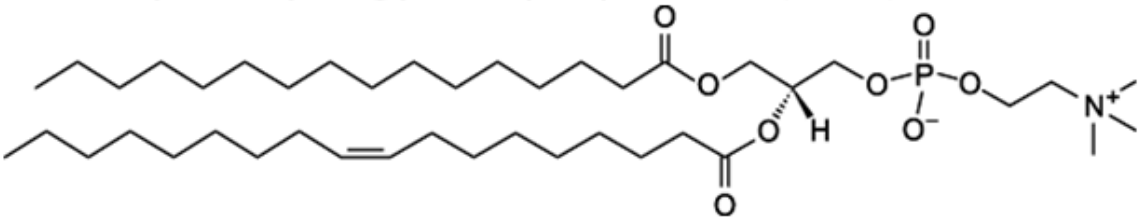
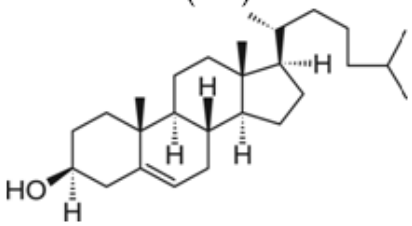
Supporting information

1-Palmitoyl-2-oleoyl-*sn*-glycero-3-phosphocholine (POPC)



Cholesterol (Ch)



1,2-Dioleoyl-3-trimethylammonium propane (DOTAP)

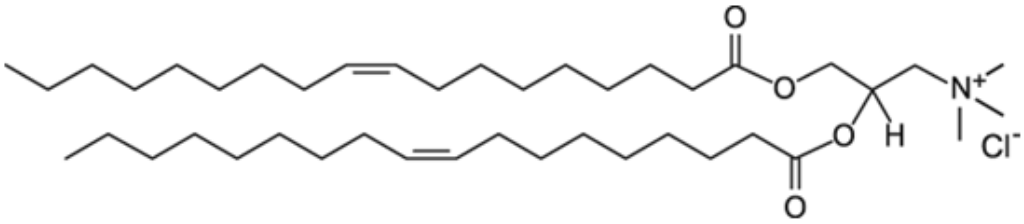


Fig. S1 The lipid structure of 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphocholine (POPC), cholesterol (Ch), and 1,2-dioleoyl-3-trimethylammonium propane (DOTAP).

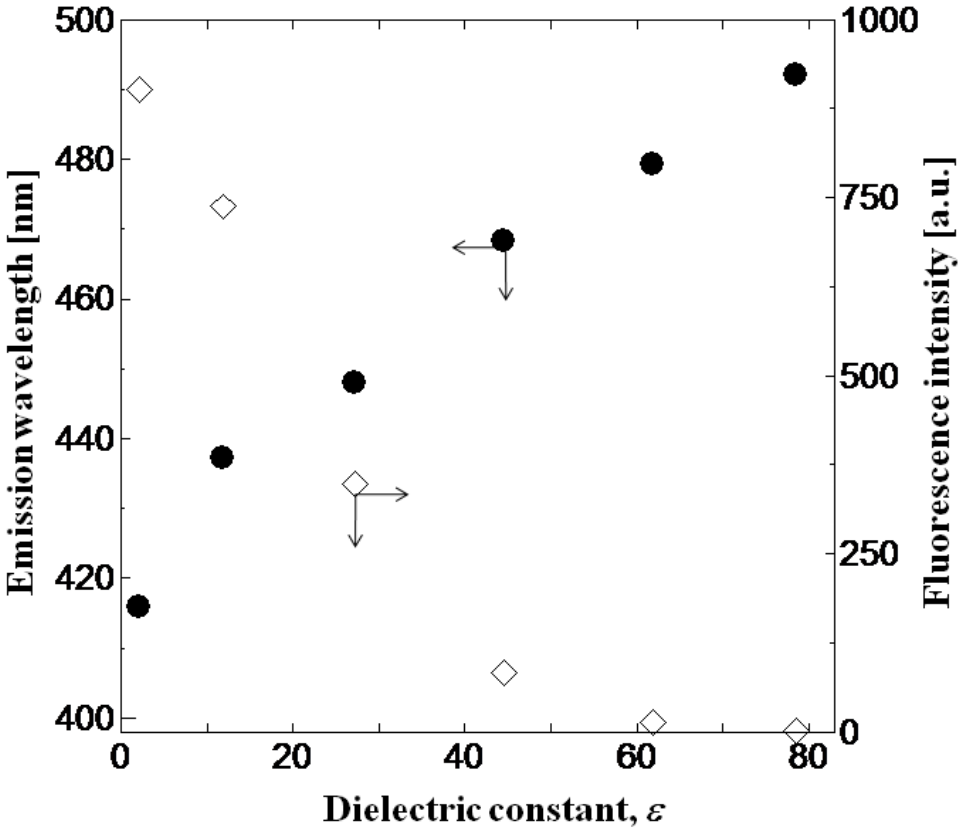


Fig. S2 Fluorescence emission peak and intensity of TNS as a function of the dielectric constant. TNS fluorescence and emission peaks were measured in water/dioxane solvent, where the e value of the water/dioxane mixture (v/v %) with 100/0, 80/20, 60/40, 40/60, 20/80, and 0/100 was 78.5, 61.9, 44.5, 27.2, 11.9, and 2.2, respectively [1]. TNS showed weak fluorescence in water (E_m: 492 nm); on the contrary, its fluorescence was very strong in dioxane solvent (E_m: 416 nm). The blue shift of TNS emission was observed in proportion to the solvent hydrophobicity. In the presence of liposomes, the TNS emission peak was 441–446 nm, indicating that TNS was binding to the liposomes' surface region (~ 1 nm depth from lipid-water interface).[1] Critchpield, F.E., Gibson Jr., J.A., Hall, J.L. (1953) Dielectric constant for the dioxane-water system from 20 to 35°. *Journal of the American Chemical Society*, 75 (8), pp. 1991-1992

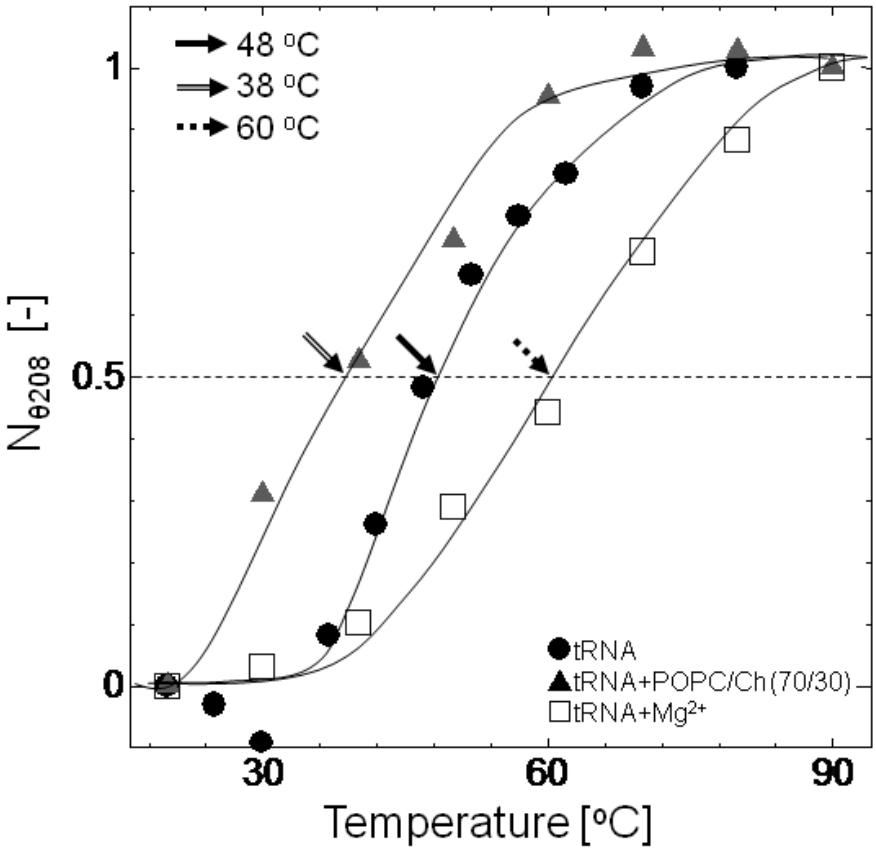


Fig. S3 The melting temperature (T_m) of tRNA was measured in the presence or Mg^{2+} or POPC/Ch (70/30). CD spectra of tRNA was measured under the heat stress conditions (20-90 °C), and then the negative peak at 208 nm (θ_{208}) was normalized based on the following equation (*); where the value of θ_{208} was minimum at 20 °C ($\theta_{208,20}$) and maximum at 80 °C ($\theta_{208,80}$) in each condition (tRNA with or without liposomes, Mg^{2+}). Then the temperature with $N_{\theta 208}$ = 0.5 was defined as the melting temperature T_m [2]. The T_m value in the presence of various kinds of liposomes was calculated. Similarly, the T_m value of mRNA in the presence or absence of liposomes was determined (summarized in **Table 1**). Final tRNA, mRNA and lipid concentrations were 2.2 μM , 0.77 μM and 1.17 mM, respectively. (*) Normalizedθ_{208}, $N_{\theta 208} = (\theta_{208} - \theta_{208,20}) / ((\theta_{208,80} - \theta_{208,20}))$

[2] Suga, K., Umakoshi, H., Tomita, H., Tanabe, T., Shimanouchi, T., Kuboi, R. (2010) Liposomes destabilize tRNA during heat stress. *Biotechnology Journal*, 5 (5), pp. 526-529

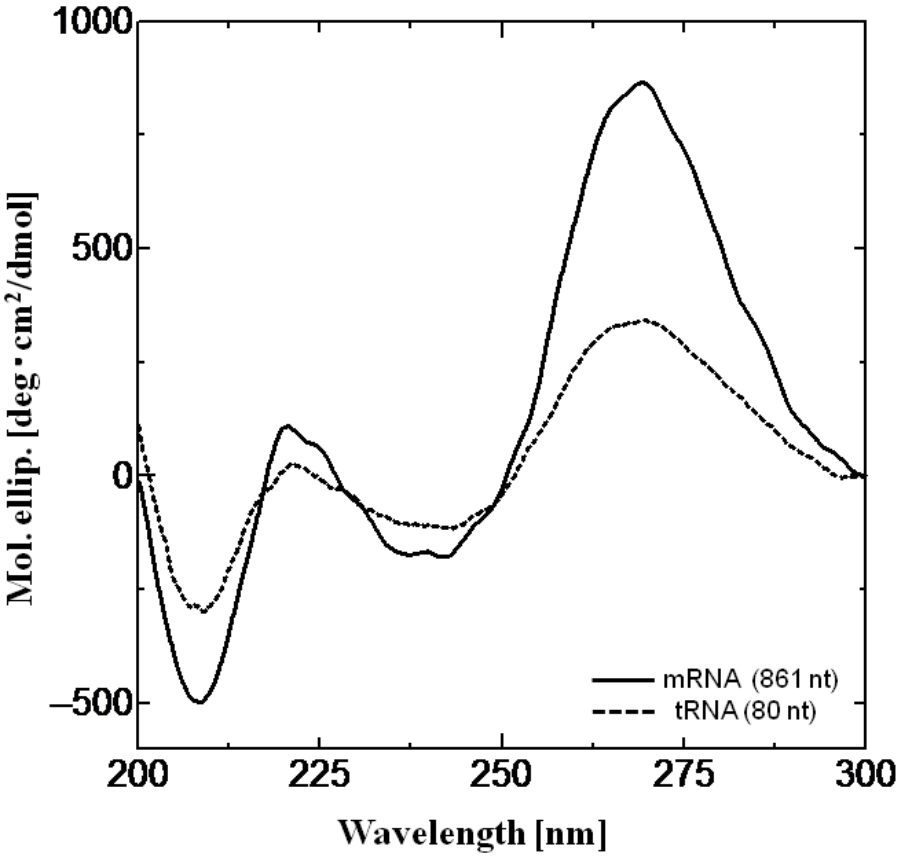


Fig. S4 The CD spectrum of mRNA and tRNA. Both spectra were found to be an A-form double helix. The difference of the peak intensity (208 nm, 265 nm) was due to the number of nucleotides; mRNA for 861 nt, tRNA for 80 nt. Final mRNA or tRNA concentrations were 0.77 μM, 2.2 μM, respectively. Thus, it was investigated that the conformation of single-stranded mRNA could be evaluated by CD sectra, similar to that of tRNA.