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Synthetic Biology-Enabled Cultured Meat

Stanford researchers have created a next-generation platform for producing real meat without raising or slaughtering animals, using a combination of rejuvenated muscle cells and a fully edible, protein-rich scaffold. This technology couples long-lived, non-genetically engineered muscle cells with an engineered extracellular matrix-like protein that is manufactured *via* microbial fermentation and crosslinked using vitamin-based chemistry.

Conventional livestock production consumes vast land, water, and feed resources and accounts for a significant share of global greenhouse gas emissions, while plant-based meat alternatives still struggle to match the taste, texture, and nutritional profile of animal meat for many consumers. Existing cultured meat methods also face bottlenecks: they often rely on repeated animal biopsies, serum-containing media, and animal-derived or carbohydrate-heavy scaffolds that limit sustainability, scalability, and protein content.

The inventors' platform uses transient mRNA delivery to extend the lifespan of bovine muscle cells without permanently altering their genomes, enabling more efficient cell expansion. In parallel, a recombinant elastin–laminin fusion protein is produced in E. coli and photo-crosslinked with riboflavin (vitamin B2) and blue light to form a robust, edible 3D matrix that supports muscle differentiation and alignment, including in bioprinted formats. The result is a scalable and animal-free route to structured, high-protein cultivated meat that can better mimic the taste and texture of conventional beef while reducing environmental impact.

Stage of Development
Proof of concept – *in vitro* data

Applications

- Production of structured, high-protein cultivated beef and other meat products using animal-free scaffolds
- Scalable 3D bioprinting of muscle tissues for food, research, and cellular agriculture process optimization
- Development of serum-free, non–GMO muscle cell banks for diverse cultivated meat manufacturers

Advantages

- Non–genetically engineered, rejuvenated muscle cells address consumer concerns about GMO foods
- Protein-based, animal-free scaffolds improve nutritional value over carbohydrate filler–based matrices
- Vitamin-activated crosslinking and microbial production support safe, sustainable, and scalable manufacturing

Innovators

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