Lab-grown meat

A questionable solution

Meat cells grown in bioreactors are intended to offer an alternative to industrial livestock farming and significantly reduce the environmental impact. Companies have raised large sums in venture capital to drive development forward and bring the product to market

Andrea Beste *explains why she does not consider this to be a solution.*

One thing is clear: industrial livestock farming can no longer be sustained in its current form – it pollutes water, soil and air, and generates a high proportion of greenhouse greenhouse gases, exacerbates deforestation in the countries where animal feed is sourced, and leads to ever-increasing levels of antibiotic residues and antibiotic-resistant bacteria in meat. Lab-grown meat – referred to by its advocates as 'cultivated meat' – has been touted and hyped for years as a solution to our meat consumption, with alleged environmental benefits. This is a lofty claim and, in all likelihood, a false hope.

Lab-grown meat consists of artificial muscle or fat cells that are grown in a laboratory. The starting point is stem cells, which are obtained via biopsy from live animals – or, in the case of poultry, from freshly fertilised eggs. They are grown through cell division in bioreactors in a nutrient solution. To accelerate growth, foetal calf serum is usually used, as it contains the necessary growth factors. This is extracted from the hearts of unborn calves following the slaughter of pregnant cows. Alternatives are still only at the trial stage. [1] Ideal conditions for growth must be created in the bioreactor. Of particular importance are sterility, oxygen content and temperature. So far, such bioreactors have only been used sporadically in pilot projects and are not designed for mass production. [1] There are products on the market, such as chicken nuggets from GoodMeat, though these are currently only available in the USA and Singapore, and even there only very sporadically. In the EU, only two applications for novel food authorisation have been submitted to the European Food Safety Authority (EFSA) to date: one in 2024 for cultured foie gras from Gourmey and another in early 2025 for cell-cultured fat from Mosa Meat. According to the Good Food Institute Europe, 155 companies worldwide are working on lab-grown meat and have so far raised around three billion US dollars in venture capital to fund their research. [2] The industry promotes its model on the grounds that it prevents animal suffering and drastically reduces the environmental impact of livestock farming. However, this overlooks the ecosystem services provided by ruminants, which are lacking in meat produced in bioreactors. Nor is the environmental footprint of such meat as favourable as is often claimed.

What the bioreactor cannot do

A cow grazing in a pasture stimulates grass growth through grazing, thereby maintaining the grassland. Globally, grassland stores 34 per cent of organic carbon and is therefore highly significant for the climate. [3] The animals' dung not only supports humus formation and thus soil life; long-term experiments show that grazing animals bring greater biodiversity to cultivated landscapes. [4] A single three-day-old cowpat can be home to up to 4,000 insects, for which the dung serves as a food source. [5] Simply doing away with cows and replacing them with lab-grown meat and milk will therefore only disrupt natural cycles. Nor are the claims regarding the high water consumption of cattle farming tenable, as they include the rain that falls on grassland. Yet this rain is not consumed – on the contrary: it replenishes groundwater and drinking water.

Ruminants such as cattle, cows, sheep and goats can be reared on pastures and grasslands that cannot be used as arable land, thereby contributing to the sustainable use of land for food production. This currently accounts for 40 per cent of global

Cattle on pasture provide ecosystem services, which lab-grown meat cannot provide.

land use area. The positive effects of grassland on CO_2 sequestration – and thus climate protection – as well as on biodiversity, water retention, flood protection and freshwater recharge are not taken into account in almost all standard climate models, nor are they considered when comparing grassland with meat substitutes. This criticism is also shared by the German Association for the Environment and Nature Conservation (BUND) in its publication 'False Hopes, Wasted Opportunities'. [6]

Friends of the Earth USA published a report as early as 2018 that takes a direct stand against lab-grown meat technology.

Instead, they call for greater support for scientific research into organic farming and agroecology, the two proven alternatives to industrial livestock farming. [7] In its latest expert report on alternative proteins from 2025, the Scientific Advisory Board for Agricultural Policy, Nutrition and Consumer Health (WBAE) states: "Increased consumption of alternative products, in conjunction with the decline in livestock farming, may also be associated with negative environmental effects in relation to grassland use". [8]

Problem for soil fertility

In organic farming – which, due to its numerous benefits for the environment and society, is regarded as the agricultural system of the future – there is already a problem today in that there is too little high-quality organic fertiliser available. A further decline in the number of livestock farms would therefore pose a serious problem for soil fertility and productivity. [9] Life cycle assessments for lab-grown meat are largely based on assumptions regarding technical developments, as there is as yet no production on an industrial scale. Several studies commissioned by manufacturers have produced very positive results for lab-grown meat, but these rarely take the entire system into account. [10] However, there are also life cycle assessments that take a critical view of the energy consumption involved in lab-grown meat production in particular. For instance, Risner et al. concluded at the end of 2024:

"Our results suggest that, from an environmental perspective, cultured meat may not perform any better than traditional meat production." Energy consumption was found to be four to 25 times higher than for conventionally produced beef. [11] Sinke et al. published an early 2023 a life-cycle assessment that rated lab-grown meat positively, though it only saw an advantage in terms of greenhouse gas emissions if renewable energy were used. [12] Earlier studies had already highlighted the high energy requirements, particularly for the culture medium. Mattick et al. concluded in 2015 that 100 grams of pork has only about half the carbon footprint of the same amount of lab-grown meat. The production of real chicken meat emits as much as 60 per cent less CO_2. [13] Lab-grown meat also performs worse in comparison with plant-based alternatives and insect-based meat substitutes.

[14] However, previous comparisons have not taken particularly sustainable livestock farming systems into account at all. The Federal Environment Agency notes that lab-grown beef consumes 35 per cent more energy than conventional beef – and that is without even considering organic beef. [15] In its latest report, the WBAE also considers greater efforts towards environmental assessment to be necessary. [8]

Where do the volumes come from?

The producers of lab-grown meat hope that upscaling – that is, the construction of large, automated facilities – will help to reduce costs. However, replacing even a small proportion of global animal protein consumption with lab-grown alternatives is utopian. In 2018, 320 million tonnes were consumed worldwide, and the trend is set to continue rising. [16] By 2030, this figure is expected to reach 400 million tonnes annually. To produce one-tenth of this – 40 million tonnes – as lab-grown meat, bioreactors worth 1.8 trillion dollars would need to be built, each with a capacity of two million litres. [17] However, research is still a long way from facilities on this scale. The largest ▷

PHOTO: Being Organic in the EU

bioreactors currently being planned have a capacity of 250,000 litres. A factory with ten such reactors is expected to produce 13,000 tonnes of meat per year. [18]

Food safety? Yes and no ...

The larger the bioreactors become, the less likely it is that they will be able to meet a crucial requirement: namely, to be completely sterile. The production of artificial cells must take place in a sterile environment. This is because bacteria multiply significantly faster than meat or milk cells and can contaminate entire bioreactors. No artificial technosphere can ever come close to matching the natural balance of microbial regulation. A sterile environment is therefore highly susceptible to one-sided bacterial infestations. [19] The journalist Joe Fassler concludes in a comprehensive investigation that this makes the large-scale production of in vitro meat impossible. [20] In a report on the food safety of cell-based foods, the Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO) also highlight microbial contamination as a major risk. [21]
Hormones and antibiotics added to lab-grown meat to accelerate cell growth and protect against contamination can have harmful effects on the human body. Furthermore, it is not yet clear to what extent products from the laboratory will be processed. It is known that highly processed foods reduce microbial diversity in our gut and are thus directly linked to the development of chronic inflammatory diseases. On average, Europeans already have a significantly poorer microbiome than isolated populations. [22] To stay healthy, we must therefore return to fresh and unprocessed foods, rather than processing them to an ever-greater extent.

Conclusion

'An opportunity for organic farming' – as Robin Rader writes in ÖKOLOGIE & LANDBAU 2/25 – is certainly not lab-grown meat, because the production of organic food is explicitly about naturalness and authenticity. This means that with every unnecessary step in food processing, organic farming moves further away from its principles. Incidentally, this also applies to highly processed vegan foods. Ultimately, the solution to the problems in our food system lies in: greater colourful, vegetarian and flexitarian diversity from the soil, forests, fields – and grassland; land-based livestock farming that does not harm the climate, and the use of the whole animal rather than just the prime cuts; diverse, resilient agricultural networks prevent future crises and keep nature – and us humans – healthy. We must invest in and promote these systems, not in 'techno-fixes' that promise ten times more than they deliver! □

▷ List of references: **oekologie-landbau.de/materialien**

Dr Andrea Beste, gesunde-erde.net
gesunde-erde@posteo.de