Electronic Supplementary Material (ESI) for Soft Matter.


**Electric Supplementary Information**

# Micrometer-sized network structure of novel DNA-lipid conjugates induced by heat stimulation

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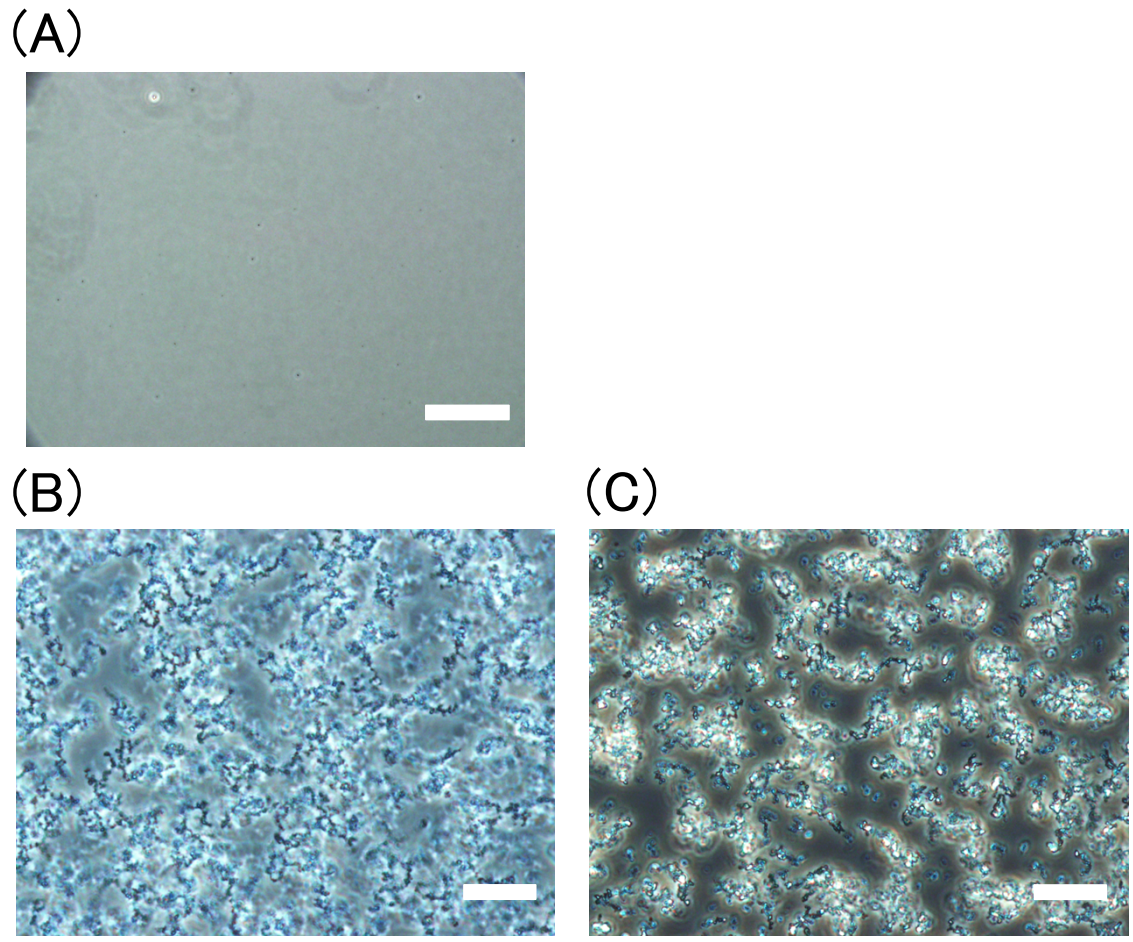


Fig. S1. Phase contrast microscopy images of $Mg^{2+}$-containing HEPES buffers including 32 μM DNA-RNA chimera lipid **1** after incubation under different temperature. (A) The solution of DNA-RNA chimera lipid **1** in the $Mg^{2+}$-containing buffer exhibited no constitution of the micrometer-sized structure 20 minutes after preparation of the chamber under room temperature. Bar = 50 μm. (B) The solution of DNA-RNA chimera lipid **1** incubated at 60°C for 20 minutes in the $Mg^{2+}$-containing buffer afforded similar structure observed in the case of heat stimulation of 40°C (see main text). Bar = 20 μm. (C) In the case of incubation of the solution at 95°C for 20 minutes, the micrometer-sized network structure were constituted in more condensed manner than the case of 40°C. Bar = 20 μm.

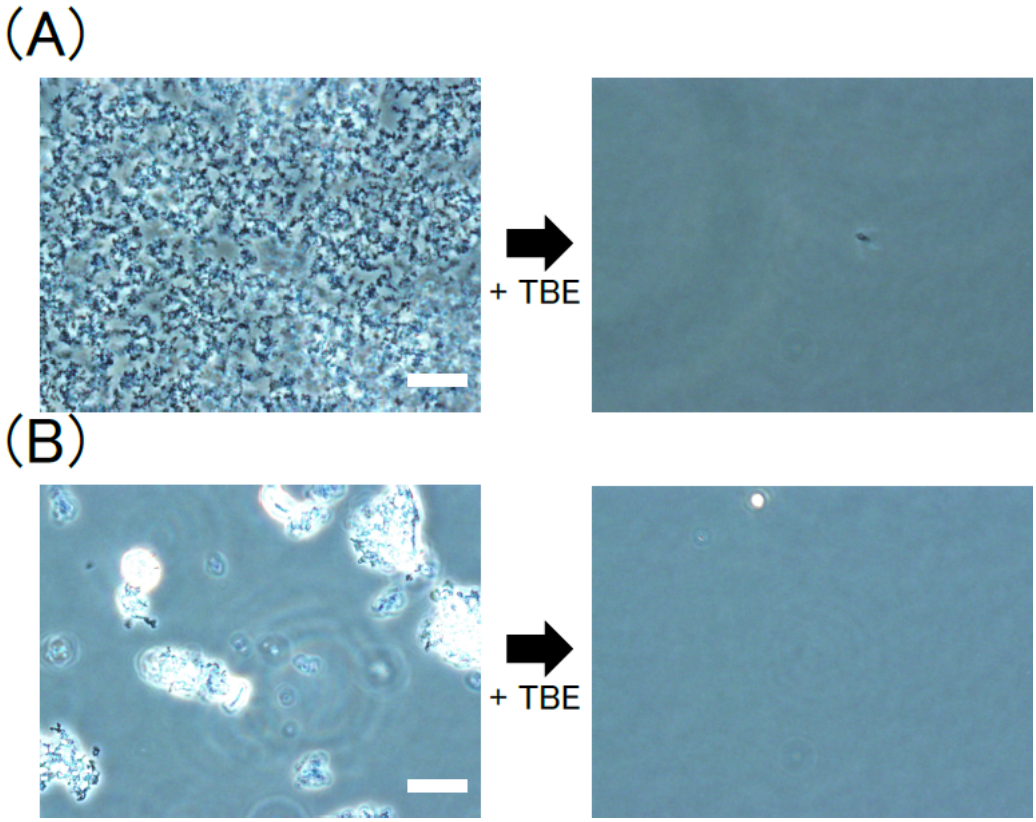


Fig. S2. Collapse of the micrometer-sized structures composed of each DNA-lipid conjugate after TBE buffer injection. (A) Phase contrast microscopy images of the $Mg^{2+}$-containing buffer solutions (20 μL of 50 mM HEPES buffer including 10 mM $MgCl_2$) containing the structure of DNA-RNA chimera lipid **1** incubated at 40°C for 15 minutes before and after 5 μL 1 × TBE buffer injection. (B) Phase contrast microscopy images of the $Mg^{2+}$-containing buffer solutions (20 μL of 50 mM HEPES buffer including 10 mM $MgCl_2$) containing the granules of 1:1 mixture of DNA-lipid conjugate **2** and **3** incubated at room temperature before and after 5 μL 1 × TBE buffer injection. Bar = 20 μm. The collapse of the structures by the chelating for the $Mg^{2+}$ ions by TBE buffer (including EDTA) implied that micrometer-sized structures of DNA-lipid conjugates were constituted in the presence of $Mg^{2+}$.

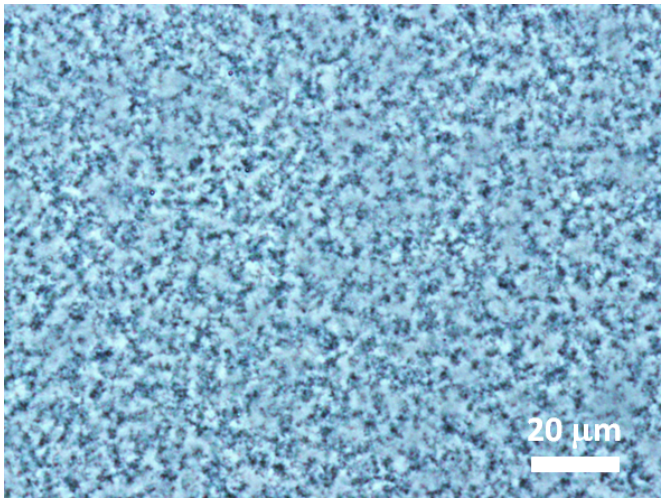


Fig. S3. Phase contrast microscopy image of the sample dispersion of **1** in the $Mg^{2+}$-containing buffer incubated at 23 ± 1 °C for 5 days.

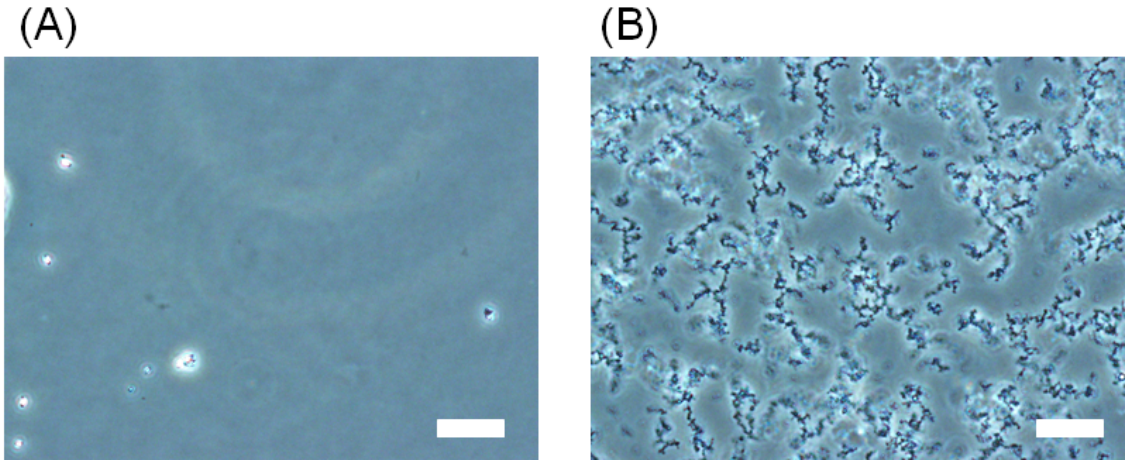


Fig. S4. Phase contrast microscopy images of the sample dispersion of **1** in the buffer without $Mg^{2+}$ incubated at 40 °C for 30 min and cooled down at room temperature for 30 min. The sample dispersion was observed before (A) and after (B) the injection of a small amount of the $MgCl_2$ solution (the final concentration in the sample was 10 mM). Bar = 20 μm.

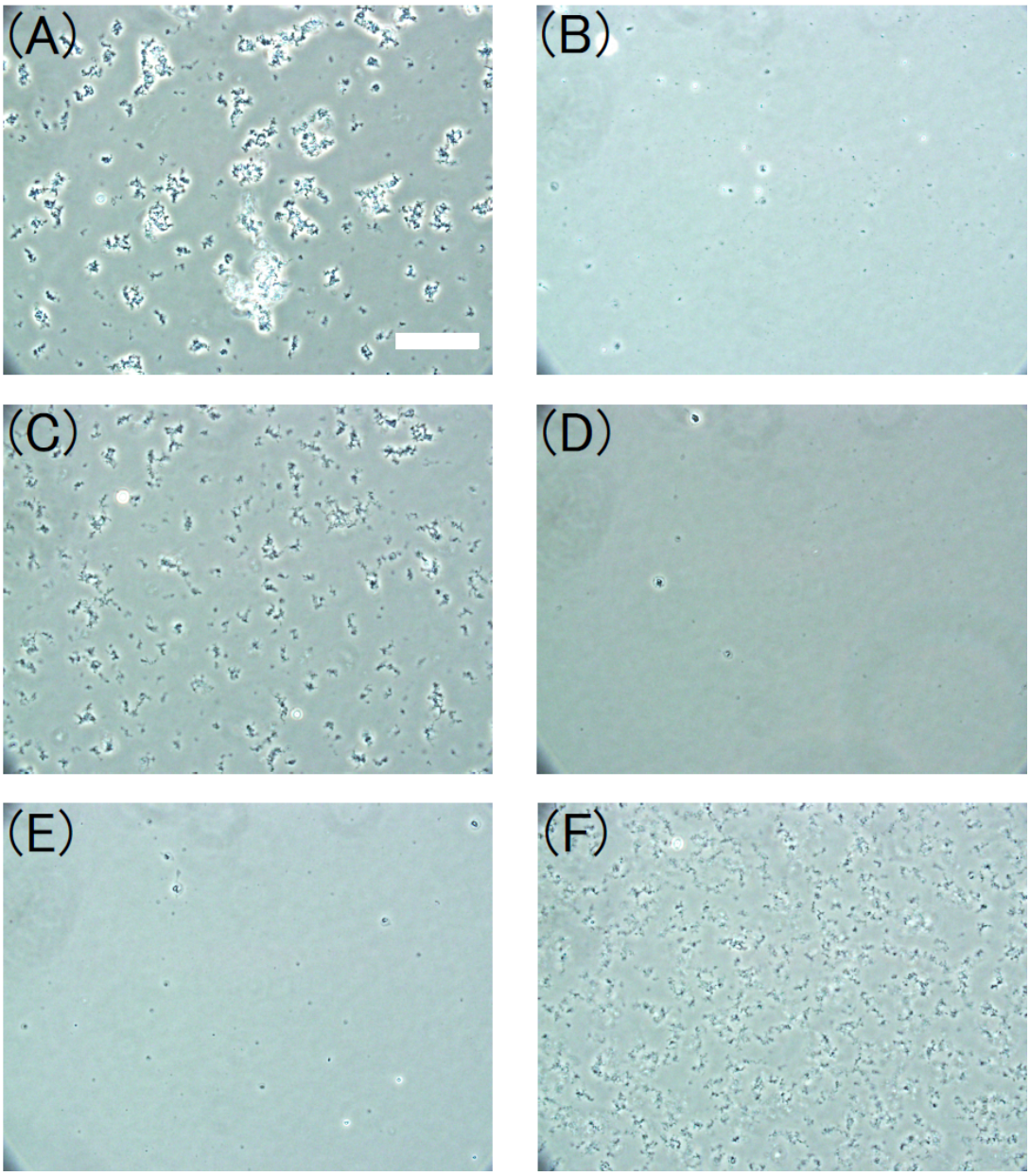


Fig. S5. Phase contrast microscopy images of $Mg^{2+}$-containing HEPES buffers including 1:1 mixtures of each oligo-A and oligo-T based DNA-lipid conjugate with oleoyl chains. The total concentration in each mixture was 32 μM. (A) A8 and T11 (B) T8 and A11 (C) A8 and A11 (D) T8 and T11 (E) A8 and T8 (F) T11 and A11. Bar = 50 μm. Oligo-A based DNA-lipid conjugate A8 and A11 had the following sequences; 5′-AAAAAAAA-3′ with the 5′ terminus modified by amide bonds linked to oleic acid, and 5′-AAAAAAAAAAA-3′ with the 3′ terminus modified by amide bonds linked to oleic acid. Oligo-T based DNA-lipid conjugate T8 and T11 had the following sequences; 5′-TTTTTTTT-3′ with 5′ terminus modified by amide bonds linked to oleic acid, and 5′-TTTTTTTTTTT-3′ with 3′ terminus modified by amide bonds linked to oleic acid, respectively.

Description of movie clip

Movie S1. Movie of the induction of a micrometer-sized three-dimensional network structure following heat stimulation (40°C) of DNA-RNA chimera lipid **1** in the $Mg^{2+}$-containing buffer (Figure 4A in main text). Movie was generated from phase contrast images taken with a time interval of 1 frame every 30 s. The granular structures appeared in the specimen 10 minutes after start of heat stimulation. The size of the observation space is 296 μm × 223 μm.