Multifunctional, Biocompatible Supramolecular Hydrogelators Consist Only of Nucleobase, Amino Acid, and Glycoside

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Supporting information

1) Materials and methods

Chemical reagents and solvents were used as received from commercial sources unless otherwise stated. ^{1}H and ^{13}C spectra were obtained on Varian Unity Inova 400, CD on a JASCO J-810 spectrometer, LC-MS on Waters Acouity ultra Performance LC with Waters MICROMASS detector, and TEM on Morgagni 268 transmission electron microscope.

2) Synthesis of hydrogelators **2C**, **1A**, **2A**, **1G**, and **2G,** and compound **1C**

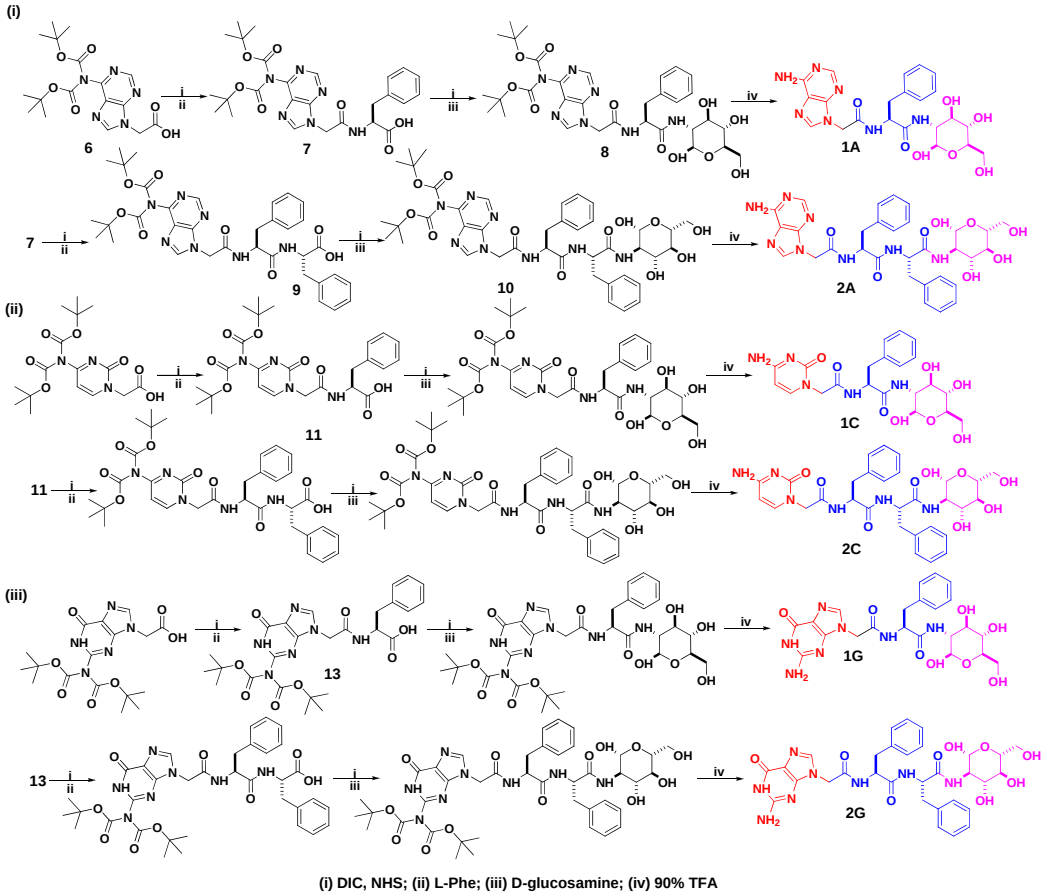

Figure S1. Molecular structures and the typical synthetic routes of hydrogelators **2C**, **1A**, **2A**, **1G**, and **2G** and compound **1C**.

Synthesis of Thymine-Phe (4). Thymine acetic acid (184 mg, 1 mmol) and NHS (126.5 mg, 1.1 mmol) were dissolved in 20 mL of DMF, and DIC (140.8 mg, 1.1 mmol) was added to the above solution with stirring. After the reaction mixture was stirred at room temperature overnight, the resulted solid was filtered off. The filtrate

was evaporated under reduced pressure to dryness, and the crude product was used in the next reaction without purification.

L-Phenylalanine (166 mg, 1 mmol) and Na_2CO_3 (84.8 mg, 0.8 mmol) were dissolved in 20 mL of water with stirring, and the solution of crude product (dissolved in 20 mL DMF) was added. The resulted reaction mixture was stirred at room temperature for 24 h. The reaction mixture was vacuum-dried, then 30 mL of water was added and acidified to pH 3.0. The resulted product was obtained by filtration, washed with water, and then dried in vacuo. The white solid was purified by HPLC using water-acetonitrile as eluent (from 8:2 to 4:6), and the purification affords the product (**8**) in 78% yield for next step reaction. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.56-8.54 (m, 1H), 7.33-7.20 (m, 6H), 4.45-4.40 (m, 1H), 4.19 (dd, *J*=16.0, 28.0 Hz, 2H), 3.04 (dd, *J*=4.0, 12.0Hz, 1H), 2.89 (dd, *J*=8.0, 16.0Hz, 1H), 1.73 (s, 3H).

Synthesis of Thymine-Phe-glucosamine (1T).
Compound **4** (331.3 mg, 1 mmol) and NHS (126.5 mg, 1.1 mmol) were dissolved in DMF (30 mL), and DIC (140.8 mg, 1.1 mmol) was added to the above solution with stirring. After the reaction mixture was stirred at room temperature for 12 h, the resulted solid was filtered off, and the filtrate was evaporated under reduced pressure to dryness. The crude product was used for the next reaction without purification.

D-glucosamine hydrochloride (215.64 mg, 1 mmol) and Na_2CO_3 (212 mg, 2 mmol) were dissolved in water (20 mL) with stirring, and the solution of crude product (dissolved in 30 mL of DMF) was added. The resulted reaction mixture was stirred at room temperature for 24 h. The reaction mixture was vacuum-dried, followed by the addition of 30 mL of water. The resulted product was isolated by filtration, washed with water, and then dried in vacuo. The white solid was purified by HPLC using water-acetonitrile as eluent (from 8:2 to 5:5). The product (**1T**) was obtained in 42% yield (206 mg). ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.34 (d, *J* = 12.0 Hz, 1H), 8.05 (d, *J* = 8.0 Hz, 1H), 7.32-7.14 (m, 5H), 6.54 (d, *J* =4.0 Hz, 1H), 4.96-4.91 (m, 2H), 4.7-4.61 (m, 1H), 4.48-4.43 (m, 1H), 4.33-4.15 (m, 2H), 3.65-3.43 (m, 4H), 3.18-3.00 (m, 3H), 2.79-2.69 (m, 2H), 1.74-1.69 (s, 3H).

Synthesis of Thymine-Phe-Phe (5). Compound **4** (331 mg, 1 mmol) and NHS (126.5 mg, 1.1 mmol) were dissolved in 20 mL of DMF, and DIC (140.8 mg, 1.1 mmol) was added to the above solution with stirring. After the reaction mixture was stirred at room temperature overnight, the resulted solid was filtered off, and the filtrate was evaporated under reduced pressure to dryness. The crude product was used in the next reaction without purification.

L-Phenylalanine (166 mg, 1 mmol) and Na_2CO_3 (84.8 mg, 0.8 mmol) were dissolved in 20 mL of water with stirring, and the solution of crude product (dissolved in 20 mL DMF) was added. The resulted reaction mixture was stirred at room temperature for 24 h. The reaction mixture was vacuum-dried, then 30 mL of water was added and the

mixture was acidified to pH 3.0. The resulted product was obtained by filtration, washed with water, and then dried in vacuum. Compound **5** (white powder) was collected with 76% yield (364 mg). ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.41-8.37 (m, 1H), 7.29-7.18 (m, 10H), 4.57-4.52 (m, 1H), 4.43-4.38 (m, 1H), 4.23 (dd, J = 16.8, 28.4 Hz, 2H), 3.06-2.89 (m, 3H), 2.72 (dd, J = 9.6, 15.2 Hz, 1H), 1.71 (s, 3H).

Synthesis of Thymine-Phe-Phe-glucosamine (2T).
Compound **5** (478.5 mg, 1 mmol) and NHS (126.5 mg, 1.1 mmol) were dissolved in DMF (30 mL), and DIC (140.8 mg, 1.1 mmol) was added to the above solution with stirring. After the reaction mixture was stirred at room temperature for 12 h, the resulted solid was filtered off, and the filtrate was evaporated under reduced pressure to dryness. The crude product was used for the next reaction without purification.

D-glucosamine hydrochloride (215.64 mg, 1 mmol) and Na_2CO_3 (212 mg, 2 mmol) were dissolved in water (20 mL) with stirring, and the solution of crude product (dissolved in 30 mL of DMF) was added. The resulted reaction mixture was stirred at room temperature for 24 h. The reaction mixture was vacuum-dried, then 30 mL of water was added. The resulted product was isolated by filtration, washed with water, and then dried in vacuo. The white solid was purified by HPLC using water-acetonitrile as eluent (from 8:2 to 5:5). We obtained the product (**2T**) in 48% yield (382 mg). ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.27 (d, J = 12.0 Hz, 1H), 8.13 (d, J = 8.0 Hz, 1H), 7.93 (d, J = 8.0 Hz, 1H), 7.33-7.13 (m, 10H), 6.56 (d, J =4.0 Hz, 1H), 4.98-4.92 (m, 2H), 4.71-4.43 (m, 3H), 4.28-4.19 (m, 2H), 3.67-3.44 (m, 4H), 3.18-2.64 (m, 7H), 1.74-1.69 (s, 3H).

Synthesis of Bis-Boc-Adenine-Phe (7). Bis-Boc adenine acetic acid (393.4 mg, 1 mmol) and NHS (126.5 mg, 1.1 mmol) were dissolved in 30 mL of THF, and DIC (140.8 mg, 1.1 mmol) was added to the above solution with stirring. After the reaction, the mixture was stirred at room temperature overnight, and the resulting solid was filtered off. The filtrate was evaporated under reduced pressure to dryness to afford the crude product for the next reaction without purification.

L-Phenylalanine (166 mg, 1 mmol) and Na_2CO_3 (84.8 mg, 0.8 mmol) were dissolved in 20 mL of water with stirring, and the solution of crude product (dissolved in 30 mL THF) was added. The resulted reaction mixture was stirred at room temperature for 24 h. After evaporation of the organic solvent, the residue was redissovled in 30 mL of water and acidified with hydrochloric acid to pH 2-3. The white precipitate was filtered off and purified by column chromatography over silica gel using chloroform/methanol as the eluents to afford compound **7** (443 mg, 82%) for next step reaction. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.80 (s, 1H), 8.66 (b, 1H), 8.50 (s, 1H), 7.27-7.17 (m, 5H), 5.03 (dd, J =20.0 Hz, 24.0 Hz, 2H), 4.37 (m, 1H), 3.08 (dd, J =4.0, 12.0 Hz, 1H), 2.92 (dd, J =8.0, 12.0 Hz, 1H), 1.37 (s, 18H).

Synthesis of Adenine-Phe-glucosamine (1A). Compound **7** (584.66 mg, 1 mmol) and NHS (126.5 mg, 1.1 mmol) were dissolved in THF (30 mL), and DIC (140.8 mg, 1.1 mmol) was added to the above solution with stirring. After the reaction mixture was stirred at room temperature for 12 h, the resulting solid was filtered off. Then the filtrate was evaporated under reduced pressure to dryness. The crude product was used for the next step reaction without purification.

D-glucosamine hydrochloride (215.64 mg, 1 mmol) and Na_2CO_3 (84.8 mg, 0.8 mmol) were dissolved in water (20 mL) with stirring, and the solution of crude product (dissolved in 30 mL of THF) was added. The resulted reaction mixture was stirred at room temperature for 24 h. After evaporation of the organic solvent, the residue treated with 90% trifluoroacetic acid in water for 2 h. Then the mixture was concentrated by vacuum and purified by HPLC using water-acetonitrile as eluent (from 8:2 to 5:5). The final product (**1A**) was obtained in 42% yield. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.57-8.49 (m, 1H), 8.13-8.09 (m, 2H), 7.91 (s, 1H), 7.30-7.15 (m, 5H), 6.55 (d, *J* =4.0 Hz, 1H), 4.95-4.47 (m, 5H), 3.71-3.48 (m, 4H), 3.16-2.71 (m, 5H).

Synthesis of Bis-Boc-Adenine-Phe-Phe (9). Compound **7** (540 mg, 1 mmol) and NHS (126.5 mg, 1.1 mmol) were dissolved in THF (30 mL), and DIC (140.8 mg, 1.1 mmol) was added to the above solution with stirring. After the reaction mixture was stirred at room temperature for 12 h, the resulting solid was filtered off. Then the filtrate was evaporated under reduced pressure to dryness. The crude product was used for the next step reaction without purification.

L-Phenylalanine (166 mg, 1 mmol) and Na_2CO_3 (84.8 mg, 0.8 mmol) were dissolved in water (20 mL) with stirring, and the solution of crude product (dissolved in 30 mL of THF) was added. The resulted reaction mixture was stirred at room temperature for 24 h. After evaporation of the organic solvent, the residue was redissovled in 30 mL of water and acidified with hydrochloric acid to pH 2-3. The white precipitate was filtered off and purified by column chromatography over silica gel using chloroform/methanol as the eluents to afford compound **6** (488 mg, 80%). ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.78 (s, 1H), 8.70 (d, *J*=8.0 Hz, 1H), 8.49 (d, *J*=8.0 Hz, 1H), 8.42 (s, 1H), 7.24-7.10 (m, 10H), 4.96 (dd, *J* =16.0, 28.0 Hz, 2H), 4.61-4.56 (m, 1H), 4.46-4.40 (m, 1H), 3.09-2.99 (m, 2H), 2.91 (dd, *J* =8.0, 12.0 Hz, 1H), 2.75 (dd, *J* =8.0, 12.0 Hz, 1H), 1.37 (s, 18H).

Synthesis of Adenine-Phe-Phe-glucosamine (2A). Compound **9** (687.7 mg, 1 mmol) and NHS (126.5 mg, 1.1 mmol) were dissolved in THF (30 mL), and DIC (140.8 mg, 1.1 mmol) was added to the above solution with stirring. After the reaction, the mixture was stirred at room temperature for 12 h, and the resulted solid was filtered off. The filtrate was evaporated under reduced pressure to dryness. The crude product was used for the next reaction without purification.

D-glucosamine hydrochloride (215.64 mg, 1 mmol) and Na_2CO_3 (212 mg, 2 mmol) were dissolved in water (20 mL) with stirring, and the solution of crude product (dissolved in 30 mL of THF) was added. The resulted reaction mixture was stirred at room temperature for 24 h. After evaporation of the organic solvent, the residue treated with 90% trifluoroacetic acid in water for 2 h. Then the mixture was concentrated by vacuum and purified by HPLC using water-acetonitrile as eluent (from 8:2 to 5:5). The product (**2A**) was obtained in 37% yield. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.45 (d, J = 8.0 Hz, 1H), 8.18 (d, J = 8.0 Hz, 1H), 8.11 (s, 1H), 7.95-7.90 (m, 2H), 6.57 (d, J =4.0 Hz, 1H), 4.96 (b, 1H), 4.82-4.50 (m, 5H), 3.67-3.45 (m, 4H), 3.18-2.69 (m, 7H).

Synthesis of Bis-Boc-Cytosine-Phe (11). Compound **11** was synthesized by following the procedures described in synthesis of compound **7** except replacing the bis-Boc adenine acetic acid with bis-Boc cytosine acetic acid. Compound **11** (white powder) was collected with 83% yield (429 mg). ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.29 (s, 1H), 8.01 (d, J=4.0 Hz, 1H), 7.22-7.16 (m, 5H), 6.79 (d, J=8.0 Hz, 1H), 4.58-4.41 (m, 2H), 4.27 (s. 1H), 1.49 (s, 18H).

Synthesis of Cytosine-Phe-Glucosamine (1C). Compound **1C** was synthesized by following the procedures described in synthesis of compound **1A** except replacing the bis-Boc adenine acetic acid with bis-Boc cytosine acetic acid. Compound **1C** (white powder) was collected with 45% yield. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.52-8.44 (m, 1H), 8.01-7.92 (m, 1H), 7.71-7.63 (m, 1H), 7.30-7.13 (m, 5H), 6.53 (d, J = 8.0 Hz, 1H), 5.93-5.84 (m, 1H), 5.03-4.90 (m, 2H), 4.69-4.28 (m, 4H), 3.72-3.34 (m, 4H), 3.18-2.69 (m, 5H).

Synthesis of Bis-Boc-Cytosine-Phe-Phe (12). Compound **12** was synthesized by following the procedures described in synthesis of compound **9** except replacing the bis-Boc adenine acetic acid with bis-Boc cytosine acetic acid. Compound **12** (white powder) was collected with 61% yield (283 mg). ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.51 (d, J=8.0 Hz, 1H), 8.41 (d, J=8.0 Hz, 1H), 7.94 (d, J=8.0 Hz, 1H), 7.29-7.16 (m, 10H), 6.77 (d, J=8.0 Hz, 1H), 4.58-4.38 (m, 4H), 3.07-2.71 (m, 4H), 1.48 (s, 18H).

Synthesis of Cytosine-Phe-Phe-Glucosamine (2C). Compound **2C** was synthesized by following the procedures described in synthesis of compound **2A** except replacing the bis-Boc adenine acetic acid with bis-Boc cytosine acetic acid. Compound **2C** (white powder) was collected with 39% yield (360 mg). ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.32 (d, J = 8.0 Hz, 1H), 8.17-8.10 (m, 1H), 7.95-7.87 (m, 1H), 7.53 (d, J = 8.0 Hz, 1H), 7.32-7.13 (m, 10H), 6.56 (s, 1H), 5.80 (d, J = 8.0 Hz, 1H), 4.96 (m, 2H), 4.71-4.29 (m, 5H), 3.71-3.45 (m, 4H), 3.18-2.66 (m, 7H).

Synthesis of Bis-Boc-Guanine-Phe (13). Compound **13** was synthesized by following the procedures described in synthesis of compound **7** except replacing the bis-Boc adenine acetic acid with bis-Boc guanine acetic acid. Compound **13** (white

powder) was collected with 81% yield (462 mg). ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.71 (d, *J*=8.0 Hz, 1H), 8.51 (d, *J*=8.0 Hz, 1H), 7.31-7.19 (m, 5H), 4.91-4.79 (m, 2H), 4.44 (m, 1H), 3.06-3.01 (m, 2H), 2.94-2.88 (m, 2H), 1.34 (s, 18H).

Synthesis of Guanine-Phe-glucosamine (1G). Compound **1G** was synthesized by following the procedures described in synthesis of compound **1A** except replacing the bis-Boc adenine acetic acid with bis-Boc guanine acetic acid. Compound **1G** (white powder) was collected with 41% yield (462 mg). ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.43 (d, *J* = 8.0 Hz, 1H), 8.11-8.04 (m, 1H), 7.30-7.14 (m, 5H), 6.57 (d, *J* =4.0 Hz, 1H), 4.92 (b, 2H), 4.71-4.46 (m, 4H), 3.70-3.44 (m, 4H), 3.16-2.67 (m, 5H).

Synthesis of Bis-Boc-Guanine-Phe-Phe (14). Compound **14** was synthesized by following the procedures described in synthesis of compound **9** except replacing the bis-Boc adenine acetic acid with bis-Boc guanine acetic acid. Compound **14** (white powder) was collected with 75% yield (528 mg). ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.52 (d, *J*=8.0 Hz, 1H), 8.45 (s, 1H), 7.93 (s, 1H), 7.23-7.17 (m, 10H), 4.83-4.70 (m, 2H), 4.56 (s, 1H), 4.40 (s, 1H), 3.08-2.99 (m, 2H), 2.92-2.71 (m, 2H), 1.33 (s, 18H).

Synthesis of Guanine-Phe-Phe-glucosamine (2G). Compound **2G** was synthesized by following the procedures described in synthesis of compound **2A** except replacing the bis-Boc adenine acetic acid with bis-Boc guanine acetic acid. Compound **2G** (white powder) was collected with 43% yield (292 mg). ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.41 (d, *J* = 8.0 Hz, 1H), 8.24 (d, *J* = 8.0 Hz, 1H), 7.99 (d, *J* = 8.0 Hz, 1H), 7.72 (b, 1H), 7.33-7.10 (m, 10H), 6.57 (s, 1H), 4.96 (s, 2H), 4.70-4.61 (m, 3H), 4.51 (m, 2H), 3.72-3.47 (m, 4H), 3.17-2.67 (m, 7H).

3) CD measurements

CD spectra were recorded (185-350 nm) using a JASCO 810 spectrometer under a nitrogen atmosphere. The hydrogels (0.2 mL, 3.0 wt %) were placed evenly on the 1 mm thick quartz curvet and scanned with 0.5 nm interval.

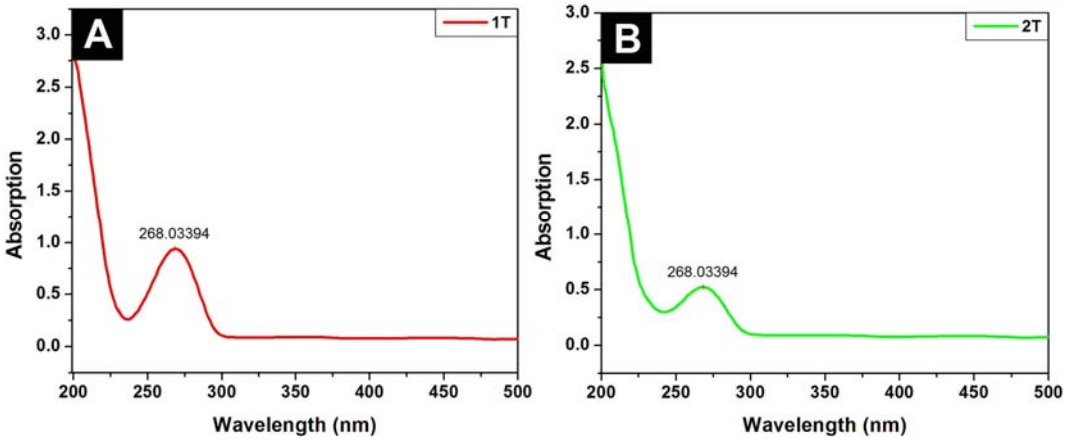

Figure S2. UV-vis absorption spectrum of (A) **1T** in solution: c = 6.0×10^{-4} M in water; (B) **2T** in solution c = 3.0×10^{-4} M in water, indicating there is no chromophoric absorption around 296 nm in solution state.

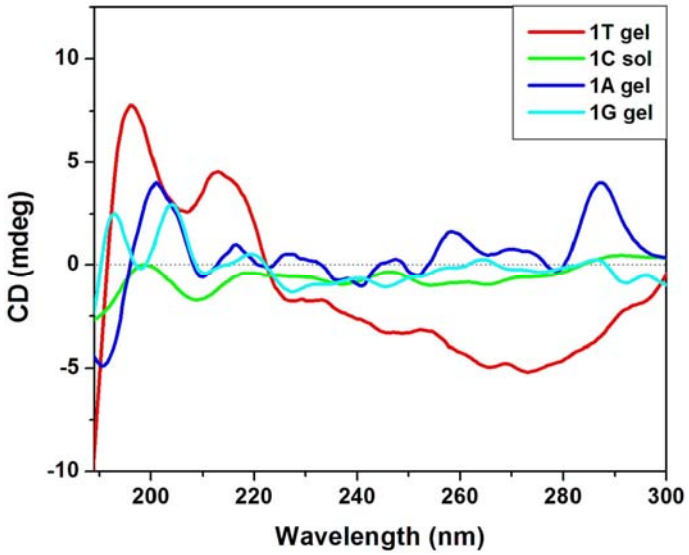

Figure S3. The CD spectra of the hydrogels **1T**, **1A**, **1G** and solution of **1C**.

4) Rheological measurement

Rheological tests were conducted on TA ARES G2 rheometer (with TA Orchestrator Software). 25 mm cone-plate was used during the experiment. 0.3 mL of hydrogel sample was placed on the cone-plate.

i) Dynamic Strain Sweep Test

Test range (0.1 to 10 % strain, frequency =10 $rads^{-1}$), 10 points per decade. Sweep mode is "log" and temperature was carried out at 25 ^{o}C.

ii) Critical strain determination

The critical strain (γ_c) value was determined from the storage-strain profiles of the hydrogel sample. The strain applied to the hydrogel sample increased from 0.1 to 100 % (10 rad/s and 25 ^{o}C). Over a certain strain, a drop in the elastic modulus was observed, and the strain amplitude at which storage moduli just begins to decrease by 5 % from its maximum value was determined and taken as a measure of the critical strain of the hydrogels, which correspond to the breakdown of the cross-linked network in the hydrogel sample.

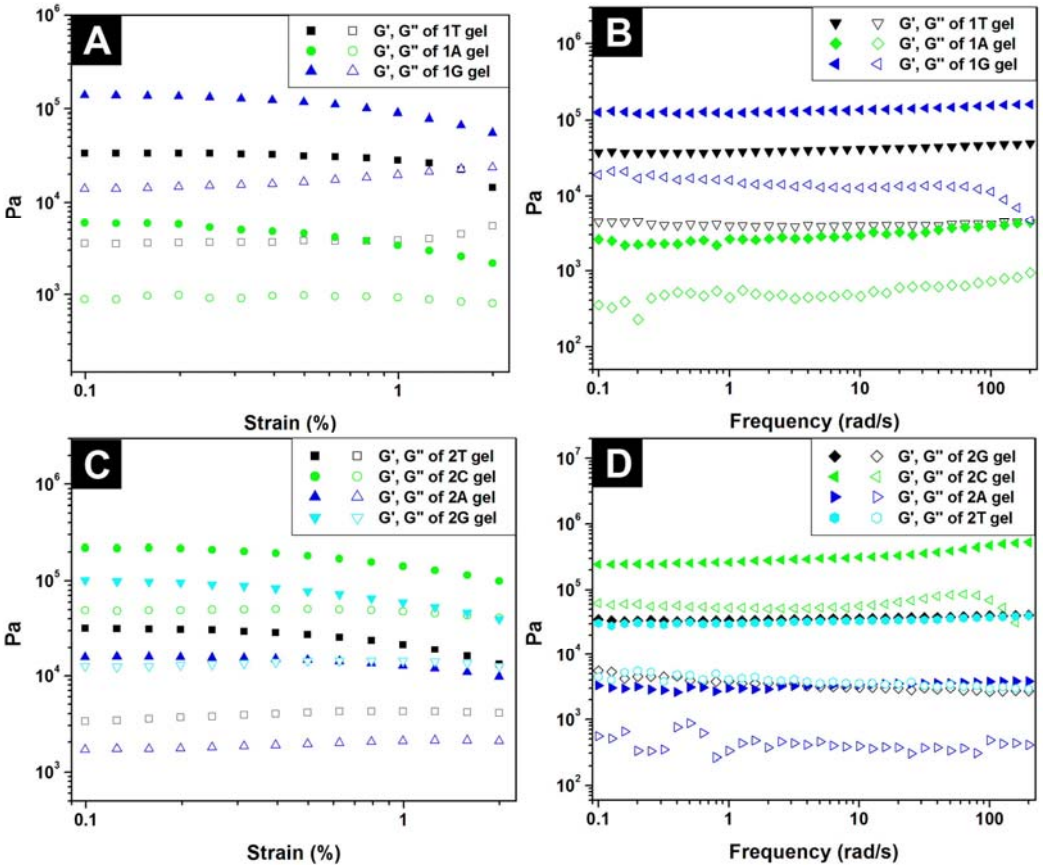

Figure S4. (A**)** Strain dependence of dynamic storage moduli (G') and loss moduli (G'') of the hydrogels of **1T**, **1A**, and **1G**; (B) frequency dependence of dynamic storage moduli (G') and loss moduli (G'') of the hydrogels of **1T**, **1A**, and **1G**; (C) strain dependence of dynamic storage moduli (G') and loss moduli (G'') of the hydrogels of **2T**, **2C**, **2A**, and **2G**; (D) frequency dependence of dynamic storage moduli (G') and loss moduli (G'') of the hydrogels of **2T**, **2C**, **2A**, and **2G** shown in Figure 1.

5) Preparation of 1T+deoxyadenosine (A_{10}) mixed gel and test of the interaction between 1T and deoxyadenosine (A_{10})

The typical procedure for hydrogelation: 5.9 mg of **1T** dissolves in 224 μL water in 2.1 wt% with gentle heating to make clear solution, and followed by the addition of 57μL of deoxyadenosine (A_{10}) (20 mM) to afford stable mixed hydrogel. And this mixed hydrogel was subject to CD, TEM and rheological studies to test the interaction between **1T** and deoxyadenosine (A_{10}).

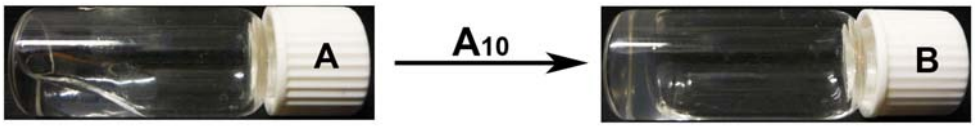

Figure S5. Optical images of (A) the highly viscous solution of **1T** (2.1 wt%, pH=7.0); (B) **1T**+deoxyadenosine (A_{10}) mixed hydrogel after the addition of deoxyadenosine (A_{10}) in 1:1 molecular ratio.

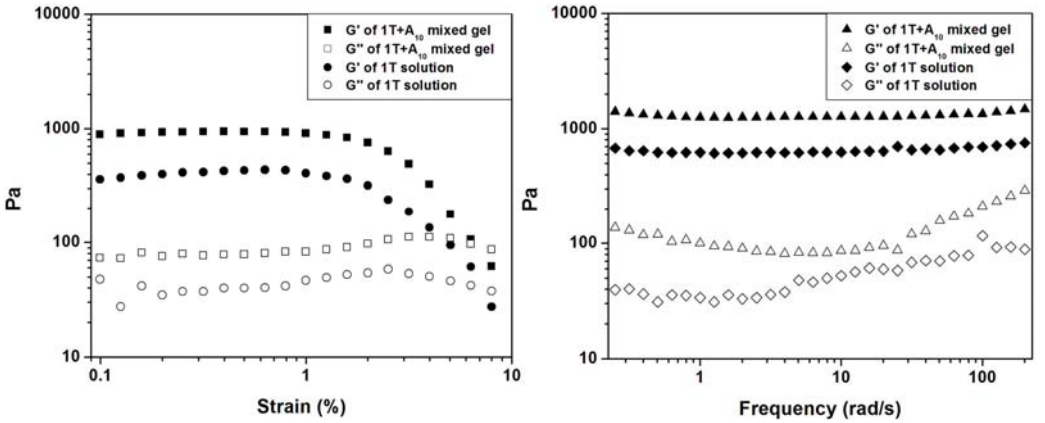

Figure S6. (A**)** Strain dependence of dynamic storage moduli (G') and loss moduli (G'') of the hydrogels of **1T**, and **1T**+deoxyadenosine (A_{10}) mixed gel; (B) frequency dependence of dynamic storage moduli (G') and loss moduli (G'') of the hydrogels of **1T**, and **1T**+deoxyadenosine (A_{10}) mixed gel shown in Figure S5.

6) Wound-healing assay

HeLa cells were re-suspended in 10 cm tissue culture dish after washing cells once with PBS. 0.8 mL 0.25 % trypsin containing 0.1 % EDTA was then added, and the cells were re-suspended with 1.6 mL complete medium. 5000 cells (in 100 μL medium) were plated into each vial on a 96 well plate to create a confluent monolayer. After adherent for 24 hr, a wound was created by scraping the cell monolayer with a p200 pipet tip. The cells were washed once with 100 μL of complete medium to remove flowing cells and replace with 100 μL of complete medium. 0 hr image was acquired as a reference point. The medium was replaced with 100 μL of medium containing 500 μM of hydrogelator **2T** and the plate was incubate at 37 ºC, 5 % CO_2 for 20 hr. 0 hr and 20 hr images were acquired at the match photographed region.

7) Biostability test with proteinase K

1 mg of each compound was dissolved in 5 mL HEPES buffer at pH 7.5. Then proteinase K were added in concentration 3.2 units/mL and incubated at 37 ^{o}C for 24 hr, then 100 μL of sample were taken out each time and analyzed by HPLC.

For the control experiment, 1 mg of NapFFCGLDD (heptapeptide derivative) and 1 mg of thymine-FF (nucleopeptides without glucosamine in conjugation) were dissolved in 5 mL HEPES buffer at pH 7.5 respectively. Then proteinase K were added in concentration 3.2 units/mL and incubated at 37 ^{o}C for 24 hr, then 100 μL of sample were taken out each time and analyzed by HPLC.

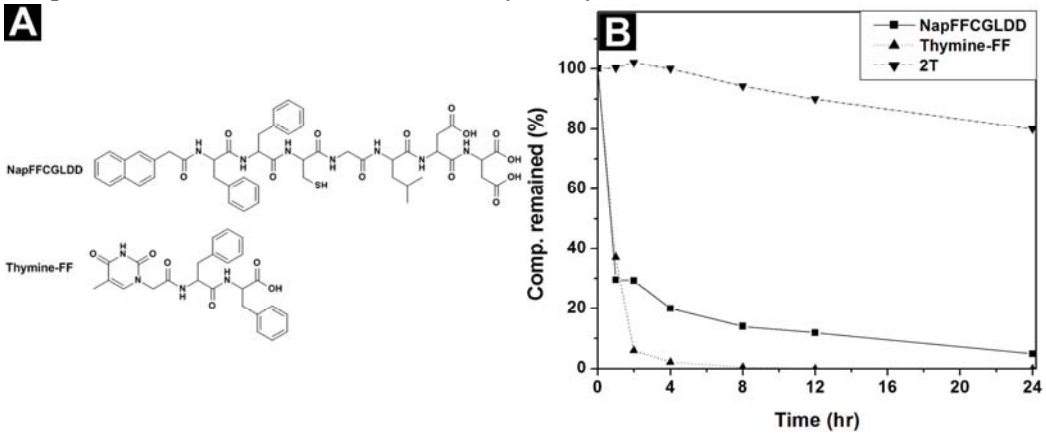

Figure S7. (A) The molecular structures of NapFFCGLDD and thymine-FF, and (B) their time-dependent course of the digestions by proteinase K as control experiment, in which NapFFCGLDD is the heptapeptide derivative and thymine-FF is the nucleopeptide without D-glucosamine in conjugation.

8) Nucleic acid transfection by using hydrogelator 1T

HeLa cells were seeded in 2 well chamber slide at a density of 10,000 cell/well. After allowing the attachment at 37 °C for 4 h, we removed culture medium and applied 1mL of culture medium containing 1 μM fluorescein (FAM) labeled poly(10A) with or without 500 μM hydrogelator **1T**. After incubation at 37 °C for 24 h, we removed the culture medium, washed the cells by 1mL PBS for 3 times, then resin the cells in 1mL PBS. Fluorescence images were taken by using confocal fluorescence microscope.

9) Biostability test of 1T' with proteinase K

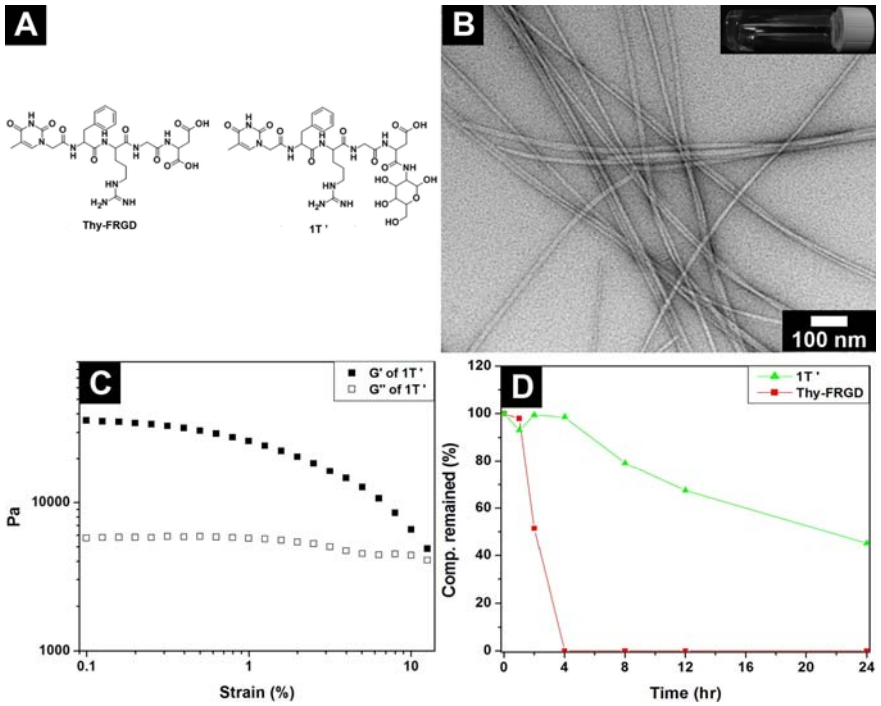

Figure S8. (A) The molecular structures of Thy-FRGD and **1T'**; (B) the optical images (inset) and transmission electron micrograph (TEM) of the negative stained hydrogels of **1T'**; (C) strain dependence of dynamic storage moduli (G') and loss moduli (G'') of the hydrogel of **1T'**; (D) The time-dependent course of the digestions of hydrogelators of **1T'** and Thy-FRGD by proteinase K.

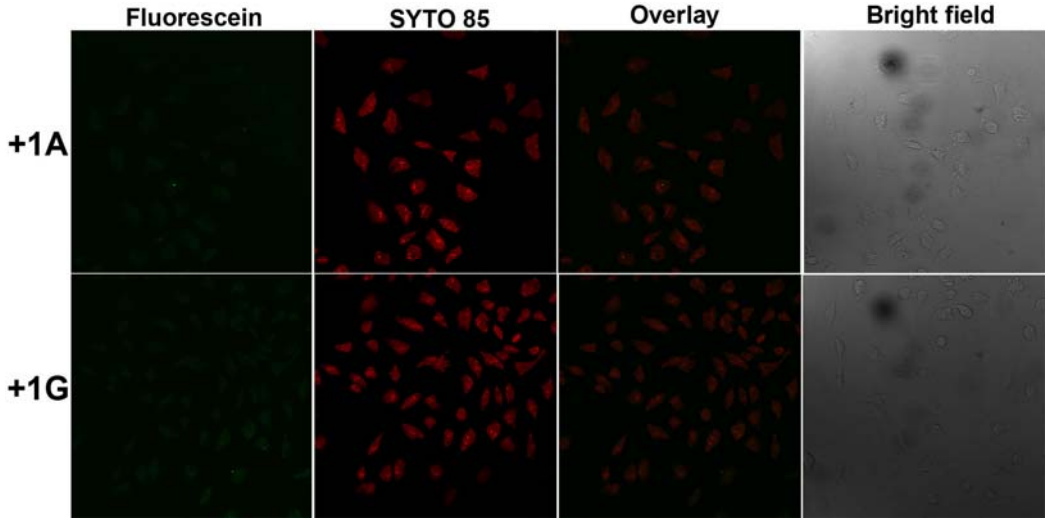

Figure S9. Fluorescence and bright field microscopy images show subcellular distribution of A_{10}, which is labeled with fluorescien dye (green). Cell nuclei were stained with SYTO 85 (orange). (Top) 500 μM **1A** and 1 μM FAM-A_{10} incubated with HeLa cells for 24 hrs. (Bottom) 500 μM **1G** and 1 μM FAM-A_{10} incubated with HeLa cells for 24 hrs.