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Modeling and imaging the topography of nascent adhesions. ERDINC ALTIGAN, DAVID ENTENBERG, BEN OVRYN, Department of Anatomy and Structural Biology, Albert Einstein College of Medicine — We have developed a model to explain the initiation of adhesions on the ventral surface of a cell. An analysis of the energetics of membrane bending and the effects of a composite system of freely diffusing repellers and receptors and a fixed network of ligands on the extracellular matrix demonstrates that a small bundle of actin filaments is able to push the membrane down to the extracellular matrix and nucleate a nascent adhesion. This model is consistent with experiments which demonstrate that cell motility requires cycles of actin polymerization and depolymerization at the leading edge of cell protrusions; the leading lamella adheres to the extracellular matrix and stable focal contacts form which can resist strong contractile forces. Although several of the mechanisms responsible for focal contact formation have been elucidated, the detailed processes leading to the formation of the earliest adhesions have remained elusive. Based upon the energetics of adhesion formation, our model predicts the shape of the membrane at the nucleated adhesion. We have developed a novel form of confocal interference microscopy to measure the distance between the ventral surface of a cell and the substratum with several nanometer precision and we have measured the topography of focal adhesions.

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