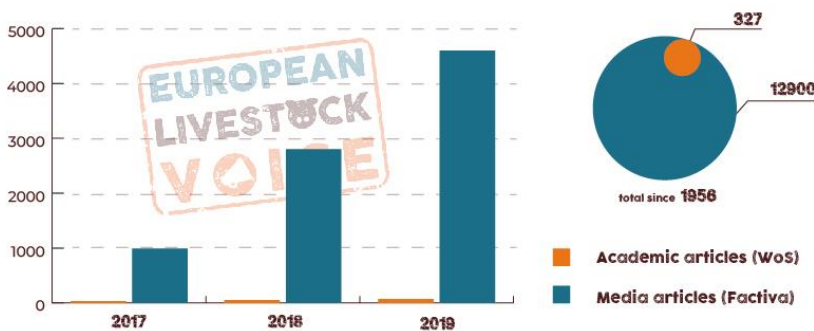


Number of academic articles (Wos) dealing with cultured meat vs. Number of articles in the media (Factiva) over recent years

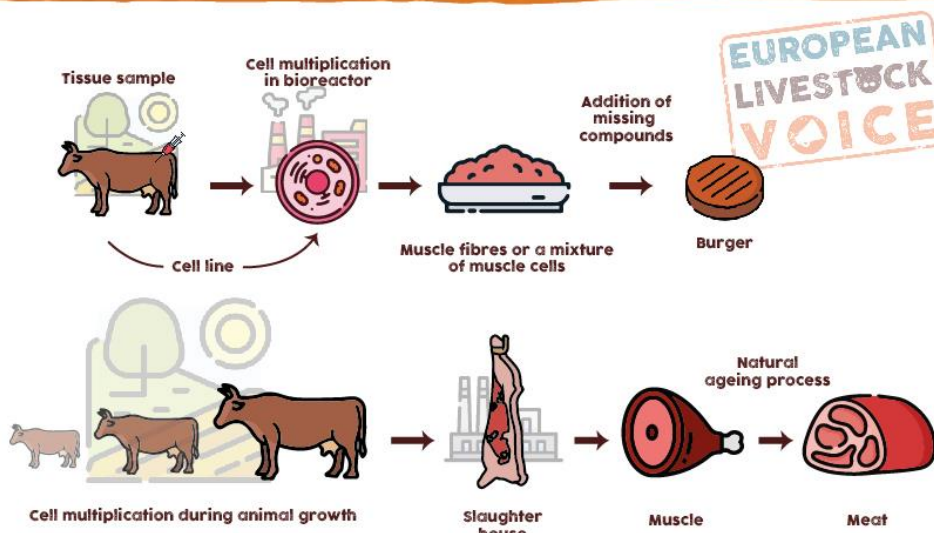


Source: Chrik, S., Ellies-Oury M.-P., Fournier D., Liu J. and Hocquette J.-F. 2020. Analysis of Scientific and Press Articles Related to Cultured Meat for a Better Understanding of Its Perception. Front. Psychol. 11:1845. doi: 10.3389/fpsyg.2020.01845

Since the launch of “Cultured Meat” a decade ago with the presentation on screens of the first “lab-grown burger”, the media interest around this agri-food technology has never waned. This to the extent that researchers have been interested in measuring this craze: in 2020 alone, more than 12,000 publications were referring to this subject! However, over the same period of time, proportionally few scientific articles dealt with the issue – around 300. A disconnection rarely observed for the academic that studied this phenomenon [“giving a biased image of the debate”](#). Media hype around

“cultured meat” has also resulted paradoxically in silencing part of the scientific debate about the real impact of this technology. A recently published [scientific review](#) provides a comprehensive overview of the actual academic knowledge around “cultured meat”. An opportunity to look at the actual state of the academic debate on the subject.

Comparison of production methods



Source: “Sghaier Chrik, Marie-Pierre Ellies-Oury, Jean-François Hocquette, is “cultured meat” a viable alternative to slaughtering animals and a good compromise between animal welfare and human expectations?, Animal Frontiers, Volume 12, Issue 1, February 2022, Pages 35-42”

Limitations related to the production process

On reading this review, it is striking to note the important limitations in the **production process** of “cultured meat”. It starts from the method that needs a biopsy of a piece of muscle from a live animal to get living **stem cells**. Consequently, as these samples have to be taken relatively regularly, this raises new ethical and welfare questions.

These cells can proliferate and then transform into different cells, such as muscle cells and fat cells. But to do that, a **culture medium** must provide nutrients, **hormones**, and **growth factors** necessary for cell proliferation and differentiation in mature tissue.

The culture medium typically used is **foetal bovine serum** taken from the foetus after slaughtering pregnant cows. Due to the **ethical questions** this practice raises, many companies have committed to substituting the foetal bovine serum with an **artificial serum**. But according to the authors of the review those **synthetic**

media have some difficulties in determining the exact concentrations of each serum component, which must be suitable and well adapted to each type of cell and its stage of development. At present time none of those synthetic medium has been presented and discussed within the scientific community.

While **synthetic hormones are necessary for the proliferation of cells**, the promoters of “cultured meat” are facing a problem in Europe: **hormones are forbidden in the Union**. This also partly explains why Singapore is, for the moment, one of the only states to have authorised the commercialisation of this technology.

“Cultured meat” producers present it as safer than conventional meat because it is produced in a fully controlled environment without any potential contamination. Hence they call it **a sterile product**, free from any health hazard. **“Lab-grown meat” is not free from contaminations**. Indeed, an issue with culturing cells is their **potential contamination by pathogenic bacteria, viruses, or fungi**. For this reason, **antibiotics and fungicide could also be needed in the culture medium**. For the authors of the review *“the lack of in-depth research related to the hazard and risk characterisation of cultured meat is considered the biggest barrier in introducing a safe product to the market”*.

Limitations related to health and taste

From a celestial perspective, natural meat is actually a complex food, more difficult to reproduce than an agglomeration of celestial and fatty tissue. According to the author of the review, it is unclear how close the levels of macronutrients and micronutrients of **“cultured meat”** are to those of traditional meat. It is likely that **“lab-grown meat”** lacks or is deficient in essential nutrients that are difficult to reproduce artificially, such as iron, zinc and vitamin B12. Any ingredient such as trace elements or **micronutrients added in vitro** will likely reduce nutritional qualities. It is not provided in its original matrix and is potentially less absorbed.

Indeed, the **artificial chemical components** of the culture medium or the biomaterials of cultured meat could have an inhibitory effect on the health benefits of some micronutrients, such as iron.

Another crucial point is that **“in vitro meat”** lacks myoglobin and pleasing aromas and flavour compounds of real meat that appear during the aging process. That is why many ingredients such as breadcrumbs, beetroot juice, saffron and egg powder have been added to mimic the **sensory quality of meat** in terms of taste and red colour. If researches are numerous, cultured meat promoters are still a long way from being able to find the diversity of meat products on the market and their grill, roast or boil properties. That is why the main products presented are still only minced meat copies such as “burgers” or “nuggets”.

Limitations related to initial sustainable claims

Contrary to what its advocates say, “cultured meat” **sustainability claims** are questioned. Reducing **methane emissions** is presented as one of the “cultured meat’s” most important potential benefits. According to academics, the comparison between the **environmental impacts** of cultured and conventional meats is incomplete and sometimes biased. Firstly, because there are still only few real “cultured meat” installations on which to base studies, and secondly, because of the way in which emissions from livestock farming can be compared with emissions from “cultured meat” plants. [A recent study](#) concluded that **global warming** would be less with “cultured meat” than with cattle in the short term, but that in the long term, “cultured meat” would be more harmful, as methane accumulates less time in the atmosphere than **CO2 produced by lab grown meat factories**.

The **bioreactors** in which cells proliferate are, in fact, very energy intensive, with **high emissions of CO2**. Regarding water, the consumption is very similar since it is now clarified that to produce 1 kg of beef, 550 litres of freshwater are required on average. In contrast, 459 litres are needed per kilogram of pork and 313 litres per kilogram of chicken. **“Lab-grown meat”** consumes about 367 to 521 litres per kilogram, so the **water footprint** is practically the same.

Regarding **land use**, the fact that “cultured meat” needs less land than conventional meat is also not an advantage. Livestock farming plays a key role by valorising flows of non-consumable plant biomass, producing **high nutritional value feed** from them then transformed into high quality proteins for humans, and maintaining **soil’s carbon** content and fertility. **Manure** from livestock is a source of organic matter, nitrogen, and phosphorus, working as a **natural fertiliser key to reduce synthetic fertilizer uses**.

If livestock were replaced by “**artificial meat**”, some ecosystem services would be lost, and the production of by-products from farm animals useful in feed, health, fashion, pharmaceuticals and cosmetics, and the production of bioenergy. Not to mention the families that depend on livestock for survival, particularly in developing countries and that still represents 45% of EU agriculture. Like any technology, “cultured meat” will be subject to intellectual property rights, as opposed to an open system like our European family farming model.

The need for a debate based on facts rather than marketing

“Cultured meat” is a subject that rightly interests people and innovations are numerous in this field. However, this should be done on a rational basis and in a fair manner. In this respect, talking about “meat” is already a problem in itself for agronomists, as tissue replication does not technically make “meat”. On the other hand, there is still a lack of studies on the subject at all levels – health, environmental and technical. In the end, the promotion of these alternatives by large groups, start-ups or NGOs should not be done by a marketing of opposition to livestock but by promoting the real advantages of the products they tend to promote!