Supplemental Information

Physical Properties of *Escherichia coli* Spheroplast Membranes

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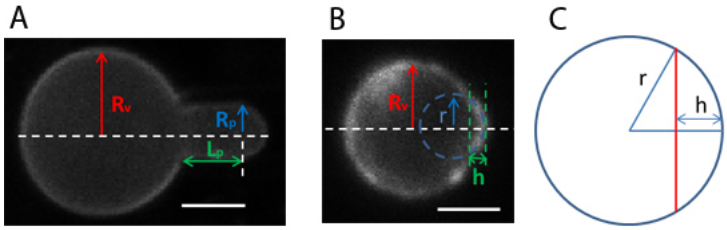

Fig. S1 Geometries of an aspirated GUV and an aspirated spheroplast are the same except in size. Two different situations are shown. A. Aspiration produced a cylindrical protrusion (shown with a GUV image; scale bar = 10 μm): definitions for R_v, R_p, L_p. B. Aspiration produced a spherical protrusion (shown with a spheroplast image; scale bar = 2.5 μm): definitions for r, h, and H. C. Formulas used for the situation B (1): the volume on the right side of the red plane = $\pi h^2 \left(r - \frac{h}{3}\right)$; the area of the partial sphere on the right side of the red plane = $2\pi r h$.

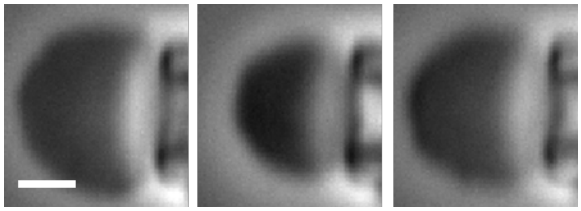

Fig. S2 (Left image) A spheroplast was held by a micropipette with a small suction pressure initially in 30% STOP solution. (Middle image) Then the solution was changed to ~85% STOP solution. (Right image) Finally the solution was changed back to ~30% STOP solution. Both the swelling and the phase contrast changes were reversible. In sequence, the diameter of the spheroplast was 5.8, 4.7, 5.8 μm; the phase contrast $(I_0 - I)/I_0$ was 0.15, 0.25, 0.17 (see Fig. 1). Scale bar = 2 μm.

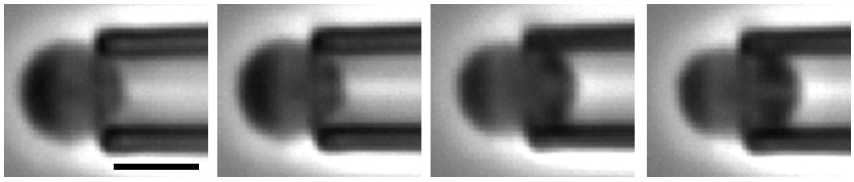

Fig. S3 The images from left to right show the response of a spheroplast in 100% STOP solution to a sucking pressure by micropipette aspiration. Note that the applied suction pressure was very small ~50 Pa, but the spheroplast was already entirely sucked into the pipette. Scale bar = 5 μm. The images were taken, from left to right, at t = 0, 79, 110, 169 s. This could be due to the size of the micropipette being too close to the size of the spheroplast, or it could be what was described as a liquid drop model in the micropipette-aspiration experiments of human blood cells (2-4). Since our interests are solely on the membrane property of spheroplasts, we will not discuss spheroplasts from 100% STOP solution.

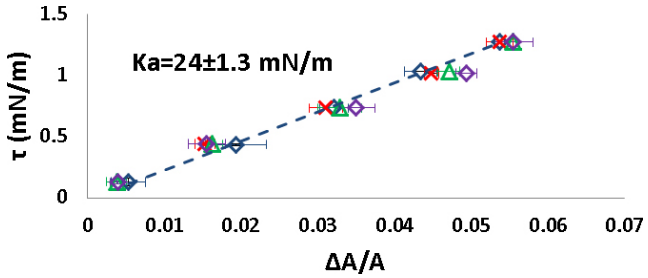

Fig. S4 The tension vs. area change measurement of a spheroplast is reversible and repeatable. In this example, the spheroplast membrane was stretched and released twice (four different colors). The error bars are explained in Fig. 3.

1. Sun, Y., C. C. Lee, and H. W. Huang. 2011. Adhesion and merging of lipid bilayers: a method for measuring the free energy of adhesion and hemifusion. Biophys J 100:987-995.
2. Evans, E., and A. Yeung. 1989. Apparent viscosity and cortical tension of blood granulocytes determined by micropipet aspiration. Biophys J 56:151-160.
3. Jones, W. R., H. P. Ting-Beall, G. M. Lee, S. S. Kelley, R. M. Hochmuth, and F. Guilak. 1999. Alterations in the Young's modulus and volumetric properties of chondrocytes isolated from normal and osteoarthritic human cartilage. J Biomech 32:119-127.
4. Hochmuth, R. M. 2000. Micropipette aspiration of living cells. J Biomech 33:15-22.