# M2 internship and PhD thesis

## Thermal fluctuations of soft cellular systems

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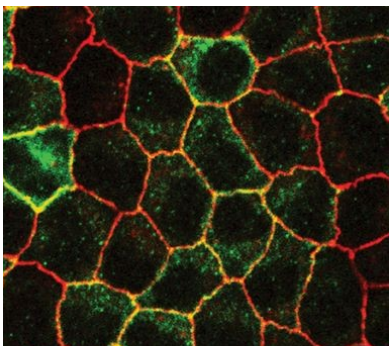
### Summary

Foams, emulsions, and biological tissues are examples of *soft cellular systems*: they are constituted of highly deformable units (bubbles, drops, cells), interacting through attractive adhesive interactions and soft steric repulsions. When highly compacted, they tile perfectly the available space (3D) or plane (2D), *i.e.* without gaps or overlaps.

In the case of biological tissues, the structure is essential for their function. Unlike foams and emulsions, biological tissues are **active cellular systems**: they consume (chemical) energy to produce motion and fluctuations of the interfaces.

The aim of the present study is to analytically and numerically investigate the interface fluctuations (lengths and heights) in active cellular systems, and compare them to the fluctuations of the same system driven by thermal agitation (thermal equilibrium). Because of the low compressibility of the cellular domains, interface fluctuations are coupled.

Of special interest, we want to investigate whether the spectrum of fluctuations captures useful information on the structural characteristics of the pattern (such as dispersity in size and side number of the cellular domains) and on the interfacial energy between domains.



*Interface fluctuations in a biological cellular systems (epithelium).*