Electronic Supplementary Material (ESI) for Nanoscale.

Electronic Supplementary Information

Pulling lipid tubes from supported bilayers unveils the underlying substrate contribution to the membrane mechanics

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Breakthrough force (F_b) values for different membrane chemical composition

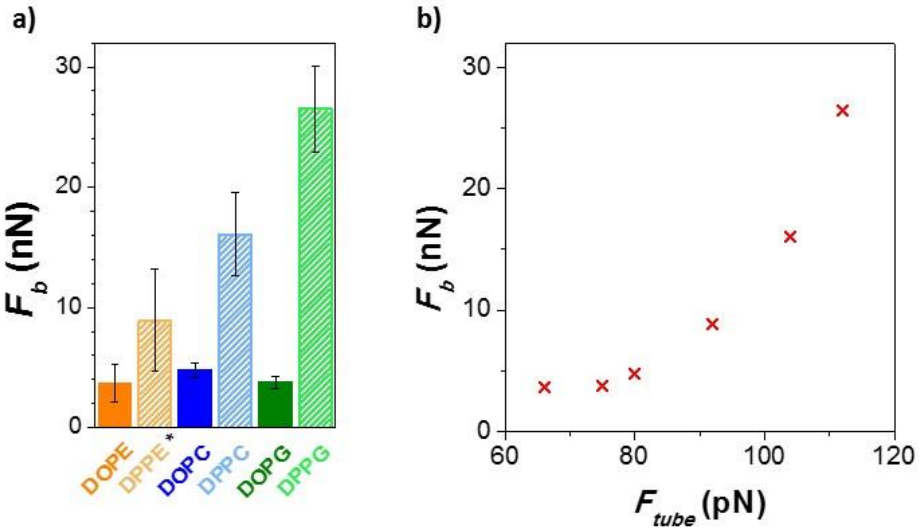

Fig. S1 a) Mean F_b values (± SD) for all the phospholipid systems: PE, PC and PG (n > 100). *Value taken from ref.[1] b) Correlation between F_b and F_{tube} values. All the measurements were performed in 150 mM NaCl, 20 mM $MgCl_2$, 20 mM HEPES (pH 7.4) buffer solution and at RT.

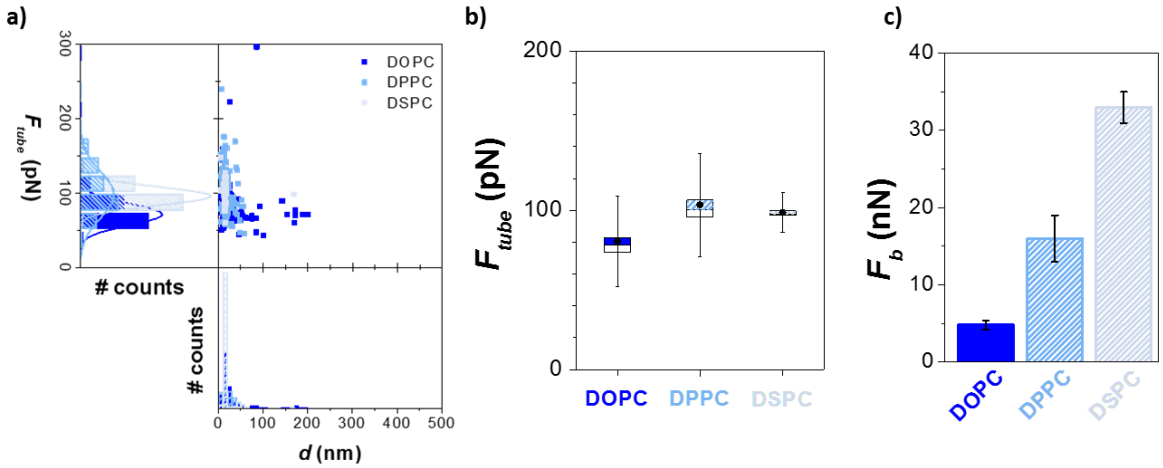

Fig. S2 a) F_{tube} *vs.* d plots and histograms for all the PC SLBs (n > 110). b) Boxchart for F_{tube} values showing the mean (●), SE (box) and SD (bars). c) Mean F_b values (± SD) for all the PC SLBs (n > 110). All the measurements were performed in 150 mM NaCl, 20 mM $MgCl_2$, 20 mM HEPES (pH 7.4) buffer solution and at RT.

Tube growing force (F_{tube}) for different pulling velocity

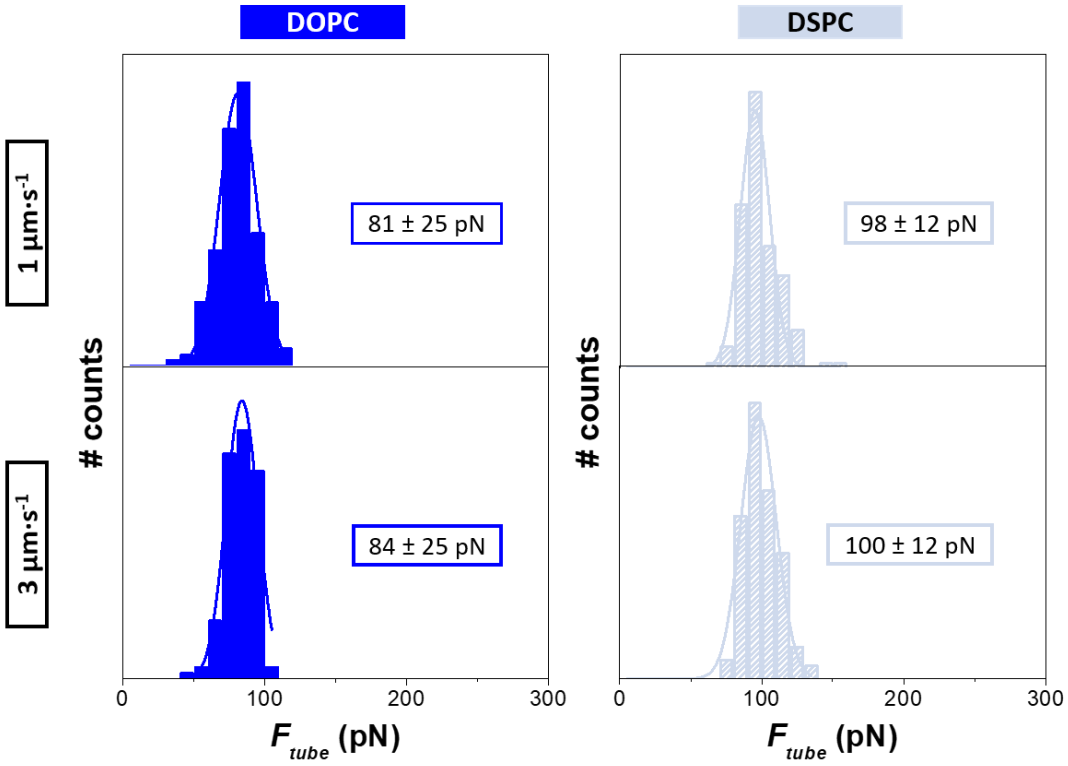

Fig. S3 F_{tube} histograms for DOPC and DSPC SLBs at tip retracting velocity of 1 and 3 µm·s^{-1} (n > 130). Mean F_{tube} values are shown (±SD). The experiments were performed in 150 mM NaCl, 20 mM $MgCl_2$, 20 mM HEPES (pH 7.4) buffer solution and at RT.

DOPC on PEG-grafted-mica

After cleaving the circular mica surfaces, they were amino-functionalized through silanization by exposing them to (3-aminopropyl)triethoxysilane (APTES) and triethylamine (TEA) vapor in a desiccator for 10 minutes. After that, the APTES and TEA containers were removed from the desiccator, and the substrates were left under vacuum for 12 h. After the silanization, the mica surfaces were rinsed with chloroform and dried under argon flow. A solution of 1 mg·ml^{-1} of poly(ethylene glycol)(1900)monomethyl ether mono(succinimidylsuccinate) ester (SS-PEG (1900), Polysciences, Inc.) in ultrapure MilliQ water was then deposited onto the substrates and incubated for 1 h at room temperature (RT). Afterwards, the substrates were rinsed with water and buffer solution, and then a DOPC vesicle suspension was deposited onto the functionalized mica surfaces and incubated for 2 h at RT to obtain the SLBs. Finally, the samples were rinsed several times with buffer solution to eliminate the unfused vesicles.

The evaluation of the F_{tube} on these PEG-DOPC SLBs (Fig. S4) was performed using V-shape silicon nitride tips (DNP, Bruker AFM Probes) at 1 µm·s^{-1}.

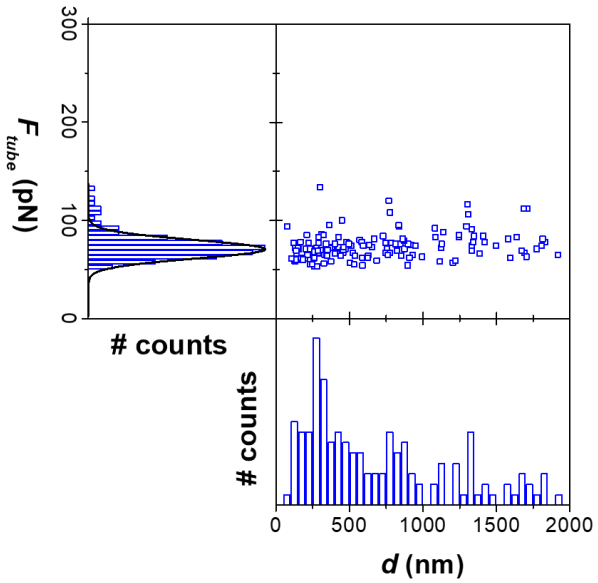

Fig. S4 F_{tube} *vs. d* plots and histograms for DOPC SLBs deposited onto a PEG-grafted-mica substrate (n > 110). Mean F_{tube}: 71 ± 13 pN. The measurements were performed in 150 mM NaCl, 20 mM HEPES (pH 7.4) buffer solution and at RT.

References

1 S. Garcia-Manyes, L. Redondo-Morata, G. Oncins and F. Sanz, *J. Am. Chem. Soc.*, 2010, **132**, 12874-12886.