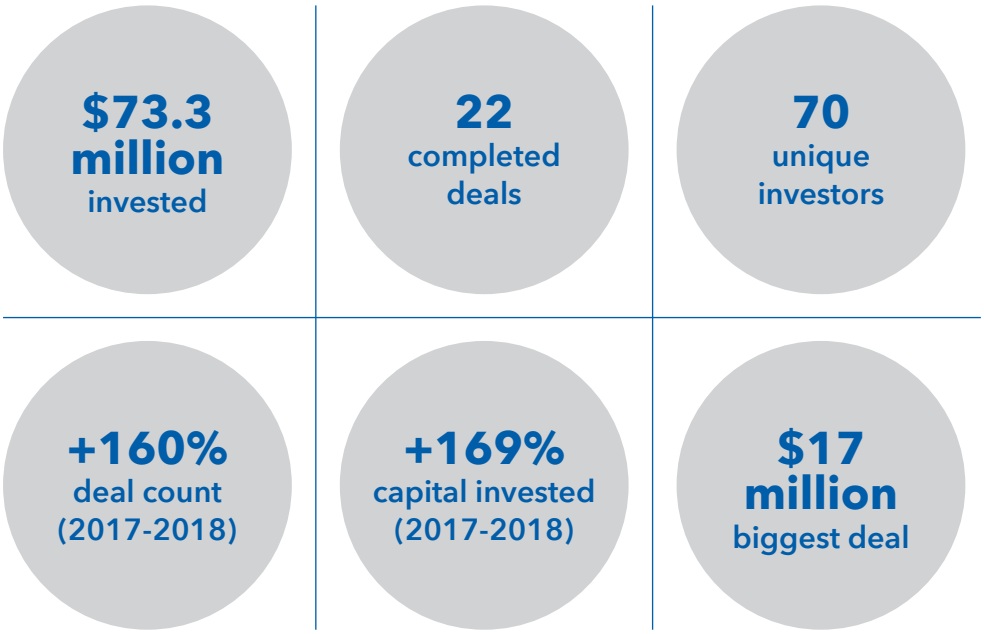
Source: Bryant et al. 2019

Section 3: Investments

Overview

Using PitchBook, GFI conducted a custom analysis of cell-based meat companies across the globe.[7] This analysis excluded companies who are pursuing cell-based meat as one aspect of a larger business (i.e., JUST and Wild Earth) since it has not been disclosed what portion of their total funding is being devoted to cell-based meat R&D. We found that $73.3 million has been invested in cell-based meat companies in 22 completed deals involving 70 unique investors (Figure 5). The first deal occured in 2015, when Memphis Meats received pre-seed funding from IndieBio. Since then, deal count and capital invested have been steadily on the rise, reaching 14 completed deals totaling nearly $50 million in 2018 (Figure 6).

Figure 5: Cell-Based Meat Industry Investment Overview

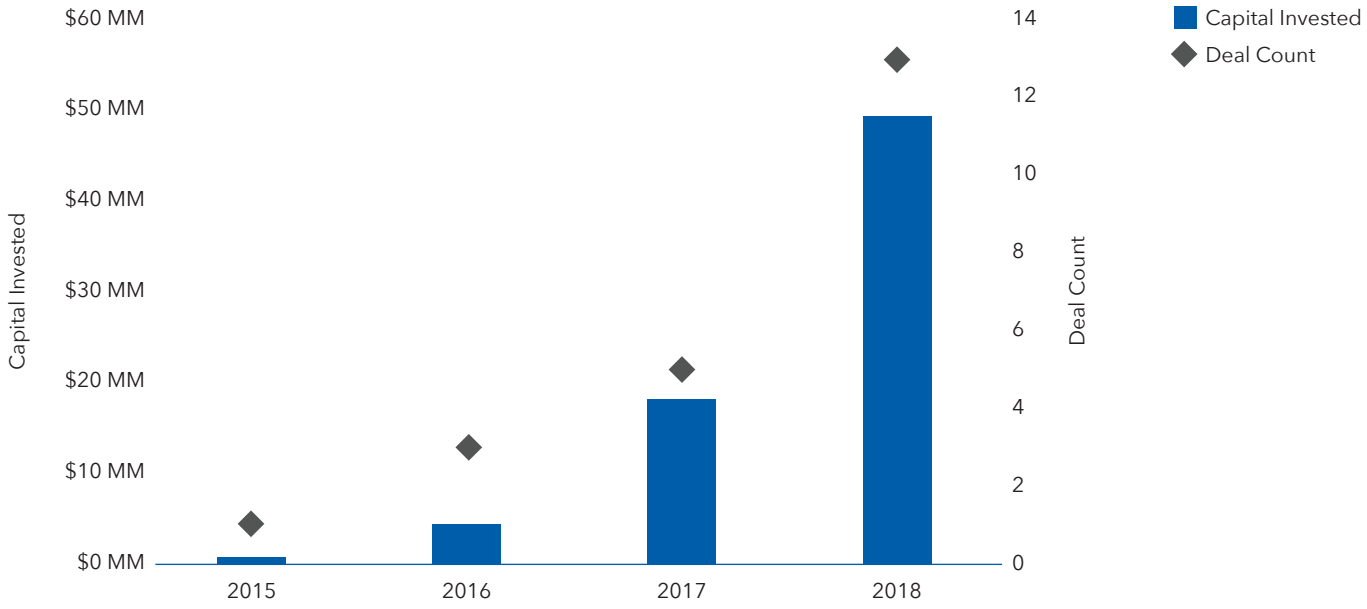


Source: GFI custom PitchBook analysis of cell-based meat companies. Does not include companies that are pursuing cell-based meat as one aspect of a larger business.

PitchBook

Section 3: Investments

Figure 6: Cell-based Meat Investment History by Capital Invested and Deal Count



Source: GFI custom PitchBook analysis of cell-based meat companies. Does not include companies that are pursuing cell-based meat as one aspect of a larger business.

PitchBook

Box 4: Is it economically feasible?

GFI Senior Scientist Dr. Liz Specht conducted a cost analysis, which concluded it is likely that cell-based meat can achieve price parity with mainstream conventional meat once produced at industrial scale.[3] We expect ground meat products like chicken nuggets, sausages, and ground beef to be the first to reach cost-competitiveness with conventional meat. More complex cuts of meat, like prime rib and T-bone steak, will require more complex production methods. Before price parity is achieved, cell-based meat companies might use go-to-market strategies such as selling at a limited number of high-end restaurants or blending with plant-based meats to lower costs.

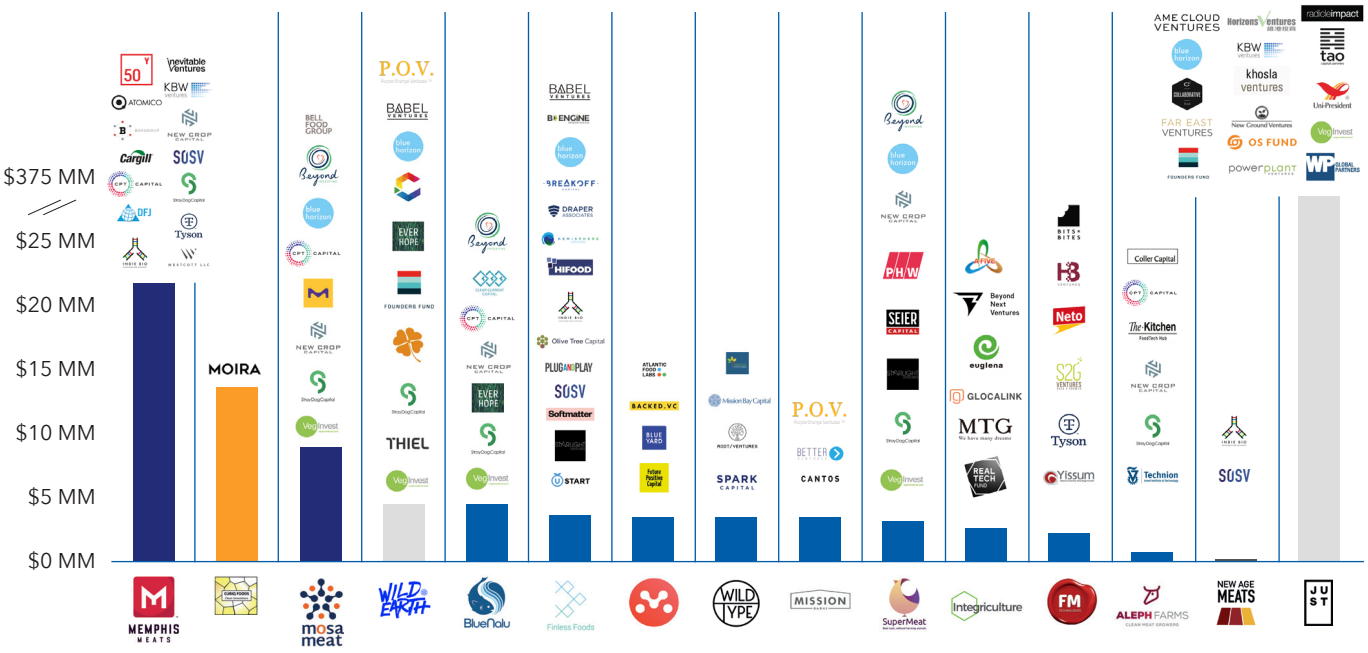
Section 3: Investments

Deals

To date, the biggest deal was Memphis Meats' $17 MM Series A round, which closed in August 2017 and included strategic meat industry partners Tyson and Cargill, as well as notable visionaries Bill Gates and Richard Branson. In July 2018, Mosa Meat became the second cell-based meat company to raise a Series A round, with a €7.5 MM ($9 MM) investment that was co-led by M Ventures, the corporate VC arm of pharmaceutical company Merck, and Bell Food Group, Switzerland's largest meat processor. In December 2018, Spanish cell-based meat company CUBIQ Foods was acquired by Moira Capital Partners, a boutique private equity firm based in Madrid, for €12 MM ($14 MM). So far, Memphis Meats, Mosa Meat, and CUBIQ Foods are the only cell-based meat companies that have raised more than $9 MM, but we expect several others to raise their Series A funding in 2019.

Companies that have raised seed funding include Aleph Farms, BlueNalu, Finless Foods, Future Meat Technologies, Integriculture, Meatable, Mission Barns, SuperMeat, and Wild Type (Figure 7). Cell-based meat companies' seed-round deals have ranged in size between $2.2 MM and $5 MM.

Figure 7: Capital Invested in Cell-based Meat Companies by Stage and Investor



- Companies that have raised **Private Equity** funding
- Companies that have raised **Series A** funding
- Companies that have raised **Seed** funding
- Companies that have raised **Pre-seed** funding
- Companies at various stages that are pursuing cell-based meat as one aspect of a larger business

PitchBook

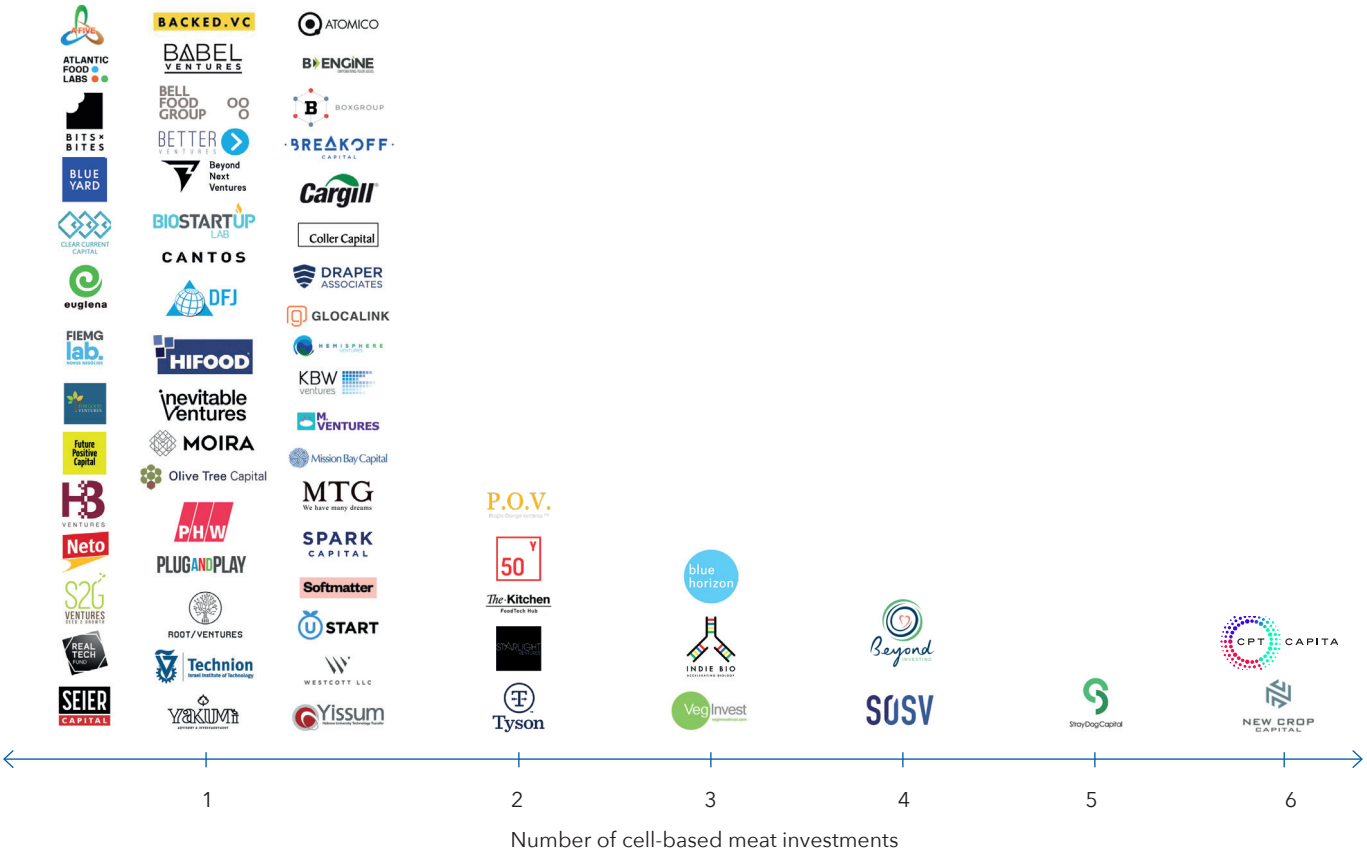
Source: GFI custom PitchBook analysis of cell-based meat companies.

Section 3: Investments

Investors

The most active investors in the cell-based meat industry are impact investors like CPT Capital (6 deals), New Crop Capital (6 deals), Stray Dog Capital (5 deals), Blue Horizon (3 deals), and VegInvest (3 deals) (Figure 8). Many of these impact investors are members of the **Glasswall Syndicate.** Accelerators and incubators are also active investors, with IndieBio investing in 3 companies (Memphis Meats, Finless Foods, and New Age Meats) and its VC arm, SOSV, having invested in all of these companies, plus one follow-on investment in Memphis Meats. The Kitchen FoodTech Hub, an initiative of the Strauss Group in Israel, is a significant funder of Aleph Farms. As noted above, strategic investors include multinational meat companies Tyson, Cargill, and PHW Group, as well as the pharmaceutical company Merck through its VC arm, M Ventures.

Figure 8: Most Active Investors in Cell-based Meat



Source: GFI custom PitchBook analysis of cell-based meat companies. Does not include companies that are pursuing cell-based meat as one aspect of a larger business. Angel investors with no logos were not included.

PitchBook

Section 3: Investments

Table 2: List of Investors in Cell-based Meat Companies

Investor Name	Investments	Investor Type	Location
CPT Capital	6	Venture Capital	London, UK
New Crop Capital	6	Venture Capital	New York, NY
Stray Dog Capital	5	Venture Capital	Leawood, KS
Beyond Impact Advisors	4	Venture Capital	Geneva, Switzerland
Blue Horizon	3	Venture Capital	Zürich, Switzerland
IndieBio	3	Accelerator/Incubator	San Francisco, CA
SOSV	3	Venture Capital	Princeton, NJ
VegInvest	3	Venture Capital	New York, NY
Fifty Years	2	Venture Capital	San Francisco, CA
Purple Orange Ventures	2	Venture Capital	Berlin, Germany
Starlight Ventures	2	Venture Capital	Miami, FL
The Kitchen FoodTech Hub	2	Accelerator/Incubator	Ashdod, Israel
Tyson Ventures	2	Corporate Venture Capital	Chicago, IL
A-Five	1	Government	Japan
Atlantic Food Labs	1	Venture Capital	Berlin, Germany
Atomico	1	Venture Capital	London, United Kingdom
BABEL Ventures	1	Venture Capital	San Francisco, CA
Backed VC	1	Venture Capital	London, United Kingdom
Bell Food Group (SWX: BELL)	1	Corporation	Basel, Switzerland
B-Engine	1	Venture Capital	Modena, Italy
Better Ventures	1	Venture Capital	Oakland, CA
Beyond Next Ventures	1	Venture Capital	Tokyo, Japan
Bits x Bites	1	Accelerator/Incubator	Shanghai, China
BlueYard Capital	1	Venture Capital	Berlin, Germany
BoxGroup	1	Venture Capital	New York, NY
Breakoff Capital	1	Venture Capital	London, United Kingdom
Cantos Ventures	1	Venture Capital	San Francisco, CA
Cargill	1	Corporation	Minneapolis, MN
Charles Songhurst	1	Angel (individual)	Seattle, WA
Clear Current Capital	1	Venture Capital	Vero Beach, FL
Coller Capital	1	PE/Buyout	London, United Kingdom
DFJ	1	Venture Capital	Menlo Park, CA
Draper Associates	1	Venture Capital	San Mateo, CA
Euglena (TKS: 2931)	1	Corporation	Tokyo, Japan
Everhope Capital	1	Venture Capital	Providence, RI
For Good Ventures	1	Venture Capital	San Francisco, CA
Future Positive Capital	1	Venture Capital	Paris, France

Section 3: Investments

Investor Name	Investments	Investor Type	Location
Gates Ventures	1	Venture Capital	San Francisco, CA
Glocalink	1	Other	Tokyo, Japan
Harrison Blue Ventures	1	Venture Capital	
HB Ventures	1	Venture Capital	Boise, ID
Hemisphere Ventures	1	Venture Capital	Seattle, WA
Hi-Food	1	Corporation	Parma, Italy
Hiroaki Kitano	1	Angel (individual)	
Inevitable Ventures	1	Venture Capital	Los Angeles, CA
Jack Welch	1	Angel (individual)	
Jörg Mohaupt	1	Angel (individual)	
KBW Ventures	1	Venture Capital	Dubai, United Arab Emirates
Kimbal Musk	1	Angel (individual)	Hawthorne, CA
Kyle Vogt	1	Angel (individual)	San Francisco, CA
Merck Ventures	1	Corporate Venture Capital	Amsterdam, Netherlands
Mission Bay Capital	1	Venture Capital	San Francisco, CA
Moira Capital Partners	1	Venture Capital	Madrid, Spain
MTG Japan (TKS: 7806)	1	Corporation	Nagoya, Japan
Neto Malinda Trading (TAE: NTML)	1	Corporation	Kiryat Malakhi, Israel
Olive Tree Capital	1	Venture Capital	Los Angeles, CA
PHW Group	1	Corporation	Visbek, Germany
Plug and Play	1	Venture Capital	Sunnyvale, CA
Real Tech Fund	1	Venture Capital	Tokyo, Japan
Richard Branson	1	Angel (individual)	Necker Island, British Virgin Islands
Root Ventures	1	Venture Capital	San Francisco, CA
S2G Ventures	1	Venture Capital	Chicago, IL
Seier Capital	1	Venture Capital	Schwarzenbach, Switzerland
Sergey Brin	1	Angel (individual)	Los Altos, CA
Softmatter	1	Venture Capital	New York, NY
Spark Capital	1	Venture Capital	Boston, MA
Supernode Ventures	1	Venture Capital	New York, NY
Technion Israel Institute of Technology	1	University	Haifa, Israel
U-Start	1	Venture Capital	Lugano, Switzerland
Vis Capital	1	Venture Capital	Italy
Westcott	1	PE/Buyout	Dallas, TX
Yakumi Investment	1	Angel Group	Tokyo, Japan
Yissum	1	Venture Capital	Jerusalem, Israel

PitchBook

Source: Source: GFI custom PitchBook analysis of cell-based meat companies. Does not include companies that are pursuing cell-based meat as one aspect of a larger business.

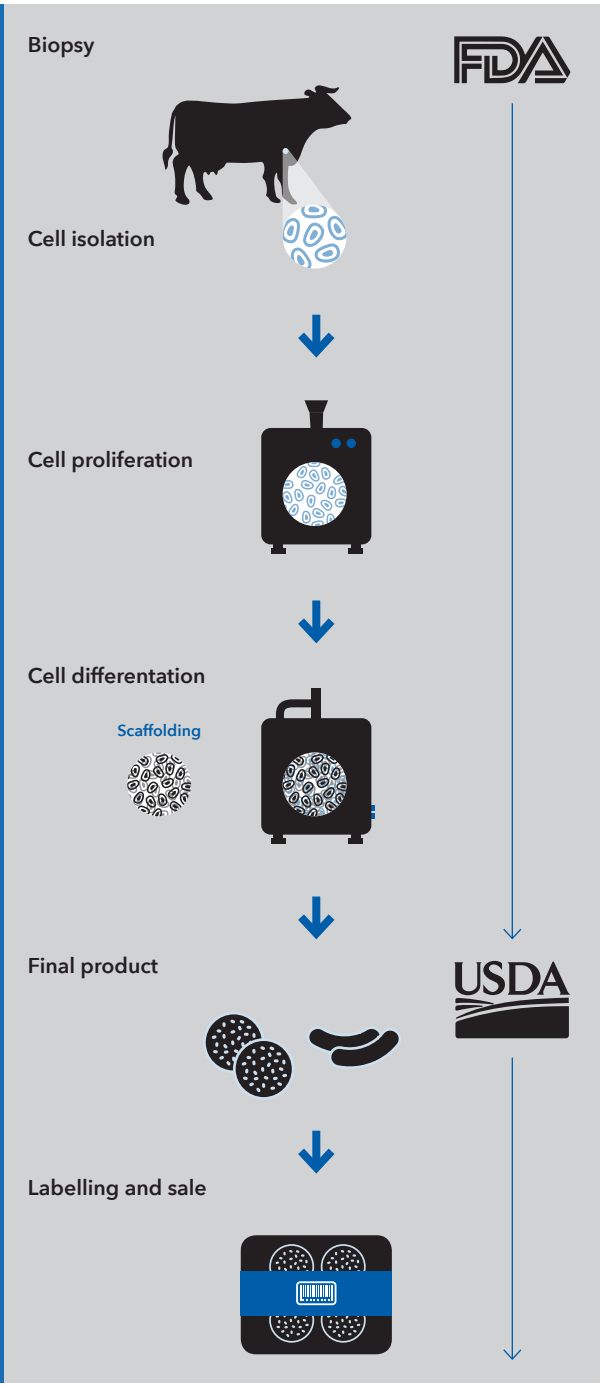
Section 3: Investments

"We want to be true world leaders on this topic… I'm glad to see the excitement over [this] new technology… It's important that we have a framework that encourages innovation and new technology while we provide the responsibility of a public, safe, wholesome, and nutritious food supply."
Sonny Perdue, United States Secretary of Agriculture

What is the regulatory pathway to market?

In the U.S., regulators have been advancing rapidly towards creating a regulatory framework specific to foods cultured from animal cells. After several months of active public discussion, the U.S. Department of Agriculture (USDA) and the U.S. Food & Drug Administration (FDA) announced on November 16, 2018, an agreement to create a joint regulatory framework to leverage both the FDA's experience regulating cell-culture technology and living biosystems and the USDA's expertise in regulating livestock and poultry products for human consumption. FDA will oversee cell collection, cell banks, and cell growth and differentiation. A transition from FDA to USDA oversight will occur during the cell-harvest stage. USDA will then oversee the production and labeling of food products derived from the cells of livestock and poultry. The agencies have said they are working to refine the technical details of this framework, which will include robust collaboration and information sharing between the agencies to permit each to carry out its role in the framework. Further guidance is anticipated in 2019.
In the meantime, legislation has been introduced in a number of states that would prevent the use of "meat" terminology on labels for cell-based meat. Where these bills become law, we can expect to see challenges based on the First Amendment and preemption.

Several cell-based meat companies are pursuing regulatory approvals outside the U.S., and some countries have clearer pathways to market than others. In Europe, cell-based meat is covered by the Novel Food Regulation, which involves a pre-market approval process. Refer to Chatham House's report Meat Analogues: Considerations for the EU for more information about regulatory status in Europe. Some Asian jurisdictions, such as Hong Kong and Japan, also may offer promising pathways to market.



Section 4: Conclusion

Mark Post created the world's first **cell-based hamburger** at Maastricht University in 2013. However, it was not until 2015 that this field emerged from academic laboratories and into a commercial industry. This was also the year that Mark Post founded Mosa Meat as a spin-out from Maastricht University, and the year that Memphis Meats joined IndieBio's second cohort. In 2016, Memphis Meats launched a product crowdfunding campaign, raised its seed round, and debuted the world's first **cell-based meatball.** By the end of that year, SuperMeat had also successfully closed a product crowdfunding campaign and Integriculture had raised a seed round.

Throughout 2017 and 2018, the cell-based meat industry continued to grow. In 2018, there were 14 completed funding events, an average of more than one per month. There were 15 funded companies across three continents, with partnerships formed with such corporate giants as Tyson, Cargill, Merck, and PHW Group.

Despite all this rapid progress, it is important to remember that the cell-based meat industry is still nascent. To put things in perspective, we analyzed funding in the cell-based meat industry compared to the plant-based food industry (covered more deeply in our **Plant-based Meat, Eggs, and Dairy State of the Industry Report**) and various other related industries (Figure 9).*

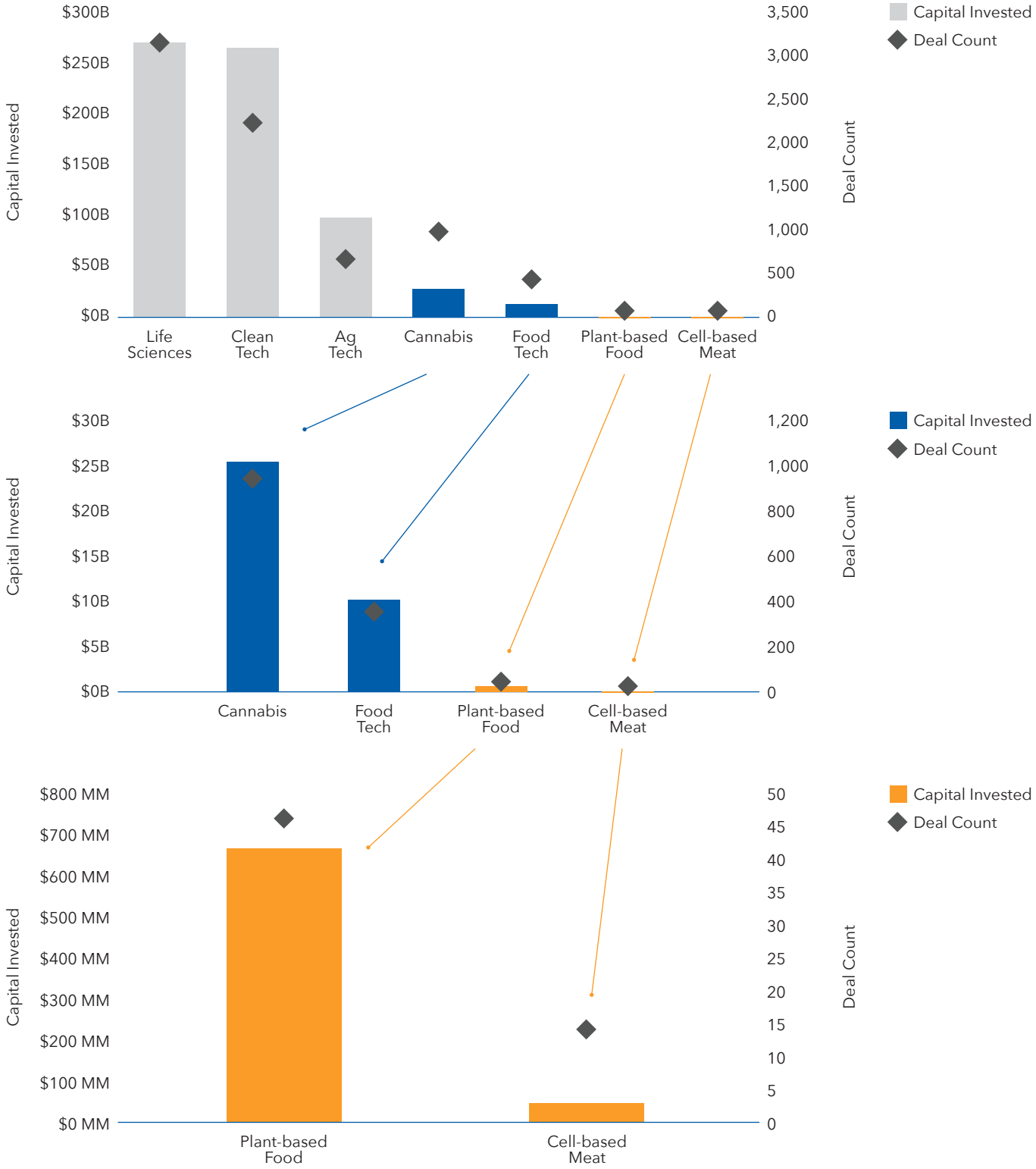
From this lens, the cell-based meat industry is so small that it barely shows up on the charts. Investments in cell-based meat were only 6% of those made in plant-based food, 0.5% of investments in FoodTech and 0.2% of those made in the cannabis industries in 2018. Compared to more established industries like agtech (0.05%), cleantech (0.02%) and life sciences (0.02%), the cell-based meat industry almost doesn't register on the graph. Another way of looking at this is that in 2018, more than 5,000 times as much money was invested into cleantech ($264 B) compared to cell-based meat ($49 MM). As the cell-based meat industry matures into a revenue-generating industry, there will be room for investment on a much larger scale than what has been injected thus far.

Photo credit: Memphis Meats

* Note that the plant-based food industry represents companies that are based in the U.S. and/or selling products in the U.S. All other industries are global. See the **Plant-based Meat, Eggs, and Dairy State of the Industry Report** for more information on data collection methodology for the plant-based food industry.

Section 4: Conclusion

Figure 9: Funding Invested in Various Industries in 2018



Source: GFI custom PitchBook analysis of cell-based meat companies. Does not include companies that are pursuing cell-based meat as one aspect of a larger business.

PitchBook

Section 4: Conclusion

The fact that the cell-based meat industry is in its infancy means there is a vast amount of opportunity for investors, entrepreneurs, and strategic partners to get involved at the early stages and capitalize on this global shift in the way meat is produced. While we believe it is still too early to make market projections without a great deal of speculation, the overall scale of the market opportunity is undeniable. In the U.S. alone, the top six publicly traded meat companies have a combined $60B valuation.[8] In 2018, the combined revenue of the top 100 U.S. meat and poultry processors totaled $228 billion.[9] Global demand for animal-based foods is expected to rise by nearly 70 percent by 2050.[10]

Capturing even a fraction of this demand for meat would represent a massive opportunity for cell-based meat companies. Considering that such companies have collectively raised less than $75 MM to date, we believe there is still substantial room for new investment. Furthermore, the industry's progress could be substantially accelerated by strategic investment partnerships with industry, governments, and VCs with subject-matter expertise in related fields. It remains to be seen which cell-based meat company will win the race to market, or which companies will become the future market leaders. GFI looks forward to supporting the growth of this young industry as the answers to these questions unfold in the coming years.

A panel discussion at the 2050 China Food Tech Summit in Shanghai, China. Photo credit: The Good Food Institute

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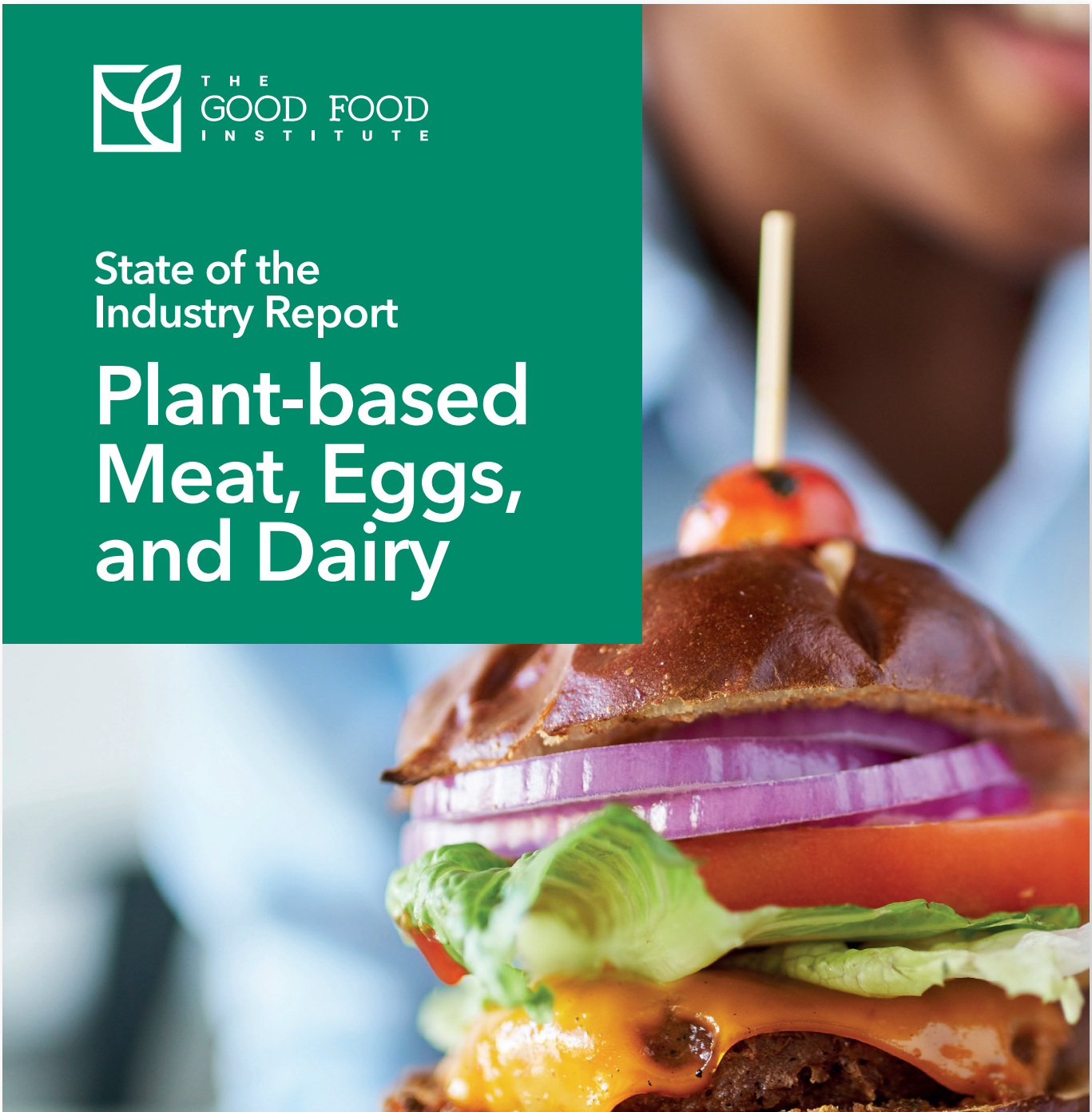
Interested in learning more about the future of food? Check out our counterpart report, Plant-based Meat, Eggs, and Dairy: State of the Industry Report, which includes a custom analysis of investments in plant-based food companies, an analysis of the current retail and foodservice market for plant-based food, and a regulatory update on issues such as labeling and approvals.



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