Supporting Information

Diversity of dye aggregates: Self-assembly of naphthalene-linked chlorophyll dyads dependent on substitution position

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S1. General Experiments

All the reactions were performed in the dark under nitrogen or argon atmosphere and monitored by thin layer chromatography and UV–vis absorption spectroscopy. UV–vis absorption and CD spectra were measured in solutions with a 10 mm quartz cell at room temperature (rt) using a Hitachi U3500 spectrophotometer and a Jasco J-720W spectropolarimeter, respectively. FT-IR spectra were measured in solution using a liquid cell and a JASCO FT/IR-6700 spectrophotometer. ^{1}H NMR spectra were recorded in CDCl$_3$ using a JEOL ECA-600 [**D-1,5**/**1,7**/**2,6**/**2,7**] or Bruker Avance 500US spectrometer [**D-1,3**/**1,6**]: CHCl$_3$ ($\delta_H = 7.26$ ppm) was used as an internal standard. High-resolution mass spectra (HRMS) were recorded on a Bruker micrOTOF II spectrometer [**D-1,5**/**1,7**/**2,6**/**2,7**] or Waters SELECT SERIES Cyclic IMS instrument [**D-1,3**/**1,6**]; atmospheric pressure chemical ionization (APCI) or electrospray ionization (ESI) and positive mode in an acetonitrile solution. AFM measurements were performed by a Bruker AXS Multimode 8 AFM system in tapping mode in air at rt on an HOPG substrate, and a Bruker silicon cantilever RTESP-300 was used. Energy-minimalization of dyads were carried out using Chem3D 26.0 (PerkinElmer) with the MM2 force field.

S2. Spectral Data of Stearyl 3-Aminomethyl-Pyropheophorbide-*a*

UV–vis (CHCl$_3$)λ_{max} = 663 ($\varepsilon = 5.5 \times 10^4$), 607 ($1.0 \times 10^4$), 538 ($1.1 \times 10^4$), 507 ($1.2 \times 10^4$), 412 ($1.0 \times 10^5$); ^{1}H NMR (CDCl$_3$) δ = 9.44 (1H, s, 10-H), 9.27 (1H, s, 5-H), 8.51 (1H, s, 20-H), 5.24, 5.09 (each 1H, d, J = 19 Hz, 13^1-CH$_2$), 5.01 (2H, s, 3-CH$_2$), 4.47 (1H, dq, J = 2, 7 Hz, 18-H), 4.28 (1H, dt, J = 8, 2 Hz, 17-H), 4.02–3.92 (2H, m, 17^2-CO$_2$CH$_2$), 3.66 (2H, q, J = 8 Hz, 8-CH$_2$), 3.62 (3H, s, 12-CH$_3$), 3.36 (3H, s, 2-CH$_3$), 3.23 (3H, s, 7-CH$_3$), 2.71–2.65, 2.55–2.50, 2.33–2.22

(1H+1H+2H, m, 17-CH_2CH_2), 1.80 (3H, d, J = 7 Hz, 18-CH_3), 1.68 (3H, t, J = 8 Hz, 8^1-CH_3), 1.49–1.43 (2H, m, 17^2-CO_2CCH_2), 1.29–1.13 (30H, m, 17^2-$CO_2C_2(CH_2)_{15}$), 0.87 (3H, t, J = 8 Hz, 17^2-$CO_2C_{17}CH_3$), 0.41, –1.73 (each 1H, NH×2) [The 3^1-NH_2 could be invisible.]; HRMS (APCI) found: m/z = 790.5614, calcd for $C_{50}H_{72}N_5O_3$: $[M+H]^+$, 790.5630.

S3. Synthesis of Naphthalenedicarboxylic Acid Dichloride

A mixture of naphthalenedicarboxylic acid (40.0 mg, 185 μmol), $SOCl_2$ (100 μL, 1.38 mmol), and a catalytic amount of DMF in dry tetrahydrofuran (THF, 4 mL) was refluxed for 3 h. After cooling down to rt, $SOCl_2$, DMF, and THF were removed *in vacuo*. The residue was dissolved in dichloromethane (DCM) and an excess amount of hexane was added to give the corresponding naphthalenedicarboxylic acid dichloride as a pale yellow solid. The solid were collected by filtration, and a part of the obtained naphthalenedicarboxylic acid dichlorides were used directly in the following synthesis of Chl dyads without further purification.

S4. Synthesis of Naphthalene-linked Chl Dyads

*S4-1. Synthesis of **D-1,3***

To a dichloromethane (DCM) solution of stearyl 3-aminomethyl-pyropheophorbide-*a* (33.4 mg, 42.2 μmol) was added the 1,3-naphthalenedicarboxylic acid dichloride (4.9 mg, 19 μmol) and triethylamine (Et_3N, 30.0 μL, 215 μmol) at 0 °C. After stirring for 1 day at rt, the reaction was quenched by addition of water, extracted by DCM, washed with water, and dried over Na_2SO_4. After evaporating the solvent, the residue was purified by silica gel column chromatography (0.5–1.5% MeOH/DCM) to give **D-1,3** as a black solid (6.6 mg, 3.5 μmol) in 18% yield.

UV–vis ($CHCl_3$) λ_{max}/nm = 665 ($\varepsilon = 1.2 \times 10^5$), 609 ($1.8 \times 10^4$), 538 ($2.0 \times 10^4$), 508 ($2.2 \times 10^4$), 411 ($2.2 \times 10^5$), 400 ($1.8 \times 10^5$), 381 ($1.3 \times 10^5$), 319 ($5.1 \times 10^4$); ^{1}H NMR ($CDCl_3$, 25 °C, 500 MHz) δ/ppm = 9.21, 9.09 (each 1H, s, 5-H×2), 8.79, 8.21 (each 1H, s, 10-H×2), 8.72 (1H, d, J = 8 Hz, 8-H of naphthalene), 8.53 (1H, s, 4-H of naphthalene), 8.03, (1H, br, 5-H of naphthalene) 8.01 (1H, s, 2-H of naphthalene), 7.74, 7.48 (each 1H, br, 3^1-NH×2), 7.69 (1H, t, J = 8 Hz, 7-H of naphthalene), 7.61 (1H, t, J = 8 Hz, 6-H of naphthalene), 7.55, 7.38 (each 1H, s, 20-H×2), 6.05, 6.00, 5.72, 5.64 (each 1H, dd, J = 14, 6 Hz, 3-CH_2×2), 4.28–3.94 (4H, m, 17-H×2, 18-H×2) 3.90 (4H, m, 17^2-$COOCH_2$×2), 3.18, 3.14 (each 3H, s, 2-CH_3×2), 3.11–3.00 (4H, br, 8-CH_2×2), 2.98, 2.84 (each 3H, s, 12-CH_3×2), 2.95, 2.84 (each 3H, s, 7-CH_3×2), 2.75–1.70 (8H, m, 17-CH_2CH_2×2), 1.51, 1.49 (each 3H, d, J = 7 Hz, 18-CH_3), 1.34 (6H, t, J = 7 Hz, 8^1-CH_3×2), 1.29–1.17 (64H, m, 17^2-$COOC(CH_2)_{16}$×2), 0.87 (6H, t, J = 7 Hz, 17^2-$COOC_{17}CH_3$×2), −1.74, −3.31 (each 2H, br-s, NH×4) [The 13^1-CH_2 peaks were not found.]; HRMS (ESI) found: m/z = 1760.1393, calcd for $C_{112}H_{146}N_{10}O_8$: M^+, 1760.1354.

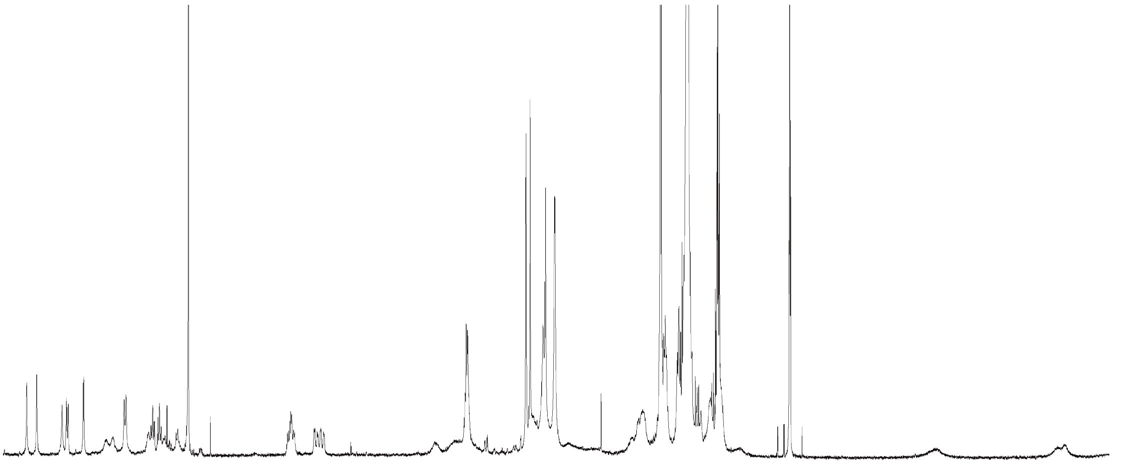

Figure S1. ^{1}H NMR spectrum of **D-1,3** in $CDCl_3$.

*S4-2. Synthesis of **D-1,5***

D-1,5 was obtained by the same procedure of **D-1,3** synthesis (Section 3-1) using stearyl 3-aminomethyl-pyropheophorbide-*a* (32.2 mg, 40.8 μmol), 1,5-naphthalenedicarboxylic acid dichloride (5.0 mg, 20 μmol), Et_3N (28.3 μL, 203 μmol), and DCM (10 mL). Yield: 26% (9.1 mg, 5.2 μmol).

UV–vis ($CHCl_3$) λ_{max}/nm = 666 ($\varepsilon = 1.0 \times 10^5$), 609 ($1.5 \times 10^4$), 538 ($1.7 \times 10^4$), 508 ($1.9 \times 10^4$), 412 ($1.9 \times 10^5$), 400 ($1.5 \times 10^5$), 381 ($1.1 \times 10^5$), 319 ($4.4 \times 10^4$); ^{1}H NMR ($CDCl_3$, 50 °C, 600 MHz) δ/ppm = 9.51 (2H, s, 5-H×2), 9.46 (2H, s, 10-H×2), 8.54 (2H, s, 20-H×2), 8.53 (2H, d, *J* = 8 Hz, 2,6-H of naphthalene), 7.54 (2H, d, *J* = 8 Hz, 4,8-H of naphthalene), 7.27 (2H, t, *J* = 8 Hz, 3,7-H of naphthalene), 6.56 (2H, br, 3^1-NH×2), 5.91 (4H, br, 3-CH_2×2), 5.24, 5.08 (each 2H, d, *J* = 19 Hz, 13^1-CH_2×2), 4.48 (2H, br-q, *J* = 8 Hz, 18-H×2), 4.29 (2H, br-d, *J* = 8 Hz, 17-H×2), 4.03–3.95 (4H, m, 17^2-$COOCH_2$×2), 3.65 (6H, s, 12-CH_3×2), 3.64 (4H, q, *J* = 8 Hz, 8-CH_2×2), 3.41 (6H, s, 2-CH_3×2), 3.19 (6H, s, 7-CH_3×2), 2.72–2.65, 2.58–2.50, 2.33–2.25 (2H+2H+4H, m, 17-CH_2CH_2×2), 1.79 (6H, d, *J* = 8 Hz, 18-CH_3×2), 1.65 (6H, t, *J* = 8 Hz, 8^1-CH_3×2), 1.29–1.19 (64H, m, 17^2-$COOC(CH_2)_{16}$×2), 0.87 (6H, t, *J* = 7 Hz, 17^2-$COOC_{17}CH_3$×2), 0.28, −1.78 (each 2H, br-s, NH×4); HRMS (ESI) found: *m/z* = 1761.1435, calcd for $C_{112}H_{147}N_{10}O_8$: $[M+H]^+$, 1761.1432.

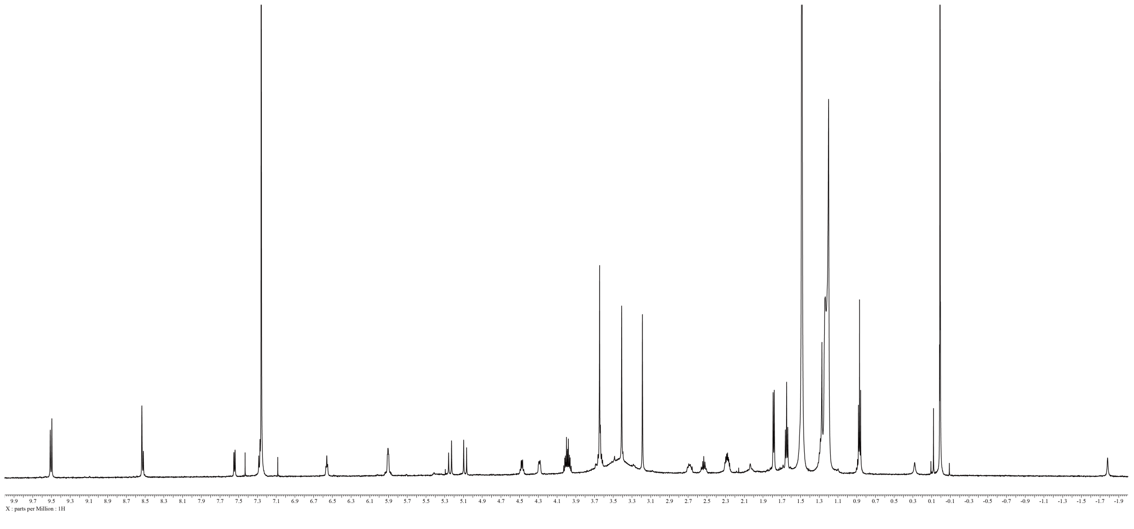

Figure S2. ^{1}H NMR spectrum of **D-1,5** in $CDCl_3$.

*S4-3. Synthesis of **D-1,6***

D-1,6 was obtained by the same procedure of **D-1,3** synthesis (Section 3-1) using stearyl 3-aminomethyl-pyropheophorbide-*a* (31.6 mg, 40.0 µmol), 1,6-naphthalenedicarboxylic acid dichloride (4.9 mg, 19 µmol), Et_3N (30.0 µL, 215 µmol), and DCM (10 mL). Yield: 57% (19.2 mg, 11.0 µmol).

UV–vis ($CHCl_3$) λ_{max}/nm = 665 ($\varepsilon = 1.1 \times 10^5$), 609 ($1.7 \times 10^4$), 538 ($1.9 \times 10^4$), 508 ($2.1 \times 10^4$), 411 ($2.1 \times 10^5$), 400 ($1.7 \times 10^5$), 381 ($1.2 \times 10^5$), 319 ($1.8 \times 10^4$); ^{1}H NMR ($CDCl_3$, 50 °C, 500 MHz) δ/ppm = 9.30 (2H, s, 5-H×2 of Chl-1,6), 8.56 (1H, d, *J* = 9 Hz, 8-H of naphthalene), 8.54, (1H, s, 10-H of Chl-6), 8.48 (1H, s, 10-H of Chl-1), 8.41 (1H, s, 5-H of naphthalene), 8.26 (1H, s, 20-H of Chl-1), 8.22 (1H, s, 20-H of Chl-6), 8.16 (1H, d, *J* = 9 Hz, 7-H of naphthalene), 7.78 (1H, br, 3^1-NH of Chl-6), 7.77 (1H, d, *J* = 9 Hz, 4-H of naphthalene), 7.64 (1H, d, *J* = 7 Hz, 2-H of naphthalene) 7.27 (1H, t, *J* = 8 Hz, 3-H of naphthalene), 7.14 (1H, br, 3^1-NH of Chl-1), 5.84, (2H, br, 3-CH_2 of Chl-6), 5.63, (2H, d, *J* = 5 Hz, 3-CH_2 of Chl-1), 4.75–4.55 (4H, m, 13^1-CH_2×2 of Chl-1,6), 4.28 (1H, m, 18-H), 4.26–4.17 (11H, m, 8-CH_2×2, 17-H×2, and 17^2-$COOCH_2$×2 of Chl-1,6, 18-H), 3.84, 3.80 (each 3H, s, 12-CH_3×2 of Chl-1,6), 3.34 (3H, s, 2-CH_3 of Chl-6), 3.24 (3H, s, 2-CH_3 of Chl-1), 3.13, 3.02 (each 3H, s, 7-CH_3×2 of Chl-1,6), 2.63, 2.30, 2.16, 2.00 (each 2H, m, 17-CH_2CH_2×2 of Chl-1,6) 1.68 (6H, t, *J* = 6 Hz, 8^1-CH_3×2 of Chl-1,6), 1.50 (6H, d, *J* = 8 Hz, 18-CH_3×2 of Chl-1,6), 1.45–1.15 (64H, m, 17^2-$COOC(CH_2)_{16}$×2 of Chl-1,6), 0.87 (6H, t, *J* = 7 Hz, 17^2-$COOC_{17}CH_3$×2 of Chl-1,6), −0.46, −0.54, −2.24, −2.35 (each 1H, br-s, NH×4 of Chl-1,6) [Chl-1 and Chl-6 were connected to the 1- and 6-positions of a naphthalene linker, respectively.]; HRMS (ESI) found: *m/z* = 879.5679, calcd for $C_{112}H_{146}N_{10}O_8$: M^{2+}, 879.5657.

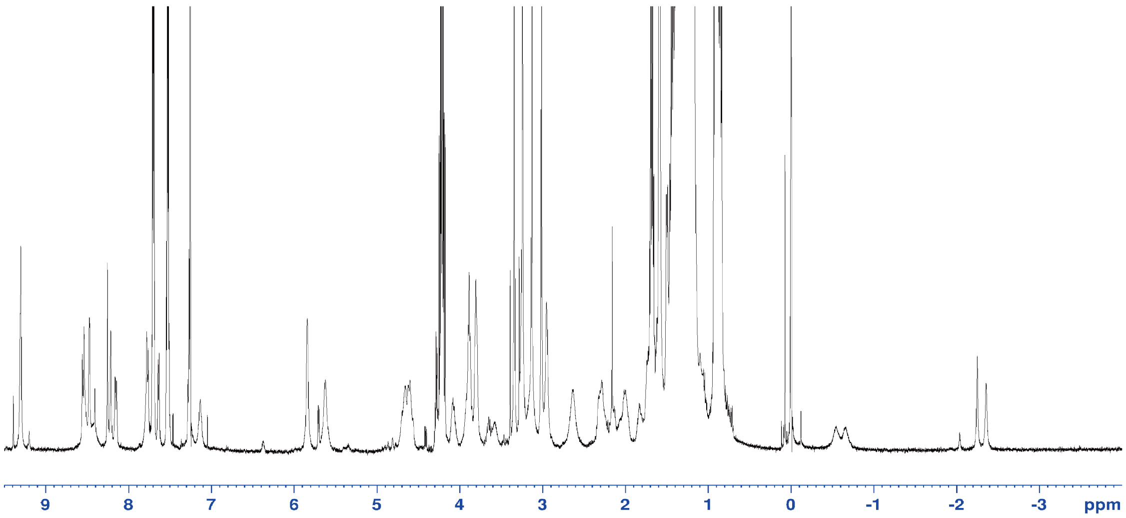

Figure S3. ^{1}H NMR spectrum of **D-1,6** in $CDCl_3$.

S4-4. Synthesis of ***D-1,7***

D-1,7 was obtained by the same procedure of **D-1,3** synthesis (Section 3-1) using stearyl 3-aminomethyl-pyropheophorbide-*a* (31.6 mg, 40.0 μmol), 1,7-naphthalenedicarboxylic acid dichloride (4.7 mg, 19 μmol), Et_3N (28.3 μL, 203 μmol), and DCM (10 mL). Yield: 28% (9.3 mg, 5.3 μmol).

UV–vis ($CHCl_3$) λ_{max}/nm = 665 ($\varepsilon = 1.1 \times 10^5$), 608 ($1.7 \times 10^4$), 537 ($1.9 \times 10^4$), 507 ($2.1 \times 10^4$), 411 ($2.1 \times 10^5$), 399 ($1.8 \times 10^5$), 381 ($1.3 \times 10^5$), 319 ($4.8 \times 10^4$); ^{1}H NMR ($CDCl_3$, 600 MHz) δ/ppm = 9.39 (1H, s, 5-H of Chl-7), 9.23 (1H, s, 10-H of Chl-7), 9.15 (1H, s, 10-H of Chl-1), 9.05 (1H, s, 5-H of Chl-1), 8.97 (1H, s, 8-H of naphthalene), 8.52 (1H, s, 20-H of Chl-7), 8.40 (1H, s, 20-H of Chl-1), 8.02 (1H, d, J = 9 Hz, 6-H of naphthalene), 7.78 (1H, d, J = 9 Hz, 5-H of naphthalene), 7.76 (1H, d, J = 8 Hz, 4-H of naphthalene), 7.47 (1H, d, J = 7 Hz, 2-H of naphthalene), 7.27 (1H, br-t, J = 8 Hz, 3-H of naphthalene), 7.16 (1H, br, 3^1-NH of Chl-7), 6.55 (1H, br, 3^1-NH of Chl-1), 5.71, 5.61 (each 1H, dd, J = 15, 5 Hz, 3-CH_2 of Chl-7), 5.51 (2H, br, 3-CH_2 of Chl-1), 5.13, 5.07, 4.98, 4.94 (each 1H, d, J = 19 Hz, 13^1-$CH_2 \times 4$ of Chl-1,7), 4.45 (1H, br-q, $J = 7$ Hz, 18-H of Chl-7), 4.38 (1H, br-q, $J = 8$ Hz, 18-H of Chl-1), 4.24–4.16 (2H, m, 17-H×2 of Chl-1,7), 4.05–3.94 (4H, m, 17^2-$COOCH_2$×2 of Chl-1,7), 3.57, 3.53 (each 1H, dq, $J = 15$, 8 Hz, 8-CH_2 of Chl-1), 3.45 (3H, s, 12-CH_3 of Chl-7), 3.38 (2H, q, $J = 8$ Hz, 8-CH_2 of Chl-7), 3.27 (6H, s, 2-CH_3 of Chl-7, 12-CH_3 of Chl-1), 3.28 (3H, s, 7-CH_3 of Chl-7), 3.16 (3H, s, 2-CH_3 of Chl-1), 2.77 (3H, s, 7-CH_3 of Chl-1), 2.65–2.56, 2.55–2.46, 2.31–2.22, 2.21–2.12 (each 2H, m, 17-CH_2CH_2×2 of Chl-1,7), 1.83 (3H, d, $J = 7$ Hz, 18-CH_3 of Chl-7), 1.74 (3H, d, $J = 8$ Hz, 18-CH_3 of Chl-1), 1.60 (3H, t, $J = 8$ Hz, 8^1-CH_3 of Chl-1), 1.50 (3H, t, $J = 8$ Hz, 8^1-CH_3 of Chl-1), 1.32–1.12 (64H, m, 17^2-$COOC_2(CH_2)_{16}$×2 of Chl-1,7), 0.87 (6H, t, $J = 7$ Hz, 17^2-$COOC_{17}CH_3$×2 of Chl-1,7), 0.12, 0.03, −1.81, −2.03 (each 1H, br-s, NH×4 of Chl-1,7) [Chl-1 and Chl-7 were connected to the 1- and 7-positions of a naphthalene linker, respectively.]; HRMS (ESI) found: $m/z = 1761.1431$, calcd for $C_{112}H_{147}N_{10}O_8$: $[M+H]^+$, 1761.1432.

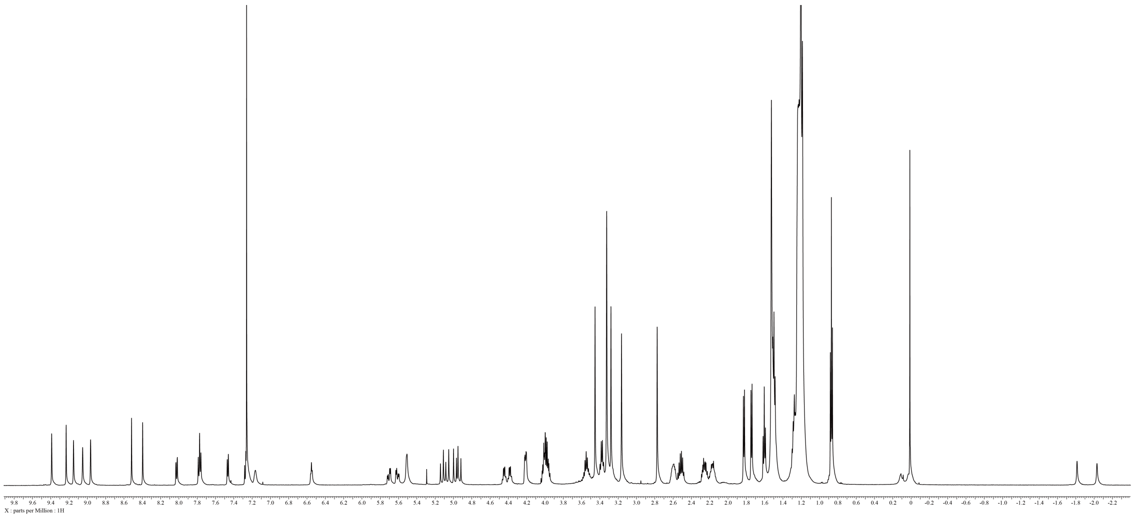

Figure S4. ^1H NMR spectrum of **D-1,7** in $CDCl_3$.

S4-5. Synthesis of ***D-2,6***

D-2,6 was obtained by the same procedure of **D-1,3** synthesis (Section 3-1) using stearyl 3-aminomethyl-pyropheophorbide-*a* (30.0 mg, 38.0 μmol), 2,6-naphthalenedicarboxylic acid dichloride (4.7 mg, 19 μmol), Et_3N (26.4 μL, 189 μmol), and DCM (10 mL). Yield: 30% (9.7 mg, 5.5 μmol).

UV–vis ($CHCl_3$) λ_{max}/nm = 666 ($\varepsilon = 1.0 \times 10^5$), 609 ($1.5 \times 10^4$), 538 ($1.7 \times 10^4$), 508 ($1.9 \times 10^4$), 412 ($1.9 \times 10^5$), 400 ($1.5 \times 10^5$), 381 ($1.1 \times 10^5$), 319 ($4.2 \times 10^4$); ^{1}H NMR ($CDCl_3$, 50 °C, 600 MHz) δ/ppm = 9.40 (4H, s, 5,10-H×2), 8.51 (2H, s, 20-H×2), 8.25 (2H, s, 1,5-H of naphthalene), 7.84 (2H, d, J = 9 Hz, 3,7-H of naphthalene), 7.76 (2H, d, J = 9 Hz, 4,8-H of naphthalene), 6.83 (2H, br, 3^1-NH×2), 5.82 (4H, s, 3-CH_2×2), 5.18, 5.03 (each 2H, d, J = 19 Hz, 13^1-CH_2×2), 4.45 (2H, br-q, J = 7 Hz, 18-H×2), 4.24 (2H, br-d, J = 9 Hz, 17-H×2), 4.02–3.94 (4H, m, 17^2-$COOCH_2$×2), 3.60 (4H, q, J = 8 Hz, 8-CH_2×2), 3.56 (6H, s, 12-CH_3×2), 3.38 (6H, s, 2-CH_3×2), 3.18 (6H, s, 7-CH_3×2), 2.67– 2.61, 2.54–2.48, 2.29–2.20 (2H+2H+4H, m, 17-CH_2CH_2×2), 1.77 (6H, d, J = 7 Hz, 18-CH_3×2), 1.62 (6H, t, J = 8 Hz, 8^1-CH_3×2), 1.30–1.26 (4H, m, 17^2-$COOCCH_2$×2), 1.25–1.17 (60H, m, 17^2-$COOC_2(CH_2)_{15}$×2), 0.87 (6H, t, J = 7 Hz, 17^2-$COOC_{17}CH_3$×2), 0.16, −1.86 (each 2H, br-s, NH×4); HRMS (ESI) found: m/z = 1761.1429 and 881.0749, calcd for $C_{112}H_{147}N_{10}O_8$: $[M+H]^+$, 1761.1432 and for $C_{112}H_{148}N_{10}O_8$: $[M+2H]^{2+}$, 881.0752.

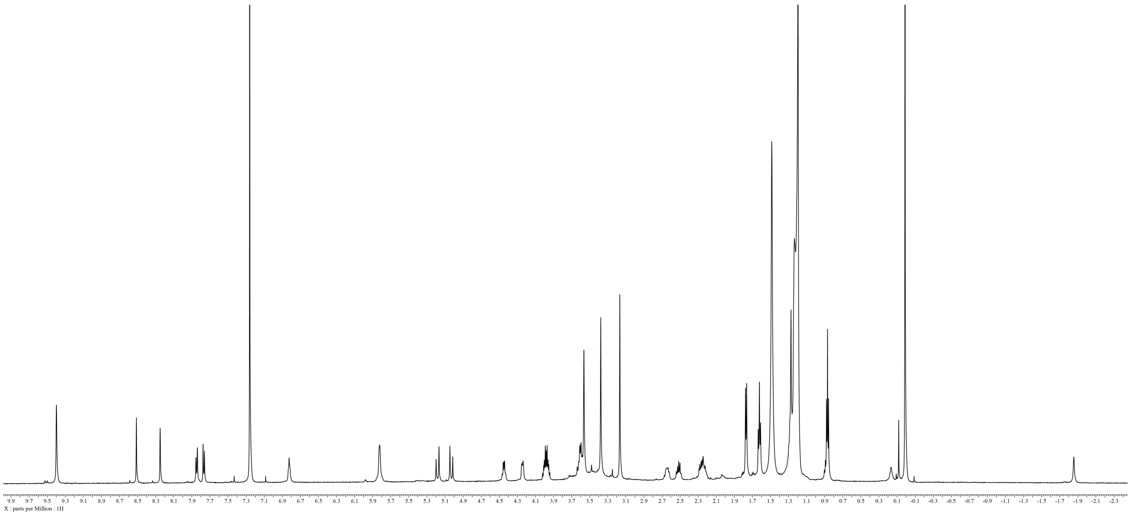

Figure S5. ^{1}H NMR spectrum of **D-2,6** in $CDCl_3$.

S4-6. Synthesis of ***D-2,7***

D-2,7 was obtained by the same procedure of **D-1,3** synthesis (Section 3-1) using stearyl 3-aminomethyl-pyropheophorbide-*a* (30.0 mg, 38.0 μmol), 2,7-naphthalenedicarboxylic acid dichloride (4.7 mg, 19 μmol), Et_3N (26.4 μL, 189 μmol), and DCM (10 mL). Yield: 62% (20.3 mg, 11.5 μmol).

UV–vis ($CHCl_3$) λ_{max}/nm = 665 ($\varepsilon = 1.0 \times 10^5$), 608 ($1.5 \times 10^4$), 537 ($1.7 \times 10^4$), 506 ($1.9 \times 10^4$), 411 ($1.9 \times 10^5$), 398 ($1.5 \times 10^5$), 382 ($1.1 \times 10^5$), 320 ($4.0 \times 10^4$); ^{1}H NMR ($CDCl_3$, 600 MHz) δ/ppm = 9.37 (2H, s, 5-H×2), 9.00 (2H, s, 1,8-H of naphthalene), 8.43 (2H, s, 10-H×2), 8.32 (2H, s, 20-H×2), 8.00 (2H, d, *J* = 8 Hz, 3,6-H of naphthalene), 7.79 (2H, d, *J* = 8 Hz, 4,5-H of naphthalene), 7.18 (2H, br, 3^1-NH×2), 5.84 (4H, d, *J* = 5 Hz, 3-CH_2×2), 4.93, 4.79 (each 2H, d, *J* = 19 Hz, 13^1-CH_2×2), 4.15 (2H, br-q, *J* = 7 Hz, 18-H×2), 4.02–3.94 (4H, m, 17^2-$COOCH_2$×2), 3.90 (2H, br-d, *J* = 8 Hz, 17-H×2), 3.41 (4H, q, *J* = 8 Hz, 8-CH_2×2), 3.34 (6H, s, 2-CH_3×2), 3.29 (6H, s, 7-CH_3×2), 3.09 (6H, s, 12-CH_3×2), 2.46–2.32, 2.19–2.10, 1.94–1.83 (4H+2H+2H, each m, 17-CH_2CH_2×2), 1.56 (6H, d, *J* = 7 Hz, 18-CH_3×2), 1.29–1.19 (10H, m, 8^1-CH_3×2, 17^2-$COOCCH_2$×2), 1.29–1.17 (60H, m, 17^2-$COOC_2(CH_2)_{15}$×2), 0.87 (6H, t, *J* = 7 Hz, 17^2-$COOC_{17}CH_3$×2), −0.27, −2.13 (each 2H, br-s, NH×4); HRMS (ESI) found: *m/z* = 1761.1432, calcd for $C_{112}H_{147}N_{10}O_8$: $[M+H]^+$, 1761.1432.

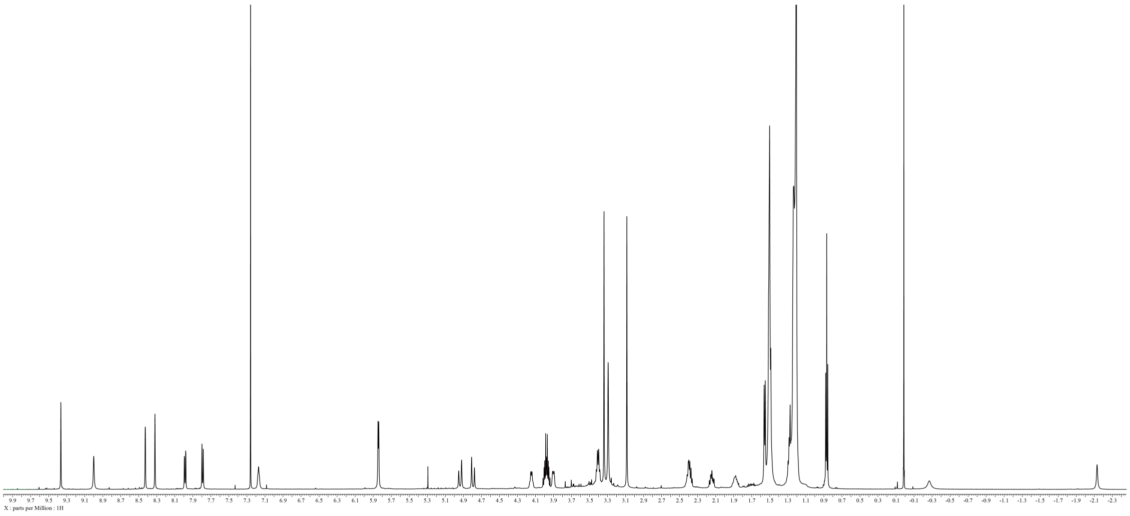

Figure S6. ^{1}H NMR spectrum of **D-2,7** in $CDCl_3$.

S5. Additional Experimental Data

S5-1. AFM Images

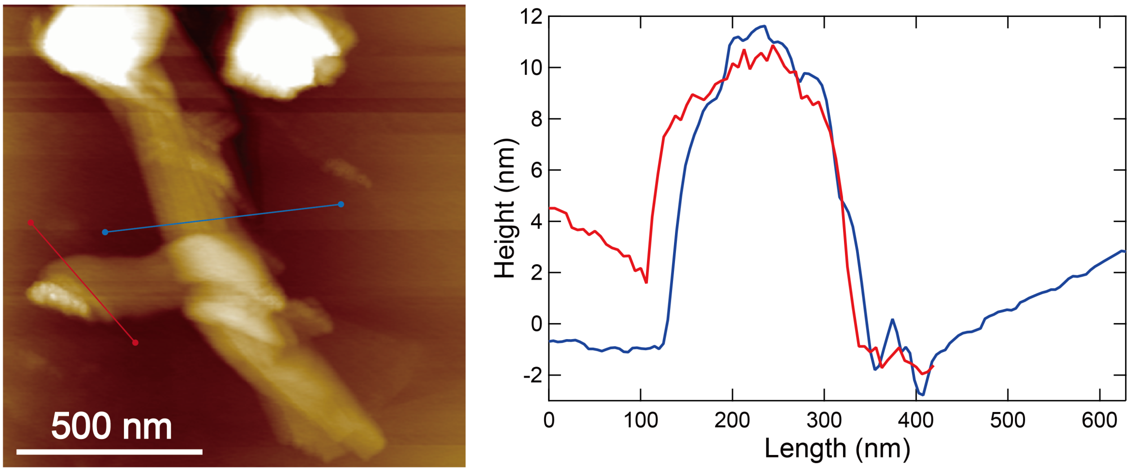

Figure S7. AFM image of **D-1,6** aggregates after standing the dispersion for 1 day on an HOPG substrate (left) and height profiles of **D-1,6** aggregates.

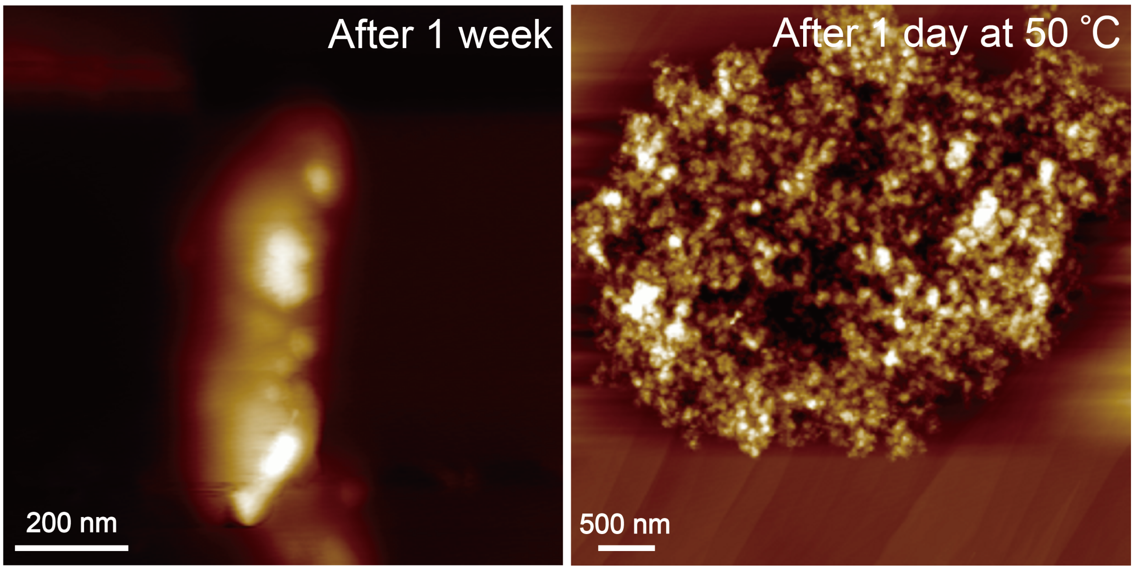

Figure S8. AFM images of **D-1,5** aggregates after standing the dispersion for 1 week at rt (left) and 1 day at 50 °C on an HOPG substrate (right).

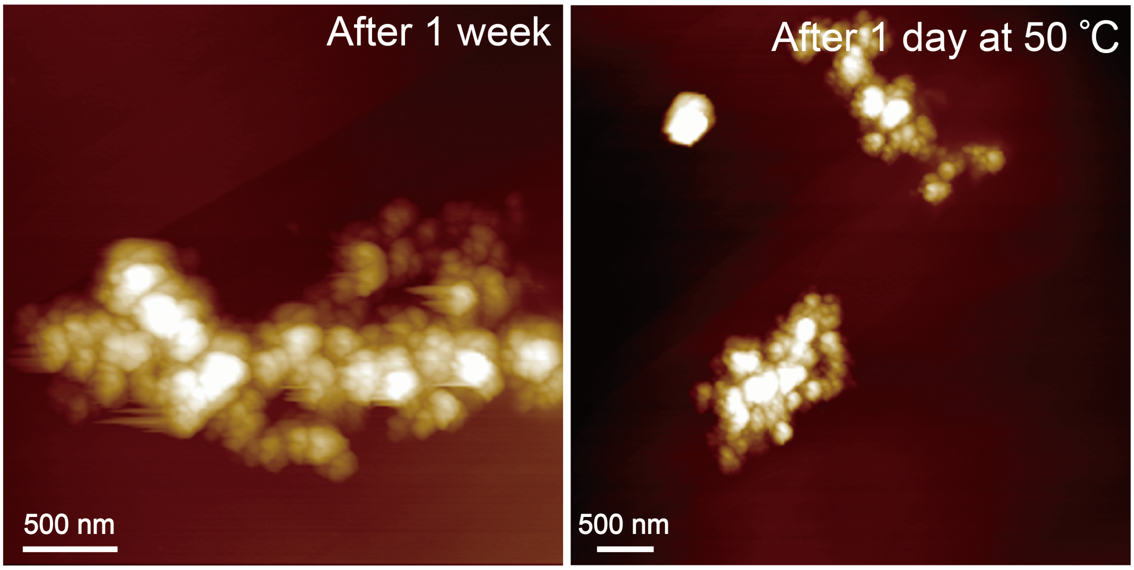

Figure S9. AFM images of **D-2,6** aggregates after standing the dispersion for 1 week at rt (left) and 1 day at 50 °C on an HOPG substrate (right).

S5-2. UV–vis absorption and CD spectra

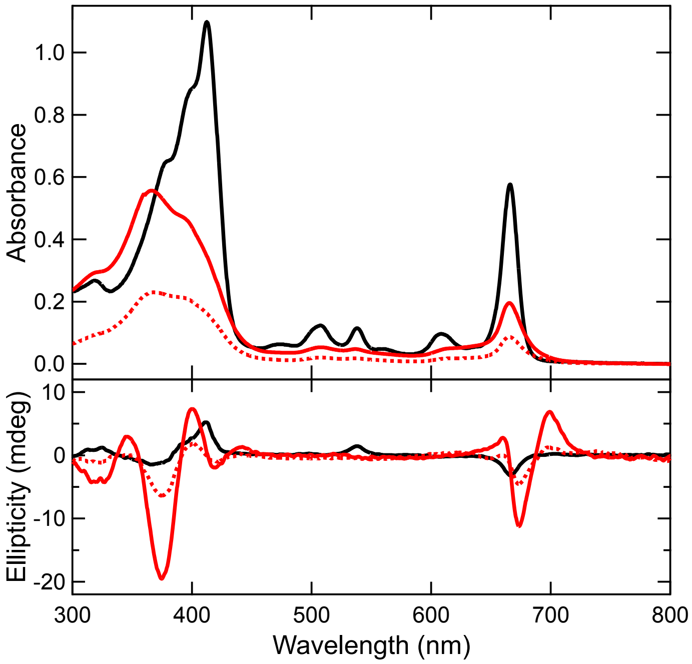

Figure S10. UV–vis absorption (upper) and CD spectra (lower) of **D-1,3** in $CHCl_3$ (black) and 5% $CHCl_3$–hexane (red) just after preparation (solid lines) and after standing the dispersion for 1 day (dotted lines).

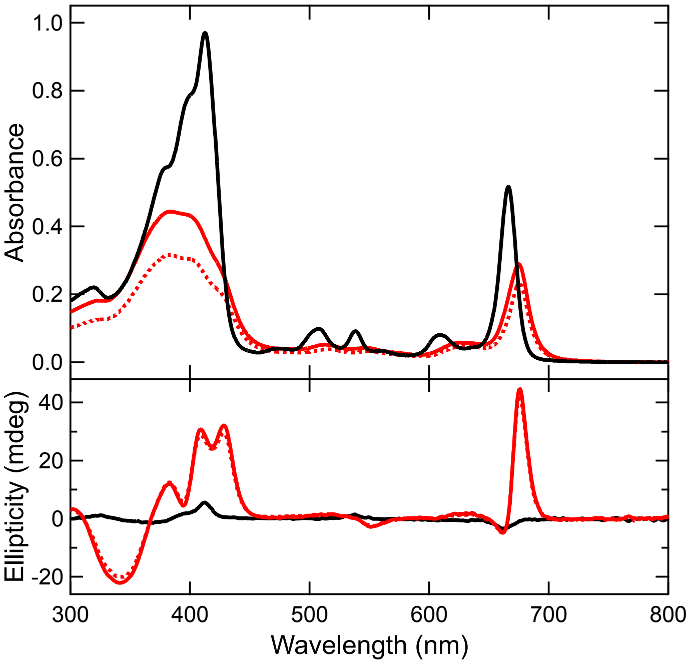

Figure S11. UV–vis absorption (upper) and CD spectra (lower) of **D-1,5** in $CHCl_3$ (black) and 5%$CHCl_3$–hexane (red) just after preparation (solid lines) and after standing the dispersion for 1 day (dotted lines).

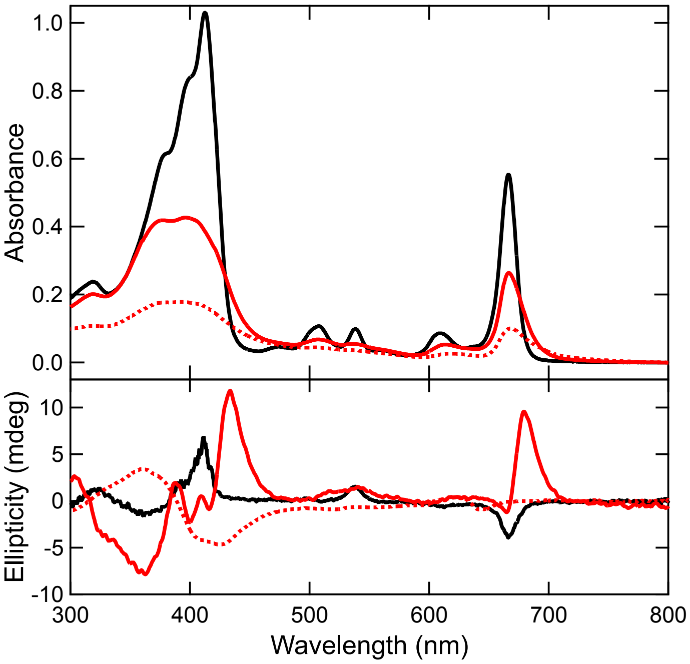

Figure S12. UV–vis absorption (upper) and CD spectra (lower) of **D-1,6** in $CHCl_3$ (black) and 5%$CHCl_3$–hexane (red) just after preparation (solid lines) and after standing the dispersion for 1 day (dotted lines).

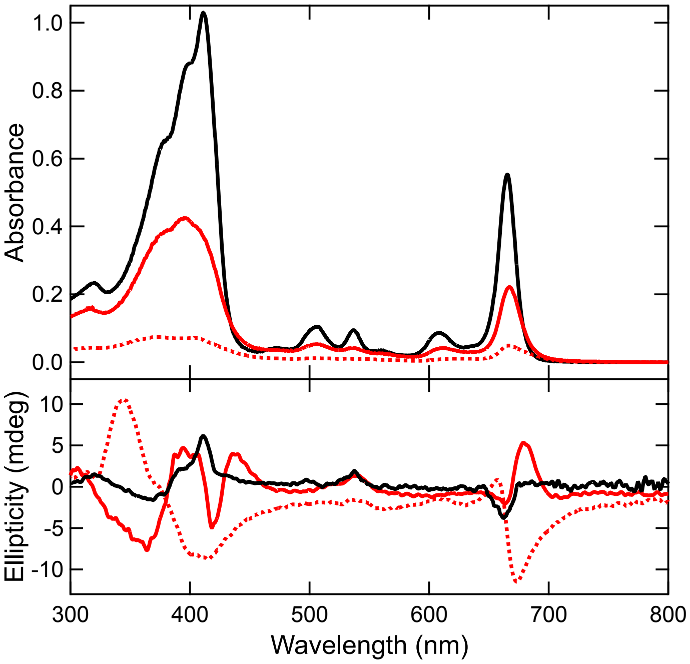

Figure S13. UV–vis absorption (upper) and CD spectra (lower) of **D-1,7** in $CHCl_3$ (black) and 5%$CHCl_3$–hexane (red) just after preparation (solid lines) and after standing the dispersion for 1 day (dotted lines).

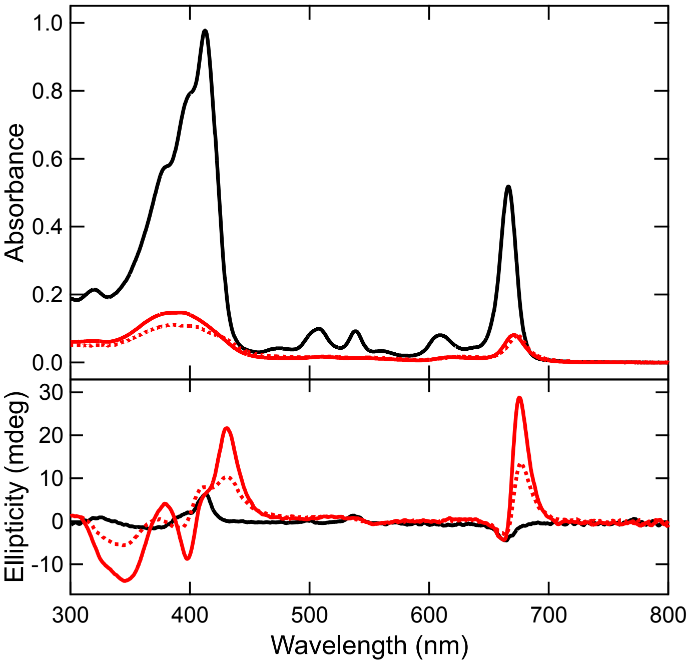

Figure S14. UV–vis absorption (upper) and CD spectra (lower) of **D-2,6** in $CHCl_3$ (black) and 5%$CHCl_3$–hexane (red) just after preparation (solid lines) and after standing the dispersion for 1 day (dotted lines).

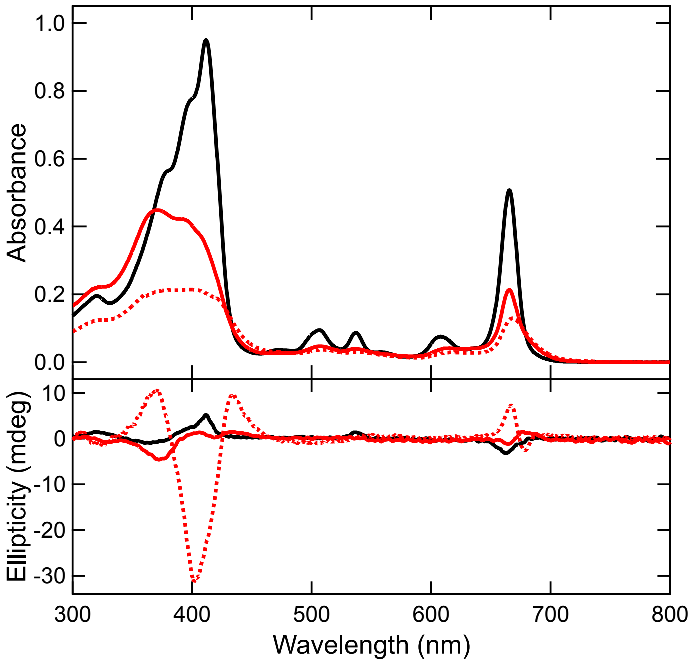

Figure S15. UV–vis absorption (upper) and CD spectra (lower) of **D-2,7** in $CHCl_3$ (black) and 5%$CHCl_3$–hexane (red) just after preparation (solid lines) and after standing the dispersion for 1 day (dotted lines).

S5-3. Molecular models

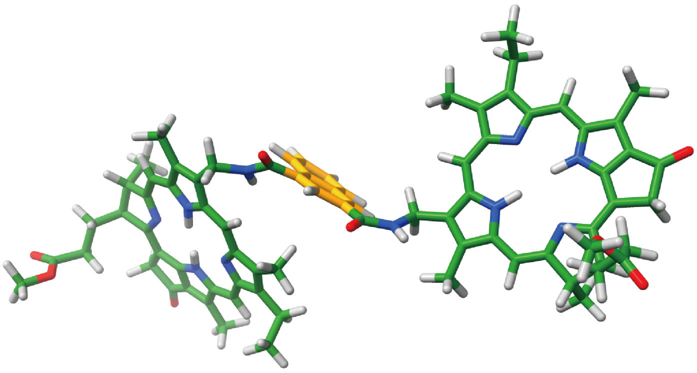

Figure S16. Energy-minimalized molecular structure of a simplified **D-1,3** model by MM2 calculation. The stearyl esters at the 17^2-position of the chlorophyll moieties were replaced by the methyl esters for the purposes of the calculation.

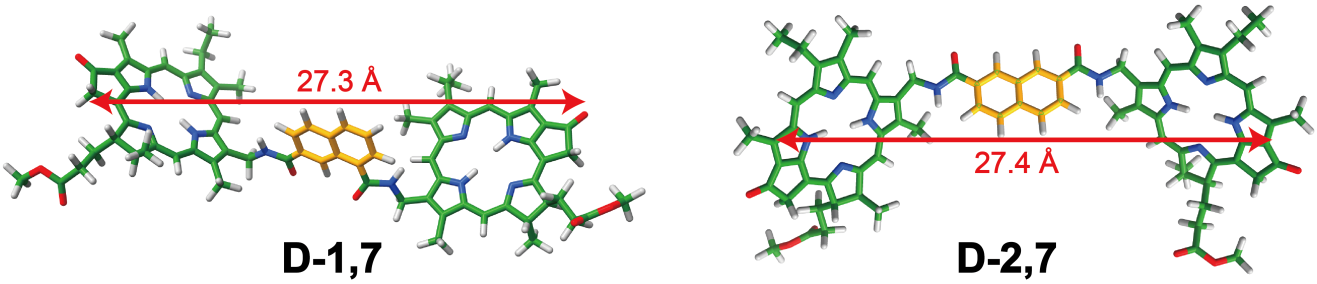

Figure S17. Energy-minimalized molecular structures of simplified **D-1,7** (left) and **D-2,7** models (right) by MM2 calculation. The stearyl esters at the 17^2-position of the chlorophyll moieties were replaced by the methyl esters for the purposes of the calculation.

S5-4. FT-IR spectra

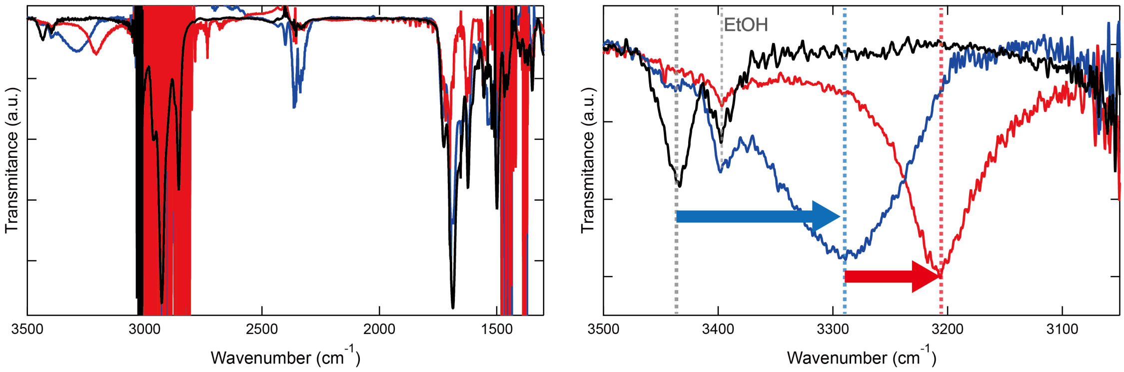

Figure S18. FT-IR spectra of **D-1,7** in $CHCl_3$ (black) and 5% $CHCl_3$–hexane just after preparation (blue) and after standing the dispersion for 1 day (red).

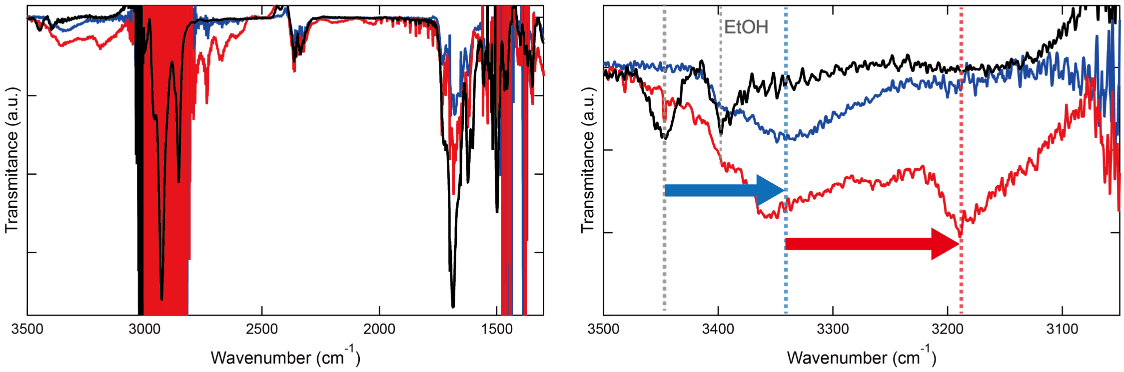

Figure S19. FT-IR spectra of **D-2,7** in $CHCl_3$ (black) and 5% $CHCl_3$–hexane just after preparation (blue) and after standing the dispersion for 1 day (red).