

## **Modulation of gastric lipase adsorption into mixed galactolipid-DPPC films by the addition of phytosterols**

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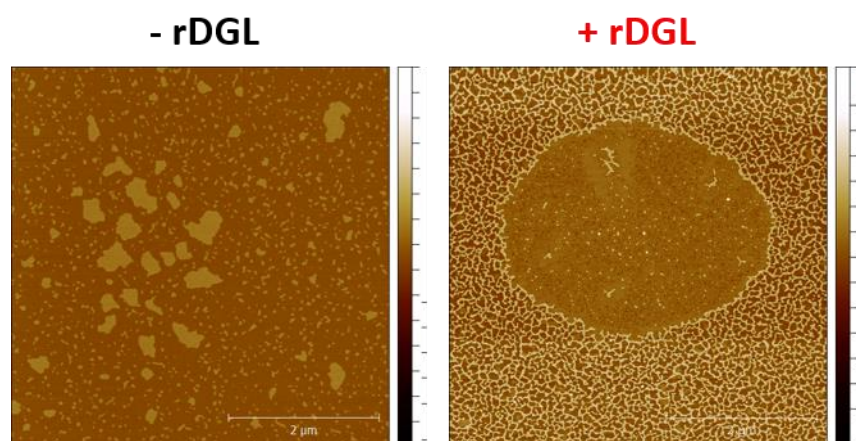
**ABSTRACT:** Gastric lipase is a very tensioactive enzyme that plays a qualitative but important part in human lipid digestion. It has been shown in animal model membrane presenting phase coexistences (Liquid condensed – liquid expanded) that gastric lipase could get very rapidly adsorbed into fluid phase and at phase boundaries as patches of enzymes at different levels of insertion, suggesting a molecular cooperation. Gastric lipase adsorption into photosynthetic plant membranes has not been yet characterized. These membranes are rich in phospholipids and galactolipids, associated to micronutrients such as phytosterols. Thus, the present study aims at determining the adsorption dynamics of a mammalian analogue to human gastric lipase into model photosynthetic membranes presenting phase co-existence.

Ellipsometry, tensiometry and atomic force microscopy were used to get an insight on the ability of the lipase to get inserted into the membrane. In this aim, Langmuir films based on various ratios of galactolipids/phospholipids/phytosterols (100:0:0, 50:50:0, 45:45:10 mol.mol<sup>-1</sup>.mol<sup>-1</sup>) were used to mimic the composition of the photosynthetic vegetal membrane. These films of various ratios helped determining the impact of various parameters, such as the lipid packing and the composition of the interface, on the adsorption and insertion capacities of the lipase. Recombinant dog gastric lipase (rDGL) was used as a model of the human gastric lipase.

The used biophysical techniques revealed the preferential adsorption of rDGL at the expanded lipid phases of galactolipid and galactolipid-phospholipid films. The addition of phytosterols to these mixtures led to the appearance of defects in the condensed phase

domains, favoring the adsorption of rDGL into the fluid phases. The AFM images revealed that the modification of the lipid packing globally improved the adsorption capacities of the lipase towards the defects created in the condensed phase, and at the edge of these domains.

This biophysical approach will be generalized to other digestive enzymes in a future work to investigate the global digestion of galactolipids in humans.



**Figure** -  $5 \times 5 \mu\text{m}^2$  AFM images of GL/DPPC/phytosterols (45:45:10 mol/mol/mol) monolayer in the presence or in the absence of rDGL (40 nM) (initial surface pressure of  $20 \text{ mN}\cdot\text{m}^{-2}$ )

**KEYWORDS:** photosynthetic membrane, galactolipids, phytosterols, gastric lipase

References:

1. Bénarouche, A., et al. (2013). New insights into the pH-dependent interfacial adsorption of dog gastric lipase using the monolayer technique, *Colloids and Surfaces B: Biointerfaces*, 111(0), 306-312.
2. Bourlieu, C., et al. (2019). Adsorption of gastric lipase onto multicomponent model lipid monolayers with phase separation. *Colloids and Surfaces B: Biointerfaces*, 143(1), 97-106.
3. Bourlieu, C., et al. (2020). Physico-chemical behaviors of human and bovine milk membrane extracts and their influence on gastric lipase adsorption. *Biochimie*, 169, 95-105.