Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Precise Control of Nanoparticle Surface by Host-Guest Chemistry and *in vivo* Disposition

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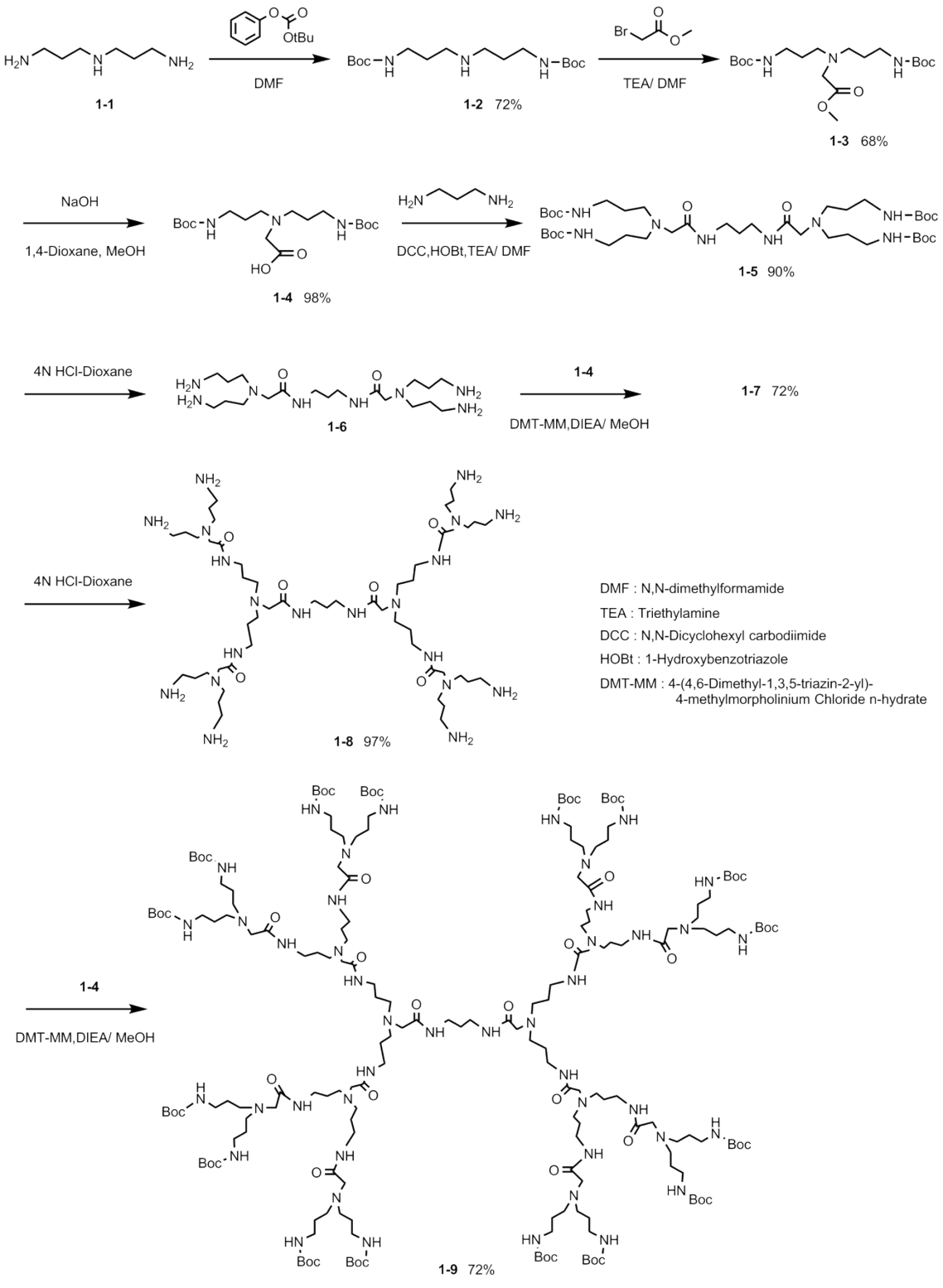
SI-1. Synthesis of 16RD (Scheme S1, S2 and Figure S1)

Scheme S1. Synthetic scheme of 16RD



1-1

1-2 72%

1-3 68%

1-4 98%

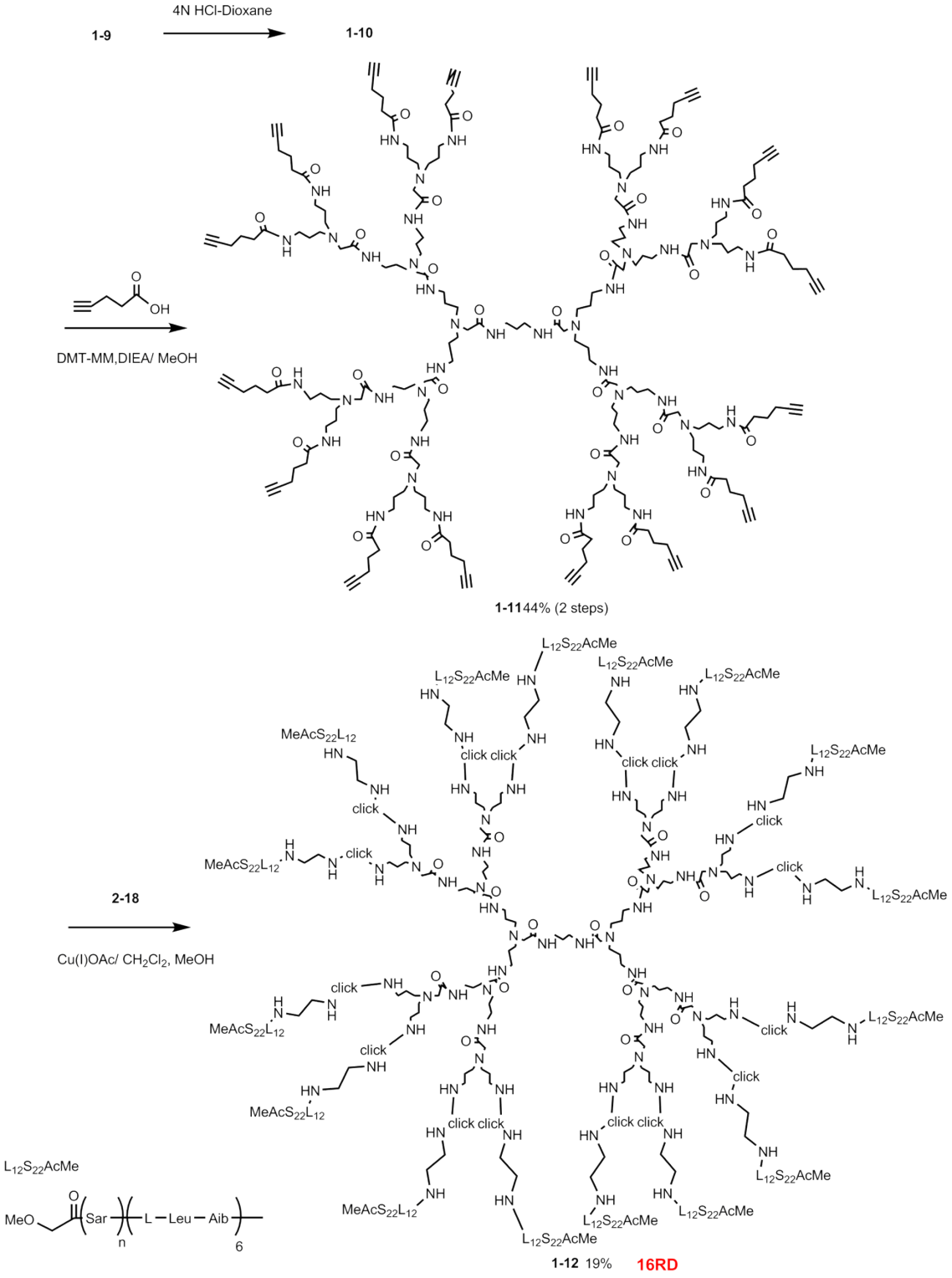
1-5 90%

1-6

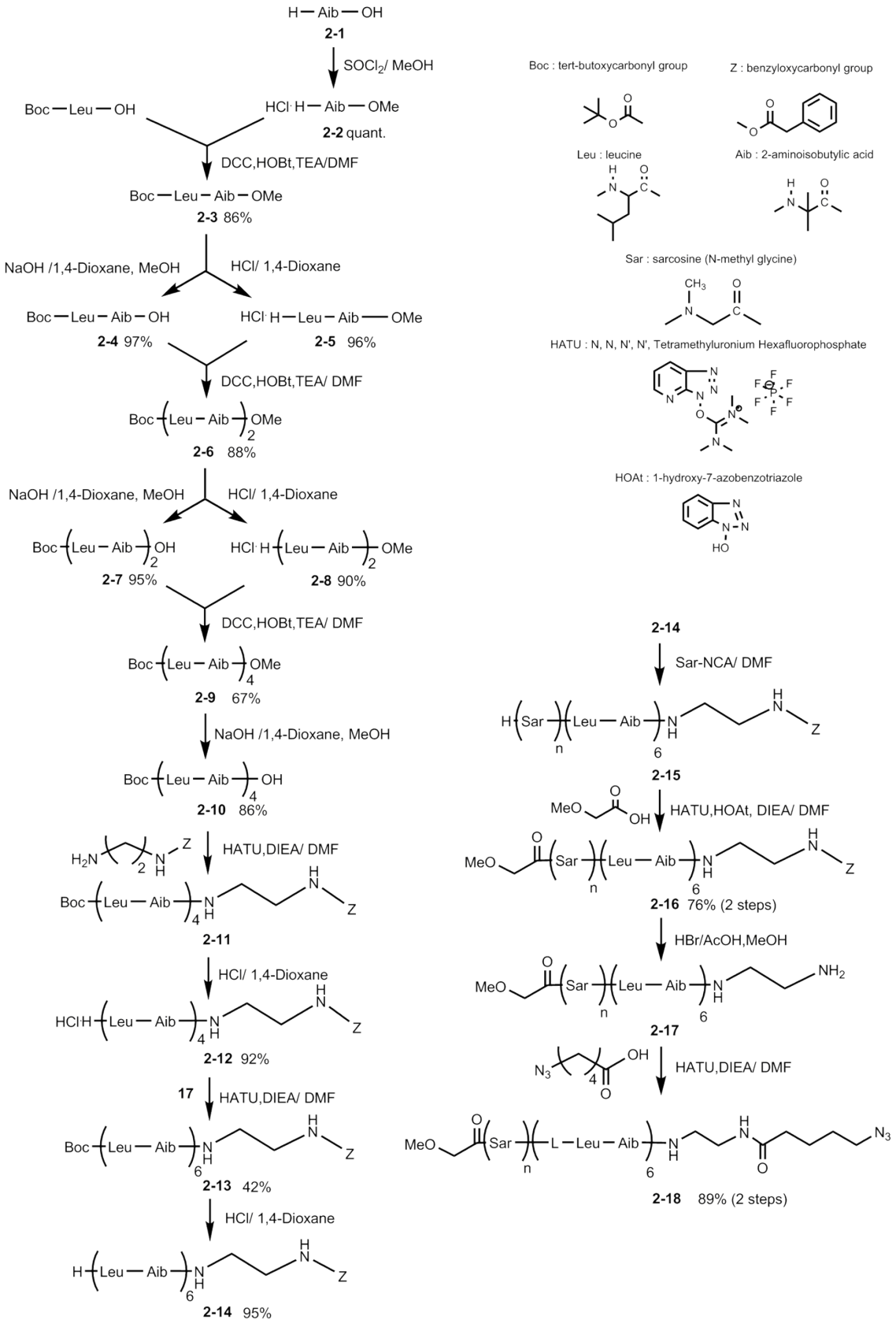
1-7 72%

1-8 97%

1-9 72%


4N HCl-Dioxane
1-9
1-10
DMT-MM,DIEA/ MeOH
1-11 44% (2 steps)
2-18
Cu(I)OAc/ CH2Cl2, MeOH
L12S22AcMe
MeAcS22L12
click
MeO
Sar
n
L
Leu
Aib
6
1-12 19%
16RD

Scheme S2. Synthetic scheme of AB-LP.



Synthesis of 16RD in Scheme S1 and S2

Compounds **1-8** and **2-18** were synthesized according to our previous reports.[1]

Compound 1-9

Compound **1-8** (170.3 μmol)was dissolved in EtOH/MeOH (2/1) (6 mL), and to this solution DIEA (1.42 mL, 7.83 mmol) was added. Compound **1-4** (1.06 g, 2.73 mmol) and DMT-MM (0.794 g, 2.73 mmol) was added in this order, and the solution was stirred for 10 days at 38 ˚C. The solvent was evaporated, and the residue was dried *in vacuo* for 1h. The residue was purified with LH20 Sephadex column eluted by $CHCl_3$/ MeOH (1/1) twice.

Yield: 0.499 g, 123 μmoL (72 %)

^{1}H NMR (400MHz, $CDCl_3$): δ(ppm) 7.90~7.45 (m, 14H, CON*H*$CH_2CH_2CH_2(G_0)$, CON*H*$CH_2CH_2CH_2(G_1)$, CON*H*$CH_2CH_2CH_2(G_2)$), 5.35~5.00 (m, 16H, urethane), 3.40~3.20 (m, 28H, NC*H*$_2$CONH$CH_2CH_2(G_0)$, NC*H*$_2$CONH$CH_2CH_2(G_1)$, NC*H*$_2$CONH$CH_2CH_2(G_2)$), 3.20~2.95 (m, 60H, C*H*$_2CH_2CH_2N(G_0)$, C*H*$_2CH_2CH_2N(G_1)$, NHC*H*$_2CH_2CH_2N(G_2)$, NHC*H*$_2CH_2CH_2N(G_3)$), 2.60~2.40 (m, 56H, CH_2CH_2C*H*$_2N(G_1)$, CH_2CH_2C*H*$_2N(G_2)$, CH_2CH_2C*H*$_2N(G_3)$), 1.95~1.55 (m, 58H, CH_2C*H*$_2CH_2N(G_0)$, CH_2C*H*$_2CH_2N(G_1)$, CH_2C*H*$_2CH_2N(G_2)$, CH_2C*H*$_2CH_2N(G_3)$), 1.45~1.30 (s, 144H, BocC*H*$_3$)

m/z : [M] calcd : 4071.851, found : 4071.822, $[M+Na]^+$ calcd : 4094.841, found : 4093.818

Compound 1-10

Compound **1-9** (0.156 g, 38.0 μmol) was dissolved in MeOH (0.5 mL), and 4N HCl/dioxane (1.66 mL) was added to the solution. After stirring the solution for 3 h, diisopropyl ether (5 mL) was added. The solution was stirred for 1 h. When the white solid was deposited, the supernatant was decanted slowly. The residue was washed by diisopropyl ether and dissolved in MeOH. The solution was evaporated and dried *in vacuo* for 3 h.

^{1}H NMR (400MHz, CD_3OD): δ(ppm) 4.35~4.10 (m, 28H, NC*H*$_2$CONH$CH_2CH_2(G_0)$, NC*H*$_2$CONH$CH_2CH_2(G_1)$, NC*H*$_2$CONH$CH_2CH_2(G_2)$), 3.55~3.35, 3.20~3.05 (m, 116H, C*H*$_2CH_2CH_2N(G_0)$, C*H*$_2CH_2CH_2N(G_1)$, CH_2CH_2C*H*$_2N(G_1)$, NHC*H*$_2CH_2CH_2N(G_2)$, CH_2CH_2C*H*$_2N(G_2)$, NHC*H*$_2CH_2CH_2NH_2(G_3)$, CH_2CH_2C*H*$_2NH_2(G_3)$), 2.35~1.80 (m, 58H, CH_2C*H*$_2CH_2N(G_0)$, CH_2C*H*$_2CH_2N(G_1)$, CH_2C*H*$_2CH_2N(G_2)$, CH_2C*H*$_2CH_2N(G_3)$)

PAMAM G_3-$(C\equiv CH)_{16}$ (1-11)

HCl salt of Compound **1-10** (38.0 μmol) was dissolved in EtOH (3 mL). DIEA (0.318 mL, 1.748 mmol) was added to the solution, and it was stirred in ice bath for 10 min. 5-pentynoic acid (0.120 g, 1.216 mmol) and DMT-MM (0.338 g, 1.216 mmol) was added to the solution, and it was stirred in ice bath for 10 min and at the room temperature for 12 h. After the solvent was evaporated, the residue

was dissolved in $CHCl_3$/ MeOH (1:1) and purified with Sephadex LH20 column for three times.

Yield: 0.0630 g, 16.8 μmoL (44%) (2steps)

^{1}H NMR (400MHz, $CDCl_3$): δ(ppm) 7.95~7.05 (m, 30H, CON*H*$CH_2CH_2CH_2(G_0)$, CON*H*$CH_2CH_2CH_2(G_1)$,CON*H*$CH_2CH_2CH_2(G_2)$, urethane), 3.40~3.20 (m, 60H, C*H*$_2CH_2CH_2N(G_0)$, C*H*$_2CH_2CH_2N(G_1)$, C*H*$_2CH_2CH_2N(G_2)$, NHC*H*$_2CH_2CH_2N(G_3)$), 3.15~2.95 (m, 28H, NC*H*$_2CONHCH_2CH_2(G_0)$, NC*H*$_2CONHCH_2CH_2(G_1)$, NC*H*$_2CONHCH_2CH_2(G_1)$), 2.70~2.35 (m, 120H, $CH_2CH_2CH_2N(G_1)$, $CH_2CH_2CH_2N(G_2)$, $CH_2CH_2CH_2N(G_3)$, NHCOC*H*$_2CH_2CCH(G_3)$), 2.05~1.95 (m, 16H, NHCOCH$_2$CH$_2$CC*H*(G_3)), 1.90~1.50 (m, 58H, $CH_2CH_2CH_2N(G_0)$, $CH_2CH_2CH_2N(G_1)$, $CH_2CH_2CH_2N(G_2)$, $NCH_2CONHCH_2CH_2(G_3)$

PAMAM G_3-(Leu-Aib)$_6$-(Sar)$_{22}$ (1-12) 16RD

CH_2Cl_2 and MeOH was bubbled by Ar gas for 45 min. Compound **1-11** (0.0108 g, 2.89 μmol) was dissolved in CH_2Cl_2/MeOH (1/1) (0.450 mL), and to this solution compound **2-18** (0.280 g, 92.3 μmol) and Cu(I)OAc (7.07 mg, 57.7 μmol) was added. The solution was stirred for 5 min in Ar atmosphere, and CH_2Cl_2/MeOH (1/1) (3.00 mL) was added to the solution. The solution was greenish colored like viridian. The solution was purged with Ar gas for four times and was stirred for 16 h in Ar atmosphere. After stirring, the color of the solution was changed to ultramarine color. The solvent was evaporated, and the residue was dried in vacuo separately for 3 h. The residue was dissolved in MeOH and purified with Sephadex LH20 column (1.0 m length, ϕ 30 mm for three times and 1.2 m length, ϕ 35 mm) for two times.

Yield : 0.0285 g, 549 nmol (19%)

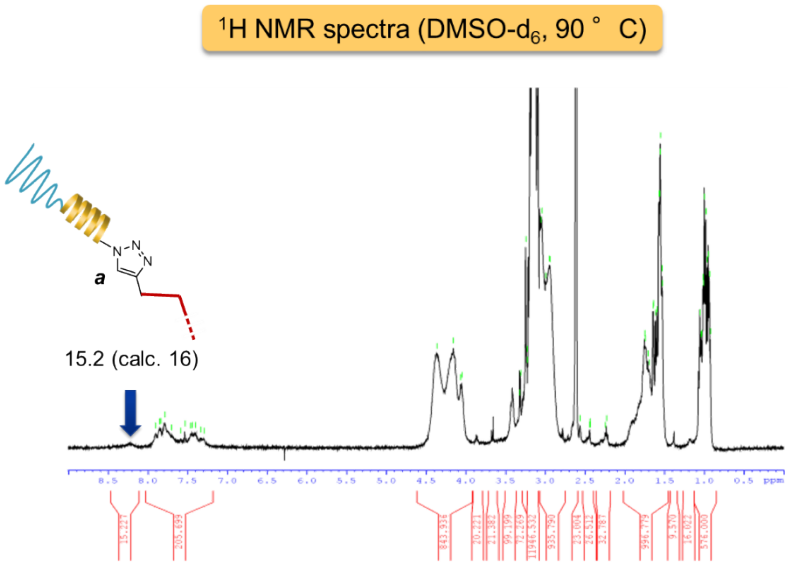
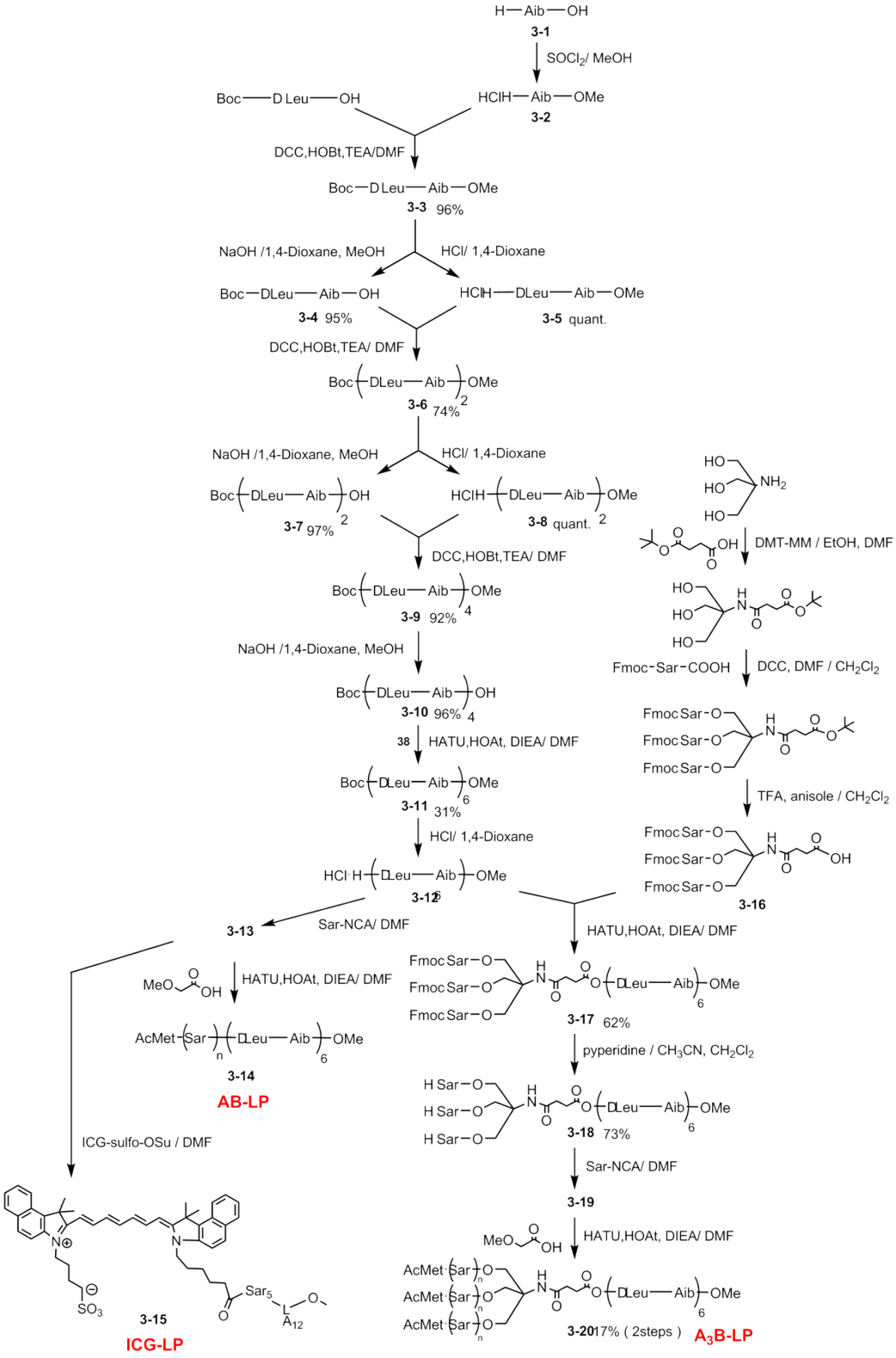


Figure S1. NMR spectra (400 MHz, DMSO-d_4) of 16RD

SI-2. Synthesis of A_3B-LP and ICG-LP (Scheme S3)

Scheme S3. Synthetic scheme of AB-LP, A_3B-LP and ICG-LP



Synthesis of ICG-LP and A_3B-LP in Scheme S3

Compounds **3-13**, **3-14** (AB-LP) and **3-16** were synthesized according to our previous reports.[1-2]

ICG-Sar$_5$-(D-Leu-Aib)$_6$-OMe (3-15) **ICG-LP**

To the solution of Sar-NCA (6.19 mg, 53.8 μmol) in distilled DMF (150 μL), the solution of desalted compound **3-13** (6.57 mg, 5.38 μmol) in distilled DMF (50 μL) was added under Ar atmosphere, and the mixed solution was stirred at the room temperature for 15 h. After polymerization, ICG-sulfo-OSu (1.00 mg, 1.08 μmol) and DCC (0.444 mg, 2.15 μmol) were added to the solution in this order and stirred at the room temperature for 25 h under Ar atmosphere. The solvent was evaporated, and the residue was dissolved in DMF and purified by Sephadex LH20 column. The chain length of Sar was determined by Sar *N-CH$_2$* peak's integrated value of ^{1}H NMR spectrum. The yield was determined by the absorbed light intensity of ICG moiety (absorption wavelength : 794 nm)

Yield: 2.33 mg, 1.02 nmol (95 %) (2steps)

m/z : $[M+Na]^+$ calcd : 2311.37, found : 2309.87, $[M+K]^+$ calcd : 2327.47, found : 2324.83

(Fmoc-Sar-OCH$_2$)$_3$-C-NHCO-(CH$_2$)$_2$-CO-(D-Leu-Aib)$_6$-OMe (3-17)

Compound **3-16** (0.150 g, 136 μmol) was dissolved in DMF (1.00 mL). To this solution, HATU (0.0748 g, 204 μmol), HOAt (0.0278 g, 204 μmol) was added. After stirring for 5 min, compound **2-12** (114 μmol) and DIEA (0.0680 mL, 420 μmol) were added, and the solution was stirred at the room temperature for 15 h under N_2 atmosphere. The solvent was evaporated, and the residue was dissolved in MeOH and purified with Sephadex LH20 column.

Yield : 0.162 g, 70.3 μmol (62%)

^{1}H NMR (400MHz, CD_3OD): δ(ppm) 8.18~7.90, 7.80~7.70, 7.63~7.42, 7.40~7.20 (m, 37H, FmocbenzeneC*H*, CN*H*COCH$_2$CH$_2$CO, LeuN*H*, AibN*H*), 4.70~4.67, 4.60~3.90 (m, 27H, FmocC*H*, FmocC*H$_2$*, SarC*H$_2$*, SarCOC*H$_2$*C, LeuC*H*), 3.65 (s, 3H, OMe), 3.00~2.87 (m, 9H, SarCH$_3$), 2.85~2.70, 2.54~2.35 (m, 4H, CNHCOC*H$_2$CH$_2$*CO), 1.95~1.40 (m, 54H, LeuC*H$_2$*, LeuC*H*, AibC*H$_3$*), 1.00~0.75 (m, 36H, LeuC*H$_3$*)

m/z : $[M+Na]^+$ calcd. : 2326.76, found : 2326.17, $[M+K]^+$ calcd : 2342.86, found : 2342.16

(H-Sar-OCH$_2$)$_3$-C-NHCO-(CH$_2$)$_2$-CO-(D-Leu-Aib)$_6$-OMe (3-18)

Compound **3-17** (0.100 g, 43.4 μmol) was dissolved in dehydrated CH_3CN (750 μL). To this solution, piperidine (215 μL), dehydrated CH_3CN (1.00 mL) and CH_2Cl_2 (0.500 mL) was added at the same time, and the solution was stirred for 25 min. After then, the main product was solidified by petroreum ether and hexane. The residue was dissolved in CH_2Cl_2, and the solvent was evaporated.

Yield : 0.0520 g, 31.8 μmol (73%)

m/z : $[M+Na]^+$ calcd. : 1661.04, found : 1659.41, $[M+K]^+$ calcd : 1677.14, found : 1675.38

(CH$_3$O-CH$_2$-CO-Sar$_{29}$-OCH$_2$)$_3$-C-NHCO-(CH$_2$)$_2$-CO-(D-Leu-Aib)$_6$-OMe (3-20) A3B-LP

To the solution of Sar-NCA (0.274 g, 2.38 mmol) in distilled DMF (5.00 mL), the solution of compound **3-18** (0.0520g, 31.8 μmol) in distilled DMF (1.50 mL) was added under Ar atmosphere, and the mixed solution was stirred at the room temperature for 15.5 h. After polymerization, methoxyacetic acid (36.3 μL, 476 μmol), HATU (0.254 g, 667 μmol) and HOAt (0.0910 g, 667 μmol) were added to the solution in this order. After stirring for 5 min at 0 °C, DIEA (0.166 mL, 0.953 mmol) was added to the solution, and the solution was stirred at the room temperature for 10 h under Ar atmosphere. The solvent was evaporated, and the residue was dissolved in MeOH and purified by Sephadex LH20 column for three times. The chain length of Sar was determined by Sar *N-CH$_2$* peak's integrated value of ^{1}H NMR spectrum and the peak top of MALDI-TOF-MS spectrum.

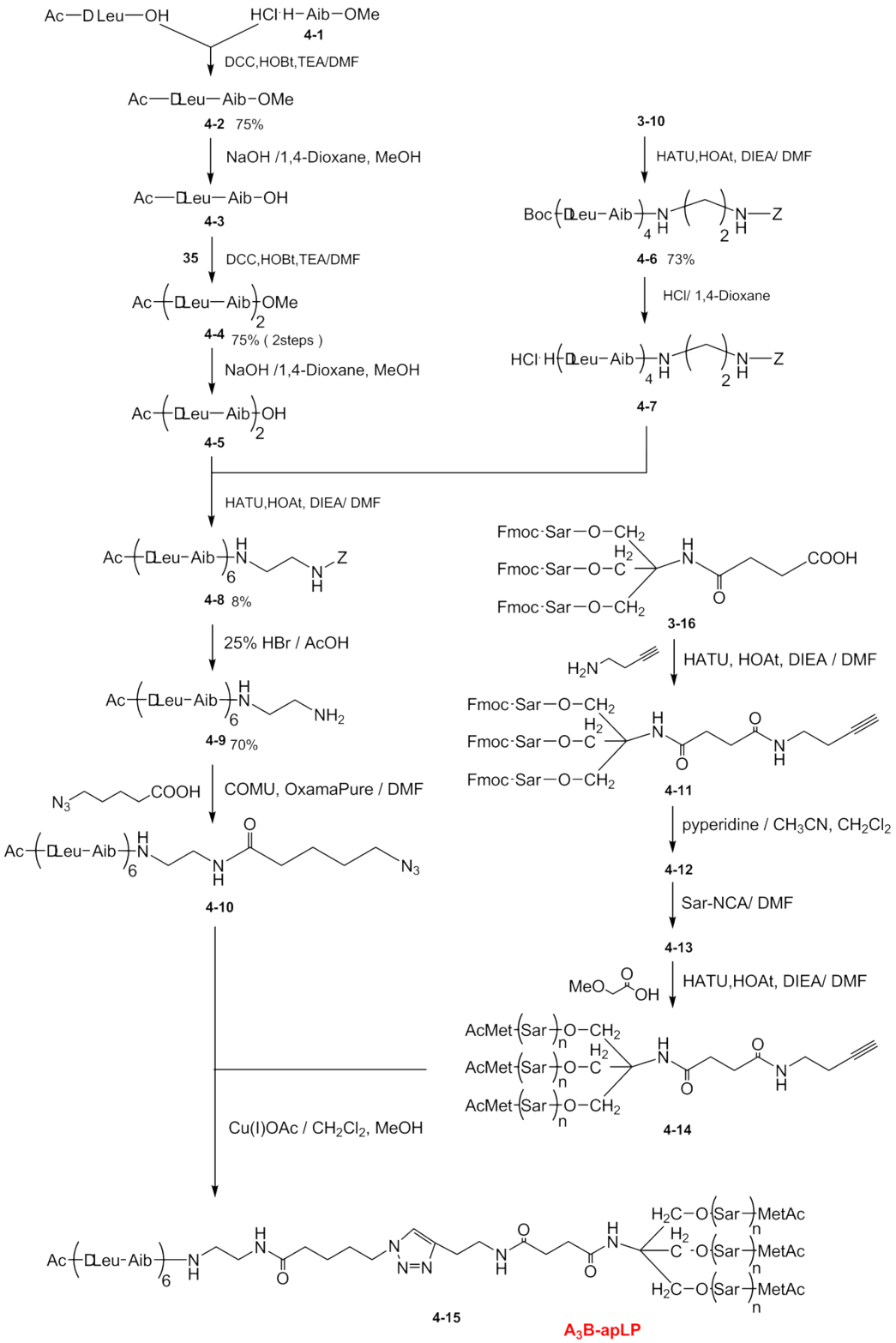
Yield : 0.0430 g, 5.50 μmol (17%) (2steps)

^{1}H NMR (400MHz, CD$_3$OD): δ(ppm) 8.25~7.70 (m, 13H, CN*H*COCH$_2$CH$_2$CO, LeuN*H*, AibN*H*), 4.60~3.95 (m, 185H, C*H$_3$*OC*H$_2$*CO, SarC*H$_2$*), 3.65 (s, 3H, OMe), 3.50~3.40 (m, 6H, LeuCH), 3.20~2.85 (m, 261H, SarC*H$_3$*), 2.82~2.70, 2.62~2.40 (m, 4H, CNHCOC*H$_2$*C*H$_2$*CO), 1.95~1.50 (m, 54H, LeuC*H$_2$,* Leu*CH*, AibC*H$_3$*), 1.05~0.85 (m, 36H, LeuC*H$_3$*)

m/z : [M+Na]$^+$ calcd. : 7847.77, found : 7848.62

SI-3. Synthesis of A_3B-apLP (Scheme S4)

Scheme S4. Synthetic scheme of A_3B-apLP



Synthesis of A_3B-apLP in Scheme S4

Ac-D-Leu-Aib-OMe (4-2)

Ac-D-Leu-OH (1.00 g, 5.77 mmol) was dissolved in DMF (3.00 mL). To this solution, DCC (1.43 g, 6.93 mmol) and HOBt (1.17 g, 8.66 mmol) dissolved in DMF (4.00 mL) were added, and compound **4-1** (1.06 g, 6.93 mol) and TEA (1.21 mL, 8.66 mmol) were added into the solution. It was stirred at 0 °C for 15 min and at the room temperature for 16 h. The solvent was evaporated, and chilled ethyl acetate was added to the residue. The solution was cooled for 1 h, filtered and washed with 4 wt% $KHSO_4$ aq. and saturated $NaHCO_3$ aq. for three times each. The organic phase was washed with brine, dried over anhydrous $MgSO_4$ and filtered. The solvent was evaporated, and the residue was dried *in vacuo.* The residue was washed with diisopropyl ether for two times, and the residue was dissolved in chloroform. The solvent was evaporated, and the residue was dried *in vacuo*.

Yield : 1.18 g, 4.33 mmol (75%)

^{1}H NMR (400MHz, $CDCl_3$): δ(ppm) 6.76 (s, 1H, AibN*H*), 6.11~6.05 (m, 1H, urethane), 4.45~4.40 (m, 1H, LeuC*H*), 3.71 (s, 3H, OMe), 2.00 (s, 3H, AcCH_3), 1.71~1.44 (m, 9H, LeuCH_2, LeuCH, AibCH_3), 1.00~0.90 (m ,6H, LeuCH_3)

Boc-(D-Leu-Aib)$_4$-NH-(CH$_2$)$_2$-NH-Z (4-6)

Compound **3-10** (0.506 g, 555 μmol) was dissolved in DMF (3.00 mL). To this solution, HATU (0.317 g, 833 μmol), HOAt (0.113 g, 833 μmol) was added. HCl ・ H_2N-$(CH_2)_2$-NH-Z (0.154 g, 666 μmol) and DIEA (0.291 mL, 1.67 mmol) were added to the solution, and the solution was stirred at 0 °C for 15 min and the room temperature for 17 h under N_2 atmosphere. The solvent was evaporated, and the residue was dissolved in $CHCl_3$ and filtered. The solution was washed with

4 wt% $KHSO_4$ aq. and saturated $NaHCO_3$ aq. for four times each. The organic phase was washed with brine and dried over anhydrous Na_2SO_4 for 1 h. After the solution was filtered, the solvent was evaporated, and the residue was dried *in vacuo*.

Yield : 0.562 g, 0.517 mmol (93%)

^{1}H NMR (400MHz, $CDCl_3$): δ(ppm) 7.64~7.62, 7.50, 7.40~7.28, 6.69, 6.37~6.30 (m, 14H, LeuN*H*, AibN*H*, N*H*CH_2CH_2N*H*, ZCH), 5.18~4.98 (m, 3H, urethane, ZCH_2), 4.28~4.20, 4.02~3.84 (m, 4H, LeuCH), 3.48~3.25 (m, 4H, NHCH_2CH_2NH), 1.85~1.40 (m, 45H, BocCH_3, LeuCH, LeuCH_2, AibCH_3), 1.05~0.80 (m, 24H, LeuCH_3)

Ac-(D-Leu-Aib)$_6$-NH-(CH$_2$)$_2$-NH-Z (4-8)

Compound **4-5** (0.470 g, 1.03 mmol) was dissolved in DMF (4.00 mL). To this solution, HATU (0.844 g, 2.22 mmol), HOAt (0.302 g, 2.22 mmol) was added. After stirring for 5 min, compound **4-7** (1.46 g, 1.48 mmol) and DIEA (0.722 mL, 4.14 mmol) were added, and the solution was stirred at the room

temperature for 16 h under N_2 atmosphere. The solvent was evaporated, and the residue was dissolved in $CHCl_3$ and filtered. The solution was washed with 4 wt% $KHSO_4$ aq. for four times and saturated $NaHCO_3$ aq. for three times. The organic phase was washed with brine and dried over anhydrous Na_2SO_4 for 1 h. After the solution was filtered, the solvent was evaporated, and the residue was dried *in vacuo,* dissolved in DMF and purified with Sephadex LH20 column.

Yield : 0.112 g, 78.6 μmol (8%)

^{1}H NMR (400MHz, $CDCl_3$): δ(ppm) 7.67~7.50, 7.35~7.27, 7.22, 6.86, 6.41 (m, 16H, LeuN*H*, AibN*H*, N*H*CH_2CH_2N*H*, ZC*H*), 5.12~4.99 (m, 3H, urethane, ZCH_2), 4.20~4.05, 4.00~3.90 (m, 6H, LeuC*H*), 3.45~3.20 (m, NHCH_2CH_2NH), 2.04 (s, 3H, AcCH_3), 1.90~1.30 (m, 54H, LeuCH_2, LeuC*H*, AibCH_3), 1.10~0.75 (m, 36H, LeuCH_3)

m/z : $[M+Na]^+$ calcd : 1447.8, found : 1448

Ac-(D-Leu-Aib)$_6$-NH-(CH$_2$)$_2$-NHCO-(CH$_2$)$_4$-N$_3$ (4-10)

Compound **4-9** (32.9 mg, 25.5 μmol) was dissolved in DMF (1.40 mL) at 0 °C, and COMU (19.7 mg, 45.9 μmol) and Oxyma Pure (6.52 mg, 45.9 μmol) were added to the solution. 5-Azido pentanoic acid (5.47 mg, 38.2 μmol) and DIEA (7.44 μL, 45.9 μmol) were added, and the solution was stirred under N_2 atmosphere at 0 °C for 20 min. After then, the solution was stirred at the room temperature for 16 h. The solvent was evaporated, and the residue was dried *in vacuo* for 4 h. The residue was dissolved in DMF, and purified by Sephadex LH20 column.

Yield : 10.6 mg, 7.49 μmol (29 %)

m/z : $[M+H]^+$ calcd : 1416.97, found : 1431.16

(Fmoc-Sar-OCH$_2$)$_3$-C-NHCO-(CH$_2$)$_2$-CONH-(CH$_2$)$_2$-C≡CH (4-11)

Compound **3-16** (0.332 g, 301 μmol) was dsissolved in DMF (2.00 mL). To this solution, HATU (0.199 g, 543 μmol), HOAt (0.0739 g, 543 μmol) was added at 0 ˚C. After stirring for 5 min at 0 °C, H_2N-$(CH_2)_2$-C≡CH (29.6 μL, 362 μmol) and DIEA (0.132 mL, 814 μmol) were added, and the solution was stirred at 0 °C for 30 min and at the room temperature for 22 h under N_2 atmosphere. The solvent was evaporated, and the residue was dissolved in $CHCl_3$/MeOH (30:1) and chromatographed on silica gel with $CHCl_3$/MeOH (30:1).

Yield : 0.355 g, 3.08 μmol (quant.)

^{1}H NMR (400MHz, $CDCl_3$): δ(ppm) 7.78~7.70, 7.64~7.45, 7.40~7.27, 6.52~6.05 (m, 26H, FmocbenzeneC*H*, CN*H*COCH$_2$CH$_2$CO), 4.50~4.30, 4.28~4.17, 4.10~3.90 (m, 15H, FmocC*H*, FmocCH_2, SarCH_2), 3.05~2.92 (m, 9H, SarCH_3), 2.50~2.30 (m, 4H, CNHCOCH_2CH_2CO, NHCH_2CH_2CCH), 1.92 (s, 1H, NHCH$_2$CH$_2$CC*H*), 1.57 (s, 6H, SarCOCH_2C)

m/z : $[M+H]^+$ calcd : 1152.46, found : 1152, $[M+Na]^+$ calcd : 1174.45, found : 1174

$(CH_3O\text{-}CH_2\text{-}CO\text{-}Sar_n\text{-}OCH_2)_3\text{-}C\text{-}NHCO\text{-}(CH_2)_2\text{-}CONH\text{-}(CH_2)_2\text{-}C{\equiv}CH$ (4-14)

Compound **4-11** (0.100 g, 86.8 μmol) was dissolved in dehydrated CH_3CN (1.50 mL), and to this solution, the mixed solution of piperidine (0.429 mL, 4.34 mmol), dehydrated CH_3CN (2.00 mL) and super-dehydrated CH_2Cl_2 (1.00 mL) was added. The solution was stirred at room temperature for 25 min. As soon as the reaction was finished, super-dehydrated CH_2Cl_2 (about 10 mL) was added, the main product was solidificated by hexane for four times. The residue was dissolved in CH_2Cl_2, the solvent was evaporated. The residue (compound **4-12**) was dried *in vacuo* for 7 h.

To the solution of Sar-NCA (0.533 g, 4.63 mmol) in distilled DMF (10.0 mL), the solution of compound **4-12** (30.0 mg, 61.8 μmol) in distilled DMF (6.00 mL) was added under Ar atmosphere, and the mixed solution was stirred at the room temperature for 14 h. After the NCA polymerization, HATU (0.494 g, 1.30 mmol), HOAt (0.177 g, 1.30 mmol), methoxy acetic acid (70.7 μL, 0.927 mmol) and DIEA (0.323 mL, 1.85 mmol) was added to the solution in this order and stirred at 0 °C for 15 min under Ar atmosphere. After then, the solution was stirred at the room temperature for 7 h under Ar atmosphere. The solvent was evaporated, and the residue was dissolved in MeOH and purified by Sephadex LH20 column for two times.

Yield : 0.154 g, 29.7 μmol (34 %) (3steps)

m/z : $[M+Na]^+$ (n = 22) calcd : 5199.64, found : 5199.69

Boc-(D-Leu-Aib)$_6$-NH-$(CH_2)_2$-NHCO-$(CH_2)_4$-1,2,3-triazolering-$(CH_2)_2$-NHCO-$(CH_2)_2$-CONH-C-$(CH_2O\text{-}Sar_n\text{-}CO\text{-}CH_2\text{-}OCH_3)_3$ (4-15) **A_3B-apLP**

CH_2Cl_2 and MeOH was bubbled by Ar gas for 50 min. Compound **4-10** (0.0660 g, 44.8 μmol) was dissolved in CH_2Cl_2/MeOH (1/1) (0.400 mL), and to this solution compound **4-14** (0.0860 g, 16.6 μmol) and Cu(I)OAc (5.49 mg, 44.8 μmol) was added. The solution was stirred for 5 min under Ar atmosphere, and CH_2Cl_2/MeOH (1/1) (0.600 mL) was added to the solution. The solution was purged with Ar gas for five times and was stirred for 23 h in Ar atmosphere with protection from light. The solvent was evaporated, and the residue was dried in vacuo separately for 5 h. The residue was dissolved in MeOH and purified with Sephadex LH20 column (1.0 m length, ϕ 30 mm for three times and 1.2 m length, ϕ 35 mm) for two times. After Sephadex LH20 column purification, the product was purified with Asahipak GS-310 20F GPC column.

Yield : 0.0203 g, 2.89 μmol (17%)

m/z : $[M+Na]^+$ (n = 24) calcd : 7102.87, found : 7093.42

SI-4. Circular Dichloism (CD) of Nanoconjugate (Figure S2)

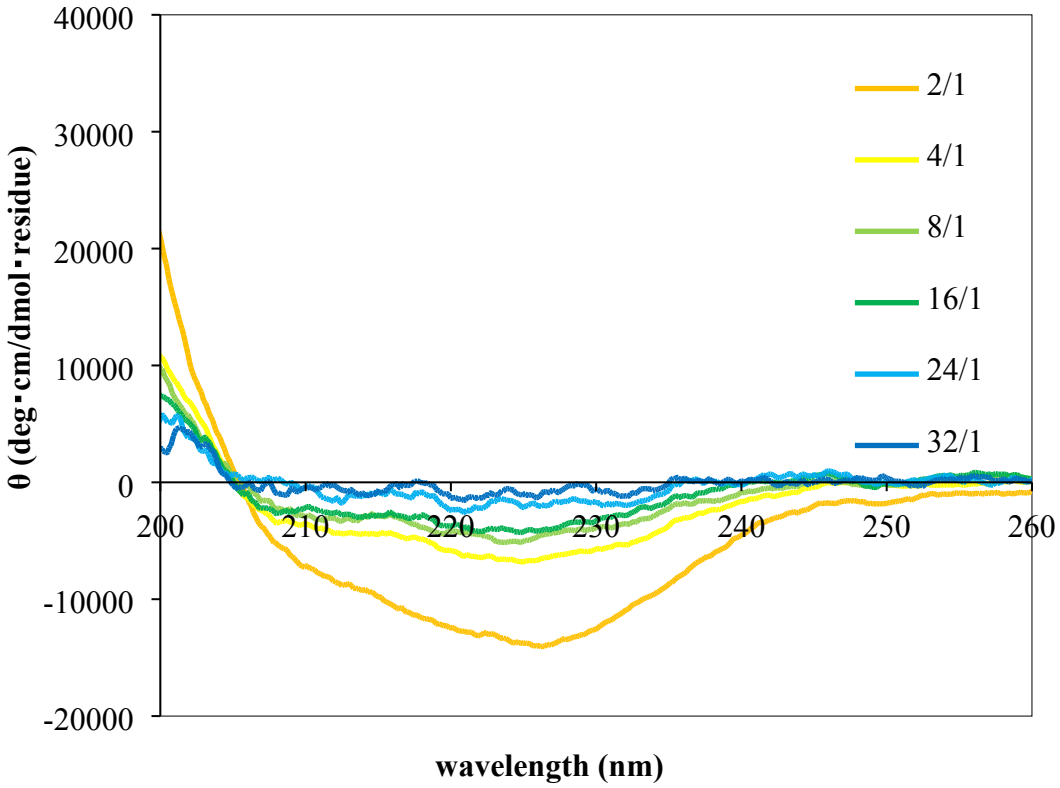


Figure S2. The self-assemblies were analyzed by circular dichroism (CD) measurements. The self-assemblies of pure 16RD showed double minima at 208 and 222 nm indicating a-helical structure. The self-assemblies prepared at the feed molar ratios of 2:1 and 4:1, which were purified by a PD-10 column (packed Sephadex G-25, GE Healthcare), decreased the intensities of the Cotton effects upon increasing the amounts of AB-LP, and no signal was observed with the self-assemblies prepared at the feed molar ratio of 16:1. The self-assemblies prepared at the feed molar ratios of 24:1 and 32:1, which were purified by a PD-10 column and a cut-off filter of 0.1 mm to obtain self-assemblies of several tens of nm, show no signal at all. These results also support the interpretation that no more than sixteen molecules of AB-LP are inserted into 16RD even in the presence of excess amounts of AB-LP.

SI-5. Size of molecular assemblies of 16RD/A_3B-LP, 16RD/A_3B-apLP (Figure S3)

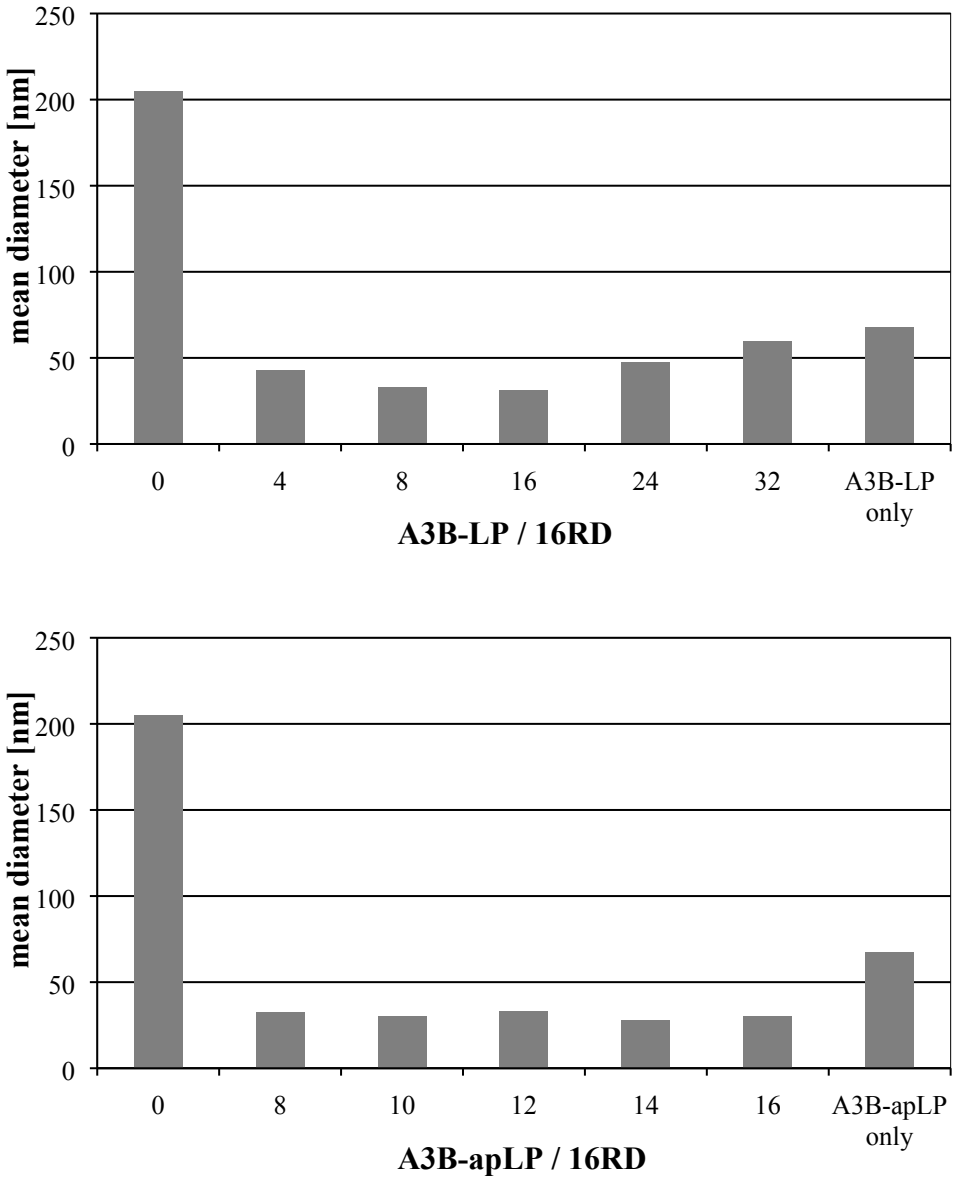


Figure S3. Hydrodynamic diameters vs feed molar ratios of A_3B-LP/16RD (up) and A3B-apLP/16RD (bottom) by DLS measurement.

SI-6. Rational size of molecular assembly with using 16RD and A_3B-apLP (Figure S4)

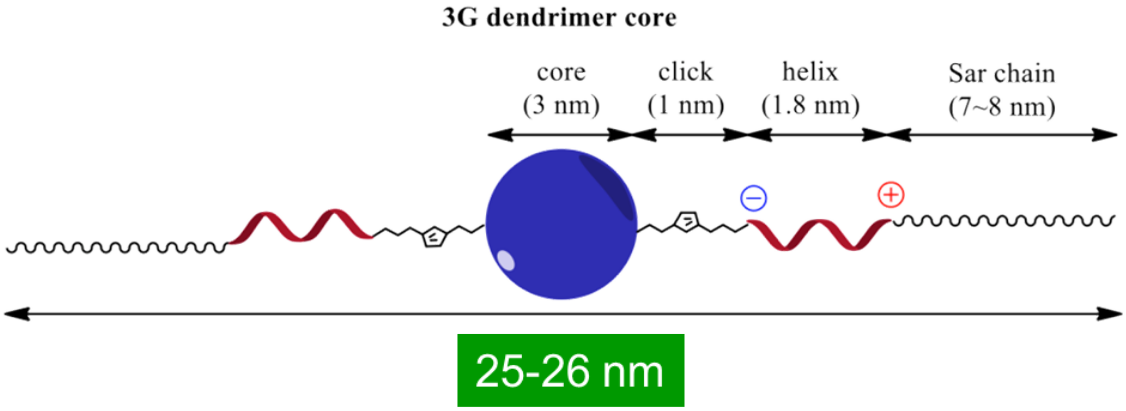


Figure S4. The schematic illustration and rational size of dendrimer 16RD

SI-7. *In vivo* NIRF imaging (Figure S5)

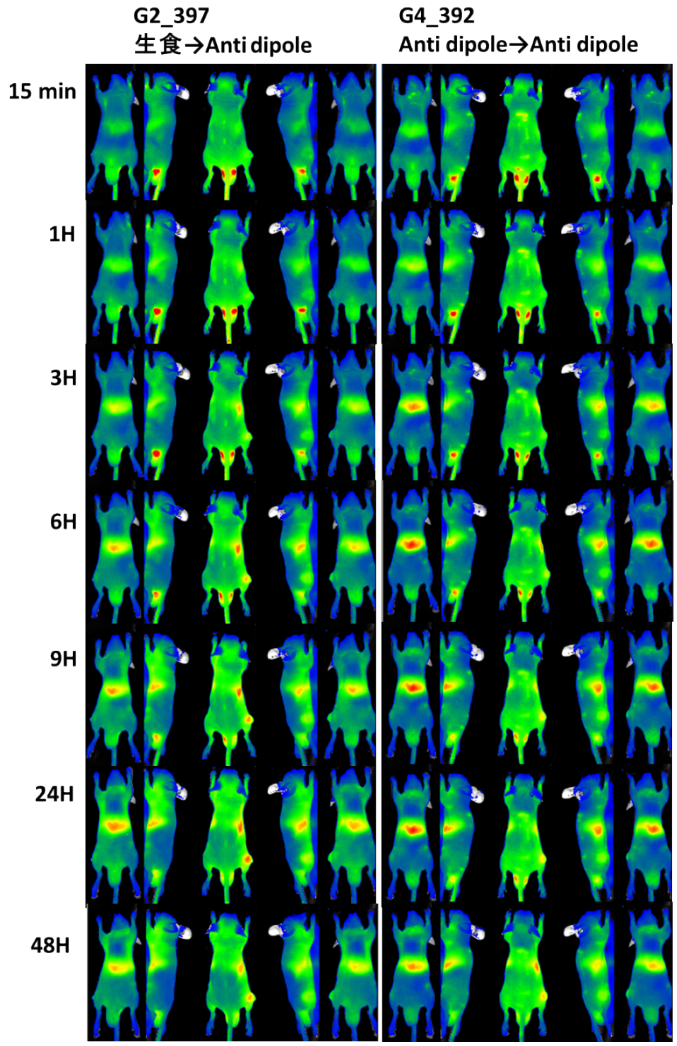


Figure S5. The time-lapsed NIRF images of nanocarrier from A_3B-apLP/16RD/ICG-LP after 1st (left column) and 2nd administrations (right column).

SI-8. 2nd administration of A_3B-LP/16RD (Figure S6)

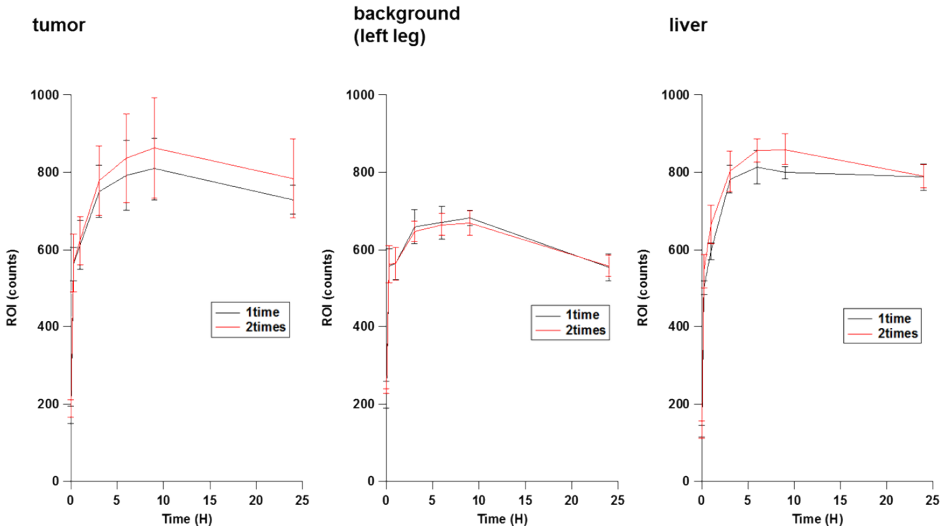


Figure S6. The time profiles of ROI at tumor site, liver site and background (left-leg site).

Reference in supporting information

1. Matsui, H.; Ueda, M.; Makino, A.; Kimura, S., Molecular assembly composed of a dendrimer template and block polypeptides through stereocomplex formation. *Chem Commun* **2012,** *48* (49), 6181-6183.

2. (a) Kanzaki, T.; Horikawa, Y.; Makino, A.; Sugiyama, J.; Kimura, S., Nanotube and Three-Way Nanotube Formation with Nonionic Amphiphilic Block Peptides. *Macromol Biosci* **2008,** *8* (11), 1026-1033; (b) Ueda, M.; Makino, A.; Imai, T.; Sugiyama, J.; Kimura, S., Rational design of peptide nanotubes for varying diameters and lengths. *J Pept Sci* **2011,** *17* (2), 94-99.