**LABORATORY OF BIOPHYSICS**

WAGENINGEN UNIVERSITY & RESEARCH

# NMR/MRI of gastric milk protein digestion

Topsector Agri& Food

Industrial preparation of infant formulas involves heating, as well as the co-existence of lipids and carbohydrates in the product matrix, which all can modify protein structure and digestibility. Accurate prediction of heating or food matrix effects on protein digestion can thus aid optimizing industrial processing of the milk proteins. Static or dynamic *in vitro* digestion models are typically used to mimic either adult or infant protein digestion. Yet, verifying *in vitro* findings *in vivo*, especially in humans, remains a big challenge.

In this collaborative project between the Laboratory of Biophysics (BIP) and Human Nutrition and Health (HNH), we develop Magnetic Resonance (MR) markers for *in vitro* and *in vivo* monitoring of gastric protein digestion (Fig. 1A) [1]. Parameters such as water-protein chemical exchange have proved successful for unravelling the effect of heat treatment and pH on protein digestion [2].

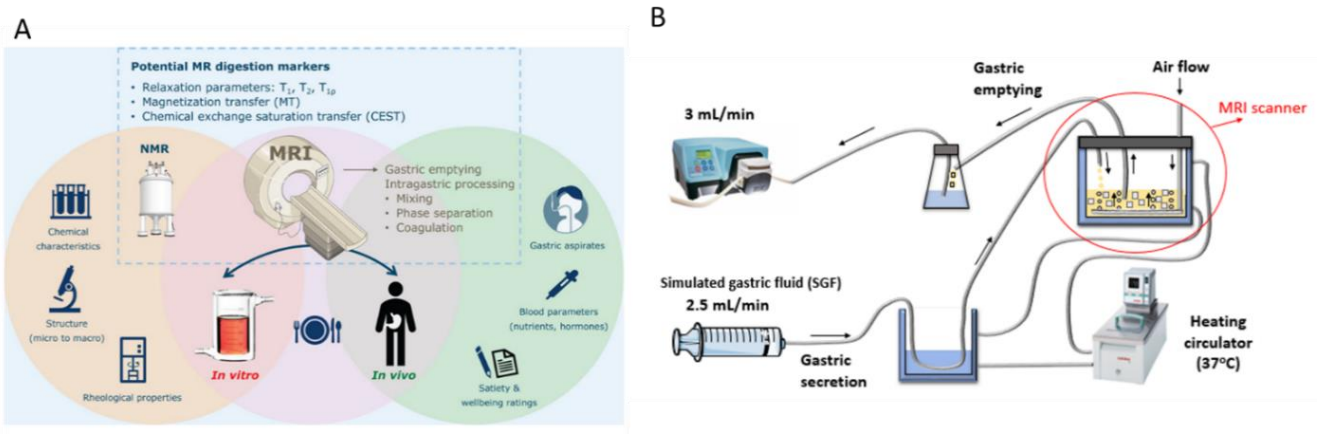


*Figure 1. (A) overview of the interdisciplinary approach to study digestion by employing magnetic resonance techniques. (B) schematic overview of the dynamic digestion model in which the influx of gastric juice and the gastric emptying are controlled to better mimic in vivo digestion.*

We are looking for **BSc** and **MSc thesis** students to apply the chemical exchange markers to:

1. study the static *in vitro* digestion of an infant formula model system using an NMR spectrometer in the NMR facility MAGNEFY.
2. study the dynamic *in vitro* digestion (Fig 1B) of milk proteins using an NMR spectrometer and a clinical MRI scanner at the Gelderse Vallei Ziekenhuis in Ede.

Data analysis is done using in-house developed scripts (MATLAB). The project offers exposure to our industrial partners and possible opportunities for internships.

**References:**


1. Smeets, P. *et al*. (2021). Monitoring food digestion with magnetic resonance techniques. Proc. Nutr. Soc., 80(2), 148-158.
2. Mayar, M. *et al.* Non-invasive monitoring of in vitro gastric milk protein digestion kinetics by $^{1}$H NMR magnetization transfer. Submitted to *Food Chem.*



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