

Electronic Supplementary Information for Manuscript Entitled with
**Schiff Base and Reductive Amination Reactions of α -Amino Acids: A
Facile Route Toward *N*-Alkylated Amino Acids and Peptoid
Synthesis**

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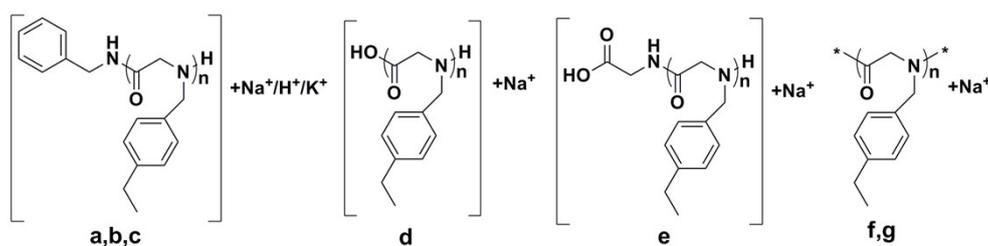


Fig. S1 The assigned molecular structures of $P(NBnEt-G)_n$ in Fig. 4b.

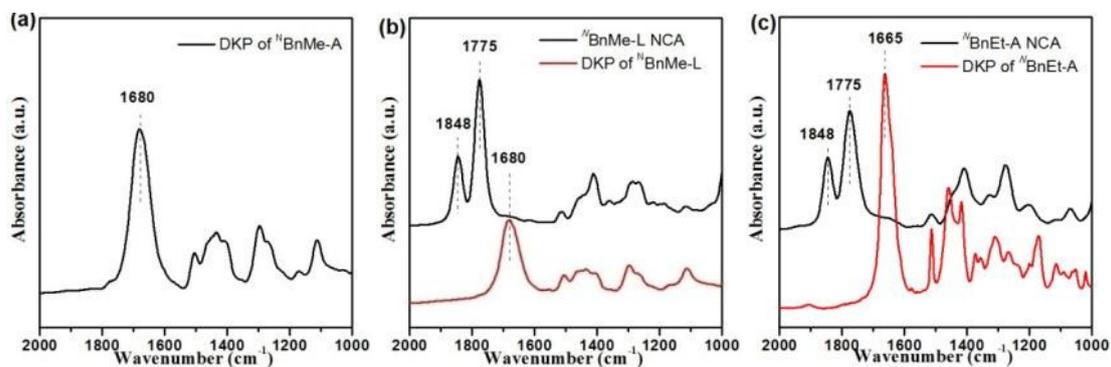


Fig. S2 Representative FT-IR spectra of NNCA and corresponding DKPs (reaction conditions: benzylamine as initiator in NMP at 56 °C for a week).

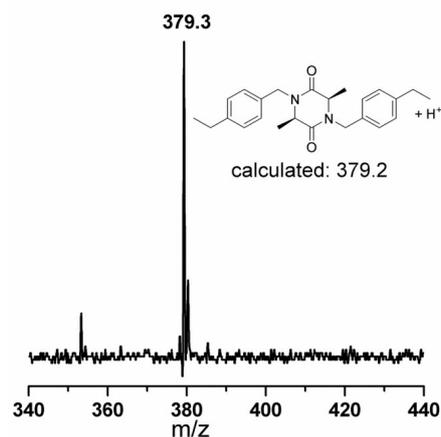


Fig. S3 Representative MALDI-TOF MS spectrum of 1,4-bis(4-ethylbenzyl)-3,6-dimethylpiperazine-2,5-dione diketopyperazine (DKP, reaction conditions: benzylamine as initiator in NMP at 56 °C for a week).

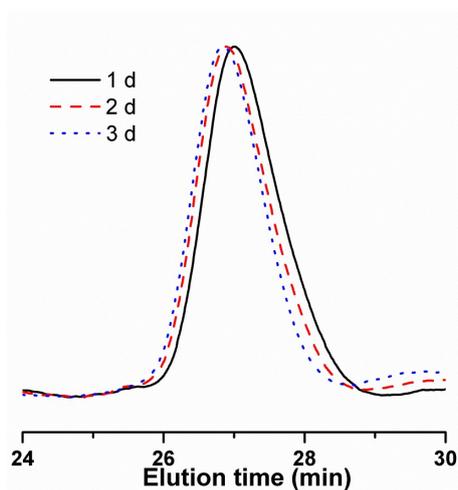
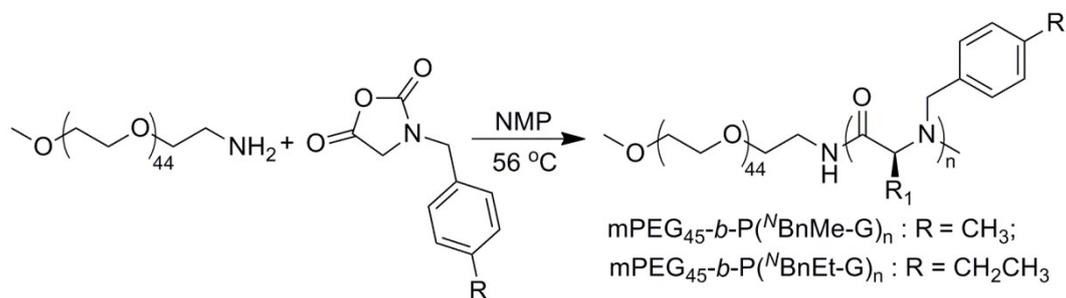
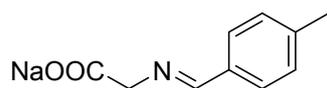


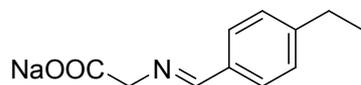
Fig. S4 GPC chromatograms of mPEG₄₅-b-P(^NBnMe-G)_n after 1 day (solid line), 2 days (dash line) and 3 days (dot line) polymerization.



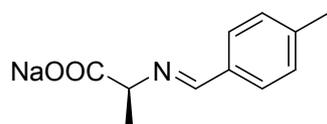
Scheme S1 Synthetic routes to mPEG₄₅-b-P(^NBnMe-G)_n and (b) mPEG₄₅-b-P(^NBnEt-G)_n diblock copolypeptides.



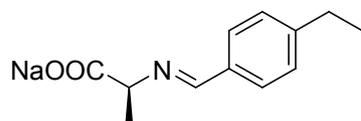
***N*-(4-methylphenyl)methyl glycine Schiff base (^N=BnMe-G, 97% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm)8.22(s, 1H), 7.67-7.68 (d, 2H), 7.23-7.25 (d, 2H), 4.22 (s, 2H), 2.37 (s, 3H).



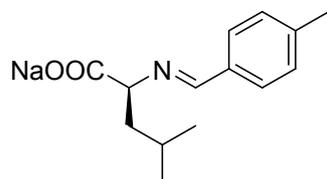
***N*-(4-ethylphenyl)methyl glycine Schiff base (^N=BnEt-G, 96% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm)8.23(s, 1H), 7.69-7.71 (d, 2H), 7.26-7.28 (d, 2H), 4.22 (s, 2H), 2.67-2.69 (q, 2H), 1.24-1.25 (t, 3H).



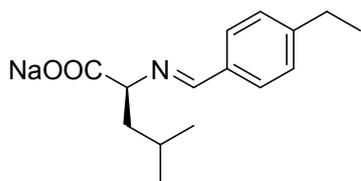
***N*-(4-methylphenyl)methyl alanine Schiff base (^N=BnMe-A, 97% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm) 8.36(s, 1H), 7.76-7.78 (d, 2H), 7.31-7.33 (d, 2H), 4.04-4.08 (q, 1H), 2.45 (s, 3H), 1.45-1.56 (d, 3H).



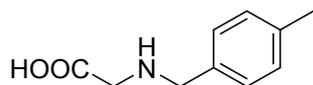
***N*-(4-ethylphenyl)methyl alanine Schiff base (^N=BnEt-A, 98% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm) 8.27(s, 1H), 7.67-7.69 (d, 2H), 7.22-7.24 (d, 2H), 3.95-3.99 (q, 1H), 2.45 (s, 3H), 1.45-1.56 (d, 3H).



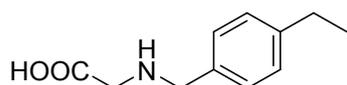
***N*-(4-methylphenyl)methyl leucine Schiff base (^N=BnMe-L, 96% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm) 8.26(s, 1H), 7.67-7.69 (d, 2H), 7.22-7.23 (d, 2H), 3.91-3.94 (t, 1H), 2.36 (s, 3H), 1.79-1.82 (m, 2H), 1.51-1.57(m, 1H), 0.95-0.93 (d, 3H), 0.92-0.90 (d, 3H).



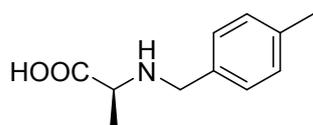
***N*-(4-ethylphenyl)methyl leucine Schiff base (^NBnEt-L, 97% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm) 8.27(s, 1H), 7.70-7.72 (d, 2H), 7.25-7.26 (d, 2H), 3.92-3.93 (t, 1H), 2.65-2.70 (q, 2H), 1.79-1.83 (m, 2H), 1.52-1.57 (m, 1H), 1.22-1.25 (t, 3H), 0.94-0.97 (d, 3H), 0.92-0.91 (d, 3H).



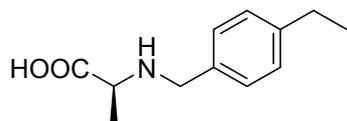
***N*-(4-methylphenyl)methyl glycine (^NBnMe-G, 74% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm)7.30-7.31 (d, 2H), 7.19-7.20 (d, 2H), 4.08 (s, 2H), 3.39 (s, 2H), 2.30 (s, 3H). ¹³C NMR (125.7 MHz, CD₃OD): δ(ppm) 170.67, 138.84, 129.31, 50.50, 48.73, 19.80.



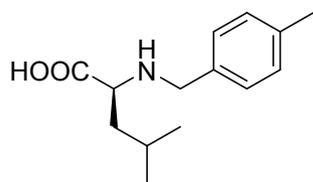
***N*-(4-ethylphenyl)methyl glycine (^NBnEt-G, 78% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm)7.30-7.31 (d, 2H), 7.19-7.20 (d, 2H), 4.08 (s, 2H), 3.39 (s, 2H), 2.30 (s, 3H). ¹³C NMR (125.77 MHz, CD₃OD): δ(ppm) 168.65, 145.81, 129.71, 128.27, 50.21, 48.08, 28.14, 14.62. HRESI-MS (m/z) [M+H]⁺ Calcd for C₁₁H₁₅NO₂, 194.1103; found 194.1183.



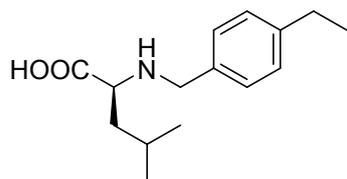
***N*-(4-methylphenyl)methyl alanine (^NBnMe-A, 79% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm) 7.39-7.41 (d, 2H), 7.26-7.27 (d, 2H), 4.22 (s, 2H), 4.15-4.18 (q, 1H), 2.36 (s, 3H), 1.53-1.59 (d, 3H). ¹³C NMR (125.77 MHz, CD₃OD): δ(ppm) 171.03, 139.47, 129.64, 128.07, 55.32, 49.22, 19.83, 14.22. HRESI-MS (m/z) [M+H]⁺ Calcd for C₁₁H₁₅NO₂, 194.1103; found 194.1180.



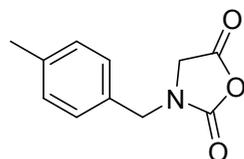
***N*-(4-ethylphenyl)methyl alanine (^NBnEt-A, 82% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm) 7.42-7.44 (d, 2H), 7.29-7.31 (d, 2H), 4.21 (s, 2H), 4.01-4.02 (q, 1H), 2.65-2.68 (q, 2H), 1.53-1.61 (d, 3H), 1.21-1.24 (t, 3H). ¹³C NMR (125.7.7 MHz, CD₃OD): δ(ppm) 170.65, 145.93, 129.75, 128.30, 54.98, 49.24, 28.15, 14.63, 14.09.



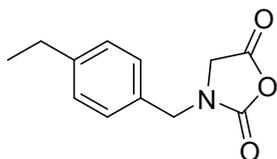
***N*-(4-methylphenyl)methyl leucine (^NBnMe-L, 77% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm) 7.48-7.49 (d, 2H), 7.36-7.38 (d, 2H), 4.28 (s, 2H), 3.97-4.00 (q, 1H), 2.46 (s, 3H), 1.90-1.92 (m, 2H), 1.80-1.89 (m, 1H), 1.04-1.11 (d, 6H). ¹³C NMR (125.7.7 MHz, CD₃OD): δ(ppm) 171.18, 139.47, 129.85, 129.36, 127.93, 58.90, 51.43, 24.56, 21.78, 20.68. HRESI-MS (m/z) [M+H]⁺ Calcd for C₁₄H₂₁NO₂, 235.1572; found 236.1653.



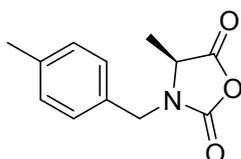
***N*-(4-ethylphenyl)methyl leucine (^NBnEt-L, 78% yield):** ¹H NMR (500 MHz, CD₃OD): δ(ppm) 7.50-7.52 (d, 2H), 7.38-7.40 (d, 2H), 4.28 (s, 2H), 3.89-3.91 (q, 1H), 2.74-2.78 (q, 2H), 1.89-1.92 (m, 2H), 1.80-1.89 (m, 1H), 1.30-1.33 (t, 3H), 1.04-1.11 (d, 6H). ¹³C NMR (125.7.7 MHz, CD₃OD): δ(ppm) 170.43, 146.00, 129.95, 128.27, 128.04, 58.17, 38.64, 28.15, 24.58, 14.62.



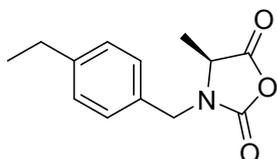
***N*-(4-methylphenyl)methyl glycine *N*-carboxyanhydride (^NBnMe-G NCA, 76% yield, mp ~110 °C):** ¹H NMR (500 MHz, CDCl₃): δ(ppm) 7.16-7.26 (q, 4H), 4.52 (s, 2H), 3.94 (s, 2H), 2.36 (s, 3H). ¹³C NMR (125.7 MHz, CDCl₃): δ(ppm) 165.25, 152.10, 138.74, 130.61, 129.91, 128.29, 48.15, 47.32, 21.11.



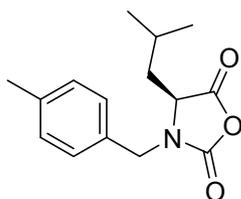
***N*-(4-ethylphenyl)methyl glycine *N*-carboxyanhydride (^NBnEt-G NCA, 72% yield, mp ~79 °C):** ¹H NMR (500 MHz, CDCl₃): δ(ppm) 7.24-7.19 (q, 4H), 4.53 (s, 2H), 3.96 (s, 2H), 2.64-2.68 (q, 2H), 1.22-1.25 (t, 3H). ¹³C NMR (125.7 MHz, CDCl₃): δ(ppm) 162.26, 152.10, 145.08, 130.83, 128.75, 128.38, 48.18, 47.32, 28.51, 15.48.



***N*-(4-methylphenyl)methyl alanine *N*-carboxyanhydride (^NBnMe-A NCA, 67% yield, mp ~200 °C):** ¹H NMR (500 MHz, CDCl₃): δ(ppm) 7.09-7.19 (q, 4H), 4.84-4.87 (d, 1H), 4.03-4.06 (d, 1H), 3.93-3.98 (q, 1H), 2.29 (s, 3H), 1.38-1.40 (d, 3H). ¹³C NMR (125.7 MHz, CDCl₃): δ(ppm) 169.37, 151.65, 145.08, 138.60, 130.87, 129.86, 128.17, 54.36, 45.32, 21.12, 15.12.

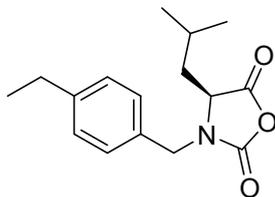


***N*-(4-ethylphenyl)methyl alanine *N*-carboxyanhydride (^NBnEt-A NCA, 70% yield, mp ~168 °C):** ¹H NMR (500 MHz, CDCl₃): δ(ppm) 7.12-7.19 (t, 4H), 4.86-4.89 (d, 1H), 4.02-4.05 (d, 1H), 3.94-3.97 (q, 1H), 2.56-2.61 (q, 2H), 1.39-1.41 (d, 3H), 1.15-1.18 (t, 3H). ¹³C NMR (125.7 MHz, CDCl₃): δ(ppm) 169.37, 151.64, 144.93, 131.08, 128.69, 128.25, 54.33, 45.31, 28.50, 15.38, 15.43, 15.14.



***N*-(4-methylphenyl)methyl leucine *N*-carboxyanhydride (^NBnMe-L NCA, 67% yield, mp ~32 °C):** ¹H NMR (500 MHz, CDCl₃): δ(ppm) 7.15-7.20 (t, 4H), 4.99-5.02 (d, 1H), 4.00-4.03 (d, 1H),

3.95-3.97 (d, 1H), 2.36 (s, 3H), 1.71-1.74 (m, 1H), 1.64-1.67 (m, 2H), 0.79-0.80(d, 3H), 0.86-0.87(d, 3H). ¹³C NMR (125.7 MHz,CDCl₃): δ(ppm) 169.00, 152.01, 138.64, 130.77, 129.86, 128.25, 56.62, 45.37, 37.56, 24.04, 23.27, 23.20, 21.78, 21.14.



***N*-(4-ethylphenyl)methyl leucine *N*-carboxyanhydride(^NBnEt-L NCA, 71% yield, oil at RT):**

¹H NMR (500 MHz, CDCl₃): δ(ppm) 7.13-7.19(t, 4H), 4.92-4.95 (d, 1H), 4.00-4.03 (d, 1H), 3.95-3.98 (d, 1H), 2.58-2.59 (q, 2H), 1.79-1.84 (m, 1H), 1.64-1.67 (m, 2H), 0.79-0.80(d, 3H), 0.86-0.87(d, 3H). ¹³C NMR (125.7 MHz,CDCl₃): δ(ppm) 169.05, 152.01, 144.95, 131.05, 128.67, 128.35, 56.70, 45.39, 37.53, 28.51, 24.05, 23.27,23.19, 21.84, 21.76, 15.51, 15.46.

Spectral Data

