

Enabling #futurefood

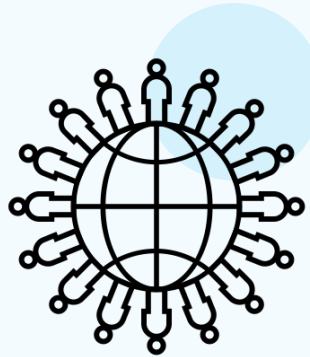
Focus: Precision fermentation

Changing the way food is made



Mind the gap

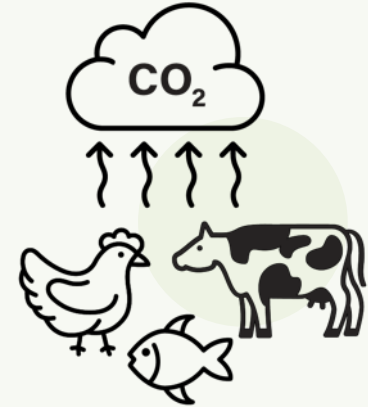
Call for protein alternatives



9.8 billion by 2050



More people
More protein



Industrial livestock farming
Ethical issues and footprints

Challenge

- Functionality & attraction of animal proteins
- Substitute traditional with alternative sources



Alternative proteins

Six categories to convince consumers

Single Cell Protein

microbial biomass from fermentation for texture and nutrients

Precision Fermentation

cultivation of trained microbes liquid media in steel tanks produce selected proteins



Fermented Food

microbial magic transforms and enriches plant matter



Plant Proteins

extracted-extruded-formulated to recreate meat and dairy

Cell Cultures

animal cells grown for clean meat or milk


Insects

modest critters turn tasty







Alternative proteins

A vibrant ecosystem

Rebuilding signature foods

Traditional source					
Food	 Dairy	 Egg	 Meat	 Seafood	 Petfood

Alternatives

Precision Fermentation 	◆ ◆◇	◆ ◆◇	◆ ◆◇	◆ ◆◇	◆
Single Cell Protein 			◆		
Fermented Food 	◆		◆		◆
Plant Protein 	◆◇	◆◇	◆◇		◆◇
Cell Culture 	◆ ◆◇		◆	◆	
Insects 			◆◇		◆◇

◆ Enabling Technology (BEC, Strains) ◆◇ Enabling Product (Enzymes, GF) ◇ Product (Dairy, Brazzein)

The promise of Precision Fermentation



Access

Desirable natural and designer proteins readily produced



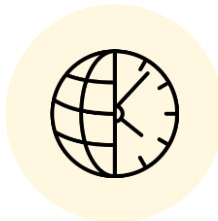
Benefit

Proteins selected for nutritional value, functionality, crave



Efficiency

Microbial cell factories for economical production



Flexibility

Produce anywhere, anytime any scale



Health

Avoid zoonoses,
Avoid antibiotics
Avoid unhealthy foods

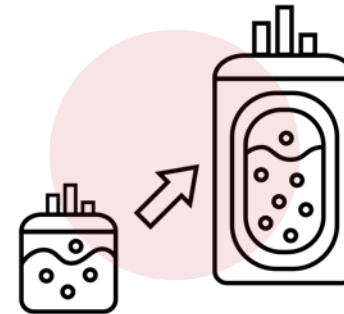
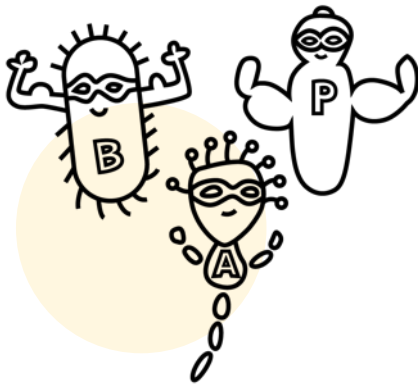


Sustainability

Improved environmental footprint

Pick from our menu of solutions

For your journey along the value chain



Capable microbes

Bacteria, Yeast and Fungi to express your protein of interest

Comprehensive platform tuning

Genetic Toolbox and Gene Editing take your expression platform to the next level

Process development

Process development from lab scale to multi-cube industrial fermenter

Production

ISO certified commercial scale manufacturing

How to work with us



**Benefit from our
expertise and services**

**Tailor-made Solutions
(TMS)**

Fit for purpose R&D
collaborations for your
outsourcing requirements



**Create and innovate
together**

**New Product Development
(NPD)**

Options to join forces in JVs
by outlicensing technologies
& resources



Validated products

Product sales

BRAIN Group's enzyme
portfolio serves Alternative
Proteins industry today

Why work with us?

Technology – Resources – Experience

- ✓ Comprehensive genetical toolkit
- ✓ Proprietary genome editing
- ✓ One contact point from proof of concept to industrial production
- ✓ Multi-dimensional support to develop
 - Microbial food ingredients
 - Protein production platforms
 - Natural taste solutions
- ✓ Different business models
- ✓ Track record

Learn more :

→ We CRISPR for You

We use our proprietary CRISPR-Cas genome scissors to meet project goals cost efficiently faster.

→ Sweetener for the future

The high intensity protein sweetener brazzein provides outstanding sweetening power.

→ Natural taste solutions

We offer a screening platform and resources to discover natural taste improvers

→ Strategic partnership of BRAIN Biotech and Formo

“With BRAIN Biotech we share a passion for more sustainability in the food system. We are very glad to have these experts in Precision Fermentation on board to help us optimize our production yields for animal-free milk proteins.”

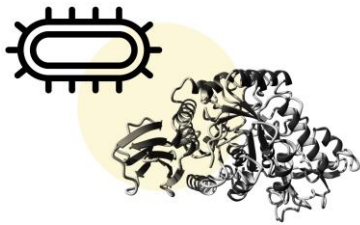
Raffael Wohlgensinger, CEO of Formo

Three cases – Precision Fermentation

Case 1



Case 2

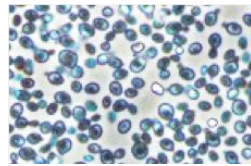
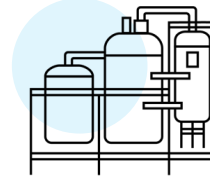
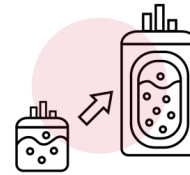
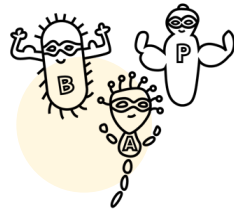


Case 3



Origin

Protein



Strain selection

Strain development

Process development

Production



Taste



Nutrition



Function

Product

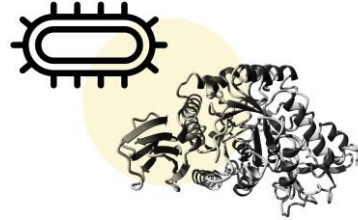
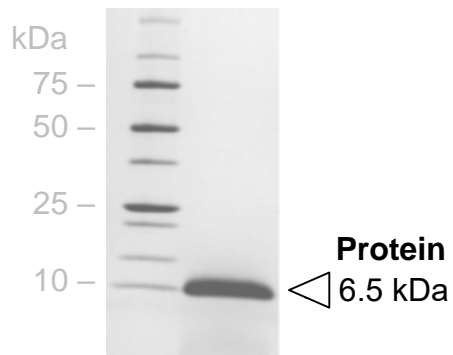
Three cases – Precision Fermentation



Case 1 - TASTE

Category: Plant Protein

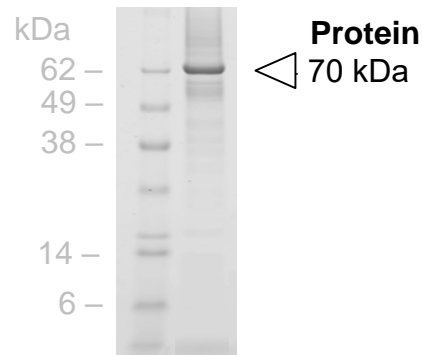
- ▶ Origin: Edible plant
- ▶ Size: 6.5 kDa
- ▶ Host: *Pichia pastoris*
- ▶ Status: Developmental
- ▶ Partner: open



Case 2 - NUTRITION

Category: Microbial Protein

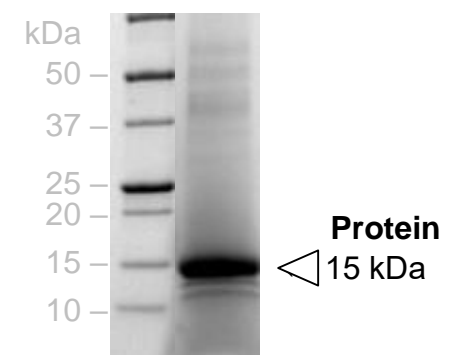
- ▶ Origin: Human gut bacterium
- ▶ Size: 70 kDa
- ▶ Host: *Aspergillus niger*
- ▶ Status: Developmental
- ▶ Partner: open



Case 3 - FUNCTIONALITY

Category: Animal Protein

- ▶ Origin: Farm animal
- ▶ Size: 15 kDa
- ▶ Host: *Yarrowia lipolytica*
- ▶ Status: Commercial
- ▶ Partner: internal



Thank you for your attention.

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