Group 2

# Final Presentation

Prepared by:

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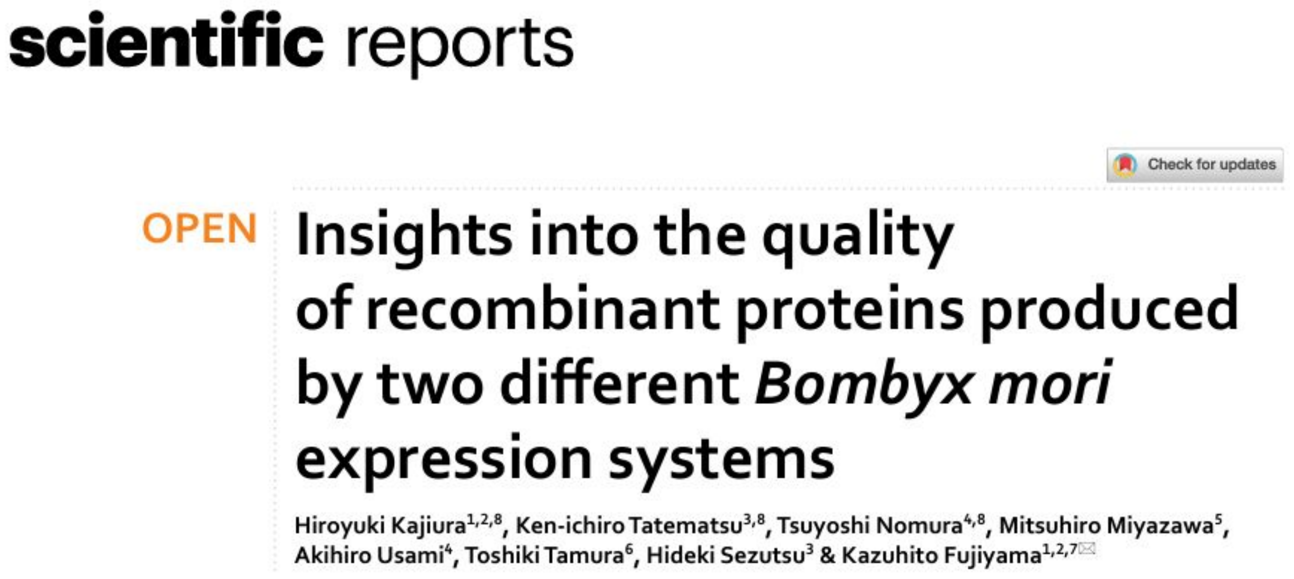
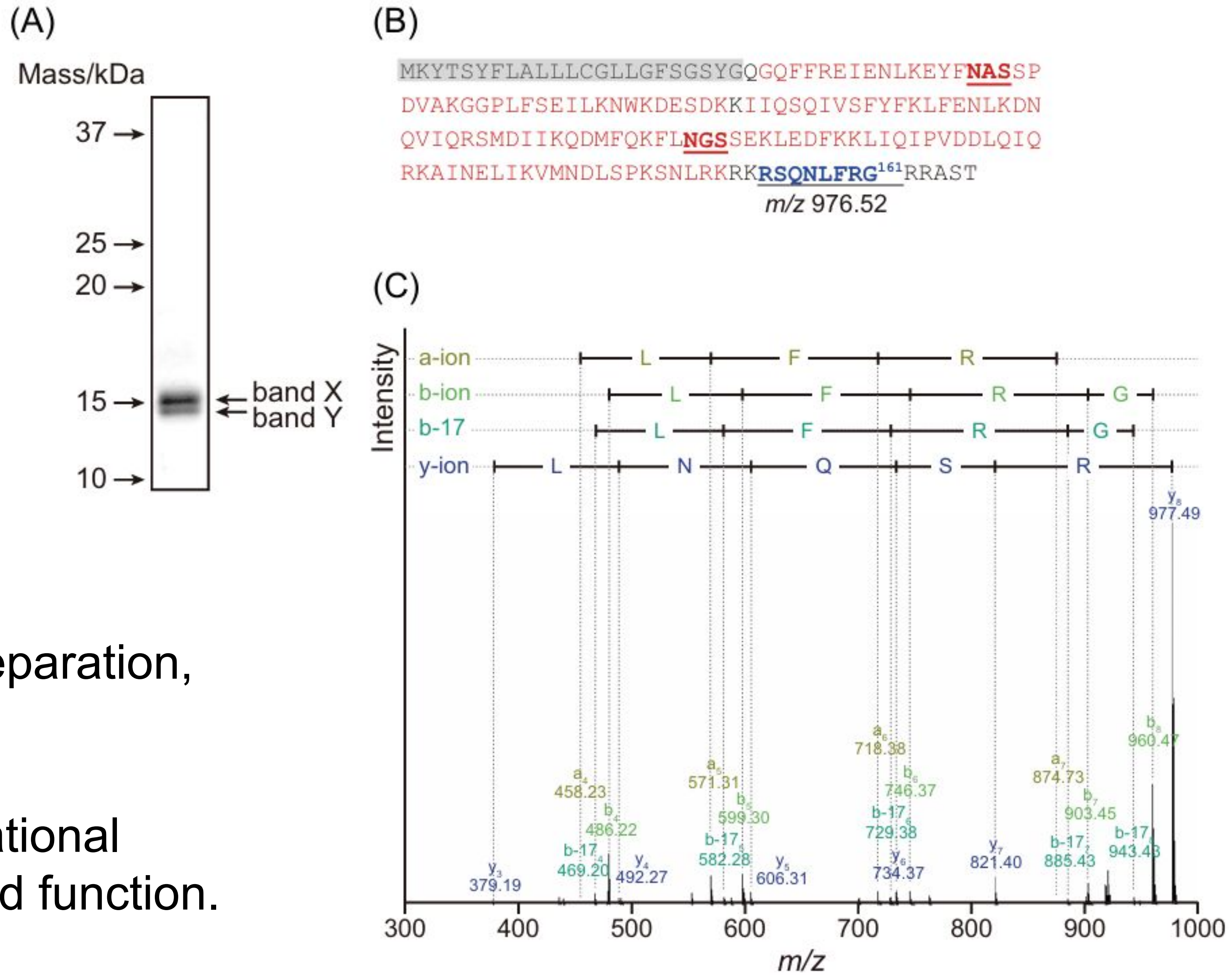
# GROUP QUESTIONS

# 1. Technologies that we learned from researches at Osaka University

# Technologies learned from the researches at Osaka U

- **Protein Analysis** of Samples (**SDS-PAGE; nanoLC-MS/MS**)




**•Protein quality assessment:** SDS-PAGE and chromatography analyzed recombinant IFN-γ.

**•C-terminal analysis:** Enzymatic digestion, gel separation, and mass spectrometry identified cleavage sites.

**•Structural differences:** Variations in post-translational modifications and degradation impact integrity and function.


Reference: Kajiura, H., Tatematsu, K., Nomura, T., Miyazawa, M., Usami, A., Tamura, T., Sezutsu, H., & Fujiyama, K. (2022). Insights into the quality of recombinant proteins produced by two different Bombyx mori expression systems. *Scientific Reports*, *12*(1). https://doi.org/10.1038/s41598-022-22565-7

# Technologies learned from the researches at Osaka U

- **Food Metabolomics** (**GC-MS; LC-MS**)

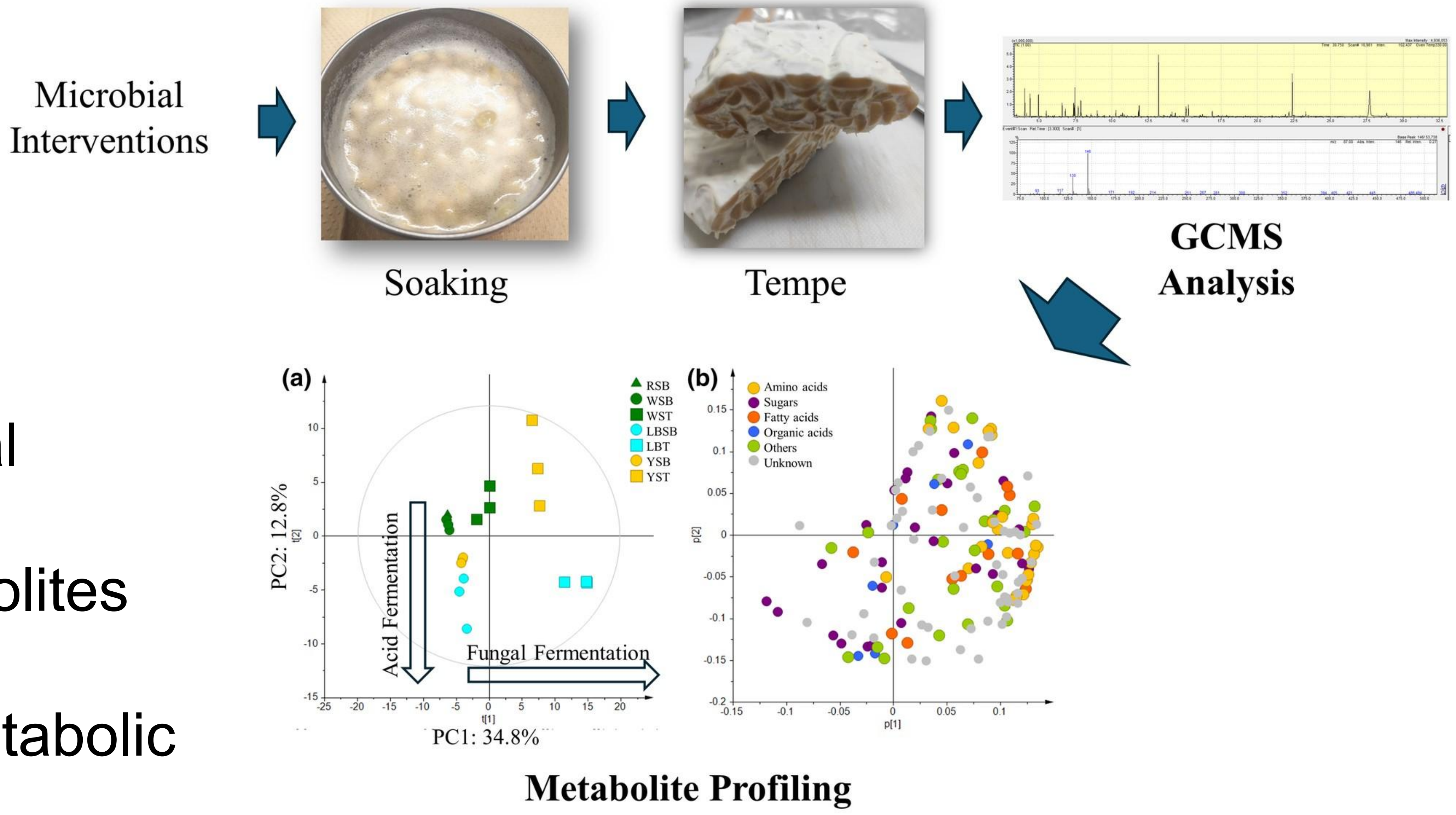
JOURNAL ARTICLE

**Metabolite profiling highlights the effect of microbial intervention in the soaking step of tempe**

Rifqi Ahmad Riyanto, Eiichiro Fukusaki, Sastia Prama Putri

*International Journal of Food Science and Technology*, Volume 59, Issue 10, October 2024, Pages 7414–7425, https://doi.org/10.1111/ijfs.17481

**Published:** 30 August 2024 **Article history** ▾




- **Metabolomics** identifies biochemical changes during fermentation.
- **GC-MS analysis** detects key metabolites affecting food quality.
- **PCA** reveals fermentation-driven metabolic shifts for optimization.

Reference: Riyanto, R. A., Fukusaki, E., & Putri, S. P. (2024). Metabolite profiling highlights the effect of microbial intervention in the soaking step of tempe. *International Journal of Food Science & Technology*, *59*(10), 7414–7425. https://doi.org/10.1111/ijfs.17481

# Technologies learned from the researches at Osaka U

- **Cultured Meat (3D bioprinting; LC; LC-MS; GC-MS)**


SHIMADZU Excellence in Science

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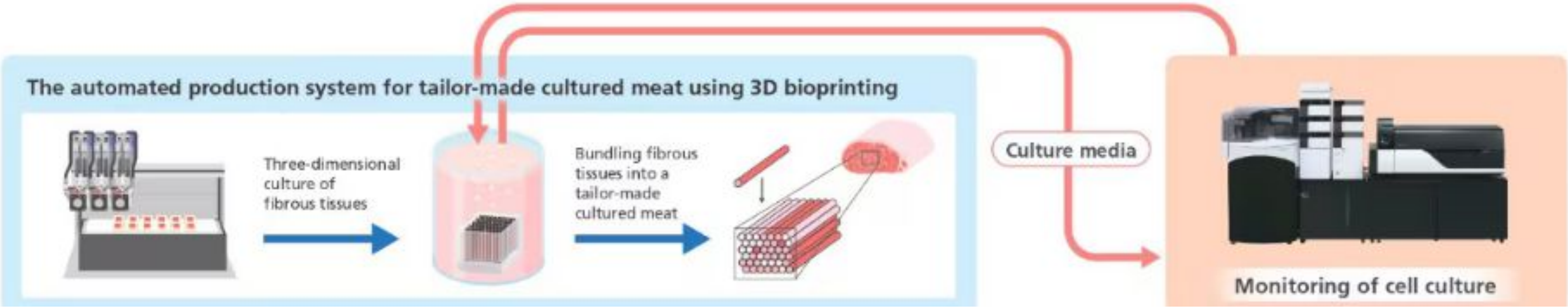
August 24, 2023

#Topics #Technology

Cultured Meat, a New Style of Food Shaping the Future





Reference: Cultured meat, a new style of food shaping the future. (2023, August 24). SHIMADZU TODAY | SHIMADZU CORPORATION. https://www.shimadzu.com/today/20230824-1.html

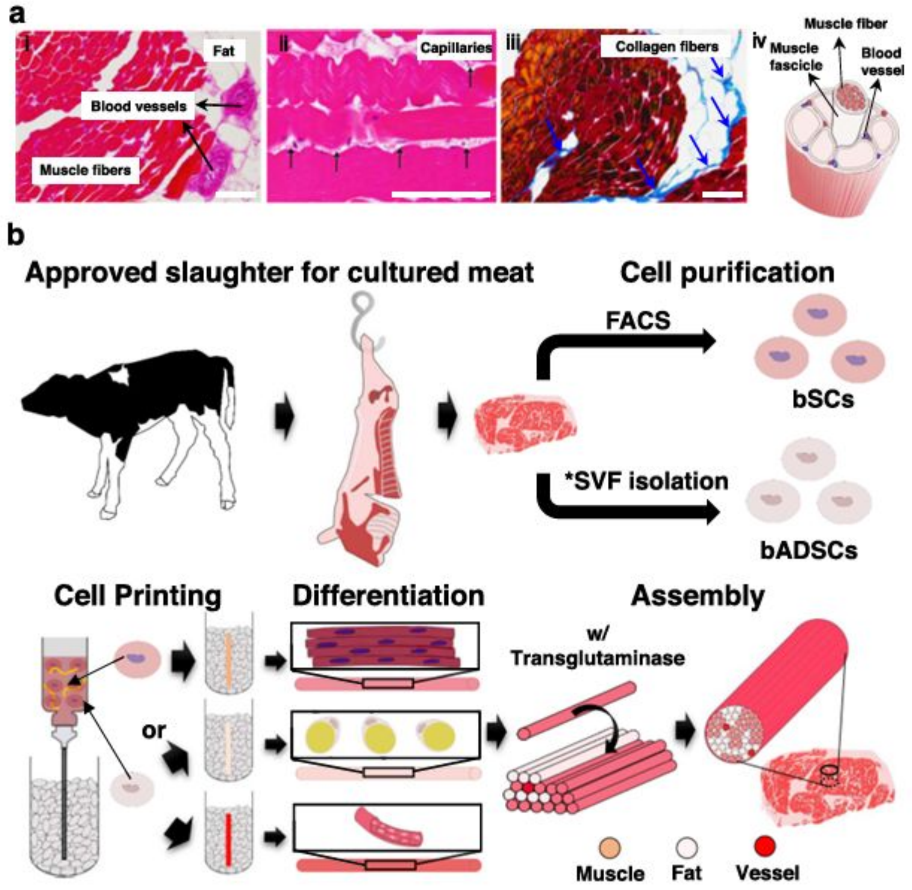

ARTICLE


https://doi.org/10.1038/s41467-021-25236-9 OPEN

Check for updates


Engineered whole cut meat-like tissue by the assembly of cell fibers using tendon-gel integrated bioprinting


Dong-Hee Kang[1], Fiona Louis[2], Hao Liu[1], Hiroshi Shimoda[3], Yasutaka Nishiyama[4], Hajime Nozawa[5], Makoto Kakitani[5], Daisuke Takagi[6], Daijiro Kasa[7], Eiji Nagamori[8], Shinji Irie[2,9], Shiro Kitano[2,9] & Michiya Matsusaki[1,2]

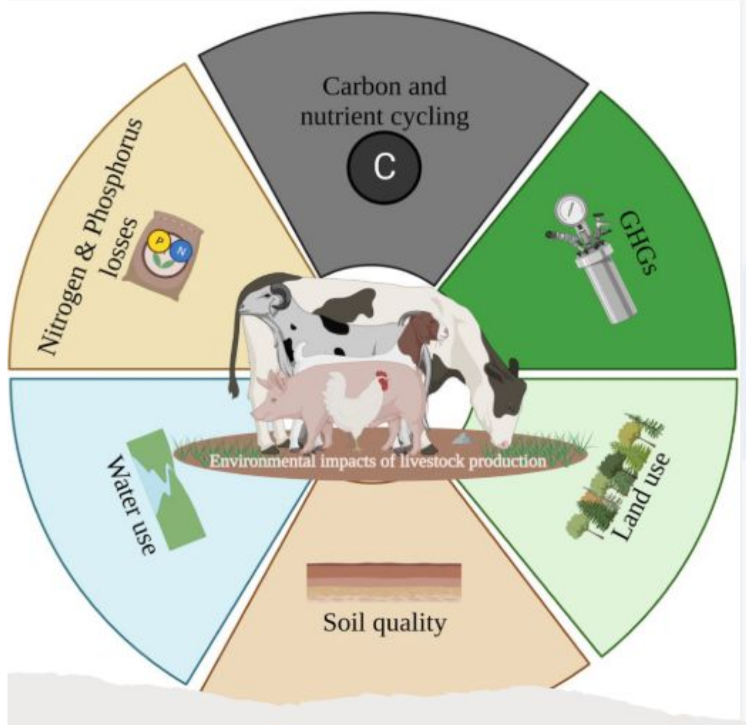


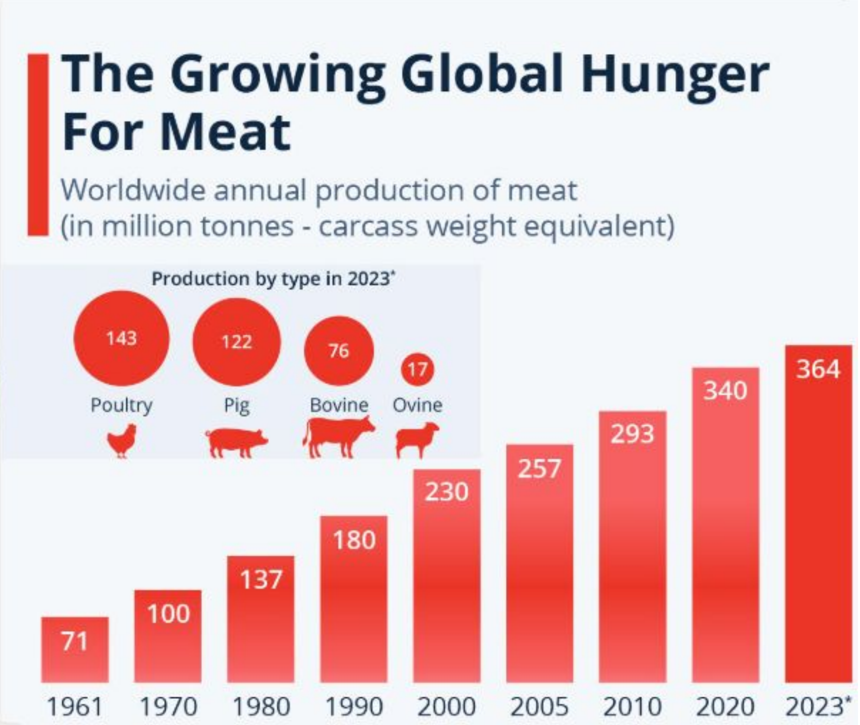
Reference: Kang, DH., Louis, F., Liu, H. *et al.* Engineered whole cut meat-like tissue by the assembly of cell fibers using tendon-gel integrated bioprinting. *Nat Commun* 12, 5059 (2021). https://doi.org/10.1038/s41467-021-25236-9

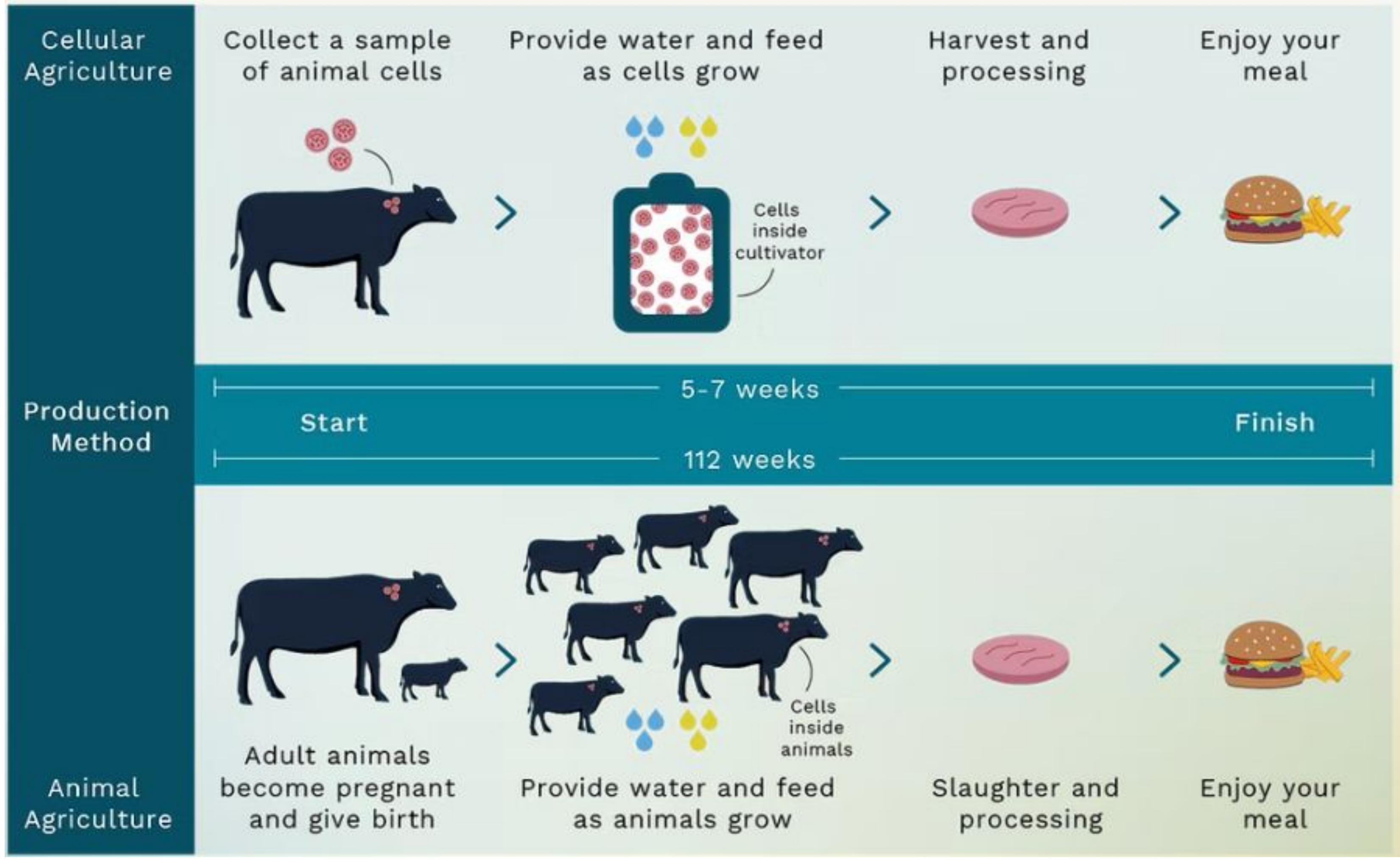
## 2. After visiting Shimadzu Co. at Osaka University, how has your knowledge and understanding improved?

# How these technologies improved our knowledge and understanding of cultured meat

- <u>Before:</u>



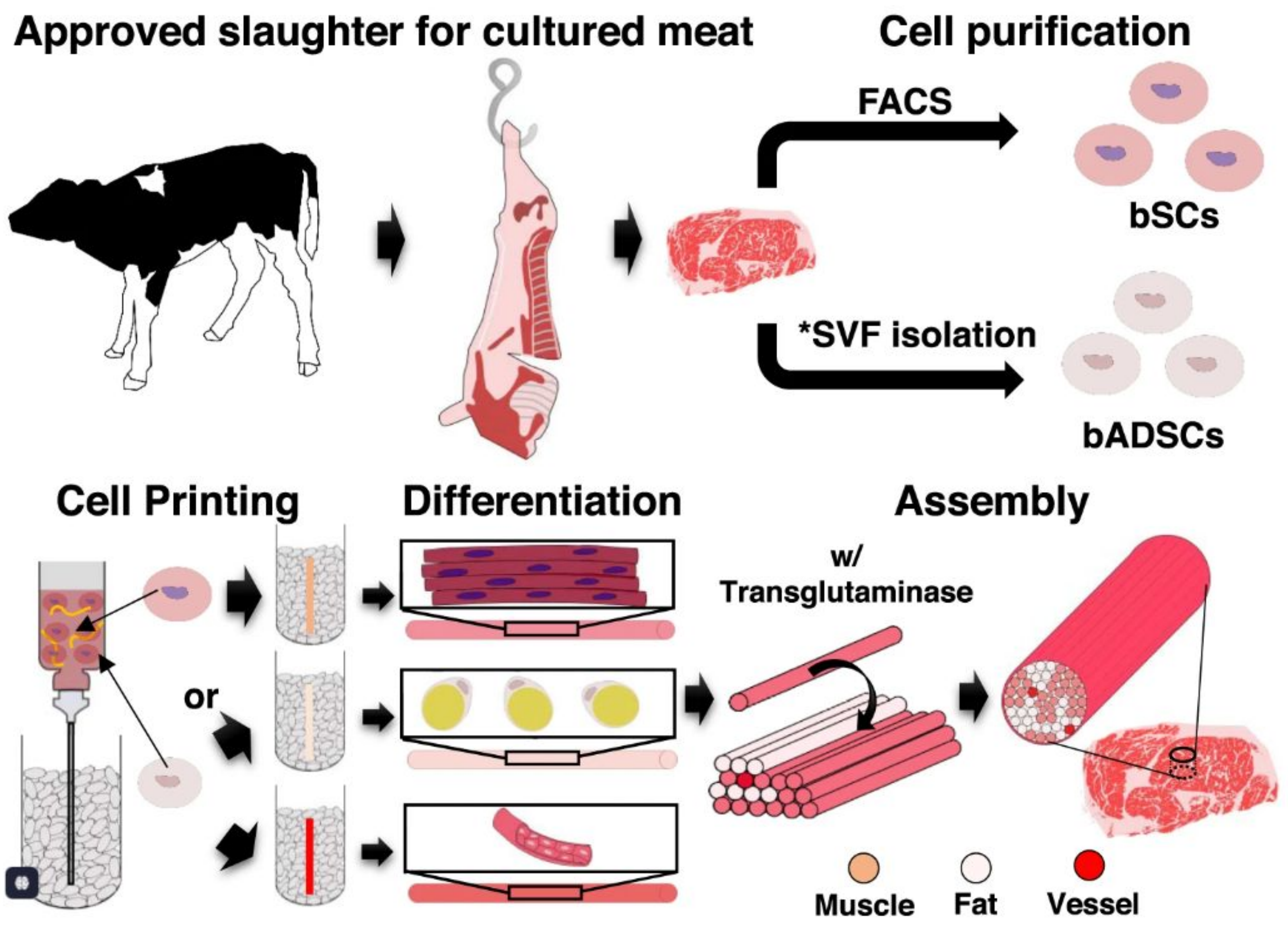

### Meat Type Comparison

| Aspect | Plant-based approach | Animal-based approach | Cell-based approach |
|---|---|---|---|
| **Environmental impact** | Lower greenhouse gas emissions, water usage, and land degradation; specific crops (e.g., nuts) can still be resource-intensive | High greenhouse gas emissions (14-51%), excessive water use (100x more than plants), and extensive land degradation | Significantly reduce resource use and environmental impacts, including energy, greenhouse gas emissions, land, and water use, compared to animal-based meat. |
| **Production method** | Proteins extracted from plants (e.g., soy, peas), mixed with nutrients, and processed to mimic meat texture using extrusion or 3D printing | Rearing and slaughtering livestock, requiring large-scale agriculture for feed and extensive land for grazing | Production involves isolating and culturing muscle and fat cells, formulating xeno-free culture media, developing scaffolds for cell growth, and designing bioreactors |
| **Nutritional content** | Offers fiber, low cholesterol, and fewer calories; fortified to meet dietary needs; potential nutrient loss in processing | High in protein, vitamin B12, and essential fats; associated with increased risks of heart disease and chronic conditions | The potential for customizable nutrition profiles through differentiated muscle and fat cells, media supplementation, and genetic modification |

# How these technologies improved our knowledge and understanding of cultured meat

- <u>After:</u>

❖ Cell isolation and cell stock
❖ Bioink design
❖ 3D bioprinting
❖ Fabrication method of each fiber by differentiation
❖ Assembly method for wagyu cultured meat
❖ Final product

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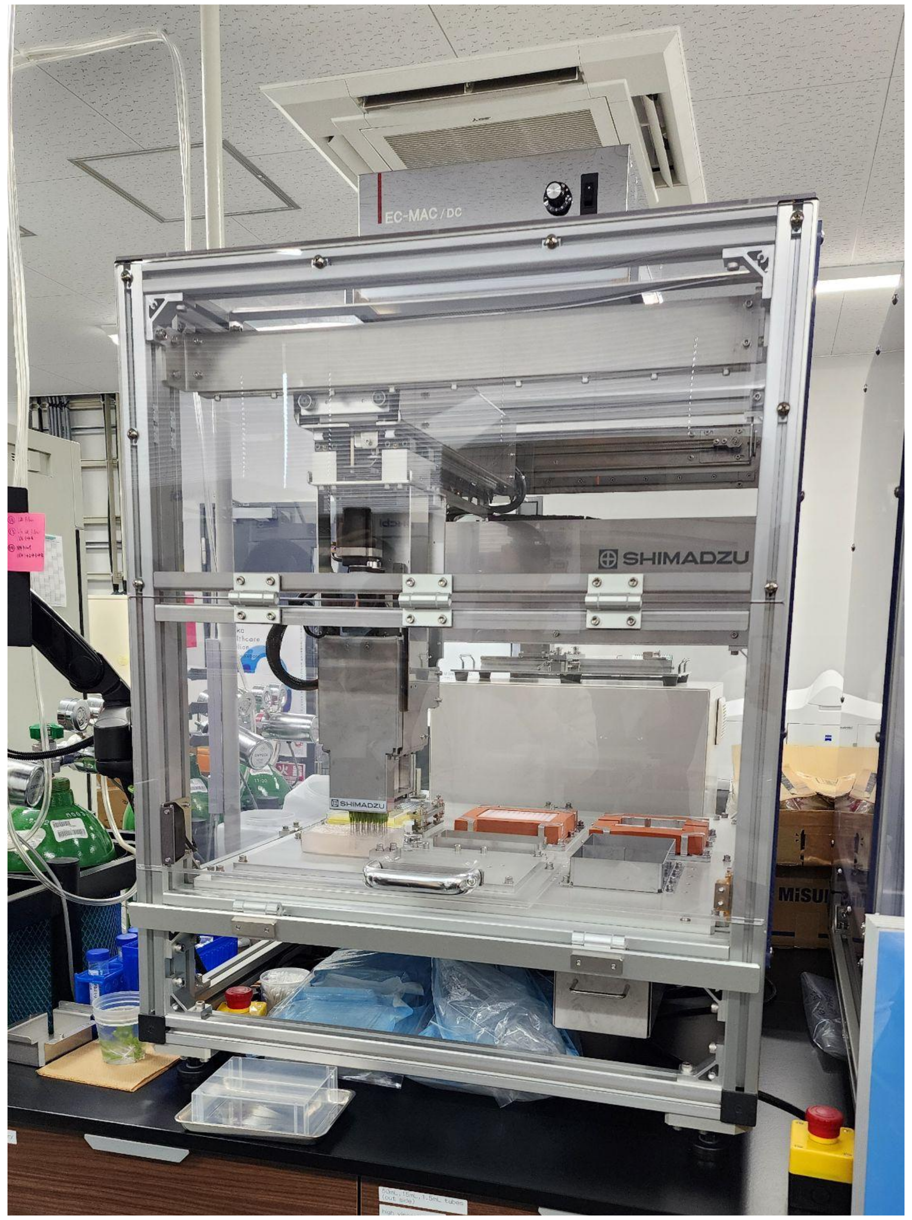
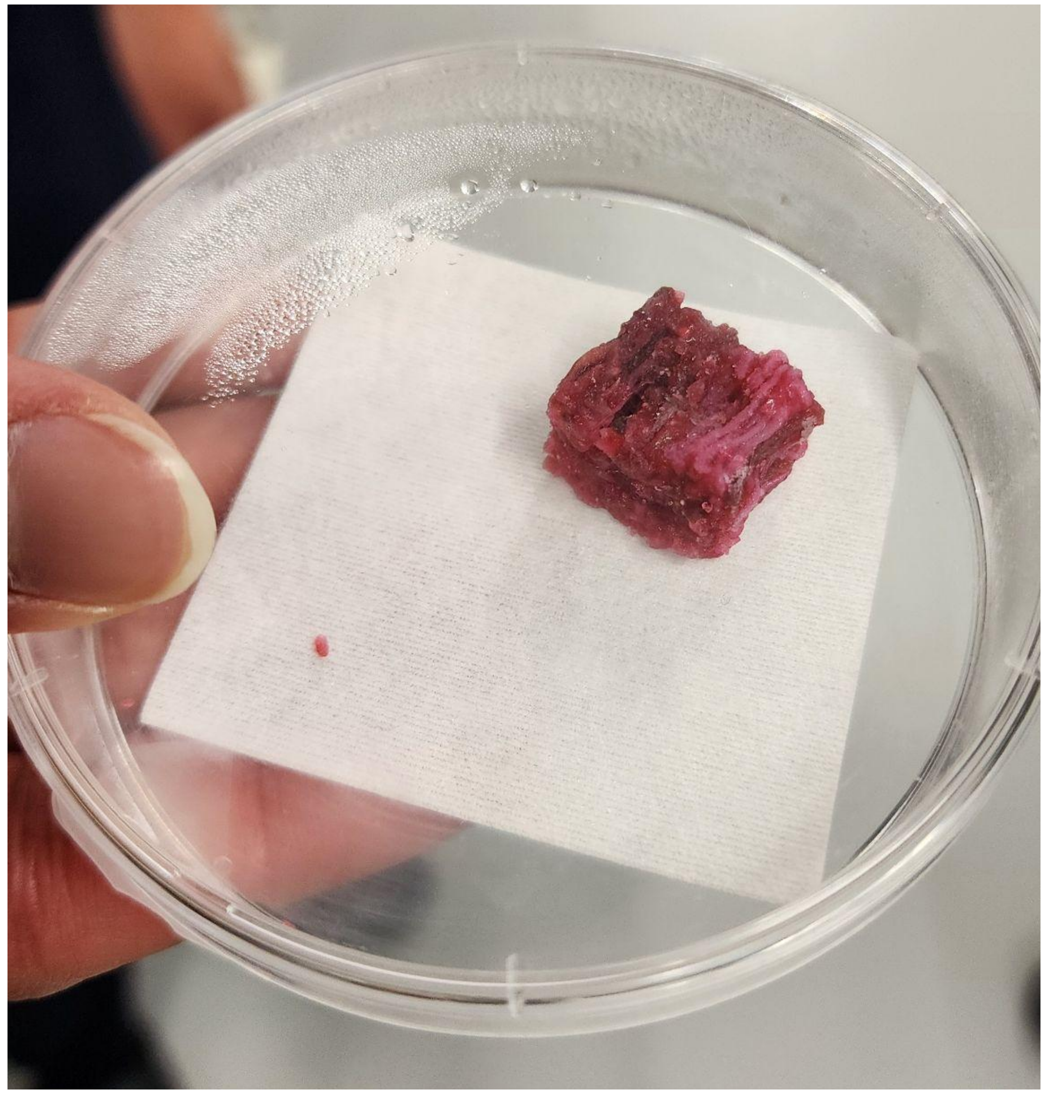
# How these technologies improved our knowledge and understanding of cultured meat

- After:

3D Bioprinting Equipment




Final Product



# 3. Examples of animal cell-cultured meat (besides mammalian cell-cultured meat)

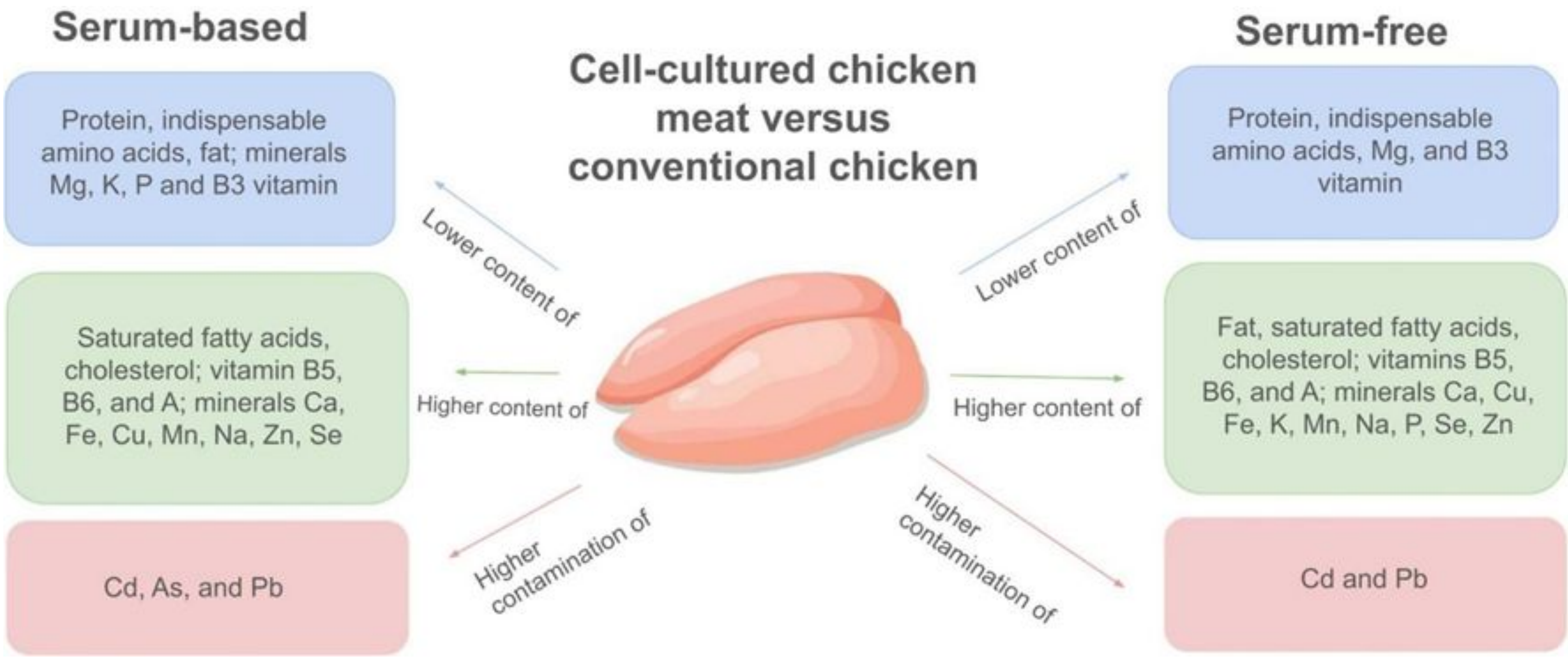
# Examples of animal cell-cultured meat

- Poultry


Journal of Food Composition and Analysis
Volume 135, November 2024, 106663

Assessment of the potential nutritional value of cell-cultured chicken meat in light of European dietary recommendations

Dominika Sikora [a] [b], Piotr Rzymski [a]




https://www.goodmeat.co/

Pasta dish with Good Meat's cultivated chicken meat in Singapore.
Eat Just's Good Meat became the first FDA and Singapore-approved cultured chicken, already served in restaurants

Sikora, D., & Rzymski, P. (2024). Assessment of the potential nutritional value of cell-cultured chicken meat in light of European dietary recommendations. Journal of Food Composition and Analysis, 135, 106663.https://doi.org/10.1016/j.jfca.2024.106663

# Examples of animal cell-cultured meat

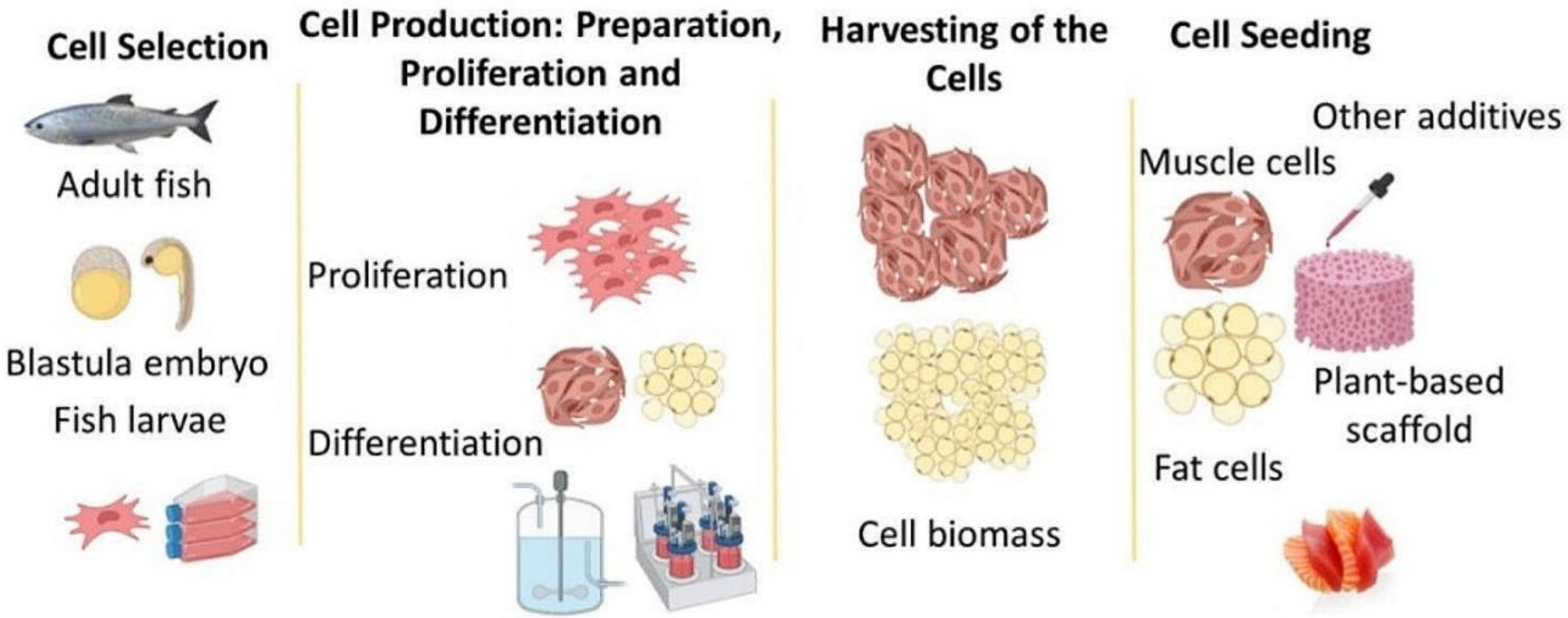
- Seafood


Goswami et al. Journal of Biological Engineering (2024) 18:43
https://doi.org/10.1186/s13036-024-00436-1
Journal of Biological Engineering

REVIEW Open Access

Cell-cultivated aquatic food products: emerging production systems for seafood

Mukunda Goswami[1*], Reza Ovissipour[2], Claire Bomkamp[3], Nitin Nitin[4], Wazir Lakra[5], Mark Post[6,7] and David L. Kaplan[8*]




Bluefin tuna (BlueNalu) – created using fish muscle stem cells.

https://www.bluenalu.com/

Goswami, M., Ovissipour, R., Bomkamp, C., Nitin, N., Lakra, W., Post, M., & Kaplan, D. L. (2024). Cell-cultivated aquatic food products: emerging production systems for seafood. Journal of Biological Engineering, 18(1), 43. 10.1186/s13036-024-00436-1

# 4. What technology can we develop to get better meat?

# Technology to get better meat

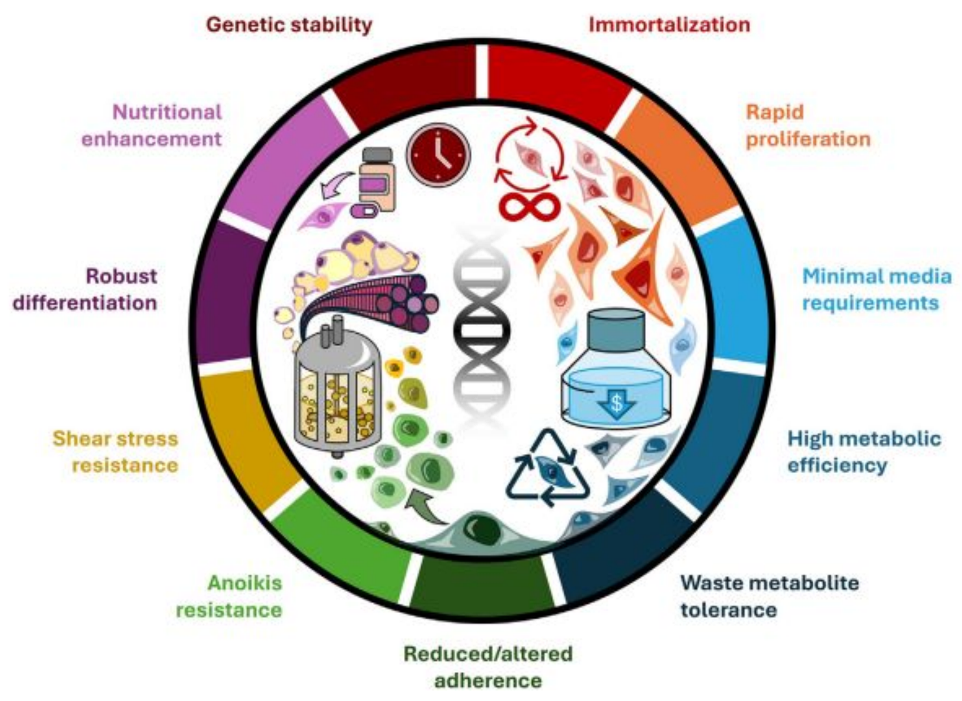
- Genetic Engineering

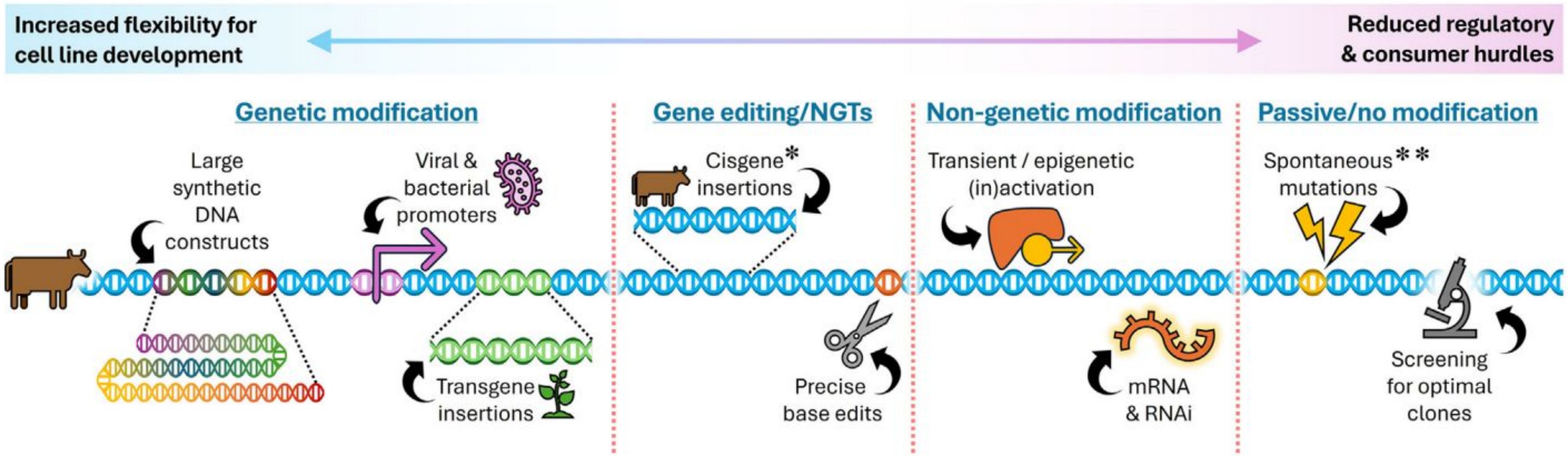
iScience

Perspective

Unlocking the potential of cultivated meat through cell line engineering

Camilo Riquelme-Guzmán,[1] Andrew J. Stout,[1,2] David L. Kaplan,[1] and Joshua E. Flack[3,*]




Riquelme-Guzmán, C., Stout, A. J., Kaplan, D. L., & Flack, J. E. (2024). Unlocking the potential of cultivated meat through cell line engineering. Iscience, 27(10). https://doi.org/10.1016/j.isci.2024.110877

# Technology to get better meat

- Optimized Growth Media

Trends in Food Science & Technology 138 (2023) 564–576

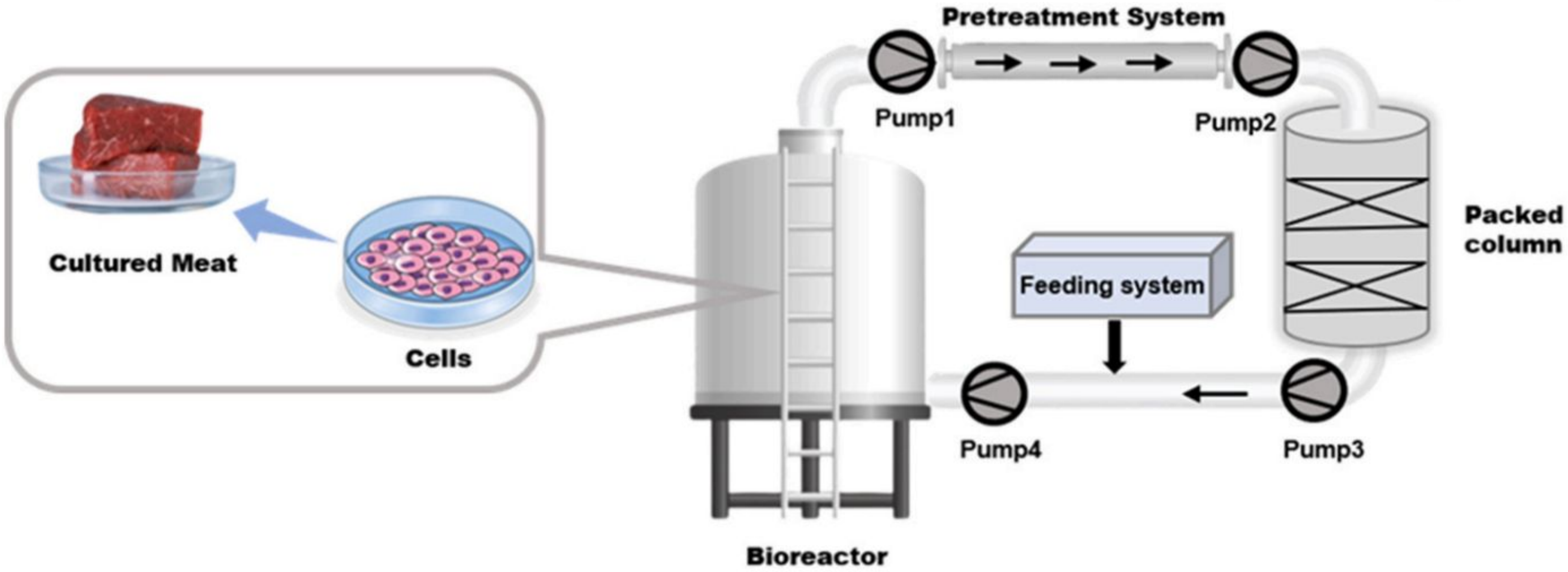
Contents lists available at ScienceDirect

Trends in Food Science & Technology

journal homepage: www.elsevier.com/locate/tifs

Cell culture medium cycling in cultured meat: Key factors and potential strategies

Ming Yang[a,b], Qiong Wang[b], Yuyan Zhu[c,d], Kuichuan Sheng[a,b,e], Ning Xiang[f,g,**], Ximing Zhang[a,b,e,h,*]


Yang, M., Wang, Q., Zhu, Y., Sheng, K., Xiang, N., & Zhang, X. (2023). Cell culture medium cycling in cultured meat: key factors and potential strategies. Trends in Food Science & Technology. https://doi.org/10.1016/j.tifs.2023.06.031

# 5. What are YOU (WE) concerned about?

# Our concerns

| Category | Concern | Description |
|---|---|---|
| Societal Concerns | Consumer Acceptance | Many people may see lab-grown meat as "unnatural" or unappetizing. |
| | Economic Disruption | The traditional livestock industry may suffer job losses. |
| | Regulatory Challenges | Governments must create new safety, labeling, and production standards. |
| Ethical Concerns | Equitable Access | High costs could make cultured meat inaccessible to lower-income groups. |
| | Religion and Cultural Acceptance | Some religious groups may question its compatibility with halal, kosher, or cultural diets. |
| Health Concerns | Long-Term Health Effects | Unknown long-term effects due to artificial growth factors and scaffold materials. |
| | Nutritional Composition | Lab-grown meat may lack the full nutrient profile of traditional meat unless fortified. |
| Environmental Concerns | Energy Consumption | Cultured meat production requires significant electricity, potentially offsetting sustainability benefits. |
| | Resource Use | The impact on water, land, and emissions depends on production methods and scalability. |
| Technological Concerns | Corporate Control and Patents | Large corporations could monopolize production, limiting competition and accessibility. |
| | Scalability and Cost | Current production methods are expensive and may take years to become cost-effective. |

# REFERENCES:


Cultured meat, a new style of food shaping the future. (2023, August 24). SHIMADZU TODAY | SHIMADZU CORPORATION. https://www.shimadzu.com/today/20230824-1.html

Kajiura, H., Tatematsu, K., Nomura, T., Miyazawa, M., Usami, A., Tamura, T., Sezutsu, H., & Fujiyama, K. (2022). Insights into the quality of recombinant proteins produced by two different Bombyx mori expression systems. *Scientific Reports*, *12*(1). https://doi.org/10.1038/s41598-022-22565-7

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