Supplementary Information

Directed self-assembly of lipid nanotubes from inverted hexagonal structures

Kaori Sugihara,[*A] *Mohamed Chami,*[B] *Imre Derényi,*[C] *János Vörös*[A] *and Tomaso Zambelli*[A]

[A]Laboratory of Biosensors and Bioelectronics, Institute for Biomedical Engineering, ETH Zurich, Gloriastrasse 35, CH-8092 Zurich, Switzerland

[B]C-CINA, Center of Cellular Imaging and Nano-analytics, Biozentrum, University of Basel, 26 Mattenstrasse, Basel, Switzerland

[C]Department of Biological Physics, Eotvos University, Pazmany P. stny. 1A, H-1117 Budapest, Hungary, and ELTE-MTA "Lendulet" Biophysics Research Group, Pazmany P. stny. 1A, H-1117 Budapest, Hungary

* Corresponding author. e-mail: sugihara@is.mpg.de

SNAPSHOTS DURING THE SELF ASSEMBLY OF NANOWIRES

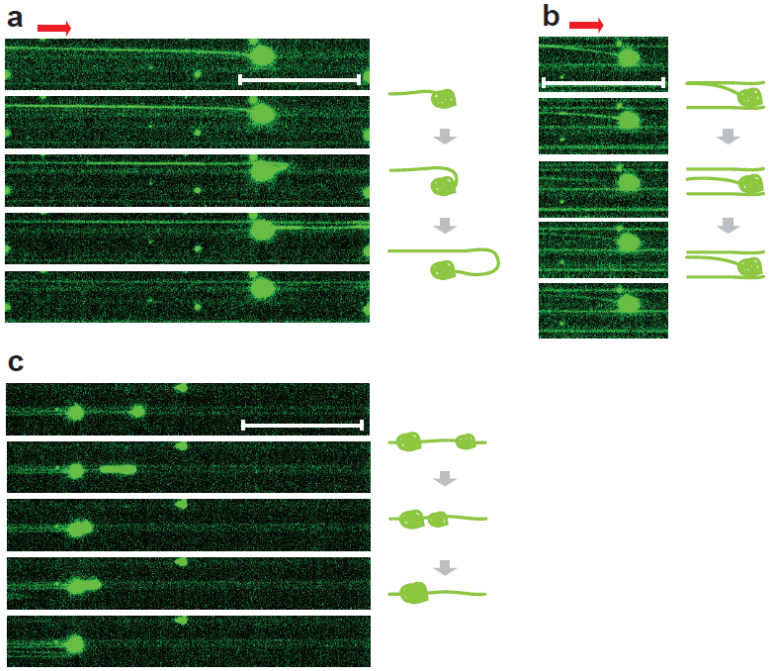

Figure S1 Snapshots from a movie recording the lipid nanowire formation

a, Nanowire growth from a immobile lipid block upon a lamellar flow (indicated with a red arrow). **b**, A nanowire swinging upon a pressure fluctuation in the solution. **c**, Merging of two blocks observed in absence of flows. All the scale bars correspond to 100 μm.

In Fig. 1e,f,g of the main text, we showed three representative events during the lipid nanotube assembly. Here in Figure S1, we show other events extracted from the same movie. In the case of Figure S1a,b, a lamellar flow is being established as indicated with a red arrow, while in the case of c, no active flow was present, although a remained pressure fluctuation of the solution can be expected. In Figure S1a, we observed a growth of a nanotube from a lipid block without immobilizing it. Additionally, a formed nanotube swung upon a fluctuation of the solution as shown in Figure S1b. Both events suggest that the assembled nanotubes are not strongly pinned, implying a relatively weak interaction between the nanotubes and the surface. On the other hand, in Figure S1c, a merge of a mobile block into a pinned block was imaged.

INTERERACTION BETWEEN LIPID BLOKS AND OTHER SURFACES

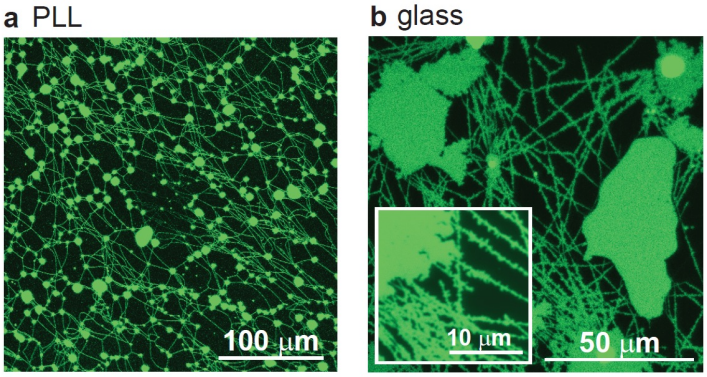

Figure S2 Confocal laser scanning microscope (CLSM) images of DOPE lipids adsorbed (a) on a Poly-L-lysine (PLL)-coated glass slide and (b) on a bare glass slide

In the main manuscript, we presented CLSM images of DOPE lipids adsorbed on PEI-coated glass slide. Figure S2 shows images of surfaces, where the same solution as the one used in the main manuscript was incubated **a)** on a Poly-L-lysine (PLL)-coated glass slide, and **b)** on a bare glass slide. Lipid blocks adsorbed as dots on the PLL-coated surface followed by a lipid nanotube formation upon a strong rinse (Figure S2a). The result is similar to the way how they adsorbed and formed nanotubes on PEI. On the other hand, lipid blocks not only adsorbed but also changed their architecture into a mixture of lipid patches and a ribbon-like structure on a glass slide (Figure S2b). The zoomed-in image (the inset in Figure S2b) shows that the ribbon-like structure appears wider in the optical image than that of the nanotubes, and is not a straight line like nanotubes but its edge is fuzzy, suggesting a possible different internal architecture. Such a mixture did not change its architecture even if another strong flow was applied during a rinse.

SUPPLEMENTARY MOVIE

Movie S1 *A movie taken with a fluorescent optical microscope showing the directed self-assembly of lipid nanotubes*.

After an adsorption of lipid blocks on a PEI-coated glass slide, a buffer solution was repeatedly injected with a syringe so that an active flow was established in the direction indicated with an arrow. On the other hand, when the syringe was hold without any active injection, both the lipid blocks and nanotubes adsorbed on the surface moved backwards compared to the direction of the injection. This may be due to a reverse flow of the solution and/or an elasticity-like property of the lipid nanotubes.