



# Shear-induced structuring to form protein based fibrous matter

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## Potential use of protein fibrous materials? → Meat analogues

### Meat consumption is not sustainable:



- 70% of annual grain crop to produce meat (US)
- App. 150 bn kg grain as feed → 20 bn kg meat products
- Water requirement compared to wheat
  - 100 x more water
  - App. 10 x more fertilizers and pesticides (based on 10 kg wheat per kg meat)
- 1 kg methane for every 3 kg meat produced (World Watch Institute)

### Alternative: Fibrous plant based products

### Current production methods of meat analogues:



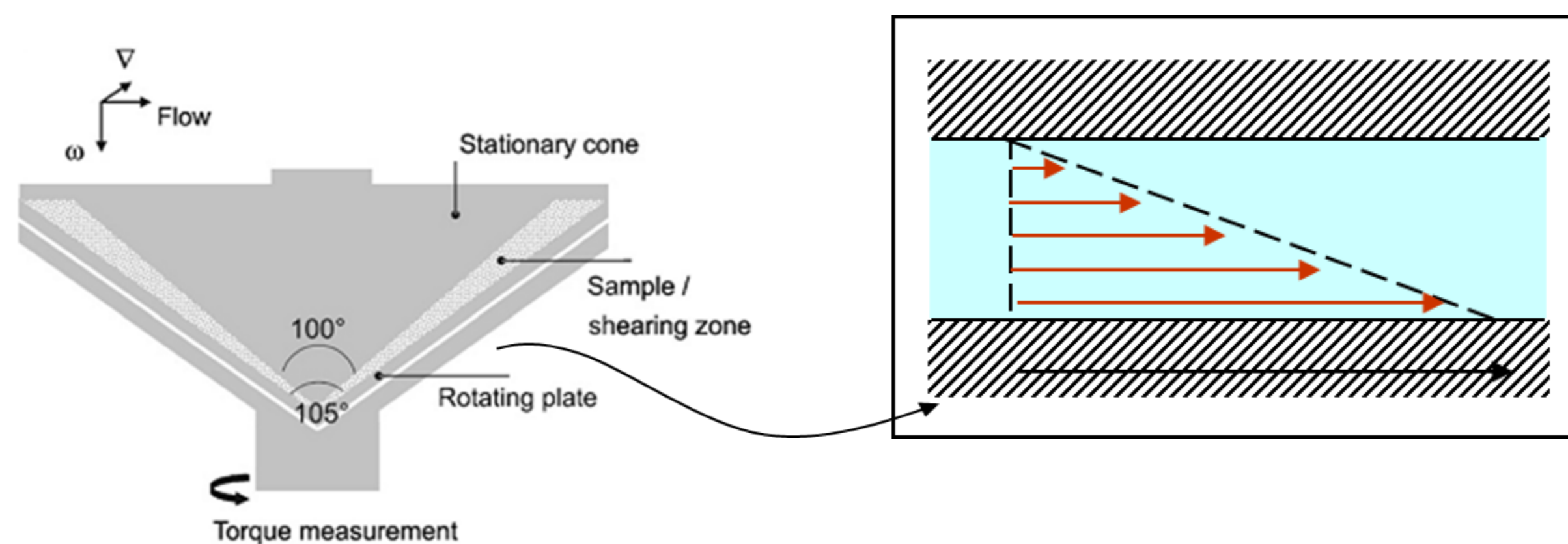
- Extrusion
- Alginate technology
  - CaCl<sub>2</sub> addition upon mixing
- Methods based on mixing process
- Making structures is not mixing



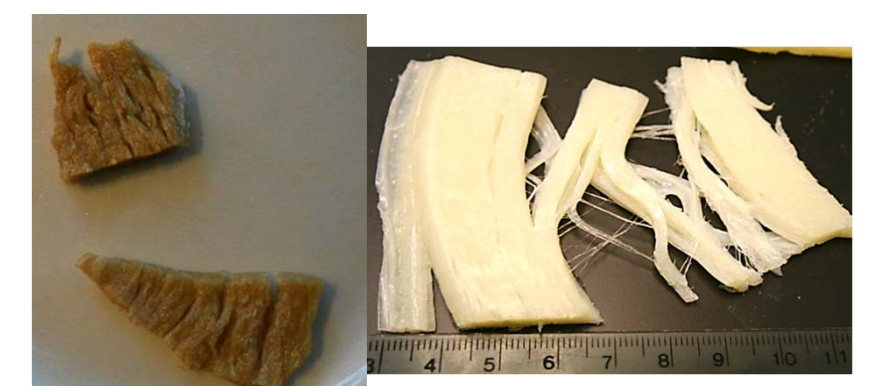
### Shear induced structuring – Fibrous macrostructure



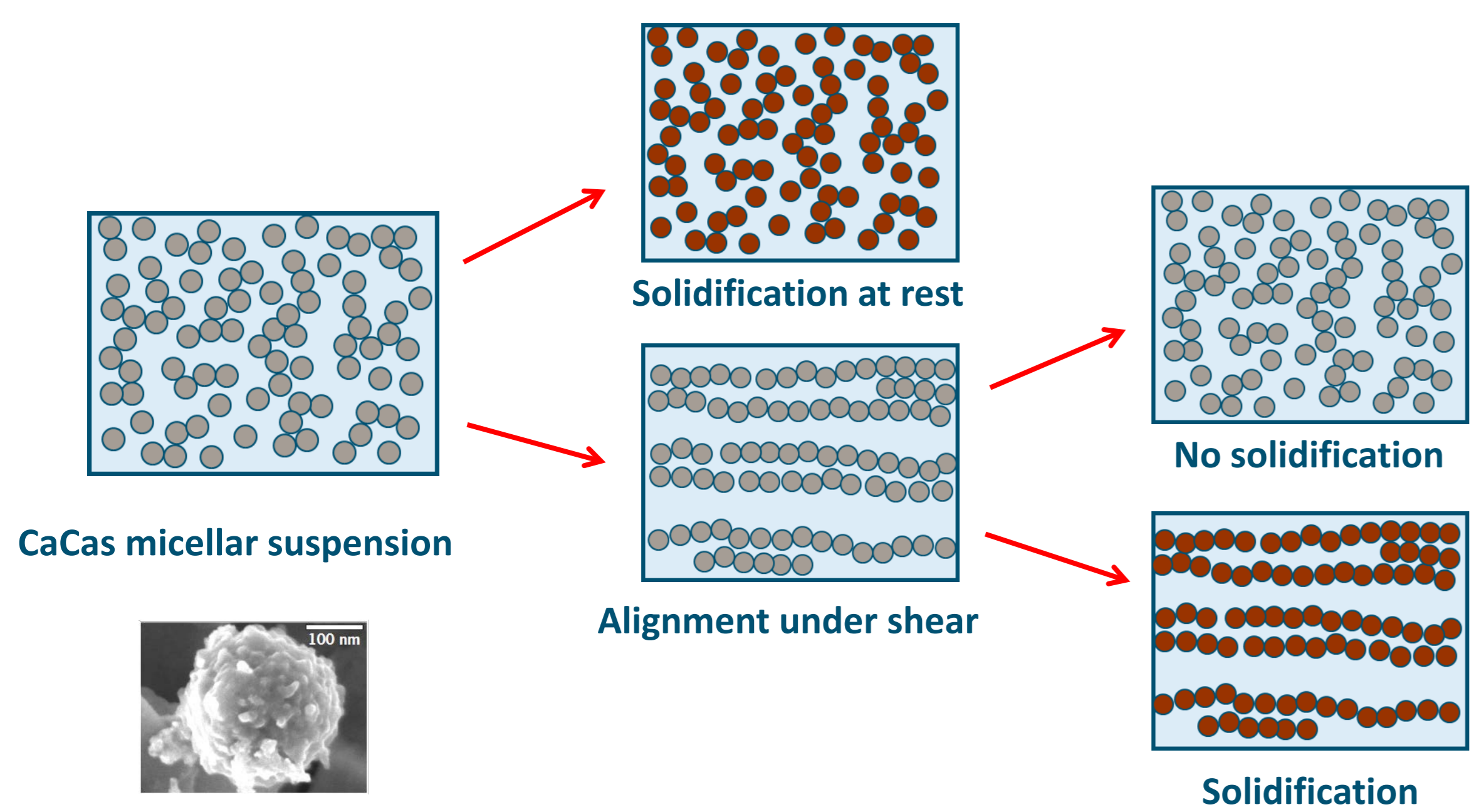
The shearing devise



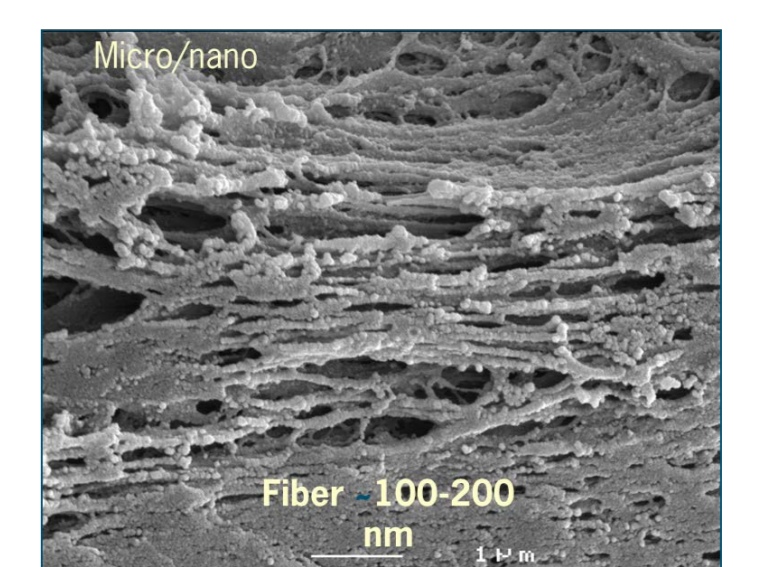
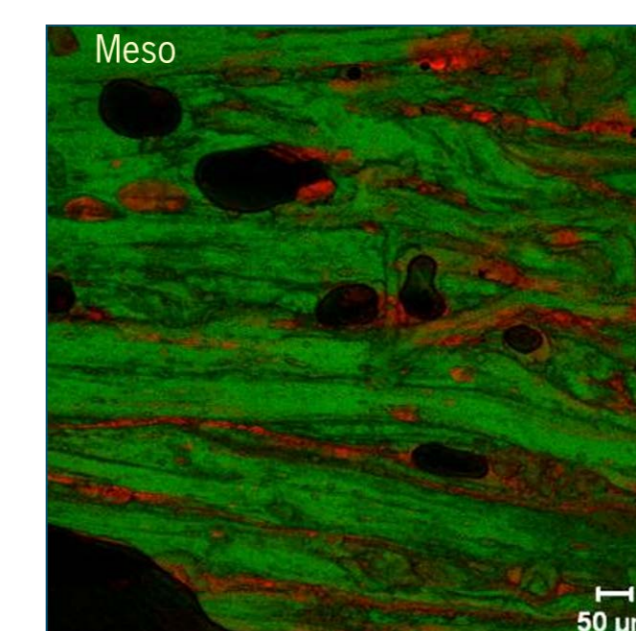
- Plain shear field in concentrated materials
- Simple shear flow



### Directed self-assembly



- 30 wt% CaCas, 15 wt% fat
- Shearing for 30 min at 120 s<sup>-1</sup>
- Solidification by Tgase



### Conclusions

- Shear-induced structuring is a promising method to make anisotropic and fibrous materials from dairy and plant proteins
- The flow type is important rather than the geometry of the device
- Cone-cone device + rheology: understanding the role of ingredients and process condition in the structure formation
- Neutron Scattering probably a useful tool to characterize the molecular interactions

