Microfluidics: Revolutionizing Sustainable Lab Grown Meat

- Utilizes microfluidic technology in bioreactors to mimic animal muscle cells closely (Godfray et al., 2018).
- Improves texture and nutritional value of lab-grown meat.
- Reduces environmental impacts of traditional lab meat production (Smetana et al., 2023).
- Eliminates ethical concerns related to animal slaughter.
- Offers a scalable, efficient, and customizable production method.
- Meets global demand for sustainable dietary options.

Microfluidic Channels & the Cultivation of Lab Grown Meat

- Cells suspended in nutrient-rich medium are encapsulated into droplets (Figure 1) using microfluidic channels (Hinton et al., 2015).

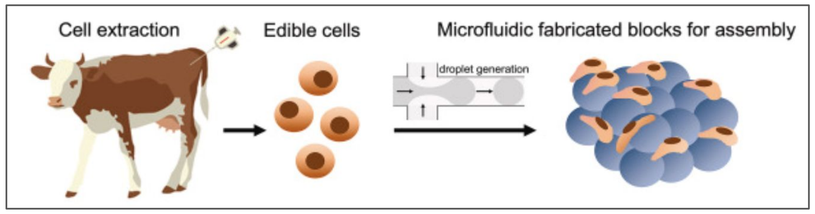


Figure 1. Application of microfluidics and droplet generation in fabricating tissues with well-designed internal structures. (Li et al., 2022).

- These are then deposited onto a scaffold and the tissues are matured in a bioreactor (Figure 2) - crucial for achieving desired texture, composition, and functionality (Shamloo et al., 2022).

- **Precision:** Controls temperature, pH, and nutrients.
- **Reduced Shear Stress:** Maintains cell integrity.
- **Scalability:** Allows for easy monitoring and flexibility.
- **Efficient Waste Removal:** Clears waste (CO_2) for clean growth.

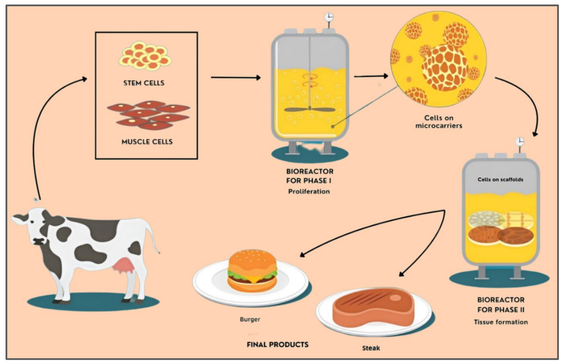
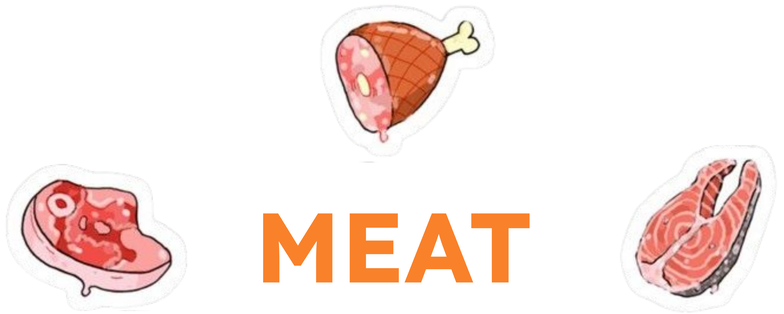


Figure 2. Simplified start-to-finish process of producing cultured meat using microfluidics and bioreactors. (Dijsalov et al., 2021)



MEAT YOUR MATCH!

Crafting cultured meat with desirable properties using the precision of Microfluidic Technologies.

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Ecological Impacts of Microfluidics

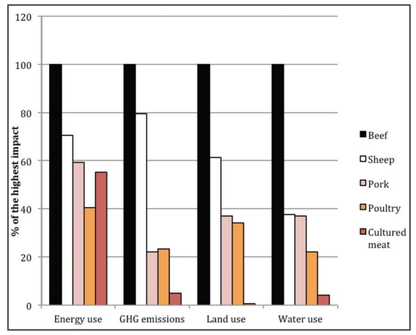

Figure 3. Cultured meat can lead to 96% reduction in GHG emissions and water use, lower energy consumption and 99% reduced land use (Tuomisto & de Mattos, 2011).

- Cultured meat production also addresses other issues of livestock farming, by contributing in the **reduction of zoonotic diseases, preservation of biodiversity,** and **mitigation of antibiotic resistance** (Treich, 2021).

Comparison of Nutritional Value in Meat Alternatives

- Plant-based meats incorporate soy, wheat, or fungi to mimic meat nutrition. Difficulty replicating precise nutrients of animal tissues, difference in texture and palatability (Lee et al., 2020).

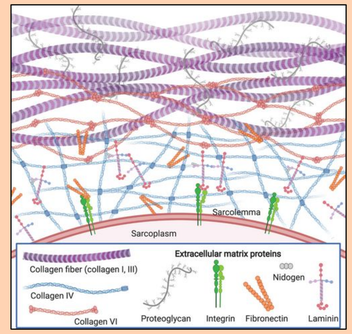

Figure 4. Scaffolding-based techniques develop stem cells in scaffolds. Collagen is used as scaffold in this example (Fraeye et al. 2021).

- Microfluidic channels are 10-100 micrometers, where cell sizes are usually 10-20 micrometers (Bomkamp et al. 2021). Microfluidic beef is histologically comparable to traditional beef (Li et al. 2022).
- Scaffolding vs microfluidics for cardiac muscle tissue > scaffolding can produce tissue lacking nutrients. (Limongi et al. 2022)

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