Lecture schedule:

04/23  04/25  
04/30  05/05  05/07

read 2.1.1 to 2.1.5 in Roger Kamm's manuscript
read 2.2.1 to 2.2.6
Peter So: guest lecture
read 2.1.6

Work done by a sarcomere:

\[
\sigma A \ell = \int_{-\infty}^{+\infty} n(x) \frac{A_0}{2} \frac{A_0}{2} \mathrm{d}x
\]

\(n(x)\) is the probability of binding, \(A_0 = \) area of half a sarcomere, \(\ell\) is the length of a sarcomere.

\(A_0 = \frac{2}{\ell} \times \text{spring force}\)

Typical numbers:
\(v_{max} = 6 \text{ mm.s}^{-1}, A_0 = 4 \text{ nm}, A_0 = 2000 \text{ A}^{-1}, F_{max} = 1 \text{ pN}\)

Goals:
1. Why is cell mechanics important?
2. What is the importance of the cell plasma membrane (biophysics today studies structural components one by one).

Plasma membrane

Reference: Israelachvili "Intermolecular & Surface Forces"

Self-assembly of amphiphiles (: amphiphilic = tolerant of both)

- Monomers
- Dynamic structures / aggregates

1. At what concentration do structures form?
2. Geometry of structures?

Critical micelle concentration (CMC)

Competing forces:
- Attractive: Hydrophobic tails
- Repulsive: Hydrophilic tails

Steric hindrance

- Qualitatively, as hydrophobicity increases, CMC decreases.
- Compare common soap (sodium stearate)
- Phospholipids (DPPC)

1 head 1 tail \(\text{CMC} \approx 1 \text{ mM}\)
1 head 2 tails \(\text{CMC} \approx 10^{-9} \text{ M}\)
* Missiles | aggregators are dynamic

... 

* Geometry of structures
  - Geometric packing parameters: \( a, r \)
  - Volume of hydrocarbon fluid: \( V \)
  - Shape factor: \( \frac{v}{a, r} \)
  - Optimal head area: \( A \)
  - Length, width & contour length of tail

* Typical resonance time (stay in approximate state)
  - Single tail: \( T_R \approx 10^{-9} \text{ s} \)
  - Double tail: \( T_R \approx 10^{-8} \text{ s} \)