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# Multi-scale exploration of the drying dynamics of dairy colloids

## Socio-economic context

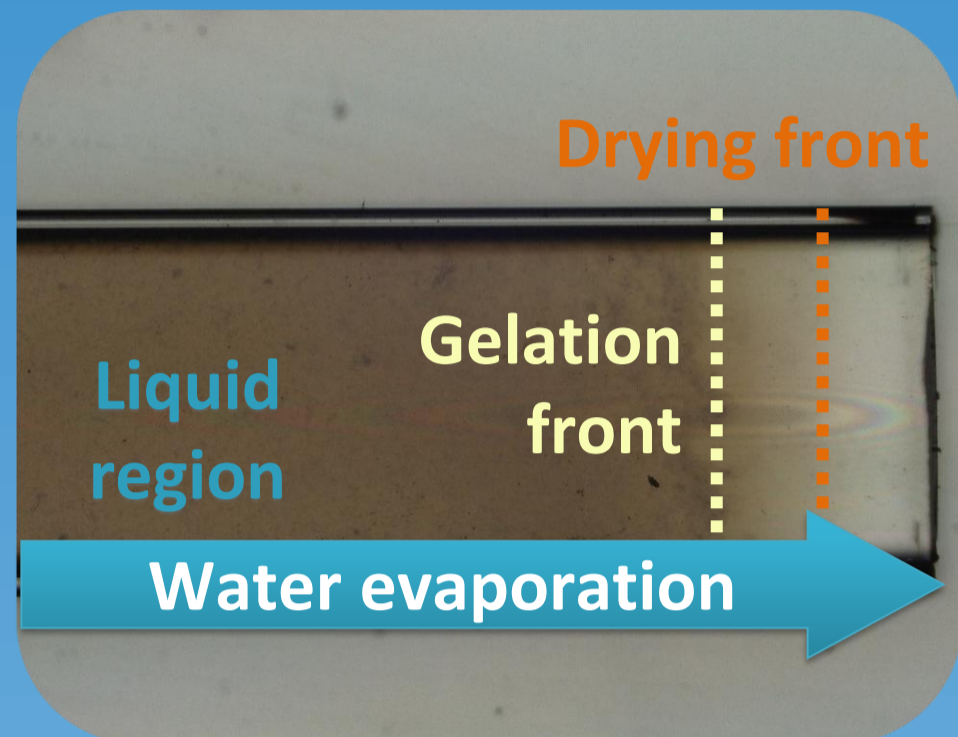
Spray drying is the standard method for converting milk into powder. However, its control remains relatively empirical. The operating parameters are mainly commanded as to achieve dehydration of the dairy fluid, with little control of the functional properties of the powders. Therefore, achieving both targets remains an open question.

## Scientific context

- Milk contains whey proteins (WPI) and casein micelles (NPC); WPI being about 10 times smaller than NPC in diameter.
- Some observations suggest that drying of WPI/NPC mixed droplets leads to a stratification of particles (small on top).
- Lack of studies about the micron-scale mechanisms of protein interfacial self-organization. → Unidirectional (1D) geometry

## Research question

- How do the drying dynamics of dairy protein systems influence or control their interfacial organization?
- How does this multi-scale colloidal organization determine the morphological and functional properties of the resulting powders?



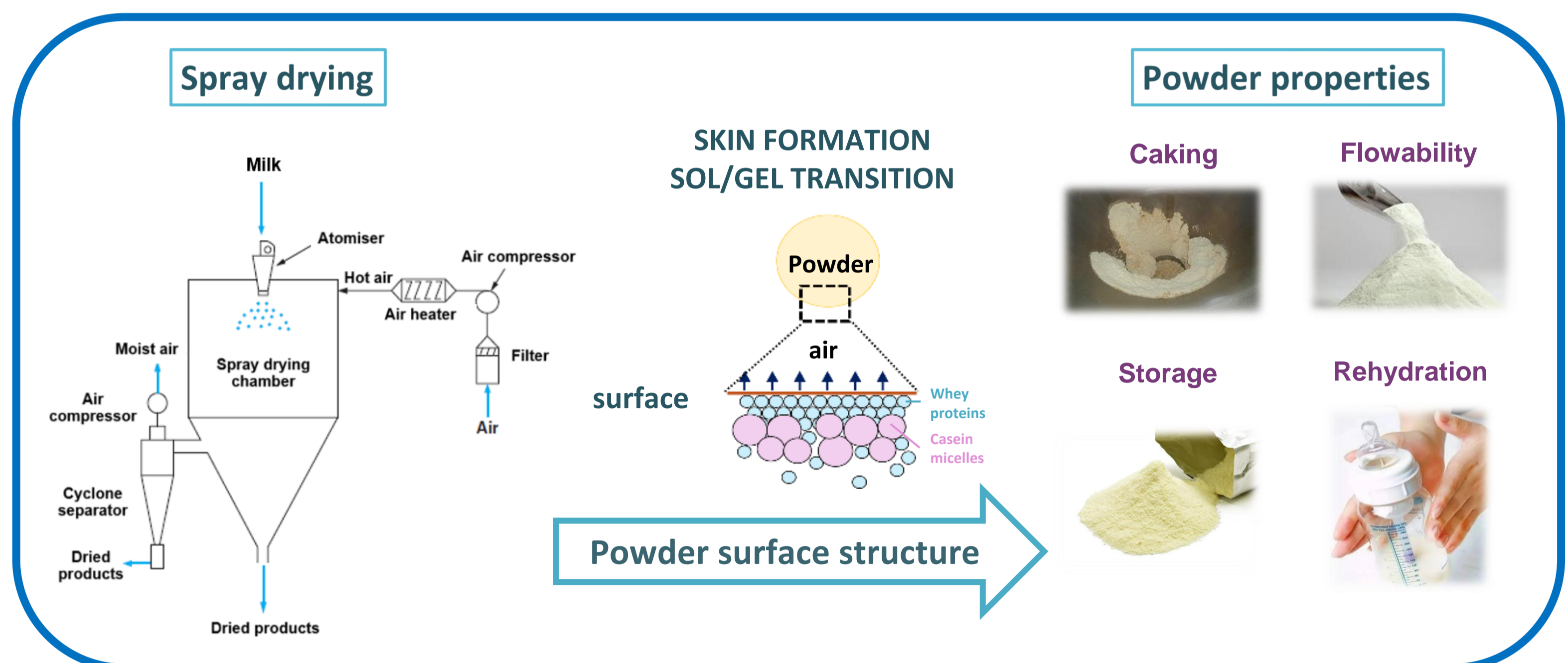
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Process – Structure – Functionality

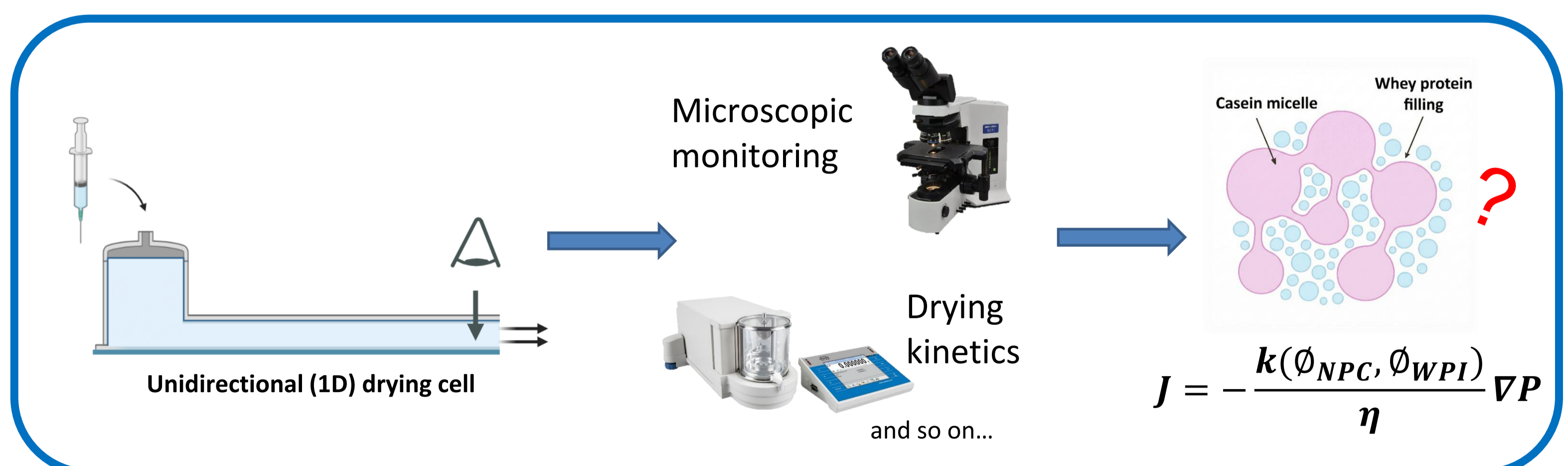
Keywords

Drying  
Colloids  
Dairy proteins  
Sol-gel transition



## Expected Results

- Development of a multi-scale experimental approach for studying the drying dynamics of milk protein suspensions.
- Understanding the self-organisation pattern of interface during drying of dairy protein mixtures.
- Modeling the drying process at the micron-scale.



## Perspectives

- Extend 1D drying insights toward 3D droplet systems.
- Develop and validate multi-physics 3D drying models.
- Generalize predictive models of drying polydisperse colloidal systems.

