

## Can the clean meat revolution address agriculture's ecological challenges?

For a cutting-edge biotechnology, cellular agriculture is actually a fairly straightforward process. It begins with stem cells, usually harvested from live animals via biopsy. The cells are placed in a bioreactor – a temperature- and pressure-controlled aseptic steel vat filled with a nutrient-dense growth medium that is basically a broth of sugars and proteins. Under these conditions, the cells proliferate and differentiate to form tissue.

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The potential benefits of this technology are manifold. Most analyses of these processes suggest they would use far less land and water, and have a smaller carbon footprint, than beef and dairy. If powered with clean energy – a big but not implausible if – they could have less environmental impact than chicken and pork. It would prevent the torture and killing of billions of creatures every year, and also greatly reduce the risk of diseases spreading from animals to humans.

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But if cellular agriculture is going to improve on the system it is displacing, then the critics are right: it needs to grow in a way that doesn't externalise the real costs of production on to workers, consumers and the environment.

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