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Modeling cell-matrix traction forces in Keratinocyte colonies[1]

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Crosstalk between cell-cell and cell-matrix adhesions plays an essential role in the mechanical function of tissues. The traction forces exerted by cohesive keratinocyte colonies with strong cell-cell adhesions are mostly concentrated at the colony periphery. In contrast, for weak cadherin-based intercellular adhesions, individual cells in a colony interact with their matrix independently, with a disorganized distribution of traction forces extending throughout the colony. In this talk I will present a minimal physical model of the colony as contractile elastic media linked by springs and coupled to an elastic substrate. The model captures the spatial distribution of traction forces seen in experiments. For cell colonies with strong cell-cell adhesions, the total traction force of the colony measured in experiments is found to scale with the colony's geometrical size. This scaling suggests the emergence of an effective surface tension of magnitude comparable to that measured for non-adherent, three-dimensional cell aggregates. The physical model supports the scaling and indicates that the surface tension may be controlled by acto-myosin contractility.

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