

EARLY WARNING SYSTEMS

Cellular Agriculture as a Case Study

Leveraging Subject Matter Experts
to cut through the noise by identifying
key trends and emerging technologies

PRESCOUTER 2022



An early warning system enables businesses to take timely actions to reduce the effects of threats in advance and capitalize on growth opportunities.



WHAT IS AN EARLY WARNING SYSTEM?

An early warning system is an integrated system of monitoring and awareness that enables businesses to take timely actions to reduce the effects of threats in advance and capitalize on growth opportunities.



HOW DOES THE EARLY WARNING SYSTEM WORK?

An early warning system involves analyzing relevant data points on a regular cadence (e.g. monthly, quarterly, bi-annually, annually, etc.). Data points could include product launches, research publications, patents, grants, startup activity, news/press releases, clinical trials, regulations, research hubs, market dynamics, and competitor/peer activity.



WHAT ARE OTHER NAMES USED FOR THIS TYPE OF RESEARCH?

Some synonyms of an early warning system include:

- Pulse sensing
- Sensing updates
- Competitive intelligence
- Competitive monitoring

How an Early Warning System Works



**Note: This briefing focused on analyzing one data source: News/Press*

The cultivated meat industry is experiencing an explosion of innovation, with a plethora of emerging players, technical advances and increasing activity from regulators. Companies who want to stay ahead of the curve must be able to identify the most promising startups and technologies at very early stages and understand the role cultivated meat could play towards their ESG goals.

Within the cellular agriculture industry, cultivated meat saw a surge of disclosed investments in 2021, totaling \$1.4B, which represented 3.5X in growth compared to 2020. Additionally, the cultivated meat sector also showed a 62% increase in the total number of investors. Considering the sustainability value, compared to conventional meat, cultivated meat could lower energy usage by 7-45%, lower GHG emissions by 78-96%, reduce land requirements up to 99%, and lower water usage by 82-96%.

The surge of investments and massive sustainability value of cultivated meat has created a fast-paced innovation area with a plethora of emerging players, a flourishing of news-related events, and increased activity from regulators.

How can one digest all of the activity in order to understand developments representing significant advances propelling the industry forward? In this Intelligence Brief, we highlight the ability to interrogate data sources using multiple Expert interviews in order to identify important, innovative, and disruptive activities that break barriers and drive adoption in a rapidly evolving industry.



\$1.4B

2021 INVESTMENTS INTO
CULTIVATED MEAT



78-96%

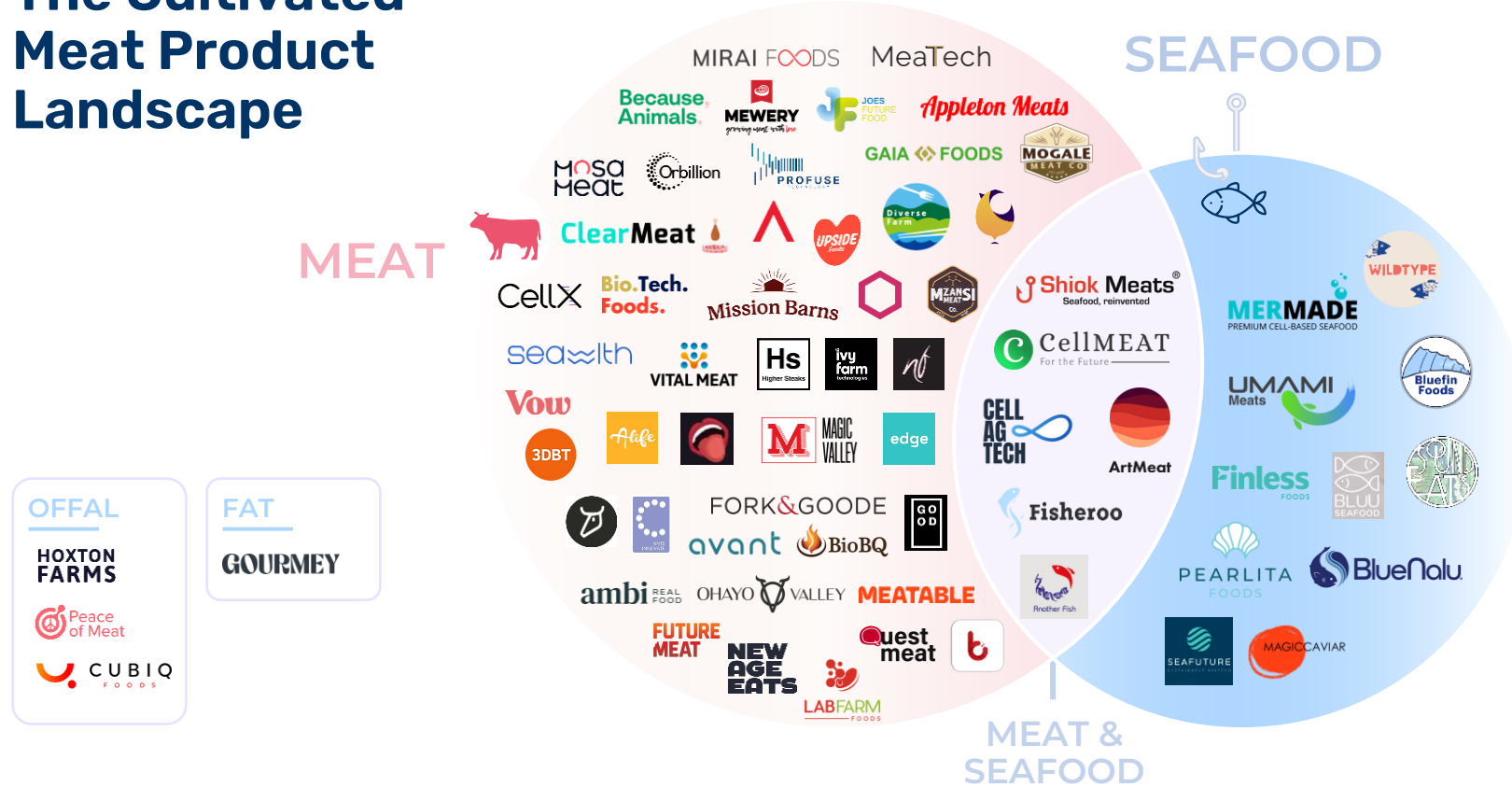
CULTIVATED MEAT'S POTENTIAL TO
LOWER GHG EMISSIONS COMPARED
TO CONVENTIONAL MEAT



60+

NUMBER OF CULTIVATED
MEAT STARTUPS

The Cultivated Meat Product Landscape



Subject Matter Expert REVIEW



3

Experts
interviewed



~30

News articles
analyzed

PreScouter leveraged three Experts within its Global Expert Network to review ~30 news articles to determine which represented innovative, disruptive, and/or important developments.



Innovation Score

If applicable, how much of a step forward does the activity discussed in the entry represent? Please rate the entry on a scale of 0 to 10 with

- > 0 being an extremely insignificant step forward
- > 5 being neither insignificant nor significant
- > 10 being an extremely significant step forward



Disruption Score

If applicable, what degree of disruption does the activity discussed in the entry represent to the status quo? Please rate the entry on a scale of 0 to 10 with

- > 0 representing an extremely insignificant disruption
- > 5 representing neither a insignificant or significant disruption
- > 10 representing an extremely significant disruption



Importance Score

Based on your perspective of the cellular agriculture industry, how important do you feel the activity discussed in the entry is to the industry? Please rate the entry on a scale of 0 to 10 with

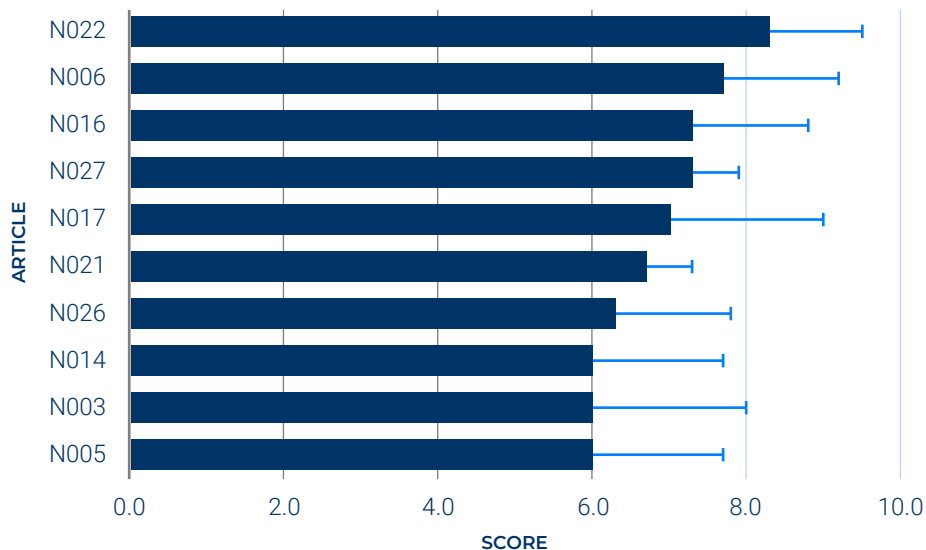
- > 0 being extremely unimportant
- > 5 being neither unimportant nor important
- > 10 being extremely important

Articles with the highest scores

- N001** Wildtype cell-grown salmon lands US\$100M in DiCaprio and Bezos backed round
- N002** Pearlita nets investment from Cult Food Science to develop "world's first" cell-based oysters
- N003** Savory, cultured seafood that won't break the bank
- N004** Commercial launch of food grade basal medium - Serum-free culture of chicken and duck liver-derived cells by CulNet™
- N005** Remilk™ raises \$120 million in series b funding - signaling animal-free dairy at scale is closer than ever
- N006** BioBetter Breaks Bottleneck in Cultivated Meat with Tobacco Plants
- N008** Dutch Parliament Approves Cultured Meat Tasting In The Netherlands
- N014** Cultured Meat Is So Close You Can Almost Taste It

- N016** 8 Players Leading the 3D Printed Meat Revolution
- N017** 3D-BioScreenPrint: A novel bioprinting approach for high scale production of cultured meat-resembling multi-layered bioink sheets
- N018** Chitosan-collagen hydrogel microparticles as edible cell microcarriers for cultured meat
- N020** Netherlands to invest in "cellular agriculture"
- N021** Here's Y Combinator's answer to cultivated meat's scaling problem
- N022** Historic inflection point for cultivated meat: Upside Foods closes \$400m series C round to support commercial-scale plant with production capacity of tens of millions of pounds
- N026** GOOD Meat strikes deal for 'largest known bioreactors for avian and mammalian cell culture' for US cultivated meat facility
- N027** Eat Just Breaks Ground On Largest-Ever Plant-Protein Factory in Singapore

Top 10 Most Innovative Activities



Statistically significant score ≥ 6

Key Takeaway



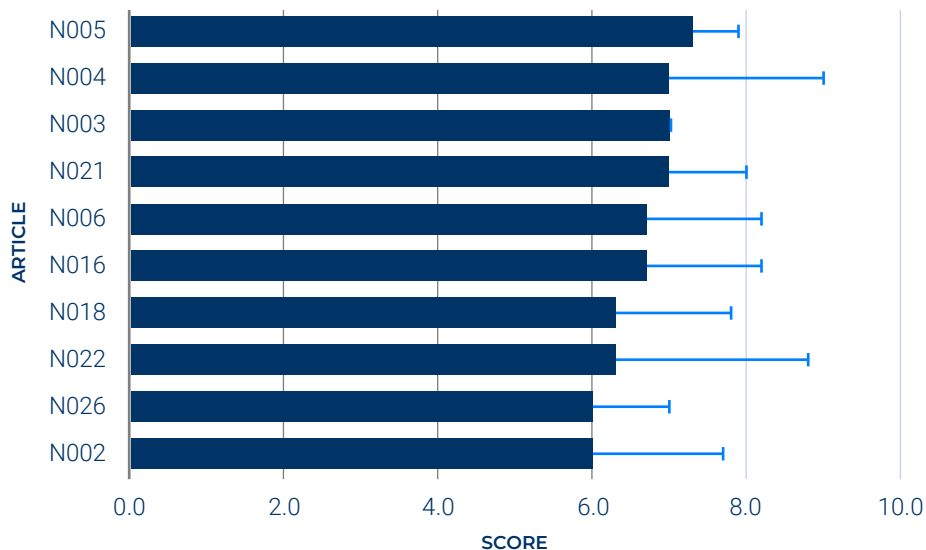
Using multiple experts, PreScouter identified **news from articles 17, 4, 21, and 16.**

News article 17 is a particularly innovative event as technology represents a **solution to the scalability challenges of whole cuts of meat.**



Represented innovative activity (**score ≥ 6**) within the **cultivated meat industry.**

Top 10 Most Disruptive Activities



Statistically significant score ≥ 6

Key Takeaway



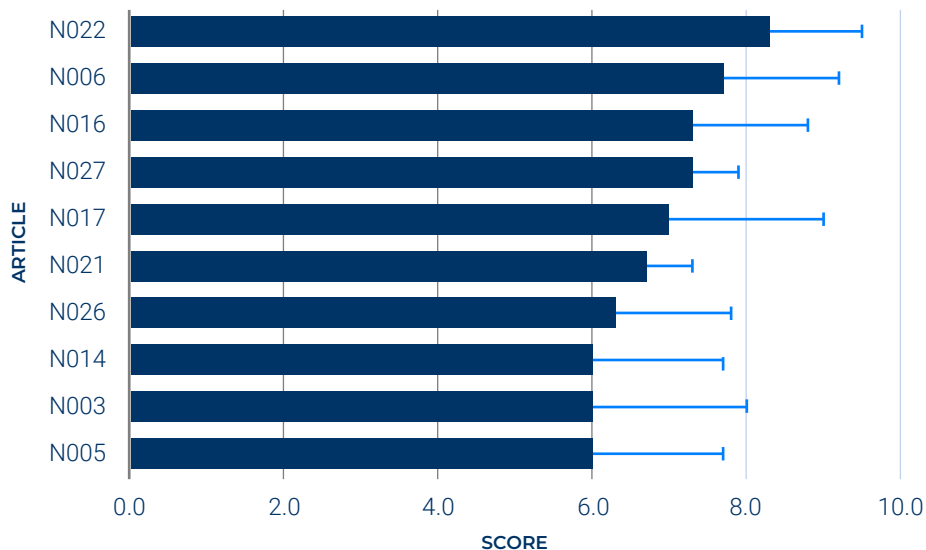
Using multiple experts, PreScouter identified news from articles **22, 16, and 27.**

News article 16 covers 8 players within the cultivated meat industry that experts agree represent disruptive forces.



Represented disruptive activity (**score ≥ 6**) within the **cultivated meat industry.**

Top 10 Most Important Activities



Statistically significant score ≥ 6

Key Takeaway



Using multiple experts, PreScouter identified news from articles **22, 20, 6, 27, 1, 3, and 5.**

Articles 22 and 27 discuss increases in production by Upside Foods and Eat Just, which are important to addressing the capacity limitations of cultivated meat.

Article 6 represents an important development in **resolving the high cost of growth media by use of molecular farming to produce growth factors.**



Represented important activity **(score ≥ 6)** within the **cultivated meat industry.**

Staying informed and ahead of the curve on innovations impacting your business can be time consuming and overwhelming, especially for fast-paced innovation areas.

PreScouter's research consultancy has helped drive strategic planning and specific solution development decisions for some of the most prominent companies in the world, for years.



PreScouter's Proven Track Record

500+
Clients
Worldwide

5000+
Challenges
Conquered

150K+
Hours of
Research

In this intelligence brief, we highlight the power of having multiple experts review data points to identify important, innovative, and disruptive developments.



"PreScouter made us aware of 23 emerging technologies that we probably would not have become aware of otherwise"

RICHARD DEMKE
Senior Director Technical &
New Product Development

SUNSTAR



"We have actually started speaking with a few potential collaborators - all within 12 weeks of working with PreScouter. So to me, the investment was incredibly well-spent."

NAVEEN NAIR
Director of Engineering,
Strategic Partnerships

Baker Hughes

Noise to Insights

Identifying top challenges, most promising solutions and potentially disruptive startups in the cellular agriculture space

The early warning system applied here identified **5 key findings** within the cellular agriculture sector.



Expected demand exceeds global production capacity

PreScouter's Experts agreed that Upside Foods and East Just's growth plans are a crucial step toward filling the production capacity gap.



Scalability methods limit cell-based meat production

PreScouter's Experts agreed that the technology being developed by researchers at the Technical University of Darmstadt is a big step forward in terms of scalability.



Growth factors drive cultivated meat prices today

Multiple Expert reviews of press releases showed that BioBetter's use of tobacco plants was an important technology that could help bring down the price of growth factors.



Startup Landscape

PreScouter identified 60+ startups developing cultivated meat and other cellular animal products whose activity should be monitored at regular intervals.



Limited regulatory approval

PreScouter digested the information from a wide geography of regulators and built a map to quickly triage regulatory status. Only one country has approved cultivated meat, but more are expected in 2023.

Production Capacity

CHALLENGE



A major challenge facing cultivated meat products is that the expected demand is much higher than global production capacity.



PreScouter's Experts agreed that increased production capacity investments are significant developments for the industry.

IMPORTANT EVENTS



Eat Just breaks ground on **largest-ever plant-protein factory** in Singapore

Experts' rating of event in terms of importance = 7.7 (+/- 0.6)

A historical tipping point for cultivated meat: Upside Foods closes a \$400 million series C round to support a commercial-scale plant with tens of millions of pounds of production capacity.

Experts' rating of event in terms of importance = 8.7 (+/- 1.2)

Scalability

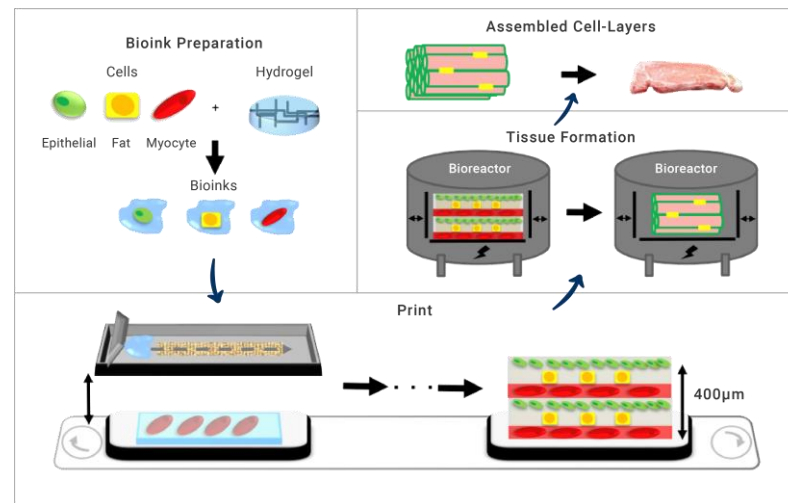
CHALLENGE

There exists limitations of 3D printing technologies for the scalability of sliced or whole-cut meat production.



PreScouter's Experts agreed that the 3D-Bio ScreenPrint process being developed by researchers at the Technical University of Darmstadt represented a significant innovation with some potential to disrupt the status quo in methods for printing whole-meat products.

IMPORTANT EVENT



The approach being developed by the Technical University of Darmstadt is a novel bioprinting approach for high-scale production of cultured meat-resembling multi-layered bioink sheets.

Experts' rating of event in terms of innovation = 8.3 (+/- 1.2)

Experts' rating of event in terms of disruption = 6.7 (+/- 1.5)

Cost of Growth Factors

CHALLENGE



Growth factors are one of the main cost drivers for cultivated meat products today.



PreScouter's Experts agree on the cultivated meat with tobacco plants developed by BioBetter is an important component of the cost reduction needed to achieve wider adoption of cultivated meat.

IMPORTANT EVENT



Startup BioBetter **plans to use tobacco plants as the source for plant-based growth factors** required in the process of cultivated meat.

Experts' rating of event in terms of importance = 8.0 (+/- 1.0)

Monitoring the Startup Landscape

CHALLENGE



The cellular agriculture industry is crowded with new players without a clear view of who will disrupt the industry.



PreScouter's Experts agreed that a handful of companies noted in the news articles represented disruptive forces in the cellular agriculture industry.

IMPORTANT EVENT



**FUTURE
MEAT**

FORK&GOODE
CellX MeaTech™

**J
U
S
T**

Shiok Meats®
Seafood, reinvented.

 **BlueNalu**

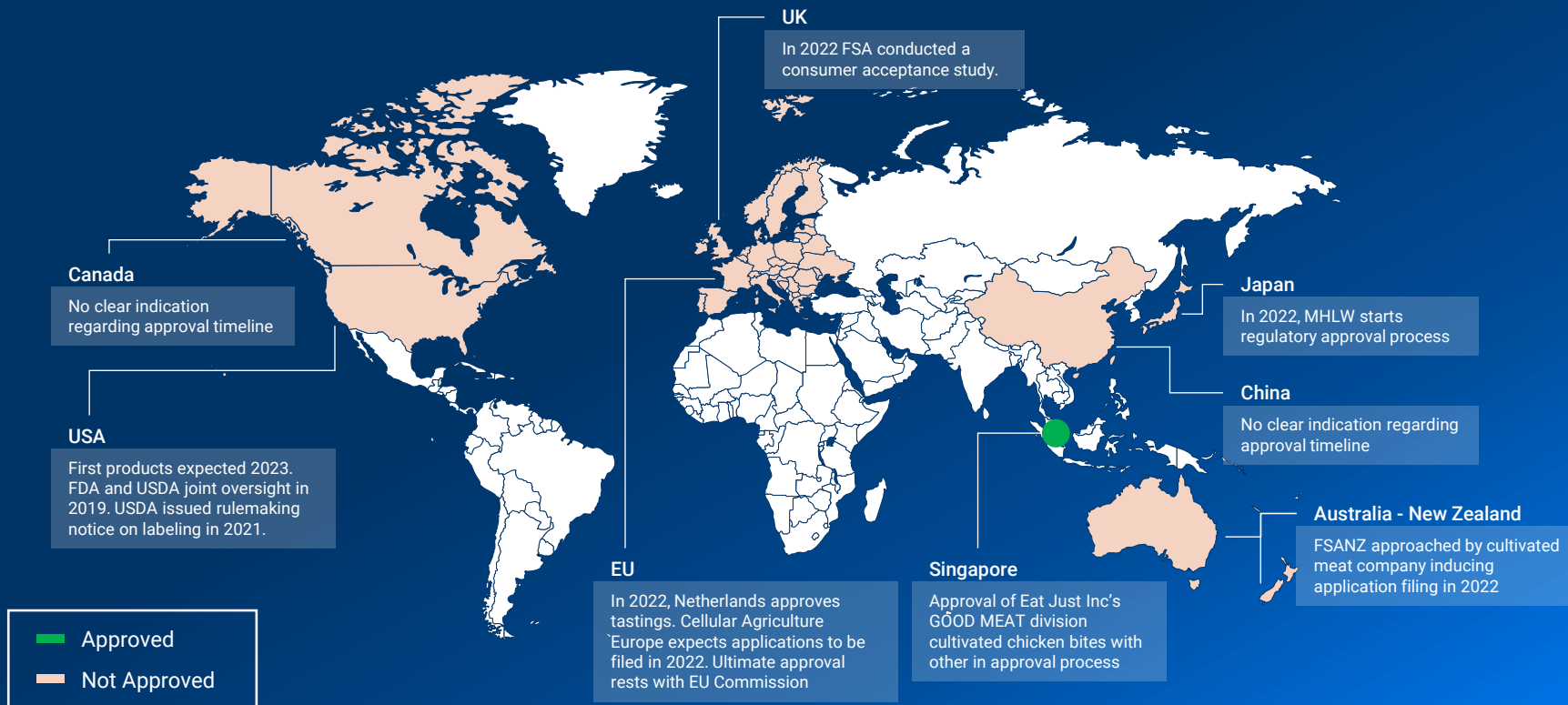


ALEPH FARMs
MEAT GROWERS

Disruptive startups are: Aleph Farms, BlueNalu, CellX, Eat Just, Fork & Goode, Future Meat Technologies, MeaTech, Shiok Meats.

Experts' rating of event in terms of disruption = 7.0 (+/- 0)

Monitoring The Regulatory Landscape



About the Authors



Garrett Wheaton

Project Architect

Garrett earned his Ph.D. in Chemical & Biomolecular Engineering from NC State University, where his research focused on metal biooxidation, resistance and toxicity in thermoacidophiles. After his graduate studies, he worked at a cannabinoid infusion technology startup, offering highly effective and bioavailable delivery solutions for cannabis and hemp customers. Before joining PreScouter, Garrett gained experience in product development and commercial launch. Garrett is based in Salt Lake City, Utah.



Jorge Hurtado, PhD

PreScouter Researcher & Team Leader

Jorge supports PreScouter as an Advanced Degree Researcher helping provide clients with high-quality information and analysis about the latest insights into disruptive technologies, helping companies find new markets and remain competitive in their market niche. Jorge holds a MA in conservation and development, a PhD in Biology and Statistics, and a diploma in Green Economy from the University of Florida, Syracuse University, and Ryerson University; respectively.

References:

1. Could cultured meat improve the environmental sustainability of meat products?
2. Record \$5 billion invested in alt proteins in 2021
3. 3D-Bio ScreenPrint: A novel bioprinting approach for high scale production of cultured meat-resembling multi-layered bioink sheets
4. 8 Players Leading the 3D Printed Meat Revolution
5. Historic inflection point' for cultivated meat: UPSIDE Foods closes \$400m series C round to support commercial-scale plant with production capacity of tens of millions of pounds
6. Eat Just Breaks Ground On Largest-Ever Plant-Protein Factory in Singapore
7. BioBetter Breaks Bottleneck in Cultivated Meat with Tobacco Plants
8. Global agriculture towards 2050
9. 6 Pressing Questions About Beef and Climate Change, Answered
10. Is cellular agriculture the climate-friendly answer to growing food demands?
11. Cultivated meat is gaining momentum—and pathways for regulatory approval
12. A new way of approaching what's for dinner
13. Cultured Meat in Europe: Which Country is Leading the Race?
14. Cultivated meat companies gear up for first EU approval applications
15. Cultivated meat could be on Australian shelves next year
16. Health Ministry of Japan Moving Forward on Cultivated Meat Regulations

Potential Next Steps

PreScouter can use it's toolbox to build an early warning system tailored to your specific needs, helping you stay ahead of the curve and monitor emerging players in markets that matter to you.

PreScouter can have it's network of experts validate important developments to help you identify growth opportunities.

PreScouter can help you search and identify potential partnerships or investment opportunities to accelerate your product portfolio.



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Our model leverages a network of 4,000+ advanced degree researchers, industrial experts, engineers, and analysts across the globe to tap into information from small businesses, national labs, markets, universities, patents, startups, and entrepreneurs.

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