Supporting Information

Deciphering How Pore Formation Causes Strain-Induced Membrane Lysis of Lipid Vesicles

Joshua A. Jackman†, Haw Zan Goh†, Vladimir P. Zhdanov†|, Wolfgang Knoll†±, Nam-Joon Cho*†,‡

†School of Materials Science and Engineering and Centre for Biomimetic Sensor Science, Nanyang Technological University, 50 Nanyang Drive 637553, Singapore

‡School of Chemical and Biomedical Engineering, Nanyang Technological University, 62 Nanyang Drive 637459, Singapore

|Boreskov Institute of Catalysis, Russian Academy of Sciences, Novosibirsk 630090, Russia

±Austrian Institute of Technology (AIT), Donau-City-Strasse 1, 1220 Vienna, Austria

E-mail: njcho@ntu.edu.sg
Table Caption

Table S1. Size distribution of extruded lipid vesicles measured by dynamic light scattering.

Figure Captions

Figure S1. Δf-ΔD plots for AH peptide-induced degradation of POPC lipid vesicles for representative peptide concentrations.

Figure S2. Rupture time as a function of peptide concentration in solution. For POPC lipid vesicles, the fit was obtained by $t_r = Dc^{-\beta}$, where $t_r$ is the rupture time, $c$ is the peptide concentration in solution, and $\beta$ and $D$ are fitting parameters. The rupture time was defined as follows: (a) Time from initial peptide attachment until there was rupture of the majority of adsorbed vesicles ($\Delta f = -45$ Hz, as compared to baseline), with fit showing $\beta = 0.97 \pm 0.20$ (p-value < 0.1, ANOVA). (b) Time from initial peptide attachment until the QCM-D inflection point (minimum value of $\Delta f$), with fit showing $\beta = 1.41 \pm 0.23$ (p-value is 0.62, ANOVA). (c) Time from initial peptide attachment until the ellipsometry inflection point (maximum value of optical mass), with fit showing $\beta = 0.90 \pm 0.20$ (p-value is 0.41, ANOVA). The inflection points define rupture time as the ensemble-averaged onset at which acoustic or optical mass loss, accordingly inferred as vesicle rupture, becomes the predominant event observed in the QCM-D or ellipsometric measurement, respectively. Rupture times based on the inflection point characterizing an ensemble of vesicles do not have a physical meaning on the single-vesicle level, and were more sensitive to variation between individual experiments at each peptide concentration (p-value > 0.1, ANOVA).

Figure S3. Normalized (a) Δf, (b) ΔD, and (c) optical mass shifts for AH peptide-induced degradation of 85 mol% POPC lipid and 15 mol% cholesterol vesicles.

Figure S4. Normalized (a) Δf, (b) ΔD, and (c) optical mass shifts for AH peptide-induced degradation of 70 mol% POPC lipid and 30 mol% cholesterol vesicles.

Figure S5. Normalized (a) Δf, (b) ΔD, and (c) optical mass shifts for AH peptide-induced degradation of 55 mol% POPC lipid and 45 mol% cholesterol vesicles.

Figure S6. Normalized (a) Δf, (b) ΔD, and (c) optical mass shifts for AH peptide-induced degradation of HIV envelope-mimicking vesicles.
<table>
<thead>
<tr>
<th>Lipid Composition</th>
<th>Diameter (nm)</th>
<th>Polydispersity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>POPC</td>
<td>56.4</td>
<td>0.078</td>
</tr>
<tr>
<td>85% POPC + 15% Cholesterol</td>
<td>56.8</td>
<td>0.074</td>
</tr>
<tr>
<td>70% POPC + 30% Cholesterol</td>
<td>59.9</td>
<td>0.093</td>
</tr>
<tr>
<td>55% POPC + 45% Cholesterol</td>
<td>99.9</td>
<td>0.240</td>
</tr>
<tr>
<td>HIV Envelope Mimic</td>
<td>89.6</td>
<td>0.117</td>
</tr>
</tbody>
</table>

**Table S1.**
Fig. S1.
Fig. S2.
Fig. S3.
Fig. S4.
Fig. S5.
Fig. S6.