Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Forces and dynamics in epithelial domes of controlled size and shape ERNEST LATORRE-IBARS, LAURA CASARES, MANUEL GOMEZ-GONZALEZ, MARINA UROZ, Institute for Bioengineering of Catalonia, MARINO ARROYO, Universitat Politcnica de Catalunya-BarcelonaTech, XAVIER TREPAT, ICREA at the Institute for Bioengineering of Catalonia — Mechanobiology of epithelia plays a central role in morphogenesis, wound healing, and tumor progression. Its current understanding relies on mechanical measurements on flat epithelial layers. However, most epithelia in vivo exhibit a curved 3D shape enclosing a pressurized lumen. Using soft micropatterned substrates we produce massive parallel arrays of epithelial domes with controlled size and basal shape. We measure epithelial traction, tension, and luminal pressure in epithelial domes. The local stress tensor on the freestanding epithelial membrane is then mapped by combining measured luminal pressure and local curvature. We show that tension and cell shape are highly anisotropic and vary along the meridional position of the domes. Finally, we establish constitutive relations between shape, tension, and pressure during perturbations of the contractile machinery, osmotic shocks, and spontaneous fluctuations of dome volume. Our findings contradict a description of the epithelium as a fluid capillary surface. Cells in the dome are unable to relax into a uniform and isotropic tensional state through sub- and supra-cellular rearrangements. Mapping epithelial shape, tension, and pressure will enable quantitative studies of mechanobiology in 3D epithelia of controlled size and shape.

Ernest Latorre-Ibars
Institute for Bioengineering of Catalonia

Date submitted: 08 Nov 2016 Electronic form version 1.4