

Changing the Future of Food with Cell-Cultured Meat

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Abstract

The challenges to ending hunger, food insecurity and all forms of malnutrition keep growing. The global population, 8 billion today, is expected to surpass 9 billion by 2050. There will be an increased demand for protein-rich food such as meat and fish, not only due to the growing population, but also due to the rising middle class in developing countries. This is a great challenge since resources and arable land are limited, while meat production is known to negatively effecting the environment (including greenhouse emissions, water use and destruction of natural habitats). One of the ways of mitigating the negative effects while meeting the dietary requirements of the population, is cellular agriculture. This is an emerging branch of biotechnology that aims to address issues associated with the environmental impact, animal welfare and sustainability challenges of conventional animal farming for meat production. Cell-cultured meat is produced directly from cell cultures instead of whole organisms or animals. While whole-cell microbial production of food protein (single cell or mycoprotein) is well established, the growth and morphogenesis of the cells to make tissue-like materials is a developing field. Biofabrication can be employed to produce sheets of fungal mycelium with a fibrillary network structure. This paper reviews the cellular agriculture approach to producing meat alternatives based on scientific literature published during the last decade with a special focus on the potential of cell-based hybrid products in producing novel sustainable foods for the future. It is evident from the literature that cellular agriculture is a rapidly developing field with an increasing number of startup companies and universities becoming involved. However, there are major challenges with upscaling, reducing the cost involved in the production of cell-cultured meat and establishing legal frameworks. Fungi, mycelia in particular, have the potential to add value to plant-based and cell-based hybrid products creating the desired sensory and nutritional profiles at an affordable cost.