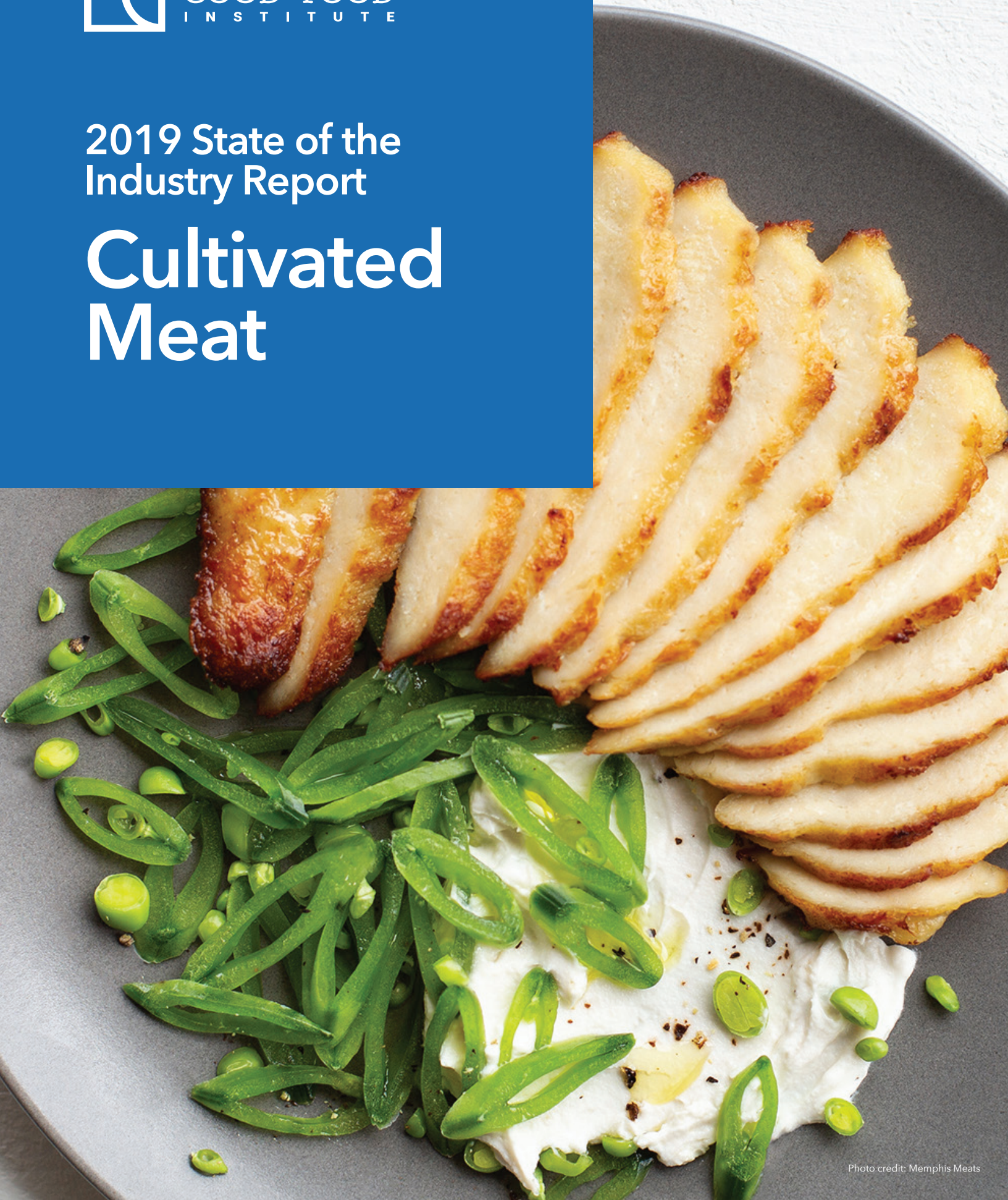


2019 State of the Industry Report

Cultivated Meat



Contents

Section 1: Introduction	3
Box 1: What Is Cultivated Meat?	4
Section 2: Companies	6
Overview	6
Table 1: Current Competitive Landscape for Cultivated Meat Industry	7
Global Perspective	11
Figure 1: Geographic Distribution of Cultivated Meat Companies	11
Product Focus: A Growing Field but Still Plenty of White Space	12
Companies Embrace Opportunities in the Cultivated Meat Value Chain	12
Box 2: Example Value-Chain Entry Points	14
Looking Ahead	15
Section 3: Investments	16
Overview	16
Figure 2: Cultivated Meat Industry Investment Overview (2016-2019)	16
Figure 3: Investments in Cultivated Meat Companies (2016-2019)	17
Deals	18
Investors	19
Figure 4: Cultivated Meat Company Investor Composition (2016-2019)	19
Table 2: Investors in Cultivated Meat Companies	20
Box 3: New Venture Funds Bring Dry Powder into 2020	24
Global Snapshot	25
Figure 5: Top Investing Countries by Number of Unique Investors	25
Box 4: Belgian Consortium Aligns Diverse Partners to Bring Cultivated Foie Gras to Market	26
Looking Ahead	26

Contents

Section 4: Science and Technology	27
Overview	27
Research Highlights	29
Box 5: Technical Opportunities for Seafood Research in 2020	30
Looking Ahead	30
Box 6: Cultivated Milk Is an Emerging Application for Cell Culture Technology	31
Section 5: Regulation	32
Overview	32
Federal Regulation of Cultivated Meat	32
International Regulation of Cultivated Meat	32
State Label Censorship	32
Box 7: AMPS Innovation	33
Section 6: Consumer Insights	34
Overview	34
Box 8: Cultivated Meat's Appeal Crosses the World's Largest Markets	34
Demographics, Drivers, and Attitudes	35
Demographics	35
Drivers	35
Figure 6: Consumer Attitudes Toward Cultivated Meat	35
Meat Cultivation Framing Overcomes Concerns	36
Figure 7: Meat Cultivation Narrative	37
Summary	37
Section 7: Conclusion	38
Box 9: Memphis Meats' Historic Series B Propels the Industry	38
Appendix: References	40

Section 1: Introduction

Humanity today faces three enormous challenges. The first is feeding 9.8 billion people by 2050.¹ The second is mitigating climate change. The third is mitigating the existential threat of antibiotic-resistant and zoonotic diseases.

Historically, new technologies and markets have allowed us to feed a growing population in increasingly efficient ways. In 1872, a farmer in the United States fed about four other people. Today, the average farmer feeds 156 people.²

Improving production methods will help us address the challenges we face today. One of the most promising new innovations is cultivated meat.

Other than plant-based meat (which is currently less than 1% of the global meat market), all the meat sold today comes from entire animals. Raising an entire animal requires enough feed to grow brain tissue, blood, and bone, as well as fuel the animal's day-to-day metabolism. No matter how much we genetically manipulate animals, this process is inherently inefficient.

By cultivating only the desired meat directly from cells, we can produce meat with fewer resources and significantly less environmental impact. For instance, compared with conventional beef, cultivated beef is estimated to reduce land use by more than 95%, climate change emissions by 74%-87%, and nutrient pollution by 94%.³ Since cultivated meat is grown in a clean facility without the need for slaughter, it also effectively eliminates the risk of contamination by harmful pathogens, such as salmonella and E. coli. One of cultivated meat's most important advantages is that it does not require therapeutic antibiotics, thereby reducing the serious and growing public health threat posed by antibiotic resistance.⁴

Once the realm of science fiction, cultivated meat has rapidly become a reality. Professor Mark Post produced the first cultivated beef burger in 2013. Since then, at least a dozen companies have debuted chicken, yellowtail, duck, minute steak, pork sausage, salmon, foie gras, kangaroo, fish maw, and more. By the end of 2019, 55 announced early-stage companies around the world were focused on producing cultivated meat and seafood or serving these producers along the value chain. Twenty of these companies launched in 2019 alone.

Now, the main challenges for making cultivated meat affordable for mass markets are scaling up production and bringing down ingredient costs. According to The Good Food Institute science and technology team's independent cost analysis, achieving price parity is likely to be technologically feasible without the development of any new "moonshot" technologies.⁵

Section 1: Introduction

As the industry matures, specialization could accelerate progress. Prior to 2019, cultivated meat companies were vertically integrated, trying to solve every technical challenge in-house. Last year, however, the industry began to diversify in terms of specialty (e.g., focusing on developing growth media). Academic research has also diversified, driven in part by [GFI's Competitive Research Grant Program](#).

It is difficult to say when cultivated meat products will hit the commercial market. However, some leading cultivated meat companies—Memphis Meats,⁶ CUBIQ Foods,⁷ and Mosa Meat⁸—have announced that they expect to start selling products in 2021, probably at a premium price and limited scale initially.

Box 1: What Is Cultivated Meat?

Cultivated meat (often referred to as clean meat, cultured meat, or cell-based meat) is identical to animal meat at the cellular level. It provides the same sensory and nutritional profile of conventionally produced meat because it comprises the same cell types and three-dimensional structure as meat from an animal. It isn't imitation or synthetic meat; it's actual animal meat grown outside an animal. At scale, it isn't produced in a lab either. The cultivated meat on your future dinner plates will be produced in cultivators in much the same way beer is brewed or plants are grown from a cutting (Figure 7). GFI's blog post "Cultivated Meat: Why GFI Is Embracing New Language" describes why GFI, in collaboration with Mattson and all the most active investors in the sector, aligned on "cultivated" terminology to describe meat produced through cellular agriculture.

In addition to technological progress, we have seen significant advancement on the regulatory front. In 2018, the U.S. Department of Agriculture (USDA) and the U.S. Food and Drug Administration (FDA) agreed to a joint regulatory framework.⁹ In 2019, they issued a formal agreement, providing cultivated meat with a much clearer path to market in the United States.¹⁰ With formal guidelines to follow, we are optimistic that both agencies are committed to creating a fair regulatory framework for cultivated meat production and sale in the United States.

Not surprisingly, since this is a global industry, some companies are also pursuing regulatory approval in other countries. GFI is working to facilitate regulatory approval around the world, including in Israel, India, Brazil, Asia Pacific, and Europe. Regulators in Singapore have shown particular interest in cultivated meat and seafood, and the country may be the first outside the United States to approve a cultivated meat product.

Section 1: Introduction

Last year was the most fruitful to date for cultivated meat companies. They not only demonstrated a multitude of product prototypes but raised more than \$75 million in funding in 2019 alone—about as much money as was raised in the previous three years combined. The momentum continued to build throughout the year, with three Series A fundraising rounds and one large seed round in the fourth quarter alone (Future Meat Technologies, \$14 million; Finless Foods, undisclosed; Wild Type, \$12.43 million; Meatable, \$7 million). BlueNalu raised a \$20 million Series A, the largest fundraising round as of then.¹¹

Equally significant, in 2019 more governments recognized that cultivated meat is the future of sustainable, scalable meat production. The EU's European Commission, for example, granted Dutch startup Meatable \$3 million to help bring cultivated pork to market,¹² and Belgium's government created a consortium of companies working on cultivated foie gras with 3.6 million euros.¹³

As exciting and groundbreaking as these developments are, this is just the beginning for the cultivated meat industry. GFI is pleased to offer our second annual state of the industry report as a snapshot of the cultivated meat industry. We expect to publish increasingly robust reports each year as cultivated meat is further capitalized, commercialized, and, ultimately, brought to market.

Shiok Meats demonstrates their cultivated shrimp at the [Disruption in Food and Sustainability Summit](#) in March (from [GFI archives](#)). (GFI-APAC managing director Elaine Siu second from right)



Section 2: Companies

Overview

Entrepreneurial investment in cultivated meat continued to accelerate in 2019. By the end of 2019, 55 total cultivated meat and seafood industry startups had publicly announced themselves (Table 1):

- More than one-third (20 total) were founded or left stealth mode in 2019.
- More than half (32 total) have raised external funding.
- Cultivated meat companies now span much of the globe, with headquarters in at least 19 countries, spurred by government investments, university research, investor interest, and favorable consumer sentiment.

Below is their breakdown according to primary business function, although some companies are pursuing multiple business functions or product types (e.g., creating both cultivated meat and cultivated seafood or both creating cultivated meat and selling cell culture media):¹⁴

- 33 cultivated meat producers (beef, chicken, pork, duck, horse, kangaroo, foie gras, bison, mouse).
- 7 cultivated seafood producers working on vertically integrated systems (tuna, salmon, crustaceans, fish maw, sturgeon).
- 15 companies serving the cultivated meat and seafood industry as a core part of their business (these business-to-business companies work to provide cell culture media, cell lines, scaffolding, and bioreactors).

With launches on five continents, 2019 was a big year for the cultivated meat industry:

- 20 new cultivated meat companies in 12 different countries.
- 13 cultivated meat or seafood producers.
- 7 business-to-business (B2B) startups focused primarily on serving cultivated meat and seafood producers.





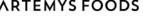






Involvement in cultivated food goes well beyond early-stage companies with cultivation at their core. Perhaps an equal amount of research is conducted by life science, therapeutics, agrifood, and industrial corporations that see the opportunity cultivated meat companies present.

In 2019, the nascent industry also showed signs of increasing maturity, with multiple lab-scale proofs of concept and a focus on scaling up production after several Series A fundraising rounds. While the degree of cultivated meat activity was unprecedented in 2019, we expect accelerated growth of the industry as cultivated meat becomes a mainstream area for investment, study, and business.















Section 2: Companies

Table 1: Current Competitive Landscape for Cultivated Meat Industry (alphabetized)

Meat is one of the world's largest industries. A robust ecosystem of cultivated meat companies is forming to fundamentally transform the way animal meat is produced. More startups are needed, however, to fill niches and support the ecosystem. Top investors, such as [Y Combinator](#), view cultivated meat as one of the great opportunities of the [Fourth Industrial Revolution](#), alongside AI, robotics, and synthetic biology. The majority of startups formed to date have set out to develop vertically integrated meat production platforms. But the opportunity for horizontal entry points is boundless, as evidenced by the growing number of upstream suppliers shown below. Equally abundant are opportunities downstream in supply chain, distribution, marketing, and foodservice.

Name and Logo	Location	Area of Focus	Total Disclosed Last-Stage Funding as of 2019	Founders	Year Founded
Agulos Biotech 	Lake Mills, WI, USA	Cell culture media	N/A	Jonathan Irwin	2017
Aleph Farms 	Rehovot, Israel	Meat production (beef)	\$14.4MM (Series A)	Didier Toubia, Shulamit Levenberg	2016
Alife Foods 	Leipzig, Sachsen, Germany	Meat production (undisclosed)	N/A	Steffen Sonnenberg, Dat Tran, Joe Natoli, Bernd Boeck	2019
Appleton Meats 	Vancouver, BC, Canada	Meat production (undisclosed)	N/A	Sid Deen	2016
Artemys Foods 	San Francisco, CA, USA	Meat production (undisclosed)	N/A	Jessica Krieger, Joshua Marsh	2019
ArtMeat  ArtMeat	Kazan, Russia	Meat producer (horse, sturgeon)	N/A	Askar Latyshev, Albert Rizvanov, Elena Zakirova	2019
Avant Meats 	Hong Kong, China	Seafood production (fish maw)	Undisclosed (seed)	Carrie Chan, Mario Chin	2018
Back of the Yards Algae Sciences 	Chicago, IL, USA	Cell culture media, meat production (various), part of a larger business of algae innovation	N/A	Leonard Lerer	2018
Balletic Foods 	San Francisco, CA, USA	Meat production (undisclosed)	Undisclosed (seed)	Anita Broellochs	2017
Because Animals 	Philadelphia, PA, USA	Meat production (mouse, pet food)	\$2.50MM (seed)	Shannon Falconer, Joshua Errett	2016
Biftek 	Gölbaşı, Turkey	Cell culture media, meat production (beef)	N/A	Can Akcali, Erdem Erikçi	2018






Section 2: Companies

Bio Tech Foods 	San Sebastián, Spain	Meat production (undisclosed)	\$2.77MM (Series A)	Mercedes Vila Juárez	2017
BioFood Systems 	Hod Hasharon, Israel	Meat production (beef)	Undisclosed (seed)	Yohai Ben Zikri, Arturo Geifman	2018
Biomimetic Solutions 	London, United Kingdom / Nova Lima, Brazil	Scaffolding (nanomaterials), part of a larger tissue engineering business	\$0.05MM (seed)	Alana Santos Benz, Lorena Viana Souza, Aline Bruna da Silva, Roberta Ferreira Viana	2017
BlueNalu 	San Diego, CA, USA	Seafood production (yellowtail tuna, salmon)	\$24.5MM (Series A)**	Lou Cooperhouse, Chris Somogyi, Chris Dammann	2017
Cell Ag Tech 	Toronto, ON, Canada	Seafood production (undisclosed)	N/A	Josh Pollack, Valentin Fulga	2018
Cell Farm Food Tech 	Buenos Aires, Argentina	Meat production (undisclosed), bovine stem cell provider	\$0.20MM (seed)	Sofia Giampaoli	2019
Cellular Agriculture Ltd. 	Carmarthenshire, United Kingdom	Meat production (pork), bioreactors (hollow fiber)	N/A	Illtud Dunsford, Marianne Ellis	2016
CellulaREvolution 	Newcastle, United Kingdom	Bioreactors (continuous production)	N/A	Leo Groenewegen, Martina Miotto, Che Cannon	2019
ClearMeat 	Delhi, India	Meat production (chicken)	Undisclosed (seed)	Pawan Dhar, Kartik Dixit, Siddharth Manvati	2018
Cubiq Foods 	Barcelona, Spain	Meat production (chicken fat)	\$14MM (private equity)	Andrés Montefeltro, Raquel Revilla	2018
Cultured Blood 	Eindhoven, Netherlands	Cell culture media, bioreactors	N/A	Robert ten Hoor	2019
Excell (Arlat Food Co.) 	Green Island, NY, USA	Scaffolding (mycelium cell culture kit)	N/A	Eben Bayer, Steve Lomnes, Russell Hazen, Gavin McIntyre, Andy Bass, Alex Carlton	2019
Finless Foods 	San Francisco, CA, USA	Seafood production (bluefin tuna)	\$3.75MM (Series A)	Mike Selden, Brian Wyrwas	2016
Fork & Goode 	New York, NY, USA	Meat production (undisclosed)	\$3.54MM (seed)	Niya Gupta, Gabor Forgacs	2018
Future Fields 	Edmonton, AB, Canada	Cell culture media	N/A	Matthew Anderson-Baron, Lejja Gafour	2017
Future Meat Technologies 	Jerusalem, Israel	Meat production (chicken, lamb, beef)	\$16.6MM (Series A)	Yaakov Nahmias	2017

Section 2: Companies

 Gourmey GOURMEY PARIS	Paris, France	Meat production (foie gras)	Undisclosed (seed)	Nicolas Morin-Forest, Antoine Davydoff, Victor Sayous	2019
 Heuros	Bisbane, Queensland, Australia	Meat production (undisclosed)	Undisclosed (seed)	Nick Beaumont	2017
 HigherSteaks	London, United Kingdom	Meat production (undisclosed)	\$0.02MM (seed)	Benamina Bollag, Stephanie Wallis	2018
 Innocent Meat	Rostock, Germany	Meat production (undisclosed)	N/A	Laura Gertenbach, Philipp Wolters	2018
 IntegriCulture IntegriCulture	Tokyo, Japan	Meat production (chicken, foie gras), cell culture media	\$2.73MM (seed)	Yuki Hanyu	2015
 JUST	San Francisco, CA, USA	Meat production (chicken), included in a larger business of plant-based egg production	\$372.53MM (Series E)	Josh Tetrick, Josh Balk	2011
 Lab Farm Foods LABFARM FOODS	New York, NY, USA	Meat production (beef)	N/A	Dave Schnettler, Tiziano Barberi	2019
 Luyef Biotechnologies	Santiago, Chile	Research and development (B2B licensing)	N/A	Kris Blanchard Tapia, Maria Soledad Gutiérrez, Randall Cossio	2019
 Matrix Meats MATRIX MEATS	Columbus, OH, USA	Scaffolding (3-D nanofibers)	Undisclosed (seed)	Flavio Lobato	2019
 Meatable	Leiden, Netherlands	Meat production (pork, beef)	\$12.5MM (seed)	Krijn de Nood, Daan Luining	2018
 MeaTech MeaTech	Ness Ziona, Israel	Meat production (beef, using 3-D printing)	\$1.99MM (seed)	Sharon Fima	2019
 Memphis Meats MEMPHIS MEATS	San Leandro, CA, USA	Meat production (beef, chicken, duck)	\$22MM (Series A)***	Uma Valeti, Nicholas Genovese, Will Clem	2015
 Mirai Foods AG MIRAI FOODS	Zürich, Switzerland	Meat production (undisclosed)	N/A	Christoph Mayr, Suman Kumar Das	2019
 Mission Barns MISSION BARNES	Berkeley, CA, USA	Meat production (duck, chicken, pork)	\$3.49MM (seed)	Eitan Fischer, David Bowman	2018
 Mosa Meat mosameat	Maastricht, Netherlands	Meat production (beef)	\$9.09MM (Series A)	Peter Verstrate, Mark Post	2015
 Multus Media multus media	London, United Kingdom	Cell culture media	N/A	Kevin Pan	2019
Nanjing Zhouzi Future Food Technology Co.	Nanjing, China	Meat production (pork)	N/A	Zhou Guanghong	2019

Section 2: Companies

New Age Meats 	San Francisco, CA, USA	Meat production (pork)	\$0.95MM (seed)	Brian Spears, Andra Necula	2018
Ospin Modular Bioprocessing 	Berlin, Germany	Bioreactors (automated systems), part of a larger bioprocess automation business	N/A	Jan Saam	2014
Peace of Meat 	Berlin, Germany	Meat producer (foie gras, fat)	\$0.779MM (seed)	Dirk von Heinrichshorst, David Brandes, Eva Sommer	2019
Planetary Foods 	Berlin, Germany	Seafood production (undisclosed)	N/A	Ines Schiller, Else Wagener	2019
SiCell BioTechnologies 	Shanghai, China	Cell culture media	\$0.25MM (seed)	Jiajing Wu	2019
Shiok Meats 	Singapore	Seafood production (shrimp, crab, lobster)	\$5.11MM (seed)	Sandhya Sriram, Ka Yi Ling	2018
SuperMeat 	Tel Aviv, Israel	Meat production (chicken)	\$4.22MM (seed)	Ido Savir, Koby Barak, Shir Friedman	2015
VOW Food 	Sydney, NSW, Australia	Meat production (kangaroo, other)	Undisclosed (seed)	George Peppou, Tim Noakesmith	2019
Wild Earth 	Berkeley, CA, USA	Meat production (mouse for pet food), part of a larger business of fermentation	\$15.55MM (Series A)	Ryan Bethencourt, Abril Estrada, Krisin Wuhrman, Ron Shigeta	2017
Wild Type 	San Francisco, CA, USA	Seafood production (salmon)	\$16.00MM (Series A)	Justin Kolbeck, Aryé Elfenbein	2017

**BlueNalu raised a \$20 million Series A in Q3 2019, which PitchBook records as closing in Q1 2020 because a portion of the funds was not wired until the latter quarter. For the purpose of this report, GFI includes the entirety of BlueNalu's Series A in our 2019 statistics.

***Memphis Meats raised a **\$186 million Series B round in early 2020**, bringing their total fundraising to more than \$200 million.

More information on these cultivated meat companies is available in GFI's [company database](#).

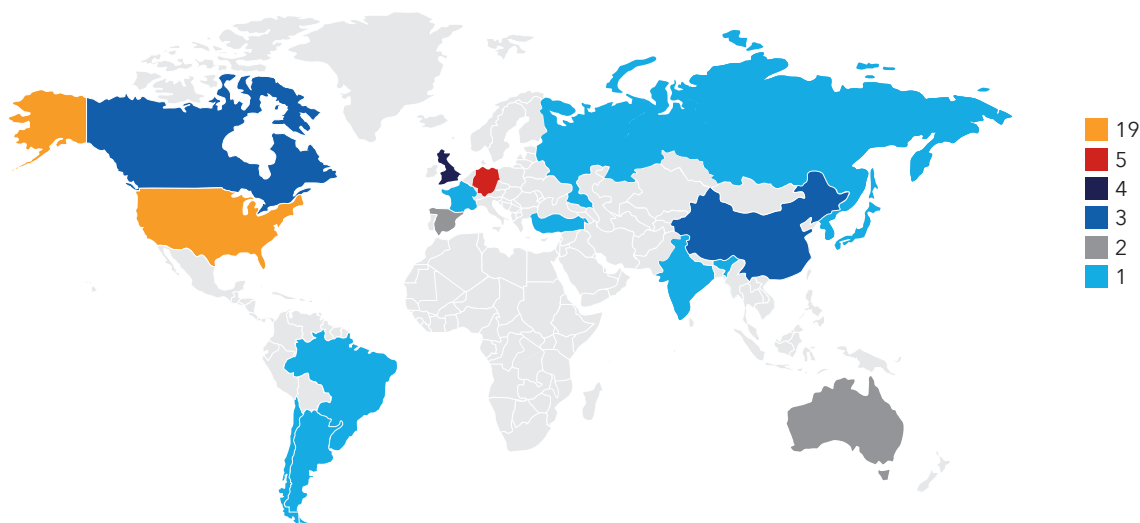
Section 2: Companies

Global Perspective

By the end of 2019, cultivated protein startups had been established in at least 19 countries across five continents (Table 1). Although more than one-third of these companies are based in the United States, large concentrations also exist in the EU-UK region, Canada, Israel, and Asia Pacific. In 2019, two-thirds of all newly formed companies were outside the United States, and the first cultivated meat companies in Russia, Switzerland, Argentina, France, and Chile formed.

Cuisines and dietary choices vary by geography. This diversity across regions offers new market opportunities for the cultivated meat industry. Fish maw, the swim bladder of large fish species, such as croaker or sturgeon, is a delicacy often consumed in soup and revered for its anti-aging properties according to Chinese medicine. In 2019, Hong Kong-based Avant Meats held the **world's first taste test of cultivated fish maw** as part of their larger plan to tackle the seafood category, and Nanjing Agricultural University **demonstrated cultivated pork**. In August, Australia-based VOW Foods offered the world's first tasting of cultivated kangaroo. In France and Belgium, startups Gourmey and Peace of Meat aim to produce cultivated foie gras by culturing duck liver cells. In Singapore, a country that imports 94% of its food, quality agricultural products are harder to come by than in surplus countries, such as the United States. To address this issue, the Singaporean government **launched** a 120-person food innovation institute to promote novel production methods, such as meat cultivation. Finally, in Russia, ArtMeat focuses on cultivated horse and sturgeon.

Figure 1: Geographic Distribution of Cultivated Meat Companies



Section 2: Companies

Product Focus: A Growing Field but Still Plenty of White Space

By the end of 2019, startups were pursuing more than 15 types of cultivated meat, including beef, chicken, pork, shrimp, duck, white fish, mouse, salmon, tuna, foie gras, fish maw, lamb, kangaroo, horse, and sturgeon. These meat types are desirable for both their technical characteristics (i.e., factors in difficulty or ease of cultivation) and their appeal to the companies' first target markets. At the [Good Food Conference](#) in September 2019, Shiok Meats CEO and co-founder Sandhya Sriram highlighted the technical advantage of focusing on crustaceans: "At least for shrimp, it's easy in the sense that it's only muscle and not any other cell or tissue, so we basically only have to grow one type ... and that's the reason that we are very confident in saying that we will be on the market in two years' time." ArtMeat, a company in Russia, is pursuing cultivated horse because horse meat is commonly consumed in the country.

Cultivated meat companies are classifiable by product focus, but they also differentiate themselves in other ways: go-to-market strategy (launch country and plan), marquee partnerships (e.g., Memphis Meats with [Tyson](#) and [Cargill](#), [BlueNalu](#) and [Mosa Meat](#) with Nutreco, and Mosa Meat with [Merck](#)), and ethics and sustainability claims. However, the primary point of differentiation is whether their teams and technical approaches can bring quality, affordable cultivated meat to market at scale. Once a company does this with one cultivated meat product, creating additional product lines and types of cultivated meat will be virtually unimpeded and [more responsive to consumer demand](#).

Because transforming the [trillion-dollar-plus](#) global meat market means massive opportunities all along the value chain, a burgeoning ecosystem of B2B startups is providing the technical "picks and shovels" to cultivated meat producers. These companies supply specialty bioreactors, scaffolding, cell culture media, cell lines, software, and even complete cultivation platforms.

Companies Embrace Opportunities in the Cultivated Meat Value Chain

Various business strategies are beginning to emerge in cultivated meat. While vertical integration is the primary business model of cultivated meat companies, 2019 saw a surge in companies focused on selling to or collaborating with cultivated meat producers. At least six startups—Agulos Biotech, Back of the Yards Algae Sciences, Biftek, Cultured Blood, Future Fields, and Multus Media—concentrate on low-cost, serum-free cell culture media or media ingredients, such as growth factors or growth factor mimetics, for producers and researchers in the cultivated meat field.

Section 2: Companies

A crop of companies focused on producing and improving bioreactors, the cultivators that cells grow in, also sprouted in 2019. **Ecovative** spun off Atlast Food Co. to provide mycelium-based scaffolding for plant-based meat (starting with **bacon**) and, through their **Excell** brand, for cultivated meat. Atlast, along with Matrix Meats and Biomimetic Solutions, is working to help other cultivated meat companies produce enhanced 3-D products.

Cell line derivation and biobanking are also rapidly growing areas. Cell Farm Food Tech, for example, derives and commercializes stem cell lines from various breeds of Argentinian cattle. In 2019, Kerafast laid the groundwork for a **partnership** with GFI, which launched in early 2020, to biobank cell lines for the cultivated meat industry. IndieBio and Wild Earth founder Ryan Bethencourt explained the value of the Kerafast partnership: “This new capability shifts the technological arms race to a new stage very similar to the early PC era. Now that cultivated meat ingredients will soon be available as ingredients, we should see a proliferation of small, faster-moving companies very similar to the personal computer brand boom (and eventual consolidation), which led to companies like Apple and HP.”

Downstream from production, companies are exploring new ways to use their products. CUBIQ Foods plans to sell cultivated fat as a healthier fat ingredient, which could be blended with plant-based meat for a new hybrid product category. Several companies are pursuing multiple strategies.

Highlighted below are some key value-chain entry points for companies exploring opportunities in the cultivated meat industry.

Section 2: Companies

Box 2: Example Value-Chain Entry Points

Creating the sustainable meat industry of the future offers many opportunities for involvement. The figure below provides a few such opportunities but is not exhaustive. GFI's *Commercialization Opportunities in the Plant-Based and Cultivated Meat Markets* provides more detail on some of the most vital, highest-impact opportunities, with particular focus on science and technology needs. GFI's scientific white paper *An analysis of culture medium costs and production volumes for cultivated meat* and GFI's *Clean Meat Production 101* primer take a deeper dive into the science of cultivated meat, providing insights into further opportunities.

Upstream/Production

Cell Line Development

- Novel/exotic cell line isolation and biobanking
- Automated image analysis for cell screening
- Footprint-free immortalization
- Genetic engineering

Cell Culture Media

- Microfluidics
- Growth factor engineering
- Small molecule screening
- Ingredient discovery software
- Fermentation

Scaffolding

- Biopolymer hydrogels and nanotubes
- 3-D printing
- Photopolymerization
- Self-directed architecture

Bioreactors/Cultivators

- IoT sensors for adaptive control
- Media recycling and filtration
- Continuous bioprocessing
- Workflow automation

Downstream/Collateral

Production

- Cultivated-plant-based hybrids
- Co-manufacturing
- White label
- Facility design and construction
- Food product development

Sales and Distribution

- Brokerage
- International expansion
- Branding and marketing
- Local cultural expertise

Supply Chain

- Efficient global sourcing
- Quality assurance
- Packaging

Other

- Safety certifications
- GRAS ingredient approval
- Production side stream utilization
- Business and legal services
- Technology transfer

Section 2: Companies

Looking Ahead

Cultivated meat has become a more mainstream field for academic research, corporate growth initiatives, and entrepreneurial company building. As companies achieve success in building their technology platforms for initial products, such as pork sausage, bluefin tuna, and foie gras, they will be able to adjust their parameters and produce a multitude of meat types, unlike in the conventional meat industry. Thus, as companies increase in headcount and maturity, so will the diversity of their product creations. With increasing support from academia and commerce, we foresee further growth of the cultivated meat industry in 2020 and beyond in the form of new and increasingly specialized companies, robust commercialization plans, and intellectual property stratification.

The next several years will be pivotal for the cultivated meat industry. After significant post-seed venture capital fundraising rounds and product proofs of concept, cultivated meat companies are using their new capital to build out pilot-scale facilities, ensure regulatory compliance, and prepare their commercialization strategies. We expect to see an increase in both new startups and large corporate business divisions focused on the cultivated meat value chain in 2020. As more B2B companies supply less expensive specialized components, such as bioreactors or growth factors, existing producers will be free to focus on core activities instead of making their own, and commercialization of cultivated meat will accelerate.

Photo credit: Wild Type



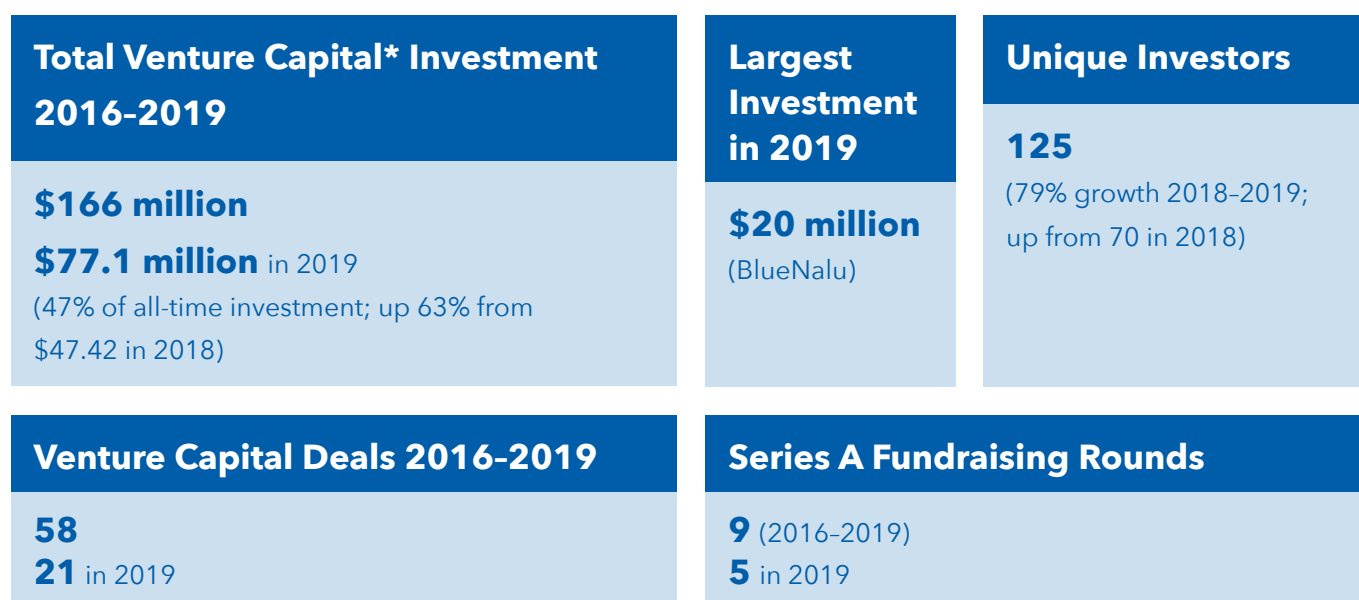
Section 3: Investments

Overview

From February 2016, when Memphis Meats closed their historic \$2.75 million seed round, through the end of 2019, cultivated meat companies received more than \$163.6 million in disclosed venture capital investment.¹⁵ Over half—more than \$77 million—of the total venture capital raised by the industry closed in 2019 alone. The year's capital investment is 63 percent more than the \$47.42 million of 2018 and more than double the capital raised in 2016 and 2017 combined. Deal count shows a similarly positive trend; in 2017 and 2018, annual deal count hovered at six and seven, and in 2018 and 2019, deal count surged to 20 and 21, respectively. Median deal size rose from \$3 million in 2018 to \$4 million in 2019.

For cultivated seafood fundraising in particular, 2019 was a watershed year. Three cultivated seafood companies raised Series A rounds. Wild Type raised \$12.5 million, BlueNalu raised a record-setting \$20 million, and Finless Foods raised an undisclosed amount. In April, just one year after their founding, Shiok Meats **secured a \$4.6 million** seed round to develop cultivated shrimp in Singapore, after support from accelerator Y Combinator.

Figure 2: Cultivated Meat Industry Investment Overview (2016–2019)



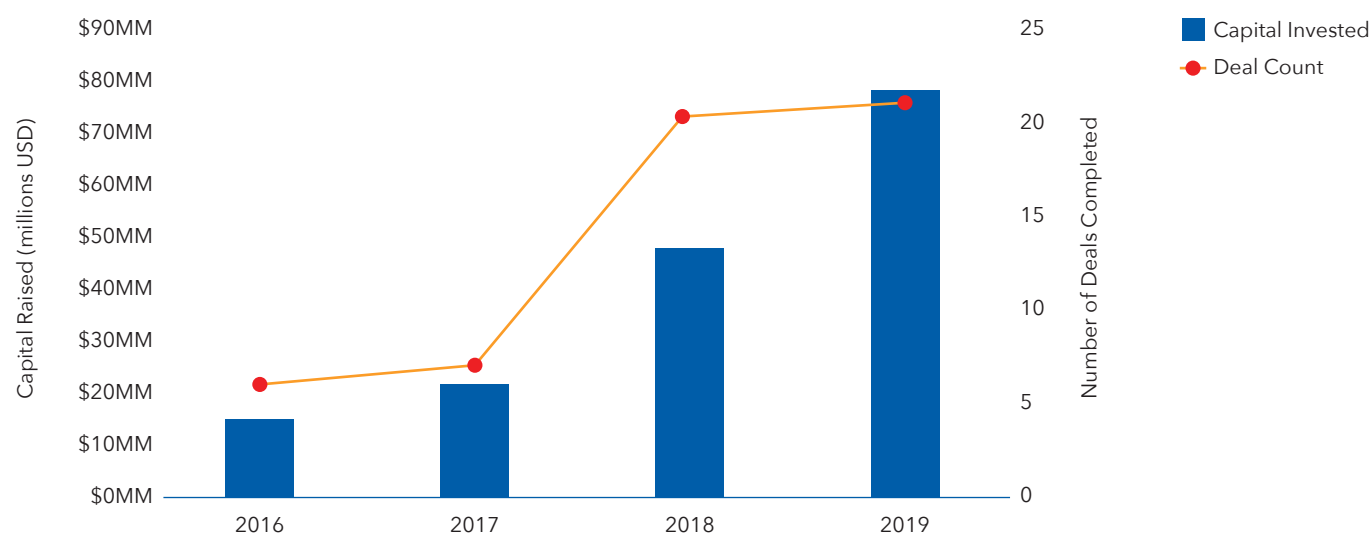
Source: GFI custom PitchBook analysis of cultivated meat companies globally, not including companies that pursue cultivated meat as part of a larger business. Last updated March 11, 2020.

 PitchBook

*"Venture capital" is broadly defined to include angel funding, seed funding, crowdfunding, early-stage venture capital, late-stage venture capital, accelerator or incubator funding, private equity growth/expansion, capitalization, corporate venture, and convertible debt.

Section 3: Investments

Figure 3: Investments in Cultivated Meat Companies (2016-2019)



Source: GFI custom PitchBook analysis of cultivated meat companies globally, not including companies that pursue cultivated meat as part of a larger business. Last updated April 21, 2020.



Data Source and Calculations

GFI conducted a custom global analysis of cultivated meat companies using PitchBook data. We built a list in PitchBook of companies that focus primarily on cultivating meat and seafood products or serving those who produce them. This list consists of 48 companies, 43 of which are cultivated meat or seafood producers. It excludes the many companies that are involved in meat cultivation but not as their core business, such as JUST, Wild Earth, and Biomimetic Solutions, because the funding these companies devote to cultivated meat is undisclosed. PitchBook profiled 29 of these 48 qualified companies—the others were too early-stage to have raised funds that would substantially impact fundraising calculations. Because these aggregate calculations include only companies with deals and deal sizes disclosed to PitchBook, they are conservative estimates. For example, \$163 million total capital raised excludes 22 deals (from a total of 58) with undisclosed or unavailable amounts. This means at least 38% of deals in this industry are not represented.

Section 3: Investments

Deals

By the end of 2019, eight companies—Aleph Farms, BlueNalu, Finless Foods, Future Meat Technologies, Memphis Meats, Mosa Meat, Wild Earth, and Wild Type—had raised their Series A fundraising rounds, a strong signal that the industry is maturing beyond the proof of concept phase to the pilot-scale manufacturing and business-building phases. Five of these Series A rounds closed in 2019, with investments between \$8.74 million and \$20 million. San Diego-based cultivated seafood company BlueNalu enjoyed the largest fundraising round of the year: a \$20 million Series A round led by LSX-traded venture capital firm Agronomics with participation from New Crop Capital, Stray Dog Capital, Clear Current Capital, and CPT Capital.

While not in the venture capital sense, 2019 also brought the first exit in cultivated meat. In October, [MeaTech](#), an Israeli-based cultivated meat producer, announced a [merger](#) with Ophectra Real Estate and Investments Ltd., a publicly traded special-purpose acquisition company, in a stock-for-stock deal. MeaTech now trades on the Tel Aviv Stock Exchange under the ticker "[MEAT](#)." Notably, according to PitchBook, in 2018 Moira Capital Partners acquired 75% of Spanish cultivated fat producer [CUBIQ Foods](#) for approximately \$13.6 million. Although it involved a significant change in ownership, for the purposes of this report, we have categorized this as a private equity growth investment. Thus, we count it as a venture capital investment, not an exit.

Photo credit: New Age Meats / image is licensed under [CC BY 4.0](#)

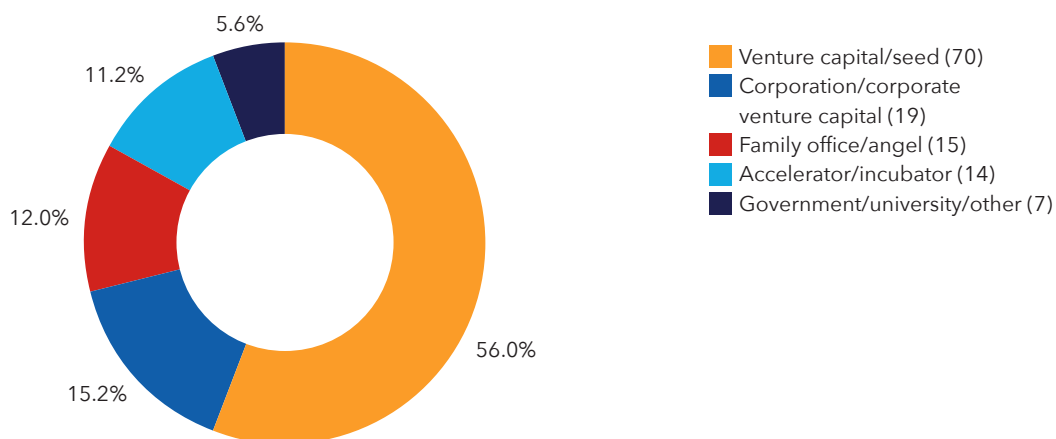


Section 3: Investments

Investors

Cultivated meat boasts 125 unique investors. The vast majority are venture capital groups, angel investors, or accelerators (Figure 4). Many investors are members of the [GlassWall Syndicate](#), a network of investors with a shared mission to accelerate the growth of animal-free industries, including alternative proteins. Tyson Ventures is among the industry's most active corporate venture capital investors, with three deals, including participation in Series A rounds for Memphis Meats and Future Meat Technologies. International protein company Cargill is also a lead corporate investor, with investment in Series A rounds for both Memphis Meats and Aleph Farms. World-leading life science accelerator IndieBio (one of SOSV's accelerator programs) is the industry's top accelerator and incubator investor, with investments in Memphis Meats, Finless Foods, and New Age Meats. California Institute for Quantitative Biosciences, Shanghai-based food industry accelerator program Bits x Bites, Israel's The Kitchen FoodTech Hub, and Y Combinator are also accelerators and incubators investing in cultivated meat companies. Notable angel investors in this space include Bill Gates, Richard Branson, Sergey Brin, Eduardo Saverin, Suzy Welch, Kimbal Musk, and Marc Benioff.

Figure 4: Cultivated Meat Company Investor Composition (2016-2019)



Source: GFI custom PitchBook analysis of cultivated meat companies globally, not including companies that pursue cultivated meat as part of a larger business. Last updated March 10, 2020.



Section 3: Investments

Table 2: Investors in Cultivated Meat Companies

Investor Name	Primary Investor Type	Headquarters	Portfolio Companies by Number of Investment Rounds
SOSV / IndieBio	Venture capital, accelerator/incubator	Princeton, NJ	New Age Meats, Finless Foods, Because Animals, Memphis Meats (10)
Unovis Partners / New Crop Capital	Venture capital	New York, NY	BlueNalu, Aleph Farms, SuperMeat, Memphis Meats, Mosa Meat (8)
Stray Dog Capital	Venture capital	Leawood, KS	Memphis Meats, Aleph Farms, BlueNalu, Because Animals, SuperMeat, Mosa Meat (7)
CPT Capital	Venture capital	London, United Kingdom	BlueNalu, Memphis Meats, Aleph Farms, Mosa Meat (5)
Beyond Investing	Venture capital	Geneva, Switzerland	BlueNalu, Gourmey, Shiok Meats, SuperMeat (4)
Strauss Group (TAE: STRS) / The Kitchen FoodTech Hub	Corporation, accelerator/incubator	Petah Tikva, Israel	Aleph Farms (4)
Agromomics (LON: ANIC)	Venture capital	Douglas, United Kingdom	BlueNalu, Meatable, Shiok Meats (3)
Blue Horizon (Zürich)	Venture capital	Zürich, Switzerland	SuperMeat, Finless Foods, Mosa Meat (3)
IndieBio	Accelerator/incubator	San Francisco, CA	New Age Meats, Finless Foods, Memphis Meats (3)
Social Starts	Venture capital	San Francisco, CA	Peace of Meat, Finless Foods, Gourmey (3)
Starlight Ventures	Venture capital	Miami, FL	Fork & Goode, SuperMeat, Finless Foods (3)
Tyson Ventures	Corporate venture capital	Chicago, IL	Future Meat Technologies, Memphis Meats (3)
VegInvest	Venture capital	New York, NY	BlueNalu, SuperMeat, Mosa Meat (3)
BABEL Ventures	Venture capital	San Francisco, CA	Mission Barns, Finless Foods (2)
Big Idea Ventures	Venture capital	New York, NY	Gourmey, Shiok Meats (2)
BlueYard Capital	Venture capital	Berlin, Germany	Meatable (2)
California Institute for Quantitative Biosciences	Accelerator/incubator	San Francisco, CA	Mission Barns, Wild Type (2)
Clear Current Capital	Venture capital	Vero Beach, FL	BlueNalu (2)
Cargill	Corporation	Minneapolis, MN	Memphis Meats, Aleph Farms (2)
Draper Associates	Venture capital	San Mateo, CA	Because Animals, Finless Foods (2)
EIT Food Accelerator Network	Accelerator/incubator	Leuven, Belgium	BioFood Systems, Aleph Farms (2)
Fifty Years	Venture capital	San Francisco, CA	Memphis Meats (2)

Section 3: Investments

HarrisonBLUE Ventures	Venture capital	New York, NY	Future Meat Technologies, Finless Foods (2)
Henry Soesanto	Angel (individual)	Makati City, Philippines	Future Meat Technologies, Shiok Meats (2)
ImpactAssets	Impact investing	Bethesda, MD	Shiok Meats, BlueNalu (2)
Jesselson Investments	Family office	Israel	Aleph Farms (2)
Lever VC	Venture capital	Brooklyn, NY	Avant Meats, Mission Barns (2)
Maven Ventures	Venture capital	Palo Alto, CA	Wild Type (2)
Nutreco	Corporation	Amersfoort, Netherlands	BlueNalu (2)
Peregrine Ventures	Venture capital	Or Yehuda, Israel	Aleph Farms (2)
Root Ventures	Venture capital	San Francisco, CA	Wild Type (2)
S2G Ventures	Venture capital	Chicago, IL	Future Meat Technologies (2)
Spark Capital	Venture capital	Boston, MA	Wild Type (2)
Technion Research and Development Foundation	Venture capital	Haifa, Israel	Aleph Farms (2)
Y Combinator	Accelerator/incubator	Mountain View, CA	Shiok Meats (2)
A-Five	Government	Japan	IntegriCulture (1)
Advisors.Fund	Venture capital	San Francisco, CA	Memphis Meats (1)
Agentschap Innoveren & Ondernemen	Other	Belgium	Peace of Meat (1)
Albert Wenger	Angel (individual)	New York, NY	Meatable (1)
Alpha Impact Investment Management	Impact investing	Palo Alto, CA	Shiok Meats (1)
Atlantic Food Labs	Venture capital	Berlin, Germany	Meatable (1)
Atomico	Venture capital	London, United Kingdom	Memphis Meats (1)
B-Engine	Venture capital	Modena, Italy	Finless Foods (1)
Backed VC	Venture capital	London, United Kingdom	Meatable (1)
Bell Food Group (SWX: BELL)	Corporation	Basel, Switzerland	Mosa Meat (1)
Better Ventures	Venture capital	Oakland, CA	Mission Barns (1)
Beyond Next Ventures	Venture capital	Tokyo, Japan	IntegriCulture (1)
Bits x Bites	Accelerator/incubator	Shanghai, China	Future Meat Technologies (1)
Blackbird Ventures	Venture capital	Melbourne, Australia	Heuros (1)
Cantos Ventures	Venture capital	San Francisco, CA	Mission Barns (1)
Charles Songhurst	Angel (individual)	Seattle, WA	Meatable (1)
CRV	Venture capital	Palo Alto, CA	Wild Type (1)
Dao Ventures/Dao Foods International	Impact investing	Beijing, China	Mission Barns (1)
Emerald Technology Ventures	Venture capital	Zürich, Switzerland	Future Meat Technologies (1)

Section 3: Investments

Enterprise Singapore	Corporation	Singapore, Singapore	Shiok Meats (1)
Euglena (TKS: 2931)	Corporation	Tokyo, Japan	IntegriCulture (1)
European Commission	Government	Brussels, Belgium	Meatable (1)
Everhope Capital	Venture capital	Providence, RI	BlueNalu (1)
Firstminute Capital	Venture capital	London, United Kingdom	Fork & Goode (1)
Five Seasons Ventures	Venture capital	Paris, France	Memphis Meats (1)
For Good Ventures	Venture capital	San Francisco, CA	Wild Type (1)
Future Positive Capital	Venture capital	Paris, France	Meatable (1)
Gastrotope	Accelerator/incubator	Bangalore, India	ClearMeat (1)
Gates Ventures	Venture capital	Kirkland, WA	Memphis Meats (1)
Glocalink	Other	Japan	IntegriCulture (1)
Good Seed Ventures	Venture capital	Rheine, Germany	SuperMeat (1)
Grid Exponential	Accelerator/incubator	Buenos Aires, Argentina	Cell Farm (1)
Griffith Foods	Corporation	Alsip, IL	BlueNalu (1)
Hatch Blue	Accelerator/incubator	Dublin, Norway	Finless Foods (1)
HB Ventures	Venture capital	Boise, ID	Future Meat Technologies (1)
Hemisphere Ventures	Venture capital	Mercer Island, WA	Finless Foods (1)
Ikove	Venture capital	Columbus, OH	Matrix Meats (1)
Inevitable Ventures	Venture capital	Los Angeles, CA	Memphis Meats (1)
Innovate 360	Accelerator/incubator	Singapore, Singapore	Shiok Meats (1)
Inter Alloys	Corporation	Vienna, Austria	Biotech Foods (1)
Jörg Mohaupt	Angel (individual)	London, United Kingdom	Meatable (1)
KBW Ventures	Venture capital	Dubai, United Arab Emirates	Memphis Meats (1)
Keen Growth Capital	Impact investing	Windermere, FL	Because Animals (1)
Kimbal Musk	Angel (individual)	Hawthorne, CA	Memphis Meats (1)
M Ventures	Corporate venture capital	Amsterdam, Netherlands	Mosa Meat (1)
M-Industry	Corporation	Switzerland	Aleph Farms (1)
Manta Ray Ventures	Venture capital	London, United Kingdom	Future Meat Technologies (1)
Mission Bay Capital	Venture capital	San Francisco, CA	Wild Type (1)
Moira Capital Partners	Venture capital	Madrid, Spain	Cubiq Foods (1)
MTG Japan (TKS: 7806)	Corporation	Nagoya, Japan	IntegriCulture (1)
nanoGUNE business incubator	Accelerator/incubator	San Sebastián, Spain	Biotech Foods (1)
Neto Malinda Trading (TAE: NTML)	Corporation	Kiryat Malakhi, Israel	Future Meat Technologies (1)
New Protein Capital (Vis Vires)	Venture capital	Singapore, Singapore	Aleph Farms (1)
New South Wales	Government	Australia	VOW Foods (1)
Olive Tree Capital	Venture capital	Los Angeles, CA	Finless Foods (1)

Section 3: Investments

Ophectra Real Estate & Investments	Corporation	Tirat Carmel, Israel	MeaTech (1)
PHW-Gruppe	Corporation	Visbek, Germany	SuperMeat (1)
Plug and Play Tech Center	Accelerator/incubator	Sunnyvale, CA	Finless Foods (1)
ProVeg Incubator	Accelerator/incubator	Berlin, Germany	ClearMeat (1)
Pulmuone Foods USA	Corporation	Fullerton, CA	BlueNalu (1)
Purple Orange Ventures	Venture capital	Berlin, Germany	Mission Barns (1)
Real Tech Fund	Venture capital	Tokyo, Japan	IntegriCulture (1)
Research fund of Barzilai hospital	Other	Ashkelon, Israel	MeaTech (1)
Rich Products Ventures	Corporate venture capital	Buffalo, NY	BlueNalu (1)
Richard Branson	Angel (individual)	Necker Island, British Virgin Islands	Memphis Meats (1)
Seier Capital	Venture capital	Jonschwil, Switzerland	SuperMeat (1)
Sergey Brin	Angel (individual)	Los Altos, CA	Mosa Meat (1)
Softmatter	Venture capital	New York, NY	Finless Foods (1)
Sumitomo Corporation of Americas	Corporation	New York, NY	BlueNalu (1)
Supernode Ventures	Venture capital	New York, NY	New Age Meats (1)
Suzy Welch	Angel (individual)	New York, NY	Memphis Meats (1)
Taavet Hinrikus	Angel (individual)	London, United Kingdom	Meatable (1)
Technion Israel Institute of Technology	University	Haifa, Israel	Aleph Farms (1)
The Pearse Lyons Accelerator	Accelerator/ incubator	Dublin, Ireland	Higher Steaks (1)
Threshold Ventures	Venture capital	Menlo Park, CA	Memphis Meats (1)
U-Start	Venture capital	Lugano, Switzerland	Finless Foods (1)
Vis Capital	Venture capital	Italy	Finless Foods (1)
VU Venture Partners	Venture capital	San Francisco, CA	Finless Foods (1)
Westcott	Family office	Dallas, TX	Memphis Meats (1)
Yakumi Investment	Angel group	Tokyo, Japan	Finless Foods (1)
Yissum	Venture capital	Jerusalem, Israel	Future Meat Technologies (1)

Source: GFI custom PitchBook analysis of cultivated meat companies globally, not including companies that pursue cultivated meat as part of a larger business. Last updated March 10, 2020.

Section 3: Investments

Box 3: New Venture Funds Bring Dry Powder into 2020

In 2019, several top venture capital investors in the alternative protein space created or raised new funds that will be available to fuel the formation and growth of new companies in the cultivated meat sector. These include SOSV's \$277 million fourth fund, Big Idea Ventures' \$50 million New Protein Fund, and AgFunder's \$20 million New Carnivore Fund. In December 2019, Agronomics raised close to \$9 million specifically for investment in cultivated meat companies. These specialized investment funds, as well as growing mainstream investor interest, mean startups will have plenty of capital to secure in the years to come, even if the broader early-stage venture capital markets slow down.

Photo credit: Aleph Farms

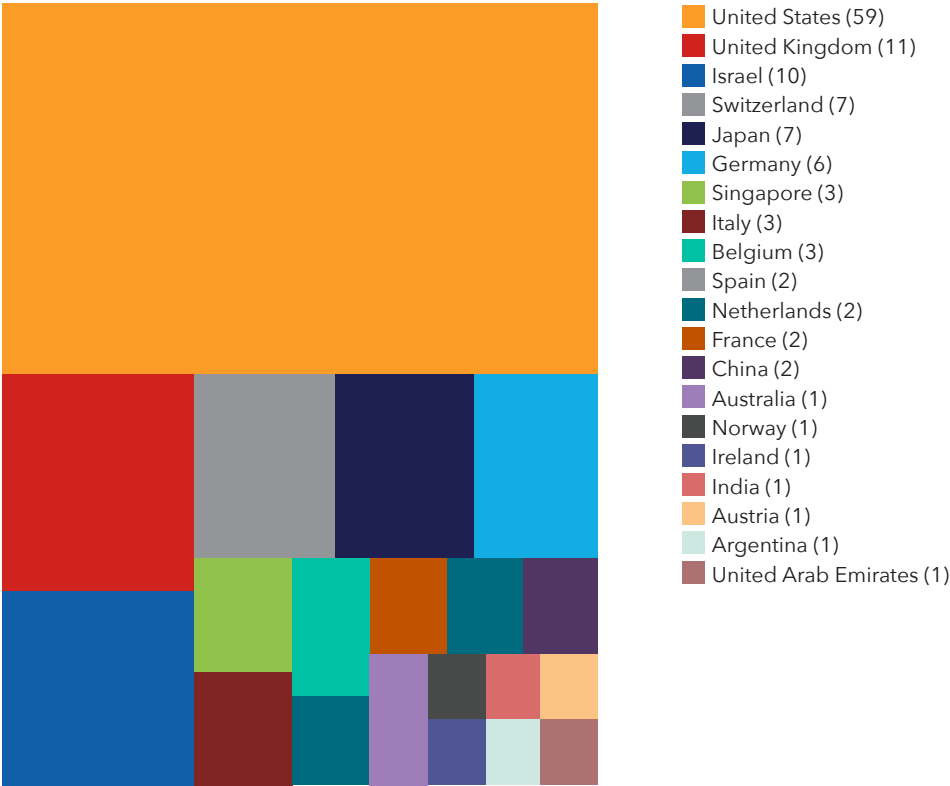


Section 3: Investments

Global Snapshot

Investors in cultivated meat companies span 21 countries. Nearly half the investors in cultivated meat are based in the United States. The most active investors are also overwhelmingly U.S.-based, including New Crop Capital, Stray Dog Capital, and SOSV. While the United Kingdom and Israel are a distant second and third, accounting for 8.8% and 8% of the industry’s investors, respectively, London-based venture capital firm CPT Capital is among the most active investors in cultivated meat. As cultivated meat companies continue to emerge outside the United States, we expect that they will tap into new sources of capital and the investor base will rapidly grow and diversify.

Figure 5: Top Investing Countries by Number of Unique Investors



Section 3: Investments

Box 4: Belgian Consortium Aligns Diverse Partners to Bring Cultivated Foie Gras to Market

While venture capital is critical in developing the cultivated meat industry, involvement from additional partners and stakeholders is essential to creating a robust innovation ecosystem. According to the community capital framework, any healthy innovation ecosystem must contain adequate financial, political, social, natural, built, human, and cultural capital.¹⁶ Building a dynamic ecosystem requires involvement from many types of stakeholders, including government, startups, universities, and mature corporations. One shining example from late 2019 is the 3.6 million euro grant from Belgium's Ministry of Innovation to jump-start a robust public-private partnership called Foieture.¹⁷ Foieture is a collaboration among Peace of Meat (a cultivated meat startup), KU Leuven (a research university), Nauta (a pâté producer), Bio Base Europe Pilot Plant (an upscaling research facility), Solina Group (an ingredient supplier), and Flanders Food (an agrifood innovation center). Foieture is a paradigmatic example of diverse, dynamic groups effectively coming together to transform the food system.

Looking Ahead

While still in its early days, the cultivated meat industry has experienced remarkable growth over the past four years, and we anticipate accelerated growth as technical advances propel the industry closer and closer to market readiness. Capital growth has surged in the past two years alone, and we expect a continued upward trend as new and mature companies grow to their Series A and Series B raises. We project that in 2020 and beyond investors will take a special interest in the cultivated meat value chain as the trillion-dollar-plus meat industry transforms—a paradigm shift that is as necessary as it is inevitable. Current methods of meat production are unsustainable, both contributing to **pandemics** and leaving supply chains incredibly **vulnerable** to them.

Section 4: Science and Technology

Overview

The success of cultivated meat will rely heavily on scientific advancements borne of industry and academia alike. As cultivated meat technology advances, support will come from entrants that integrate horizontally into the value chain according to specialty. In 2019, the cultivated meat industry began to diversify across three main areas: company specialty, company creation opportunities, and academic research focus.

Startup companies in the cultivated meat sector appear to be highly vertically integrated, often attempting to address multiple technical challenges simultaneously, such as cell line optimization, cost reduction, and scalable bioprocess design. Startups are building larger project teams to specialize in these areas as companies scale, bolstered by Series A raises.

As discussed, opportunities for collaboration with existing cultivated meat producers abound. Not only other startups but large corporations are pursuing these opportunities. In 2019, leading life science and protein companies created divisions and forged partnerships along the cultivated meat value chain. Merck, for example, created a [team devoted to cultivated meat](#). The company is actively seeking partnerships in cell culture media, cell lines, monitoring and analytical tools, and bioreactors. German chicken producer [PHW-Gruppe](#) has partnered with Israeli startup SuperMeat to bring cultivated chicken to market. Japanese beef producer [Toriyama](#) has partnered with California startup JUST to bring cultivated Wagyu beef to market. Lifecycle Biotechnologies, a life science tools and service provider in Texas, formed a cellular agriculture division that aims to optimize and provide a variety of media, scaffolding, and bioprocessing solutions for the cultivated meat industry.

Opportunities supporting the formation of new cultivated meat companies expanded in 2019, both in number and type. For instance, [Purple Orange Ventures](#) launched a fellowship program for teams to create animal products using cultivation methods (among others). International life science companies, such as [Merck KGaA](#) and [DSM](#), introduced their own accelerator or incubator programs focused on cultivated meat. Cultivated meat companies also received capital from accelerators, such as [Pearse Lyons](#), and competitions, such as the [Faculty of Natural Sciences Make a Difference Competition](#), which was won by Multus Media at [Imperial College London](#). Investment from local governments, including those of [New South Wales](#), Flanders, and the [European Union](#), began to accelerate, as did investment from government investment arms, such as [Innovate UK](#). This increasing diversification of funding opportunities for cultivated meat companies strongly signals continued growth and innovation.

Section 4: Science and Technology

Academic research will accelerate technology transfer to cultivated meat and remove barriers to entry by creating shared resources, such as cell lines and protocols. In 2019 in India, a \$640,000 investment jump-started the world's first center dedicated [to cellular agriculture](#), a partnership facilitated by GFI India and the Institute of Chemical Technology in Mumbai. Interest from academia continued to grow, as GFI's [Competitive Research Grant Program](#) saw a 92% increase from 2018 in proposals submitted for cultivated meat projects. These proposals generated \$1.75 million in additional GFI-funded research. (Including 2018's projects, GFI has funded \$3.25 million in cultivated meat research to date.)

In Singapore, the governmental research agency [A*STAR released their first round of funding calls](#) for alternative proteins, including cultivated meat. The [Cultivated Meat Modeling Consortium](#) also launched in 2019. This interest group aims to partner with scientists in academia and industry to create computational models that reduce costs and time in solving technical challenges for cultivated meat. GFI encourages and expects more cultivated meat research centers and consortia to form in the coming years.

Bringing down costs and developing robust, scalable bioprocesses remain high priorities for cultivated meat companies. ([Meeting the Needs of the Cultivated Meat Industry](#) by GFI senior scientist Dr. Elliot Swartz provides a technical view.) Costs can be immediately and significantly reduced by engineering growth factors in serum-free media and scaling their production. This fact is [exemplified by researchers at Northwestern University](#) who decreased a popular stem cell medium's costs by 97%. No publicly available data on pilot-scale bioprocesses for cultivated meat production currently exist, and the best indicators for progress in scaling are likely to come from Series B raises. BlueNalu, however, released a five-stage [commercialization strategy](#) in August 2019, which calls for moving the company from pilot-scale research and development to facilities with 150,000 square feet of food production space and the capacity to make 18 million pounds of finished seafood products (or 72 million four-ounce seafood fillets) per year. With U.S. per capita consumption of seafood at around [16 pounds per year](#), this amounts to seafood for well over one million people.

The creation of thick multicellular products, such as whole muscle cuts, remains a challenge. Finally, public data is needed on cultivated meat's ability to replicate the sensory aspects of conventional meat. These and other technical challenges will be best addressed by fostering collaborative efforts from interdisciplinary scientists and engineers across academia and the life science and cultivated meat industries. An influx of public dollars is especially needed to fund the growing number of scientists interested in solving challenges of bringing cultivated meat to market.

Section 4: Science and Technology

Research Highlights

A foundation of research is needed to sustain the cultivated meat industry with new ideas, technologies, and talent. In 2019, researchers made headway in addressing known problems and providing novel ideas. Their progress, shared in various publications, fuels a growing body of public cultivated meat research.

For instance, [Japanese researchers](#) grew mammalian cells using amino acids and glucose derived from microalgae extracts, potentially providing a more sustainable and affordable supply of these important components of cell culture media. The [Shojinmeat Project](#), a grassroots cultivated meat biohacking nonprofit in Japan, developed an edible DIY cell culture media from energy drinks.

That same year, cultivated meat companies [Mosa Meat](#) and [Because Animals](#) publicly stated that they no longer used animal serum in their growth media. A team of [Harvard researchers](#) used a scalable scaffolding technology to grow thin strips of bovine and rabbit cells that recapitulate some of the mechanical and textural aspects of conventional meat. Teams led by David Kaplan of Tufts University [discovered](#) that adding myoglobin and heme proteins to cultures of bovine muscle cells could assist in modifying the color of cultivated beef to more closely resemble that of conventional beef. They were also the first to [demonstrate](#) that insect cells have [particular advantages](#) for cultivated meat: They adapt to suspension culture and are more resilient to changes in temperature, pH, and osmolarity.

Lastly, a group of [Chinese researchers](#) at Jiangnan University outlined a computational fluid dynamic model of a 300,000 liter bioreactor for cultivated meat production. Additionally, the highly regarded *Frontiers in Sustainable Food Systems* published reviews related to [tissue engineering](#), [bioprocessing](#), and [scaffolding](#).

Section 4: Science and Technology

Box 5: Technical Opportunities for Seafood Research in 2020

Cultivated seafood somewhat lags cultivated meat from terrestrial species in dedicated research, with an incomplete understanding of the underlying biology and fewer researchers tackling these issues. Accordingly, much is to be gained by generating more knowledge and making it accessible to the entire field. While established companies and startups play an important role in moving specific cultivated seafood products toward commercialization, the long-term viability of this field will be enhanced by more dedicated open-access research.

GFI is working to fill in some of the current knowledge and resource gaps in the field of cultivated seafood. Key focus areas of GFI's [Sustainable Seafood Initiative](#) include publicly accessible cell lines from marine species, protocols for working with these lines, low-cost and animal-free media formulations, and detailed characterization of the tissue microstructure of traditional seafood products to better direct efforts in both cultivated and plant-based seafood products.

Looking Ahead

Although recent years have brought tremendous advancements in basic scientific meat-cultivation research, this area is still in its infancy. Every critical technological element is in need of vast additional research to optimize and scale, address bottlenecks, and reduce costs. GFI will continue to guide researchers to the highest-impact research areas through our competitive grant program, technological readiness assessments, and other initiatives, such as our [research funding database](#). Increasing commitment from governments to fund both public and private cultivated meat research will further accelerate this progress. We expect that as meat cultivation becomes a thoroughly mainstream area for academic research, the formation of specialized labs and creation of corporate divisions will lead to unprecedented improvements all along the cultivated meat value chain.

Section 4: Science and Technology

Box 6: Cultivated Milk Is an Emerging Application for Cell Culture Technology

Although animal cell cultivation is applied primarily to cultivated meat production, similar processes can be used to produce milk components, such as whey and casein proteins, lipids, and lactose. These cultivated proteins are identical to those produced in mammals. For instance, mammary epithelial cells involved in the synthesis and secretion of milk can be cultured. In 2019, two startups formed to commercialize methods for producing milk from mammary cells in bioreactors. Both [TurtleTree Labs](#), based in Singapore, and [BIOMILQ](#), based in Durham, North Carolina, are applying this technology to produce human breast milk for infant formula. The same technology could produce animal milk, including cow and goat.



Section 5: Regulation

Overview

Federal Regulation of Cultivated Meat

Before cultivated meat can come to market, a regulatory framework must be in place. The joint regulatory framework announced in November 2018 by the U.S. Department of Agriculture (USDA) and the U.S. Food and Drug Administration (FDA) moved forward in 2019. In March, the USDA and FDA released a [formal agreement](#) outlining regulatory roles that leverage each agency's expertise—the FDA will oversee the earlier stages of cultivated meat production, and the USDA will oversee the later stages.¹⁸ Specifically, the FDA will oversee cell collection, cell banks, and cell proliferation and differentiation, including inspections of cell banks and culturing facilities to ensure compliance with FDA regulations. The USDA will inspect harvesting and post-harvesting facilities, approve cultivated meat labels, and verify the applicability of these labels through inspections.

The FDA and USDA have since formed three interagency working groups focused on premarket review, harvest and inspection, and labeling of cultivated meat. These developments strongly signal that the agencies will work together to ensure that cultivated meat products are safe and accurately labeled when they hit the market.

International Regulation of Cultivated Meat

Regulators in other countries have taken an interest in cultivated meat as well, with some governments displaying strong support. The [government of Singapore](#) has devoted millions to promoting the local cultivated meat industry and installed a progressive regulatory framework.¹⁹ This means Singaporean cultivated shrimp startup [Shiok Meats](#) may be among the first companies to bring a cultivated seafood product to market.²⁰ Similarly, Hong Kong, home of [Avant Meats](#), is expected to institute a smooth regulatory process to reduce time to market. And, as noted above, the government of India has dedicated a total of \$740,000 in [funding](#) to research in cellular agriculture, hoping to establish India as a hub for the future of protein production. GFI is also working in the EU, Israel, and Brazil to ensure adoption of a rigorous and fair food-safety regulatory process for cultivated meat.

State Label Censorship

After Missouri's 2018 enactment of a law prohibiting the use of meat terminology on cultivated and plant-based meat labels, legislators in a range of states introduced similar bills that would unconstitutionally censor cultivated meat labels. Most of the bills introduced in 2019 failed—but not all. The enacted laws are subject to constitutional challenges on multiple [grounds](#), including federal preemption of state laws and commercial free speech. As of December 31, 2019, lawsuits are pending in [Missouri](#) and [Arkansas](#).²¹

Section 5: Regulation

Box 7: AMPS Innovation

"The Alliance for Meat, Poultry & Seafood Innovation was founded on a desire for members of our industry to come together and speak with a unified voice as we emerge as a viable, impactful partner in the overall food and agriculture sector."

Alliance for Meat, Poultry & Seafood Innovation (AMPS Innovation)

On August 29, 2019, five U.S. cultivated meat companies [announced](#) the formation of a coalition focused on advocating regulatory clarity for their industry and educating consumers and stakeholders about their products. AMPS Innovation aims to help the industry thrive as the founding members (BlueNalu, Finless Foods, Fork & Goode, JUST, and Memphis Meats) and other companies work to bring their products to market. Looking ahead, AMPS Innovation hopes to support continued innovation in this sector to meet the world's growing demand for animal protein.

Photo credit: Mosa Meat



Section 6: Consumer Insights

Overview

In 2019, researchers published results from several groundbreaking studies that together predict the success of cultivated meat with consumers when it becomes available. Survey and focus group studies indicate that enthusiastic innovator and early adopter segments will readily purchase cultivated meat once it hits the market. About one in three U.S. consumers say they are likely to regularly purchase cultivated meat, and about one in five respond that they are willing to pay a higher price for cultivated meat than for its conventional counterpart. Dutch consumers indicate that they are **willing to pay nearly 40% more**.²²

As cultivated meat becomes more accessible and normalized in society, we expect adoption by the majority of the population to build over time, as has been the case with innovations throughout history. The early and late majority groups, composing about 68% of any population, already express interest in cultivated meat but desire more information about taste, price, and safety.²³ Once cultivated meat is on the market, the taste will be apparent and regulatory approval will cue safety. As supply increases and price reaches an acceptable threshold (e.g., price parity in grocery stores), these majority groups will also be likely to purchase cultivated meat. Familiarity with meat cultivation and cultural normalization of eating cultivated meat will also drive these later segments to adopt.

Box 8: Cultivated Meat's Appeal Crosses the World's Largest Markets

By 2050, the U.S. population is expected to reach 329 million, whereas populations in China and India are projected to reach about 1.4 billion each. Although many cultivated meat companies will first go to market in the United States, Singapore, Israel, or the EU, ultimately India and China will be monumental opportunities for cultivated meat producers to sell to populations growing rapidly in size, wealth, and per capita meat consumption. A survey for *Frontiers in Sustainable Food Systems* found that 59% of Chinese consumers and 56% of Indian consumers were very or extremely likely to regularly purchase cultivated meat.²⁴

Section 6: Consumer Insights

Demographics, Drivers, and Attitudes

Demographics

Compared with the general U.S. population, consumers with a high interest in *regularly purchasing* cultivated meat are slightly overrepresented by Generation Z and millennials, urbanites, and liberals. Consumers willing to pay more are also somewhat overrepresented by these groups and are more often heavy meat eaters, men, college or university graduates, and higher earners.

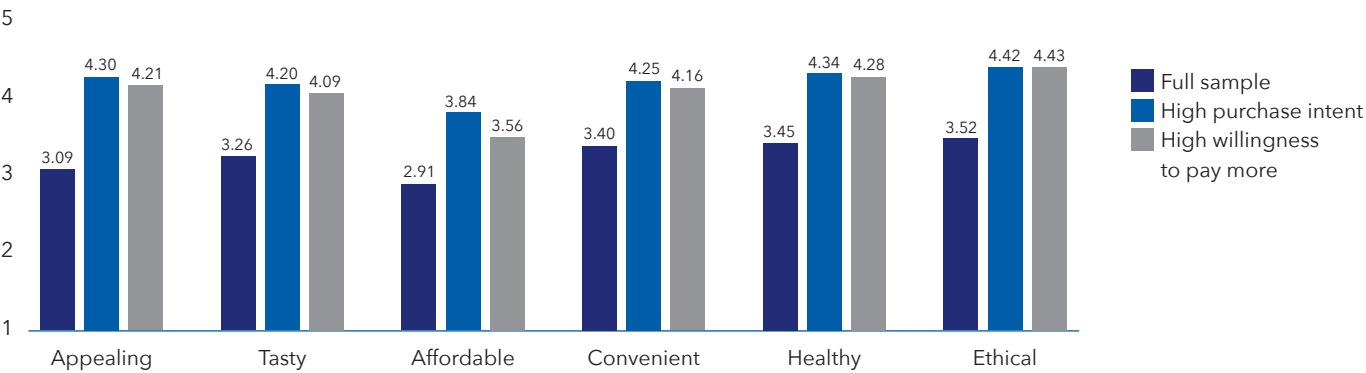
GFI’s [interactive graphs](#) compare different types of early adopters with general populations in the United States, India, and China.

Drivers

There are many demographic and attitudinal predictors of cultivated meat acceptance, which vary among cultures,²⁵ but prior familiarity and an openness to trying new foods are both proven strong predictors of acceptance across cultures. Since taste is the strongest driver of food choice,²⁶ we expect consumer adoption rates to rise the more consumers hear about cultivated meat products and have the opportunity to try them in culturally relevant dishes.

Many consumers are excited about cultivated meat’s potential benefits to society, including reducing environmental impact, eliminating the need to raise animals, and decreasing public health risks.²⁷ Attitudinal analysis of consumer segments also predicts an increase in cultivated meat adoption over time as affordability and taste appeal are demonstrated in the marketplace.

Figure 6: Consumer Attitudes Toward Cultivated Meat



Source: Szedja & Urbanovich, 2019. *Plant-based and cultivated meat diffusion of innovation: Profiles of U.S. early adopter consumer segments.*

U.S. consumers in a representative sample view cultivated meat as ethical and healthy on a scale of one to five. They also view it favorably in terms of convenience, taste, and appeal. Consumers are most skeptical of affordability.

Section 6: Consumer Insights

Meat Cultivation Framing Overcomes Concerns

Barriers strongly influence food choice. While some consumers express concern over taste, price, safety, and naturalness of cultivated meat,²⁸⁻³¹ early adopters are less concerned than the general population about factors such as naturalness and price.³²

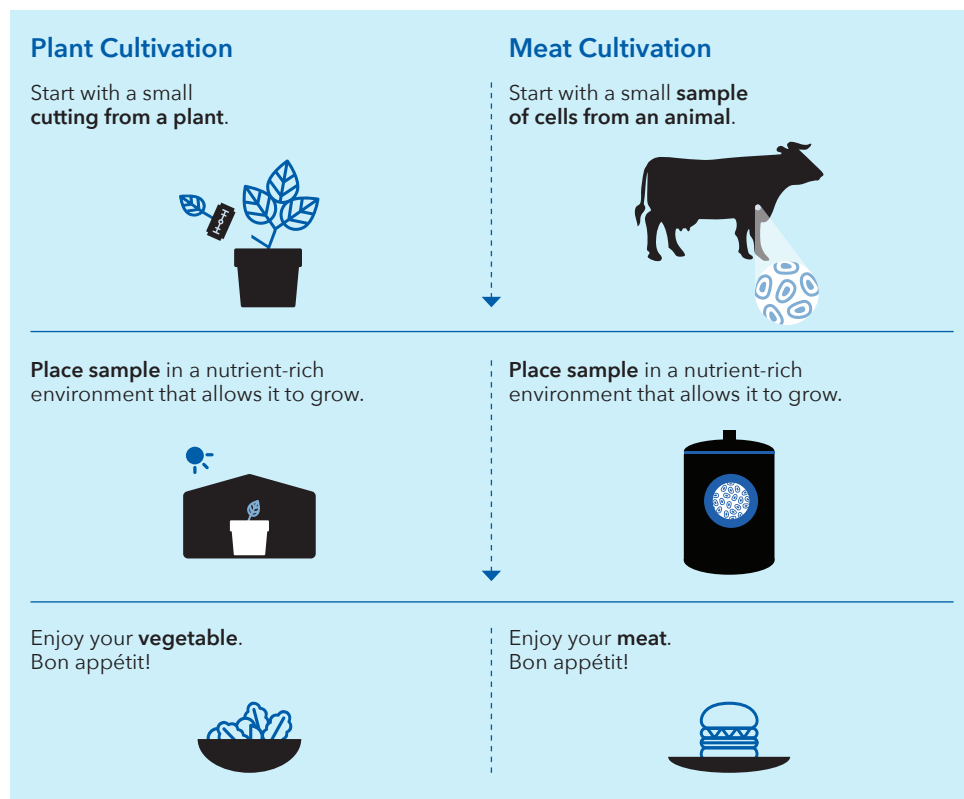
Clear strategies are available to address barriers among skeptical groups. Research has shown that employing effective science communication concepts, such as transparency, familiarity, and narrative building, ameliorates the naturalness concerns of skeptical consumer segments.³³

A cohesive market introduction strategy around terminology is likely to accelerate consumer adoption of cultivated meat. To help the industry achieve this, in early 2019 GFI and **Mattson** undertook a collaborative category messaging and nomenclature **project**. GFI's report ***Meat Cultivation: Embracing the Science of Nature*** provides a narrative text, a graphic analogy (see Figure 7), and insights into the benefits and challenges of various nomenclature choices. Key name criteria include descriptiveness, differentiation from other types of meat, and appeal. GFI and Mattson recommend broad use of the term "cultivated meat" because consumer survey and focus group studies indicate that the term is descriptive, differentiating, and strong on the metric of consumer appeal.

The project also involved a set of science-forward, evidence-based communication tools—rooted in transparent and familiar language—to help explain and introduce meat cultivation to the consumer market. In consumer testing, after reading the meat cultivation narrative, early adopters expressed great enthusiasm. The early and late majority groups expressed keen interest but desired more information on taste, price, and safety.³⁴ Thus, by using transparent messaging, rooting novel concepts in the familiar, and comparing the meat cultivation process to natural biological processes, meat cultivation concept framing helps bypass naturalness concerns and engage the early and late majority groups, the largest consumer segments.

Section 6: Consumer Insights

Figure 7: Meat Cultivation Narrative



Source: GFI blog, “[Cultivated Meat: Why GFI is Embracing New Language](#),” September 13, 2019.

Summary

We expect cultivated meat product launches in major global markets to be met with enthusiasm from early adopters and increasing acceptance as familiarity grows and cost decreases. Evidence indicates that after learning about the meat cultivation process, mainstream consumers have high purchase intent and even a willingness to pay more. This holds true across some of the world’s largest markets, including the United States, India, and China. This consumer research ameliorates some of the “market risk” sometimes associated with investing in cultivated meat—the risk that supply will not be met by demand for a new product.

Section 7: Conclusion

In 2013, Mark Post created the world's first cultivated hamburger at Maastricht University in the Netherlands. However, the field did not emerge from academic laboratories until 2015—the year Professor Post founded Mosa Meat as a spinoff from Maastricht University. That was also the year Berkeley-based Memphis Meats joined IndieBio's second cohort.

Perhaps the first major inflection point for cultivated meat as an industry was 2016. Memphis Meats raised the first seed round ever for a cultivated meat company and debuted the world's first cultivated meatball. By the end of the same year, Israel's SuperMeat had successfully closed a product crowdfunding campaign, and IntegriCulture had raised a seed round in Japan.

Since then, the growth of the cultivated meat industry has accelerated. By the end of 2019, there were at least 32 venture-backed companies across five continents, some in partnerships with corporate giants such as Tyson, Cargill, Merck, and PHW-Gruppe. Globally, a total of \$166 million in venture capital had been invested in the field.³⁵

Box 9: Memphis Meats' Historic Series B Propels the Industry

In 2019, Memphis Meats laid the groundwork for their monumental \$186 million Series B fundraising round. SoftBank, Temasek, Norwest Venture Partners, Tyson, Cargill, and a variety of other angel and venture capital investors participated in this round, which closed in January 2020.

Memphis Meats' Series B is not included in our current report's calculations but merits mentioning. Such a large investment from notable investors further validates the cultivated meat industry while giving Memphis Meats the capital to build a pilot-scale production facility. This proof of concept will be among the most powerful catalysts in cultivated meat's history and thus will further accelerate industry investment.

Despite this rapid progress, we must remember that the cultivated meat industry is still nascent. For perspective, compare the cultivated meat industry with the plant-based food industry (covered in depth in GFI's [plant-based meat, eggs, and dairy state of the industry report](#)) and other growing industries. Through this lens, the cultivated meat industry is currently very small, notwithstanding its enormous potential to transform a trillion-dollar market. Global 2019 venture investments in cultivated meat (more than \$77 million) were 0.8% of investments in food tech (\$9.35 billion) and 2.9% of investments in the cannabis industry (\$2.7 billion). Clearly, cultivated meat remains an incredibly ripe opportunity for those who understand its promise. As cultivated meat matures into a revenue-generating industry, room will grow for investment on a much larger scale.

Section 7: Conclusion

Because the cultivated meat industry is in its infancy, investors, entrepreneurs, and strategic partners have vast opportunities to get involved in the early stages and capitalize on this global shift in meat production. While we believe it is still too early to make firm market projections, the enormous overall scale of opportunity is undeniable. Cargill, Tyson, and JBS alone brought in more than \$200 billion in global revenue in 2019. The meat market is also expected to grow significantly, with global demand for meat projected to rise by more than 50 percent by 2050.³⁶

Capturing even a fraction of this demand is a massive opportunity for cultivated meat companies. If cultivated meat captured only 10 percent of the approximately **\$1.7 trillion** global meat market, that would be \$170 billion in annual revenue. Because such companies have collectively raised less than \$400 million in disclosed funding as of year-end 2019, we believe substantial room for new investment still exists.

Significant opportunities don't end at private investors. Strategic investment partnerships between cultivated meat companies and governments could advance the field more rapidly than private investment alone. Expanded partnerships with larger food companies could also accelerate the field.

GFI looks forward to continuing to support the growth of this burgeoning field as it transforms the meat industry into one that is more sustainable, humane, economical, and secure.

Photo credit: Finless Foods



Appendix: References

1. United Nations, Department of Economic and Social Affairs, Population Division (2017). *World population prospects: The 2017 revision, key findings and advance tables*. (Working Paper No. ESA/P/WP/248). Retrieved from https://population.un.org/wpp/Publications/Files/WPP2017_KeyFindings.pdf
2. Lewis, M. (2018). *The fifth risk*. New York: W. W. Norton & Company.
3. Emery, I. (2018). *Growing meat sustainably: The clean meat revolution*. Washington: The Good Food Institute. Retrieved from <https://www.gfi.org/images/uploads/2018/10/CleanMeatEnvironment.pdf>
4. Ibid.
5. Specht, L. (2018). *An analysis of culture medium costs and production volumes for cultivated meat*. Washington: The Good Food Institute. Retrieved from <https://www.gfi.org/files/sci-tech/clean-meat-production-volume-and-medium-cost.pdf>
6. Bercovici, J. (2017, October). Why this cardiologist is betting that his lab-grown meat startup can solve the global food crisis. *Inc. magazine*. Retrieved from <https://www.inc.com/magazine/201711/jeff-bercovici/memphis-meats-lab-grown-meat-startup.html>
7. Wyers, R. (2019, February). The finishing touch for cultured meat? Spanish start-up scores in fat replication. *FoodIngredientsFirst.com*. Retrieved from <https://www.foodingredientsfirst.com/news/The-finishing-touch-for-cultured-meat-Spanish-start-up-scores-in-fat-replication.html>
8. Lucas, S. (2019, November 5). Welcome to our new investors [Web log post]. Retrieved from <https://www.mosameat.com/blog/2018/7/16/welcome-to-our-new-investors>
9. Ball, M. (2018, November 16). GFI applauds joint statement from USDA & FDA on cultivated meat regulation [Web log post]. Retrieved from <https://www.gfi.org/gfi-applauds-joint-statement-from-usda-fda>
10. Ball, M. (2019, March 8). Closer to your table—USDA and FDA reach cultivated meat milestone [Web log post]. Retrieved from <https://www.gfi.org/closer-to-your-table-usda-and-fda-reach-cell>
11. In early 2020, Memphis Meats broke the record with an announcement of a \$186 million Series B from SoftBank and others.
12. Schieber, J. (2019, December). Dutch startup Meatable is developing lab-grown pork and has 10 million dollars in new financing to do it. *TechCrunch.com*. Retrieved from <https://techcrunch.com/2019/12/06/dutch-startup-meatable-is-developing-lab-grown-pork-and-has-10-million-in-new-financing-to-do-it/>
13. 3,6 miljoen euro Vlaams geld voor foie gras uit labo. (n.d.). *Nieuwsblad.be*. Retrieved from https://www.nieuwsblad.be/cnt/dmf20191216_04768928
14. These categorizations are based on the authors' understanding of the core functions of the businesses referenced. As stated, many of these companies are pursuing multiple business lines simultaneously or plan to do so sequentially. Although we categorize 33 companies as cultivated meat producers, seven as cultivated seafood producers, and 15 as B2B companies, the lines between these categories are imperfectly drawn. At the end of 2019, 46 companies were working on vertically integrated meat or seafood cultivation systems while the others pursued purer B2B strategies.
15. For the purpose of investment analytics in this section, "venture capital" refers to angel funding, seed funding, crowdfunding, early-stage venture capital, late-stage venture capital, accelerator or incubator funding, private equity growth/expansion, capitalization, corporate venture, and convertible debt but not mergers, acquisitions, buyouts, or grants.
16. Mattos, D. (2015, September). Community capitals framework as a measure of community development. *Cornhusker Economics*. Retrieved from the website of the University of Nebraska-Lincoln: <https://agecon.unl.edu/cornhusker-economics/2015/community-capitals-framework>
17. 3,6 miljoen euro Vlaams geld voor foie gras uit labo. (n.d.). *Nieuwsblad.be*. Retrieved from https://www.nieuwsblad.be/cnt/dmf20191216_04768928
18. This excludes some cultivated seafood.
19. Lamb, C. (2019, March). Singapore to invest \$535 million in R&D, including cultured meat and robots. *TheSpoon.uk*. Retrieved from <https://thespoon.tech/singapore-to-invest-535-million-in-rd-including-cultured-meat-and-robots/>
20. Lamb, C. (2019, March). Cultured meat will likely debut in Asia, not Silicon Valley. Here's why. *TheSpoon.uk*. Retrieved from <https://thespoon.tech/cultured-meat-will-likely-debut-in-asia-not-silicon-valley-heres-why/>
21. GFI is actively involved in the litigation against Missouri and Arkansas.
22. Szejda, K., & Urbanovich, T. (2019). *Plant-based and cultivated meat diffusion of innovation: Profiles of U.S. early adopter consumer segments*. Washington: The Good Food Institute. Retrieved from [go.gfi.org/alternative-protein-early-adopter-US](https://www.gfi.org/alternative-protein-early-adopter-US)
23. Szejda, K., Allen, M., Cull, A., Banisch, A., Stuckey, B., Dillard, C., & Urbanovich, T. (2019). *Meat cultivation: Embracing the science of nature*. Washington: The Good Food Institute. Retrieved from [go.gfi.org/meat-cultivation-project](https://www.gfi.org/meat-cultivation-project)

References

24. Bryant, C., Szejda, K., Parehk, N., Deshpande, V., & Tse, B. (2019). A survey of consumer perceptions of plant-based and clean meat in the USA, India, and China. *Frontiers in Sustainable Food Systems*, 3(11), 1–11. doi:10.3389/fsufs.2019.00011
25. Bryant, C., Szejda, K., Parehk, N., Deshpande, V., & Tse, B. (2019). A survey of consumer perceptions of plant-based and clean meat in the USA, India, and China. *Frontiers in Sustainable Food Systems*, 3(11), 1–11. doi:10.3389/fsufs.2019.00011; Wilks, M., Phillips, C. J. C., Fielding, K., & Hornsey, M. J. (2019). Testing potential psychological predictors of attitudes towards cultured meat. *Appetite*, 136, 137–145. doi:10.1016/j.appet.2019.01.027
26. Szejda, K., Urbanovich, T., & Wilks, M. (2020). *Accelerating consumer adoption of plant-based meat: An evidence-based guide for effective practice*. Washington: The Good Food Institute.
27. Bryant, C., Szejda, K., Parehk, N., Deshpande, V., & Tse, B. (2019). A survey of consumer perceptions of plant-based and clean meat in the USA, India, and China. *Frontiers in Sustainable Food Systems*, 3(11), 1–11. doi:10.3389/fsufs.2019.00011
28. Ibid.
29. Szejda, K., Allen, M., Cull, A., Banisch, A., Stuckey, B., Dillard, C., & Urbanovich, T. (2019). *Meat cultivation: Embracing the science of nature*. Washington: The Good Food Institute. Retrieved from go.gfi.org/meat-cultivation-project
30. Szejda, K., & Urbanovich, T. (2019). *Plant-based and cultivated meat diffusion of innovation: Profiles of U.S. early adopter consumer segments*. Washington: The Good Food Institute. Retrieved from go.gfi.org/alternative-protein-early-adopter-US
31. Wilks, M., & Phillips, C. (2017). Attitudes to in vitro meat: A survey of potential consumers in the United States. *PLoS ONE*, 12(2), 1–14. doi:10.1371/journal.pone.0171904
32. Szejda, K., & Urbanovich, T. (2019). *Plant-based and cultivated meat diffusion of innovation: Profiles of U.S. early adopter consumer segments*. Washington: The Good Food Institute. Retrieved from go.gfi.org/alternative-protein-early-adopter-US
33. Szejda, K., Allen, M., Cull, A., Banisch, A., Stuckey, B., Dillard, C., & Urbanovich, T. (2019). *Meat cultivation: Embracing the science of nature*. Washington: The Good Food Institute. Retrieved from go.gfi.org/meat-cultivation-project
34. Ibid.
35. This figure does not include the \$186 million Series B raised by Memphis Meats in early 2020.
36. United Nations, Food and Agriculture Organization. (2018). *The future of food and agriculture—Alternative pathways to 2050* (Supplementary material). Rome: Food and Agriculture Organization. Retrieved from <http://www.fao.org/3/CA1564EN/CA1564EN.pdf>

Principal Author

Nate Crosser, JD
Startup Growth Specialist

Contributing Authors

Caroline Bushnell
Associate Director, Corporate Engagement

Elizabeth Derbes, JD, MPH
Assistant Director of Regulatory Affairs

Bruce Friedrich
Executive Director

Jen Lamy, MA
Sustainable Seafood Manager

Nicole Manu, JD
Staff Attorney

Elliot Swartz, PhD
Senior Scientist

We'd also like to thank **Azi Akpan, Matt Ball, Adam Cohen, Alicia Crawford, Christine Dvorak, Emma Ignaszewski, Mark Langley, Brooke Mays, Maille O'Donnell, Alison Rabschnuk, and Keri Szejda** for their assistance.

GFI IS A NONPROFIT WORKING TO CREATE A SUSTAINABLE, HEALTHY, AND JUST GLOBAL FOOD SYSTEM. PLANT-BASED, CULTIVATED, AND OTHER ALTERNATIVE PROTEINS OFFER A BETTER WAY TO FEED THE WORLD.

The Challenge:

- Current meat production is unsustainable and inefficient. It is a key driver of climate change, environmental degradation, and antibiotic-resistant disease.
- Yet these facts have not sparked significant behavior change: People are eating more meat than ever, in the United States and around the world.

GFI's Solution:

- We can create meat from plants or cultivate it directly from cells more sustainably and efficiently.
- We will make more progress by changing the default choices than by trying to change every single person's mind.

GFI IS ACCELERATING THE TRANSITION OF THE GLOBAL FOOD SYSTEM TO ALTERNATIVE PROTEINS BY MAKING THEM MORE DELICIOUS, AFFORDABLE, AND ACCESSIBLE THAN CONVENTIONAL ANIMAL PRODUCTS.

Our Programmatic Priorities:

SciTech

Bridging gaps in scientific research, funding, and talent across the alternative protein sector.

Corporate Engagement

Helping the food industry and investor communities put delicious, affordable alternative proteins on every menu and in every food retailer.

Policy

Advancing government investment in sustainable proteins as well as fair regulation and legislation.

GFI works around the world with team members based in the United States, Brazil, India, Europe, Asia-Pacific, and Israel. We engage companies across the supply chain—from startups to legacy meat and food conglomerates, major chain restaurants, and retailers—as well as individual scientists, policymakers, investors, and entrepreneurs.

This transformational work is made possible through philanthropic support. Our supporters make reimagining protein possible.



Stay in the know with **GFI's email newsletter.**



Find business resources and insights at **gfi.org.**



Fuel the future of food at **gfi.org/donate.**

Amplify your impact. Join us.

GFI.ORG

POWERED BY PHILANTHROPY.

GFI IS A NONPROFIT 501(C)(3) ORGANIZATION.

The Good Food Institute ©2020



THE
GOOD FOOD
INSTITUTE