CELLSTOCK VS LIVESTOCK

Lab-grown meat is a disruptive innovation that could help resolve sustainability and health issues related to livestock, as well as reduce the numbers of animals farmed. But the sustainability gains do not yet match expectations.

Cell-based (or "cultured" or "cellular") meat is an emerging technology that takes certain types of cells from animal muscle and cultures them in the lab. Fed with the right mix of ingredients, these cells grow and multiply to produce meat. This avoids the hassle, and the ethical concerns, of raising or hunting animals to kill them.

Its proponents say that cultured meat can fulfil the rising global demand for meat, and that it is healthier and more sustainable than livestock raising, as well as being better for animal welfare. The first studies supported such claims. Compared to conventional meat production in Europe, cultured meat was found to use 7–45 percent less energy, emit 78–96 percent less greenhouse gas, and use 99 percent less land and 82–96 percent less water. Although muscle taken from animals would still be required, far fewer livestock would have to be slaughtered, with consequent gains for animal welfare. And advocates have claimed that the final product is safer than conventional meat: a fully controlled lab environment would reduce the risk of food-borne diseases and eliminate the need for antibiotics.

But these purported benefits may be exaggerated. More recent studies show that producing cell-based meat is very energy-intensive. Taking the whole product life cycle into account, the energy demand is far higher than that of conventional meat production. Depending on the energy source, culturing meat may emit even more greenhouse gases than raising animals does. Livestock emit methane, a potent greenhouse gas, but one that does not stay in the atmosphere for a long time. Cell culture, on the other hand, produces carbon dioxide, which persists for hundreds of years. That makes any potential emissions advantage of cultured meat unclear.

Another potential problem is pathogens. These might not be eliminated by lab-grown meat, but may simply change in nature. Keeping out contamination may prove a problem when manufacturing is moved to factory scale.

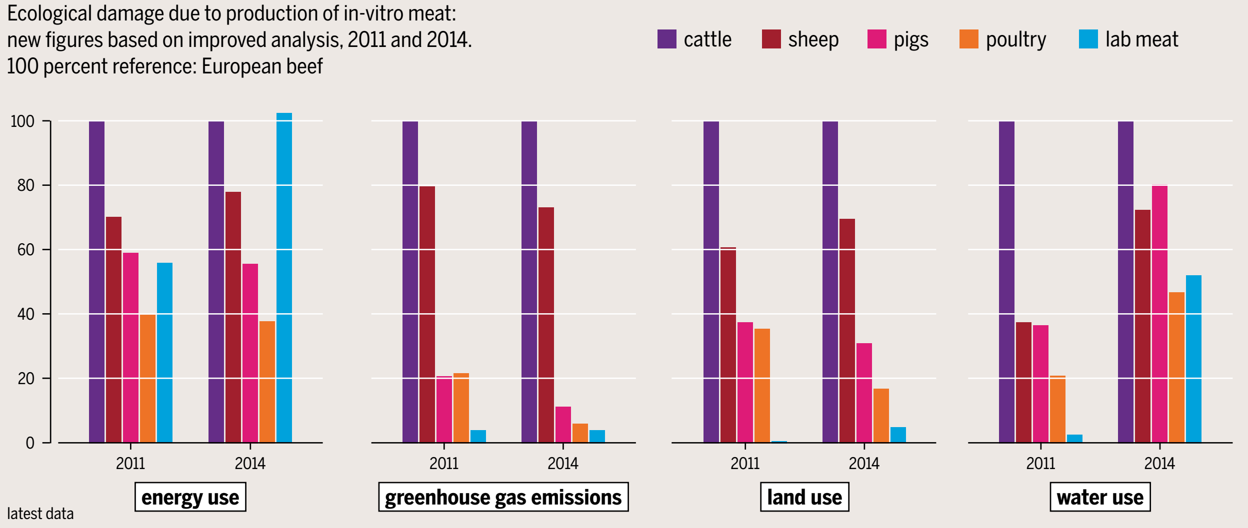
If cultured cells are to proliferate and create the muscle mass that an animal builds over years, they must be stimulated with growth factors. These include sex hormones. No limit currently exists for such hormones in cellular-based meat, but the European Union has prohibited their use in conventional meat production since 1981 due to their human health risks. And no method has yet been developed to ensure that cellular meat contains crucial micronutrients, such as vitamin B12 and iron, that are specific to animal products.

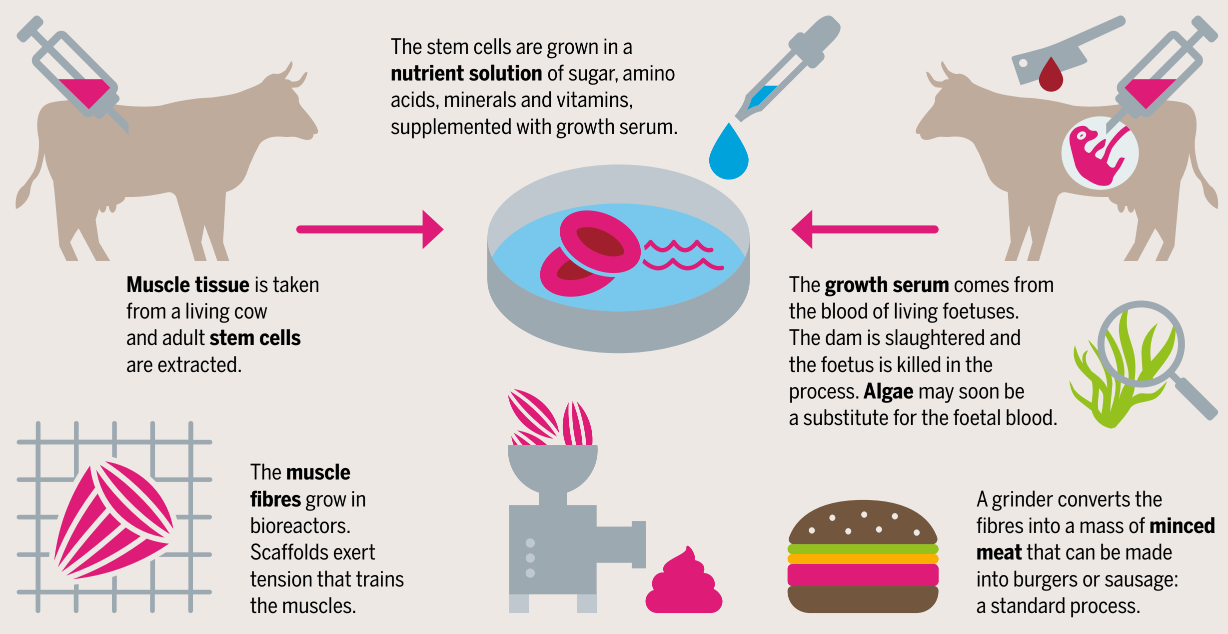
A rapid shift from conventional to cell-based meat seems improbable in the near future. Unlike livestock farming, cell-based meat requires a lot of expensive new investment. Industry projections assume price parity between conventional and cell-based meat by the early 2030s – but this appears optimistic. The same projections assume that the overall market for meat alternatives is growing fast. But even by 2035, cell-based meat is projected to add just

Contrary to previous assumptions, producing lab-grown meat takes a lot more energy than conventional meat. The figures for water use have also been revised upwards

PROGRESS BUT QUESTION MARKS

Ecological damage due to production of in-vitro meat: new figures based on improved analysis, 2011 and 2014. 100 percent reference: European beef





BURGERS FROM THE PETRI DISH
Production of in-vitro meat, simplified

6 million tonnes to the 97 million tonnes of all meat alternatives – though its share will grow rapidly after that. While some analysts expect the market for cultured meat to approach 100 billion US dollars by 2030, their figures are based on assumptions such as dramatically reduced costs, increased scale of production, and broader consumer acceptance. Even some of the most optimistic forecasters do not expect lab-grown alternatives to be comparable to meat in taste, texture and price until 2032.

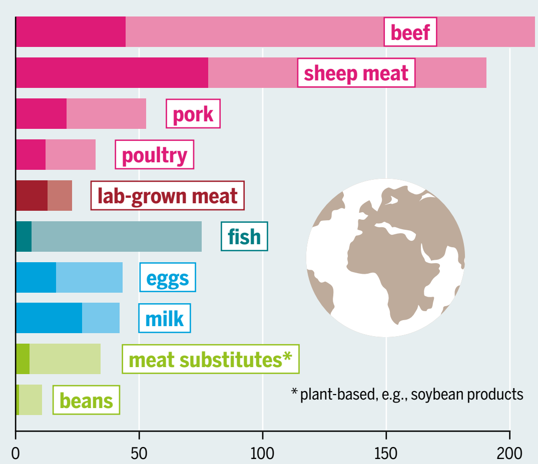
Depending on how much of the market they capture, meat alternatives will affect various aspects of the livestock industry: economics, market dominance, employment and ecology. Cell-based meats are capital-intensive, so may become highly concentrated in the hands of a few large investors. These fundings have totalled more than $1 billion since 2013. Current investors in cell-based meat start-ups include some of the world's biggest meat processors and animal-feed firms, such as Tyson and Cargill. They also include billionaires such as Bill Gates (Microsoft), Sergey Brin (Google) and Li Ka-shing (CK Hutchison, a Hong Kong conglomerate).

If the market share of meat alternatives increases steadily over the next two or three decades, it could lead to a significant overhaul of employment in food production: from a system primarily dependent on farmers, farm workers, meat processors and veterinarians to one based on chemists, cell biologists, engineers, and factory and warehouse workers. Although farmers and farm workers would still be needed to produce raw ingredients or inputs for meat alternatives, a decline in livestock production could lead to massive job losses in livestock farming and meat processing. It is unclear how many new jobs would be created by lab-grown meat industries.

From an ecological point of view, extensive and sustainable livestock farming maintains landscapes, conserves biomes and protects agrobiodiversity. Advocates of lab-grown meat promote the idea that people necessarily damage nature. But livestock play an important role in agroecological practices that protect ecosystems and livelihoods. ●

Maybe lab meat can function without having to kill any animals. A problem remains: the melding of biotechnology and gene technology

BIOTECH AGAINST GLOBAL WARMING
Range of climate impacts caused by food production, kilograms of carbon dioxide equivalent per kilogram of protein



In-vitro meat tends to have a smaller carbon dioxide footprint than the average for conventional meat. Only beans produce less CO_2 at the high end of estimates