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Meat the Future:

The Lab-grown Revolution of Protein

“We shall escape the absurdity of growing a whole chicken in order to eat the breast or wing, by growing these parts separately under a suitable medium”

– Winston Churchill, 1931

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In 2013, Dutch professor Mark Post created at Maastricht University the first lab-grown burger, made from cultured beef cells. It was developed as a response to the growing concerns over the environmental impact of traditional meat production and animal welfare.

Post's team spent two years perfecting the process, using over 20,000 thin strands of muscle tissue cultivated from cow stem cells in a laboratory. It was then cooked by chef Richard McGeown and tasted by food researchers in London.

The burger came with a hefty price tag of $330,000 and was financed by google's co-founder Sergey Brin. However, in 2019 the price dropped impressively to less than 12$ per patty.

Will lab-grown meat remain a niche product or will it arrive on the average kitchen table?

Executive Summary

What’s beyond meat?

The global food industry is under pressure to find sustainable alternatives to meat. Simultaneously, consumer interest in plant-based substitutes is cooling due to concerns over ultra-processing, taste, and nutritional profile.

In this context, lab-grown meat (also known as cultured meat) is emerging as a powerful third path: **real meat, grown with science**.

Using GetFocus’s proprietary AI-driven technology scouting and predictive improvement rate analysis, this report uncovers the true trajectory of cultured meat technologies. We reveal that **lab-grown meat** is already improving faster than traditional livestock production, and that **bioreactors**, the critical enabling technology, are doubling in capability every 3.6 years.

If this pace continues, cost-effective, scalable production could be within reach much sooner than expected.

While the path to mainstream adoption still faces challenges, including regulatory barriers, cost parity, and public acceptance, the rate of innovation in cultured meat and its enabling systems is outpacing historical food technology benchmarks.

What once sounded like science fiction is now a matter of science, strategy, and timing. With GetFocus, you don’t need to spend months researching which food technologies will win, we deliver the answer in just **one day**.

Introduction

Global appetite for meat is growing fast.

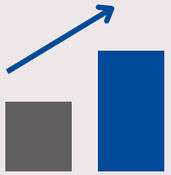
The FAO projects meat consumption will rise by over 14% by 2030, putting even more strain on an already resource-intensive industry, from high greenhouse gas emissions to land use. At the same time, the early hype around plant-based meat is losing steam. Sales are dipping, and consumers are pushing back on taste, pricing, and ultra-processed ingredients. These dynamics create a golden opportunity for real meat made with science, that could offer the flavor and sensory experience that consumers are still craving.

To address whether lab-grown meat can adequately match the mainstream demand for meat consumption, it is necessary to understand the progress of culturing technologies.

At Getfocus we unravel technology improvement rates, which allows us to break down how fast the field is developing and how it compares to traditional meat production.

Projected meat demand

+14%
by 2030



Enviromental Footprint

14.5%
Of greenhouse gas emission

77%
Of farmland

Plant-Based Market

-13%
Dollars Sales U.S. 2021 - 2023

-26%
Unit Sales U.S. 2021 - 2023

Cultured Meat

Snapshots in 2024

174 Companies Worldwide

$3.1B All-time Investment

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Upsides and Downsides

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Traditional Meat Production

Upsides

Established Supply Chains: Mature global infrastructure for livestock farming, slaughter, processing, and distribution.

Consumer Familiarity: Deep cultural, culinary, and sensory integration with minimal resistance to taste, texture, and appearance.

Cost Advantage: Economies of scale and commodity pricing make traditional meat highly affordable in most regions.

Byproduct Utilization: Existing value chains for secondary products (e.g., leather, gelatin, bone meal) increase economic efficiency.

Policy Support: Many countries subsidize livestock farming, making it resilient to short-term disruptions.

Downsides

Environmental Impact: Significant contributor to greenhouse gas emissions, deforestation, biodiversity loss, and freshwater consumption.

Ethical Concerns: Increasing scrutiny over animal welfare, intensive farming practices, and slaughterhouse conditions.

Antibiotic Resistance: Heavy antibiotic use in livestock is accelerating antimicrobial resistance, a major public health threat.

Zoonotic Risk: Industrial farming has been linked to disease outbreaks (e.g., avian flu, swine flu) due to close animal-human contact.

Cultured Meat

Upsides

Sustainability: Drastically lower greenhouse gas emissions, land use, and water consumption compared to conventional meat production.

Animal Welfare: No slaughter required, which aligns with ethical and regulatory pressure to reduce animal suffering.

Health & Hygiene: Reduced risk of foodborne illness, antibiotic resistance, and zoonotic disease transmission due to sterile, controlled production environments.

Precision Control: Potential to fine-tune nutritional profiles (e.g. reduce saturated fat, increase protein or micronutrients).

Long-Term Cost Decline: Rapid improvement rates suggest price parity could be achieved sooner than expected.

Downsides

Consumer Acceptance: Uncertainty around public perception and psychological barriers to adoption.

Energy Intensity: Current production processes are still energy-intensive at scale.

Cost Competitiveness: Despite falling costs, achieving full price parity with conventional meat remains a challenge.

Regulatory Hurdles: Novel food regulation varies widely across regions and can slow commercialization.

GetFocus Forecasting Methodology

At GetFocus, we developed a quantitative method inspired by MIT research to **forecast the technological future** based on metrics that can be identified in patent data.

Using the latest advancements in AI technology, we have created a system that can estimate how rapidly any area of technology is improving.

Our method revolves around **3 key steps.**

1

We identify every single patent that relates to an area of technology using AI. The resulting dataset represents the entire developmental history of an area of technology.

2

Once this dataset is created we measure 2 key metrics.

Cycle Time - How many years it takes for a technology to produce a new generation of itself.
The lower the cycle time, the better.

Knowledge Flow - How significant of a step forward a new generation represents.
The higher the knowledge flow, the better.

3

Using the previous metrics, we calculate the **'Technology Improvement Rate',** which represents the average percentage (%) increase in performance per dollar that can be expected from an area of technology in one year.

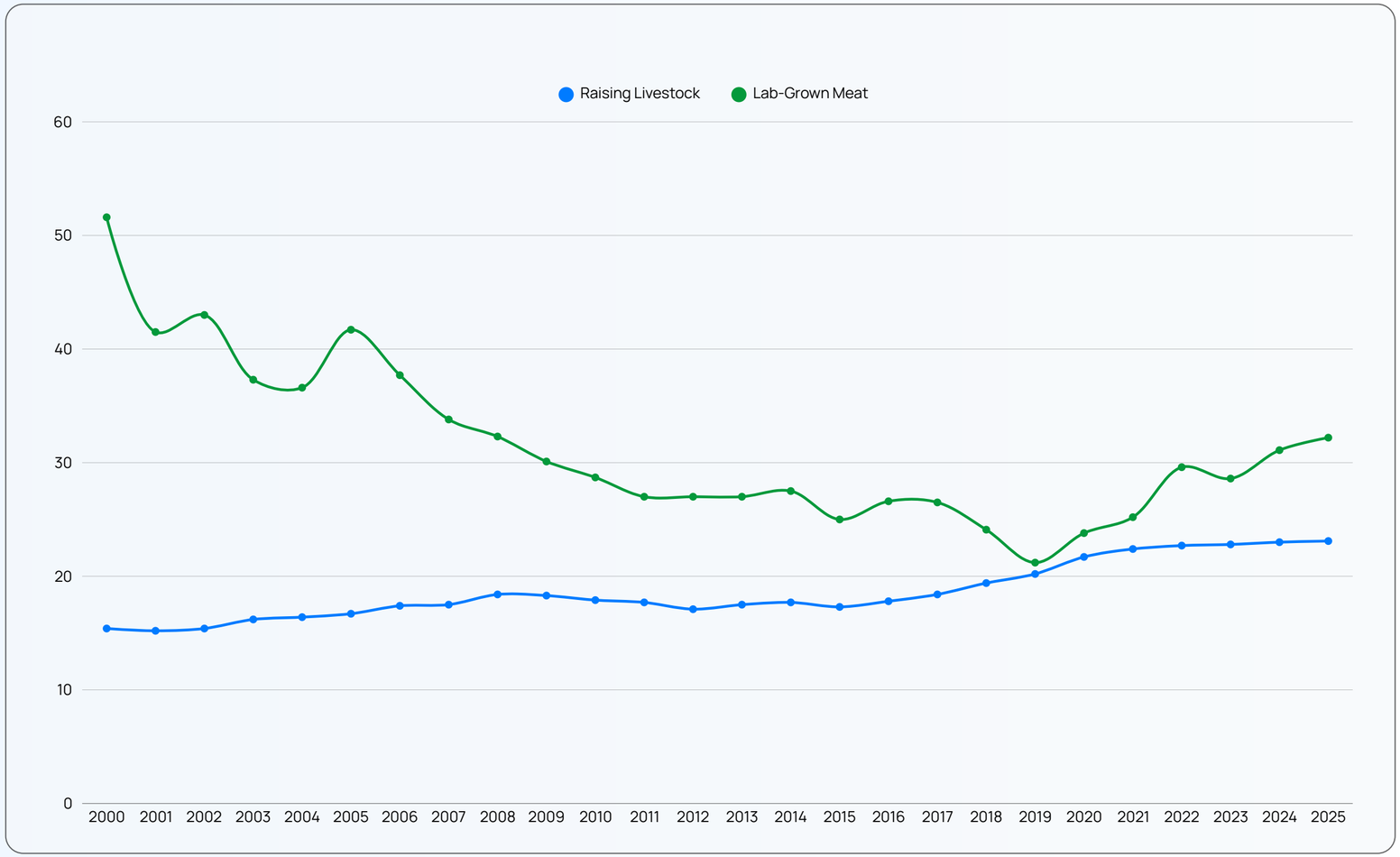
By using the above methodology, technology improvement speeds can be accurately measured, and those speeds can be used to predict technological disruption well ahead of time.

The developments in raising livestock have always maintained a steady but slow growth.

Cultured meat technologies, on the other hand, showed a peaked improvement rate with the first attempts at creating meat in a laboratory, and it is now starting to rise again.

At every point in time, cultured meat has demonstrated a higher improvement rate than traditional livestock raising, signaling that while it may still be in its developmental stage, its pace of innovation is outstripping that of conventional alternatives.

Improvement Rates for Cultured Meat and Raising Livestocks Techniques



Source: GetFocus Platfrom

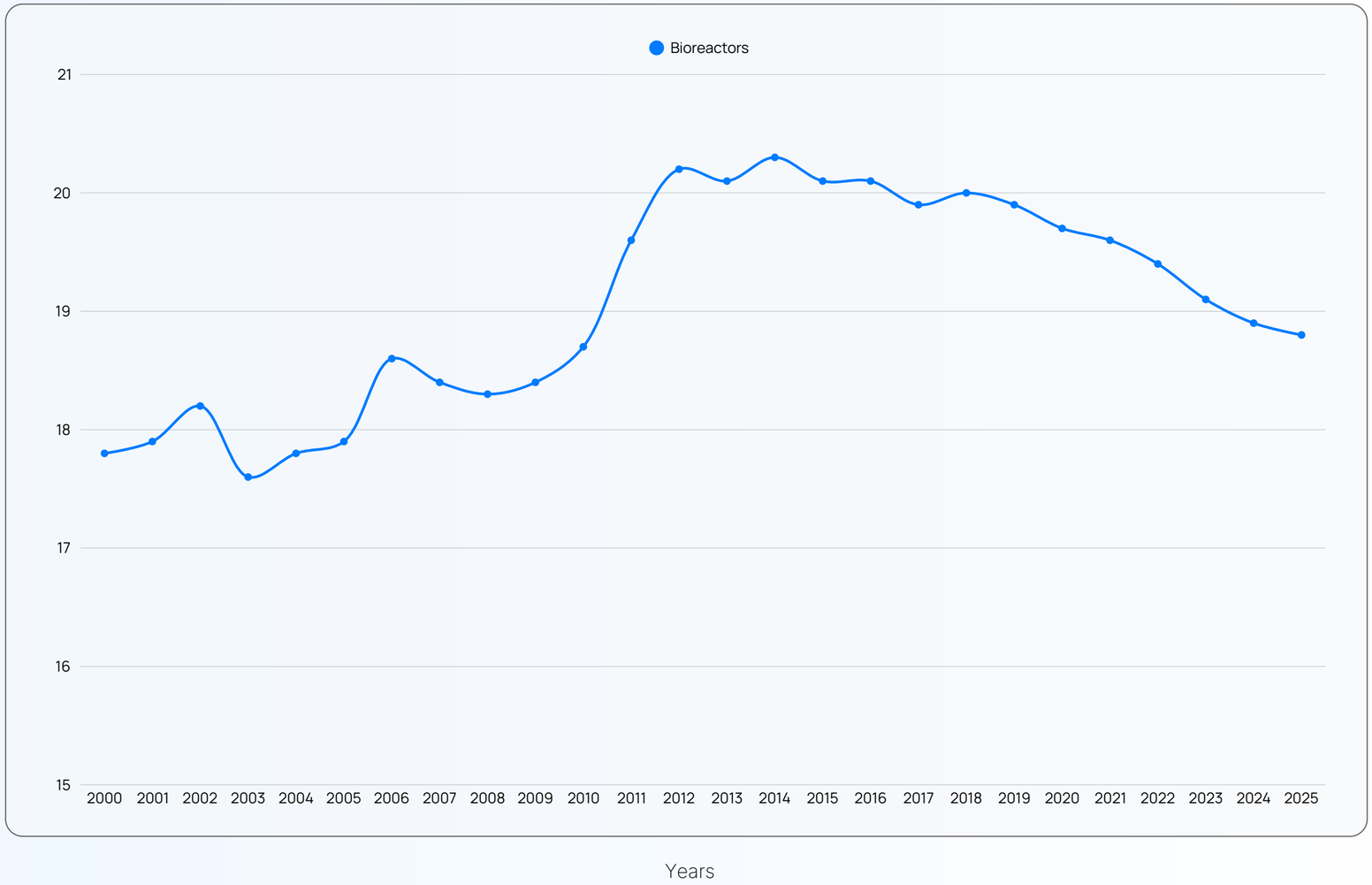
Bioreactors: high-tech wombs

Bioreactors at the moment come with significant challenges. Large-scale bioreactors are expensive to build, operate, and maintain. They must be categorically sterile to prevent contamination, requiring clean rooms, advanced monitoring, and automated cleaning systems. Operational complexity also makes it hard to reach cost parity with traditional meat production.

However, around 2013, when professor Post announced the first cultured burger, the advancement in bioreactors show a peak in improvement rate, and bioreactors technologies has grown steadily at around 20% since.

At this rate, **bioreactor capabilities are expected to double every 3.6 years**

Improvement Rate for Bioreactors



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Cultured ground meat is nearing TRL **7–8**, especially in burger or nugget form.

Whole-cut meat and advanced bioreactor integration remain in TRL 4–5, representing the **key bottlenecks**.

Growth medium innovation is a critical frontier for both cost and ethics.

Systems-level maturity is high enough to justify pilot commercialization, but scaling still hinges on cost-effective, high-volume bioreactor operations and regulatory readiness.

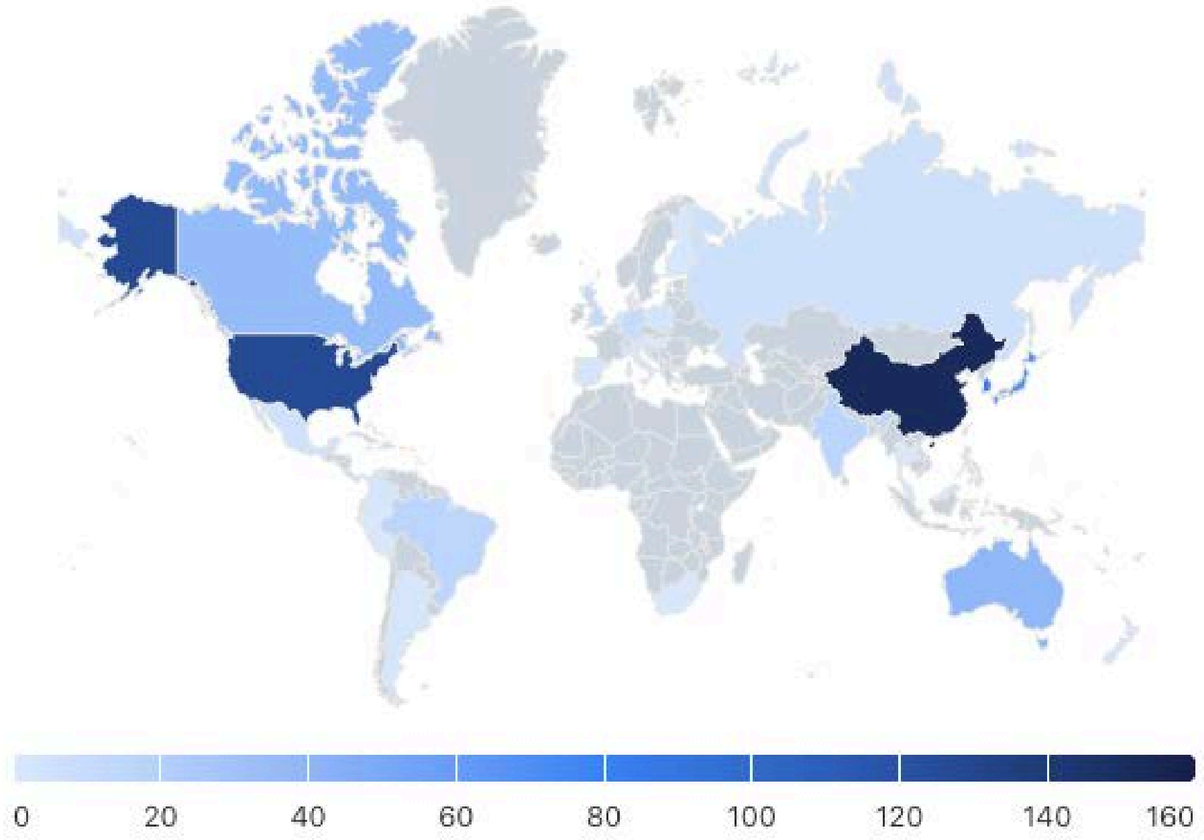
Technology Readiness Level

Category	Technology	Estimated TRL (1–9)
Cultured Meat Core	Muscle Tissue Cultivation	7
	Fat Cell Cultivation	6
	Structured (whole-cut) Meat	4
Bioreactor Systems	Stirred-Tank Bioreactors	8
	Perfusion Bioreactors	6
	Scaffold-Integrated Bioreactors	4
Growth Medium	Fetal Bovine Serum (FBS)-Free Medium	6
	Plant-Based or Recombinant Growth Factors	5
Downstream Processing	Harvesting & Texturizing Systems	5
	Quality Control & Safety Systems	7

Cultured meat is being mainly researched in the **US** and in **China**.

Families, Per Geography Map

Shows the number of patent families per geography, as well as the relative size of the geography its portfolio. It gives insight into where in the world innovation in your technology area is being pursued.



Investors and corporates looking to form strategic partnerships should focus on **Chinese** and **American** startups.

Regulatory harmonization in **Europe** will be critical to unlocking more IP generation and startup momentum.

The current IP imbalance presents an opportunity for players in underrepresented regions to secure market space.

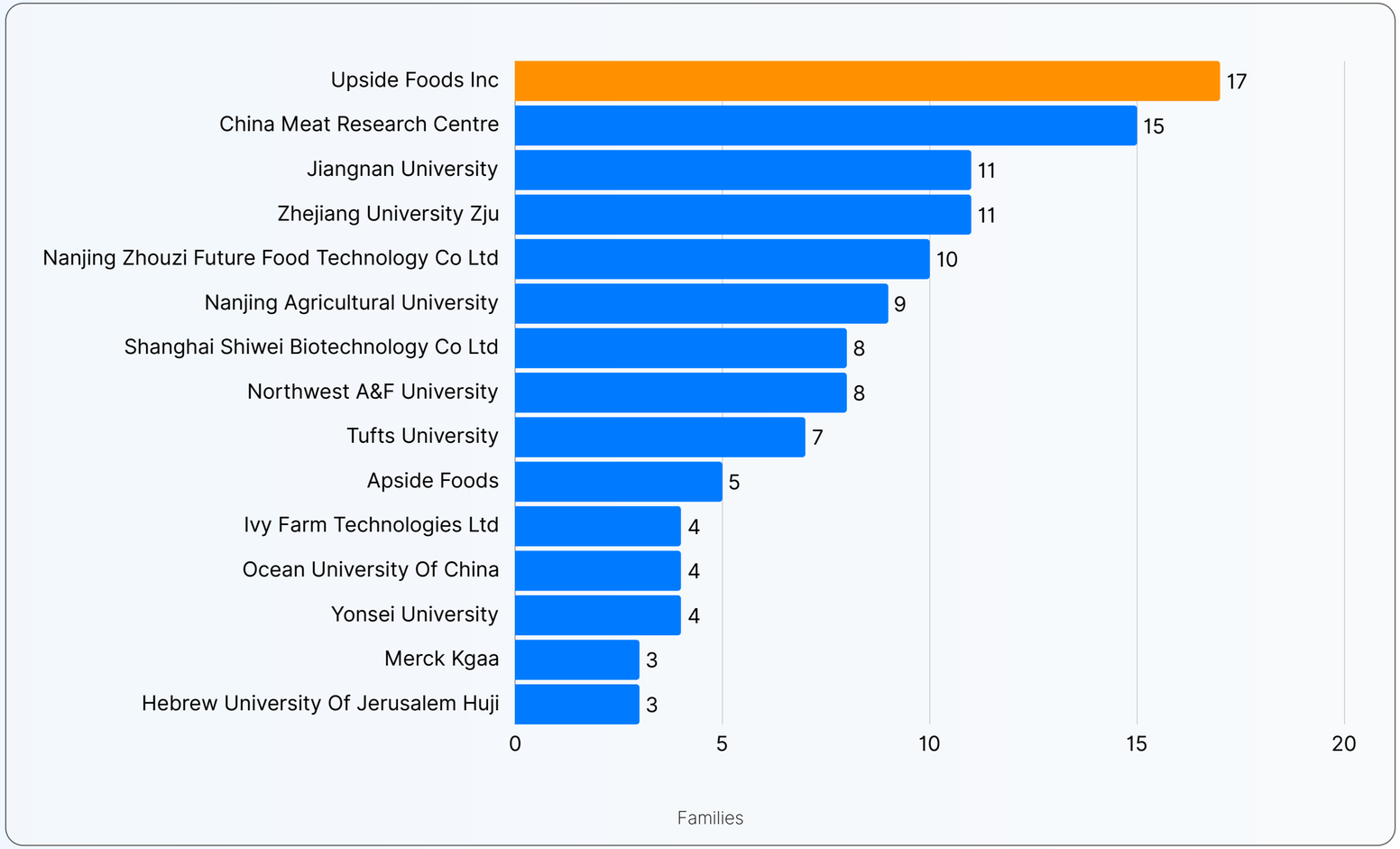
Families, Per Organization

Shows the number of patent families per organization. It gives insight into which organizations are most aggressively pursuing innovation in this area.

This chart highlights the organizations that most actively patenting **cultured meat** technologies, offering a clear view of global innovation leadership in this field.

Upside Foods leads the global IP race, consistent with its early-mover advantage and regulatory milestones.

Four of the top five patent holders are **Chinese** institutions or companies, reflecting strong investment in food innovation.



Source: GetFocus Platfrom

Regulation-Ready: Will Cultured Meat Pass the Law’s Taste Test?

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The global regulatory landscape for cultured meat is rapidly evolving, marked by significant milestones and regional disparities.

December

2020

Singapore became the first country to approve the sale of cultivated meat, granting regulatory approval to Eat Just's cultivated chicken bites.

June

2023

The United States followed suit in June 2023, when the U.S. Department of Agriculture (USDA) approved the sale of cell-cultivated chicken from two companies, Good Meat and Upside Foods, marking a significant change in the food industry.

January

2024

Israel's Ministry of Health granted regulatory approval to Aleph Farms for the world's first cultured beef steaks, allowing the company to market its products domestically.

April

2024

In the European Union, the regulatory process is more cautious. While **the Netherlands** permitted its first public tasting of cultivated meat in April 2024, full market approval remains pending.

Despite many success story, the road to broad regulatory approval for cultured meat is not always smooth.

In November 2023, Italy became the first country to ban the production and commercialization of cultivated meat for human and animal consumption, citing the protection of food heritage.

These developments reflect a global testing ground for how innovation, regulation, and culture will shape the future of protein.

Technology	Relative Cost	Scalability	Composite Score
Muscle Tissue Cultivation	Medium	Medium-High	7
Fat Cell Cultivation	High	Medium	4
Structured (whole-cut) Meat	High	Low	2
Stirred-Tank Bioreactors	Medium	High	8
Perfusion Bioreactors	High	Medium-High	5
Scaffold-Integrated Bioreactors	High	Low-Medium	3
FBS-Free Medium	Medium	Medium-High	7
Plant-Based/Recombinant Growth Factors	High	Medium	4
Harvesting & Texturizing Systems	Medium-High	Medium	5
Quality Control & Safety Systems	Medium	High	8

Stirred-Tank Bioreactors are currently the most scalable and cost-effective solution for cell cultivation, widely adapted from pharma and fermentation industries. Their maturity makes them a logical foundation for near-term production scaling.

On the other hand, **Perfusion Bioreactors** offer higher yields and continuous processing, but come with increased operational complexity and cost. These are important for long-term efficiency, but may need more engineering refinement for broad adoption.

Fat Cell Cultivation is also essential for replicating flavor and nutrition, but still costly and less optimized than muscle cell lines. Improving fat cell media and process scalability will be critical for consumer acceptance of premium cuts.

Next-Gen Pioneers: Innovators in Cultured Meat

As lab-grown meat progresses from pilot phase to early commercialization, several companies are leading innovation across the value chain, from bioreactors and cell lines to growth media and regulatory breakthroughs.

Cultured Meat Specialists:

- **Upside Foods (USA)**
  One of the earliest pioneers in the field, Upside Foods is the first company to receive full regulatory approval from the USDA and FDA to sell cultivated chicken in the U.S. Their innovation spans bioreactor design, cell cultivation, and food safety.
- **Good Meat (USA/Singapore)**
  A subsidiary of Eat Just, Good Meat was the first company in the world to sell cultured meat (approved in Singapore in 2020). It remains a key player in commercial rollout and large-scale fermentation technologies.
- **Aleph Farms (Israel)**
  Known for its structured, whole-cut cultured beef steaks, Aleph Farms became the first to receive regulatory approval for cultivated beef in Israel in 2024. The company is advancing tissue engineering and sustainable 3D scaffolding techniques.
- **Meatable (Netherlands)**
  Focused on scalable pork cultivation using opti-ox technology, Meatable is one of the EU's top players. It was the first to conduct public tastings in the Netherlands under EFSA guidance.
- **Vow (Australia)**
  A creative force in species diversification and cellular design, Vow specializes in gourmet and exotic lab-grown meats, such as quail, and is progressing through Australia's regulatory pipeline.
- **Believer Meats (USA/Israel)**
  Formerly Future Meat, this company is focused on reducing cost curves via continuous cultivation systems and has broken ground on one of the largest cultured meat facilities in the world.

Conclusion

The transformation of meat is already underway. Our analysis reveals that cultured meat is not a futuristic fantasy, it's a **rapidly advancing technology that is outperforming traditional livestock production** in improvement rate, sustainability, and innovation activity, with critical enablers like bioreactors doubling in performance roughly every 3.6 years.

While challenges remain around cost, scale, and consumer acceptance, the technologies driving this revolution are improving fast. Muscle tissue cultivation is nearing commercial readiness, and early adopters in countries like Singapore, the U.S., and Israel have already reached **regulatory milestones**.

There are several strategies to stay ahead of the protein revolution:

- **Prioritize near-term viable tech like** ground meat and modular bioreactor systems.
- **Collaborate with strategic partners** in high-signal regions such as the U.S., Israel, China, and the Netherlands.
- **Monitor regulatory signals** to identify launch-ready markets early, to gain first-mover advantages

From petri dish to dinner plate: the meat may not be real, but the data is

The early challenges faced by cultured meat may reflect the typical slow start seen in many transformative technologies, where initial progress appears limited before accelerating.

If current progress continues, bioreactors could soon be efficient and scalable enough to help bring lab-grown meat from the lab to dinner tables around the world.

There are already approximately **170 companies worldwide** developing cultured meat products and a selected few, like Upside Foods and Good Meat, have already received regulatory approval to sell their lab-grown meat for human consumption.

Join us for our upcoming **webinar**, where we'll dive deeper into the data behind lab-grown meat, including improvement rate forecasting, patent landscape visualizations, and strategic implications for your packaging roadmap.

You'll hear directly from our analysts and tech scouts as we walk through how to use these insights to guide R&D investment and innovation strategy.

At **GetFocus** we can help you monitor emerging markets such as cultured meat, and keep track of which companies are making the most innovative progress, so that you can be the first to place early bets on the winning technology.

About GetFocus

We are on a mission to **fast-track technological progress worldwide**.
What started with foundations laid by MIT researchers, is now a full blown technology forecasting system. By equipping innovators with **data-driven technological foresight**, we help them make the right investment decisions and innovate faster.

Emerging technologies that turn into winners show clear and measurable signals early on in their development. By giving you access to this data, we help you innovate faster.

Our method has been verified to work on more than **50 technological areas.**

If GetFocus and our method had been around in the past, one could have known that:

- Lithium-ion batteries would eventually become cheaper than combustion engines for vehicles by 1995,
- Digital photography would disrupt film by 1975.
- SSDs would become cheaper than HDDs by the early '80s

If you'd like to see the full data set of this report or discuss a technology you'd like us to analyse, please contact us via :

www.getfocus.eu contact@getfocus.eu

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“In **one week with GetFocus**, we gained more technology insights than we previously could in 9 months”