

Supporting Information

Substituted Terphenyl Compounds as the First Class of Low Molecular Weight Allosteric Inhibitors of the Luteinizing Hormone Receptor

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Table of Contents:

S1: Title page

S2-S7: Synthetic procedures and spectral data of compounds **4, 6-41**

S8: Combustion analyses of compounds **4, 16-41**

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Synthetic procedures and spectral data

General methods for microwave assisted Suzuki–Miyaura cross coupling reaction

Method (A) for compounds 6–10. To a solution of 3,5-dibromophenol (1 eq) in toluene, (Ph₃P)₄Pd (5 mol.%), substituted phenylboronic acid (3 eq), 2 M aq. Na₂CO₃ (2 eq) was added and the resulting mixture was heated in microwave at 150 °C for 10 min. Upon completion (TLC), the reaction mixture was diluted with EtOAc (100 mL), washed with H₂O, brine, dried over anhydrous Na₂SO₄ and evaporated under reduced pressure. The crude compound was purified by flash column chromatography (EtOAc/petroleum ether, 1:9) to afford the desired product.

Method (B) for compounds 12–15. To a solution of 5-bromo-biphenyl-3-ol (**11**) in toluene, (Ph₃P)₄Pd (5 mol.%), substituted phenylboronic acid (1.5 eq) and 2 M aq. Na₂CO₃ (2 eq) were added and the resulting mixture was heated in microwave at 150 °C for 10 min. Upon completion (TLC), the reaction mixture was diluted with EtOAc (100 mL), washed with H₂O, brine, dried over anhydrous Na₂SO₄ and evaporated under reduced pressure. The crude compound was purified by flash column chromatography (EtOAc/petroleum ether, 1:9) to yield the desired product.

[1,1',3',1'']Terphenyl-5'-ol (**6**).

Low melting colorless solid, yield 71%. ¹H NMR (400 MHz, CDCl₃): δ = 7.69–7.58 (m, 5H), 7.44–7.33 (m, 5H), 7.03 (d, *J* = 1.6 Hz, 2H), 5.29 (brs, 1H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 156.3, 143.5, 140.8, 129.4, 128.9, 128.0, 127.7, 127.3, 117.4, 113.0 ppm.

4,4''-Dichloro-1,1',3',1''-terphenyl-5'-ol (**7**).

Yield: 130 mg, 34%. ¹H NMR (400 MHz, CDCl₃): δ = 7.56 (d, *J* = 8.1 Hz, 4H), 7.41 (d, *J* = 8.4 Hz, 4H), 7.23 (s, 1H), 7.03 (s, 2H), 4.65 (brs, 1H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 157.7, 141.8, 139.4, 133.3, 128.6, 128.2, 117.0, 112.0 ppm.

3,3'',4,4''-Tetrachloro-1,1',3',1''-terphenyl-5'-ol (**8**).

Yield: 280 mg, 61%. ¹H NMR (400 MHz, CDCl₃): δ = 7.78 (s, 2H), 7.53–7.48 (m, 4H), 7.25 (s, 1H), 7.03 (s, 2H), 4.63 (brs, 1H) ppm.

4,4''-Dimethoxy-1,1',3',1''-terphenyl-5'-ol (**9**).

Yield: 150 mg, 41%. ¹H NMR (400 MHz, CDCl₃): δ = 7.51 (d, *J* = 8.8 Hz, 4H), 7.29 (s, 1H), 6.98–6.93 (m, 6H), 5.35 (brs, 1H) 3.82 (m, 6H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 159.5, 156.4, 143.2, 133.6, 128.5, 118.3, 114.5, 111.4, 55.7 ppm.

4,4''-Dimethyl-1,1',3',1''-terphenyl-5'-ol (**10**).

Yield: 220 mg, 67%. ¹H NMR (400 MHz, CDCl₃): δ = 7.51 (d, *J* = 8.0 Hz, 4H), 7.27 (s, 1H), 7.24 (d, *J* = 8.0 Hz, 4H), 6.99 (s, 2H), 4.90 (brs, 1H), 2.38 (s, 6H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 145.7, 141.0, 139.6, 131.8, 129.2, 129.1, 119.3, 114.8 22.5 ppm.

5-Bromo-biphenyl-3-ol (**11**).

To a stirred solution of 3,5-dibromophenol (11.95 mmol, 3 g) in toluene (50 mL), phenylboronic acid (12.55 mmol, 1.53 g), (Ph₃P)₄Pd (0.6 mmol, 0.69 g), and 2 M aqueous solution of Na₂CO₃ (23.91 mmol, 2.53 g) was added and refluxed for 3 h. The progress of the reaction was monitored by TLC. Upon completion, the reaction was cooled to ambient temperature, diluted with EtOAc (150 mL), washed with water, brine, dried over anhydrous Na₂SO₄ and evaporated under reduced pressure. The crude compound was purified by column chromatography using 10% EtOAc in petroleum ether

to afford the title compound as colorless oil (0.89 g, 30%). ^1H NMR (400 MHz, CDCl_3): $\delta = 7.52$ (d, $J = 7.2$ Hz, 2H), 7.43 (t, $J = 7.2$ Hz, 2H), 7.37 (d, $J = 7.2$ Hz, 1H), 7.31 (s,

1H), 6.98 (d, $J = 2.8$ Hz, 2H), 5.06 (brs, 1H) ppm. ^{13}C NMR (100 MHz, CDCl_3): $\delta = 154.5, 141.2, 135.1, 129.2, 128.4, 127.4, 125.1, 123.3, 117.8, 113.5$ ppm.

4-Chloro-[1,1',3',1'']terphenyl-5'-ol (12).

Yield: 200 mg, 67%. ^1H NMR (400 MHz, CDCl_3): $\delta = 7.65$ (d, $J = 8.0$ Hz, 2H), 7.58 (d, $J = 7.6$ Hz, 2H), 7.49–7.36 (m, 5H), 7.34 (s, 1H), 7.03 (s, 1H), 6.98 (s, 1H), 5.14 (brs, 1H) ppm. ^{13}C NMR (100 MHz, CDCl_3): $\delta = 156.5, 143.9, 142.4, 140.8, 139.4, 129.3, 129.2, 129.1, 128.7, 128.0, 127.5, 119.1, 113.7, 113.2$ ppm.

3,4-Dichloro-[1,1',3',1'']terphenyl-5'-ol (13).

Yield: 265 mg, 70%. ^1H NMR (400 MHz, CDCl_3): $\delta = 7.69$ (d, $J = 2.0$ Hz, 2H), 7.53–7.36 (m, 6H), 7.25 (s, 1H), 7.07 (s, 1H), 6.98 (s, 1H), 5.04 (brs, 1H) ppm. ^{13}C NMR (100 MHz, CDCl_3): $\delta = 155.5, 143.3, 141.1, 140.2, 139.1, 134.3, 132.2, 131.8, 129.8, 129.4, 128.5, 127.5, 126.7, 119.0, 114.2, 113.9$ ppm.

4-Methoxy-[1,1',3',1'']terphenyl-5'-ol (14).

Yield: 300 mg, 64%. ^1H NMR (400 MHz, CDCl_3): $\delta = 7.59$ (d, $J = 7.6$ Hz, 2H), 7.53 (d, $J = 8.4$ Hz, 2H), 7.42 (t, $J = 7.4$ Hz, 2H), 7.36–7.33 (m, 2H), 6.99 (s, 2H), 6.96 (d, $J = 8.4$ Hz, 2H), 5.27 (brs, 1H), 3.83 (s, 3H) ppm. ^{13}C NMR (100 MHz, CDCl_3): $\delta = 159.6, 156.5, 143.7, 143.3, 141.2, 133.6, 129.1, 128.5, 127.9, 127.5, 118.8, 114.6, 113.0, 112.8, 55.7$ ppm.

4-Methyl-[1,1',3',1'']terphenyl-5'-ol (15).

Yield: 194 mg, 62%. ^1H NMR (400 MHz, CDCl_3): $\delta = 7.60$ (d, $J = 7.6$ Hz, 2H), 7.51 (d, $J = 8.0$ Hz, 2H), 7.44 (t, $J = 7.8$ Hz, 2H), 7.38–7.34 (m, 2H), 7.25 (d, $J = 7.2$ Hz, 2H), 7.01 (s, 2H), 4.99 (brs, 1H), 2.42 (s, 3H) ppm. ^{13}C NMR (100 MHz, CDCl_3): $\delta = 155.6, 141.7, 140.3, 139.7, 139.1, 133.6, 129.8, 129.7, 129.1, 127.9, 127.5, 127.3, 119.1, 113.2, 113.1, 21.4$ ppm.

General procedure for carbamate synthesis. Triethylamine (1.5 eq) was added to a stirred solution of phenol (1 eq) in anhydrous dichloromethane and stirred at ambient temperature for 15 min. Isocyanate (1.5 eq) was added and stirred for another 12 to 18 h at ambient temperature. Upon completion (TLC), the reaction mixture was diluted with dichloromethane (100 mL), washed with water, brine, dried and evaporated under reduced pressure. The crude compound was purified by flash column chromatography (dichloromethane/petroleum ether, 4:1) to get the carbamate. The column purified carbamate was crystallized using dichloromethane and petroleum ether.

Phenyl-carbamic acid [1,1',3',1'']terphenyl-5'-yl ester (4).

Yield: 259 mg, 87%. M.p.: 165–166 °C. ^1H NMR (200 MHz, CDCl_3): $\delta = 7.68$ –7.61 (m, 5H), 7.51–7.31 (m, 12H), 7.17–7.05 (m, 2H), 4.08 (brs, 1H), 3.85 (s, 3H) ppm. ^{13}C NMR (50 MHz, CDCl_3): $\delta = 164.1, 151.1, 143.0, 137.2, 129.1, 128.7, 127.6, 127.2, 123.9, 123.3, 119.1, 118.8$ ppm. MS (ES^+): 366 (MH^+).

(4-Chloro-phenyl)-carbamic acid [1,1',3',1'']terphenyl-5'-yl ester (16).

Yield: 290 mg, 89%. ^1H NMR (400 MHz, CDCl_3): $\delta = 7.67$ (t, $J = 1.6$ Hz, 1H), 7.63–7.57 (m, 4H), 7.48–7.35 (m, 10H), 6.88 (td, $J = 8.8$ Hz, $J = 2.4$ Hz, 2H), 7.04 (brs, 1H) ppm. ^{13}C NMR (100 MHz, CDCl_3): $\delta = 151.5, 143.6, 140.5, 129.5, 129.2, 128.1, 127.6, 123.9, 119.5, 114.3$ ppm.

(4-Methoxy-phenyl)-carbamic acid [1,1',3',1'']terphenyl-5'-yl ester (17).

Yield: 300 mg, 93%. ^1H NMR (400 MHz, CDCl_3): $\delta = 7.67$ –7.59 (m, 5H), 7.47–7.35 (m, 10H), 6.88 (d, $J = 8.8$ Hz, 2H), 4.08 (brs, 1H), 3.85 (s, 3H) ppm. ^{13}C NMR (100 MHz,

CDCl₃): δ = 151.6, 143.1, 140.3, 128.8, 127.8, 127.2, 123.1, 120.8, 119.3, 114.3, 55.5 ppm.

Ethyl-carbamic acid [1,1',3',1'']terphenyl-5'-yl ester (18).

Yield: 240 mg, 93%. ¹H NMR (400 MHz, CDCl₃): δ = 7.62–7.55 (m, 5H), 7.48–7.40 (m, 4H), 7.39–7.32 (m, 4H), 5.08 (brs, 1H), 3.38–3.29 (m, 2H), 1.24 (t, J = 7.2 Hz, 3H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 152.1, 143.2, 140.7, 129.1, 129.0, 127.9, 127.8, 127.6, 127.5, 123.3, 119.6, 36.5, 15.4 ppm.

Propyl-carbamic acid [1,1',3',1'']terphenyl-5'-yl ester (19).

Yield: 180 mg, 66%. ¹H NMR (400 MHz, CDCl₃): δ = 7.65–7.60 (m, 5H), 7.46–7.41 (m, 4H), 7.38–7.32 (m, 4H), 5.12 (brs, 1H), 3.27–3.20 (m, 2H), 1.64–1.55 (m, 2H), 0.95 (t, J = 8.3 Hz, 3H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 152.1, 143.2, 140.7, 129.1, 128.0, 127.6, 127.5, 123.3, 119.6, 43.3, 23.4, 11.6 ppm.

Butyl-carbamic acid [1,1',3',1'']terphenyl-5'-yl ester (20).

Yield: 240 mg, 85%. ¹H NMR (400 MHz, CDCl₃): δ = 7.63–7.60 (m, 5H), 7.46–7.39 (m, 4H), 7.38–7.33 (m, 4H), 5.08 (brs, 1H), 3.31–3.24 (m, 2H), 1.60–1.53 (m, 2H), 1.44–1.35 (m, 2H), 0.95 (t, J = 7.2 Hz, 3H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 154.6, 143.0, 140.4, 129.5, 128.8, 127.7, 127.3, 127.2, 124.0, 123.0, 119.2, 41.0, 31.9, 19.9, 13.7 ppm.

Pentyl-carbamic acid [1,1',3',1'']terphenyl-5'-yl ester (21).

Yield: 130 mg, 89%. ¹H NMR (400 MHz, CDCl₃): δ = 7.66–7.61 (m, 5H), 7.45–7.40 (m, 4H), 7.38–7.31 (m, 4H), 5.10 (brs, 1H), 3.30–3.21 (m, 2H), 1.63–1.52 (m, 2H), 1.41–1.28 (m, 4H), 0.91 (t, J = 6.4 Hz, 3H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 152.0, 143.2, 140.7, 129.0, 128.1, 127.9, 127.5, 127.2, 123.2, 123.0, 119.5, 41.6, 31.9, 29.8, 22.6, 14.2 ppm.

Isopropyl-carbamic acid [1,1',3',1'']terphenyl-5'-yl ester (22).

Yield: 174 mg, 65%. M.p.: 160 °C. ¹H NMR (200 MHz, CDCl₃): δ = 7.67–7.64 (m, 4H), 7.50–7.36 (m, 9H), 7.39–7.32 (m, 4H), 4.97 (m, 1H), 4.00–3.90 (m, 1H), 1.27 (d, J = 6.6 Hz, 6H) ppm. ¹³C NMR (50 MHz, CDCl₃): δ = 151.6, 142.8, 140.3, 130.0, 128.7, 127.6, 127.2, 122.9, 119.2, 98.0, 43.4, 22.8 ppm. MS (ES⁺): 332 (MH⁺).

tert-Butyl-carbamic acid [1,1',3',1'']terphenyl-5'-yl ester (23).

Yield: 200 mg, 71%. M.p.: 139 °C. ¹H NMR (200 MHz, CDCl₃): δ = 7.66–7.63 (m, 5H), 7.49–7.35 (m, 8H), 5.06 (m, 1H), 1.43 (s, 9H) ppm. ¹³C NMR (50 MHz, CDCl₃): δ = 151.5, 142.8, 140.4, 128.7, 127.5, 127.2, 122.8, 119.3, 28.7 ppm.

Cyclopentyl-carbamic acid [1,1',3',1'']terphenyl-5'-yl ester (24).

Yield: 197 mg, 68%. M.p.: 136 °C. ¹H NMR (200 MHz, CDCl₃): δ = 7.67–7.64 (m, 4H), 7.51–7.38 (m, 9H), 5.18–5.14 (m, 1H), 4.16–4.10 (m, 1H), 2.07–2.04 (m, 2H), 1.70–1.30 (m, 6H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 153.9, 151.7, 142.8, 140.3, 128.7, 127.6, 127.2, 122.9, 119.2, 53.0, 33.1, 23.9 ppm.

Cyclohexyl-carbamic acid [1,1',3',1'']terphenyl-5'-yl ester (25).

Yield: 139 mg, 70%. ¹H NMR (400 MHz, CDCl₃): δ = 7.74–7.64 (m, 5H), 7.54–7.47 (m, 4H), 7.45–7.39 (m, 4H), 5.13 (t, J = 7.6 Hz, 1H), 3.74–3.60 (m, 1H), 2.17–2.02 (m, 2H), 1.85–1.53 (m, 3H), 1.48–1.20 (m, 5H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 154.0, 152.1, 143.2, 140.7, 129.7, 129.0, 128.2, 127.9, 127.5, 123.1, 119.6, 50.5, 33.5, 25.7, 25.0 ppm.

4-Chloro-1,1',3',1''-terphenyl-5'-yl cyclopentylcarbamate (34).

Yield: 149 mg, 73%. ¹H NMR (400 MHz, CDCl₃): δ = 7.60 (d, *J* = 7.6 Hz, 2H), 7.56 (s, 1H), 7.54 (d, *J* = 8.4 Hz, 2H), 7.47–7.38 (m, 5H), 7.34 (s, 1H), 7.30 (s, 1H), 5.06 (d, *J* = 7.2 Hz, 1H), 4.12–4.04 (m, 2H), 2.08–1.98 (m, 2H), 1.78–1.61 (m, 4H), 1.57–1.47 (m, 2H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 152.2, 144.5, 141.2, 139.7, 137.7, 133.0, 129.2, 129.1, 128.8, 128.1, 127.6, 123.1, 119.9, 119.5, 53.4, 33.5, 23.9 ppm.

4,4''-Dichloro-1,1',3',1''-terphenyl-5'-yl cyclopentylcarbamate (35).

Yield: 118 mg, 88%. ¹H NMR (400 MHz, CDCl₃): δ = 7.54 (s, 1H), 7.52 (d, *J* = 8.0 Hz, 4H), 7.40 (d, *J* = 8.0 Hz, 4H), 7.30 (s, 2H), 5.06 (d, *J* = 7.2 Hz, 1H), 4.12–4.04 (m, 2H), 2.10–1.99 (m, 2H), 1.78–1.60 (m, 4H), 1.57–1.47 (m, 2H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 152.2, 142.2, 139.0, 134.2, 129.3, 128.8, 122.8, 119.8, 53.4, 33.5, 23.9 ppm.

3,4-Dichloro-1,1',3',1''-terphenyl-5'-yl cyclopentylcarbamate (36).

Yield: 130 mg, 87%. ¹H NMR (400 MHz, CDCl₃): δ = 7.45 (d, *J* = 7.6 Hz, 1H), 7.65–7.52 (m, 3H), 7.50–7.34 (m, 6H), 7.28 (s, 1H), 5.07 (d, *J* = 6.4 Hz, 1H), 4.10–4.01 (m, 2H), 2.10–1.98 (m, 2H), 1.75–1.62 (m, 4H), 1.56–1.46 (m, 2H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 152.2, 140.5, 139.2, 137.7, 136.7, 132.5, 132.0, 131.1, 130.6, 129.7, 129.3, 128.5, 127.5, 123.1, 119.5, 119.4, 53.4, 33.5, 23.9 ppm.

3,3'',4,4''-Tetrachloro-1,1',3',1''-terphenyl-5'-yl cyclopentylcarbamate (37).

Yield: 200 mg, 70%. ¹H NMR (400 MHz, CDCl₃): δ = 7.68 (d, *J* = 2.0 Hz, 2H), 7.54–7.49 (m, 2H), 7.46 (s, 1H), 7.43–7.38 (m, 2H), 7.34 (d, *J* = 1.0 Hz, 2H), 5.07 (d, *J* = 7.2 Hz, 1H), 4.12–4.03 (m, 2H), 2.09–2.01 (m, 2H), 1.78–1.62 (m, 4H), 1.57–1.47 (m, 2H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 152.4, 141.1, 140.3, 133.3, 132.4, 131.1, 129.3, 126.8, 122.7, 120.3, 53.5, 33.5, 23.9 ppm.

4-Methoxy-1,1',3',1''-terphenyl-5'-yl cyclopentylcarbamate (38).

Yield: 220 mg, 68%. ¹H NMR (400 MHz, CDCl₃): δ = 7.66 (d, *J* = 7.2 Hz, 2H), 7.62 (s, 1H), 7.60 (d, *J* = 8.8 Hz, 2H), 7.48 (t, *J* = 7.2 Hz, 2H), 7.39 (t, *J* = 7.2 Hz, 1H), 7.33 (s, 2H), 7.01 (d, *J* = 8.8 Hz, 2H), 5.09 (d, *J* = 7.6 Hz, 1H), 4.17–4.10 (m, 2H), 3.92 (s, 3H), 2.09–1.99 (m, 2H), 1.76–1.62 (m, 4H), 1.56–1.47 (m, 2H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 156.5, 152.5, 141.5, 140.2, 138.7, 136.7, 129.0, 128.6, 127.9, 127.6, 122.9, 119.1, 119.0, 114.5, 55.7, 53.4, 33.5, 23.9 ppm.

4,4''-Dimethoxy-1,1',3',1''-terphenyl-5'-yl cyclopentylcarbamate (39).

Yield: 142 mg, 86%. ¹H NMR (400 MHz, CDCl₃): δ = 7.56 (s, 1H), 7.54 (d, *J* = 8.8 Hz, 4H), 7.24 (s, 2H), 6.90 (d, *J* = 8.8 Hz, 4H), 5.02 (d, *J* = 7.6 Hz, 1H), 4.12–4.04 (m, 2H), 3.85 (s, 6H), 2.09–2.01 (m, 2H), 1.77–1.62 (m, 4H), 1.57–1.48 (m, 2H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 158.2, 152.7, 140.2, 138.0, 132.2, 131.3, 128.7, 118.6, 114.5, 55.6, 53.5, 33.5, 23.9 ppm.

4-Methyl-1,1',3',1''-terphenyl-5'-yl cyclopentylcarbamate (40).

Yield: 140 mg, 75%. ¹H NMR (400 MHz, CDCl₃): δ = 7.65–7.58 (m, 3H), 7.52 (d, *J* = 8.0 Hz, 2H), 7.43 (t, *J* = 7.6 Hz, 2H), 7.37–7.30 (m, 3H), 7.24 (d, *J* = 8.0 Hz, 2H), 5.06 (d, *J* = 7.6 Hz, 1H), 4.12–4.05 (m, 2H), 2.38 (s, 3H), 2.08–1.99 (m, 2H), 1.75–1.59 (m, 4H), 1.54–1.46 (m, 2H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 156.5, 152.0, 143.1, 140.8, 137.8, 137.7, 129.8, 129.0, 127.9, 127.6, 127.4, 123.0, 119.4, 119.3, 53.3, 33.5, 23.8, 21.4 ppm.

4,4''-Dimethyl-1,1',3',1''-terphenyl-5'-yl cyclopentylcarbamate (41).

Yield: 215 mg, 82%. ¹H NMR (400 MHz, CDCl₃): δ = 7.59 (s, 1H), 7.51 (d, *J* = 8.0 Hz, 4H), 7.29 (s, 2H), 7.24 (d, *J* = 8.0 Hz, 4H), 5.04 (d, *J* = 6.8 Hz, 1H), 4.12–4.03 (m, 2H),

2.39 (s, 6H), 2.08–1.98 (m, 2H), 1.77–1.60 (m, 4H), 1.57–1.47 (m, 2H) ppm. ^{13}C NMR (100 MHz, CDCl_3): δ = 152.0, 143.1, 137.9, 129.8, 127.4, 127.3, 122.9, 119.1, 53.3, 33.5, 23.9, 21.4 ppm.

Cyclopentanecarboxylic acid [1,1',3',1'']terphenyl-5'-yl ester (26).

To a solution of cyclopentanecarboxylic acid (1.95 mmol, 0.18 mL) in dichloromethane, Et_3N (1.95 mmol, 0.27 mL) was added and stirred for 15 min. To it, EDAC (0.21 mmol, 400 mg) and HOBt (0.21 mmol, 290 mg) were added followed by [1,1',3',1'']terphenyl-5'-ol (**6**) (1.62 mmol, 400 mg) and Et_3N (1.62 mmol, 0.23 mL). The reaction mixture was then stirred at ambient temperature for 24 h. Upon completion (TLC), the reaction mixture was diluted with dichloromethane (100 mL), washed with water, brine, dried over anhydrous Na_2SO_4 and evaporated under reduced pressure. The crude compound was purified by flash column chromatography (EtOAc/petroleum ether, 1:5) to afford the desired product as colorless solid (130 mg, 24%). ^1H NMR (400 MHz, CDCl_3): δ = 7.65 (s, 1H), 7.62 (d, J = 7.6 Hz, 4H), 7.44 (t, J = 7.6 Hz, 4H), 7.36 (t, J = 7.6 Hz, 2H), 7.28 (s, 2H), 3.07–2.98 (m, 1H), 2.08–1.96 (m, 4H), 1.83–1.75 (m, 2H), 1.71–1.62 (m, 2H) ppm. ^{13}C NMR (100 MHz, CDCl_3): δ = 152.0, 143.4, 140.6, 129.1, 128.0, 127.6, 123.7, 119.5, 44.2, 30.4, 26.2 ppm.

1,3-Dibromo-5-nitro-benzene (28).

To a solution of sodium nitrite (2.07 g, 30 mmol) in concentrated sulfuric acid (20 mL) was added slowly a suspension of 2,6-dibromo-4-nitroaniline (**27**) (6 g, 20 mmol) in glacial acetic acid (74 mL), maintaining an internal temperature below 20 °C. After stirring for 30 min, the resulting diazonium salt was then slowly added to a suspension of cuprous oxide (0.24 g, 3 mmol) in 95% ethanol (55 mL). After stirring overnight, the mixture was quenched with water (10 mL). The organic layer was separated, washed with saturated NaHCO_3 , dried over anhydrous Na_2SO_4 , filtered, and concentrated to afford a brown solid. The aqueous layer from the extracts was diluted, in portions, into 4 times the volume of water, causing precipitation of additional product which was collected by suction filtration. The combined lot of crude product was purified by flash column chromatography (dichloromethane/petroleum ether, 3:2) to afford analytically pure title compound as pale yellow solid (2.4 g, 42%). ^1H NMR (400 MHz, CDCl_3): δ = 8.40 (s, 2H), 8.00 (s, 1H) ^{13}C NMR (100 MHz, CDCl_3): δ = 151.2, 140.4, 125.9, 123.8 ppm.

5'-Nitro-[1,1',3',1'']terphenyl (29).

To a stirred solution of 1,3-dibromo-5-nitro-benzene (**28**) (5.33 mmol, 1.5 g) in toluene (50 mL), phenylboronic acid (16 mmol, 1.95 g), $(\text{Ph}_3\text{P})_4\text{Pd}$ (5 mol.%, 310 mg), and 2 M aq. solution of Na_2CO_3 (16 mmol, 1.7 g) was added and refluxed for 16 h. The progress of the reaction was monitored by TLC. Upon completion, the reaction was cooled to ambient temperature, diluted with EtOAc (400 mL), washed with water, brine, dried over anhydrous Na_2SO_4 and evaporated under reduced pressure. The crude compound was purified by flash column chromatography (EtOAc/petroleum ether, 1:19) to yield the title compound as lemon colored fluffy solid (800 mg, 54%).

[1,1',3',1'']Terphenyl-5'-ylamine (30).

A homogeneous solution of 3,5-diphenyl-nitrobenzene (**29**) (500 mg, 1.81 mmol) and anhydrous stannous chloride (1.72 g, 9 mmol) in EtOH (5 mL) was heated at 70 °C for 30 min under N_2 . Upon cooling, the solvent was removed under reduced pressure and the residue diluted with excess 20–30% aqueous NaOH. The aqueous layer was extracted with dichloromethane (3 x 50 mL). The combined organic extracts were washed with

brine, dried over anhydrous NaSO₄, filtered, and concentrated under reduced pressure. The crude compound was purified by flash column chromatography (EtOAc/petroleum ether, 1:5) to afford colorless solid of analytically pure title compound (250 mg, 56%). ¹H NMR (400 MHz, CDCl₃): δ = 7.61 (d, *J* = 7.6 Hz, 4H), 7.42 (t, *J* = 7.2 Hz, 4H), 7.33 (t, *J* = 7.2 Hz, 2H), 7.20 (s, 1H), 6.95 (s, 2H), 3.78 (brs, 2H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 147.4, 143.2, 141.7, 129.0, 127.7, 127.5, 117.3, 113.2 ppm.

Cyclopentanecarboxylic acid [1,1',3',1'']terphenyl-5'-yl amide (31).

To a solution of cyclopentanecarboxylic acid (1.47 mmol, 0.16 mL) in dichloromethane, Et₃N (1.47 mmol, 0.21 mL) and ethyl chloroformate (1.47 mmol, 0.14 mL) was added and stirred for 30 min at 0 °C. To it, [1,1',3',1'']terphenyl-5'-yl amine (**30**) (1.22 mmol, 300 mg) and Et₃N (1.22 mmol, 0.17 mL) was added and stirred at ambient temperature for 6 h. Upon completion (TLC), the reaction mixture was diluted with dichloromethane (100 mL), washed with water, brine, dried over anhydrous Na₂SO₄ and evaporated under reduced pressure. The crude compound was purified by flash column chromatography (EtOAc/petroleum ether, 1:4) to afford the desired product as colorless solid (205 mg, 60%). ¹H NMR (400 MHz, CDCl₃): δ = 7.81 (s, 2H), 7.61 (d, *J* = 7.2 Hz, 4H), 7.53 (s, 1H), 7.41 (t, *J* = 7.4 Hz, 4H), 7.34 (t, *J* = 7.2 Hz, 2H), 2.75–2.69 (m, 1H), 2.01–1.86 (m, 4H), 1.84–1.72 (m, 2H), 1.64–1.55 (m, 2H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 142.8, 141.0, 139.3, 129.1, 127.9, 127.6, 122.1, 117.8, 47.2, 30.9, 26.4 ppm.

Cyclopentyl-3-[1,1',3',1'']terphenyl-5'-yl-urea (32).

Triethylamine (0.98 mmol, 0.13 μL) was added to a stirred solution of [1,1',3',1'']terphenyl-5'-yl amine (**30**) (0.81 mmol, 200 mg) in anhydrous dichloromethane and stirred at ambient temperature for 15 min. To it, cyclopentyl isocyanate (1.22 mmol, 138 μL) was added and stirred for another 18 h at ambient temperature. Upon completion (TLC), the reaction mixture was diluted with dichloromethane (100 mL), washed with water, brine, dried over anhydrous Na₂SO₄ and evaporated under reduced pressure. The crude compound was purified by flash column chromatography (EtOAc/petroleum ether, 1:5) to get the titled compound (200 mg, 69%). The column purified carbamate was crystallized using dichloromethane and petroleum ether. ¹H NMR (400 MHz, CDCl₃): δ = 7.72–7.58 (m, 6H), 7.49–7.31 (m, 7H), 5.82 (d, *J* = 6.4 Hz, 1H), 4.18–4.10 (m, 1H), 2.07–1.91 (m, 2H), 1.74–1.57 (m, 4H), 1.51–1.39 (m, 2H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 156.5, 142.5, 141.1, 138.2, 128.8, 127.5, 127.2, 120.2, 116.8, 49.0, 33.4, 23.6 ppm.

Cyclopentyl-carbamic acid biphenyl-3-yl ester (33).

The title compound was synthesized from commercially available 3-phenylphenol using the general method for carbamate synthesis. Yield: 279 mg, 81%. ¹H NMR (400 MHz, CDCl₃): δ = 7.57 (d, *J* = 7.2 Hz, 2H), 7.47–7.39 (m, 4H), 7.37–7.31 (m, 2H), 7.11 (s, 1H), 4.10–4.02 (m, 1H), 2.08–1.98 (m, 2H), 1.70–1.56 (m, 4H), 1.52–1.46 (m, 2H) ppm. ¹³C NMR (100 MHz, CDCl₃): δ = 142.8, 138.2, 129.7, 129.0, 128.9, 127.8, 127.7, 127.4, 124.1, 120.6, 53.2, 33.4, 23.8 ppm.

Combustion analysis

nr.	Code	Mol. Formula	Calculated			Found		
			C%	H%	N%	C%	H%	N%
4	LUF5769	C ₂₅ H ₁₉ NO ₂	82.17	5.24	3.83	82.14	5.24	3.92
16	LUF6197	C ₂₅ H ₁₈ ClNO ₂	75.09	4.54	3.50	74.82	4.91	3.57
17	LUF6198	C ₂₆ H ₂₁ NO ₃	78.97	5.35	3.54	78.62	5.51	3.54
18	LUF6196	C ₂₁ H ₁₉ NO ₂ ·0.5 H ₂ O	77.27	6.17	4.29	77.52	6.42	4.45
19	LUF6195	C ₂₂ H ₂₁ NO ₂ ·0.5 H ₂ O	77.62	6.51	4.11	77.75	6.76	4.27
20	LUF6194	C ₂₃ H ₂₃ NO ₂ ·0.5 H ₂ O	77.93	6.82	3.95	78.09	7.06	4.12
21	LUF6193	C ₂₄ H ₂₅ NO ₂ ·0.5 H ₂ O	78.23	7.11	3.80	77.85	7.44	4.00
22	LUF5770	C ₂₂ H ₂₁ NO ₂	79.21	6.42	4.20	79.20	6.77	4.28
23	LUF5772	C ₂₃ H ₂₁ NO ₂ ·0.14 H ₂ O	79.39	6.79	4.03	79.39	6.84	4.14
24	LUF5771	C ₂₄ H ₂₃ NO ₂	80.16	6.51	3.89	80.42	6.83	4.00
25	LUF6192	C ₂₅ H ₂₅ NO ₂ ·0.5 H ₂ O	78.91	6.88	3.68	78.52	6.54	3.72
33	LUF6226	C ₁₈ H ₁₉ NO ₂	76.84	6.81	4.98	76.84	7.18	5.05
34	LUF6224	C ₂₂ H ₂₂ ClNO ₂	73.56	5.66	3.05	73.21	6.03	3.46
35	LUF6221	C ₂₄ H ₂₁ Cl ₂ NO ₂ ·0.5 H ₂ O	66.21	5.09	3.21	66.62	5.45	3.16
37	LUF6222	C ₂₄ H ₁₉ Cl ₄ NO ₂ ·0.5 H ₂ O	57.16	3.99	2.77	57.13	3.98	2.70
38	LUF6219	C ₂₅ H ₂₅ NO ₃	77.49	6.50	3.61	77.39	6.77	3.51
39	LUF6223	C ₂₆ H ₂₇ NO ₄	74.80	6.52	3.35	77.42	6.87	3.29
40	LUF6218	C ₂₅ H ₂₅ NO ₂	80.83	6.78	3.77	80.74	7.09	3.85
41	LUF6220	C ₂₆ H ₂₇ NO ₂ ·0.5 H ₂ O	79.15	7.15	3.52	78.68	7.27	3.55