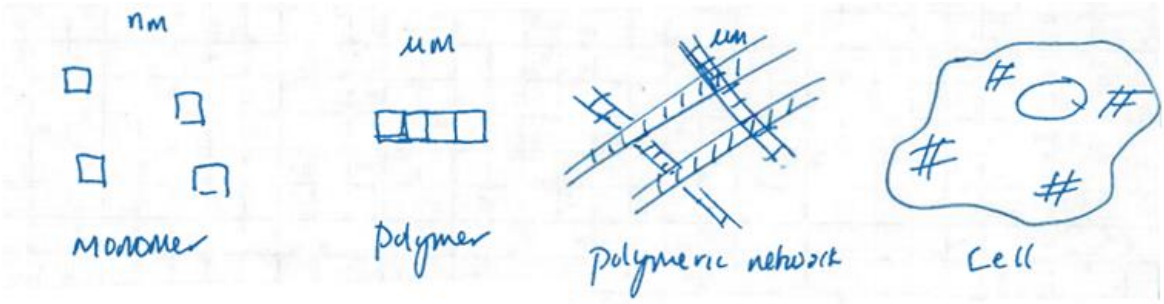
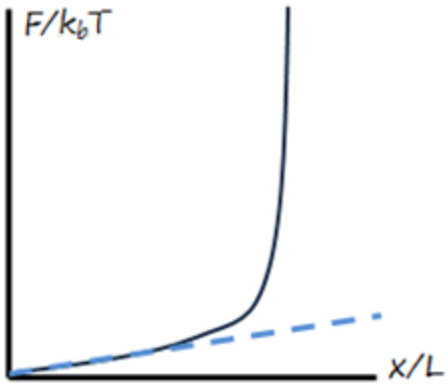
Lecture #5 Notes: Adhesion, Migration, and Contraction

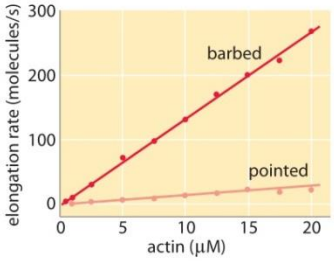
Let's review what we have learned so far!

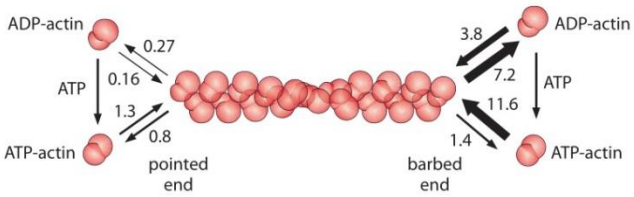


Energy vs. Entropy



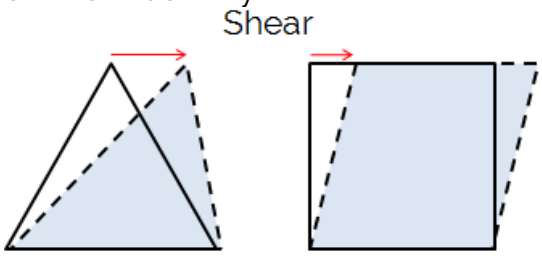
Polymerization Kinetics





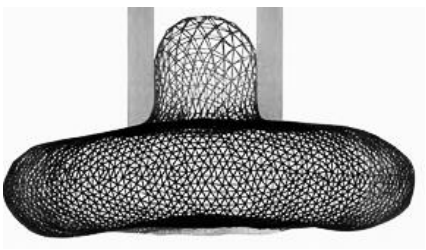
Fiber Bundle Model

Network Connectivity

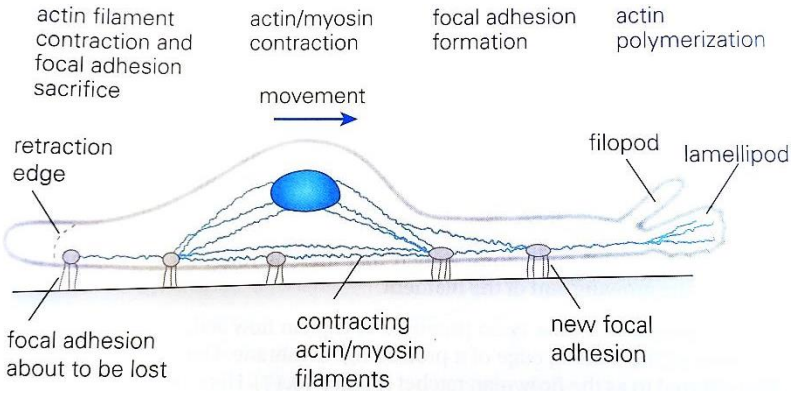


Membrane Mechanics (Soap Bubble)

$n[\nabla^2 w] - K_B[\nabla^4 w] + p_z = 0$

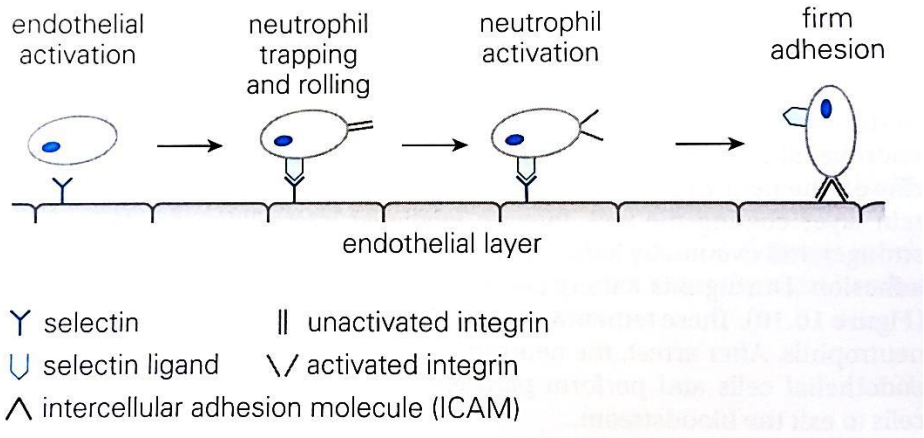


Migration (Speed, Persistence, and Traction Forces)



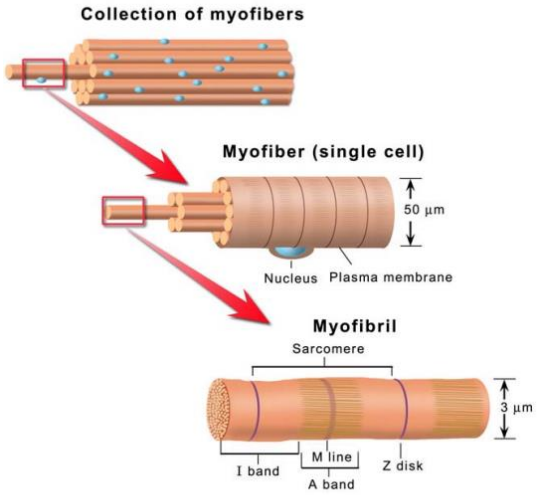
Adhesion (The Bell Model)

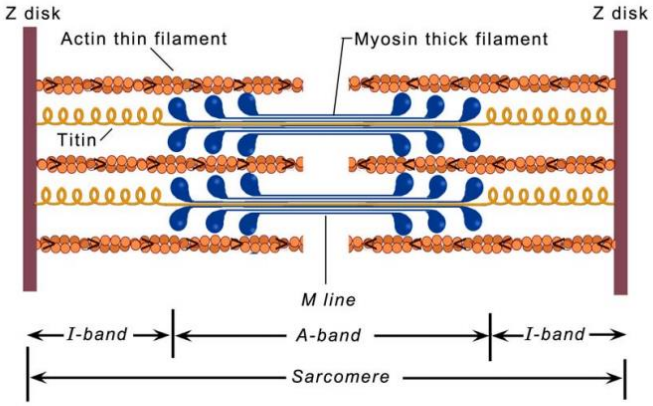
Classic Example: White Blood Cells and Endothelial Layer



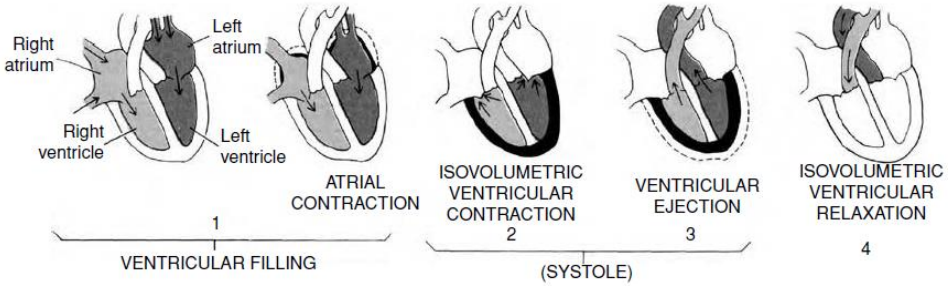
Contraction (Intracellular Contractile Forces)

*Muscle Cells: Smooth, **Skeletal & Cardiac***





Actin: semiflexible polymer
Myosin: molecular motor
Titin: resting elasticity

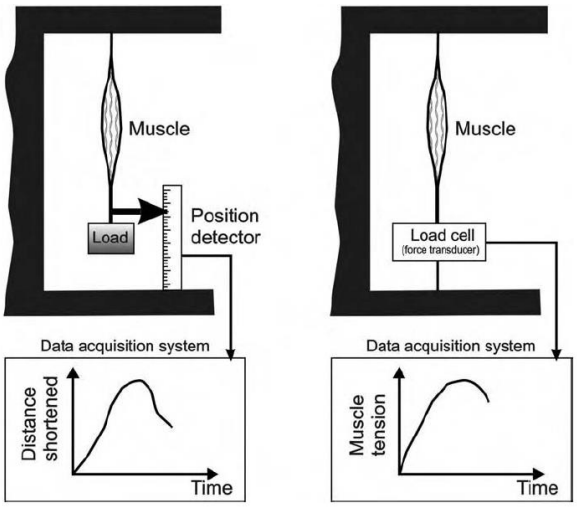


Our understanding of muscle force generation comes from understanding the pumping action of the heart. Frank Sterling Law states that as the heart stroke volume increases, owing to more diastolic filling, the muscle contracts with more force, leading to higher systolic pressure.

higher EDV → more stretching of muscle fibers and more forceful ejection

→ the tension a sarcomere is able to generate must increase with its initial stretch of length

Hill's Model



Spring-Mass-Damper Model