$CoFe_2O_4/Cu(OH)_2$ magnetic nanocomposite: an efficient and reusable heterogeneous catalyst for one-pot synthesis of *β*-hydroxy-1,4-disubstituted-1,2,3-triazoles from epoxides

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Spectral data for *β*-hydroxy-1,2,3-triazoles **(1-21)b** are presented as following:

2-Phenyl-2-(4-phenyl-1*H*-1,2,3-triazol-1-yl)ethanol (**1b**) [23]

Pale yellow solid: m.p. 125.5-127.0 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.26 (s, 1H, NCH=C), 7.86 (d, J = 7.3 Hz, 2H, Ar-H), 7.44 (t, J = 7.3 Hz, 2H, Ar-H), 7.40-7.31 (m, 6H, Ar-H), 5.80 (dd, J = 8.7, 4.7 Hz, 1H, CHN), 4.46-4.36, 4.21-4.12 (2 m, 2H, CH_2), 3.40 (t, J = 6.5 Hz, 1H, OH); ^{13}C NMR (100 MHz, $CDCl_3$) δ 147.8 (=CN), 138.1, 131.9 (2 × ArC), 129.9, 129.8, 129.5, 128.9, 128.2, 126.4 (10 × ArCH), 121.6 (NCH=), 67.6 ($CHCH_2$), 64.7 (CH_2); FT-IR (KBr) ν/cm^{-1} 685, 700, 713, 757, 1026, 1050, 1079, 1148, 1212, 1361, 1436, 1457, 1497, 2939, 3032, 3087, 3123, 3478; MS (70 eV) m/z (%) 265 (22) [M+], 207 (14), 206 (86), 178 (17), 146 (10), 117 (30), 116 (100), 104 (42), 103 (40), 102 (17), 91 (17), 90 (11), 89 (27), 77 (26).

2-(4-Phenyl-1*H*-1,2,3-triazol-1-yl)-1-*p*-tolylethanol (**2b**) [30]

Yellow solid: m.p. 124.0-126.0 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69-7.66 (m, 3H, 2 × Ar-H, NCH=C), 7.39 (m, 3H, Ar-H), 7.27-7.21 (m, 3H, Ar-H), 5.68-5.66 (dd, J = 8 Hz, 3.2 Hz, 1H, $CHCH_2$), 4.66-4.61 (dd, J = 12.6, 8.4 Hz, 1H, CH_2), 4.24-4.20 (dd, J = 9, 3.6 Hz, 1H, CH_2), 2.38 (s, 3H, CH_3), 2.36 (t, J = 2.8 Hz, 1H, OH); FT-IR (KBr) ν/cm^{-1} 696, 724, 755, 1047, 1075, 1008, 1185, 1220, 1380, 1457, 1496, 2927, 3029, 3092, 3418.

2-(4-Chlorophenyl)-2-(4-phenyl-1*H*-1,2,3-triazol-1-yl)ethanol (**3b**) [23]

White solid: m.p. 139.6-142.1 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (s, 1H, NCH=C), 7.8 (d, J = 7.5 Hz, 2H, Ar-H), 7.46-7.27 (m, 7H, Ar-H), 5.76 (dd, J = 9.0, 3.0 Hz, 1H, $CHCH_2$), 4.39-4.27, 4.17-4.07 (2 m, 2H, CH_2), 3.38 (t, J = 6.0 Hz, 1H, OH); ^{13}C NMR (100 MHz, $CDCl_3$) δ 148.0 (=CN), 137.0, 134.8, 131.9 (3 × ArC), 130.1, 129.8, 129.7, 129.0, 126.4 (9 × ArCH), 121.7 (NCH=), 66.8 ($CHCH_2$), 64.6 (CH_2); FT-IR (KBr) ν/cm^{-1} 691, 730, 764, 819, 1015, 1050, 1092, 1223, 1432, 1460, 1492, 2938, 3085, 3331; MS (70 eV) m/z (%): 301 (4) [M^+ +2], 299 (13) [M^+], 242 (16), 240 (41), 138 (18), 137 (10), 117 (23), 116 (100), 102 (18), 91 (15), 89 (23); HRMS (EI) m/z calcd for $C_{16}H_{14}ClN_3O$ 299.0825, found 299.0830.

1-Phenoxy-3-(4-phenyl-1*H*-1,2,3-triazol-1-yl)propan-2-ol (**4b**) [23]

Pale yellow solid: m.p. 125.0-127.0 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.15 (s, 1H, NCH=C), 7.86 (d, J = 7.5 Hz, 2H, Ar-H), 7.44 (td, J = 7.5, 1.6 Hz, 2H, Ar-H), 7.40-7.17 (m, 3H, Ar-H), 7.08-6.72 (m, 3H, Ar-H), 4.66 (dd, J = 14.1, 3.8 Hz, 1H, CHHN), 4.52 (dd, J = 14.1, 7.6 Hz, 1H, CHHN), 4.43-4.27 (m, 1H, CHO), 4.09-3.87 (m, 2H, CH_2O), 3.75 (d, J = 5.4 Hz, 1H, OH); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.6 (=CN), 147.8, 132.1 (2 × ArC), 130.5, 129.9, 128.9, 126.3, 122.8, 122.0 (10 × ArCH), 115.5 (NCH=), 70.1 (CH_2O), 69.5 (CHO), 53.9 (CH_2N); FT-IR (KBr) ν/cm^{-1} 691, 755, 982, 1043, 1245, 1494, 1595, 2867, 2927, 3087, 3429. ESI-MS: *m/z* 296 $(M+H)^+$. HRMS calctd. For 296.1393 found 296.1389. $C_{17}H_{18}O_2N_3$.

1-(4-Methoxyphenoxy)-3-(4-phenyl-1*H*-1,2,3-triazol-1-yl)propan-2-ol (**5b**)[29]

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (s, 1H, NCH=C), 7.76 (d, 2H, J = 6.9 Hz, Ar-H), 7.47-7.21 (m, 3H, Ar-H), 6.85 (s, 4H, Ar-H), 4.70 (dd, J = 13.4, 2.8 Hz, 1H, CHO), 4.63-4.40 (m, 2H, CH_2O), 4.10-3.91 (m, 2H, CH_2N), 3.76 (3H, s, CH_3), 3.52 (d, J = 4.7 Hz, 1H, OH); ^{13}C NMR (100 MHz, $CDCl_3$) δ 154.3, 152.1 (2 × ArC), 147.6 (NC=), 130.2, 128.8, 128.1, 125.6 (8 × ArC), 121.2 (NCH=), 115.5, 114.7 (2 × ArC), 69.5 (CH_2O), 68.9 (CHO), 53.7 (OCH_3), 53.0 (CH_2N); ESI-MS: *m/z* 326 $(M+H)^+$. HRMS calctd. For 326.1499 found 326.1492. $C_{18}H_{20}O_2N_3$.

1-(4-Phenyl-1*H*-1,2,3-triazol-1-yl)-3-(o-tolyloxy)propan-2-ol (**6b**)[29]

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (s, 1H, NCH=C), 7.72-7.59 (m, 2H, Ar-H), 7.36-7.27 (m, 3H, Ar-H), 7.14 (t, J = 7.3 Hz, 2H, Ar-H), 6.89 (t, J = 7.3 Hz, 1H, Ar-H), 6.80 (d, J = 8.3 Hz, 1H, Ar-H), 4.72 (dd, J = 13.7, 1.8 Hz, 1H, CHO), 4.57-4.48 (m, 2H, CH_2O), 4.05 (d, J = 5.4 Hz, 2H, CH_2N), 2.25 (s, 3H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) δ, 156.1 (NC=), 147.1(ArC), 130.7 (NCH=), 129.9, 128.7, 128.0, 126.8, 126.5, 125.3, 121.4, 121.0, 111.0 (11

× ArC), 68.9 (CH_2O), 68.7 (CHO), 53.5 (CH_2N), 16.2 (CH_3); ESI-MS: *m/z* 310 $(M+H)^+$. HRMS calctd. For 310.1550 found 310.1543. $C_{18}H_{20}O_2N_3$.

2-Hydroxy-3-(4-phenyl-1*H*-1,2,3-triazol-1-yl)propyl methacrylate (7b)

Yellow solid: m.p. 104-108 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (s, 1H, NCH=C), 7.66-7.64 (d, 2H, Ar-H), 7.34-7.31 (m, 2H, Ar-H), 7.28-7.25 (m, 1H, Ar-H), 4.48-4.34 (m, 2H, CH_2=C), 4.16-4.12 (dd, 2H, *J* = 14.0, 6.1, CH_2O), 3.66 (m, 1H, CH-O), 3.57 (m, 2H, CH_2N), 3.33 (d, *J* = 4.9, 1H, OH), 2.05 (s, 3H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) δ 147.4 (C=O), 131.6 (NC=), 129.9 (C=C), 128.8 (Ar-C, NCH=), 128.6 (2 × ArCH), 128.3 (Ar-CH), 125.5 (2 × ArCH), 121.6 (=CH_2), 70.9, 70.6, 63.9, 63.6; FT-IR (KBr) ν/cm^{-1} 692, 762, 916, 1042, 1092, 1214, 1366, 1454, 1611, 1719, 2102, 2859, 2925, 3090, 3396, 3467.

3-Isoproxy-2-(4-phenyl-1*H*-1,2,3-triazol-1-yl)propan-1-ol (8b)[30]

Yellow solid: m.p. 61.0-63.0 °C. ^{1}H NMR (400 MHz, $CDCl_3$) *δ* 7.91 (s, 1H, NCH=C), 7.79-7.77 (m, 2H, Ar-H), 7.42-7.38 (m, 2H, Ar-H), 7.34-7.30 (m, 1H, Ar-H), 4.59 (dd, *J* = 10.3, 3.6 Hz, 1H, CH_2N), 4.49-4.42 (m, 1H, CH_2N), 4.24-4.17 (m, 1H, CHO), 3.61 (quint, *J* = 12.2, 6.1 Hz, 1H, CHO), 3.51 (dd, *J* = 9.6, 4.5 Hz, 1H, CH_2O), 3.39-3.34 (m, 1H, CH_2O), 1.25 (s, 1H, OH), 1.17 (d, *J* = 6.1 Hz, 6H, $2CH_3$); ^{13}C NMR (400 MHz, $CDCl_3$) *δ* 131.5 (NC=), 130.3 (ArC), 129.9 (=CHN), 129.2 (2 × ArCH), 126.7 (ArCH), 122.4 (2 × ArCH), 73.5 (CHO), 70.4 (CH_2O), 70.1 (COH), 54.4 (CH_2N), 23.1 (2 × CH_3); FT-IR (KBr) ν/cm^{-1} 695, 765, 924, 975, 1078, 1127, 1228, 1373, 1468, 2866, 2973, 3062, 3138, 3425.

1-(Allyloxy)-3-(4-phenyl-1*H*-1,2,3-triazol-1-yl)propan-2-ol (9b)[38]

White solid: m.p. 71.5-72.0 °C. ^{1}H NMR ($CDCl_3$, 400 MHz) *δ* 7.91 (s, 1H, NCH=C), 7.82 (d, *J* = 8.0 Hz, 2H, Ar-H), 7.43 (t, *J* = 7.5 Hz, 2H, Ar-H), 7.34 (t, *J* = 7.0 Hz, 1H, Ar-H), 5.90 (ddd, *J* = 16.0, 10.5, 5.5 Hz, 1H, =CH), 5.29 (d, *J* = 17.0 Hz, 1H, =CH_2), 5.23 (d, *J* = 10.5 Hz, 1H, =CH_2), 4.61 (dd, *J* = 14.0, 3.5 Hz, 1H, =CCH_2O), 4.47 (dd, *J* = 14.0, 7.0 Hz, 1H, =CCH_2O), 4.27 (d, *J* = 4.0 Hz, 1H, OH), 4.03 (d, *J* = 5.5 Hz, 2H, CH_2O), 3.54 (dd, *J* = 9.5, 4.5 Hz, 1H, CHO), 3.41 (dd, *J* = 9.5, 6.0 Hz, 1H, CH_2N), 3.00 (d, *J* = 4.5 Hz, 1H, CH_2N); ^{13}C NMR ($CDCl_3$, 100 MHz) *δ* 147.5 (NC=), 134.1 (=CH), 130.4, ArC), 128.8 (=CHN), 128.1 (2 × ArCH), 125.6 (ArCH), 121.3 (2 × ArCH), 117.8 (=CH_2), 72.5 (CH_2O), 71.0 (CH_2O), 69.2 (COH), 53.2 (CH_2N); FT-IR (KBr) ν/cm^{-1} 3385, 3010, 2930, 1471, 1350, 1136, 1089, 981, 871, 767, 696; ESI-MS: m/z = 260 $(M+1)^+$.

1-(4-Phenyl-1*H*-1,2,3-triazol)hexan-2-ol (**10b**)[30]

Cream solid: m.p. 92.0 -94.0 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (s, 1H, NCH=C), 7.77-7.75 (m, 2H, Ar-H), 7.42-7.40 (m, 2H, Ar-H), 7.34-7.32 (m, 1H, Ar-H), 4.52-4.49 (m, 2H, CH_2N), 4.29-4.24 (m, 1H, CHO), 4.15-4.13 (m, 1H, OH), 1.57-1.51 (m, 3H, CH_2), 1.44-1.37 (m, 3H, CH_2), 0.95-0.92 (t, 3H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) δ 147.2 (NC=), 130.3 (ArC), 128.7 (=CHN), 128.0 (2 × ArCH), 125.5 (ArCH), 121.1 (2 × ArCH), 70.4 (COH), 56.3 (CH_2N), 34.1(CH_2), 28.0 (CH_2), 22.5 (CH_2), 13.9 (CH_3); FT-IR (KBr) ν/cm^{-1} 694, 764, 1087, 1138, 1227, 1463, 2862, 2925, 2959, 3141, 3248, 3408.

2-Hydroxy-3-(4-phenyl-1*H*-1,2,3-triazol-1-yl)propyl acrylate (**11b**)[30]

Livid solid: m.p. 101.0-103.0 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (s, 1H, NCH=C), 7.79-7.77 (m, 1H, Ar-H), 7.43-7.40 (m, 2H, Ar-H), 7.35-7.31 (m, 2H, Ar-H), 7.02-6.99 (t, 1H, =CH), 6.93-6.91 (m, 2H, =CH_2), 4.22 (m, 1H, OH), 3.64-3.58 (m, 1H, CHO), 4.07-3.98 (m, 2H, CH_2O), 3.38-3.37 (m, 2H, CH_2N); ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.2 (C=O), 147.2 (=CN), 130.1 (=CH_2), 129.6 (ArC), 128.8 (=CHN), 128.1, 125.5, 121.6, 121.4, 121.1 (5 × ArCH), 114.5 (=CH), 68.9 (CH_2O), 68.7 (COH)), 53.5 (CH_2N). FT-IR (KBr) ν/cm^{-1} 692, 756, 1044, 1246, 1494, 1596, 2925, 3087, 3425.

1-(4-phenyl-1*H*-1,2,3-triazol-1-yl)butan-2-ol (**12b**)[30]

White solid: m.p. 110.0-111.0 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (s, 1H, NCH=C), 7.81-7.79 (m, 2H, Ar-H), 7.44-7.40 (m, 2H, Ar-H), 7.34 (m, 1H, Ar-H), 4.55-4.51 (dd, J = 14 Hz, 1H, CH_2N), 4.33-4.29 (dd, J = 13.8, 7.6 Hz, 1H, CH_2N), 3.32-3.20 (m, 1H, CHO), 2.66-2.65 (d, J = 4.4, 1H, OH), 1.66-1.53 (m, 2H, CH_2), 1.09-1.05 (t, 3H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) δ 147.44 (=CN), 130.40 (ArC), 128.82 (=CHN), 128.12, 125.61, 121.09 (5 × ArCH), 71.86 (CHO), 55.84 (CH_2N), 27.48 (CH_2), 9.81 (CH_3). FT-IR (KBr) ν/cm^{-1} 694, 763, 982, 1078, 1136, 1228, 1457, 1617, 2926, 2962, 3139, 3254, 3419.

1-(4-Phenyl-1*H*-1,2,3-triazol-1-yl)hex-5-en-2-ol (**13b**)[23]

White solid: m.p. 104.9-107.9 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.11 (s, 1H, NCH=C), 7.86 (d, J = 7.5 Hz, 2H, Ar-H), 7.44 (t, J = 7.5 Hz, 2H, Ar-H), 7.34 (t, J = 7.5 Hz, 1H, Ar-H), 5.93-5.81 (m, 1H, CH=), 5.06 (dd, J = 12.9, 1.2 Hz, 1H, CH_2=C), 4.98 (dd, J = 7.8, 1.2 Hz,

1H, CH_2=C), 4.45 (dd, *J* = 14.0, 3.6 Hz, 1H, CH_2N), 4.30 (dd, *J* = 14.0, 7.6 Hz, 1H, CH_2N), 4.03-3.93 (m, 1H, CHO), 3.27 (d, *J* = 5.6 Hz, 1H, OH), 2.30-2.10 (m, 4H, 2 × CH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ 147.7 (=CN), 139.3 (CH=), 132.3 (ArC), 129.9, 128.8, 126.3 (5 × ArCH), 122.6 (CHN), 115.4 (CH_2=), 70.2 (CHO), 56.8 (CH_2N), 34.3, 30.3 (2 × CH_2); FT-IR (KBr) ν/cm^{-1} 693, 771, 832, 921, 983, 1097, 1227, 1443, 1472, 1639, 2919, 2939, 3143, 3241; MS (70 eV) m/z (%) 243 (20) [M^+], 214 (15), 158 (215), 156 (130), 146 (26), 132 (10), 130 (33), 118 (12), 117 (100), 105 (16), 104 (10), 103 (34), 102 (55), 91 (10), 90 (15), 89 (22); HRMS (EI) m/z calcd. for $C_{14}H_{17}N_3O$ 243.1372, found 243.1350.

1-(4-Phenyl-1*H*-1,2,3-triazol-1-yl)octan-2-ol (**14b**)[23]

White solid: m.p. 125.5-127.0 °C. ^1H NMR (400 MHz, $CDCl_3$) *δ* 8.12 (s, 1H, NCH=C), 7.85 (d, *J* = 7.8 Hz, 2H, Ar-H), 7.44 (t, *J* = 7.8 Hz, 2H, Ar-H), 7.34 (t, *J* = 7.8 Hz, 1H, Ar-H), 4.43 (dd, *J* = 14.0 Hz, *J* = 3.5 Hz, 1H, CH_2N), 4.27 (dd, *J* = 14.0, 7.6 Hz, 1H, CH_2N), 4.00-3.88 (m, 1H, CHO), 3.47 (d, *J* = 5.4 Hz, 1H, OH), 1.53-1.15 (m, 10 H, 5 × CH_2), 0.88 (t, *J* = 6.6 Hz, 3H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) *δ* 147.4 (=CN), 130.2 (ArC), 128.8, 128.1, 125.6 (5 × ArCH), 121.1 (=CHN), 70.5 (CHO), 56.2 (CH_2N), 34.4, 31.7, 29.1, 25.4, 23.0 [$(CH_2)_5$], 14.0 (CH_3); FT-IR (KBr) ν/cm^{-1} 693, 771, 828, 983, 1089, 1142, 1227, 1464, 1602, 2854, 2915, 3135, 3229; MS (70 eV) m/z (%) 273 (20) [M^+], 146 (33), 132 (25), 118 (13), 117 (100), 105 (10), 103 (18), 102 (32), 89 (10), 77 (10), 69 (24), 55 (18), 43 (15), 41 (13); HRMS (EI) m/z calcd. for $C_{16}H_{23}N_3O$ 273.1841, found 273.1850.

3-Chloro-1-(4-phenyl-1H-1,2,3-triazol-1-yl)propan-2-ol (15b) [26]

Solid, m.p. 100-102 °C. ^1H NMR (400 MHz, $CDCl_3$) *δ* 7.80 (s, 1H), 7.68-7.72 (m, 2H), 7.29-7.40 (m, 3H), 4.63-4.69 (m, 1H), 4.45-4.52 (m, 1H), 4.31-4.38 (m, 1H), 3.56-3.63 (m, 2H). FT-IR (KBr) ν/cm^{-1} 761, 1020, 1217, 1379, 1461, 1632, 1741, 2364, 2852, 2922, 3446. LC-MS: m/z: 238 (M+1). HRMS calcd. for $C_{11}H_{13}N_3OCl(35)$ (M+1): 238.0747; found, 238.0739.

2-(4-Phenyl-1*H*-1,2,3-triazol-1-yl)cyclopentanol (**16b**)[45]

Yellow oil: ^1H NMR (400 MHz, $CDCl_3$) *δ* 7.78-7.72 (m, 2H, Ar-H), 7.49-7.45 (m, 1H, NCH=C), 7.44-7.37 (m, 2H, Ar-H), 7.35-7.30 (m, 1H, Ar-H), 4.60 (t, *J* = 6.1 Hz, 1H, CHN), 4.06-3.76 (m, 1H, CHO), 2.47-2.37 (m, 1H, CH_2), 2.31-2.09 (m, 2H, CH_2), 2.01-1.89 (m, 3H, CH_2), 1.25 (s, 1H, OH); ^{13}C NMR (100 MHz, $CDCl_3$) *δ* 147.1 (=CN), 130.8 (ArC), 130.2 (=CHN), 128.7, 128.0, 125.5 (5 × ArCH), 77.7 (CHO), 68.3 (CHN), 22.6, 20.1 (3 × CH_2);

FT-IR (KBr) ν/cm^{-1} 3422, 2923, 2852, 1456, 1264, 1084, 764, 695; HRMS (ESI) calcd. for $C_{13}H_{16}ON_3$, 230.1287 $[M + H]^+$; found, 230.1284.

2-(4-Phenyl-1*H*-1,2,3-triazol-1-yl) cyclohexanol (17b) [30]

White solid; m.p. 167.8-171.8 ^{o}C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.58 (s, 1H; NCH=C), 7.85 (d, J = 7.5 Hz, 2H, Ar-H), 7.45 (t, J = 7.5 Hz, 2H, Ar-H), 7.32 (dt, J = 7.5, 1.2 Hz, 1H, Ar-H), 5.00 (d, J = 5.8 Hz, 1H, OH), 4.24 (ddd, J = 12.1, 9.9, 4.2 Hz, 1H, CHN), 3.85-3.65 (m, 1H, CHO), 2.13-1.11 (m, 8H, 4 × CH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ 145.6 (=CN), 131.2 (ArC), 128.9, 127.6, 122.9 (5 × ArCH), 120.5 (=CHN), 71.3 (CHO), 66.0 (CHN), 34.7, 31.9, 24.4, 23.9 (4 × CH_2); FT-IR (KBr) ν/cm^{-1} 3307, 3119, 2937, 2858, 1441, 1234, 1083, 1053, 768, 713, 699.

2-Phenyl-2-(4-propyl-1*H*-1,2,3-triazol-1-yl)ethanol (18b) [38]

Oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35-7.31 (m, 4H, Ar-H), 7.18 (d, J = 8.0 Hz, 2H, Ar-H), 5.65 (dd, J = 9.0, 4.5 Hz, 1H, CHN), 4.61 (ddd, J = 12.5, 8.5, 6.0 Hz, 1H, CH_2O), 4.18 (ddd, J = 12.5, 8.5, 4.0 Hz, 1H, CH_2O), 2.88-2.86 (m, 1H, OH), 2.68 (t, J = 7.5 Hz, 2H, CH_2-C=), 1.77-1.67 (m, 2H, CH_2), 0.95 (t, J = 7.5 Hz, 3H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.1 (=CN), 136.4 (ArC), 128.7, 128.4, 127.0, 120.3 (5 × ArCH), 65.8 (CHO), 65.0 (CHN), 25.4 (CH_2), 22.0 (CH_2), 13.7 (CH_3); FT-IR (KBr) ν/cm^{-1} 3414, 2929, 1460, 1419, 1055, 653, 538; ESI-MS: m/z = 232 $[M+1]^+$.

2-(4-Cyclohexyl-1*H*-1,2,3-triazol-1-yl)-2-phenylethanol (19b) [23]

White solid; m.p. 128.2-131.8 ^{o}C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 (s, 1H; NCH=C), 7.42-7.26 (m, 5H, Ar-H), 5.68 (dd, J = 8.7, 4.8 Hz, 1H, CHN), 4.40-4.28, 4.15-4.03 (2 m, 2H, CH_2O), 3.32 (t, J = 5.9 Hz, 1H, OH), 2.77-2.65 (m, 1H, CH_2CHCH_2), 1.83-1.65 (m, 4H; 2 × CH_2CH_2CH), 1.46-1.34 (m, 4H, 2 × CH_2CH_2CH), 1.29-1.18 [m, 2H, $(CH_2)_2CH_2(CH_2)_2$]; ^{13}C NMR (100 MHz, $CDCl_3$) δ 153.4 (NCCH), 138.5 (ArC), 129.8, 129.4, 128.2 (5 × ArCH), 120.9 (NCCH), 65.0 (CH_2O), 64.7 ($NCHCH_2$), 36.1 (CH_2CHCH_2), 33.8, 26.9, 26.8 [$(CH_2)_5$]; FT-IR (KBr) ν/cm^{-1} 3233, 3117, 3061, 2923, 2849, 1448, 1067, 889, 756, 697; MS (70 eV) m/z (%) 271 (23) $[M^+]$, 213 (18), 212 (100), 149 (21), 130 (12), 123 (10), 122 (14), 121 (64), 109 (12), 104 (37), 103 (72), 95 (14), 94 (12), 93 (12), 91 (58), 81 (17), 80 (39), 79 (27), 78 (10), 77 (36), 69 (10), 67 (27), 65 (11), 56 (13), 55 (18), 43 (13), 41 (21); HRMS (EI) m/z calcd for $C_{16}H_{21}N_3O$ 271.1685, found 271.1685.

2-[4-(Hydroxymethyl)-1H-1,2,3-triazol-1-yl]-1-phenylethanol (20b) [25]

Colourless solid; m.p. 110–111 ^{o}C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (s, 1H, NCH=C), 7.30-7.13 (m, 5H, Ar-H), 5.58 (dd, J = 8.8, 3.8 Hz, 1H, CH-O), 4.52 (s, 2H, CH_2-O), 4.46-4.33 (m, 3H, 2 × OH, CH_2N), 4.03 (dd, J = 12.3, 3.6 Hz, 1H, CH_2N); ^{13}C NMR (100 MHz, $CDCl_3$) δ 147.3 (=CN), 136.0 (ArC), 128.9, 127.1, 125.9 (5 × ArCH), 122.9 (=CHN), 67.1 (CHOH), 64.5 (CH_2N), 53.1 (CH_2OH); FT-IR (KBr) ν/cm^{-1} 3340, 3167, 2932, 2893, 1454, 1234, 1119, 1084, 1011, 849, 795, 702; anal. calcd. for $C_{11}H_{13}N_3O_2$ (219.240): C 60.26, H 5.98, N 19.17%; found: C 60.22, H 6.04, N 19.22%.

2-(4-Pentyl-1*H*-1,2,3-triazol-1-yl)-2-phenylethanol (21b) [38]

Oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35-7.27 (m, 4H, Ar-H), 7.19 (d, J = 7.0 Hz, 2H, Ar-H), 5.65 (dd, J = 8.5, 4.0 Hz, 1H, CH_2O), 4.59 (dd, J = 12.0, 8.5 Hz, 1H, CH_2O), 4.19-4.16 (m, 2H, CH-N, OH), 2.69 (t, J = 7.5 Hz, 2H, CH_2), 2.36 (t, J = 7.0 Hz, 2H, CH_2), 1.74-1.68 (m, 2H, CH_2), 1.54-1.48 (m, 2H, CH_2), 0.91-0.87 (m, 3H, CH_3); ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.3 (=CN), 136.3 (ArC), 128.8, 128.5, 127.0 (5 × ArCH), 120.3 (=CHN), 65.8 (CH_2O), 64.9 (CHN), 30.9, 27.8, 25.4, 22.3 (4 × CH_2), 14.0 (CH_3); FT-IR (KBr) ν/cm^{-1} 3414, 3090, 2930, 1492, 1435, 1209, 1109, 1068, 752, 600; ESI-MS: m/z = 260 $[M+1]^+$; HRMS calcd. for $C_{15}H_{21}N_3O$ $[M+H]^+$: 260.1767; found: 260.1763.