

# **How to develop competitive meat alternatives**

**A guide for food companies**

**beyond the obvious**



# How to develop competitive meat alternatives

We know that animal farming makes our supply chains vulnerable and threatens our access to food. With innovations based on combining cellular agriculture (Such as cellular biomasses or specific ingredients produced via precision fermentation) with traditionally challenging plant-based materials, businesses can solve challenges associated with most current meat alternatives and offer an identical sensory experience to the real deal, on an industrial scale. Here's how.

In an era of accelerating food shortages and crises, greater attention is being afforded to the role that meat plays in exacerbating these problems. Generally speaking, meat production is inefficient, resource-intensive, and relies on overly centralised supply chains that are intensely vulnerable to disruption. That's to say nothing of the devastating environmental impact of meat production.

Despite these problems, meat doesn't seem to be going away any time soon. All projections anticipate global demand for meat to skyrocket in the coming years, with nearly all of that growth coming from emerging economies in Asia, the Middle East, and Latin America.

So, if we can't expect consumption or demand to fall in any meaningful way, how do we solve the problem of meat? There is no shortage of efforts. The meat alternatives market has grown exponentially in recent years, with high-profile brands and start-ups bringing Beyond Burgers and Chick'N to plates and tables around the world.

To solve the challenge we need foods that are indistinguishable from meat in every way, and produced from versatile, plant-based raw materials.

This is where the hybrid approach comes in. By this, we mean an approach that takes

these challenging plant-based raw materials, improves their performance through innovative processing, and combines them with cellular agriculture based products to unlock the complexity required to design game-changing meat alternatives. By then combining biotechnological and thermomechanical approaches to replicate the food matrices of "real" meat, we can create proof-of-concept of prototypes for tasty, identical meat alternatives, ready to be scaled up for industrial production.

Below are our scientists' five key points to consider if you want to produce the meat alternatives that consumers everywhere will love.



# 1: Opt for challenging, plant-based raw materials

**Why:** The current ingredients market for meat alternatives is dominated by a small number of crops that can only grow in limited geographic regions. Under-utilised crops such as fava beans, oats or sorghum, meanwhile, can be grown almost anywhere and offer a very high nutritional value. For food security, sustainability, and human health, we need to re-think the ingredients we are using to solve the meat challenge.

**The Challenge:** These under-utilised plant materials can provide essential nutrients, but also dietary fiber. However, getting there

is much more difficult, due to the structural characteristics of these plant materials and their incompatibility with the more “traditional” plant protein isolates used in producing meat alternatives.

**How to solve it:** A tailored approach that combines bioprocessing and thermomechanical processes, as well as a wide analytical toolkit for facilitating R&D can unlock the potential of these plant materials and enable you to produce authentic ingredients for meat alternatives.

## 2: Securing the sizzle and flavor

**Why:** If we truly want to meet the soaring demand for meat in the coming years, we'll need to do better. It's not enough for something to look like meat – we need to create a 100% identical sensory experience that meat lovers will enjoy. This means getting everything about the product perfect, right down to the “sizzle” of the marbled fat in the pan.

**The Challenge:** Viable plant-based materials do not, on their own, contain the proteins and fats that would create the tastes and textures of real meat. This continues to represent one of the most significant challenges for meat alternatives producers around the globe.

**How to solve it:** We need to know how to process the plant raw materials and how to combine them with cellular agriculture (precision fermentation) based ingredients to design delicious meat alternatives. For example, by using a host organism such as yeast, you can create fats or the essential flavor and color components of meat that completely mirror the textures, taste, and appearance of “real” meat into your product.





### 3: Producing cost-efficient ingredients for meat alternatives

**Why:** Current ingredients for meat alternatives are resource-intensive and expensive to produce. Bringing meat-free food to the masses requires producers to be able to access and synthesise raw inputs in an efficient, cost-effective, and scalable manner.

**How to solve it:** Leveraging dry fractionation and opting for a synergistic use of both dry and wet fractionation technologies, as well as the upcycling side streams such as feed stocks for cellular agriculture, can save you vast amounts of energy and water during production.

**The Challenge:** Developing a process that does not consume vast amounts of water and energy is difficult, especially when producing protein isolates by wet fractionation technologies.

## 4: Nutritional value and clean labelling should be a priority

**Why:** Meat is a cause of food crises, but it is also a major source of nutrients and calories for much of the world's population. That's why it is essential that we can create meat alternatives with high nutritional value, that can contribute to a balanced, healthy diet across the world.

**The Challenge:** Traditional plant materials are not comparable to animal sources of essential amino acids with respect to composition and bioavailability. Meanwhile, it has traditionally proved difficult to avoid using unwanted additives such as palm oil or e-numbers to create an edible and tasty product.

**How to solve it:** Bioprocessing, including traditional fermentation and germination technologies can turn plant materials into more nutritious, digestible and functional foods. Cellular agriculture-based ingredients can compliment the nutritional value and functionality of meat alternatives, right down to specific fats and proteins.





## 5: A holistic approach to the development of meat analogues is key

**Why:** Being a one-trick pony is not enough. Capturing the bigger picture is essential for long-term success.

**The challenge:** The meat alternatives market is yet to produce a product that can perfectly replace “traditional” meat. Meat comes in many forms, from whole chops to meatballs to burger patties. Getting the versatility right is key, as are the additional challenges relating to functionality, taste, texture, and clean labelling.

**How to solve it:** Mastering the development of meat alternatives is not just about getting one

technology or competence right — it depends on a range of capabilities. It starts with the selection of raw material, and depends on your ability to turn this into new ingredients via bioprocessing technologies (both enzymatic and microbial), or through the use of precision fermentation. Any missing lipids, flavours and colours can be produced separately with microbes. These ingredients can then be combined through thermomechanical or other techniques to produce novel meat alternatives with a truly holistic taste experience. Once you have this, even the most seasoned carnivore will not be able to tell it apart.



# **Our hybrid approach unlocks the potential of plants and other ingredients**

At VTT, we have gathered excellent expertise in the fields of plant-based ingredient & food design and cellular agriculture. By embracing us as a partner for change, you can develop a product and production process that will appeal to your customers, while working towards a future that is free from food crises.



# VTT's food expertise

## Diverse ingredient sources

- We have proven expertise on diverse raw material sources
- Plant-based
- Cellular agriculture
- Precision fermentation
- Side streams
- Insects

## New ingredient technologies

- Target-driven refinery concepts, relying on diverse separation technologies
- Competitive edge with ingredients produced by cell factories
- Improved performance with better functionality
- Agile development via the use of predictive tools

## Food prototyping

- Proof-of-concept through prototyping
- New technologies
- Competitive edge with hybrid solutions
- Quality improvement through bioprocessing
- Agility and added value through AI-assisted modelling and data analysis

## Process optimisation

- Improvement of taste, texture, and cooking performance
- Ensuring lasting product shelf life and process safety
- Cost-efficiency via predictive tools, modelling, and sensing solutions

VTT is a visionary research, development and innovation partner for companies and the society. We bring together people, business, science and technology to solve the biggest challenges of our time. This is how we create sustainable growth and bring exponential hope.

We are one of the leading research organisations in Europe, and we have more than 80 years of experience in cutting-edge research and science-based results. Carbon neutral solutions, sustainable products and materials and digital technologies are at the core of what we do.

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