

# Plant and hybrid meat alternatives

Nesli Sözer (Res Prof)

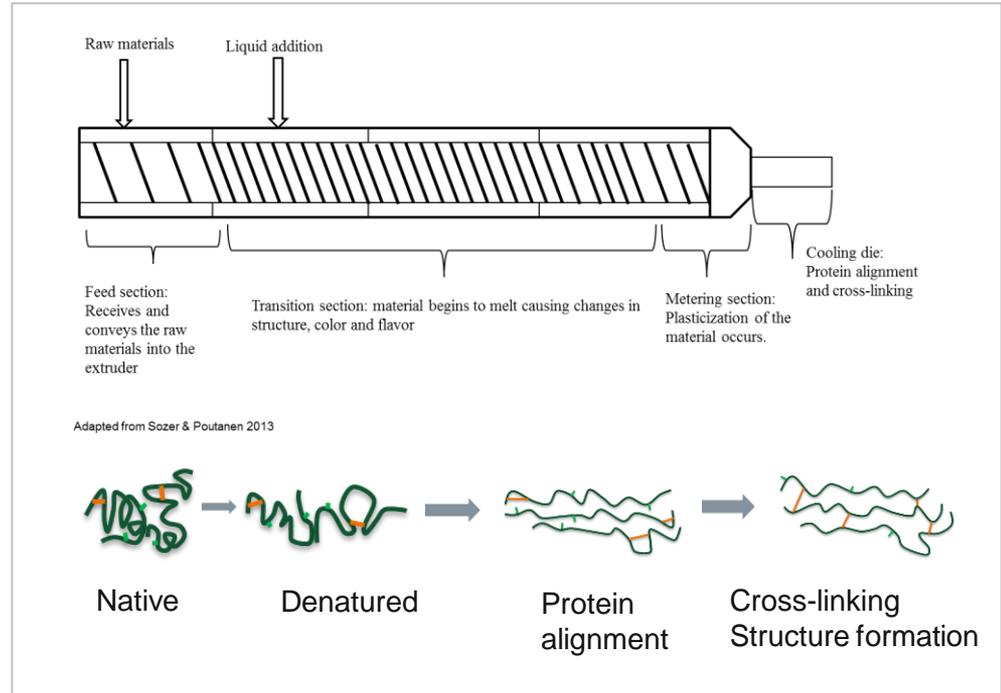
Industrial biotechnology  
and food



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# High moisture extrusion processing

- Requires protein rich ingredients
- Twin screw extruder with a long cooling die
- Long cooling die enables the protein alignment in the direction of flow forming an anisotropic protein network



# From side-streams to tasty meat alternatives and hybrids (Taste2Meat)

	<b>Dry separation</b>	
<ul style="list-style-type: none"> <li>• Air classification</li> </ul>	<ul style="list-style-type: none"> <li>• Triboelectric separation</li> </ul>	
	<b>Bioprocessing</b>	
	<ul style="list-style-type: none"> <li>• Fermentation / enzymatic treatment</li> </ul>	
	<b>High moisture extrusion</b>	
<ul style="list-style-type: none"> <li>• Laboratory scale</li> </ul>	<ul style="list-style-type: none"> <li>• Sunflower protein/ Meat side streams</li> </ul>	<ul style="list-style-type: none"> <li>• Pilot scale</li> </ul>
	<b>Product development</b>	
	<ul style="list-style-type: none"> <li>• Meat analogues / Hybrid products</li> </ul>	
	<b>Consumer liking tests</b>	
	<ul style="list-style-type: none"> <li>• Final products → flavour, texture</li> </ul>	

Research partners:  
VTT-University of Helsinki- DIL

Industry partners:  
DSM-ABP Beef

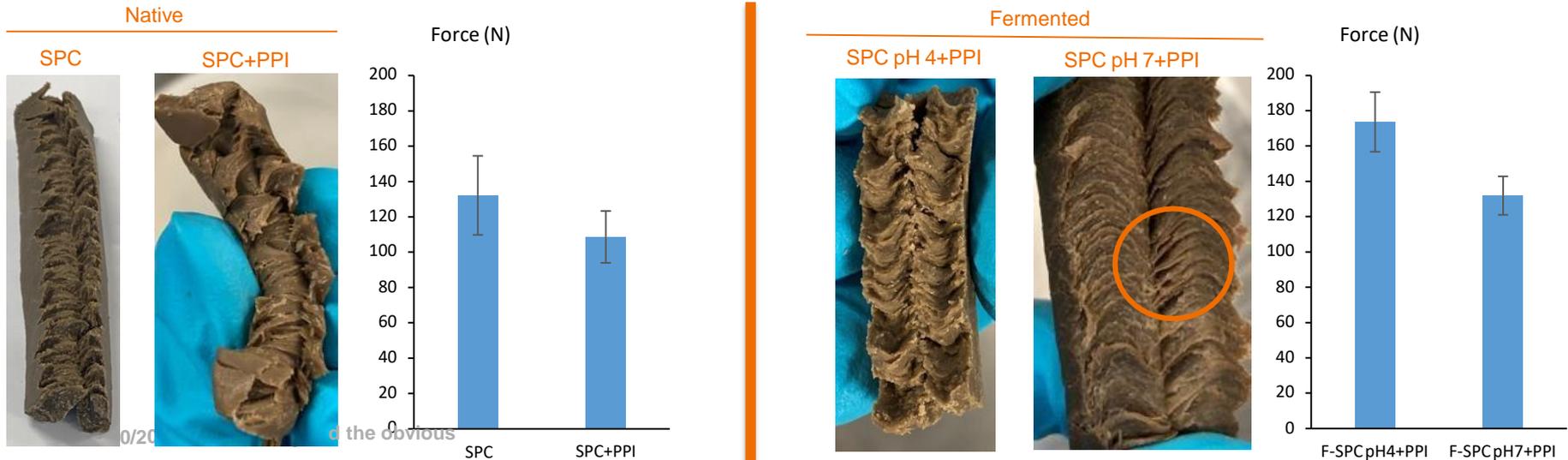
Activity leader: Nesli Sözer, VTT  
Project duration: 2021-2022

# Plant-based extrudates from sunflower protein concentrate and pea protein isolate

- Plant-based extrudates were made from sunflower protein concentrate (SPC), as native or fermented, in 1:1 ratio with pea protein isolate (PPI).
- Native SPC had some fibrils while the extrudates with PPI were more fibrous. Fermented SPC with pH adjustment to 7 had a clearly layered structure.
- Fermented extrudates were slightly harder than the extrudates made from the native SPC.



Taste2Meat





## Hybrid foods as new frontiers

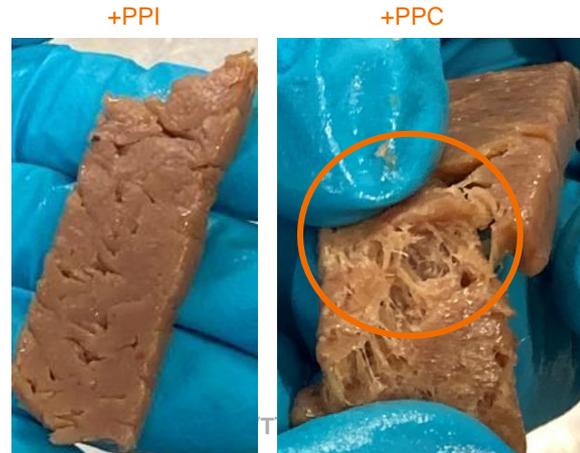
# Plant-meat hybrids: Hybrid extrudates from pea protein and minced beef

- Consumers want healthier beef products where addition of plant protein was one of the most common suggestions based on a large consumer study done in UK, Denmark and Spain (EIT Consumer attitudes towards healthier processed meat products)
- Hybrid extrudates were made from minced beef (7 or 17% fat) mixed with pea protein isolate (PPI) or texturized and milled pea protein concentrate (PPC) in 1:1 ratio.
- Hybrid extrudates were quite oily and brittle, except when mixed with the texturized PPC, the structure became more compact (harder) and fibrous with thin fibrils.

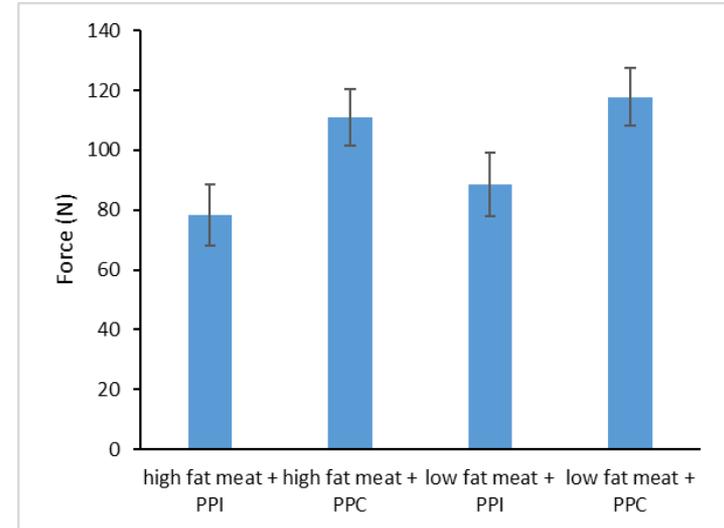


Taste2Meat

High fat meat (17%)



Low fat meat (7%)

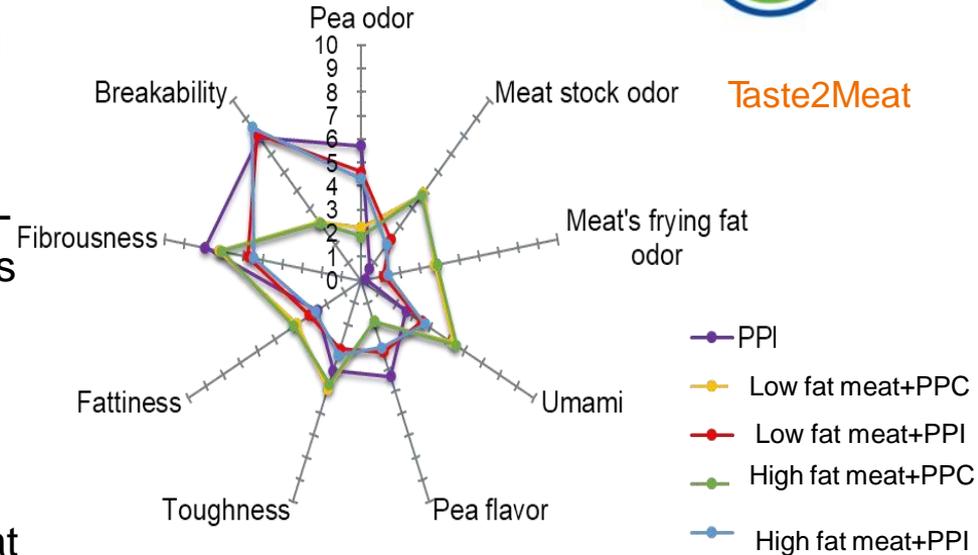


# Sensory evaluation of the plant-meat hybrid extrudates

- The flavour, structure, and texture of the hybrid extrudates were evaluated by trained sensory panellists.
- The hybrid extrudates with PPC had a meat-like odour and umami taste, while extrudates with PPI still had a dominant pea-like taste and odour.
- Fat content did not significantly affect the sensory properties → low levels of animal fat can enhance the flavour and odour of plant protein extrudates.



Taste2Meat



# Meat lipids are critical in giving the unique taste and eating experience

Microbes as cell factories for sustainable production of lipids



# Plant-cellag hybrids

**PLANT OR  
CULTURED  
PROTEIN**

**+**

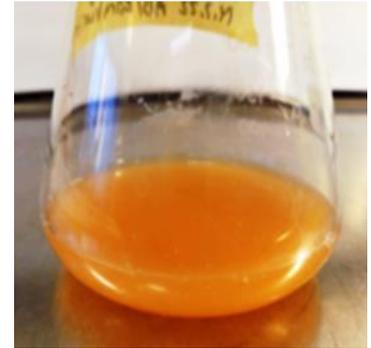
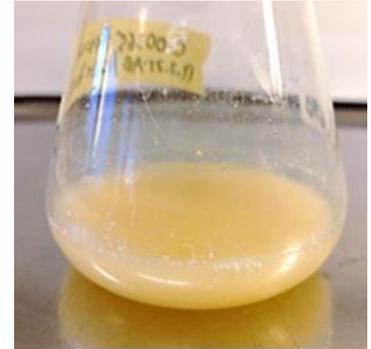
**MICROBIAL  
LIPIDS**

**=**

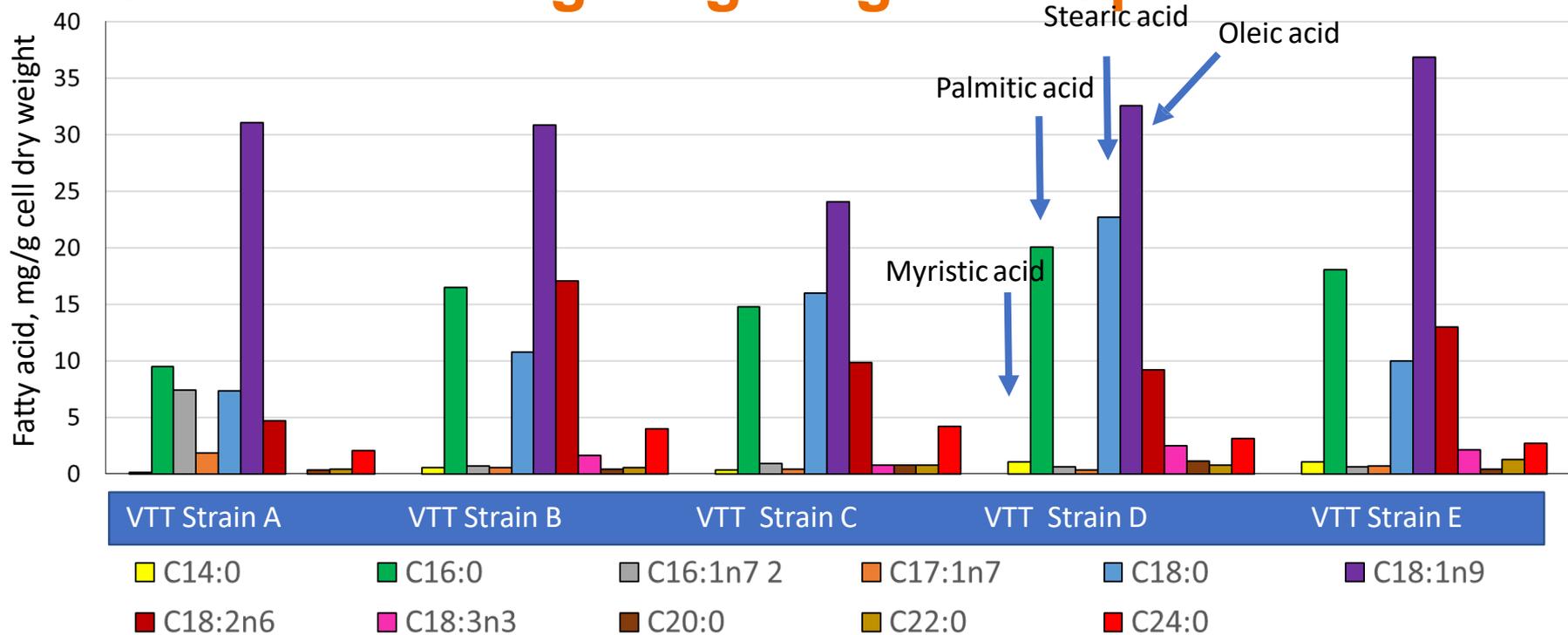
**DELICIOUS  
MEAT (DAIRY)  
PRODUCTS**

# Triacylglycerols (TAGs) are major components of animal fats

- TAGs contain three fatty acid residues esterified into glycerol molecule and most calorie dense nutrient
- Oleaginous yeasts are efficient cell factories for production of TAGs. (> 50% of the total dry cell mass)
- Some examples of oleaginous yeasts are:
  - Yarrowia
  - Cryptococcus
  - Rhodotorula
  - Trichosporon
- Lipid yield and composition can be tailored towards targeted functionality via controlling growth parameters (pH, T, O<sub>2</sub>, C:N ratio)



# Fatty acid profile from different yeasts and filamentous fungi targeting meat lipids



# Take home

- There are lots of untapped potential in efficient use of plant based side streams for food. Upcycling of sunflower press cake as protein ingredient is only one case.
- Fermentation combined with high moisture extrusion can develop nutritious and tasty plant based meat alternatives.
- Hybrid foods combining plant-meat or plant-collagen ingredients have a huge potential in getting the “reluctant meat reducers”.

# ACKNOWLEDGEMENTS

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Anna Borisova (strain selection and screening, lipid production)

Fiona Smaros (MSc student, lipid production)



# bey<sup>0</sup>nd

## the obvious

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