

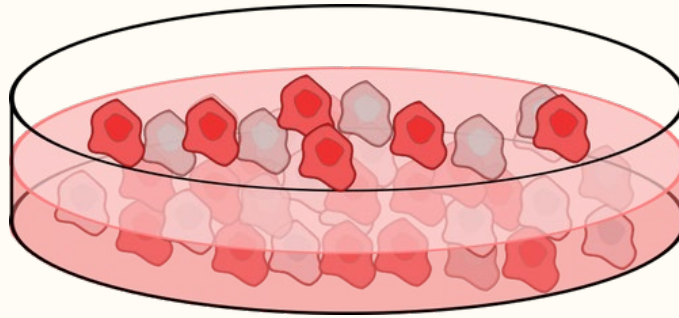
# CELL-CULTURED MEAT: INNOVATIONS, POSSIBILITIES, AND CHALLENGES

## Group 1

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## Applications of Growth Factor

- **Cosmetics and Medicine** (e.g. collagen production & skin regeneration; androgenic alopecia)
- **Component of Animal Cell Culture Medium** (GFs in bovine serum)
  - **Gene Modification Technology**
    - *S. cerevisiae* - EGF
    - Chinese Hamster Cell - anticancer

## Metabolomics Approach

- **Large Scale Analysis of Metabolites in Plants and Food Products** (Exotic Foods)
  - Uses spectroscopy, spectrometry, purification, statistical analysis

## Analysis of Proteins and/or Metabolites

- **Liquid Chromatography - Mass Spectrometry (e.g. nanoLC-MS/MS)**
  - analytical technique combining physical separation capabilities of LC and mass spectrometry analysis capabilities of MS

## Wagyu Beef Culture Meat Production

### 1. Cell Isolation and cell stock

- Wagyu beef meats are sent directly from contract farms and each cell type is collected and preserved

### 1. Bioink Design

- Cells and biomaterials are mixed to make bioink for 3D printing

### 1. 3D Bioprinting

- Printing of fibers with satellite cells and adipose tissue stem cells

## Analysis of Volatile Compounds

- **Gas Chromatography - Mass Spectrometry**

- Volatile samples are separated by GC and analyte molecules are eluted into the MS for detection

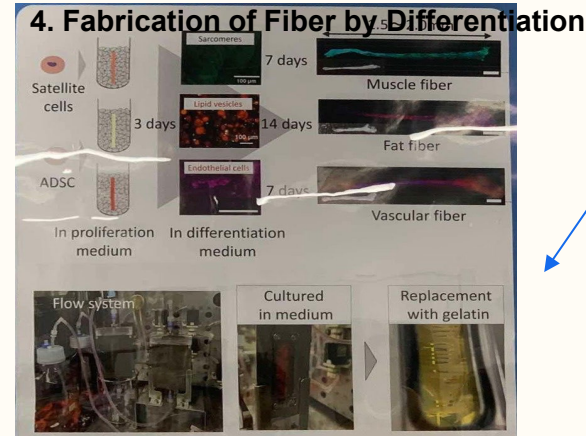
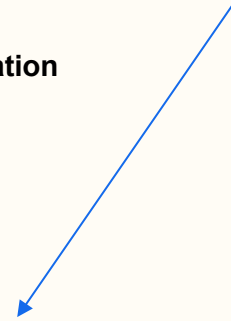
### 4. Fabrication Method of Each Fiber by Differentiation

- Switched to differentiation medium to induce differentiation into each fiber

### 5. Assembly Method for Wagyu Cultured Meat

- Manually assembling each fiber to reproduce the tissue structure of Wagyu beef

## 1



## Knowledge gained after Visiting Shimadzu Co. at Osaka

- **The Wagyu beef cultured meat has DHA while the normal beef doesn't have DHA**
  - Cultured meat MAY have more benefits than conventional meat
- **LC and GC-MS/MS can be used on wide field, including detect insect metabolite and the aroma of different chocolate**

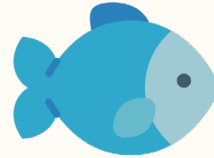
# Cell-cultured meat & Future Possibilities

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Examples beyond mammalian cell-cultured meat



Poultry



Fish



Crustaceans

Types of cell	Muscle satellite cells	Fibroblast cells	Stem cell to myoblasts
Temperature	37°C	15 to 30°C	28°C
Oxygen concentration	High	Low	Low
Company	Upside Foods, Good Meat(USA)	Bluu Seafood Company(Germany)	Shiok Meats(Singapore)

(Joo et al., 2022)

(Xu et al., 2023; Rubio et al., 2019)

(Mosgrove et al., 2024)

# Cell-cultured meat & Future Possibilities

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## Potential & Applications

- **Environmental Impact:** Potential to reduce overfishing, habitat destruction, and greenhouse gas emissions.
- **Physiological Suitability:** Fish cells may be uniquely suited for in vitro cultivation due to their tolerance to hypoxia, high buffering capacity, and ability to grow at lower temperatures
- **Economic Feasibility:** Currently, production costs for cultivated meat are high. However, as technology improves, these costs are expected to decrease.
- **Market Acceptance:** As production scales up and more products become available, consumer perceptions and willingness to try these novel food items will play a significant role in shaping the industry's future.



<https://techcrunch.com/2023/06/28/bluu-seafood-reels-in-17-5m-to-bring-cultivated-fish-products-to-market/>

**Fish cell-based meat  
(Bluu seafood, fish ball)**



[https://www.instagram.com/goodmeatinc/p/DE3HVqvy6L8/?img\\_index=2](https://www.instagram.com/goodmeatinc/p/DE3HVqvy6L8/?img_index=2)

**Poultry cell-based meat (Good Meats, Good Meats 3)**

<https://thefishsite.com/articles/mou-could-take-shiok-meats-cell-based-shrimp-to-vietnam>

**Crustacean cell-based meat  
(Shiok, shrimp dumpling)**



# Why Do We Need New Innovations?

## **Taste & Texture**

Still doesn't fully replicate traditional meat.



## **High Costs**

Growth mediums & production are expensive.



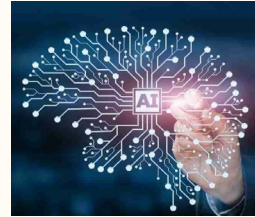
## **Scalability Issues**

Difficult to mass-produce efficiently.

# Future Innovations in Cultured Meat

## **AI-Optimized Tissue Growth**

Machine learning to perfect muscle structure.



## **Self-Sustaining Growth**

**Mediums** Using engineered microbes to produce nutrients.

## **Electrostimulation for Muscle Development**

Simulating real animal movement for better texture.





# Our Concerns: Health, Environment, and Long-Term Sustainability

## Health & Safety

- Uncertainty about long-term health effects.
- Potential use of additives like dyes to replicate meat appearance.

## Environmental & Economic Impact


High production costs and energy consumption, how sustainable is it really?


## Regulatory and Safety Challenges


How long will it take for regulatory bodies to ensure safety?



# Conclusion

 **Scientific Advancement:** From multi-omics analysis to 3D bioprinting, biotechnology is revolutionizing medicine, food, and sustainability.

 **Environmental & Economic Potential:** Cultivated meat could reduce overfishing, deforestation, and emissions, but challenges remain in cost, scalability, and consumer acceptance.

 **The Path Forward:** Continued research, optimization, and policy development will determine the success of these technologies in reshaping our future.

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# Thank You

