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Shape determination in motile cells

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Flat, simple shaped, rapidly gliding fish keratocyte cell is the model system of choice to study cell motility. The cell motile appendage, lamellipod, has a characteristic bent-rectangular shape. Recent experiments showed that the lamellipodial geometry is tightly correlated with cell speed and with actin dynamics. These quantitative data combined with computational modeling suggest that a model for robust actin treadmill inside the 'unstretchable membrane bag'. According to this model, a force balance between membrane tension and growing and pushing actin network distributed unevenly along the cell periphery can explain the cell shape and motility. However, when adhesion of the cell to the surface weakens, the actin dynamics become less regular, and myosin-powered contraction starts playing crucial role in stabilizing the cell shape. I will illustrate how the combination of theoretical and experimental approaches helped to unravel the keratocyte motile behavior.