

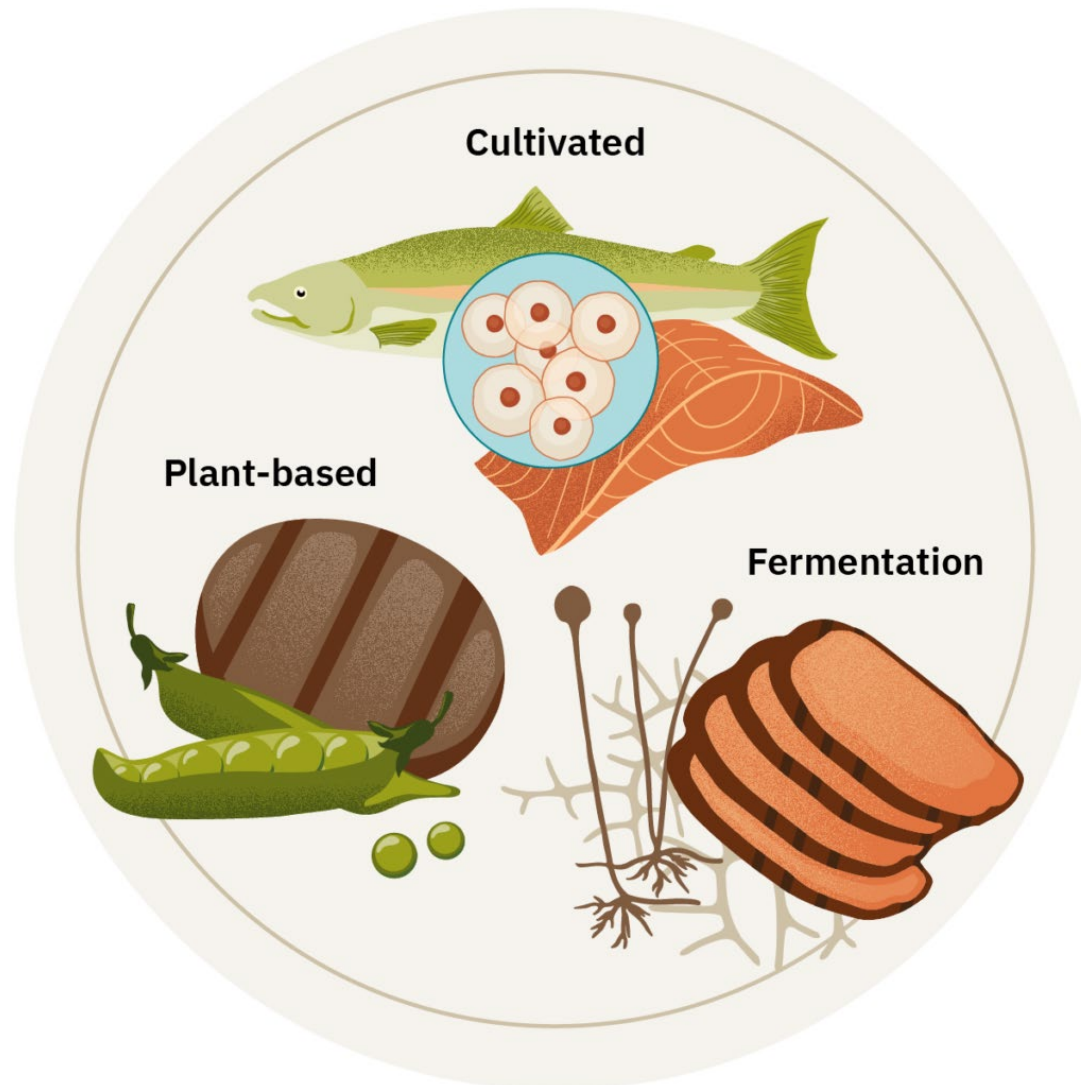
Microbial Foods

Opportunities and challenges

Sonja Billerbeck, PhD

Associate Professor, Imperial College London.

The Future of Foods – Alternative Protein



Microbial Foods and the Future of Food

“Microbial foods” refers to any food product or ingredient produced via microbial intervention, including...

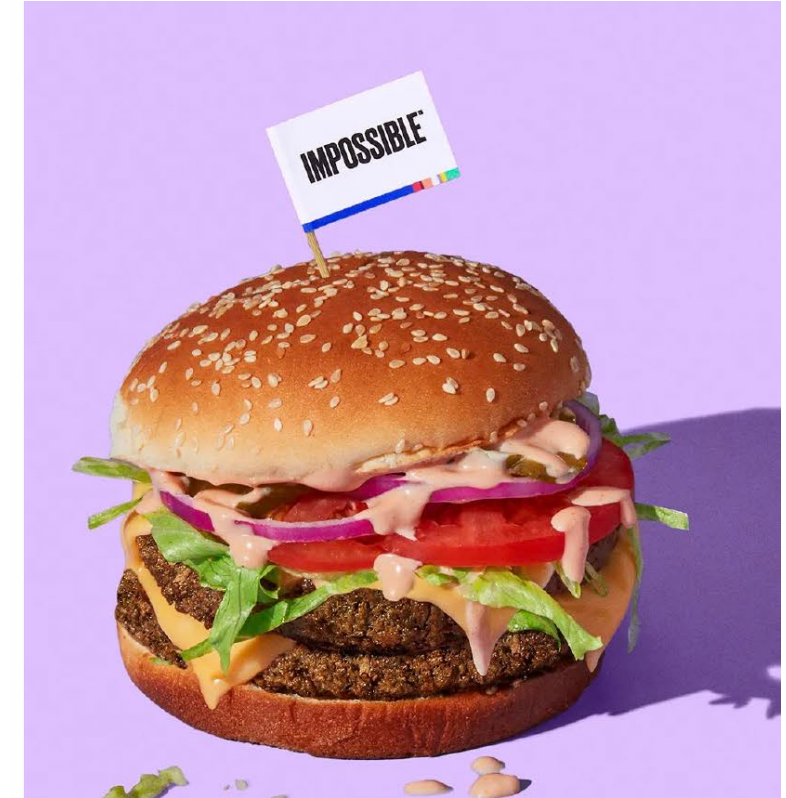
Traditional fermentation



Biomass fermentation

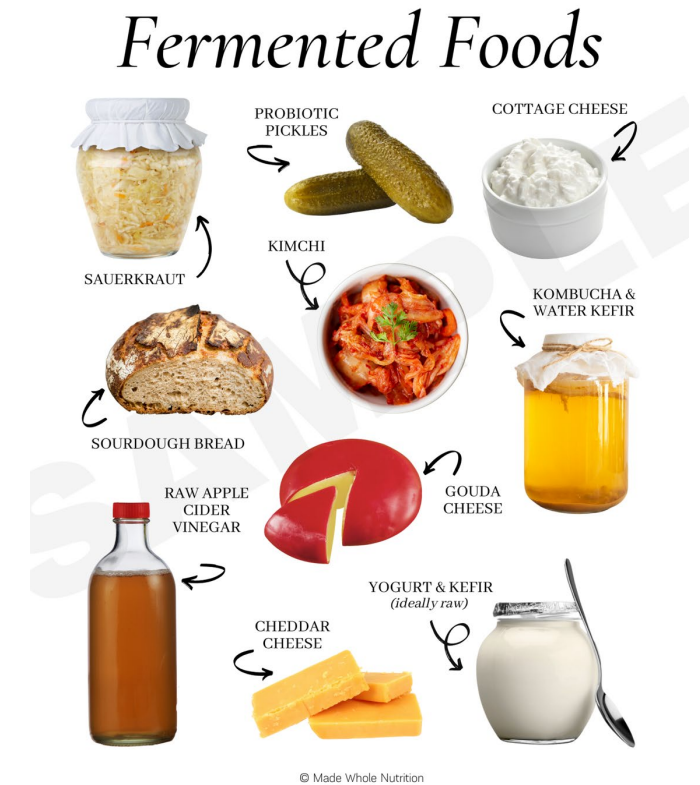
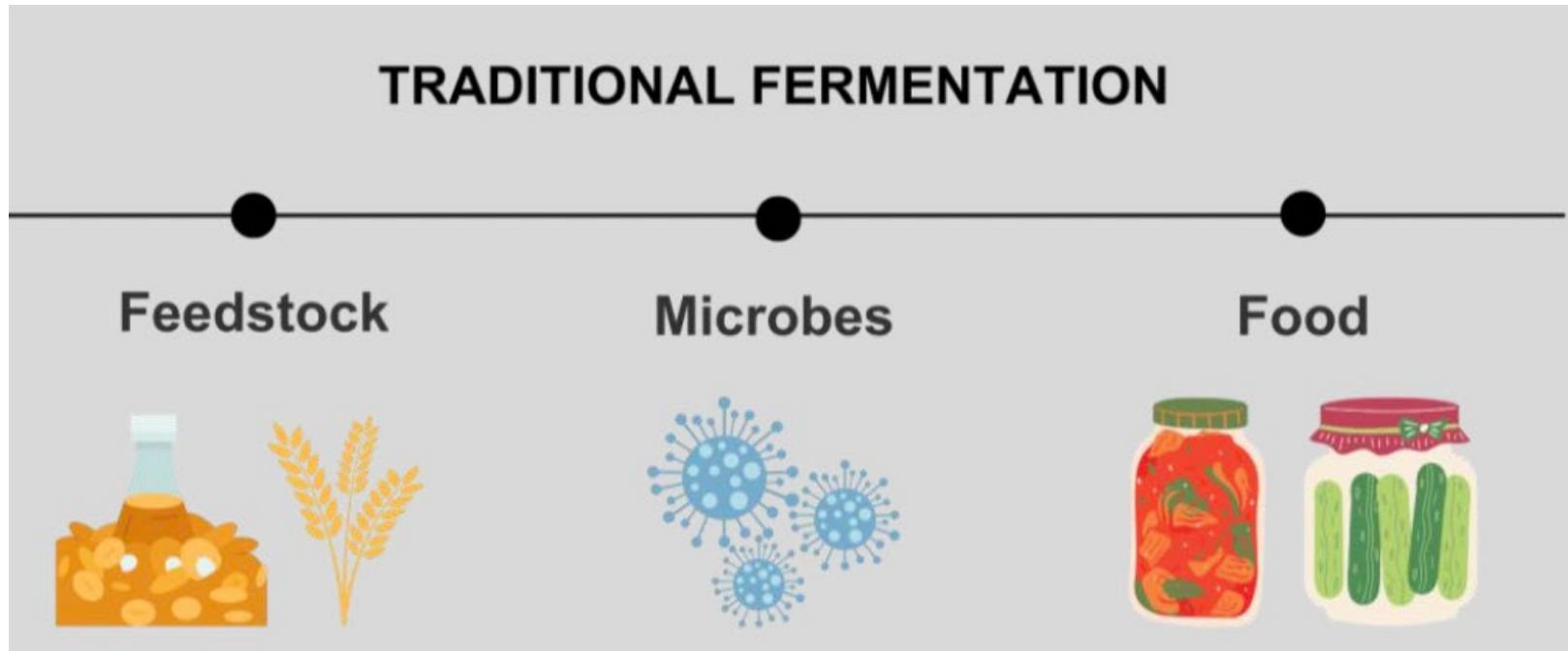


Precision fermentation



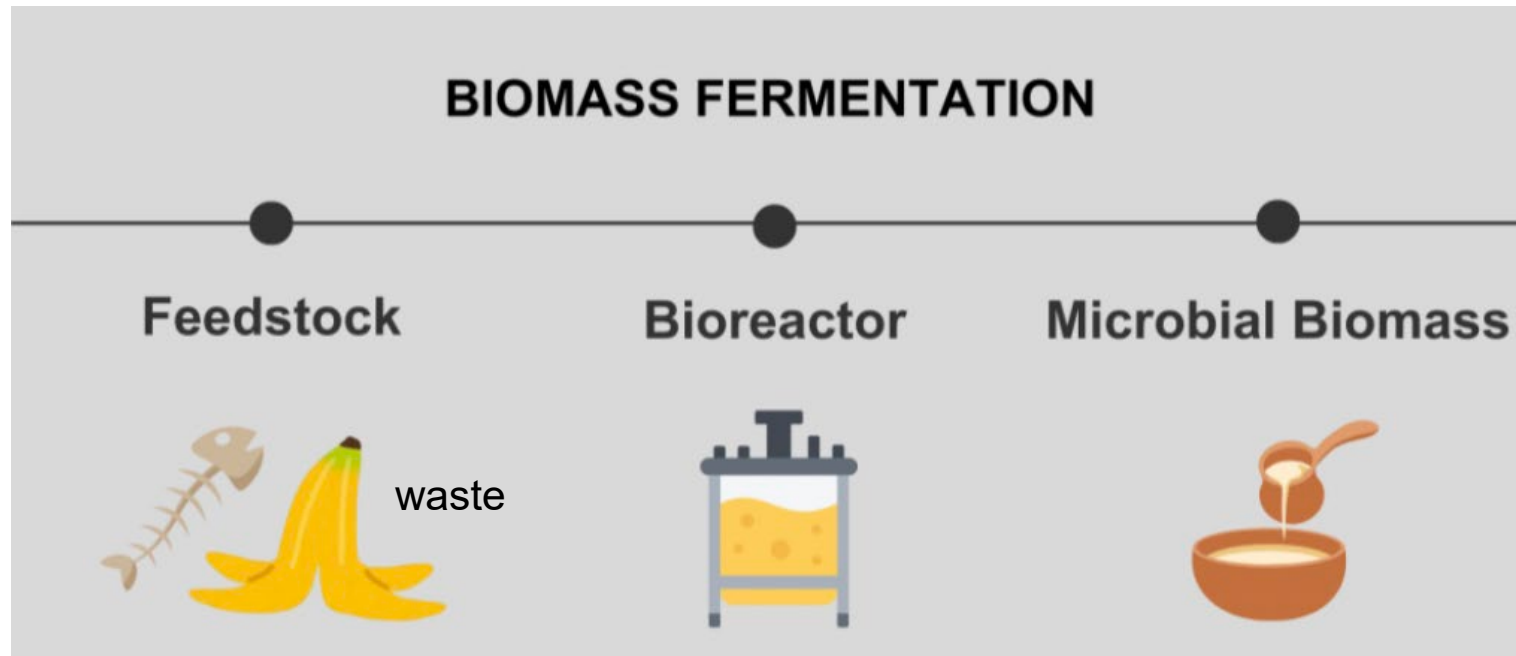
Traditional fermentation

- Accounts for around one-third of our diets globally.
- Enhances food preservation.
- Improves flavour, texture, nutrient availability, and supports gut health.



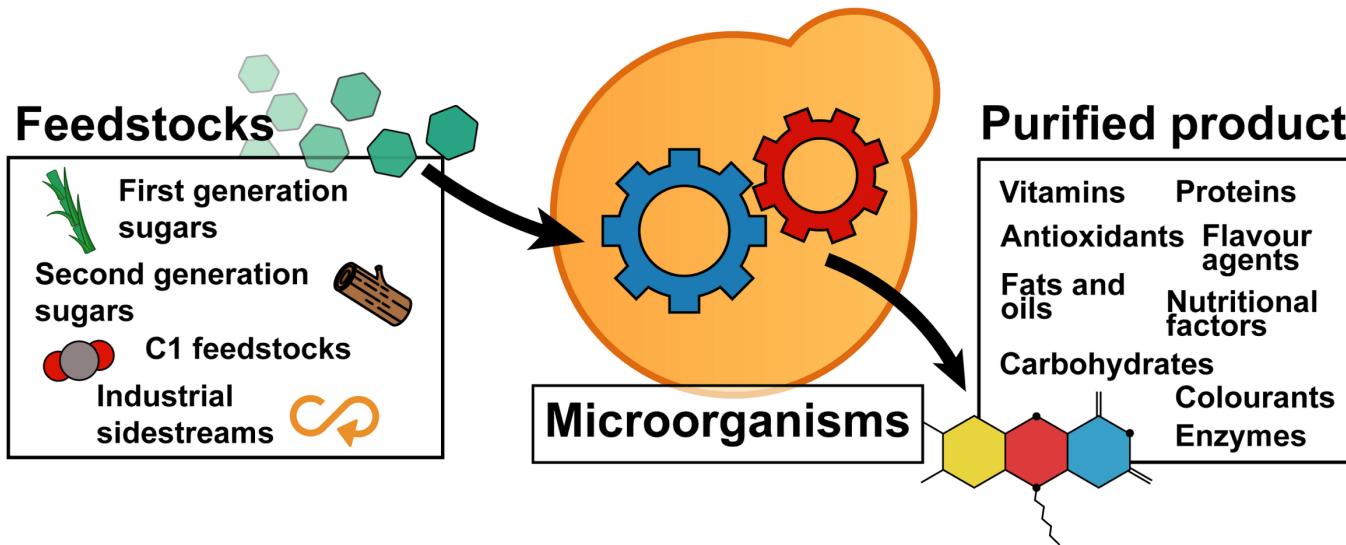
Biomass Fermentation

- Uses fast-growing, protein-rich microbes to efficiently produce protein.
- Biomass can be used whole or processed to boost digestibility or protein levels.
- Examples....



Precision Fermentation

- Microbes as “cell factories” to produce specific functional ingredients.
- Used in small amounts to enhance taste, texture, or nutrition.
- Examples: dairy, egg, and heme proteins made by e.g., Perfect Day, Clara Foods, and Impossible Foods.



Opportunities and challenges



Sustainable

- Less land and water
- Less emissions
- Can use CO2/waste as feedstock



Nutritious and healthy

- Balanced nutrition
- Micronutrients, fibers and proteins
- Gut for gut health



Security and resilience

- Independent of climate, season, disasters
- Short production cycles
- Scalable on demand

Opportunities and challenges



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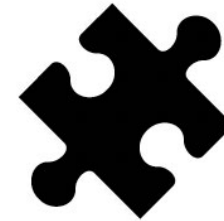
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Challenge

- Cost
- Quality
- Consumer acceptance

Opportunities and challenges



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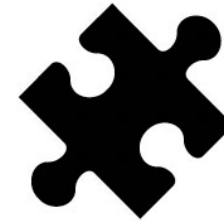
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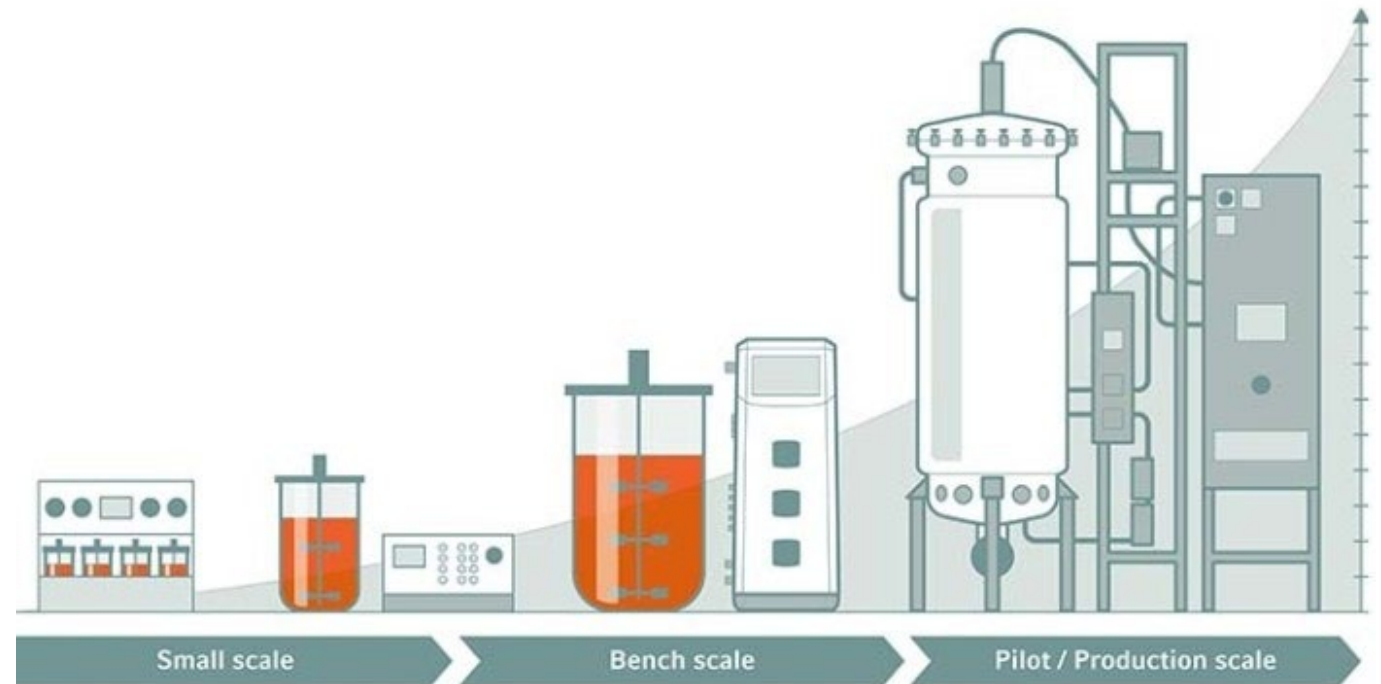
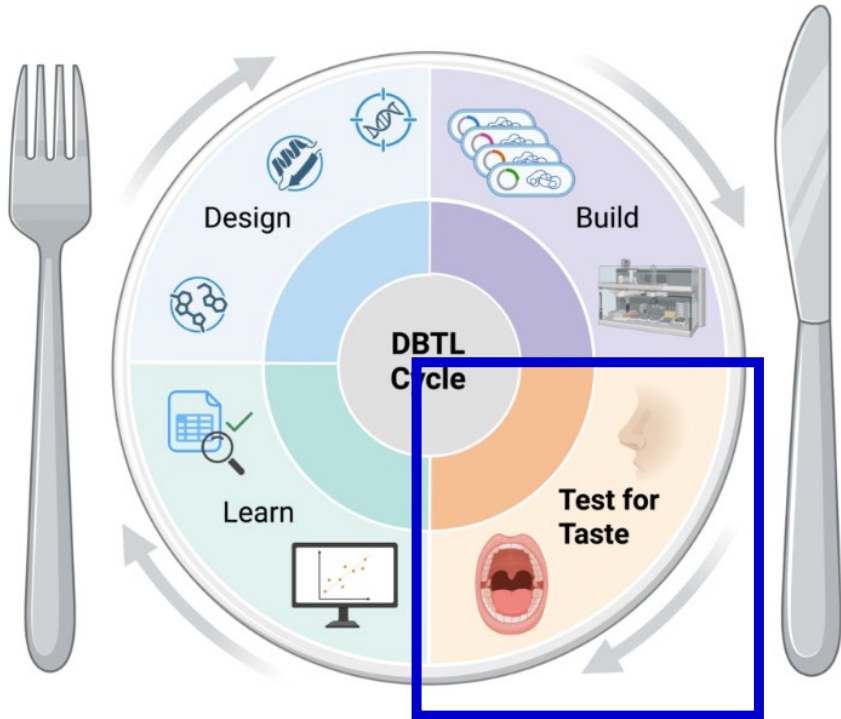
Solutions

- Engineering Biology
- Scale up
- Regulation
- Policy

Challenges in engineering food fermentation.

Design-Build-**Test**-Learn cycles.

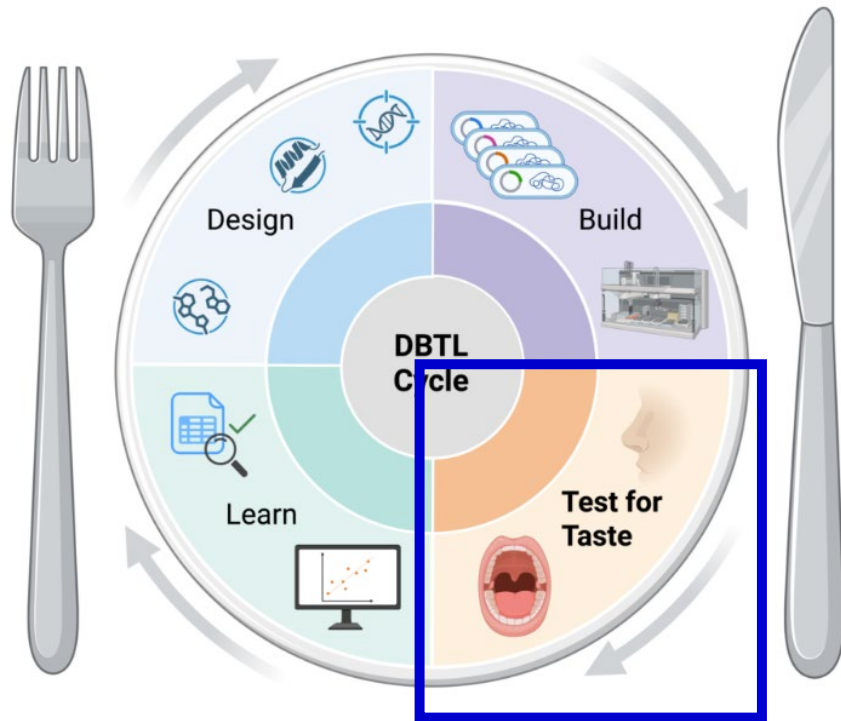
Scaling from lab- to production-scale.



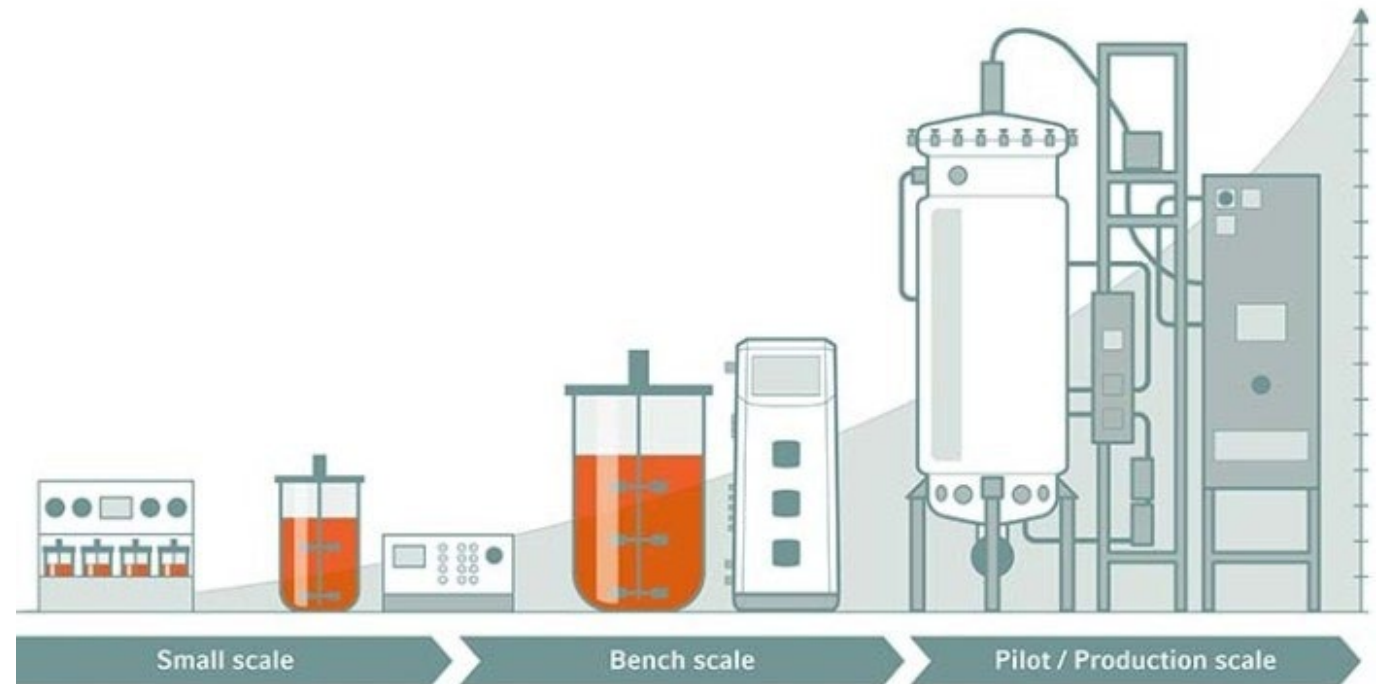
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Design-Build-Test-Learn cycles.

How can we analyze **taste, texture, nutritional profiles**, and other functional properties in small scale and in high throughput?



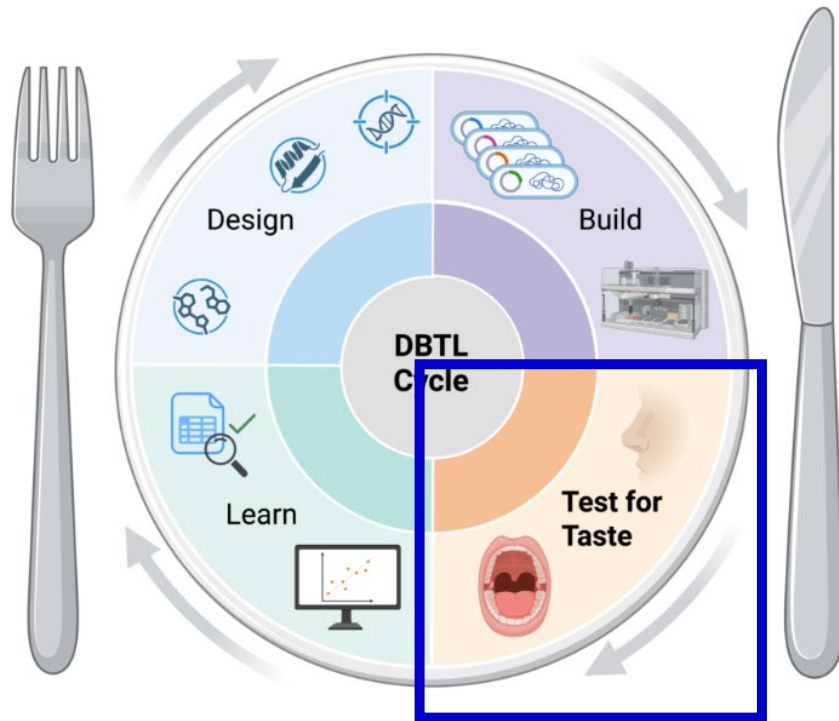
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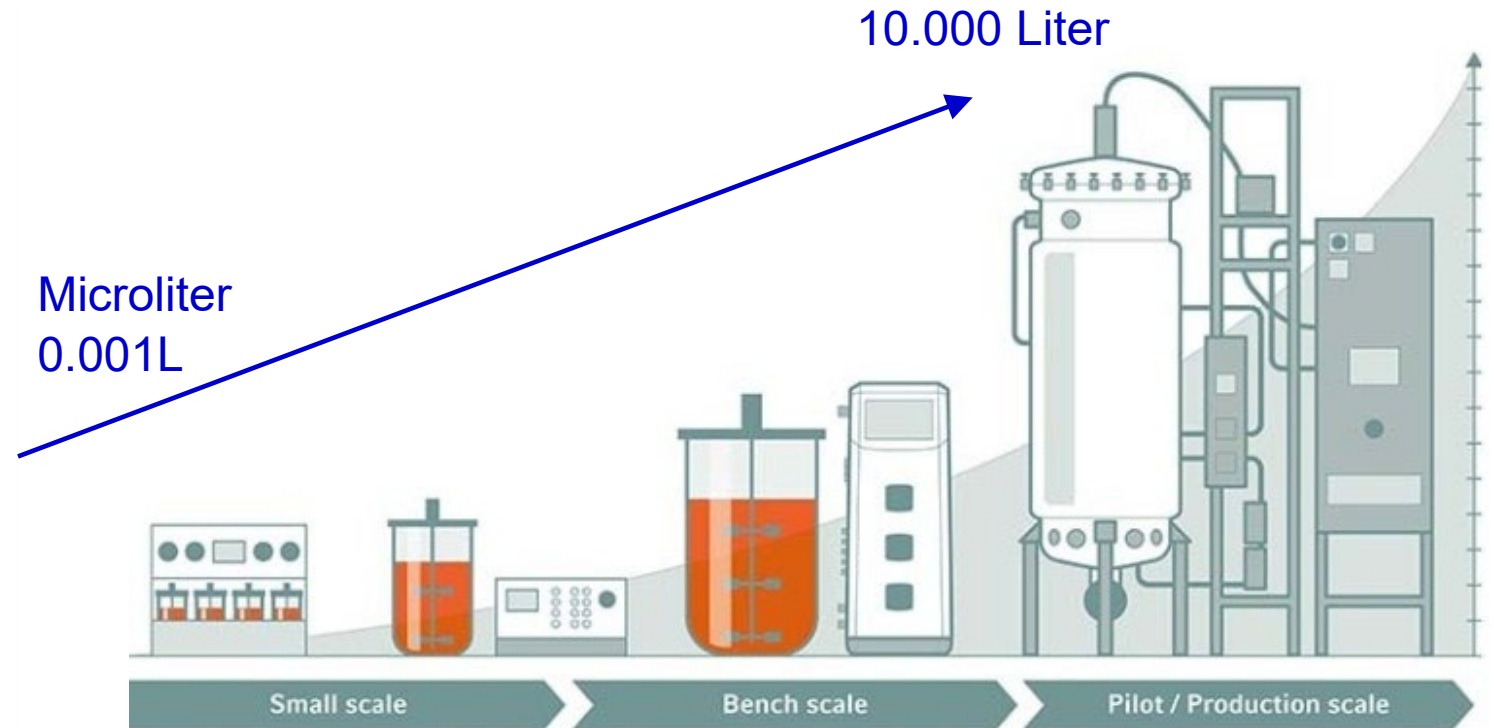
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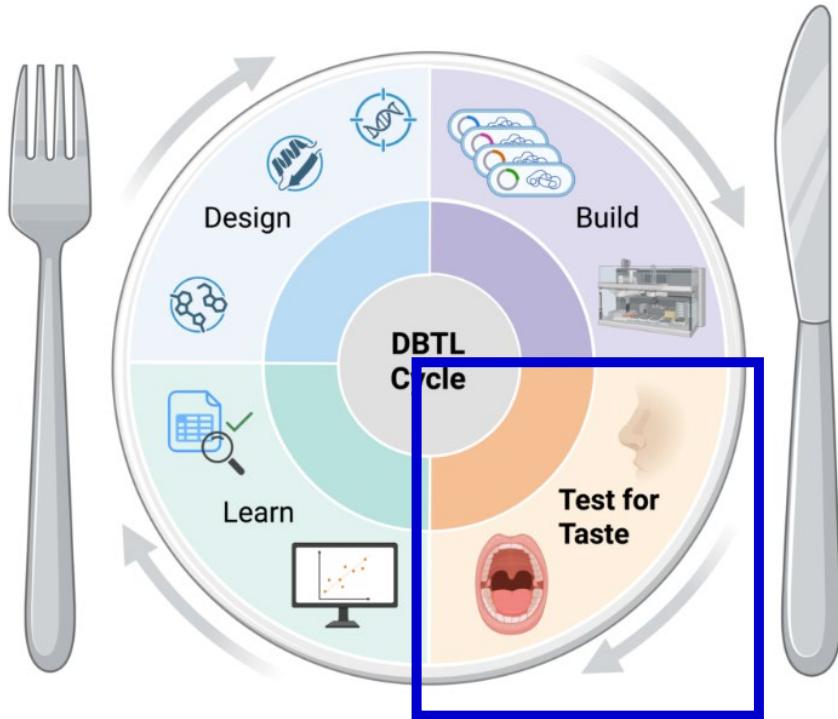
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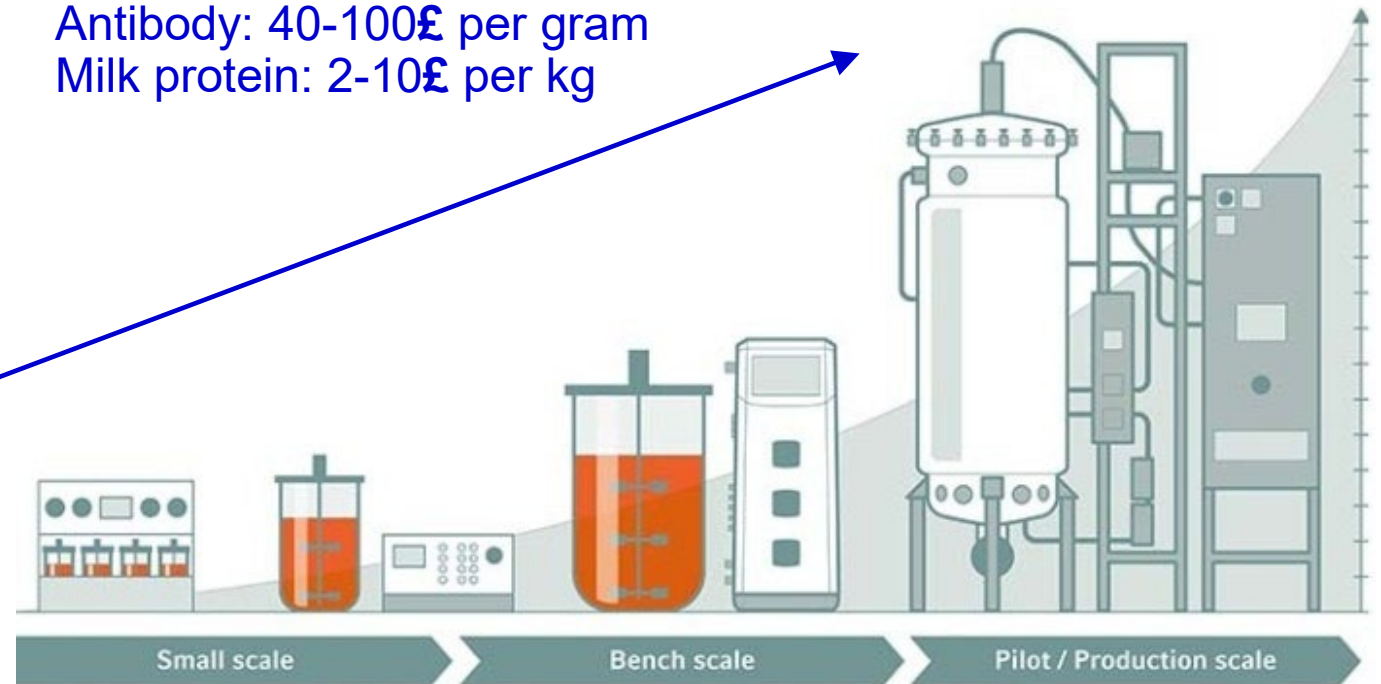
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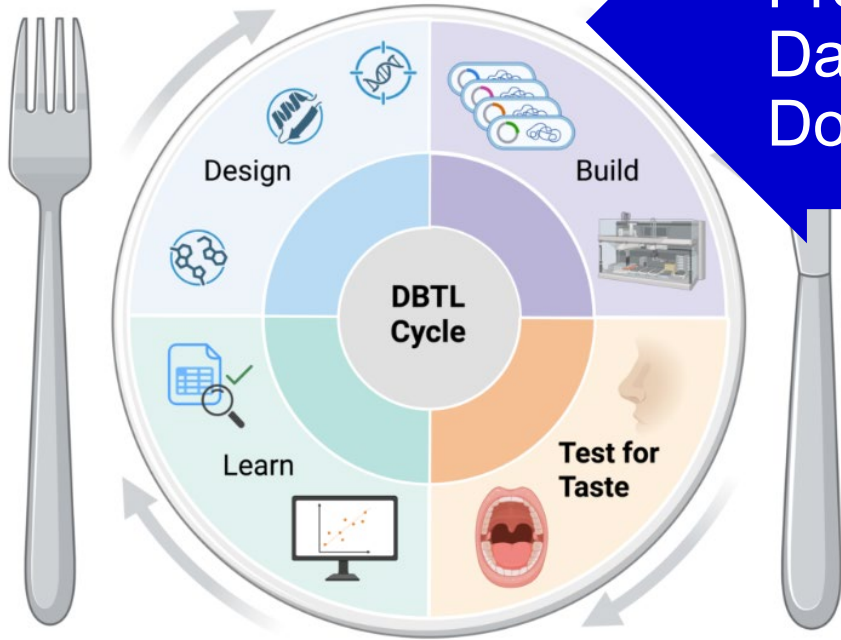
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Antibody: 40-100£ per gram
Milk protein: 2-10£ per kg

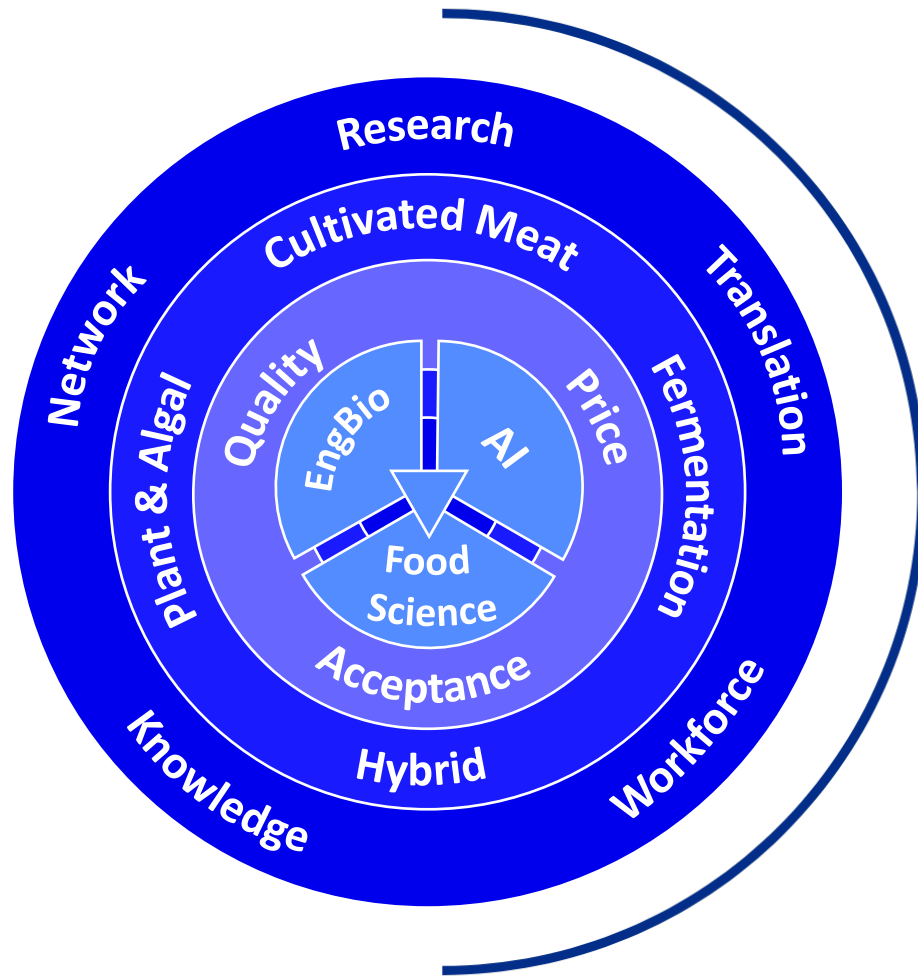


Engineering for Scaling.

Engineering Biology
Process optimization
Data /AI
Downstream processing



Our Vision at the Imperial Bezos Center and Microbial Food Hub



Research + Facilities

Cutting-edge applied research in all the areas of sustainable foods (Engineering Biology, AI, Automation, etc).

Education

Training the next generation of Alternative Proteins professionals -> New PhD programme and Masters.

Translation

Maximise commercialisation, licensing, startup creation.

Knowledge & Network

Thought-leader, high-profile voice, respected scientific authority → impact in society, policy and industry.

How to regulate these new technologies?

