Active wetting of epithelial tissues

R. Alert[1], C. Pérez-González[2], C. Blanch-Mercader[3], X. Trepat[2], J. Casademunt[1]

[1]*Departament de Física de la Matèria Condensada, Universitat de Barcelona, Spain*
[2]*Institute for Bioengineering of Catalonia, Barcelona, Spain*
[3]*Laboratoire Physico Chimie Curie, Institut Curie, Paris, France*

Collective cell migration in freely spreading epithelia in controlled environments has become a landmark in our current understanding of fundamental biophysical processes in development, regeneration, wound healing and cancer. Here we study experimentally and theoretically the mechanics of an epithelial monolayer by extending the classical concept of wetting to an active material that generates contractile stresses and exerts active traction on the substrate. The tissue is modelled as an active polar viscous fluid, and the advance or retraction (wetting vs de-wetting) of the monolayer front is understood as the result of the competition between contractility and traction. The model and the experiments show excellent quantitative agreement in a broad variety of aspects, thus building a complete physical picture of the mechanics of the problem. The emerging scenario introduces novel features with no counterpart in classical wetting phenomena, such as the existence of a critical wetting size or the morphological instability of retracting fronts during de-wetting. In all, our results emphasize the collective nature of dynamical modes in spreading epithelia, as a result of the long-range hydrodynamic coupling of the tissue understood as an active polar fluid.