MATIERE et SYSTEMES COMPLEXES

INTERNSHIP AND PHD PROPOSAL

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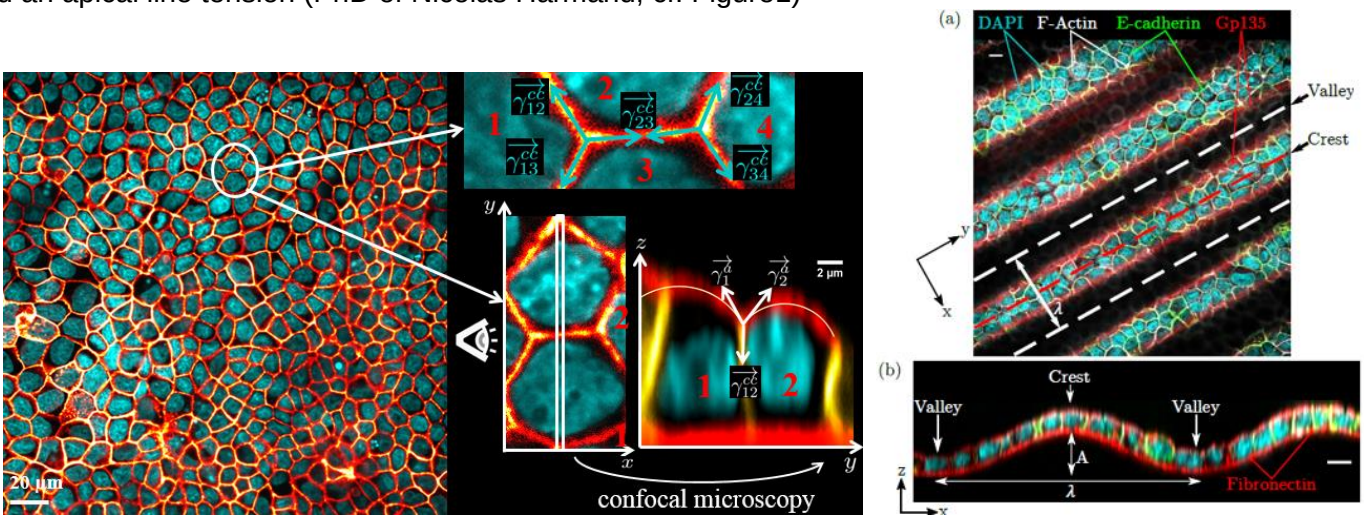
Shape of epithelia and 3D force inference

Building a physical framework to account for the shape of cells in epithelia is an important challenge to understand various biological processes, such as embryogenesis. We aim at understanding how surface tensions and line tensions shape epithelial cells.
We were able to account for the 3D shape of cultured epithelial cells on both flat und curved substrates, using differentiated surface tensions for the different interfaces (cell-cell, cell-substrate and apical surface tensions) and an apical line tension (PhD of Nicolas Harmand, cf. Figure1)



MDCK cells grown either on flat on curved substrates (PhD Nicolas Harmand, 2019)
The nuclei are in cyan, the basal and apical membranes in red, the cell-cell membranes in yellow, F-actin in white.

The aim of the internship is to apply the 3D inference model to unravel the driving forces of morphogenetic events such as gastrulation or invagination of cephalic furrow in drosophila embryos. During these morphogenetic events, cells undergo large morphological deformations, which typically cannot be properly explained in the frame of existing 2D force inference models.

The internship may continue with a thesis.