



**Nourish Ingredients**

# **Unlocking delicious with deep tech.**

**Surinder Singh FAA FTSE  
Nourish Ingredients**

**n**

Croplife Members Forum 5th Sept 2023

# Why Plant-based meat: Some drivers

## The carbon impact.



**Animal agriculture's impact on climate change surpasses that of the entire transportation sector's exhaust emissions worldwide.**

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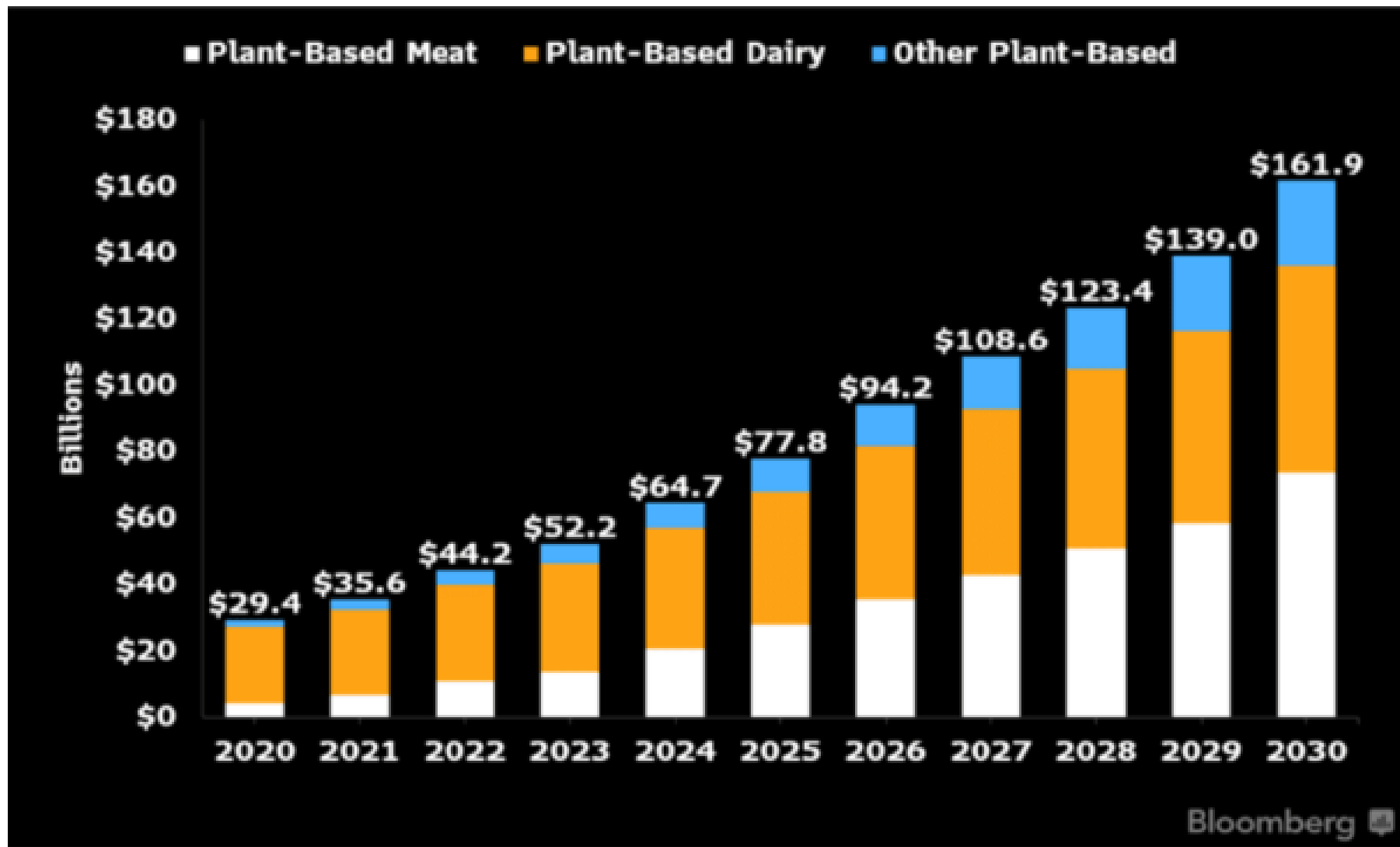


**Despite occupying 77% of agricultural land, animal agriculture provides only 17% of the global food supply.**

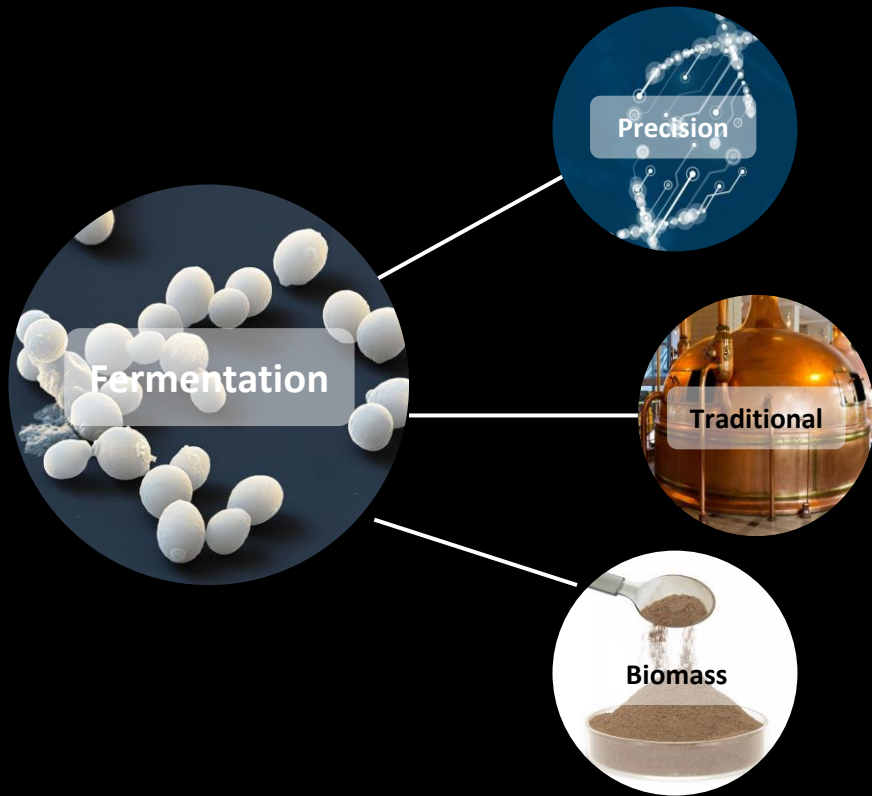
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**Plant-based meat can save between 72%—99% more water compared to conventional meat.**



# Precision Fermentation: Australian Players



Product categories	Global market (2020, bn US\$)	
Meat substitutes and cultured meat	3.3 (CAGR 15.7 %)	
Egg	239.7 (CAGR 3.6 %)	
Dairy	718.7 (CAGR 2.2 %)	
Food additives & ingredients	50.5 (CAGR 3.6 %)	

# Challenges impeding growth of plant based meat

**The market fundamentals of plant protein foods are strong but there are challenges:**

**1** The taste is not authentic enough

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**2** Highly processed and artificial labels

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**3** The cost of scale is too expensive

# Nourish Ingredients- delivering meaty taste from non animal fats

We identify **potent natural fats** responsible for real cooking reactions. We recreate these animal fats to provide an **authentic taste experience.**

Launched  
2020

Series A  
US\$40 Million

Employees  
50+

Next milestone  
**Commercial scale roll-out**



# Nourish Ingredients- What we do



## INNOVATION

Strain Development

Lipid Biotechnology

Food Science



## PRODUCTION

Precision Fermentation

Thermal Processing

Delivery Systems



## PRODUCT DESIGN

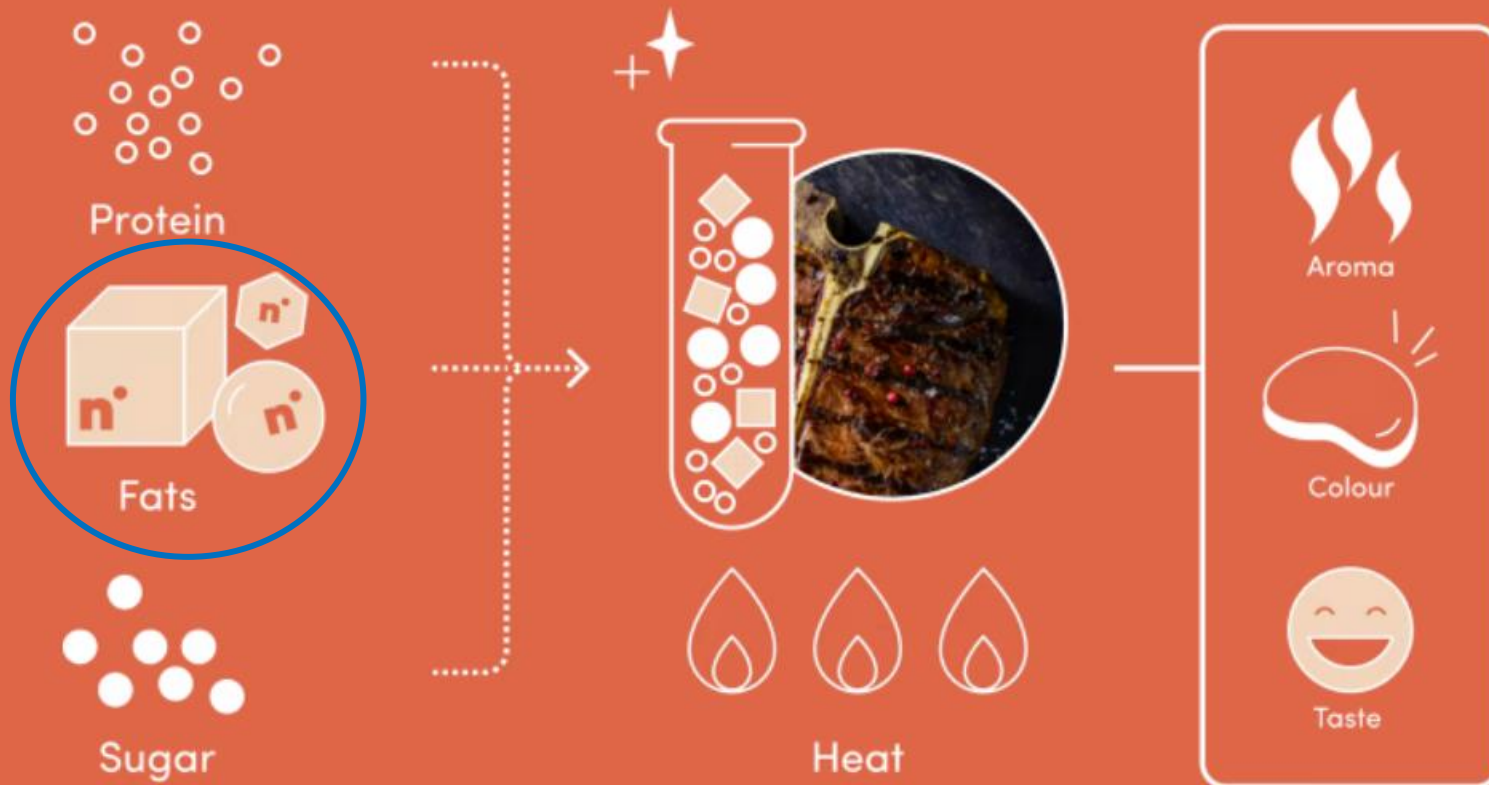
Taste Solutions

Sensory Evaluation

Consumer Insights

# The Maillard Reaction

This interactive alchemy takes place when a protein's fats connect with heat, producing new flavours, aromas, and colours that get our noses' attention and make our mouths water. It's science, not magic, but the way this reaction so compellingly transforms our food certainly feels (and tastes) magical.



Many alternative proteins lack the fully developed, delicious fats needed to foster a superior Maillard reaction. However, our animal-free fats, specially engineered through precision fermentation, are Maillard makers. With Nourish as an integral ingredient in your plant-based foods, you can get the reaction you need to delight your customers.

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# Key fatty acid derived volatiles formed during Maillard rxn

Cooked Meat type	Key volatiles
Roast Chicken	hexanal, 1-hexanol, pentanal, heptanal, 1-octen-3-ol, octanal, nonanal
Roast Beef	2-methyl-butanal, isovaleric aldehyde, 1-decene, tetradecanol, 2-undecanone, 2-methyl-hexanoic acid
Roast Pork	ethyl butyl ketone, 2-methyl-butanal, isovaleric aldehyde, tetradecanol, 2-undecanone, 2-methyl hexanoic acid

# Key meaty aroma generating lipids

**Phospholipid fatty acid profile helps define which taste and aroma volatiles are produced**

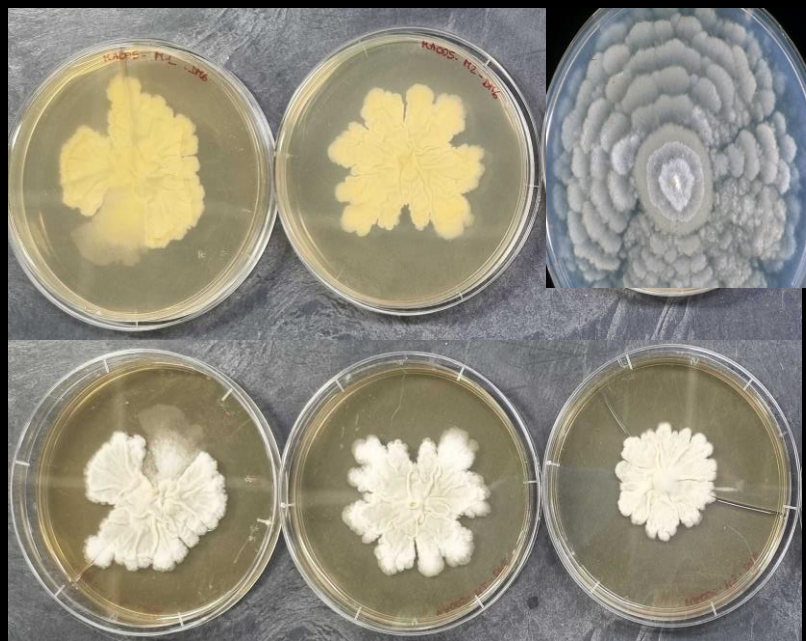
**Table 4.** Potential Precursors and Intermediate Hydroperoxides of Aroma Compounds Formed by Degradation of Phosphatidylcholine and Phosphatidylethanolamine

odorant	precursors	intermediates <sup>a</sup>	refs
hexanal ( <b>1</b> )	linoleate (C18:2)	13-HPOD	29
	arachidonate (C20:4)	15-HPETE	14
1-octen-3-one ( <b>2</b> )	linoleate (C18:2)	10-HPOD	30, 31
	arachidonate (C20:4)	12-HPETE	32, 14
( <i>Z</i> )-1,5-octadien-3-one ( <b>3</b> )	linolenate (C18:3)	10-HPOT	33
( <i>E</i> )/( <i>Z</i> )-2-nonenal ( <b>6/7</b> )	linoleate (C18:2)	9-HPOD	34, 30
	arachidonate (C20:4)	12-HPETE	
( <i>E</i> )/( <i>Z</i> )-2-decenal ( <b>10/11</b> )	oleate (C18:1)	9-HPOE	34, 30
( <i>E,Z</i> )/( <i>E,E</i> )-2,4-decadienal ( <b>12/13</b> )	linoleate (C18:2)	9-HPOD	35, 30
	arachidonate (C20:4)	11-HPETE	14
( <i>E</i> )-2-undecenal ( <b>14</b> )	oleate (C18:1)	8-HPOE	30, 31
<i>trans</i> -4,5-epoxy-( <i>E</i> )-2-decenal ( <b>15</b> )	linoleate (C18:2)	13-HPOD <sup>b</sup>	23, 36
	arachidonate (C20:4)	15-HPETE <sup>c</sup>	14
( <i>E,Z,Z</i> )-2,4,7-tridecatrienal ( <b>16</b> )	arachidonate (C20:4)	8-HPETE	14

## Odorants Generated by Thermally Induced Degradation of Phospholipids

Lin & Blank, 2003 | DOI: 10.1021/jf034300m

# Selected fungi and yeast harbour meaty aroma lipids



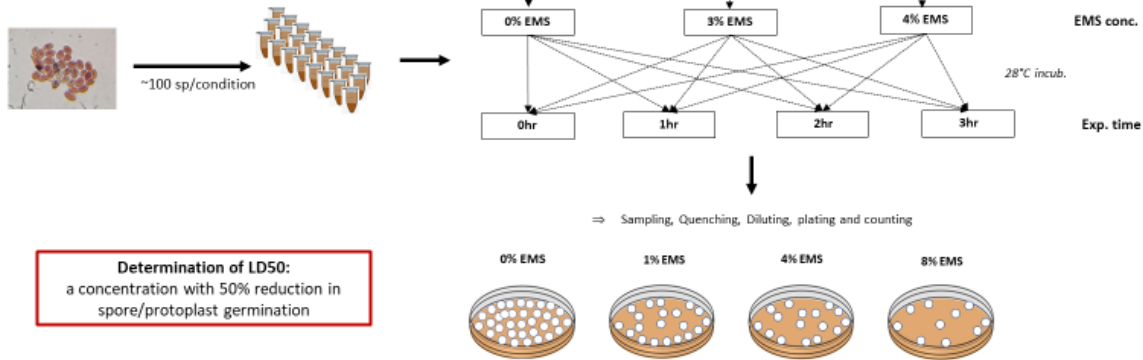
# Improvement of meaty aroma lipids via mutagenesis

## EMS lethal dose:

- Rational & Hypothesis:**

1. Need to determine the Lethal Dose of EMS on spores/protoplast for best exposure conditions

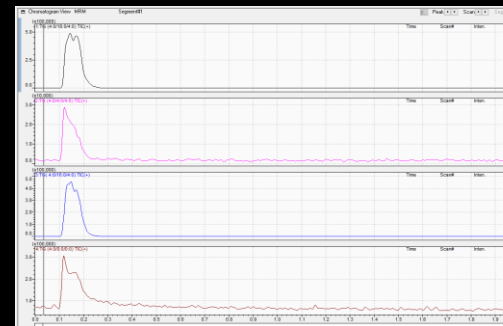
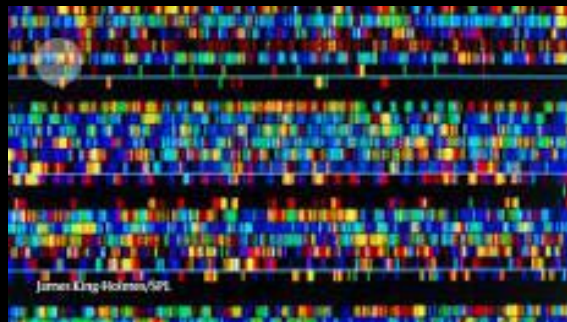
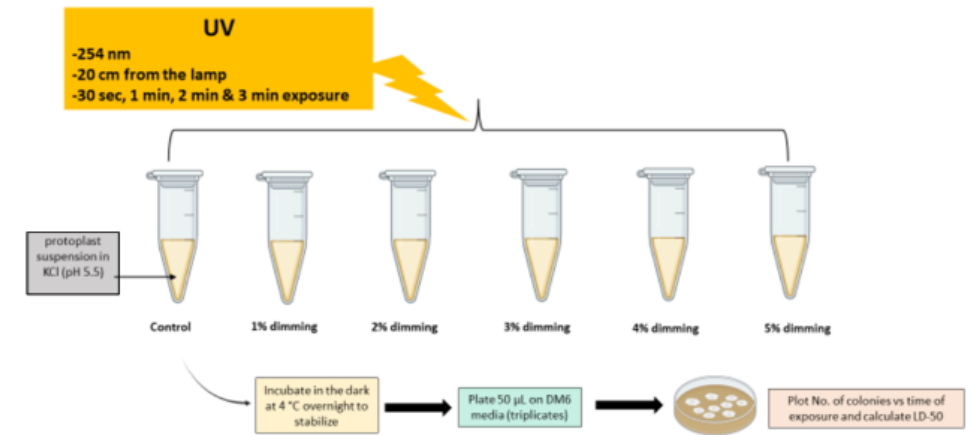
- DOE:**



**Determination of LD50:**  
a concentration with 50% reduction in spore/protoplast germination

## UV exposure of protoplast and determination of lethal doses

### Trial 4: Different intensities with dimming option



# Improvement of meaty aroma lipids through SynBio

DESIGN

BUILD

TEST

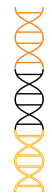


Design and synthesise DNA fragments



High-throughput assembly of DNA constructs

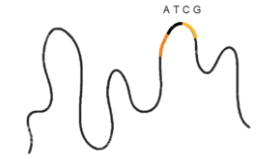
Insertion of DNA constructs into yeast



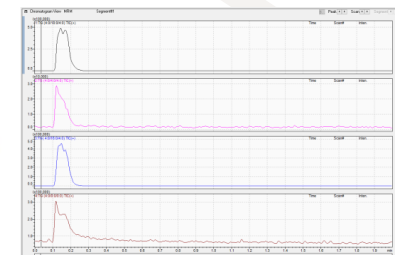
Extraction of genomic DNA from modified yeast



Whole-genome sequencing of modified yeast



Yeast fermentation and analysis of lipid profile



# First wave of Ingredients

## Tastilux™

### MEAT TASTE AND AROMA

The Tastilux™ products showcase authentic animal taste and aromas for beef, chicken, pork, and beyond. This suite of functional pre-flavours will have a deep complex foundation to build taste complexity as required, while offering a clean label experience.

Ready to market in 2024

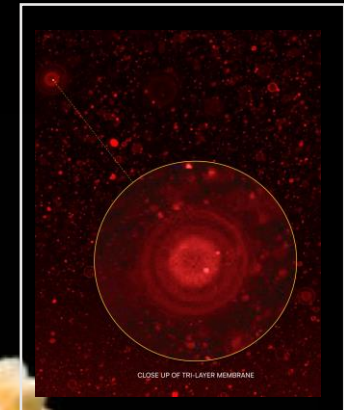


## Creamilux™

### DAIRY PERFORMANCE

The Creamilux™ products offer a genuine creamy texture and excellent emulsification that accurately replicates the mouth-coating sensation of full cream. The market opportunity is huge for its scope of applications.

Prototyping now



# Acknowledgements

## Team Nourish

<https://w3.nourishingredients.io/>



**James Petrie**  
CEO & Founder Director



**Anna El Tahchy**  
CTO & Founder Director