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Active properties of living tissues lead to size-dependent dewetting CARLOS PEREZ-GONZALEZ, Institute for Bioengineering of Catalonia and University of Barcelona, RICARD ALERT, CARLES BLANCH-MERCADER, University of Barcelona, MANUEL GOMEZ-GONZALEZ, Institute for Bioengineering of Catalonia, JAUME CASADEMUNT, University of Barcelona, XAVIER TREPAT, ICREA at Institute for Bioengineering for Catalonia — Key biological processes such as cancer and development are characterized by drastic transitions from 2D to a 3D geometry. These rearrangements have been classically studied as a wetting problem. According to this theory, wettability of a substrate by an epithelium is determined by the competition between cell-cell and cell-substrate adhesion energies. In contrast, we found that, far from a passive process, tissue dewetting is an active process driven by tissue internal forces. Experimentally, we reproduced epithelial dewetting by promoting a progressive formation of intercellular junctions in a monolayer of epithelial cells. Interestingly, the formation of intercellular junctions produces an increase in cell contractility, with the subsequent increase in traction and intercellular stress. At a certain time, tissue tension overcomes cell-substrate maximum adhesion and the monolayer spontaneously dewets the substrate. We developed an active polar fluid model, finding both theoretically and experimentally that critical contractility to promote wetting-dewetting transition depends on cell-substrate adhesion and, unexpectedly, on tissue size. As a whole, this work generalizes wetting theory to living tissues, unveiling unprecedented properties due to their unique active nature.

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