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Title:

Precision Fermentation of Smart Fats: Unlocking Sustainable Lipid Ingredients for Future Foods

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Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text into it.)

Preparation of Your Abstract

1. The title should be as brief as possible but long enough to indicate clearly the nature of the study. Capitalise the first letter of the first word ONLY (place names excluded). No full stop at the end.
2. Abstracts should state briefly and clearly the purpose, methods, results and conclusions of the work.

Introduction: Clearly state the purpose of the abstract
Methods: Describe your selection of observations or experimental subjects clearly
Results: Present your results in a logical sequence
Discussion: Emphasize new and important aspects of the study and conclusions that are drawn from them

Sustainable alternatives to animal- and crop-derived fats are urgently needed to address the nutritional, environmental, and supply chain challenges of current food systems. This research explores precision fermentation as a platform for producing smart fats—engineered lipid ingredients that combine tailored nutritional quality with desirable functional properties for food applications. Using microbial hosts optimised through exogenous engineering and laboratory evolution, we express key lipid biosynthesis pathways to generate structured fats with specific profiles of fatty acids and bioactive components. Bioprocess optimisation, including batch fermentation and metabolic flux balancing, enables scalable production while reducing resource intensity compared to conventional fat sources. The resulting smart fats evaluated based on molecular screening (biomass concentration), biochemical composition (e.g., lipid yields and total fatty acid), would be shared at the presentation. This work emphasises the opportunities in lipid downstream processing to expand on future food development.

Our findings demonstrate the feasibility of developing a precision fermentation platform in New Zealand to deliver next-generation lipid ingredients that are healthier, more sustainable, and versatile for integration into plant-based, hybrid, and novel food formulations. This work lays the foundation for smart fats as a critical enabler of sustainable nutrition, bridging the gap between consumer expectations for taste and texture and the urgent need to decarbonise global food production.