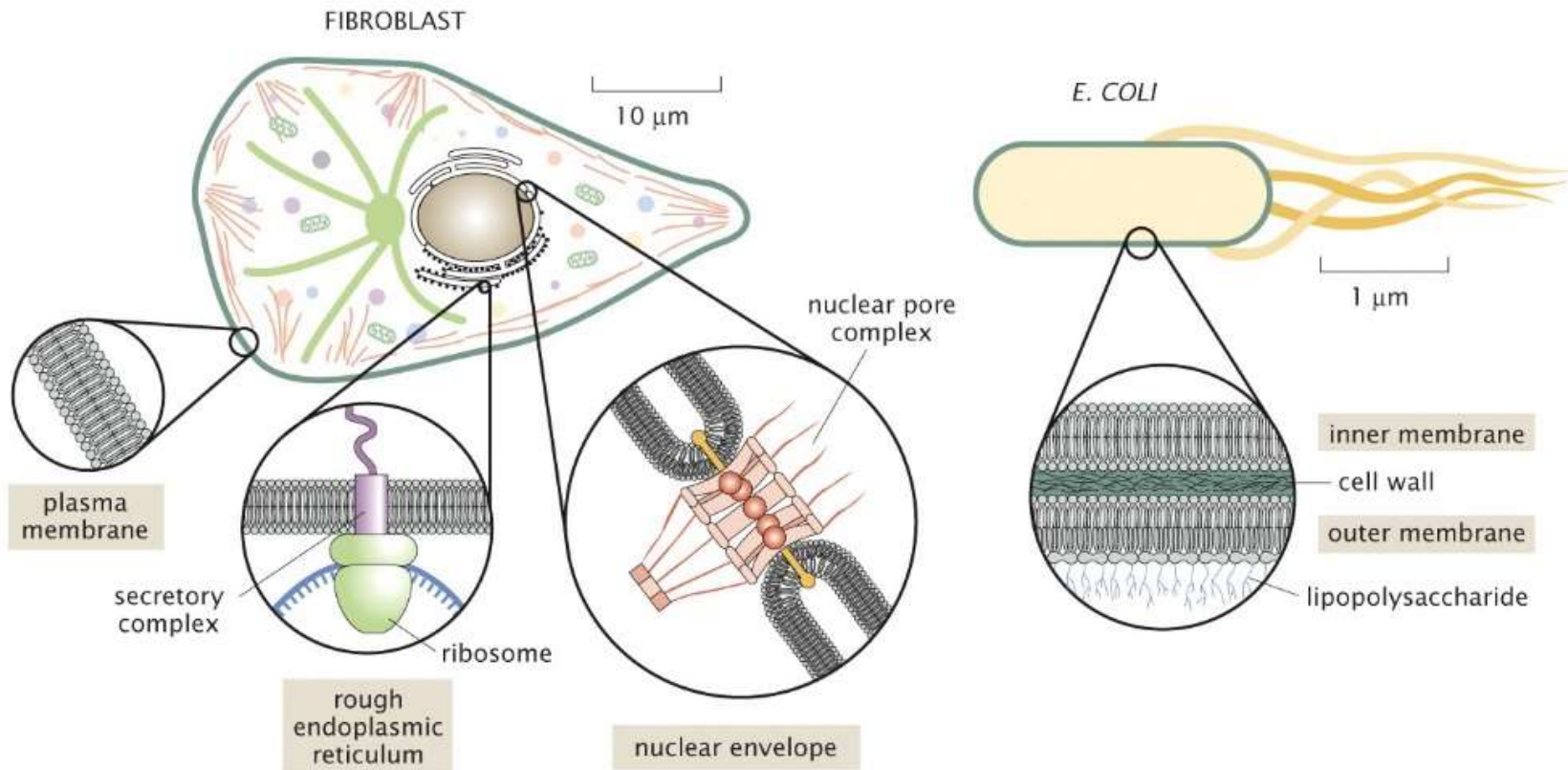


Biological Membranes

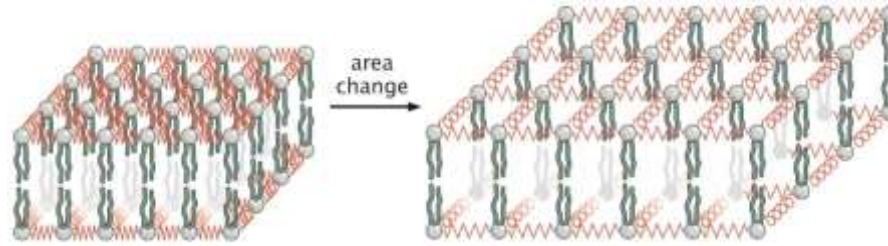


http://microsite.garlandscience.com/pboc2/resources/jpegs/figures/ch11/ch11/figure_11_02.jpg

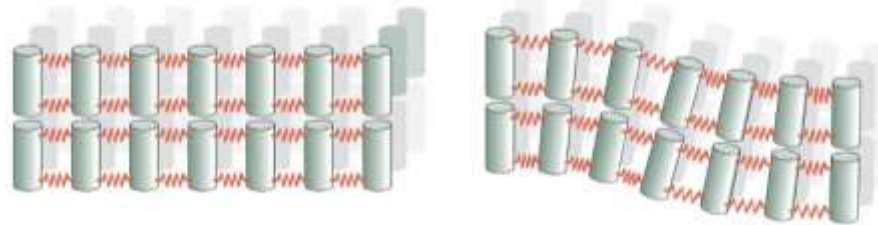
Membrane tension in cell biology review:
Diz-Muñoz *et al.* Trends Cell Biol. **23** (2013)
<http://dx.doi.org/10.1016/j.tcb.2012.09.006>

Physics of Lipid Bilayers

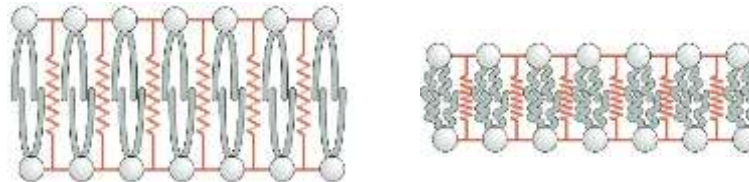
Stretching



Bending



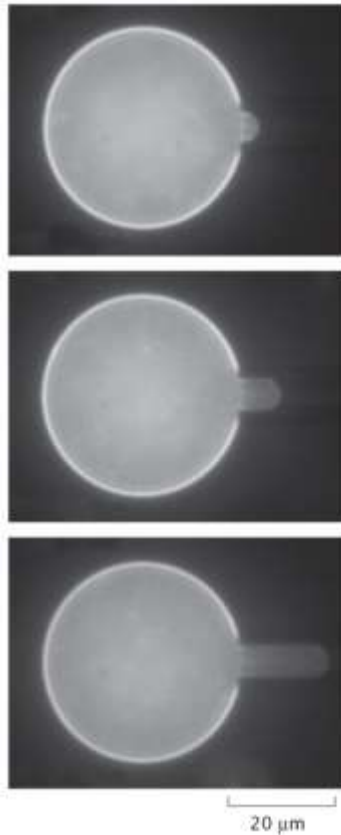
Compression



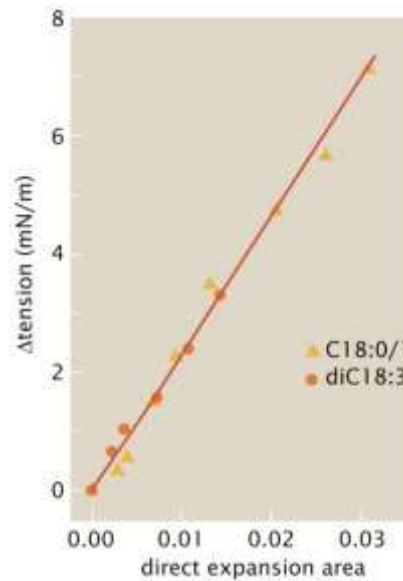
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Physics of Lipid Bilayers

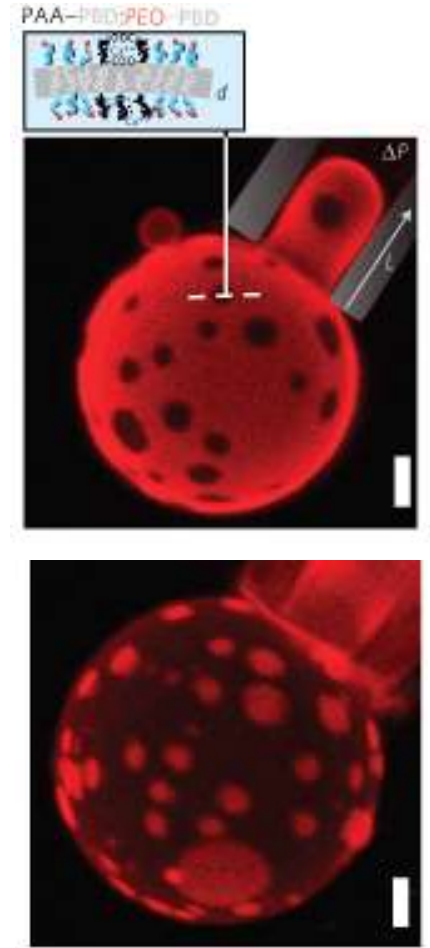
Micropipette Aspiration



Rhodamine-labeled vesicle under tension of 1.1 mN/m, 3.2 mN/m, 7.4 mN/m



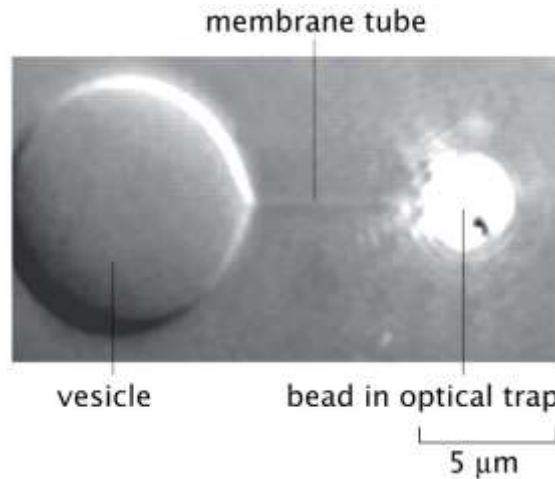
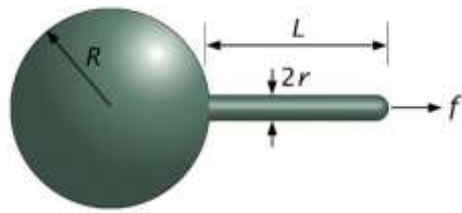
Rawicz *et al.* Biophys. J. **79** (2000)



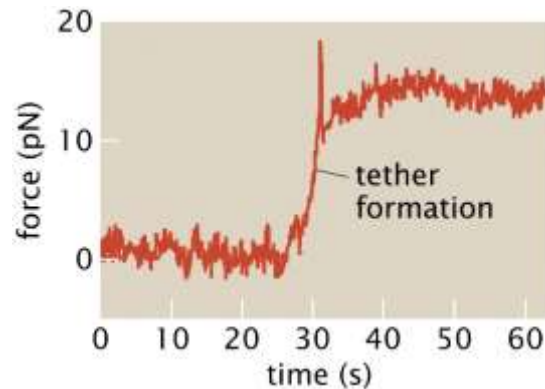
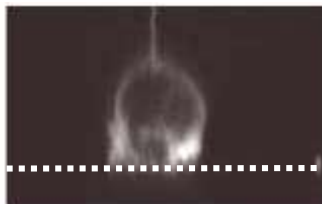
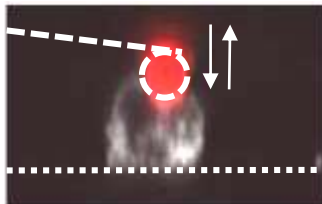
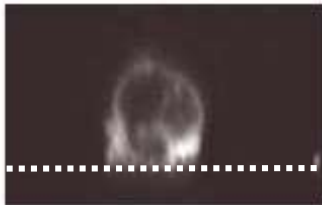
Mixed AB1/OB18(labeled) vesicles
Christian *et al.* Nat. Mater. **8** (2009)

Physics of Lipid Bilayers

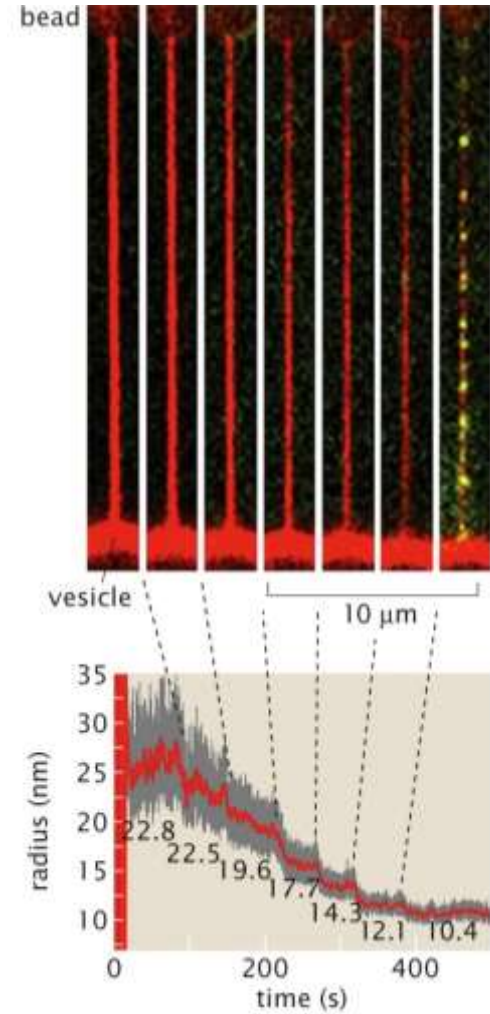
Tether Pulling



AFM Microglia



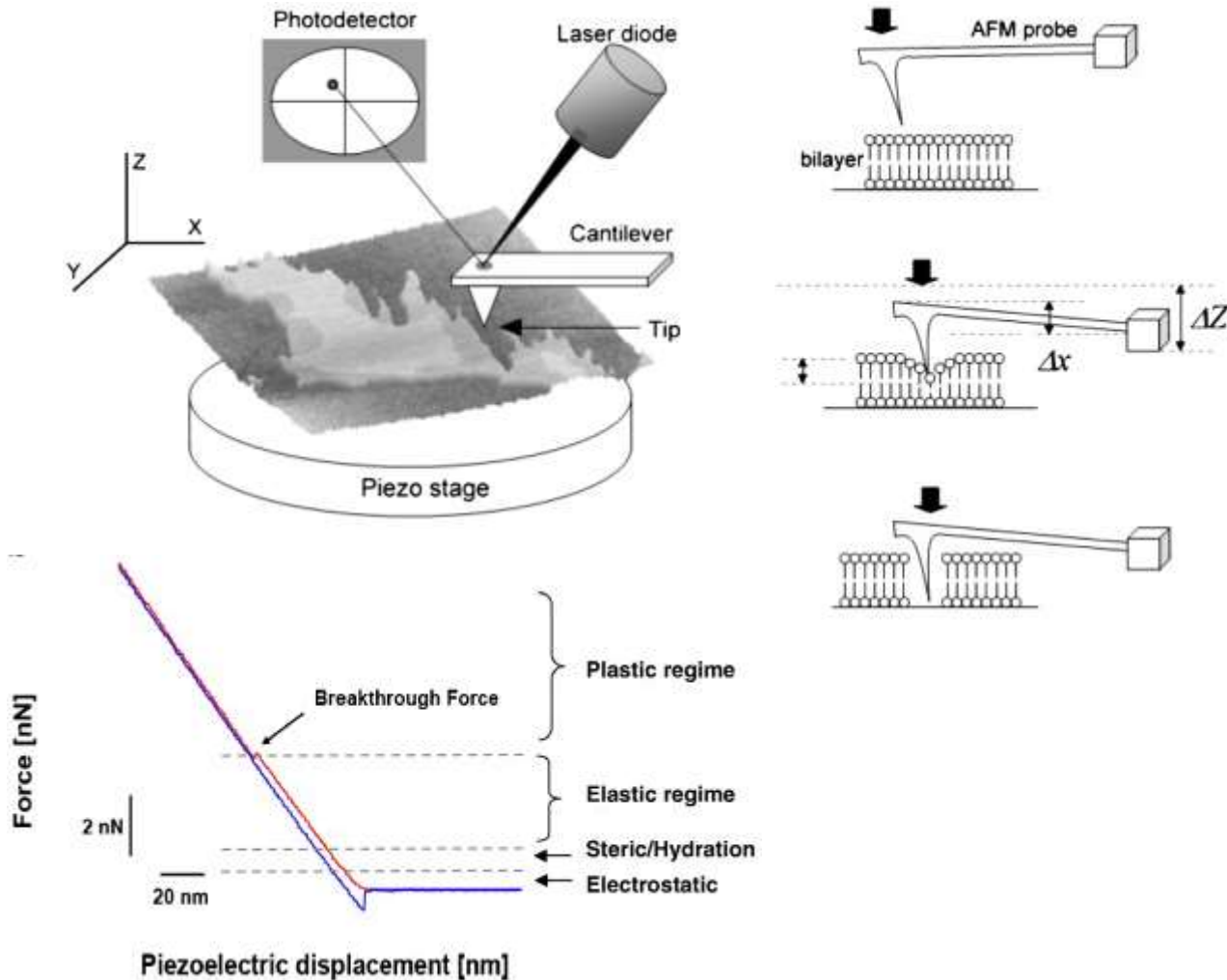
Rheinlaender *et al.* unpublished



Radius reduction by stepwise increase in pipette pressure
Roux *et al.* PNAS **107** (2010)

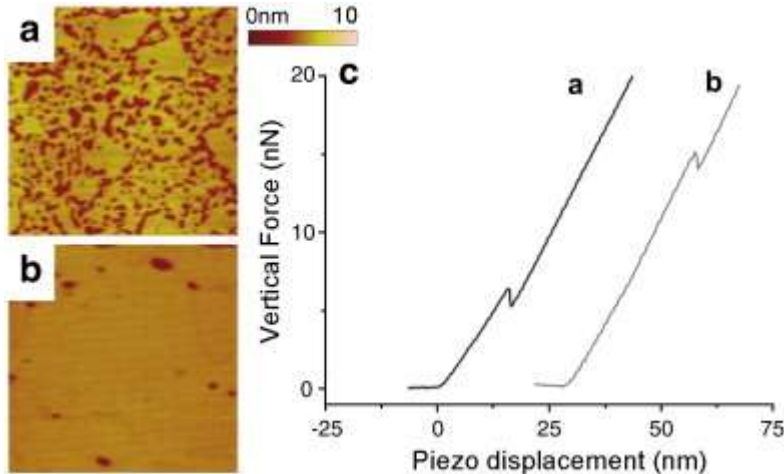
Physics of Lipid Bilayers

AFM



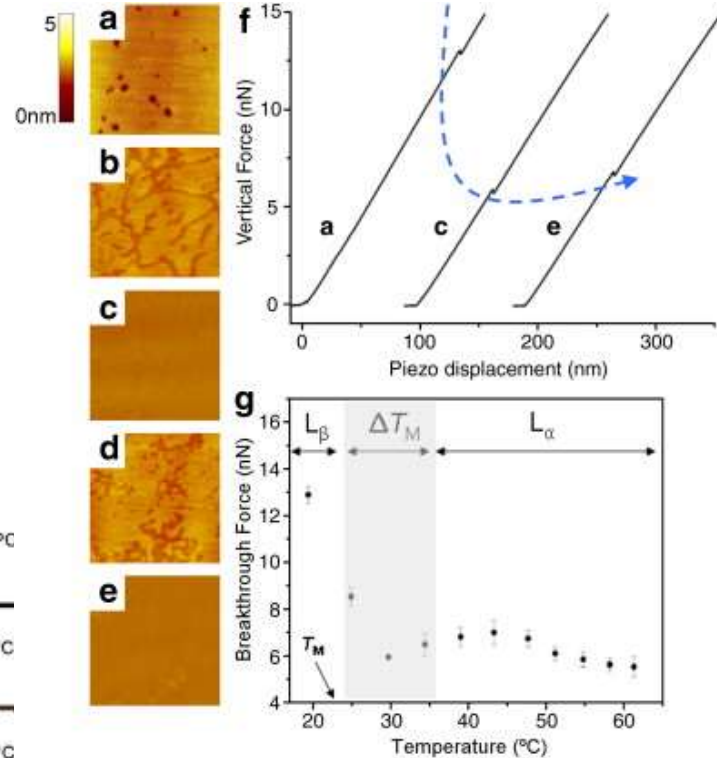
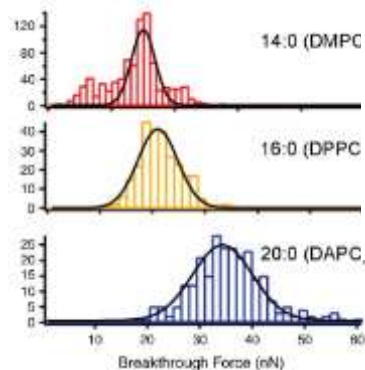
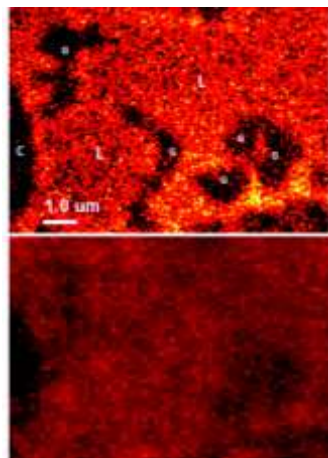
Garcia-Manyes *et al.* Biochim. Biophys. Acta **1798** (2010)
<http://dx.doi.org/10.1016/j.bbamem.2009.12.019>

Physics of Lipid Bilayers



a: low ionic strength
b: high ionic strength (stabilizes bilayer)

PALM/STORM vs. TIRF

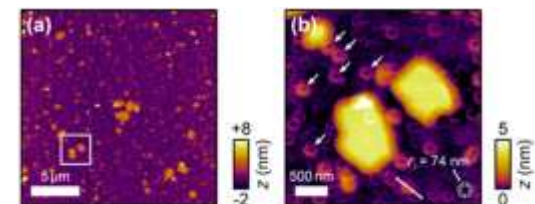


Phase transition (softening) from 19 (a) to 37.5°C (e)

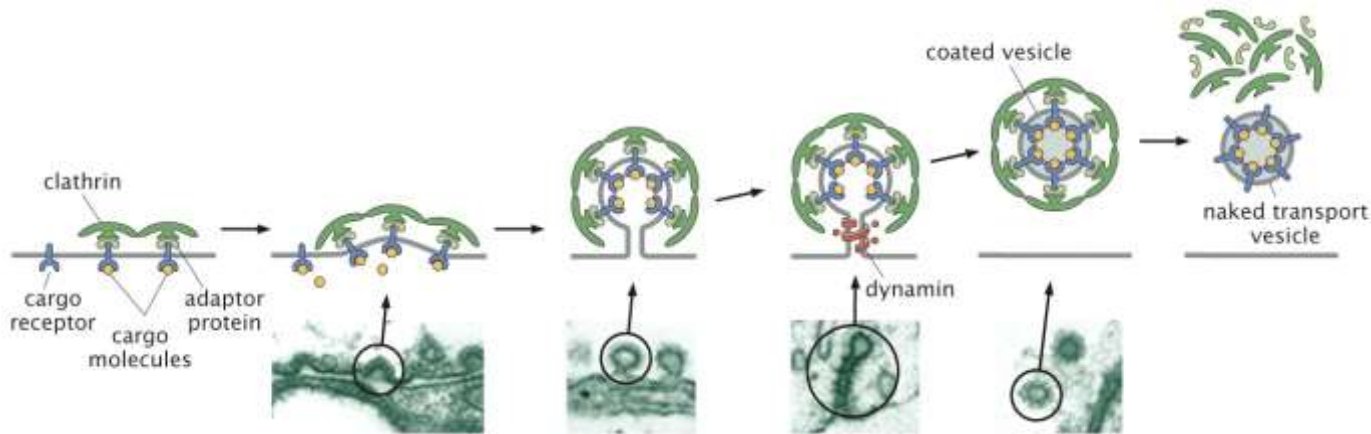
Garcia-Manyes *et al.* Biochim. Biophys. Acta **1798** (2010)
<http://dx.doi.org/10.1016/j.bbamem.2009.12.019>

Kuo *et al.* J. Am. Chem. Soc. **133** (2011)
<http://dx.doi.org/10.1021/ja1099193>

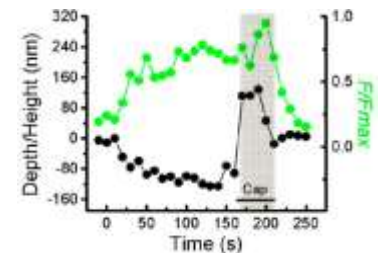
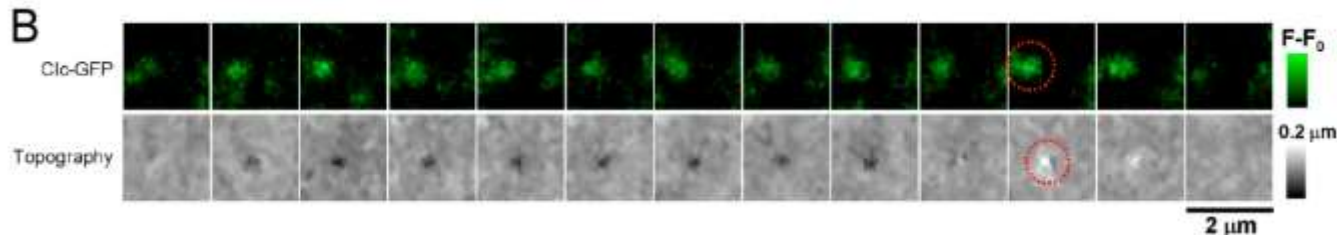
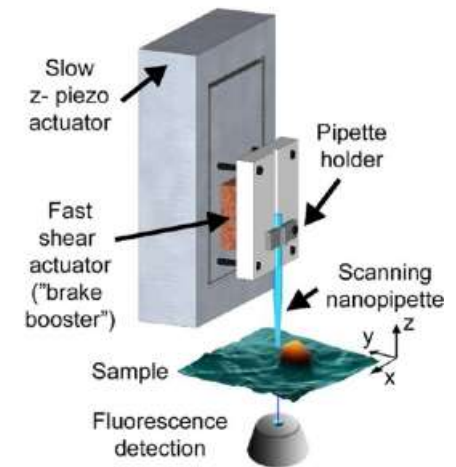
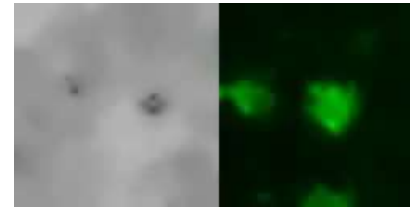
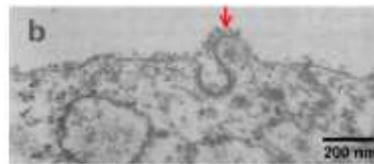
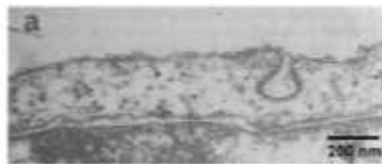
Rheinlaender *et al.* Anal. Chem. **87** (2015)
<http://dx.doi.org/10.1021/acs.analchem.5b00900>



Vesicle Formation by Clathrin



HS-SICM

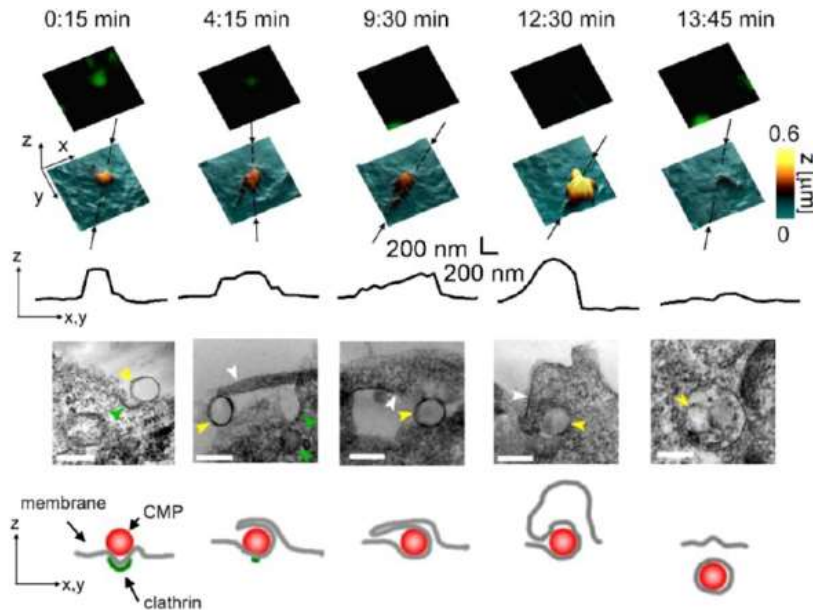


Shevchuk *et al.* J. Cell Biol. **197** (2012)
<http://www.jcb.org/cgi/doi/10.1083/jcb.201109130>

Novak *et al.* Nano Letters **14** (2014)
<http://dx.doi.org/10.1021/nl404068p>

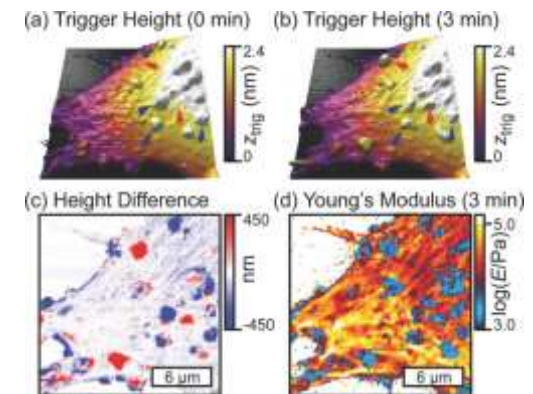
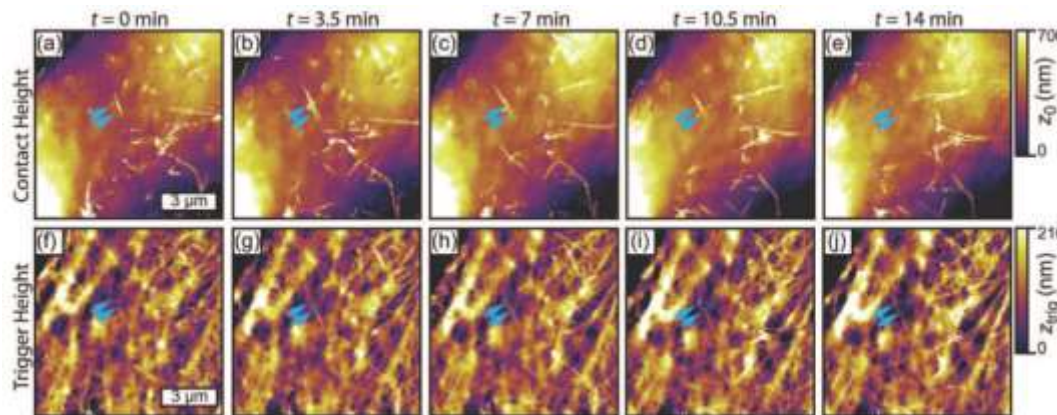
Vesicle Formation in Endocytosis

HS-SICM



Novak *et al.* Nano Letters **14** (2014)
<http://dx.doi.org/10.1021/nl404068p>

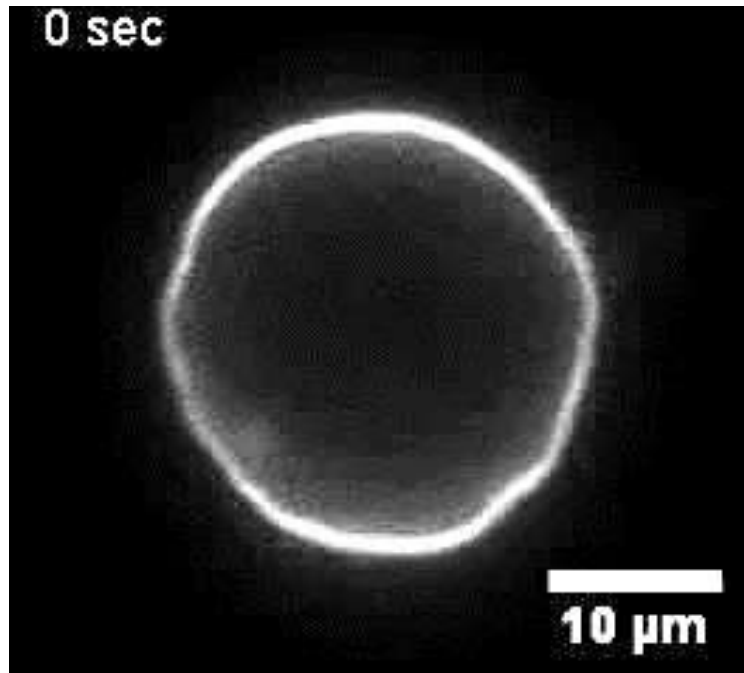
HS-AFM



Braunsmann *et al.* Rev. Sci. Instr. **85** (2015)
<http://dx.doi.org/10.1063/1.4885464.3>

Membrane Fluctuations

Lipid Vesicle

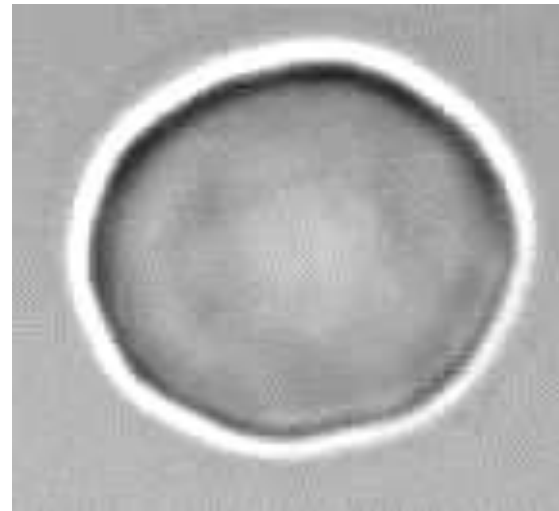


<https://www.youtube.com/watch?v=K4wEYCZGNGQ>



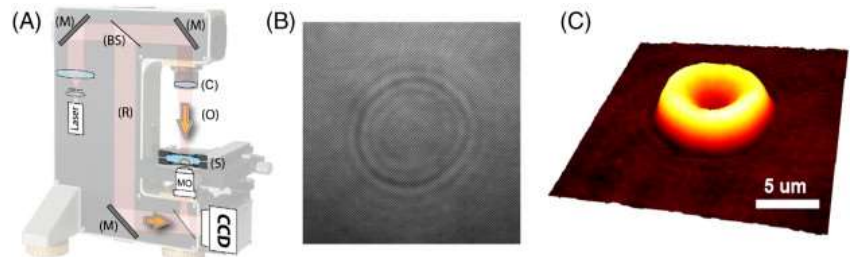
Evans *et al.* Biophys J. **94** (2008)
<https://dx.doi.org/10.1529%2Fbiophysj.107.117952>

RBCs



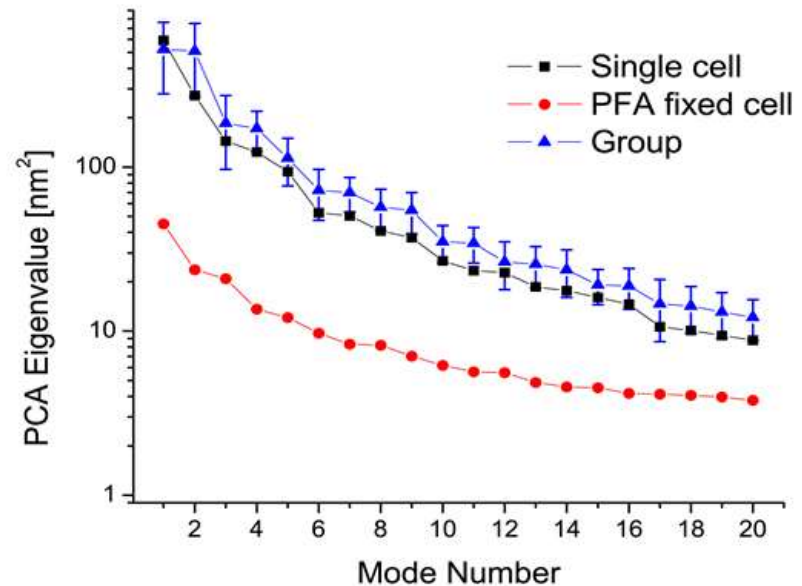
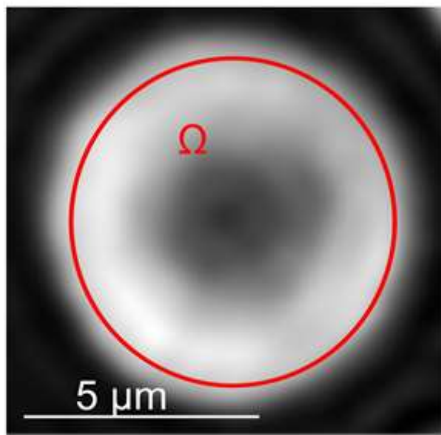
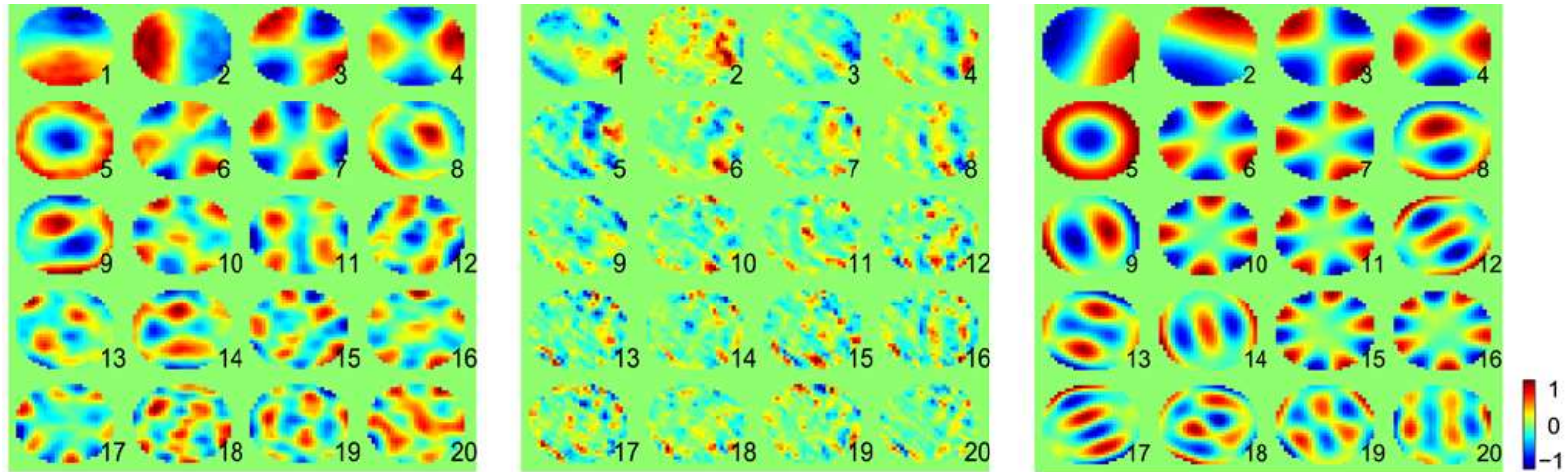
<https://www.youtube.com/watch?v=VwhNLaRCD-4>

Quantitative Phase Contrast Microscopy



Rappaz *et al.* Blood Cells Mol. Dis. **42** (2009)
<http://dx.doi.org/10.1016/j.bcmd.2009.01.018>

RBC Membrane Fluctuations



RBC Membrane Fluctuations

