

## Cell-based (fish) meat – no longer a pie in the sky

Nobody doubts that the world's meat consumption is far from being sustainable. For many people, and also for many reasons, making do without animal protein is out of the question. For some years now, cellular-based meat production has been discussed as a potential alternative. A brief stocktaking of developments.

By Gommaar D'Hulst

Worldwide consumption and production of meat continue to surge as demand is boosted by increases in population growth, but also by urbanisation and individual economic gain. The United Nations projected in 2012 that demand for meat would augment towards 455 million metric tons by 2050, while similarly, the global demand for fish is projected to reach 140 million metric tons by 2050 – an increase by over 50 per cent from 2005. With such rapid growth, food demand may outpace production via conventional farming and aquaculture techniques, thus rendering sustainable food production methods highly desirable. Cellular agriculture denotes a method to produce food products such as meat via animal cell-based cultivation techniques and in the absence of farming or killing of animals. This technology is expected to provide an alternative “cleaner” and sustainable approach to produce meat products for food consumption.

Generating cell-based meat can be segmented into isolation and culturing of starter cell lines, tissue building and output. The primary inputs are starter cells derived from muscle stem cells or engineered cells that are isolated from a tissue sample obtained from an animal. In the initial stages, these cells are 2D-cultured in a cell culture dish and fed with the necessary nutritional inputs, such as amino acids, sugars, fats vitamins and inorganic salts. During this step, culture conditions are optimised to maximise proliferation capacity.

The next segment is bioprocessing, whereby starter cells are proliferated at large scale in bioreactors and subsequently structured via scaffolds to produce tissue-like meat structures in 3D. It is estimated that 45.2 billion starter cells need to be grown to produce a standard, daily dose of fish meat (155.5g). Therefore, optimisation of proliferation capacity (doubling time) of the starter cell lines is an essential prerequisite for time- and resource-efficient production of cell-based fish. Finally, meat can be placed on the market as finished products, like fillets or steaks, etc., or included in existing products, such as chicken or fish nuggets, burgers, etc... The generation of cell-based meat is considered to be highly disruptive in the Foodtech



A wide range of cell-based meat products are expected to hit the shelves within the next two years.

Photo: AdobeStock/tilialucida

industry and is foreseen to dramatically change the landscape of how humans view and consume meat.

Currently, roughly 80 early-phase companies exist with a primary focus on generating cell-based meat, of which 30 are directed towards cell-based seafood. A major breakthrough in the commercialisation of cell-based meat products came in late 2020, when the Singapore Food Agency (SFA) gave its seal of approval for cultivated meat products made by US firm Eat Just. It is expected that a variety of cell-based meat products will hit the shelves within the next two years as more regulatory instances green-light such products for human consumption. Nevertheless, most cellular agriculture companies are backed by private investors emphasising impact and unique intellectual property, which threatens sound, shared scientific knowledge. Few biological or engineering breakthroughs get published in open scientific journals, which dramatically delays progress in the field. Until a few years ago, biomedical funding agencies were reluctant to fund research on cell-based meat as the science was unproven and too many disciplines were

intercrossing. Luckily, non-profit organisations like the Good Food Institute and New Harvest are filling the funding gaps, and more and more governments have begun injecting cash into the field.

Clearly, cell-based meat is growing rapidly worldwide, and the technology could prove to be a more efficient, less resource-intensive method of producing fish meat. A more open approach with synergies between academia and early phase ventures is needed to drive the field forward by providing trained workforce and efficient use of basic biological or engineering knowledge.

---

**Gommaar D'Hulst** is a postdoctoral student at the Regenerative Movement Biology lab at ETH Zurich, Switzerland. He has been working in the field of muscle biology for years. His overarching goal is to bring science into practice. Hence, Gommaar has switched interests towards cellular agriculture. He wants to use his multi-year expertise to develop starter cell lines that are optimised for the generation of cell-based seafood and meat. Contact: [gommaar-dhulst@ethz.ch](mailto:gommaar-dhulst@ethz.ch)