Supplementary Material (ESI) for Organic and Biomolecular Chemistry

Supporting Information

Synthesis of Mono- and 1,3-Disubstituted Allenes from Propargylic Amines via Palladium-Catalysed Hydride-Transfer Reaction

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***N,N*-dicyclohexyl-(1-phenylprop-2-ynyl)amine (1b):** ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69 (d, *J* = 8.4 Hz, 2H), 7.31 (t, *J* = 7.2 Hz, 2), 7.23 (t, *J* = 7.2 Hz, 1H), 4.84 (s, 1H), 2.66 (tt, *J* = 3.6 Hz, 11.6 Hz,2H), 2.44 (d, *J* = 2 Hz, 1H), 2.26 (d, *J* = 12.4 Hz, 2H), 1.79 - 1.65 (m, 4H), 1.57 - 0.97 (m, 14H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 141.7, 127.8, 127.7, 126.7, 86.2, 73.3, 56.0, 50.7, 34.2, 32.1, 26.6, 26.5, 26.1; IR (neat) 3304, 2926, 2853, 1448, 1103, 891 cm^{-1}; MS (EI) *m/z* 295 (M^+); Anal. calcd for $C_{21}H_{29}N$: C, 85.37; H, 9.89; N, 4.74. Found: C, 85.30; H, 9.60; N, 4.67.

***N,N*-dicyclohexyl-(1-cyclohexylprop-2-ynyl)amine (1c):** ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.04 (dd, *J* = 2.4 Hz, 10 Hz, 1H), 2.68 - 2.60 (m, 2H), 2.17 - 2.06 (m, 5H), 1.78 - 0.64 (m, 27H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 87.9, 70.9, 55.9, 53.3, 41.4, 34.5, 31.9, 31.2, 31.0, 26.9, 26.8, 26.6, 26.5, 26.3, 26.1; IR (neat) 3306, 2924, 2851, 1450, 1103, 891 cm^{-1}; MS (EI) *m/z* 301 (M^+); Anal. calcd for $C_{21}H_{35}N$: C, 83.65; H, 11.70; N, 4.65. Found: C, 83.61; H, 11.93; N, 4.95.

***N,N*-dicyclohexyl-(1-pentylprop-2-ynyl)amine (1d):** ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.43 (dt, *J* = 2.4 Hz, 7.2 Hz, 8 Hz, 1H), 2.69 - 2.62 (m, 2H), 2.12 (d, *J* = 2.4 Hz, 1H), 2.08 (d, *J* = 11.2 Hz, 2H), 1.76 - 0.98 (m, 26H), 0.87 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 89.0, 69.5, 55.5, 46.9, 36.6, 34.7, 32.0, 31.7, 26.8, 26.6, 26.3, 26.1, 22.6, 14.1; IR (neat) 3308, 2926, 2853, 1450, 1175, 891 cm^{-1}; MS (EI) *m/z* 289 (M^+).

***N,N*-dicyclohexyl-(1-phenethylprop-2-ynyl)amine (1e):** ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28 (t, *J* = 7.6 Hz, 2H), 7.20 - 7.17 (m, 3H), 3.50 (dt, *J* = 2 Hz, 7.6 Hz, 1H), 2.81 - 2.59 (m, 4H), 2.17 (d, *J* = 2.4 Hz, 1H), 2.07 (dq, *J* = 9.2 Hz, 2H), 2.97 - 0.87 (m, 20H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 142.4, 128.4, 128.3, 125.7, 88.3, 70.1, 55.6, 46.9, 38.3, 34.7, 33.2, 32.0, 26.8, 26.6, 26.1; IR (neat) 3306, 2926, 2851, 1452, 1109, 891 cm^{-1}; MS (EI) *m/z* 323 (M^+); Anal. calcd for $C_{23}H_{33}N$: C, 85.39; H, 10.28; N, 4.33. Found: C, 85.14; H, 10.10; N, 4.41.

***N,N*-diisopropyl-3-phenylprop-2-ynylamine (2a).** Colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41-7.38 (m, 2H), 7.28-7.26 (m, 3H), 3.65 (s, 2H), 3.26 (sept, *J* = 6.4 Hz, 2H),

1.15 (d, J = 6.4 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 131.2, 128.0, 127.5, 123.6, 88.9, 83.4, 48.5, 34.8, 20.7; IR 2966, 1598, 1488, 1380, 1203, 1176 cm^{-1}; HRMS (FAB) calcd for $C_{15}H_{22}N$: $(M+H)^+$ 216.1752, found 216.1747.

***N,N*-diethyl-3-phenylprop-2-ynylamine (2b).** Colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42-7.39 (m, 2H), 7.28-7.26 (m, 2H), 3.63 (s, 2H), 2.61 (q, J = 7.2 Hz, 4H), 1.10 (t, J = 7.2 Hz, 6H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 131.6, 128.1, 127.6, 123.2, 84.9, 84.3, 47.3, 41.5, 12.8; IR 2970, 1599, 1489, 1443, 1200, 1092, 1069 cm^{-1}; HRMS (FAB) calcd for $C_{13}H_{18}N$: $(M+H)^+$ 188.1439, found 188.1434.

***N,N*-dibenzyl-3-phenylprop-2-ynylamine (2c).** White solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50~7.47 (m, 2H), 7.43~7.41 (m, 3H), 7.34~7.30 (m, 6H), 7.27~7.22 (m, 4H), 3.74 (s, 4H), 3.46 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 138.8, 131.7, 129.0, 128.2, 127.9, 127.0, 85.8, 84.4, 57.7, 42.1;IR 3028, 2826, 1597, 1489, 1454, 918cm^{-1}; HRMS (FAB) calcd for $C_{23}H_{22}N$: $(M+H)^+$ 312.1752, found 312.1747, $C_{23}H_{21}NNa$: $(M+Na)^+$ 334.1572, found 334.1566.

***N,N*-diisobutylprop-3-phenylprop-2-ynylamine (2d).** Colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43–7.41 (m, 2H), 7.31-7.26 (m, 3H), 3.55 (s, 2H), 2.26 (d, J = 7.2 Hz, 4H), 1.73, (tsept, J = 7.2, 6.4 Hz, 2H), 0.90 (d, J = 6.4 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 131.5, 128.0, 127.6, 123.5, 85.4, 84.6, 62.7, 43.5, 26.4, 20.9; IR 2953, 2868, 1597, 1489, 1468, 1364, 1072 cm^{-1}; HRMS (FAB) calcd for $C_{17}H_{26}N$: $(M+H)^+$ 244.2065, found 244.2060.

***N,N*-dicyclohexyl-3-phenylprop-2-ynylamine (2e).** Colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41-7.38 (m, 2H), 7.32-7.27 (m, 3H), 3.70 (s, 2H), 2.83 (tt, J = 11.2, 2.8 Hz, 2H), 1.91 (d, J = 10.8 Hz, 4H), 1.79 (d, J = 12.8 Hz, 4H) 1.62 (m, 4H), 1.44-1.06 (m, 10H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 131.4, 128.2, 127.6, 123.9, 89.5, 83.3, 57.5, 35.7, 31.3, 26.3, 26.2; IR 2928, 2853, 1489, 1448, 1340, 1103, 891 cm^{-1}; HRMS (ESI) calcd for $C_{21}H_{30}N$: $(M+H)^+$ 296.2378, found 296.2381.

***cis*-2,6-dimethyl-1-(3-phenyl-prop-2-ynyl)-piperidine (2f).** Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45-7.43, (m, 2H), 7.32-7.29 (m, 3H), 3.87 (s, 2H), 2.61-2.58 (m, 2H), 1.69-1.62 (m, 4H), 1.42-1.29 (m, 2H), 1.17 (d, J = Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 131.6, 128.1, 127.7, 123.3, 85.0, 83.5, 54.8, 38.1, 35.4, 24.8, 21.1; IR 1926, 1489, 1441, 1317, 1200, 1094, 1059 cm^{-1}; HRMS (FAB) calcd for $C_{16}H_{22}N$: $(M+H)^+$ 228.1752, found 228.1747, $C_{16}H_{21}NNa$: $(M+Na)^+$ 250.1572, found 250.1566.

***N,N*-diisopropyl-3-(3-naphthyl)prop-2-ynylamine (2g).** Colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.33 (d, J = 8.4 Hz, 1H), 7.79 (dd, J = 8.4, 7.2 Hz, 2H), 7.62 (d, J = 7.2 Hz, 1H), 7.56-7.37 (m, 3H), 3.83 (s, 2H), 3.34 (sept, J = 6.8 Hz, 2H), 1.21 (d, J = 6.8 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 133.3, 133.0, 130.0, 128.0, 127.9, 126.4, 126.0, 125.0, 121.3, 93.8, 81.6, 48.5, 35.0, 20.8; IR 3057, 2968, 1508, 1458, 1380, 1203, 1176 cm^{-1}; HRMS (FAB) calcd for $C_{19}H_{24}N$: $(M+H)^+$ 266.1906, found 266.1903, $C_{19}H_{23}NNa$: $(M+H)^+$ 288.1728, found 288.1723.

***N,N*-diisopropyl-3-(4-methoxypheyl)-prop-2-ynylamine (2h).** Colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.33 (d, J = 8.8 Hz, 2H), 6.81, (d, J = 8.8Hz, 2H), 3.78 (s, 3H), 3.64 (s,

2H), 3.26 (sept, *J* = 6.8 Hz, 2H), 1.14 (d, *J* = 6.8 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 158.9, 132.6,115.8, 113.6, 87.3, 83.1, 55.2, 48.4, 34.8, 20.7; IR 2966, 1606, 1508, 1463, 1290, 1247, 1176, 1035 cm^{-1}; HRMS (FAB) calcd for $C_{16}H_{24}NO$: $(M+H)^+$ 246.1858, found 246.1852, $C_{16}H_{23}NONa$: $(M+Na)^+$ 268.1677, found 268.1672.

***N*-4-(3-*N,N*-diisopropylaminoprop-1-ynyl)-phenylacetamide (2i).** White solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (bs, 1H), 7.45 (d, *J* = 8.4 Hz, 2H), 7.32 (d, *J* = 8.4 Hz, 2H), 3.63 (s, 2H), 3.25 (sept, *J* = 6.4 Hz, 2H), 2.15 (s, 3H), 1.14 (d, *J* = 6.4 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 168.3, 137.3, 131.9, 119.3, 119.2, 88.4, 83.0, 48.5, 34.8, 24.6, 20.7; IR 3257, 2972, 1664, 1600, 1510, 1373, 1203, 1178, 1029, 839cm^{-1}; HRMS (FAB) calcd for $C_{17}H_{25}N_2O$: $(M+H)^+$ 273.1967, found 273.1961, $C_{17}H_{24}N_2NaO$: $(M+Na)^+$ 295.1786, found 295.1781, $C_{34}H_{48}N_4NaO_2$: $(2M+Na)^+$ 567.3675, found 567.3669.

4-(3-*N,N*-diisopropylaminoprop-1-ynyl)-benzoic acid ethylester (2j). Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.8 Hz, 2H), 7.44 (d, *J* = 8.8Hz, 2H), 4.36 (q, *J* = 7.2 Hz, 2H), 3.66 (s, 2H), 3.25 (sept, *J* = 6.8 Hz, 2H), 1.38 (t, *J* = 7.2 Hz, 3H), 1.15 (d, *J* = 6.8 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 165.8, 131.8, 129.2, 128.2, 92.4, 82.8, 61.0, 48.5, 34.9, 20.7, 14.3; IR 2970, 1720, 1606, 1463, 1365, 1271, 1174, 1105, 1020, 858 cm^{-1}; HRMS (FAB) calcd for $C_{18}H_{26}NO_2$: $(M+H)^+$ 288.1964, found 288.1958, $C_{18}H_{25}NNaO_2$: $(M+Na)^+$ 310.1783, found 310.1778.

***N,N*-diisopropyl-3-(4-nitrophenyl)-prop-2-ynylamine (2k).** Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.16 (d, *J* = 9.2 Hz, 2H), 7.52 (d, *J* = 9.2 Hz, 2H), 3.71 (s, 2H), 3.28 (sept, *J* = 6.8 Hz, 2H), 1.17 (d, *J* = 6.8 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 146.5, 131.9, 130.4, 123.3, 94.8, 82.0, 48.8, 34.9, 20.5; IR 2970, 2229, 1593, 1519, 1342, 1307, 1203, 1194, 1101, 854 cm^{-1}; HRMS (FAB) calcd for $C_{15}H_{21}N_2O_2$: $(M+H)^+$ 261.1603, found 261.1598.

4-(3-*N,N*-diisopropylaminoprop-1-ynyl)-benzaldehyde (2l). Brown Oil ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.98 (s, 1H), 7.80 (d, *J* = 7.2 Hz, 2H), 7.53 (d, *J* = 7.2 Hz, 2H), 3.70 (s, 2H), 3.28 (sept, *J* = 6.4 Hz, 2H), 1.17 (d, *J* = 6.4 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 191.1, 134.9, 131.7, 129.8, 129.3, 93.4, 82.9, 48.7, 34.9, 20.6; IR 2970, 1703, 1602, 1560, 1263, 1301, 1207, 1164, 831 cm^{-1}; HRMS (ESI) calcd for $C_{16}H_{22}NO$: $(M+H)^+$ 244.1701, found 244.1696.

***N,N*-dicyclohexyl-(1-phenylnonadec-2-ynyl)amine (2m):** ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 (d, *J* = 8 Hz, 2H), 7.28 (t, *J* = 7.2 Hz, 2H), 7.20 (t, *J* = 7.2 Hz, 1H), 4.78 (s, 1H), 2.62 (tt, *J* = 3.2 Hz, 11.6 Hz, 2H), 2.27 (dt, *J* = 2 Hz, 6.8 Hz, 2H), 2.23 (d, *J* = 12.4 Hz, 2H),1.71 (dd, *J* = 12.8 Hz, 32 Hz, 4H), 1.57 - 0.97 (m, 42H), 0.88 (t, *J* = 6.4 Hz, 7.2 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ143.2, 127.9, 127.5, 126.4, 85.2, 81.8, 56.0, 50.9, 34.3, 32.3, 31.9, 29.7, 29.6, 29.4, 29.2, 29.0, 28.9, 26.7, 26.7, 26.6, 26.1, 22.7, 19.0, 14.1; IR (neat) 2924, 2853, 1448, 1256, 1123, 891 cm^{-1}; MS (EI) *m/z* 519 (M^+).

***N,N*-dicyclohexyl-(1-cyclohexylnonadec-2-ynyl)amine (2n):** ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.99 (d, *J* = 10 Hz, 1H), 2.63 - 2.57 (m, 2H), 2.16 – 2.03 (m, 6H), 1.74 – 0.62 (m, 58H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 83.4, 82.6, 55.9, 53.5, 41.8, 34.6, 32.1, 31.9, 31.2, 29.7, 29.6, 29.4, 29.2, 29.0, 28.9, 27.0, 26.9, 26.7, 26.6, 26.4, 26.2, 22.7, 18.9, 14.1; IR (neat) 2924, 2853, 1450, 1199, 891 cm^{-1}; MS (EI) *m/z* 525 (M^+).

***N,N*-dicyclohexyl-(1-pentyl-nonadec-2-ynyl)-amine (2o):** ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.39 - 3.36 (m, 1H), 2.65 - 2.59 (m, 2H), 2.16 - 2.12 (m, 2H), 2.05 (d, *J* = 12 Hz, 2H), 1.75 - 1.72 (m, 4H), 1.59 - 1.01 (m, 58H), 0.88 (t, *J* = 6.8 Hz, 6H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 84.5, 81.5, 55.5, 47.2, 37.1, 34.8, 32.2, 31.9, 31.7, 29.7, 29.4, 29.2, 29.0, 28.9, 26.9, 26.7, 26.5, 26.2, 22.7, 18.8; IR (neat) 2926, 2853, 2341, 1450, 1105, 891 cm^{-1}; MS (EI) *m/z* 513 (M^+).

***N,N*-dicyclohexyl-(1-phenethyl-nonadec-2-ynyl)-amine (2p):** ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27 (d, *J* = 7.6 Hz, 2H), 7.20 - 7.14 (m, 3H), 3.48 - 3.43 (m, 1H), 2.81 - 2.55 (m, 4H), 2.15 (dt, *J* = 2 Hz, 7.2 Hz, 2H), 2.07 (d, *J* = 11.6 Hz, 2H), 1.89 - 0.97 (m, 4H), 0.88 (t, *J* = 6.8 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ142.8, 128.4, 128.2, 125.5, 83.8, 82.1, 55.6, 47.2, 39.0, 34.8, 33.4, 32.2, 31.9, 29.7, 29.4, 29.2, 29.0, 28.9, 26.9, 26.6, 26.1, 22.7, 18.8, 14.1; IR (neat) 2922, 2853, 1452, 1103, 891 cm^{-1}; MS (EI) *m/z* 547 (M^+); Anal. calcd for $C_{39}H_{65}N$: C, 85.49; H, 11.96; N, 2.56. Found: C, 85.62; H, 11.84; N, 2.43.

***N,N*-dicyclohexyl-(1-phenethylbut-2-ynyl)amine (2q):** ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27 (t, *J* = 7.6 Hz, 2H), 7.20 - 7.14 (m, 3H), 3.46 - 3.41 (m, 1H), 2.79 - 2.56 (m, 4H), 2.04 (d, *J* = 10 Hz, 2H), 1.90 - 0.87 (m, 23H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 142.8, 128.4, 128.2,125.5, 83.0, 77.2, 55.6, 47.1, 38.7, 34.8, 33.3, 32.2, 26.9, 26.6, 26.1; IR (KBr) 2928, 2849, 1452, 1173, 893, 845 cm^{-1}; MS (EI) *m/z* 337 (M^+); Anal. calcd for $C_{24}H_{35}N$: C, 85.40; H, 10.45; N, 4.15. Found: C, 85.54; H, 10.73; N, 4.33.

***N,N*-dicyclohexyl-(1,3-diphenylprop-2-ynyl)amine (2r)**. The procedure for the synthesis of **2a** via Sonogashira coupling reaction was utilized for the reaction of **1d** with iodobenzene to yield **2r** in 86% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 (d, *J* = 7.2 Hz, 2H), 7.46 (dd, *J* = 2 Hz, 7.2 Hz, 2H), 7.34 - 7.22 (m, 6H), 5.03 (s, 1H), 2.70 (tt, *J* = 3.2 Hz, 11.2 Hz, 2H), 2.31 (d, *J* = 12.4 Hz, 2H), 1.78 - 1.00 (m, 18H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 142.3, 131.3, 128.3, 127.9, 127.7, 126.7, 124.0, 92.0, 85.2, 56.1, 51.5, 34.3, 32.4, 26.7, 26.6, 26.1; IR (KBr) 3059, 2918, 2851, 1489, 1447, 1258, 1101, 891 cm^{-1}; MS (EI) *m/z* 371 (M^+); Anal. calcd for $C_{27}H_{33}N$: C, 87.28; H, 8.95; N, 3.77. Found: C, 87.25; H, 9.00; N, 3.95.

1-Allenylnaphthalene (3b). White solid ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 (d, *J* = 7.6 Hz, 1H), 7.85 (d, *J* = 7.6 Hz, 1H), 7.74 (d, *J* = 8.4 Hz, 1H), 7.58 (d, *J* = 6.8 Hz, 1H), 7.52-7.42 (m, 3H), 6.86 (t, *J* = 6.8 Hz, 1H), 5.20 (d, *J* = 6.8 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 210.7, 133.7, 129.9, 128.5, 127.3, 125.8, 125.5, 125.4, 125.1, 124.7, 123.3, 90.3, 77.8; IR (KBr) 1940, 1649, 1494, 1392, 1301, 1232, 1101, 987 cm^{-1}; HRMS (EI) calcd for $C_{13}H_{10}$: (M^+) 166.0781, found 166.0777.

1-Methoxy-4-allenylbenzene (3c). Colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.21 (d, *J* = 8.8 Hz, 2H), 6.84 (d, *J* = 8.8 Hz, 2H), 6.11 (t, *J* = 6.8 Hz, 1H), 5.11 (d, *J* = 6.8Hz, 2H), 3.79 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 209.4, 158.5, 127.6, 125.9, 114.0, 93.3, 78.6, 55.3; IR(neat) 2837, 1942, 1608, 1487, 1247, 1087, 1035 cm^{-1}; MS (EI) *m/z* 146 (M^+), 131 ($[M\text{-}Me]^+$), 115 ($[M\text{-}OMe]^+$).

4-Allenylacetanilide (3d). White solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (bs, 1H), 7.45 (d, *J* = 8.4 Hz, 2H), 7.23 (d, *J* = 8.4 Hz, 2H), 6.12 (t, *J* = 6.8 Hz, 1H), 5.13 (d, *J* = 6.8 Hz,

2H), 2.15 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 209.7, 168.4, 136.7, 129.8, 127.2, 120.1, 93.3, 78.9, 24.5; IR (KBr) 3057, 1944, 1660, 1602, 1508, 1404, 1369, 1263 cm^{-1}; MS *m/z* 173 (M^+), 130 ($[M-Ac]^+$), 115 ($[M-NHAc]^+$).

Ethyl 4-allenylbenzoate (3e). Colorless oil ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98 (d, *J* = 8.4 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 6.19 (d, *J* = 6.8 Hz, 1H), 5.20 (t, *J* = 6.8 Hz, 2H), 4.37 (q, *J* = 7.2 Hz, 2H), 1.25 (t, *J* = 6.0, Hz); ^{13}C NMR (75 MHz, $CDCl_3$) δ 210.6, 166.4, 138.8, 129.8, 128.7, 126.4, 93.6, 79.1, 60.8, 14.2; IR (neat) 3357, 2981, 1940, 1716, 1608, 1517, 1274 cm^{-1}; HRMS (EI) calcd for $C_{12}H_{12}O_2$: (M^+) 188.0837, found 188.0843.

4-Allenylnitrobenzene (3f). Yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.16 (d, *J* = 8.7Hz, 2H), 7.42 (d, *J* = 8.7 Hz, 2H), 6.24 (t, *J* = 6.6 Hz, 1H), 5.27 (d, *J* = 6.6 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 210.9, 141.2, 126.9, 123.9, 93.0, 79.7; IR (neat) 1938, 1643, 1595, 1471, 1384, 1342, 1139, 858 cm^{-1}; HRMS (EI) calcd for $C_9H_7NO_2$: (M^+) 161.0477, found 161.0466.

4-Allenylbenzaldehyde (3g). Colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.97 (s, 1H), 7.82 (d, *J* = 8.0 Hz, 2H), 7.44 (d, *J* = 8.0 Hz, 2H), 6.22 (t, *J* = 6.8 Hz, 1H), 5.24 (d, *J* = 6.8 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 210.7, 191.4, 140.7, 134.8, 130.0, 126.9, 93.6, 79.4; IR (neat) 2734, 1938, 1697, 1602, 1573, 1487, 1438, 1388 cm^{-1}; HRMS (EI) calcd for $C_{15}H_{14}N_2O$: (M^+) 144.0575, found 144.0576.

Nonadeca-1,2-dienylbenzene (3h): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 - 7.25 (m, 4H), 7.16 (sext, *J* = 4 Hz, 4.4 Hz, 1H), 6.11 (dt, *J* = 2.8 Hz, 3.2 Hz, 1H), 5.55 (dt, *J* = 6.8 Hz, 6.4 Hz, 1H), 2.11 (dq, *J* = 3.2 Hz, 6.8 Hz, 7.6 Hz, 2H), 1.51 - 1.42 (m, 2H), 1.36 - 1.12 (m, 26H), 0.88 (t, *J* = 6.4 Hz, 7.2 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 205.2, 135.2, 128.5, 128.1, 126.6, 95.1, 94.5, 32.0, 31.6, 29.7, 29.5, 29.4, 29.2, 28.8, 22.7, 14.1; IR (neat) 2924, 2853, 1950, 1497, 1458 cm^{-1}; MS (EI) *m/z* 340 (M^+); Anal. calcd for $C_{25}H_{40}$: C, 88.16; H, 11.84. Found: C, 88.12; H, 11.72.

Nonadeca-1,2-dienylcyclohexane (3i): ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.13 - 5.03 (m, 2H), 2.00 - 1.89 (m, 3H), 1.76 - 1.02 (m, 40H), 0.88 (t, *J* = 6.8 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 202.6, 97.0, 91.8, 37.3, 33.2, 32.0, 29.7, 29.5, 29.4, 29.3, 29.2, 29.1, 26.2, 26.1, 22.7, 14.1; IR (neat) 2924, 2853, 1962, 1448 cm^{-1}; MS (EI) *m/z* 346 (M^+).

Tetracosa-6,7-diene (3j): ^{1}H NMR (400 MHz, $CDCl_3$) δ 5.06 (q, *J* = 5.2 Hz. 4.4 Hz, 2H), 2.00 - 1.92 (m, 4H), 1.43 – 1.21 (m, 38H), 0.91 - 0.86 (m, 6H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 203.8, 90.9, 31.9, 31.3, 29.7, 29.5, 29.4, 29.2, 29.1, 29.0, 28.9, 22.7, 22.5, 14.1; IR (neat) 2924, 2855, 2361, 1962, 1466, 872 cm^{-1}; MS (EI) *m/z* 334 (M^+).

Heneicosa-3,4-dienylbenzene (3k): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 (t, *J* = 7.6 Hz, 2H), 7.19- 7.14 (m, 3H), 5.14 - 5.04 (m, 2H), 2.71 (t, *J* = 7.6 Hz, 2H), 2.33 - 2.26 (m, 2H), 1.96 - 1.90 (m, 2H), 1.30 – 1.26 (m, 28H), 0.88 (t, *J* = 6.8 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 204.0, 141.9, 128.5, 128.2, 125.8, 91.5, 90.2, 35.5, 32.0, 31.6, 30.7, 29.7, 29.5, 29.4, 29.2, 29.1, 28.9, 22.7, 14.1; IR (neat) 2924, 2853, 1962, 1497, 1456 cm^{-1}; MS (EI) *m/z* 368 (M^+); Anal. calcd for $C_{27}H_{44}$: C, 87.97; H, 12.03. Found: C, 87.93; H, 12.14.

Hexa-3,4-dienylbenzene (3l): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28 (t, *J* = 8 Hz, 7.2 Hz, 2H), 7.21 - 7.16 (m, 3H), 5.14 - 5.02 (m, 2H), 2.72 (t, *J* = 7.6 Hz, 2H), 2.33 - 2.27 (m, 2H), 1.61 (dd, *J* = 3.2 Hz, 3.6 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 204.8, 141.9, 128.5, 128.2, 125.7, 89.6, 86.0, 35.4, 30.5, 14.5; IR (neat) 2924, 1965, 1497, 1454, 868 cm^{-1}; MS (EI) *m/z* 158 (M^+).

Octa-1,2-dienylbenzene (3m): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 (d, *J* = 4 Hz, 4H), 7.18 (sext, *J* = 2.8 Hz, 3.2 Hz, 1H), 6.13 - 6.10 (m, 1H), 5.56 (dt, *J* = 6.8 Hz, 6.4 Hz, 1H), 2.12 (dq, *J* = 2.8 Hz, 7.2 Hz, 2H),1.52 - 1.29 (m, 6H), 0.89 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 205.1, 135.2, 128.5, 126.5, 95.1, 94.5, 31.4, 28.8, 28.7, 22.4, 14.0; IR (neat) 2930, 1948, 1705, 1497, 1458, 1167 cm^{-1}; MS (EI) *m/z* 186 (M^+).

4-(*N*,*N*-diisopropylamino)-1-phenylbut-2-yn-1-ol (6a): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (dt, *J* = 7.2, 1.6, 2H), 7.40-7.29 (m, 3H), 7.41–7.21 (m, 6H), 5.47 (s, 1H), 3.51 (d, *J* = 2.0 Hz, 2H), 3.19 (sept, *J* = 6.4 Hz, 2H), 1.09 (d, *J* = 6.4 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 141.1, 128.3, 128.0, 126.5, 85.7, 83.3, 64.4, 48.4, 34.2, 20.4, 20.4; IR (neat) 2970, 1454, 1387, 1337, 1175, 1115, 1011 cm^{-1}; MS (ESI) *m/z* 246 $(M+H)^+$.

4-(*N*,*N*-diisopropylamino)-1-phenylbut-2-yn-1-yl benzyl ether (6b): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53-7.50 (m, 2H), 7.40-7.27 (m, 8H), 7.41–7.21 (m, 6H), 5.23 (s, 1H), 4.72 (d, *J* = 12.0 Hz, 1H), 4.64 (d, *J* = 12.0 Hz, 1H), 3.57 (d, *J* = 2.0 Hz, 2H), 3.22 (sept, *J* = 6.4 Hz, 2H), 1.11 (d, *J* = 6.4 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 139.0, 137.9, 128.3, 128.1, 128.0, 127.6, 127.4, 87.4, 80.8, 70.7, 69.8, 48.4, 34.3, 20.7, 20.7; IR (neat) 2968, 1454, 1382, 1364, 1204, 1177, 1061, 1028 cm^{-1}; MS (ESI) *m/z* 336 $(M+H)^+$.

4-(*N*,*N*-diisopropylamino)-1-(4-methoxyphenyl)but-2-yn-1-ol (6c): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 (d, *J* = 6.8 Hz, 2H), 6.91-6.88 (m, 2H), 5.41 (s, 1H), 3.81 (s, 3H), 3.50 (d, *J* = 2.0 Hz, 2H), 3.19 (sept, *J* = 6.4 Hz, 2H), 1.09 (d, *J* = 6.4 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 159.4, 133.5, 127.9, 113.7, 85.5, 83.4, 64.0, 55.2, 48.3, 34.2, 20.4, 20.4; IR (neat) 2986, 2835, 1611, 1510, 1464, 1387, 1248, 1173, 1105, 1034 cm^{-1}; MS (ESI) *m/z* 276 $(M+H)^+$.

4-(*N*,*N*-diisopropylamino)-1-(3,5-dimethoxyphenyl)but-2-yn-1-ol (6d): ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.70 (d, *J* = 2.4 Hz, 2H), 6.41 (t, *J* = 2.4 Hz, 2H), 5.40 (s, 1H), 3.80 (s, 6H), 3.52 (d, *J* = 1.6 Hz, 2H), 3.21 (sept, *J* = 6.4 Hz, 2H), 1.10 (d, *J* = 6.4 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 160.9, 143.4, 104.5, 100.5, 86.0, 82.8, 64.8, 55.4, 48.5, 34.3, 20.6; IR (neat) 3103, 2835, 2718, 1593, 1460, 1429, 1387, 1327, 1159, 1111, 1040 cm^{-1}; MS (ESI) *m/z* 306 $(M+H)^+$.

1-(*N*,*N*-diisopropylamino)-non-2-yn-4-ol (6e): ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.36 (tt, *J* = 6.4, 1.6 Hz, 1H), 3.45 (d, *J* = 1.6 Hz, 2H), 3.18 (sept, *J* = 6.4 Hz, 2H), 1.67 (m, 2H), 1.44 (m, 2H), 1.31 (m, 4H), 1.091 (d, *J* = 6.4 Hz, 12H), 0.90 (t, *J* = 6.8 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 84.4, 84.0, 62.6, 48.4, 37.9, 34.2, 31.5, 24.9, 22.6, 20.5, 14.0; IR (neat) 3148, 2932, 2571, 1740, 1468, 1387, 1339, 1281, 1169, 1130 cm^{-1}; MS (ESI) *m/z* 240 $(M+H)^+$.

1-[3-(*N*,*N*-diisopropylamino)-1-propyn-1-yl]-cyclohexanol (6f): ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.49 (s, 2H), 3.19 (sept, *J* = 6.4 Hz, 2H), 2.03 (m, 1H), 1.88 (m, 2H), 1.67 (m, 2H), 1.54 (m, 5H9, 1.24 (m, 1H), 1.11 (d, *J* = 6.4 Hz, 12H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 87.0, 83.3, 68.8,

48.4, 40.4, 40.1, 34.1, 25.3, 23.4, 20.7; IR (neat) 2932, 2860, 1466, 1364, 1327, 1177, 1138, 1045 cm^{-1}; MS (EI) *m/z* 238 (M^+).

4-(*N,N*-dicyclohexylamino)-1,4-diphenylbut-2-yn-1-ol (6g): ^1H NMR (400 MHz, $CDCl_3$) δ 7.67 (d, *J* = 7.6, 2H), 7.58 (d, *J* = 7.6, 2H), 7.41–7.21 (m, 6H), 5.59 (bs, 1H), 4.93 (s, 1H), 2.62 (t, *J* = 11.2 Hz, 2H), 2.14–0.96 (m, 20H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 141.9, 140.9, 128.4, 128.1, 127.7, 126.6, 126.5, 89.0, 88.9, 84.6, 77.2, 64.9, 55.9, 50.9, 34.1, 32.2, 26.6, 26.4, 26.0; IR (neat) 3383, 2928, 2853, 1601, 1448, 1119, 891 cm^{-1}; MS (EI) *m/z* 401 (M^+).

1-(*N,N*-dicyclohexylamino)-1-phenylnon-2-yn-4-ol (6h): ^1H NMR (400 MHz, $CDCl_3$) δ 7.65 (d, *J* = 7.6 Hz, 2H), 7.32–7.20 (m, 3H), 4.86 (s, 1H), 4.51–4.45 (m, 1H), 2.67–2.60 (m, 2H), 2.20 (d, *J* = 12.4 Hz, 2H), 1.78–0.87 (m, 29H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 142.2, 127.8, 127.7, 126.6, 87.0, 86.9, 86.1, 86.0, 72.0, 65.8, 63.0, 62.9, 56.0, 50.8, 38.0, 37.9, 34.2, 32.3, 31.5, 26.6, 26.5, 26.0, 24.9, 22.6, 15.2, 14.1, 14.0; IR (neat) 3337, 2928, 2853, 1448, 1121, 1028, 891 cm^{-1}; MS (EI) *m/z* 395 (M^+).

1-[3-(*N,N*-dicyclohexylamino)-3-phenylpropyn-1-yl]-cyclohexanol (6i): ^1H NMR (400 MHz, $CDCl_3$) δ 7.67 (d, *J* = 8 Hz, 2H), 7.29 (t, *J* = 7.2 Hz, 8 Hz, 2H), 7.21 (t, *J* = 7.2 Hz, 1H), 4.86 (s, 1H), 2.65 (tt, *J* = 3.2 Hz, 11.6 Hz, 2H), 2.23 (d, *J* = 12 Hz, 2H), 2.13 (s, 2H), 1.99–0.97 (m, 28H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 142.3, 127.6, 127.5, 126.5, 88.5, 85.8, 68.8, 55.9, 50.7, 40.0, 39.9, 34.2, 32.2, 26.5, 26.4, 25.9, 25.1, 23.3, 23.2; IR (KBr) 3410, 2928, 2853, 1699, 1448, 1161, 964, 891 cm^{-1}; MS (EI) *m/z* 393 (M^+).

4-Cyclohexyl-4-(*N,N*-dicyclohexylamino)-1-phenylbut-2-yn-1-ol (6j): ^1H NMR (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 7.2 Hz, 2H), 7.37 (t, *J* = 6.8 Hz, 7.6 Hz, 2H), 7.31 (t, *J* = 7.2 Hz, 1H), 5.46 (d, *J* = 6.4 Hz, 1H), 3.14 (d, *J* = 10 Hz, 1H), 2.63–2. 57 (m, 2H), 2.13–2.00 (m, 5H), 1.76 - 0.68 (m, 27H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 128.4, 128.1, 126.6, 126.5, 90.9, 82.3, 65.0, 55.9, 53.6, 41.4, 34.5, 32.1, 31.2, 31.1, 26.8, 26.6, 26.4, 26.3, 26.1; IR (neat) 3422, 2924, 2851, 2322, 1734, 1506, 1256, 1113 cm^{-1}; MS (EI) *m/z* 407 (M^+).

4-(*N,N*-dicyclohexylamino)-1-phenylnon-2-yn-1-ol (6k): ^1H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 6.8 Hz, 2H), 7.38–7.28 (m, 3H), 5.44 (bs, 1H), 3.51 (t, *J* = 7.2 Hz, 1H), 2.65–2.59 (m, 2H), 2.11 (bs, 1H), 1.95 (d, *J* = 12.4 Hz, 2H), 1.72–0.95 (m, 28H), 0.88 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 141.2, 128.4, 128.0, 126.6, 126.5, 91.7, 81.1, 64.9, 55.5, 47.2, 36.5, 34.6, 32.2, 31.6, 26.8, 26.6, 26.3, 26.1, 22.6, 14.1; IR (neat) 3339, 2928, 2853, 1450, 1105, 891 cm^{-1}; MS (EI) *m/z* 395 (M^+).

4-(*N,N*-dicyclohexylamino)-1,6-diphenylhex-2-yn-1-ol (6l): ^1H NMR (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 7.2 Hz, 2H), 7.39–7.26 (m, 5H), 7.17 (t, *J* = 7.2 Hz, 3H), 5.46 (d, *J* = 6 Hz, 1H), 3.59 (t, *J* = 7.2 Hz, 1H), 2.83 - 2.75 (m, 1H), 2.68–2.61 (m, 3H), 2.04–0.87 (m, 22H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 142.4, 128.4, 128.3, 128.1, 126.6, 125.7, 91.1, 64.9, 55.6, 47.2, 38.3, 34.7, 33.2, 32.2, 26.8, 26.5, 26.0; IR (neat) 3368, 2928, 2851, 1452, 1117, 908, 891 cm^{-1}; MS (EI) *m/z* 429 (M^+).

1-Phenyl-2,3-butadien-1-ol (7a). Colorless oil ^1H NMR (400 MHz, $CDCl_3$) δ 7.42-7.25 (m, 5H), 5.45, (q, *J* = 3.6 Hz, 1H), 5.27 (s, 1H), 4.94-4.91 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 206.7, 142.2, 128.3, 127.7, 125.9, 95.1, 78.2, 71.9; IR (neat) 3373, 3030, 2891,

1955, 1494, 1454, 1002, 850 cm^{-1}; HRMS (EI) calcd for $C_{10}H_{10}O$:(M^+) 146.0732, found 146.0726.

1-Benzyloxy-1-phenyl-2,3-butadiene (7b). Yellow oil; ^1H NMR (400 MHz, $CDCl_3$) 7.40-7.28 (m, 10H), 5.35 (q, *J* = 6.8 Hz, 1H), 4.94 (d, *J* = 7.6 Hz, 1H), 4.88-4.77 (m, 2H), 4.58 (q, *J* = 8.0 Hz, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 208.50, 141.18, 138.08, 128.26, 128.20, 127.65, 127.58, 127.40, 126.50, 92.71, 79.27, 76.46, 70.18; IR (neat) 2868, 1953, 1645, 1519, 1487, 1386, 1276, 1097 cm^{-1}; HRMS (EI) calcd for $C_{17}H_{16}O$: (M^+) 236.1201, found 236.1196.

1-(4-Methoxyphenyl)-2,3-butadien-1-ol (7c). Colorless oil; ^1H NMR (300 MHz, $CDCl_3$) δ 7.32 (d, *J* = 8.7 Hz, 2H), 6.88 (d, *J* = 8.7 Hz, 2H), 5.43 (q, *J* = 6.6 Hz, 1H), 5.23 (s, 1H), 4.93-4.89 (m, 2H), 3.81, (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 206.7, 159.0, 134.9, 127.2, 113.7, 95.2, 78.0, 71.5, 55.2; IR (neat) 3402, 2837, 1955, 1610, 1585, 1514, 1247, 1174, 1033 cm^{-1}; HRMS (EI) calcd for $C_{11}H_{12}O_2$: (M^+) 176.0838, found 176.0832.

1-(3,5-Dimethoxyphenyl)- 2,3-butadien-1-ol (7d). Colorless oil; ^1H NMR (400 MHz, $CDCl_3$) δ 6.56 (d, *J* = 6.0 Hz, 2H), 6.39 (t, *J* = 6.4 Hz, 1H), 5.42 (q, *J* = 6.4 Hz, 1H), 5.21 (s, 1H), 4.95-4.93 (m, 2H), 3.80 (s, 6H) ; ^{13}C NMR (75 MHz, $CDCl_3$) δ 206.8, 160.6, 145.2, 103.8, 99.6, 94.9, 78.1, 71.9, 55.3; IR (neat) 3421, 2839, 1955, 1596, 1458, 1296, 1205, 1060 cm^{-1}; HRMS (EI) calcd for $C_{12}H_{14}O_3$: (M^+) 206.0943, found 206.0937.

1,2-Nonadien-4-ol (7e). Colorless oil; ^1H NMR (400 MHz, $CDCl_3$) δ 5.24 (q, *J* = 6.8 Hz, 1H), 4.86-4.84 (m, 2H), 4.19-4.14 (m, 1H), 1.58-1.54 (m, 2H), 1.43-1.25 (m, 6H), 0.89 (t, *J* = 6.8 Hz, 3H); ^{13}C NMR ($CDCl_3$) δ 206.6, 94.8, 77.3, 69.7, 37.5, 31.7, 25.1, 22.6, 14.1; IR(neat) 3336, 2931, 1955, 1508, 1458, 1022, 842 cm^{-1}. Since the M^+ of **7e** was not detected by the mass spectroscopy, the alcohol **7e** was transformed into the benzoate form and assigned. Colorless oil; ^1H NMR (400 MHz, $CDCl_3$) δ 8.03 (d, *J* = 7.2 Hz, 2H), 7.53 t, *J* = 7.2 Hz, 1H), 7.42 (t, *J* = 7.6 Hz, 2H), 5.27 (t, *J* = 5.1 Hz, 1H), 5.30 (q, *J* = 5.1 Hz, 1H), 4.87-4.81 (m, 2H), 1.83-1.73 (m, 2H), 1.43-1.28 (m, 6H), 0.86 (t, *J* = 6.8 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 206.6, 94.8, 77.3, 69.7, 37.5, 31.7, 25.1, 22.6, 14.1; MS (EI) *m/z* 244 (M^+), 173 ([M-C_5H_{11}]$^+$), 123 ([M-OBz]$^+$).

1-Allenylcyclohexanol (7f). Colorless oil; ^1H NMR (400 MHz, $CDCl_3$) δ 5.29 (t, *J* = 6.8 Hz, 1H), 4.87 (d, *J* = 6.8Hz, 2H), 1.69-1.59 (m, 4H), 1.47 (t, *J* = 5.2 Hz, 4H), 1.37-1.34 (m, 2H); ^{13}C NMR ($CDCl_3$) δ 205.9, 99.3, 78.0, 70.4, 38.3, 25.5, 22.6; IR(neat) 3367, 2933, 2856, 1955, 1508, 952cm^{-1}; the M^+ of **7f** was not detected by the mass spectroscopy.

Diphenylbuta-2,3-dien-1-ol (7g): ^1H NMR (400 MHz, $CDCl_3$) δ 7.45 (d, *J* = 7.2 Hz, 2H), 7.38 (dt, *J* = 1.2 Hz, 7.2 Hz, 7.6 Hz, 2H), 7.32 - 7.19 (m, 6H), 6.38 (dd, *J* = 2.4 Hz, 6.4 Hz, 1H), 5.89 - 5.85 (m, 1H), 5.37 (dd, *J* = 6 Hz, 6.4 Hz, 14 Hz, 1H), 2.30 (bs, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 203.8, 203.5, 142.8, 133.6, 128.7, 128.6, 127.9, 127.4, 127.3, 126.9, 126.1, 126.0, 100.1, 100.0, 98.2, 97.9, 72.4, 72.2; IR (neat) 3364, 3030, 1952, 1599, 1495, 1456, 1030, 878 cm^{-1}; MS *m/z* 222 (M^+).

1-Phenylnona-1,2-dien-4-ol (7h): ^1H NMR (400 MHz, $CDCl_3$) δ 7.31 - 7.29 (m, 4H), 7.23 - 7.18 (m, 1H), 6.32 - 6.29 (m, 1H), 5.72 - 5.65 (m, 1H), 4.31 - 4.24 (m, 1H), 1.70 - 1.28 (m, 8H),

0.89 (t, *J* = 6.8 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 203.6. 203.4, 133.9, 128.6, 127.2, 126.7, 99.8, 99.6, 97.4, 97.0, 77.2, 70.3, 69.9, 37.6, 37.5, 31.7, 31.6, 25.2, 25.1, 22.6, 14.0; IR (neat) 3337, 2930, 2858, 2332, 1950, 1458, 1028, 876 cm^{-1}; MS *m/z* 206 (M^+).

1-(3-Phenylpropa-1,2-dienyl)cyclohexanol (7i): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32 - 7.26 (m, 4H), 7.19 (sext, *J* = 4 Hz, 4.4 Hz, 1H), 6.30 (d, *J* = 6.4 Hz, 1H), 5.73 (d, *J* = 6.4 Hz, 1H), 1.87 (bs, 1H), 1.71 - 1.33 (m, 10H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 202.8, 134.0, 128.6, 127.0, 126.6, 104.3, 97.6, 71.4, 38.3, 25.4, 22.4; IR (neat) 3385, 2932, 2855, 1950, 1493, 953cm^{-1}; MS *m/z* 214 (M^+); Anal. calcd for $C_{15}H_{18}O$: C, 84.07; H, 8.47. Found: C, 84.34; H, 8.27.

4-Cyclohexyl-1-phenylbuta-2,3-dien-1-ol (7j): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 - 7.34 (m, 4H), 7.30 - 7.26 (m, 1H), 5.48 - 5.43 (m, 1H), 5.39 - 5.35 (m, 1H), 5.22 (t, *J* = 6 Hz, 1H), 2.16 (s, 1H), 2.06 - 1.96 (m, 1H), 1.78 - 1.61 (m, 7H), 1.34 - 1.01 (m, 7H), 0.88 (t, J = 6.8, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 201.1, 200.8, 143.2, 143.1, 128.4, 127.6, 126.2, 126.1, 101.4, 101.1, 97.1, 97.0, 72.4, 72.1, 37.4, 37.1, 33.0, 31.6, 26.0, 25.9, 22.6, 14.1; IR (neat) 3362, 2924, 2851, 1962, 1448, 1016, 870 cm^{-1}; MS *m/z* 228 (M^+); Anal. calcd for $C_{16}H_{20}O$: C, 84.16; H, 8.83. Found: C, 84.20; H, 8.62.

1-Phenylnona-2,3-dien-1-ol (7k): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 - 7.34 (m, 4H), 7.30 - 7.26 (m, 1H), 5.44 -5.34 (m, 2H), 5.25 - 5.21 (m, 1H), 2.16 (bs, 1H), 2.07 - 1.99 (m, 2H), 1.43 - 1.26 (m, 6H), 0.90 - 0.87 (m, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 202.2, 143.2, 128.4, 127.7, 127.6, 126.1, 126.0, 99.2, 96.1, 95.4, 95.1, 72.4, 72.1, 31.6, 31.3, 28.7, 28.6, 22.6, 22.4, 14.1; IR (neat) 3369, 2928, 1963, 1454, 1015, 874 cm^{-1}; MS *m/z* 216 (M^+).

1,6-Diphenylhexa-2,3-dien-1-ol (7l): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 - 7.25 (m, 7H), 7.21 - 7.16 (m, 3H), 5.41 - 5.36 (m, 2H), 5.01 (d, *J* = 22.8 Hz, 1H), 2.77 - 2.66 (m, 2H), 2.43 - 2.31 (m, 2H), 2.03 - 1.92 (d, *J* = 40.4 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 202.4, 143.0, 141.4, 128.5, 128.4, 128.3, 127.6, 96.6, 96.5, 94.1, 72.1, 72.0, 35.1, 30.2; IR (neat) 3383, 3026, 2924, 2361, 1963, 1495, 1454, 1030, 872 cm^{-1}; MS *m/z* 250 (M^+); Anal. calcd for $C_{18}H_{18}O$: C, 86.36; H, 7.25. Found: C, 86.40; H, 7.32.