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The role of anisotropy in cell morphology KOEN SCHAKENRAAD, WIM POMP, Univ of Leiden, ROELAND MERKS, Univ of Leiden, Centrum Wiskunde en Informatica Amsterdam, THOMAS SCHMIDT, LUCA GIOMI, Univ of Leiden — The shape of adhering cells is determined by the interplay between contractile forces, arising from the cytoskeleton, and the resistance of the underlying substrate. In particular, experiments with fibroblasts on an elastic micro-pillar array show that fibroblasts posess a high degree of orientational order of the actin stress fibers. This anisotropy causes the shape of the cell edge to deviate from the shape of cells with an isotropic cytoskeleton. We present a model that describes the contractility of the cytoskeleton as a combination of directed forces, in the direction of stress fibers, and isotropic forces. We found that cell morphology is described by an anisotropic generalization of the Young-Laplace law, which describes the cell edges as parts of an ellipse. Experiments on the shape of and adhesion forces on fibroblasts show good agreement with our model. Our work highlights the strong coupling between the organization of the internal cytoskeleton and the shapes and forces on the outside of the cell.

Koen Schakenraad
Univ of Leiden

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