



2022 STATE OF THE INDUSTRY REPORT

# Fermentation:

Meat, seafood, eggs, and dairy



# Executive summary

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The global fermentation industry focused on animal-free alternatives to conventional proteins continued to break new ground in 2022. Scientific advances, new products and prototypes, manufacturing facilities, and partnerships brought the world more meat, seafood, eggs, and dairy made via microorganisms—a nature-inspired technology primed to transform the future of food.

## Commercial landscape

### New industry associations.

A group of 12 companies and two nonprofits cofounded the new **Fungi Protein Association**, a milestone for the industry in advancing fair policies and consumer research.

In early 2023, nine precision fermentation companies cofounded the **Precision Fermentation Alliance**, which will focus on regulatory engagement and consumer messaging.

### Known companies.

The number of companies focused on fermentation for alternative proteins rose to 136, an increase of 12% over the number of known companies in 2021.

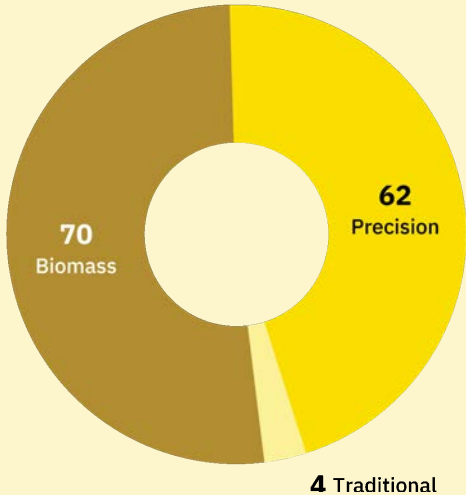
### Business lines.

At least 100 additional companies have a business line in alternative protein fermentation, including major food companies such as **Nestlé**, **Unilever**, and **Bel Group**.

### Partnerships and capacity building.

In 2022, 21 new partnerships focused on end products and bioprocess scaling. Two startups launched to focus on building contract manufacturing facilities specifically for precision fermentation for alt proteins. BioP2P and Capacitor established open-access resources for capacity planning in biomanufacturing.

**Figure 1: Total number of fermentation companies by category**





## Products

In 2022, companies applied fermentation technology to develop end products and ingredients to enhance plant-based products across categories:

### Significant expansion in dairy.

A number of companies used **Perfect Day's** whey protein from fermentation to launch a range of new products, from animal-free milk and ice cream to chocolate and protein powder.

### Eggs.

**The EVERY Company** continued their focus on precision fermentation egg proteins in 2022, partnering with brands to launch macarons and a line of hard juices featuring animal-free egg protein.

### Meat.

New fermentation-enabled meat products, including breakfast sausage, steak, bacon, and deli meats, launched in 2022.

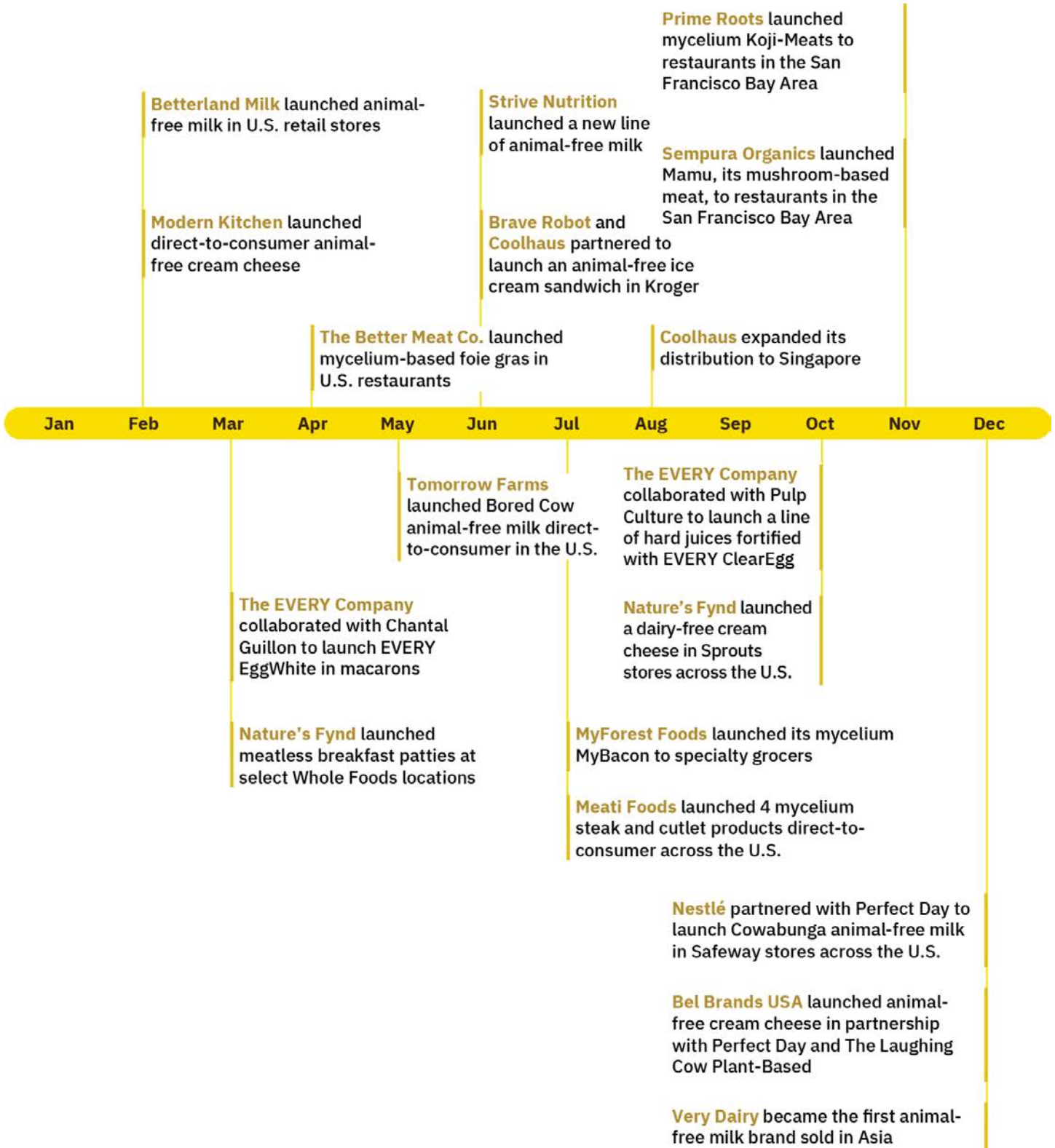
### Product prototypes.

**Aqua Cultured Foods** created a mycoprotein calamari, **Bosque Foods** showcased mycelium-based pork and chicken fillets, and **Mycorena** developed a mycoprotein-based butter.



Photo: Perfect Day

**Figure 2: Fermentation product launches in 2022**



# Investments

Fermentation companies raised \$842 million in 2022, a year-over-year deceleration mirroring similar trends across markets amid challenging macroeconomic conditions and other global factors. Still, investments in 2022 represented almost a quarter of all-time funding, and funding grew in APAC (by 67%), Europe (37%), and the Middle East & Africa (26x). Additionally, the number of unique investors in fermentation grew by 38 percent to 713 investors, a trend likely to continue in 2023 given investors' growing interest in the microbial fermentation market opportunity and environmental, social, and governance-aligned investment.

**Table 1: Invested capital in fermentation**

Category	2022	2013–2022	Highlights
<b>Total invested capital</b>	\$842 MM	\$3.69B	From 2013 to 2022, investments in fermentation-derived proteins tripled on average annually.
<b>Invested capital deal count</b>	89	301	2022's largest investment was \$150MM (Meati Foods).
<b>Unique investors</b>	196 new	713	The number of new, unique investors grew by 38% in 2022.
<b>Growth-stage fundraising (Series B and above)</b>	5	23	2022 fermentation industry growth-stage fundraising totaled \$398MM.
<b>Liquidity events</b>	\$0	\$1.50B	While no liquidity events occurred in 2022, plant molecular farming company Moolec Science went public via a special purpose acquisition company (SPAC) and began trading on the NASDAQ on January 3, 2023.

# Science and technology

## Research and development

- The **DSMZ culture collection** published Mediadive, an open-source database to help researchers bioprospect novel strains for use in microbial fermentation.
- Startup **Shiru** pioneered the use of AI and machine learning to aid development of animal-free egg prototypes.
- **Aqua Cultured Foods**, who produce seafood alternatives, doubled their production output through bioprocess improvements.

## Environmental and social impact

- Six different teams of researchers published findings on using side streams as feedstock for microbial fermentation, further documenting alternative proteins' role in circular economies.
- Researchers found that replacing just 20% of per-capita beef consumption with microbial protein from sugar-fed fermentation by 2050 would be sufficient to reduce deforestation and related emissions by 50 percent.

# Government and regulation

## Investments and funding

- Europe funneled more than \$155 million into cellular agriculture research and commercialization, including microbial fermentation and cultivated foods. The Netherlands announced a record-breaking \$65 million investment in cell agriculture and the completion of one of the world's largest protein facilities, supported by public and private funding.
- The United States supported cellular agriculture at the federal and state levels, including \$5.5 million for alt protein research through USDA and a state-level tax credit to support **Perfect Day's** construction of a precision fermentation facility in Salt Lake City from the Utah Governor's Office of Economic Opportunity.
- The UAE supported the construction of a precision fermentation facility in Abu Dhabi, to be operated by U.S.-based **Change Foods**. The facility will create casein, the key protein in cheese, using 1/10th of the water and 1/5th of the energy required by conventional dairy production.
- The Israel Innovation Authority issued a NIS 50 million (\$14.4MM) request for proposals for precision fermentation infrastructure, designed to enable multiple companies to share R&D facilities.