Electronic Supplementary Material (ESI) for Materials Advances.

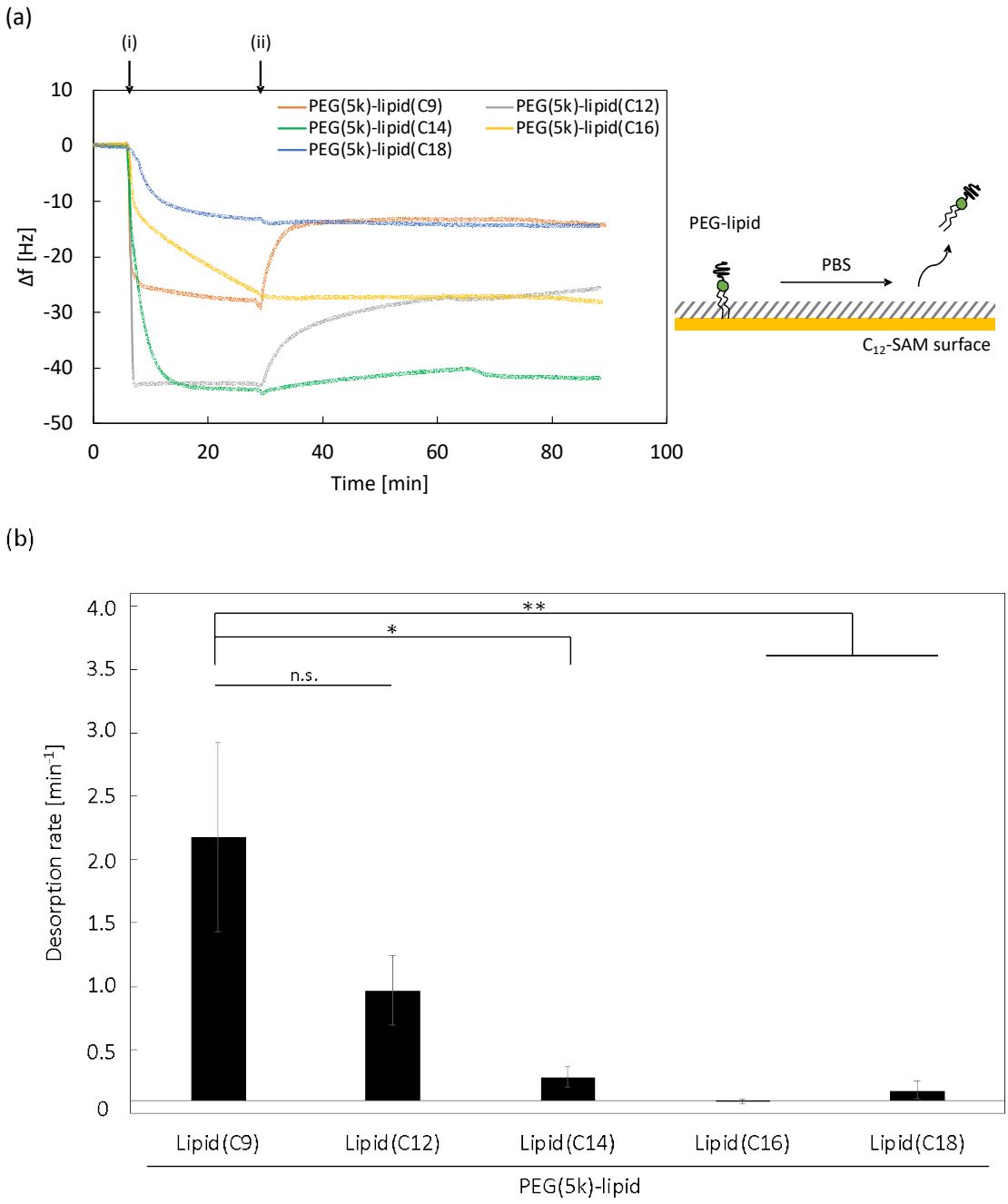
Supporting information

Cell membrane fusion induced by surface modification with cell-penetrating peptide-lipid conjugates that facilitates close contact between distinct membranes

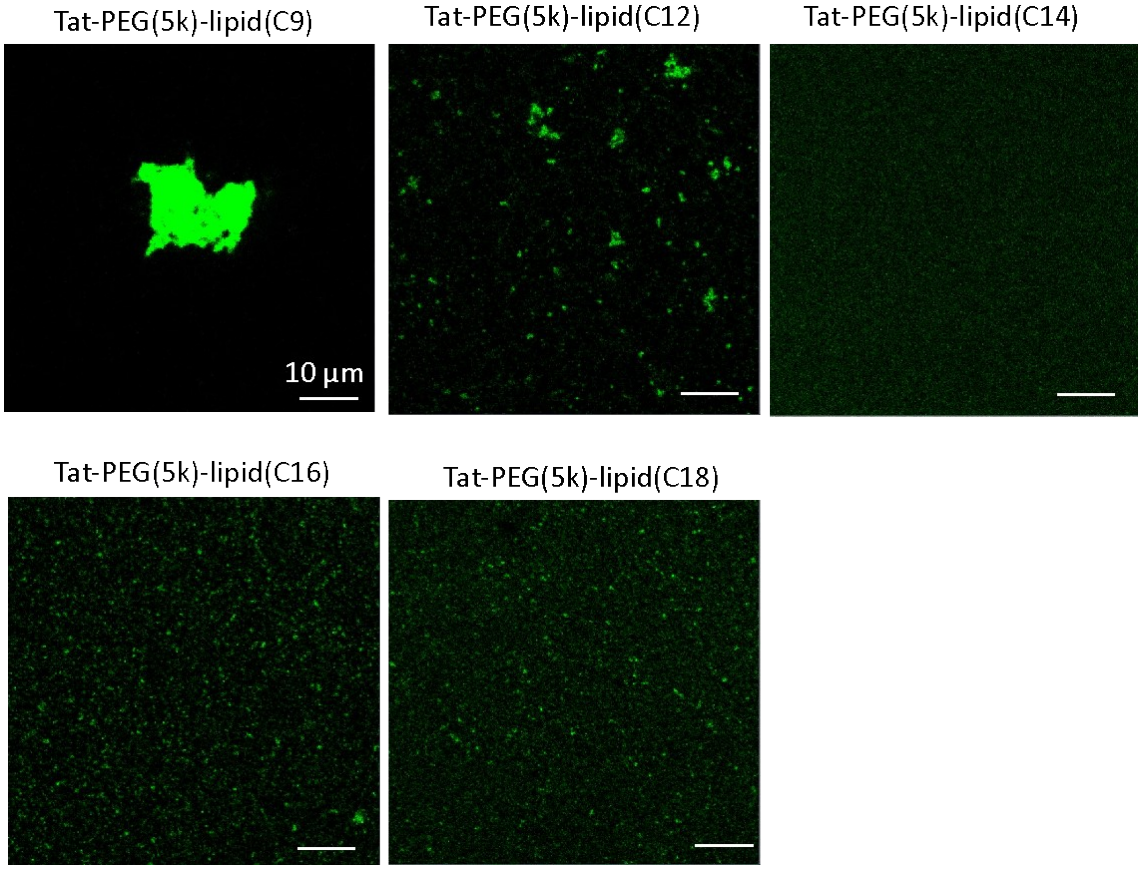
Yuya Sato[1,2], Teruhiko Baba[2], Takeyuki Uchida[3], Ung-il Chung[1], and Yuji Teramura[2,4,5]*

[1]Department of Bioengineering, Graduate School of Engineering, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-8656, Japan
[2]Cellular and Molecular Biotechnology Research Institute (CMB), National Institute of Advanced Industrial Science and Technology (AIST), AIST Tsukuba Central 5, 1-1-1 Higashi, Tsukuba, Ibaraki 305-8565, Japan
[3]Research Institute of Electrochemical Energy, Department of Energy and Environment, National Institute of Advanced Industrial Science and Technology (AIST), 1-8-31 Midorigaoka, Ikeda, Osaka 563-8577, Japan
[4]Department of Immunology, Genetics and Pathology (IGP), Uppsala University, Dag Hammarskjölds väg 20, SE-751 85, Uppsala, Sweden
[5]Master's/Doctoral Program in Life Science Innovation (T-LSI), University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8577 Japan

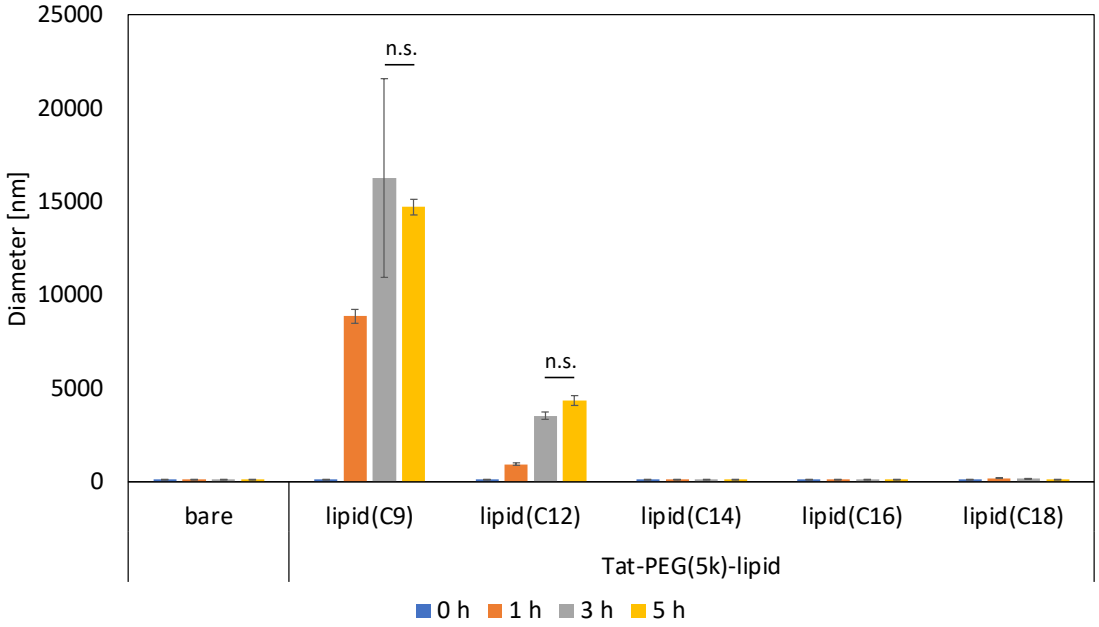
***Corresponding Author**
Yuji TERAMURA
Tel: +81(0)29-861-6582
E-mail: y.teramura@aist.go.jp



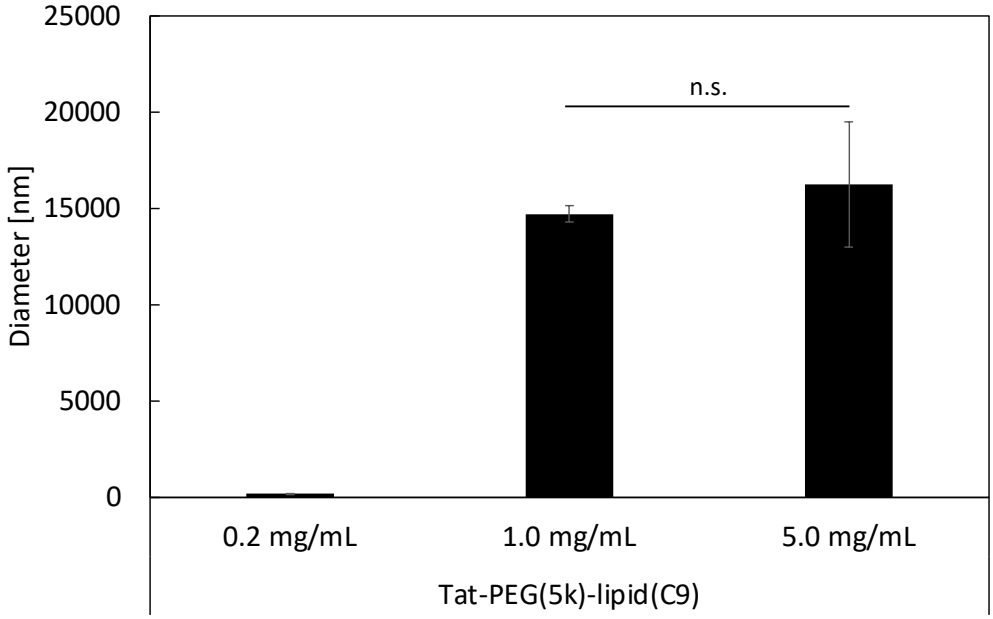
Supplementary Figure S1. Analysis of the interaction between PEG(5k)-lipids with different lipid lengths and hydrophobic C_{12}-SAM surface by a quartz crystal microbalance with dissipation monitoring (QCM-D). (a) Raw profiles of QCM-D for the interaction of PEG(5k)-lipids(C9, C12, C14, C16, C18) with the SAM surface. After the PEG-lipid (50 μg/mL) flowed to the sensor surface (arrow i), it was rinsed with PBS (arrow ii). (b) Quantitative analysis of desorption rate of PEG(5k)-lipids. Error bars indicate standard deviation; n = 3.



Supplementary Figure S2. Confocal images of liposome(CF) treated with Tat-PEG(5k)-lipids with different lipid lengths. Liposome(CF) was treated with Tat-PEG(5k)-lipids(C9, C12, C14, C16, C18) and then observed using a confocal laser scanning microscope.

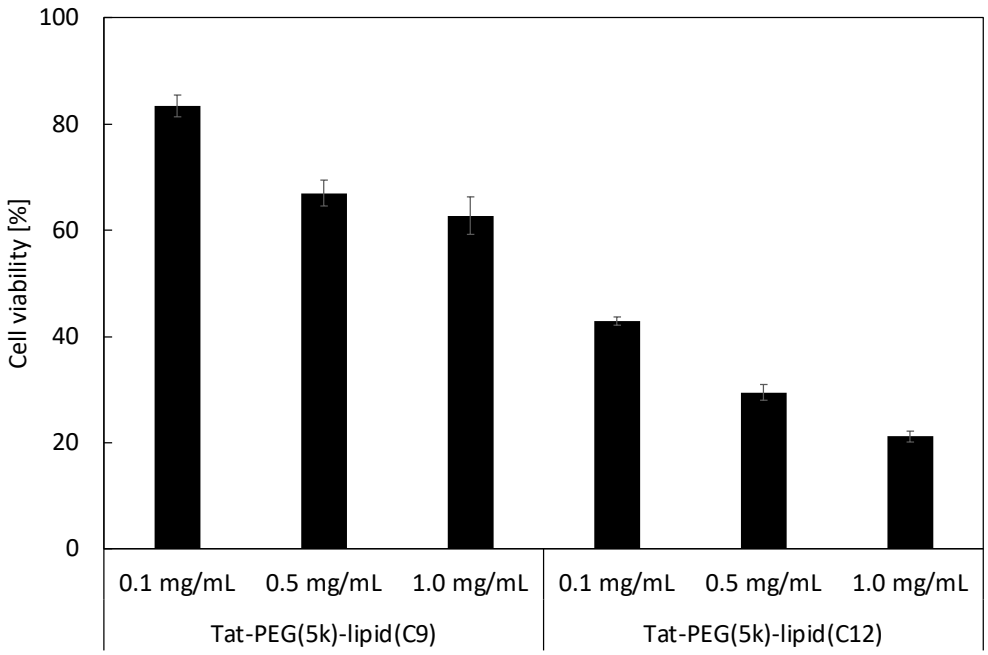


Supplementary Figure S3. Liposome size change treated with Tat-PEG(5k)-lipids with different lipid lengths at 0, 1, 3, and 5h. Liposome was treated with Tat-PEG(5k)-lipids(C9, C12, C14, C16, C18) for 0, 1, 3, and 5h, and then observed using dynamic light scattering analysis. Error bars indicate standard deviation; n = 3.

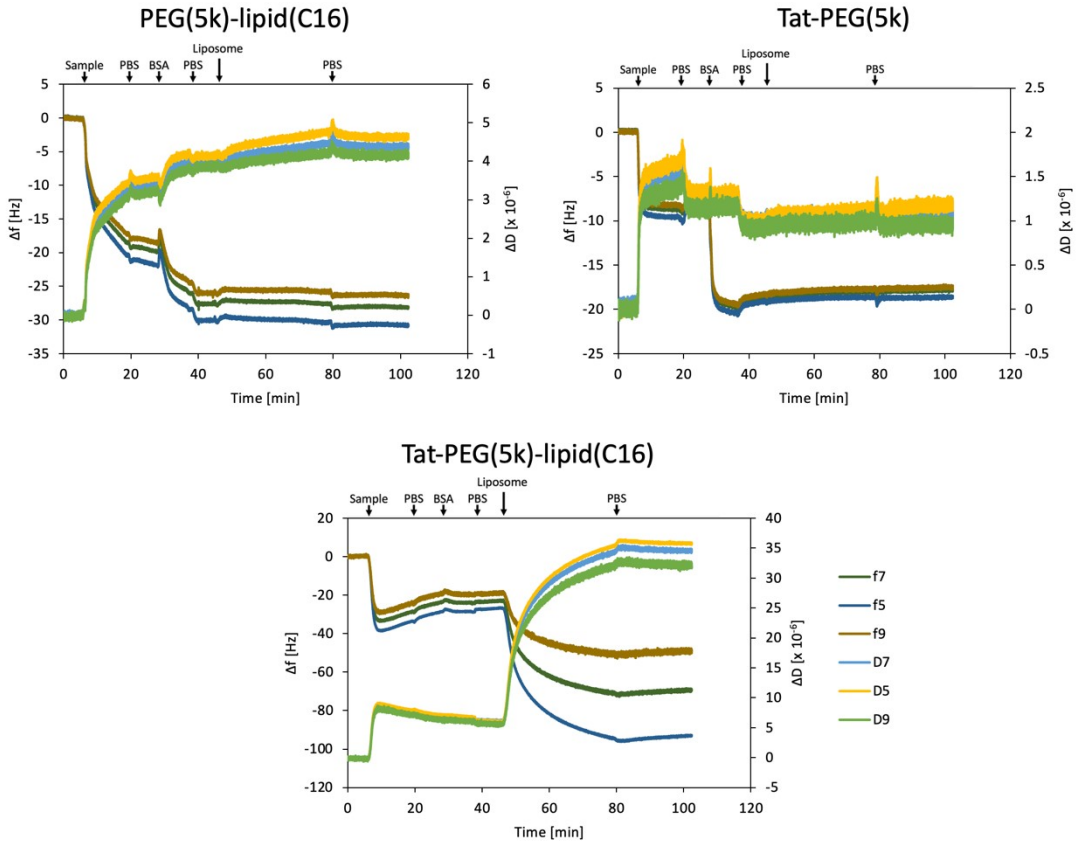


Supplementary Figure S4. Liposome size treated with each different concentration of Tat-PEG(5k)-lipid(C9) for 5h. Liposome was treated with Tat-PEG(5k)-lipids(C9) (0.2 1.0, 5.0 mg/mL) for 5h and then observed using dynamic light scattering analysis. Error

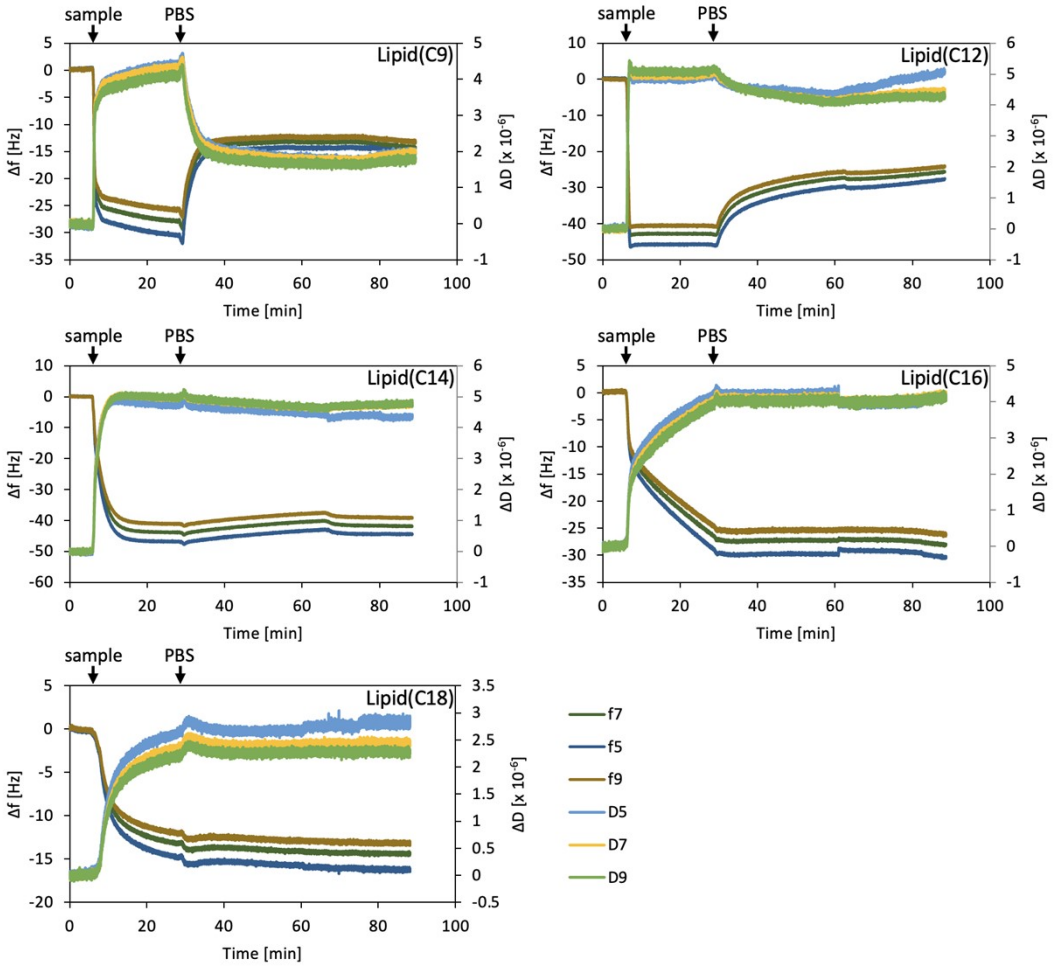
bars indicate standard deviation; n = 3.



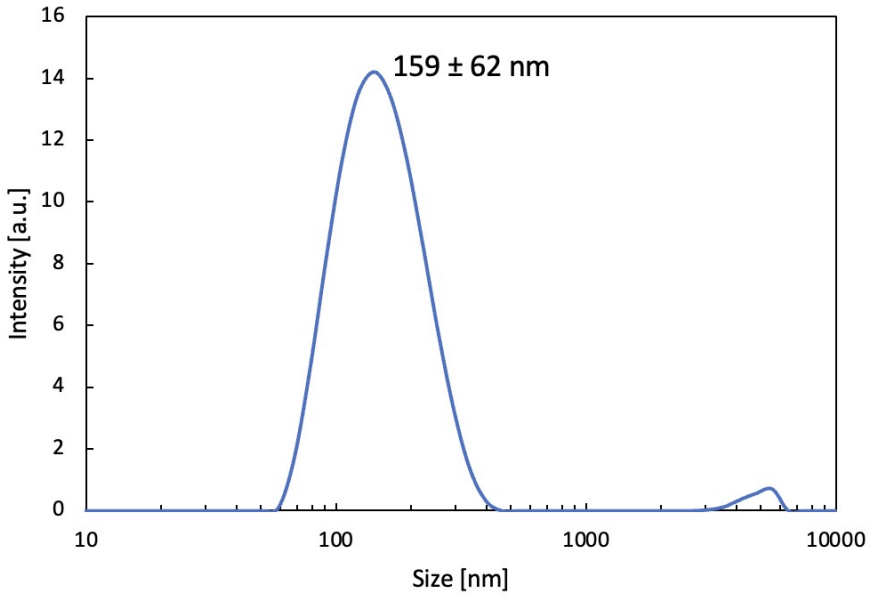
Supplementary Figure S5. Cell viability after treatment. Cells were treated with each concentration of Tat-PEG(5k)-lipid(C9, 12) for 6h. Cell suspension of CCRF-CEM and ADSCs was treated with Tat-PEG(5k)-lipids(C9) (0.1, 0.5, 1.0 mg/mL) for 6h and then analyzed the cell viability using Cell Counting Kit-8. Error bars indicate standard deviation; n = 3.



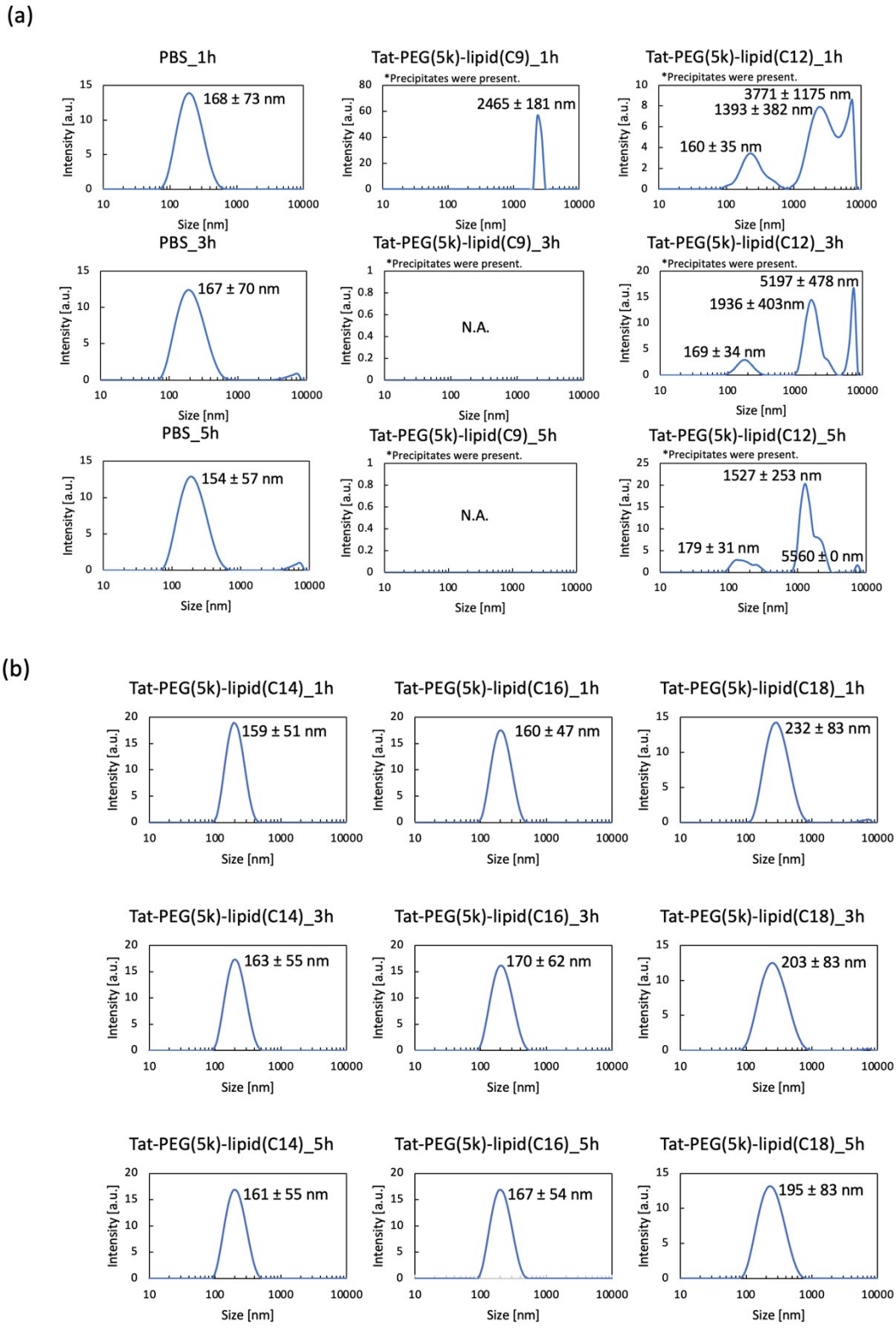
Supplementary Figure S6. QCM-D analysis of the interaction between Tat-PEG(5k)-lipid(C16) and the liposome on a hydrophobic C_{12}-SAM surface. For all experiments n = 3.



Supplementary Figure S7. QCM-D analysis of the interaction between PEG(5k)-lipids with different lipid lengths and hydrophobic C_{12}-SAM surface. For all experiments n = 3.



Supplementary Figure S8. Analysis of liposome size distribution and particle number by dynamic light scattering (DLS).



Supplementary Figure S9. Dynamic light scattering (DLS) analysis of size distribution of treated liposomes with PBS and Tat-PEG(5k)-lipids(C9, 12, 14, 16, 18) at 1, 3, 5 h. Visible precipitate was present in liposome suspension after treatment with Tat-PEG(5k)-lipids(C9,12).