

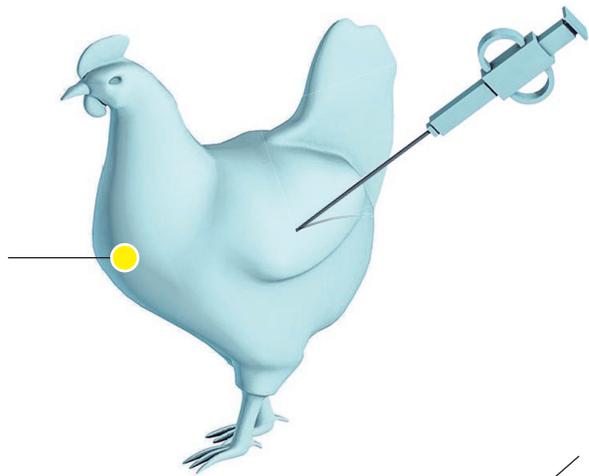
The case for alternative proteins

Singapore has become the world's first country to approve the sale of a cultured meat product – chicken bites by Californian start-up Eat Just. But unlike meat from farm-raised animals, cultured meat products will not involve the slaughter of the animals. **AUDREY TAN, LEE HUP KHENG** and **LIM KAILI** take a look at the general process of culturing meat.

PROCESS

1 SOURCING CELLS

- Cells are sourced from the animal and screened for diseases.
- Depending on the final product, different types of cells can be selected for culture, for example, muscle cells or fat cells.
- The cells are taken without slaughtering the animal. Methods include performing a biopsy, or getting cells from an established animal cell bank.



2 GROWING THE CELLS

- Cells are placed in a nutrient broth in culture and scaled up in a bioreactor, which mimics conditions similar to what is inside the body of an animal.
- The nutrient broth contains a mix of nutrients such as proteins, sugars and salts. No synthetic hormones are used, unlike other conventional livestock rearing, which may use substances that make the animal grow faster.
- Immersed in the nutrient broth under ideal conditions, the cells start to multiply.
- Eat Just now produces chicken cells with a low level of bovine serum, which is commonly used as a growth supplement. This is largely removed during harvesting.
- The company has developed an animal-free recipe and aims to replace the serum with this recipe.

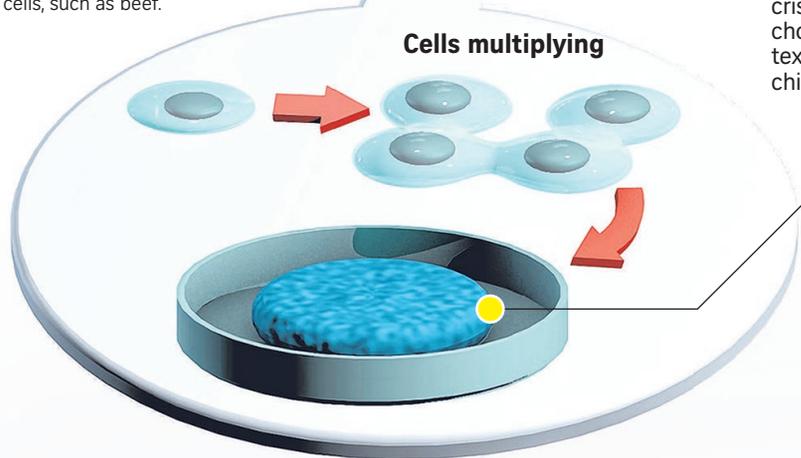
3 HARVESTING THE CELLS

- Once the animal cells achieve a sufficient density within the bioreactor, they are harvested.
- Eat Just says its chicken cells are harvested after being cultured for up to seven days in the bioreactor.
- Then, the harvested product can be used by chefs in multiple final formats, from less structured crispy chicken bites, savoury chorizo and sausages, to more textured products such as grilled chicken breast.

Bioreactor

Cells multiplying

NOTE: The company says this process can also be used to grow other meat cells, such as beef.



Chickens slaughtered for food every year

60b

World population

7.5b 2017

Almost 10b 2050 (projected)

Livestock sector
Responsible for **about 14.5%** of total greenhouse gas emissions from human activity.

Food production
The United Nations projects that this needs to go up by some **70%** between 2005 and 2050 to feed the growing population.

Meat consumption
In developing countries, it is expected to account for **82%** of projected global growth in the next decade.

PROS

- ✓ **Improving food security**
 - Eat Just plans to manufacture its chicken cells in Singapore, reducing the need to import chicken.
- ✓ **Sustainable**
 - Culturing meat requires a smaller land area for production and manufacture, reducing emissions from transport.
 - Less emissions from clearing forests to rear livestock or grow crops to feed them.
- ✓ **Reducing factory farming**
 - Reduces the threat of diseases spreading from animals to humans.
 - Reduces antibiotic resistance.
- ✓ **Ethical**
 - No need to slaughter animals for meat.

CONS

- ✗ **Energy intensity**
 - Culturing cells may require more energy than traditional farming. More studies are needed to determine if overall emissions from culturing meat are lower than from traditional farming.
- ✗ **'Ick' factor**
 - Some consumers may be hesitant about trying out a product made with new technology.
- ✗ **Expensive**
 - But costs will come down when production is scaled up, says Eat Just.
- ✗ **Implications for animal farmers**
 - The growth of the cultured meat sector may cause farmers in rural communities to lose their jobs.



A facility where meat is made without slaughter, with large glass walls where people can come see their meat being made.

NOTE: The future farm illustration is purely conceptual.



A fillet of lab-grown cultured chicken developed by Eat Just.

CELL PROPAGATION

Cells are sequentially expanded into progressively larger vessels

