Important CPM parameters

temperature

J values

λ

targetvolume: too small vs too large

Guideline: multiplying J, λ and T by the same constant keeps the dynamics the same T and J in order 10, λ in order one typically yields decent dynamics.

Objections and limitations

volume fluctuations are required for dynamics

no explicit membrane

When J is lower: more adhesion, more fluctuations

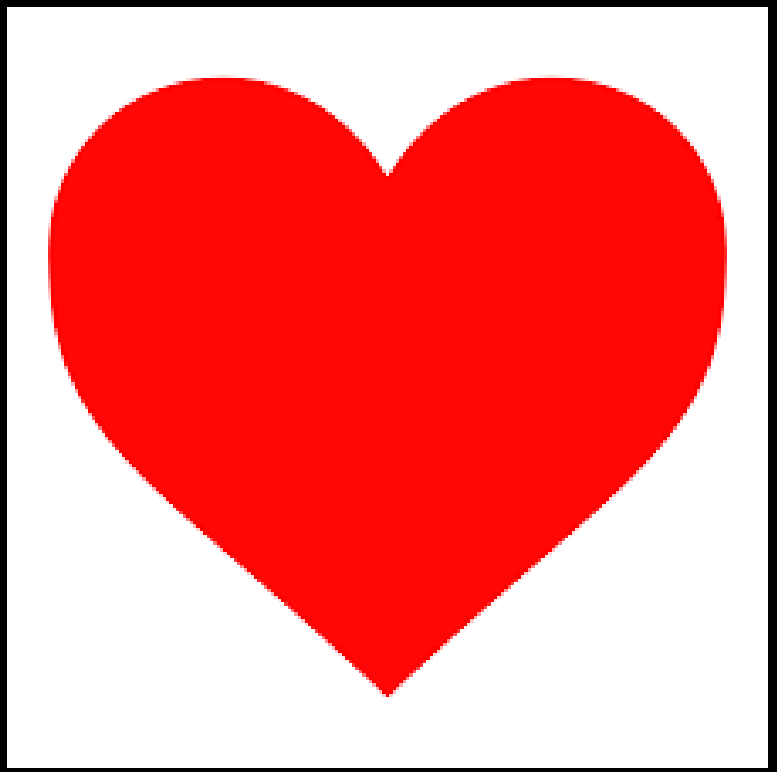
no explicit time scale

computational costs

Do due diligence

“minimal” energy configurations

Depending on initial conditions and parameters, reaching the minimal energy configuration may take very long.



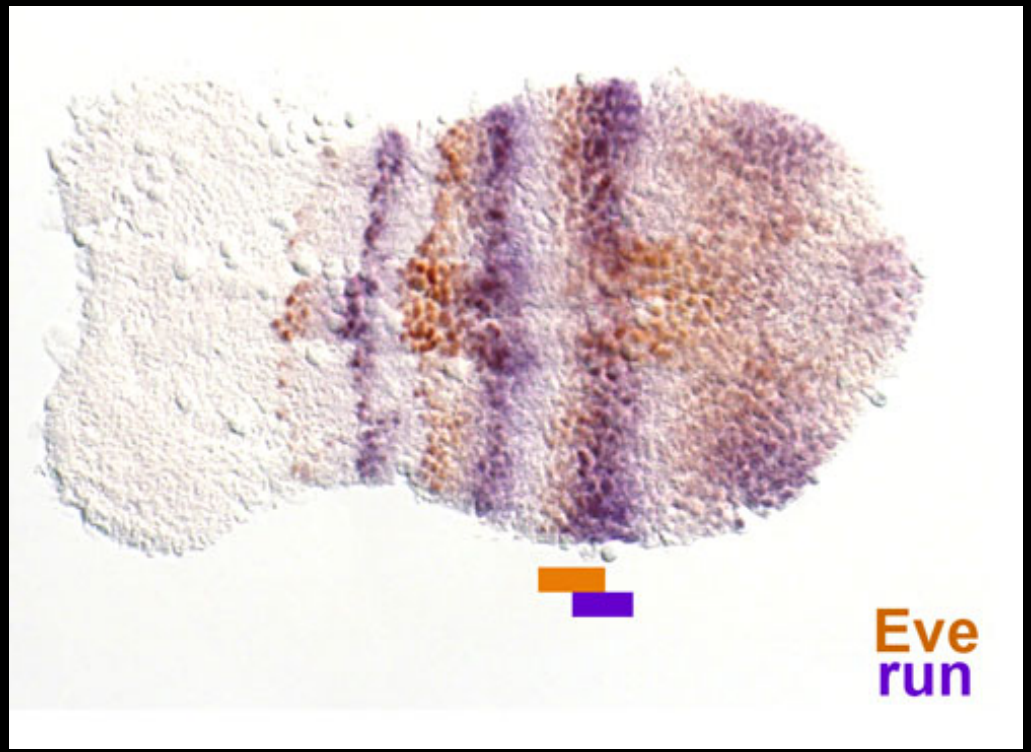
we can also use this in our favour

Convergent extension

or

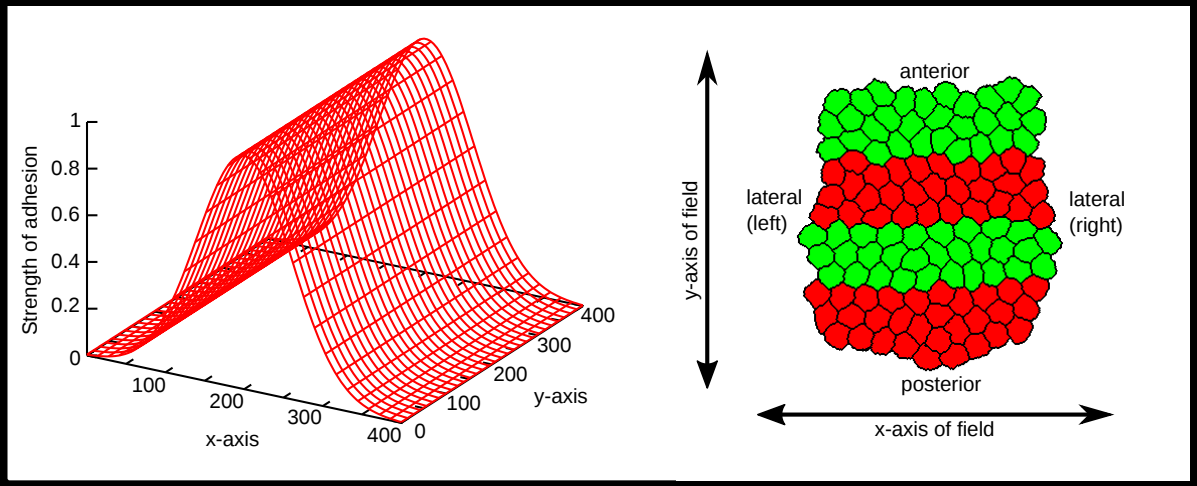
the importance of where you start from

Differential adhesion and convergent extension

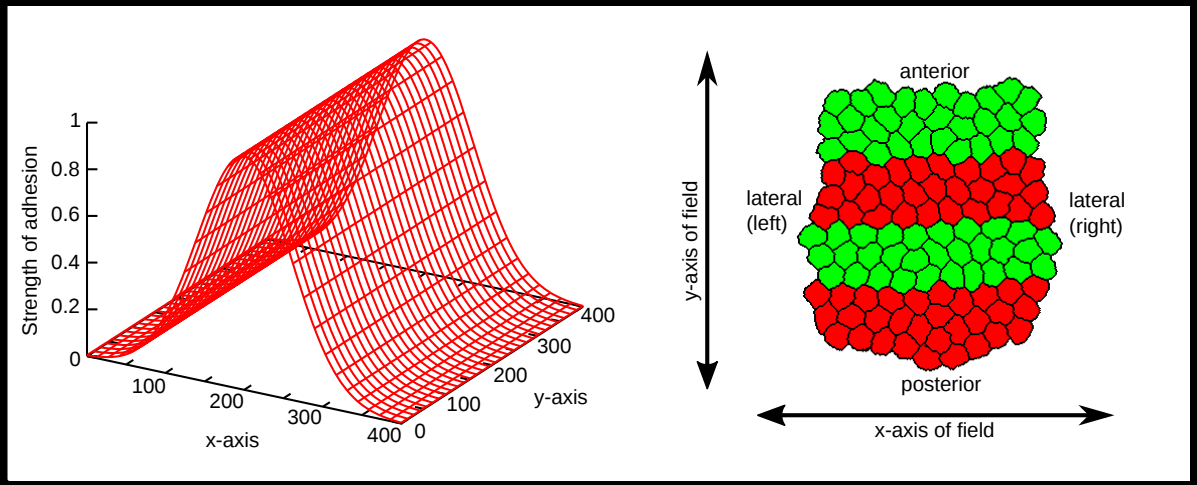


from Choe *et al.* 2006

Convergent extension could potentially mess up segments

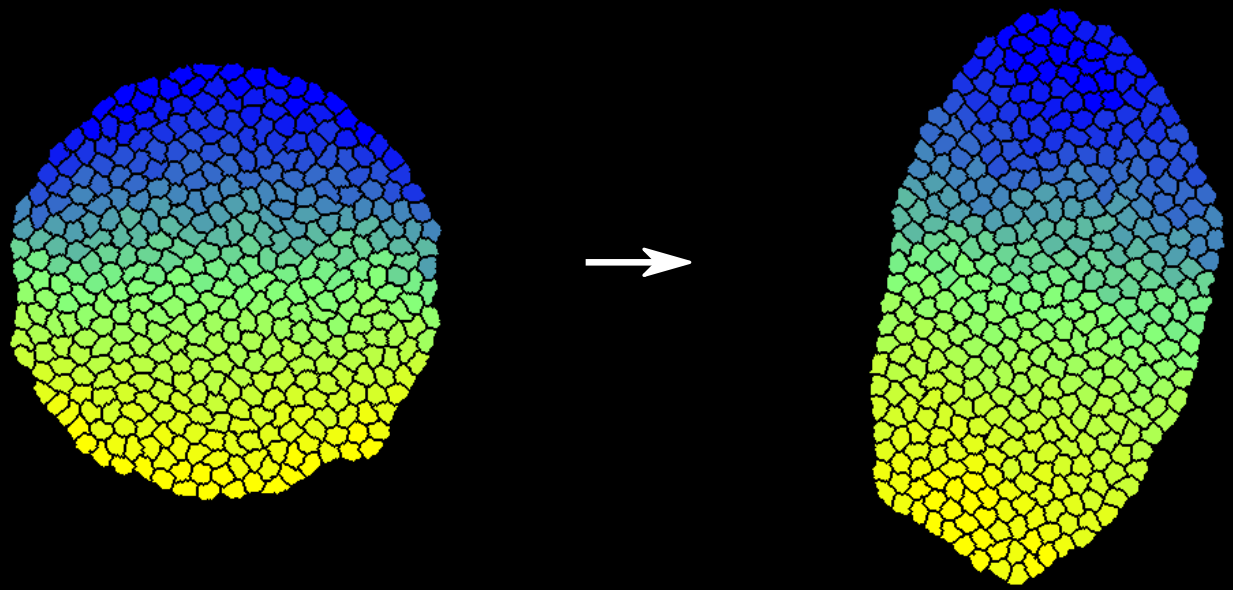


segment-specific adhesion solves this



Convergent extension **by** differential adhesion

Convergent extension by graded expression of adhesive proteins



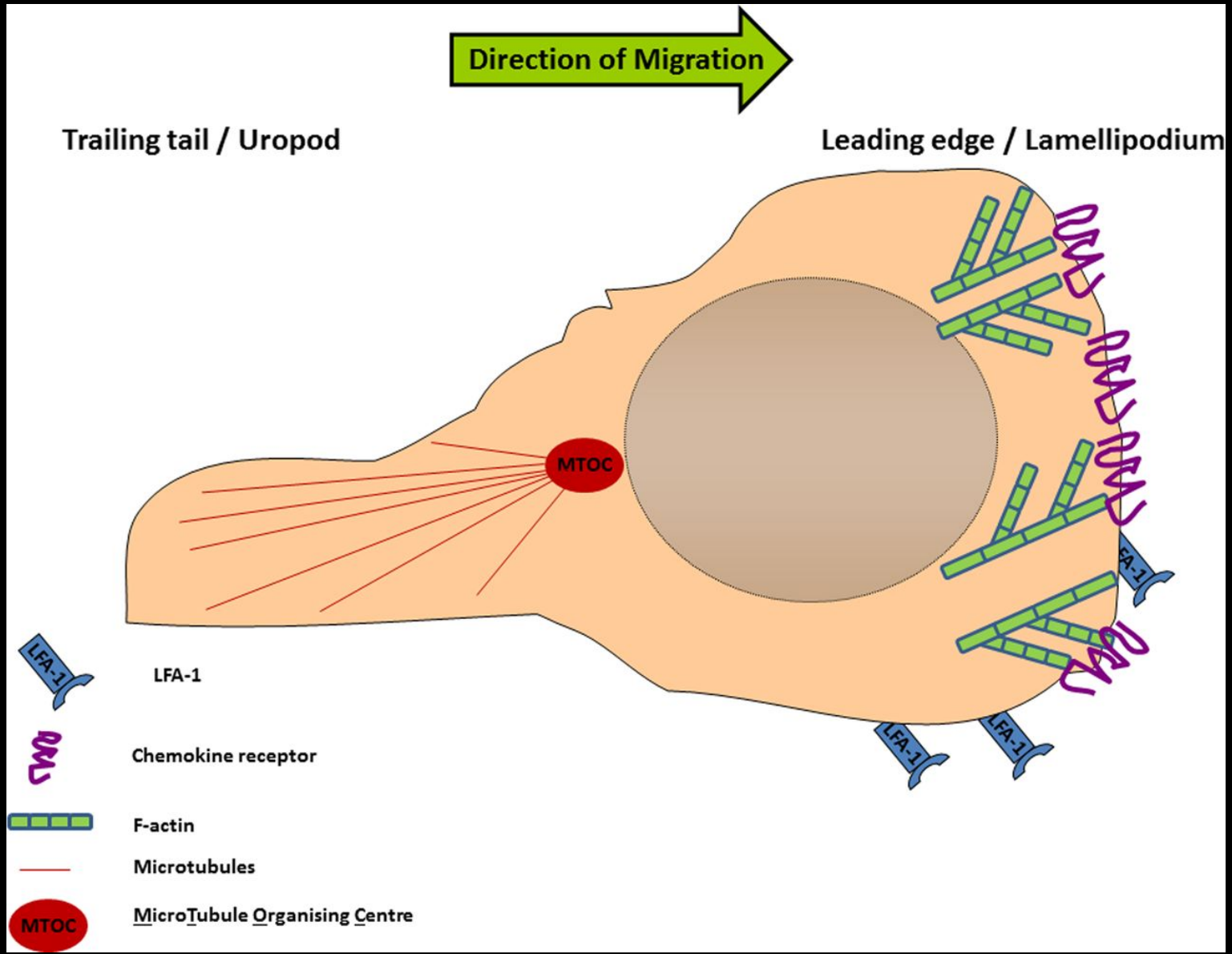
Cell migration

Persistent random walk in T cells

From Beltman *et al*, 2007

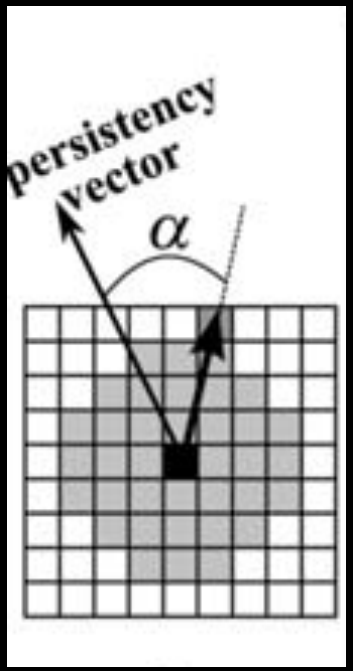
"stop-and-go motion"

Underlying mechanism in brief



Persistent random walk in CPM

$$\Delta H+ = -\mu cos(\alpha)$$



The angle is updated every x timesteps, to reflect the actual direction of motion of the cell

We define this mechanism as change in the Hamiltonian: directly add an extra bias to copy probability

Exercises part 2