

## A Culture of Success

### Emerging Trends in Cell Technology

The ability to facilitate the growth and expansion of mammalian cells *in vitro* has been at the backbone of a wave of therapeutic innovations in the biotech space. Increasingly the know-how, materials, and equipment to harness cells as factories to produce complex proteins for therapeutic uses is being directed toward consumer applications.

As an example, cultured meat is manufactured for human consumption by growing animal cells *in vitro*. In 2023, the FDA and USDA approved [Upside Foods'](#) and [Good Meat's](#) cultivated chicken for commercial production and sale. A key challenge for the next stage of this and other emerging technologies (e.g., VitroLab's lab-grown leather, Biomilk's cultured breast milk) is to bring down costs and make it viable for mass-production.

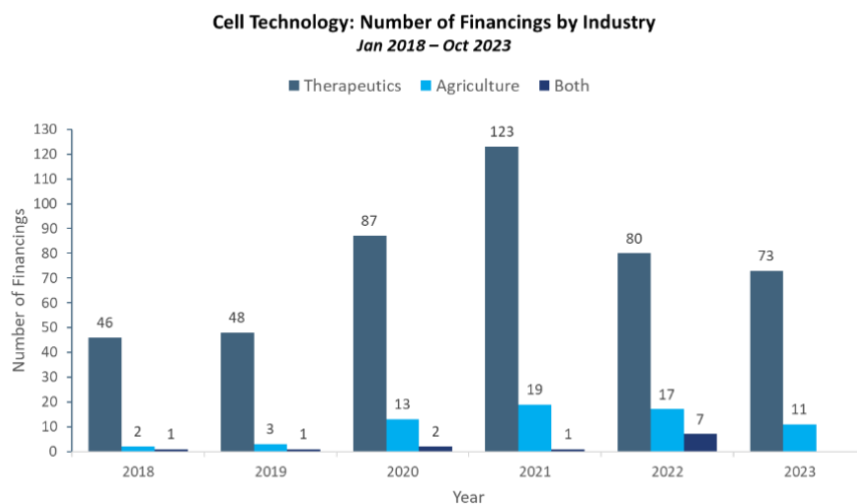
While a more established technologies, the propagation and growth of cells as medicine faces its own manufacturing challenges as demand is outpacing capacity. Significant innovation is occurring to streamline and scale cell processes for timely and cost-effective manufacturing. Given the critical nature of production and scale to both medical and consumer applications, Back Bay Life Science Advisors assessed the financing landscape for cell culture technologies across these business models.

**Venture financing volume for cell agriculture technologies has increased, with more emerging companies developing across both therapeutics and agriculture.**

Investment in cell agriculture technology (i.e., cultured meat and related manufacturing) was sparse prior to 2020, with 16x less investment volume than in the therapeutics space. However, 2020 was a watershed year in the field with several notable technological and regulatory advancements. Mosa Meat announced they were able to significantly [reduce the cost of their cell-culture medium](#) by successfully developing animal-free media. The Cultivated Meat Modeling Consortium [developed a proof-of-concept model](#) for large-scale cultured meat manufacturing. Alongside progress in scaffold technologies, Nature published a notable research article on soy protein scaffolds (Ben-Arye et al, 2020) which provide support for cells while mimicking the extracellular matrix of tissues. Singapore

was the [first country to grant regulatory approval for cultured meat](#) in 2020. As a result, from 2020 onwards, investment volume in cell therapeutic technology was therefore only 5-7x higher (Figure 1), highlighting cultured meat as an area of high growth. Nevertheless, venture financing volume across both industries decreased in 2022 relative to 2021 similar to macro trends observed within life sciences.

Figure 1 – Number of venture financings (Series A – Series D) for cell technology developers by industry

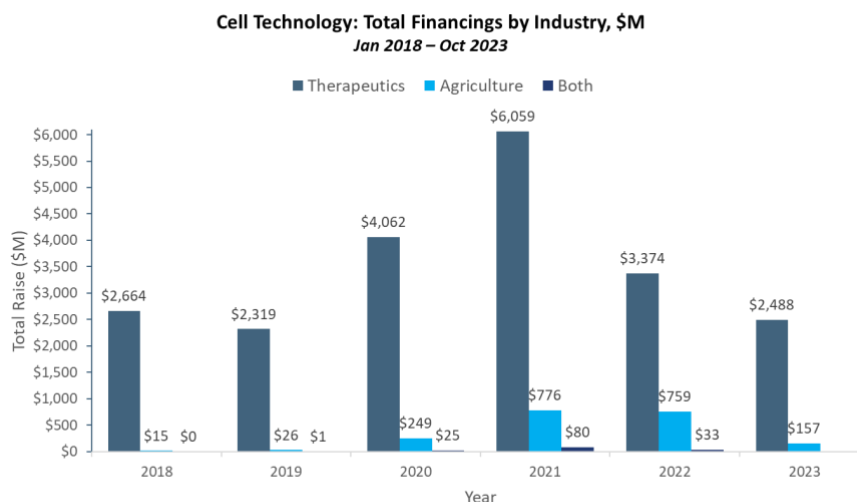


Sources: Pitchbook

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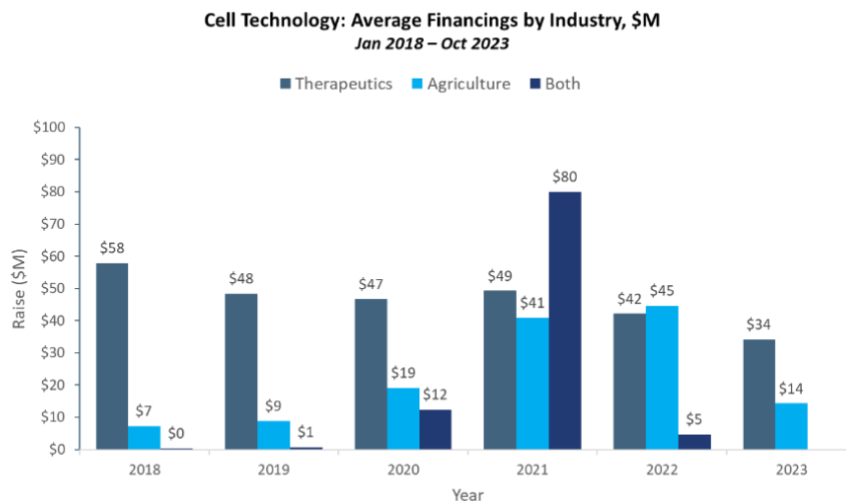
Since 2018, cell technology companies have raised upwards of \$20B in venture capital (Figure 2), with cell agriculture technology capturing ~9% of total funds. Despite the lower financing volume in cell agriculture technology, the average deal size remained similar across therapeutics and agriculture sectors in 2021 and 2022 (Figure 3).

Figure 2 – Aggregate venture financings (Series A – Series D) for cell technology developers by industry



Sources: Pitchbook

Figure 3 – Average venture financings (Series A – Series D) for cell technology developers by industry

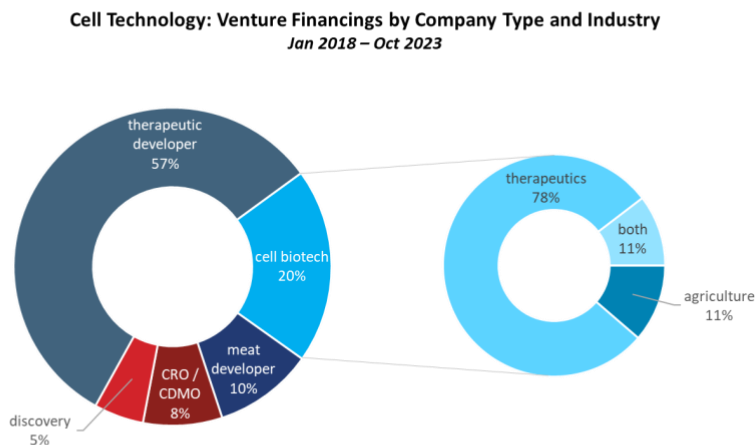


Sources: Pitchbook

Several biotechnology companies have begun to capitalize on the cell culturing technology opportunity.

The majority of financings have been for companies solely focused on therapeutics discovery, development, and manufacturing (Figure 4). VC-funded CROs and CDMOs have mostly focused on therapeutics but have an opportunity to expand into agriculture with similar cell culturing equipment and processes. Cultured meat developers captured only a small portion (~10%) of the financing landscape within the past 5 years. However, the area with significant industry overlap was with cell biotechnology companies.








Figure 4 – Venture financings (Series A – Series D) for cell technology developers by company type and industry



Sources: Pitchbook

Cell biotechnology companies focused on both therapeutics and agriculture include manufacturing process, equipment, cell line, cell culturing component, and scaffold developers (Figure 5). For example, CellRev and Unicorn are developing manufacturing technologies to streamline and scale cell culturing processes, while Core Biogenesis and Qkine have developed animal-free growth factors and cytokines to reduce the cost and variability of culture consumables.

Figure 5 – Select Cell Technology Companies within overlapping industries

Company	Ownership	Total Raised / Market Cap	Relevant Technology	Additional Details
 CELLREV	Private (UK)	\$4.21M	Cell manufacturing technology	Continuous adherent cell culture platform with proprietary cell detachment process intended for cultivated meat and cell therapy manufacturing
 unicorn	Private (UK)	\$2.50M		Bio-reactor platform enabling end-to-end automation of cell culture workflows with custom programmable protocols and scaling capabilities
 CARROUCELL <small>Labeling microcarriers</small>	Private (France)	\$1.56M	Cell culture microcarriers	Patented microcarrier solution for improved culture surface, cell harvesting, cell separation, and cell viability
 CID DaNAgreen	Private (South Korea)	\$8.45M	Cell culture 3D scaffolds	Extracellular matrix-like scaffold made of crosslinked proteins for mass production of culture meats (Protinet™-P) or clinical applications (Protinet™-S)
 CORE BIOGENESIS	Private (France)	\$14.17M	Cell culture growth factors and cytokines	<i>Camelina sativa</i> -based growth factors and cytokines intended for cellular agriculture and cell therapy manufacturing
 Qkine	Private (US)	\$7.95M		Animal-free growth factors, cytokines, and other complex proteins for emerging life science fields such as cellular agriculture and regenerative medicine
 KCELL	Private (South Korea)	\$8.60M	Cell culture media	Serum-free and chemically defined cell culture media for biopharma and cell-cultured meat industries

**Notes:**

- Data includes financings completed January 2018 – October 2023 for companies developing technology for both cellular therapeutics and cellular agriculture, excluding software
- Encompassing WW financings with disclosed deal value only

Sources: Pitchbook, company website, and press releases

Looking to capital markets, cultured meat made an appearance on the stock market with Steakholder Foods (formerly MeaTech 3D), a cultured meat developer, but the stock has not been performing well as of H2:2023. As for strategics, the transaction landscape is currently sparse but has started to include some larger partners. For example, Thermo Fisher Scientific announced a partnership with SuperMeat in 2022 to create an open-source tech platform to produce cost-effective cultivated meat.

## Outlook

Overall, cultured meat is a nascent technology, however, we expect to see continued investment in this budding industry. As therapeutic developers, manufacturers, and CDMOs are innovating emerging technologies to create streamlined and scalable cell processes, the adjacent cellular agriculture industry may continue to profit from the therapeutics industry's innovations. Cellular technology developers may decide to expand their reach by servicing both industries unlocking potential adjacent opportunities for CDMOs, equipment, manufacturing process, and cell component developers in space.