Stereoselective Synthesis of *β*-Hydroxy Enamines, Amino Cyclopropanes and 1,3-Amino Alcohols via Asymmetric Catalysis

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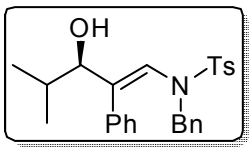
General Methods. All reactions were performed under a nitrogen atmosphere with oven dried glassware using standard Schlenk or vacuum line techniques. The progress of reactions was monitored by thin-layer chromatography performed on Whatman precoated silica gel 60 Å K6F plates and visualized by ultra-violet light or by staining with ceric ammonium molybdate. THF was distilled from Na/benzophenone and toluene was dried through an alumina column. The optical rotations were recorded using a JASCO DIP-370. Melting points were determined using automatic melting-point meter Buchi Melting Point B-545, with temperature gradient 1 °C/min. The ^{1}H NMR and $^{13}C\{^{1}H\}$ NMR spectra were obtained on a Brüker Fourier transform NMR spectrometer at either 360 and 90.6 MHz, respectively. ^{1}H NMR spectra were referenced to tetramethylsilane in $CDCl_3$ or residual protonated solvent; $^{13}C\{1H\}$ NMR spectra were referenced to residual solvent. Analysis of enantiomeric excess was performed using a Hewlett-Packard 1100 Series HPLC and a chiral column. Infrared spectra were obtained using a Perkin-Elmer Spectrum 100 Series spectrometer. All reagents were purchased from Aldrich or Acros. All solvents were purchased from Fischer Scientific. All the commercially available liquid aldehyde substrates were distilled prior to use. Silica gel (Silicaflash P60 40–63 μm, Silicycle) and basic alumina (Fisher, 60–325 mesh) were used for air-flashed chromatography. Ynamides were prepared by method of Stahl.[1] *N*-benzyl-*N*-ethynyl-4-methylbenzenesulfonamide was synthesized by method of Bruckner.[2]

Caution. Diethylzinc is pyrophoric. Care must be used when handling this reagent.

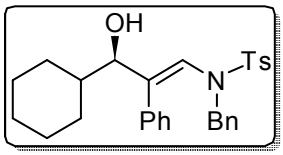
General Procedure A. Asymmetric Amino Vinylation of Aldehydes with *β*-Amino Vinyl Zinc Reagents:



(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-4-methyl-2-phenylpent-1-en-1-yl)-4-methylbenzenesulfonamide (1a).

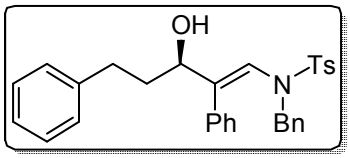
A 10 mL Schlenk flask was charged with a solution of *N*-benzyl-*N*-(*p*-toluenesulfonyl)-2-phenylethynylamine (1.0 mL, 0.25 M in toluene, 0.25 mmol) and a solution of diethylborane (0.25 mL, 1.0 M in toluene, 0.25 mmol) was added dropwise at room temperature. The resulting solution was stirred at room temperature for 20 min. The reaction flask was then cooled to –78 °C and Et_2Zn (0.25 mL, 2.0 M in toluene, 0.5 mmol) was added and the reaction mixture was stirred for 20 min. (–)-MIB (3.0 mg, 0.012 mmol, 5 mol %) was added followed by dropwise addition of isobutyraldehyde (24 μL, 0.3 mmol) at –78 °C. The reaction flask was placed in a –30 °C cold bath and allowed to warm to 0 °C over several hours. The solution was stirred at 0 °C until vinyl addition was complete by TLC (typically 12 h). The reaction was then quenched by addition of brine (2 mL). The organic and aqueous layers were separated, and the aqueous layer was extracted with 3 × 20 mL of diethyl ether. The combined organic layers were then washed with 50 mL of water and dried over $MgSO_4$. The filtrate was concentrated in vacuo and the residue was chromatographed on deactivated silica gel (10% ethyl acetate in hexanes) to afford 107 mg (82% yield) of **1a** as an amorphous solid. $[\alpha]_D^{20}$: –19.5 (*c* = 1.0, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.82 (d, 3H, *J* = 7.0 Hz), 1.01 (d, 3H, *J* = 7.0 Hz), 1.57 (sept., 1H, *J* = 7.0 Hz), 2.07 (s, 3H), 3.84 (d, 1H, *J* = 6.4 Hz), 4.27 (dd, 2H, *J* = 21.3 Hz, 15.0 Hz), 6.54 (s, 1H), 6.94–7.02 (m, 4H), 7.09–7.19 (m, 7H), 7.29 (s, 1H), 7.84–7.90 (m, 2H); ^{13}C{^{1}H} NMR ($CDCl_3$, 75 MHz): δ 27.65, 28.66, 35.45, 44.95, 77.47, 127.52, 127.66, 127.89, 128.81, 129.09, 129.62,

129.91, 134.50, 136.20, 136.32, 156.2; IR (neat): 3537 (OH), 2961, 2870, 1723, 1643, 1598, 1494, 1455, 1343, 1162, 1092, 1026, 814 cm^{-1}; HRMS-CI: *m*/*z* 458.1766 [$(M + Na)^+$; calculated for $C_{26}H_{29}NO_3SNa$: 458.1766].



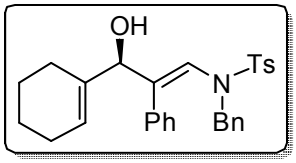
(*R*, *E*)-*N*-Benzyl-*N*-(3-cyclohexyl-3-hydroxy-2-phenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1b).

Title compound **1b** was prepared by General Procedure A using cyclohexane carboxaldehyde (36 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 104 mg (73% yield) of **1b** as a white solid (mp = 137.3–142.0 °C). The enantiomeric excess was determined by HPLC with a Chiralcel OD-H column (hexanes:2-propanol = 9:1, flow rate = 0.8 mL/min), t_r (1) = 15.0 min, t_r (2) = 18.7 min, $[\alpha]_D^{20}$: –30.0 (c = 0.04, $CHCl_3$, 91% ee). ^1H NMR ($CDCl_3$, 360 MHz): δ 0.49–0.61 (m, 1H), 0.61–0.81 (m, 1H), 0.86–1.20 (m, 3H), 1.20–1.38 (m, 2H), 1.50–1.75 (m, 4H), 2.45 (s, 3H), 3.75–3.85 (m, 1H), 4.21 (iso(AB)quadruplet, J_{AB} = 15.2 Hz, Δ = 120.0 Hz, 2H), 6.62 (s, 1H), 7.02–7.10 (m, 4H), 7.18–7.24 (m, 7H), 7.35–7.39 (m, 1H), 7.92–7.98 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 21.6, 26.1, 26.6, 28.2, 28.9, 44.3, 51.8, 76.3, 124.0, 127.6, 127.7, 128.1, 128.3, 128.6, 129.0, 129.9, 135.9, 136.1, 136.3, 140.9, 143.9. IR (neat): 3543 (OH), 3061, 2921, 2852, 1951, 1643, 1598, 1495, 1452, 1338, 1155, 1091, 1026, 936, 811 cm^{-1}; HRMS-CI: m/z 498.2059 [$(M + Na)^+$; calculated for $C_{29}H_{33}NO_3SNa$: 498.2079].



(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-2,5-diphenylpent-1-en-1-yl)-4-methylbenzenesulfonamide (1c).

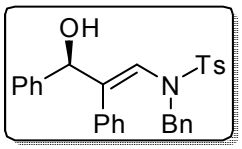
Title compound **1c** was prepared by General Procedure A using hydrocinnamaldehyde (40 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 116 mg (78% yield) of **1c** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel OD-H column (hexanes:2-propanol = 9:1, flow rate = 0.8 mL/min), t_r (1) = 19.2 min, t_r (2) = 29.1 min, $[\alpha]_D^{20}$: –5.11 (c = 0.09, $CHCl_3$, 54% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 1.60–1.68 (m, 2H), 2.45 (s, 3H), 2.47–2.60 (m, 2H), 4.09 (s, 2H), 4.20–4.27 (m, 1H), 6.32 (s, 1H), 6.68–6.71 (m, 1H), 6.71–6.73 (m, 1H), 6.92–6.96 (m, 2H), 7.02–7. 07 (m, 2H), 7.13–7.15 (m, 1H), 7.15–7.17 (m, 2H), 7.17–7.19 (m, 2H), 7.19–7.21 (m, 2H), 7.21–7.23 (m, 2H), 7.30–7.35 (m, 2H), 7.67–7.72 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 21.7, 31.6, 36.9, 52.2, 74.9, 123.8, 125.9, 127.5, 127.9, 128.2, 128.3, 128.4, 128.46, 128.51, 129.0, 129.9, 135.4, 136.1, 136.2, 140.3, 141.8, 143.9. IR (neat): 3449 (OH), 3028, 2927, 2862, 1951, 1648, 1599, 1495, 1454, 1344, 1163, 1090, 1029, 939, 814 cm^{-1}; HRMS-CI: m/z 520.1922 [(M – Na)+; calculated for $C_{31}H_{31}NO_3SNa$: 520.1922] and 398.2103 [(M + H)$^+$; calculated for $C_{31}H_{32}NO_3S$: 498.2103].



(*R*,*E*)-*N*-Benzyl-*N*-(3-(cyclohex-1-en-1-yl)-3-hydroxy-2-phenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1d).

Title compound **1d** was prepared by General Procedure A using 1-cyclohexene-1-carboxaldehyde (34 μL, 0.3 mmol). The product was purified by column chromatography on

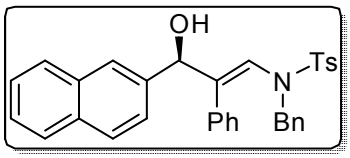
deactivated silica gel (10% ethyl acetate in hexanes) to afford 99 mg (70% yield) of **1d** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel OD-H column (hexanes:2-propanol = 19:1, flow rate = 0.5 mL/min), t_r (1) = 29.8 min, t_r (2) = 38.4 min, $[\alpha]_D^{20}$: –29.6 (c = 0.05, $CHCl_3$, 93% ee). ^{1}H NMR (C_6D_6, 360 MHz): δ 1.52–1.66 (m, 4H), 1.88–2.04 (m, 4H), 2.17 (s, 3H), 4.42 (iso(AB)quadruplet, J_{AB} = 15.2 Hz, Δ = 43.2 Hz, 2H), 4.66 (s, 1H), 5.58 (s, 1H), 6.92 (s, 1H), 7.02–7.08 (m, 3H), 7.08–7.11 (m, 1H), 7.19–7.26 (m, 7H), 7.38–7.42 (m, 1H), 7.98–8.03 (m, 2H); ^{13}C{1H} NMR (C_6D_6, 90 MHz): δ 21.5, 23.2, 23.3, 24.6, 25.6, 52.7, 79.5, 124.4, 124.8, 127.9, 128.0, 128.2, 128.3, 128.7, 129.0, 129.7, 130.1, 137.2, 137.7, 137.8, 138.6, 143.6. IR (neat): 3490 (OH), 2925, 1598, 1494, 1455, 1344, 1162, 1091, 1029, 941, 813 cm^{-1}; HRMS-CI: m/z 496.1936 [$(M + Na)^+$; calculated for $C_{29}H_{31}NO_3SNa$: 496.1922].



(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-2,3-diphenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1e).

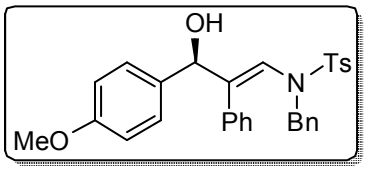
Title compound **1e** was prepared by General Procedure A using benzaldehyde (30 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 119 mg (85% yield) of **1e** as a white solid (mp = 99.8–103.2 °C). The enantiomeric excess was determined by HPLC with a Chiralcel OD-H column (hexanes:2-propanol = 19:1, flow rate = 0.5 mL/min), t_r (1) = 47.9 min, t_r (2) = 65.6 min, $[\alpha]_D^{20}$: –108.0 (c = 0.1, $CHCl_3$, 91% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 2.43 (s, 3H), 4.11 (d, J = 5.8 Hz, 2H), 4.90–4.99 (m, 1H), 7.16–7.23 (m, 7H), 7.23–7.41 (m, 7H), 7.42–7.58 (m, 3H), 7.58–7.66 (m, 1H), 7.73–7.82 (m, 2H), 8.08–8.18 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 21.7, 52.0, 77.1, 123.9, 126.7, 127.5, 127.6, 127.8, 127.9, 128.28, 128.34, 129.1, 129.9, 135.3, 136.1,

136.3, 139.1, 141.4, 143.8. IR (neat): 3504 (OH), 3031, 2957, 2837, 1893, 1609, 1511, 1495, 1456, 1344, 1249, 1162, 1091, 1034, 943, 815 cm^{-1}; HRMS-CI: m/z 452.1684 $[(M - OH)^+$; calculated for $C_{29}H_{26}NO_2S$: 452.1679].



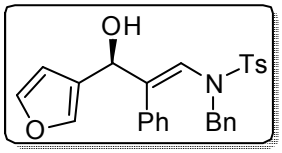
(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-3-(naphthalen-2-yl)-2-phenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1f).

Title compound **1f** was prepared by General Procedure A using 2-naphtaldehyde (47 mg dissolved in 0.5 mL of dry toluene, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 126 mg (81% yield) of **1f** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel OD-H column (hexanes:2-propanol = 9:1, flow rate = 0.8 mL/min), t_r (1) = 34.7 min, t_r (2) = 44.1 min, $[\alpha]_D^{20}$: –270.1 (c = 0.03, $CHCl_3$, 98% ee). ^1H NMR ($CDCl_3$, 360 MHz): δ 2.43 (s, 3H), 4.09 (iso(AB)quadruplet, J_{AB} = 15.3 Hz, Δ = 88.2 Hz, 2H), 5.44 (s, 1H), 6.39–6.44 (m, 2H), 6.58–6.61 (m, 1H), 6.88–6.94 (m, 2H), 6.95–7.02 (m, 2H), 7.03–7.09 (m, 2H), 7.10–7.14 (m, 1H), 7.17–7.19 (m, 1H), 7.19–7.21 (m, 1H), 7.21–7.25 (m, 2H), 7.25–7.27 (m, 1H), 7.27–7.30 (m, 1H), 7.41–7.46 (m, 2H), 7.55–7.59 (m, 1H), 7.61–7.65 (m, 1H), 7.67–7.71 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 21.7, 51.9, 77.3, 124.4, 125.6, 127.5, 127.6, 127.8, 128.0, 128.08, 128.13, 128.3, 129.2, 129.9, 133.0, 135.3, 136.2, 138.6, 139.0, 143.9. IR (neat): 3503 (OH), 3057, 2927, 2867, 1952, 1682, 1598, 1495, 1455, 1344, 1163, 1090, 1041, 942, 815 cm^{-1}; HRMS-CI: m/z 542.1743 $[(M + Na)^+$; calculated for $C_{33}H_{29}NO_3SNa$: 542.1766].



(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-3-(4-methoxyphenyl)-2-phenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1g).

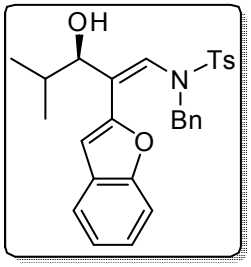
Title compound **1g** was prepared by General Procedure A using *p*-anisaldehyde (37 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 129 mg (86% yield) of **1g** as a white solid (mp = 172.0–174.2 °C). The enantiomeric excess was determined by HPLC with a Chiralcel AD-H column (hexanes:2-propanol = 9:1, flow rate = 0.8 mL/min), t_r (1) = 53.3 min, t_r (2) = 86.4 min, $[\alpha]_D^{20}$: –69.5 (c = 0.05, $CHCl_3$, 96% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 2.44 (s, 3H), 3.74 (s, 3H), 4.06 (iso(AB)quadruplet, J_{AB} = 15.0 Hz, Δ = 44.2 Hz, 2H), 5.20 (s, 1H), 6.39 (s, 1H), 6.40–6.42 (m, 1H), 6.48–6.52 (m, 1H), 6.65–6.70 (m, 2H), 6.86–6.92 (m, 4H), 6.97–7.04 (m, 2H), 7.09–7.22 (m, 4H), 7.28–7.35 (m, 2H), 7.66–7.72 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 21.7, 52.1, 55.4, 76.7, 113.7, 123.5, 127.6, 127.8, 128.0, 128.1, 128.4, 129.1, 129.7, 129.9, 133.7, 135.6, 135.6, 136.2, 136.4, 139.4, 143.8. IR (neat): 3504 (OH), 3032, 2956, 2837, 1891, 1610, 1511, 1495, 1456, 1344, 1249, 1162, 1090, 1034, 943, 814 cm^{-1}; HRMS-CI: m/z 500.1912 $[(M + H)^+$; calculated for $C_{30}H_{30}NO_4S$: 500.1896].



(*S*,*E*)-*N*-Benzyl-*N*-(3-(furan-3-yl)-3-hydroxy-2-phenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1h).

Title compound **1h** was prepared by General Procedure A using 3-furalaldehyde (26 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 94 mg (68% yield) of **1h** as an yellow oil. The enantiomeric

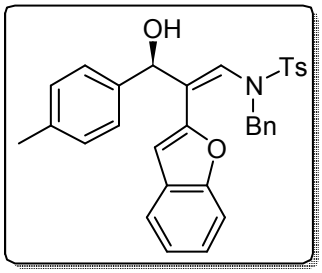
excess was determined by HPLC with a Chiralcel OD-H column (hexanes:2-propanol = 9:1, flow rate = 0.8 mL/min), t_r (1) = 17.7 min, t_r (2) = 24.1 min, $[\alpha]_D^{20}$: –29.8 (c = 0.04, $CHCl_3$, 89% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 2.46 (s, 3H), 4.08 (iso(AB)quadruplet, J_{AB} = 15.2 Hz, Δ = 116.3 Hz, 2H), 5.22 (d, J = 5.2 Hz, 1H), 6.40–6.45 (m, 1H), 6.49–6.52 (m, 1H), 6.54–6.59 (m, 2H), 6.85–6.87 (m, 1H), 6.87–6.90 (m, 1H), 6.93–6.95 (m, 1H), 7.04–7.10 (m, 2H), 7.16–7.21 (m, 4H), 7.22–7.23 (m, 1H), 7.30–7.36 (m, 2H), 7.66–7.72 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 21.8, 51.9, 70.8, 109.2, 123.8, 123.9, 127.5, 127.7, 128.1, 128.3, 128.4, 129.1, 130.0, 135.2, 136.1, 138.2, 140.0, 144.0. IR (neat): 3515 (OH), 3062, 2925, 2877, 1953, 1644, 1598, 1496, 1456, 1345, 1267, 1159, 1089, 1024, 940, 874, 813 cm^{-1}; HRMS-CI: m/z 460.1583 [(M + H)$^+$; calculated for $C_{30}H_{30}NO_3S$: 460.1583].



(*R*,*Z*)-*N*-(2-(Benzofuran-2-yl)-3-hydroxy-4-methylpent-1-en-1-yl)-*N*-benzyl-4-methylbenzenesulfonamide (1i).

Title compound **1i** was prepared by General Procedure A using *N*-(benzofuran-2-ylethynyl)-*N*-benzyl-4-methylbenzenesulfonamide (161 mg dissolved in 1 mL dry toluene, 0.40 mmol) and isobutyraldehyde (24 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 117 mg (82% yield) of **1i** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel AD-H column (hexanes:2-propanol = 9:1, flow rate = 0.8 mL/min), t_r (1) = 25.0 min, t_r (2) = 30.7 min, $[\alpha]_D^{20}$: –88.1 (c = 0.07, $CHCl_3$, 91% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.69 (d, J = 6.7 Hz, 3H), 0.88 (d, J = 6.7 Hz, 3H), 1.71 (sept., J = 6.7 Hz, 1H), 2.45 (s, 3H), 4.01 (m, 1H), 4.32 (iso(AB)quadruplet, J_{AB} = 14.6 Hz, Δ = 39.5 Hz, 2H), 6.21

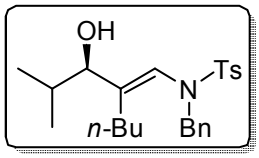
(s, 1H), 6.73 (s, 1H), 6.96–7.05 (m, 2H), 7.08–7.16 (m, 3H), 7.16–7.24 (m, 2H), 7.25–7.28 (m, 1H), 7.30–7.37 (m, 2H), 7.48–7.54 (m, 1H), 7.73–7.80 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 18.1, 19.5, 21.8, 32.9, 53.0, 79.6, 108.3, 111.2, 121.4, 123.1, 124.8, 126.9, 127.7, 127.8, 128.3, 128.7, 129.9, 130.9, 135.6, 135.9, 144.1, 150.8, 154.3. IR (neat): 3432 (OH), 2959, 1638, 1453, 1349, 1163, 1092, 1019, 930, 815 cm^{-1}; HRMS-CI: m/z 498.1694 $[(M + Na)^+$; calculated for $C_{28}H_{29}NO_3SNa$: 498.1715] and 476.1896 $[(M + H)^+$; calculated for $C_{28}H_{30}NO_3S$: 476.1896].



(*R*,*Z*)-*N*-(2-(Benzofuran-2-yl)-3-hydroxy-3-(p-tolyl)prop-1-en-1-yl)-*N*-benzyl-4-methylbenzenesulfonamide (1j).

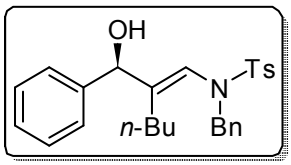
Title compound **1j** was prepared by General Procedure A using *N*-(benzofuran-2-ylethynyl)-*N*-benzyl-4-methylbenzenesulfonamide (161 mg dissolved in 1 mL dry toluene, 0.40 mmol) and *p*-tolualdehyde (35 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 133 mg (85% yield) of **1j** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel AD-H column (hexanes:2-propanol = 9:1, flow rate = 0.8 mL/min), t_r (1) = 49.8 min, t_r (2) = 56.2 min, $[\alpha]_D^{20}$: –90.7 (c = 1.0, $CHCl_3$, 98% ee). ^1H NMR ($CDCl_3$, 360 MHz): δ 2.29 (s, 3H), 2.44 (s, 3H), 4.37 (iso(AB)quadruplet, J_{AB} = 14.7 Hz, Δ = 22.1 Hz, 2H), 5.48 (s, 1H), 6.44 (s, 1H), 6.50 (s, 1H), 6.93–7.02 (m, 4H), 7.02–7.07 (m, 2H), 7.10–7.15 (m, 2H), 7.15–7.22 (m, 4H), 7.30–7.34 (m, 2H), 7.39–7.44 (m, 1H), 7.76–7.84 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 21.3, 21.8, 52.8, 74.8, 108.1, 111.1, 121.5, 123.0, 124.8, 126.6, 127.1, 127.8, 127.9, 128.3, 128.5, 128.7, 129.3, 129.4, 129.9, 135.9, 136.1, 137.6,

138.5, 144.0, 150.6, 154.2. IR (neat): 3431 (OH), 2958, 1638, 1452, 1346, 1162, 1092, 1019, 930, 814 cm^{-1}; HRMS-CI: m/z 546.1698 [$(M + Na)^+$; calculated for $C_{28}H_{29}NO_3SNa$: 546.1715].



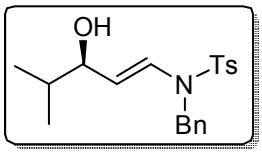
(*R*,*E*)-*N*-Benzyl-*N*-(2-(1-hydroxy-2-methylpropyl)hex-1-en-1-yl)-4-methylbenzenesulfonamide (1k).

Title compound **1k** was prepared by General Procedure A using *N*-benzyl-*N*-(hex-1-yn-1-yl)-4-methylbenzenesulfonamide (137 mg dissolved in 1 mL dry toluene, 0.4 mmol) and isobutyraldehyde (24 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 101 mg (81% yield) of **1k** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel OD-H column (hexanes:2-propanol = 19:1, flow rate = 0.5 mL/min), t_r (1) = 48.3 min, t_r (2) = 54.1 min, $[\alpha]_D^{20}$: –11.6 (c = 0.10, $CHCl_3$, 93% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.76 (t, J = 7.2 Hz, 3H), 0.81 (t, J = 7.1 Hz, 6H), 0.87–1.03 (m, 2H), 1.08 (sept., J = 7.2 Hz, 2H), 1.75 (sept., J = 7.1 Hz, 1H), 1.69–1.92 (m, 1H), 2.20–2.32 (m, 1H), 2.43 (s, 3H), 3.74 (d, J = 5.3 Hz, 1H), 4.14 (iso(AB)quadruplet, J_{AB} = 13.3 Hz, Δ = 33.7 Hz, 2H), 5.29 (s, 1H), 7.20–7.29 (m, 5H), 7.29–7.36 (m, 2H), 7.66–7.72 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 14.0, 16.9, 19.7, 21.7, 23.4, 28.4, 30.2, 31.8, 55.2, 78.1, 122.2, 127.8, 127.9, 128.5, 129.5, 129.8, 135.0, 135.9, 143.7, 150.9. IR (neat): 3369 (OH), 2959, 1598, 1455, 1344, 1261, 1163, 1091, 1028, 801 cm^{-1}; HRMS-CI: m/z 438.2082 [$(M + Na)^+$; calculated for $C_{26}H_{29}NO_3SNa$: 438.2079].



(*R*,*E*)-*N*-Benzyl-*N*-(2-(hydroxy(phenyl)methyl)hex-1-en-1-yl)-4-methylbenzenesulfonamide (1l).

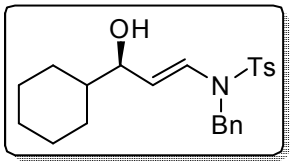
Title compound **1l** was prepared by General Procedure A using *N*-benzyl-*N*-(hex-1-yn-1-yl)-4-methylbenzenesulfonamide (137 mg dissolved in 1 mL dry toluene, 0.4 mmol) and benzaldehyde (30 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 114 mg (85% yield) of **1l** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel OD-H column (hexanes:2-propanol = 19:1, flow rate = 0.5 mL/min), t_r (1) = 51.6 min, t_r (2) = 58.9 min, $[\alpha]_D^{20}$: –28.5 (c = 0.08, $CHCl_3$, 96% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.68 (t, J = 7.2 Hz, 3H), 0.76–0.91 (m, 2H), 0.93–1.10 (m, 2H), 1.53–1.65 (m, 1H), 2.14–2.26 (m, 1H), 2.42 (s, 3H), 4.06–4.09 (m, 1H), 4.16 (iso(AB)quadruplet, J_{AB} = 13.4 Hz, Δ = 30.0 Hz, 2H), 5.08 (s, 1H), 5.50 (s, 1H), 7.07–7.13 (m, 2H), 7.13–7.21 (m, 2H), 7.25–7.41 (m, 6H), 7.65–7.76 (m, 3H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 13.9, 21.7, 23.3, 28.4, 29.8, 55.2, 75.0, 122.5, 127.1, 127.4, 127.9, 128.1, 128.5, 128.6, 129.6, 129.9, 135.0, 135.9, 142.0, 143.8, 150.0. IR (neat): 3496 (OH), 2957, 1953, 1598, 1455, 1338, 1162, 1092, 1028, 814 cm^{-1}; HRMS-CI: m/z 472.1904 [$(M + Na)^+$; calculated for $C_{27}H_{31}NO_3SNa$: 472.1922] and 450.2095 [$(M + H)^+$; calculated for $C_{27}H_{32}NO_3S$: 450.2103].



(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-4-methylpent-1-en-1-yl)-4-methylbenzenesulfonamide (1m).

Title compound **1m** was prepared by General Procedure A using *N*-benzyl-*N*-ethynyl-4-methylbenzenesulfonamide (114 mg dissolved in 1 mL dry toluene) and isobutyraldehyde (24

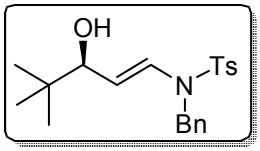
μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 86 mg (80% yield) of **1m** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel OD-H column (hexanes:2-propanol = 19:1, flow rate = 0.5 mL/min), t_r (1) = 54.4 min, t_r (2) = 60.1 min, $[\alpha]_D^{20}$: –5.6 (c = 0.06, $CHCl_3$, 93% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.55 (d, J = 6.8 Hz, 3H), 0.68 (d, J = 6.8 Hz, 3H), 1.50 (sext., J = 6.6 Hz, 1H), 2.40 (s, 3H), 3.67–3.74 (m, 1H), 4.49 (iso(AB)quadruplet, J_{AB} = 15.9 Hz, Δ = 73.8 Hz, 2H), 4.63 (dd, J_1 = 14.3 Hz, J_2 = 7.9 Hz, 1H), 6.83 (d, J = 14.3 Hz, 1H), 7.18–7.34 (m, 7H), 7.64–7.71 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 17.7, 18.3, 21.7, 34.4, 49.7, 77.0, 113.4, 127.13, 127.15, 127.6, 128.0, 128.7, 130.1, 135.4, 136.2, 144.1. IR (neat): 3285 (OH), 2961, 2080, 1600, 1455, 1330, 1160, 1093, 1062, 815 cm^{-1}; HRMS-CI: m/z 382.1451 [$(M + Na)^+$; calculated for $C_{20}H_{25}NO_3SNa$: 382.1453].



(*R*,*E*)-*N*-Benzyl-*N*-(3-cyclohexyl-3-hydroxyprop-1-en-1-yl)-4-methylbenzenesulfonamide (1n).

Title compound **1n** was prepared by General Procedure A using *N*-benzyl-*N*-ethynyl-4-methylbenzenesulfonamide (114 mg dissolved in 1 mL dry toluene) and cyclohexane carboxaldehyde (36 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 92 mg (77% yield) of **1n** as a white solid (mp = 123.0–125.2 °C). The enantiomeric excess was determined by HPLC with a Chiralcel AS-H column (hexanes:2-propanol = 9:1, flow rate = 1.0 mL/min), t_r (1) = 18.9 min, t_r (2) = 22.9 min, $[\alpha]_D^{20}$: –10.3 (c = 0.09, $CHCl_3$, 94% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.48–0.63 (m, 1H), 0.63–0.79 (m, 1H), 0.95–1.09 (m, 2H), 1.12–1.23 (m, 1H), 1.24–1.31 (m, 1H),

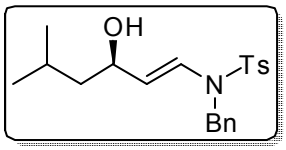
1.32–1.42 (m, 1H), 1.52–1.71 (m, 4H), 2.43 (s, 3H), 3.67–3.80 (m, 1H), 4.52 (iso(AB)quadruplet, J_{AB} = 15.7 Hz, Δ = 201.4 Hz, 2H), 4.59–4.69 (dd, overlapped with AB-quadruplet, 1H), 6.80 (d, J = 14.2 Hz, 1H), 7.19–7.44 (m, 7H), 7.66–7.80 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 21.7, 26.1, 26.6, 28.2, 28.9, 44.3, 49.7, 76.3, 114.2, 127.2, 127.3, 127.6, 127.7, 128.7, 130.1, 135.5, 136.2, 144.1. IR (neat): 3284 (OH), 2960, 2082, 1599, 1455, 1332, 1160, 1094, 1062, 814 cm^{-1}; HRMS-CI: m/z 422.1775 [$(M + Na)^+$; calculated for $C_{23}H_{29}NO_3SNa$: 422.1766].



(*S*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-4,4-dimethylpent-1-en-1-yl)-4-methylbenzenesulfonamide (1o).

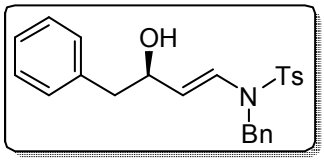
Title compound **1o** was prepared by General Procedure A using *N*-benzyl-*N*-ethynyl-4-methylbenzenesulfonamide (114 mg dissolved in 1 mL dry toluene) and pivalaldehyde (36 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 90 mg (80% yield) of **1o** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel AS-H column (hexanes:2-propanol = 9:1, flow rate = 1.0 mL/min), t_r (1) = 24.0 min, t_r (2) = 29.0 min, $[\alpha]_D^{20}$: –8.1 (c = 0.1, $CHCl_3$, 93% ee). ^1H NMR ($CDCl_3$, 360 MHz): δ 0.71 (s, 9H), 1.99 (s, 3H), 3.47 (d, J = 7.7 Hz, 1H) 4.41 (iso(AB)quadruplet, J_{AB} = 15.6 Hz, Δ = 102.7 Hz, 2H), 4.74 (dd, J_1 = 14.5 Hz, J_2 = 7.7 Hz, 1H), 6.87 (d, J = 14.5 Hz, 1H), 7.00–7.07 (m, 7H), 7.74–7.78 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 21.4, 26.0, 47.7, 50.1, 79.6, 113.6, 127.7, 127.8, 127.9, 128.5, 129.0, 130.1, 135.4, 136.6, 144.0. IR (neat): 3285 (OH), 2961, 2082, 1599, 1456, 1330, 1160, 1090, 1062, 815 cm^{-1};

HRMS-CI: m/z 396.1621 [(M – Na)+; calculated for $C_{21}H_{27}NO_3SNa$: 396.1609] and 374.1801 [$(M + H)^+$; calculated for $C_{21}H_{28}NO_3S$: 374.1790].



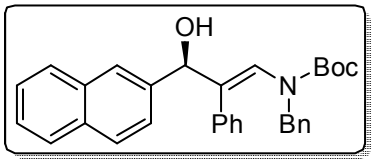
(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-5-methylhex-1-en-1-yl)-4-methylbenzenesulfonamide (1p).

Title compound **1p** was prepared by General Procedure A using *N*-benzyl-*N*-ethynyl-4-methylbenzenesulfonamide (114 mg dissolved in 1 mL dry toluene) and isovaleraldehyde (32 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 91 mg (81% yield) of **1p** as a white solid (mp = 112.0–114.3 °C). The enantiomeric excess was determined by HPLC with a Chiralcel AS-H column (hexanes:2-propanol = 9:1, flow rate = 1.0 mL/min), t_r (1) = 24.7 min, t_r (2) = 29.4 min, $[\alpha]_D^{20}$: –4.8 (c = 0.7, $CHCl_3$, 76% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.78 (t, J = 6.9 Hz, 6H), 1.32–1.41 (m, 3H), 2.43 (s, 3H), 4.06 (pent., J = 7.1 Hz, 1H), 4.51 (iso(AB)quadruplet, J_{AB} = 15.9 Hz, Δ = 32.3 Hz, 2H), 4.66 (dd, J_1 = 14.0 Hz, J_2 = 7.8 Hz, 1H), 6.89 (d, J = 14.0 Hz, 1H), 7.20–7.38 (m, 7H), 7.66–7.77 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 21.7, 22.7, 22.8, 24.6, 46.9, 49.7, 77.2, 115.6, 127.1, 127.6, 127.7, 128.7, 130.1, 135.5, 136.2, 144.1. IR (neat): 3284 (OH), 2960, 2082, 1599, 1455, 1330, 1160, 1093, 1062, 814 cm^{-1}; HRMS-CI: m/z 396.1610 [$(M + Na)^+$; calculated for $C_{21}H_{27}NO_3SNa$: 396.1609].



(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-4-phenylbut-1-en-1-yl)-4-methylbenzenesulfonamide (1q).

Title compound **1q** was prepared by General Procedure A using *N*-benzyl-*N*-ethynyl-4-methylbenzenesulfonamide (114 mg dissolved in 1 mL dry toluene) and phenylacetaldehyde (35 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 96 mg (79% yield) of **1q** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel AS-H column (hexanes:2-propanol = 9:1, flow rate = 1.0 mL/min), t_r (1) = 32.1 min, t_r (2) = 38.9 min, $[\alpha]_D^{20}$: –21.5 (c = 0.1, $CHCl_3$, 83% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 2.42 (s, 3H), 2.59–2.74 (m, 2H), 4.20–4.28 (m, 1H), 4.47 (iso(AB)quadruplet, J_{AB} = 16.0 Hz, Δ = 48.7 Hz, 2H), 4.71 (dd, J_1 = 14.1 Hz, J_2 = 7.4 Hz, 1H), 6.87 (d, J = 14.1 Hz, 1H), 6.89–6.97 (m, 2H), 7.16–7.39 (m, 10H), 7.58–7.68 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 21.7, 44.6, 49.7, 72.6, 113.4, 126.6, 127.1, 127.7, 128.2, 128.6, 128.8, 129.7, 130.1, 135.4, 136.2, 144.1. IR (neat): 3289 (OH), 2964, 2080, 1601, 1455, 1330, 1160, 1093, 1062, 815 cm^{-1}; HRMS-CI: m/z 408.1623 $[(M + Na)^+$; calculated for $C_{24}H_{25}NO_3SH$: 408.1633] and 390.1509 $[(M – OH)^+$; calculated for $C_{24}H_{24}NO_2S$: 390.1522].

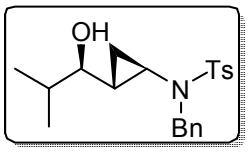


(*R*,*E*)-Tert-butyl benzyl(3-hydroxy-3-(naphthalen-2-yl)-2-phenylprop-1-en-1-yl)carbamate (1r).

Title compound **1r** was prepared by General Procedure A using *tert*-butyl benzyl(phenylethynyl)carbamate (123 mg dissolved in 1 mL dry toluene) and 2-naphtaldehyde (47 mg dissolved in 0.5 mL of dry toluene, 0.3 mmol). The product was purified by column

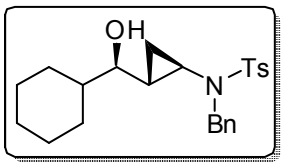
chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 34 mg (25% yield) of **1r** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel AS-H column (hexanes:2-propanol = 19:1, flow rate = 0.5 mL/min), t_r (1) = 15.0 min, t_r (2) = 19.5 min, $[\alpha]_D^{20}$: +56.5 (c = 0.1, $CHCl_3$, 97% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 1.42 (s, 9H), 4.59 (s, 2H), 5.33 (s, 1H), 6.70–6.76 (m, 2H), 6.84–6.90 (m, 3H), 6.91–7.03 (m, 3H), 7.03–7.11 (m, 2H), 7.14–7.19 (m, 2H), 7.19–7.38 (m, 6H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 28.5, 55.5, 65.2, 81.3, 113.7, 127.1, 127.67, 127.8, 128.0, 128.4, 128.8, 129.1, 129.2, 129.3, 131.3, 133.4, 134.3, 136.5, 139.3, 159.1. IR (neat): 3553 (OH), 3057, 2927, 2867, 1952, 1682, 1598, 1495, 1455, 1344, 1163, 1090, 1041, 942, 815 cm^{-1}; HRMS-CI: m/z 466.2391 [$(M + H)^+$; calculated for $C_{31}H_{32}NO_3S$: 466.2382].

General Procedure B. Asymmetric Amino Vinylation of Aldehydes/Diastereoselective Cyclopropanation:



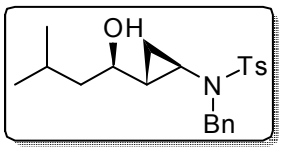
***N*-Benzyl-*N*-((1*R*,2*R*)-2-((*R*)-1-hydroxy-2-methylpropyl)cyclopropyl)-4-methylbenzenesulfonamide (2a).** A 10 mL Schlenk flask was charged with a solution of *N*-benzyl-*N*-ethynyl-4-methylbenzenesulfonamide (1.0 mL, 0.25 M in toluene, 0.25 mmol) and a solution of diethylborane (0.25 mL, 1.0 M in toluene, 0.25 mmol) was added dropwise at room temperature. The resulting solution was stirred at room temperature for 20 min. The reaction flask was then cooled to –78 °C, Et_2Zn (0.25 mL, 2.0 M in toluene, 0.5 mmol) was added, and the reaction mixture was stirred for 20 min. (–)-MIB (3.0 mg, 0.012 mmol, 5 mol %) was added followed by dropwise addition of isobutyraldehyde (24 μL, 0.3 mmol) at –78 °C. The reaction flask was placed in a –30 °C IPA/dry ice cold bath

and allowed to warm to 0 °C over 12 h. The solution was stirred at 0 °C until vinyl addition was complete by TLC (typically 12 h). The volatile materials, including Et_3B byproduct, were removed in vacuo at 0 °C. Hexanes (2 mL) was added, and the volatile materials were again removed under reduced pressure. This step was repeated two more times to ensure the complete removal of Et_3B. A solution of Et_2Zn (0.63 mL, 2.0 M in toluene, 1.25 mmol) and neat CF_3CH_2OH (91 μL, 1.25 mmol) were added slowly at 0 °C and the Schlenk flask was wrapped in aluminum foil to exclude light. The resulting mixture was stirred at 0 °C for 5 min and diiodomethane (101 μL, 1.25 mmol) was added. The stirring was continued at 0 °C for 40 h, after which the reaction mixture was quenched with brine (2 mL). The organic and aqueous layers were separated and the aqueous layer was extracted with 3 × 20 mL of diethyl ether. The combined organic layers were then washed with 50 mL of water and dried over $MgSO_4$. The filtrate was concentrated under reduced pressure and the residue was chromatographed on deactivated silica gel (10% ethyl acetate in hexanes) to afford 59 mg (80% yield) of **2a** as an yellow oil. $[\alpha]_D^{20}$: –28.1 (*c* = 0.5, $CHCl_3$); ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.68 (dd, 1H, *J* = 14.32 Hz, 6.95 Hz), 0.74 (d, 3H, *J* = 6.7 Hz), 0.77 (d, 3H, *J* = 6.7 Hz), 1.00 (d, 1H, *J* = 5.2 Hz), 1.09 (m, 1H), 1.52 (m, 1H), 2.00 (m, 1H), 2.42 (s, 3H), 3.16 (q, 1H, *J* = 4.6 Hz), 4.18 (d, 1H, *J* = 14.6 Hz), 4.38 (d, 1H, *J* = 14.6 Hz), 7.20–7.38 (m, 7H), 7.67–7.76 (m, 2H); $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ 9.90, 17.22, 18.94, 21.77, 23.69, 34.11, 34.44, 54.96, 74.52, 127.78, 127.86, 128.61, 128.65, 129.84, 135.68, 137.40, 143.67; IR (neat): 3538 (OH), 2960, 2873, 1598, 1495, 1455, 1341, 1163, 1093, 927, 815 cm^{-1}; HRMS-CI: *m*/*z* 396.1604 [(M + Na)+; calculated for $C_{21}H_{27}NO_3SNa$: 396.1609].



_N_-Benzyl-_N_-((1_R_,2_R_)-2-((_R_)-cyclohexyl(hydroxy)methyl)cyclopropyl)-4-methylbenzenesulfonamide (2b).

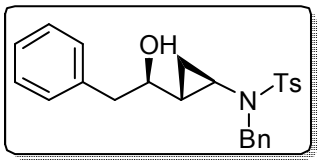
Title compound **2b** was prepared by General Procedure B using cyclohexane carboxaldehyde (36 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 94 mg (76% yield) of **2b** as an yellow oil. $[\alpha]_D^{20}$: –5.0 (c = 0.07, $CHCl_3$). ^{1}H NMR (C_6D_6, 360 MHz): δ 0.68–0.76 (m, 1H), 0.80–0.87 (m, 1H), 1.09–1.19 (m, 4H), 1.19–1.27 (m, 2H), 1.48 (d, J = 12.8 Hz, 1H), 1.54–1.63 (m, 2H), 1.63–1.77 (m, 3H), 2.01 (s, 3H), 2.17–1.22 (m, 1H), 3.21 (t, J = 4.1 Hz, 1H), 4.62 (iso(AB)quadruplet, J_{AB} = 14.7 Hz, Δ = 53.3 Hz, 2H), 6.91–6.98 (m, 2H), 7.08–7.20 (m, 3H), 7.35–7.42 (m, 2H), 7.83–7.89 (m, 2H); ^{13}C{1H} NMR (C_6D_6, 90 MHz): δ 10.0, 21.5, 24.0, 26.9, 27.0, 27.2, 28.2, 29.7, 34.9, 44.7, 55.3, 73.7, 128.0, 128.5, 129.0, 130.0, 137.1, 138.5, 143.4. IR (neat): 3543 (OH), 3031, 2925, 2852, 1600, 1495, 1451, 1341, 1163, 1094, 815 cm^{-1}; HRMS-CI: m/z 436.1927 [$(M + Na)^+$; calculated for $C_{24}H_{31}NO_3SNa$: 436.1922].



_N_-Benzyl-_N_-((1_R_,2_R_)-2-((_R_)-1-hydroxy-3-methylbutyl)cyclopropyl)-4-methylbenzenesulfonamide (2c).

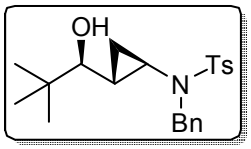
Title compound **2c** was prepared by General Procedure B using isovaleraldehyde (32 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 90 mg (78% yield) of **2c** as an yellow oil. $[\alpha]_D^{20}$: –5.4 (c = 0.08, $CHCl_3$). ^{1}H NMR (C_6D_6, 360 MHz): δ 0.44–0.52 (m, 1H), 0.72–0.76 (m, 1H), 0.77 (d, J =

6.7 Hz, 3H), 0.82 (d, J = 6.7 Hz, 3H), 0.97 (dd, J_1 = 8.7 Hz, J_2 = 4.2 Hz, 1H), 1.06 (dd, J_1 = 8.6 Hz, J_2 = 5.2 Hz, 1H), 1.10–1.20 (m, 1H), 1.55–1.70 (m, 1H), 1.92 (s, 3H), 2.08 (pent., J = 3.4 Hz, 1H), 3.26–3.36 (m, 1H), 4.19 (iso(AB)quadruplet, J_{AB} = 14.6 Hz, Δ = 17.7 Hz, 2H), 6.80–6.87 (m, 2H), 7.04–7.14 (m, 3H), 7.28–7.36 (m, 2H), 7.77–7.86 (m, 2H); ^{13}C{1H} NMR (C_6D_6, 90 MHz): δ 9.5, 20.8, 21.7, 23.2, 24.2, 26.5, 34.3, 45.6, 54.5, 67.7, 128.3, 128.5, 129.3, 136.4, 137.6, 142.7. IR (neat): 3545 (OH), 3031, 2925, 2852, 1599, 1495, 1450, 1341, 1163, 1094, 814 cm^{-1}; HRMS-CI: m/z 410.1765 [(M + Na)$^+$; calculated for $C_{22}H_{29}NO_3SNa$: 410.1766].



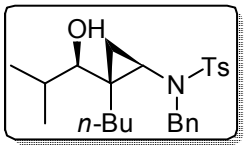
_N_-Benzyl-_N_-((1_R_,2_R_)-2-((_R_)-1-hydroxy-2-phenylethyl)cyclopropyl)-4-methylbenzenesulfonamide (2d).

Title compound **2d** was prepared by General Procedure B using phenylacetaldehyde (35 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 98 mg (78% yield) of **1q** as an yellow oil. $[\alpha]_D^{20}$: –6.2 (c = 0.1, $CHCl_3$). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.68–0.75 (m, 1H), 0.78–0.85 (m, 1H), 1.31 (d, J = 3.9 Hz, 1H), 2.10–2.16 (m, 1H), 2.44 (s, 3H), 2.50 (dd, J_1 = 12.5 Hz, J_2 = 8.9 Hz, 1H), 2.75 (dd, J_1 = 13.8 Hz, J_2 = 3.8 Hz, 1H), 3.53–3.61 (m, 1H), 4.31 (iso(AB)quadruplet, J_{AB} = 14.6 Hz, Δ = 40.0 Hz, 2H), 7.08–7.14 (m, 2H), 7.18–7.24 (m, 2H), 7.25–7.29 (m, 2H), 7.29–7.35 (m, 6H), 7.70–7.75 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 10.1, 21.8, 26.2, 34.6, 43.6, 54.8, 71.3, 126.8, 127.9, 128.6, 128.7, 128.8, 129.5, 129.9, 135.8, 137.2, 138.1, 143.7. IR (neat): 3543 (OH), 3031, 2925, 2852, 1599, 1495, 1451, 1341, 1163, 1094, 814 cm^{-1}; HRMS-CI: m/z 422.1779 [(M + H)$^+$; calculated for $C_{25}H_{28}NO_3S$: 422.1790] and 444.1609 [(M + Na)$^+$; calculated for $C_{25}H_{27}NO_3SNa$: 444.1612].



***N*-Benzyl-*N*-((1*R*,2*R*)-2-((*S*)-1-hydroxy-2,2-dimethylpropyl)cyclopropyl)-4-methylbenzenesulfonamide (2e).**

Title compound **2e** was prepared by General Procedure B using pivalaldehyde (36 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 84 mg (72% yield) of **2e** as an yellow oil. $[\alpha]_D^{20}$: –6.3 (c = 0.08, $CHCl_3$). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.73 (s, 9H), 0.75–0.77 (m, 1H), 1.14 (d, J = 5.9 Hz, 1H), 1.98–2.04 (m, 1H), 2.43 (s, 3H), 3.18–3.22 (m, 1H), 4.27 (iso(AB)quadruplet, J_{AB} = 14.4 Hz, Δ = 62.3 Hz, 2H), 4.89–4.91 (m, 1H), 7.15–7.22 (m, 1H), 7.22–7.28 (m, 4H), 7.70–7.80 (m, 4H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 9.6, 21.2, 21.7, 25.7, 33.5, 35.8, 54.8, 75.8, 127.3, 127.9, 128.0, 128.8, 129.8, 135.5, 136.5, 137.4. IR (neat): 3545 (OH), 3030, 2925, 2852, 1603, 1495, 1450, 1341, 1163, 1094, 815 cm^{-1}; HRMS-CI: m/z 388.1961 [$(M + H)^+$; calculated for $C_{22}H_{30}NO_3S$: 388.1946].

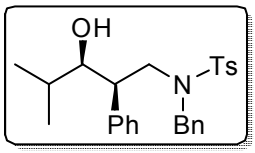


***N*-Benzyl-*N*-((1*R*,2*R*)-2-butyl-2-((*R*)-1-hydroxy-2-methylpropyl)cyclopropyl)-4-methylbenzenesulfonamide (2f).**

Title compound **2f** was prepared by General Procedure B using *N*-benzyl-*N*-(hex-1-yn-1-yl)-4-methylbenzenesulfonamide (137 mg dissolved in 1 mL dry toluene, 0.4 mmol) and isobutyraldehyde (24 μL, 0.3 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 36 mg (28% yield) of **2f** as an yellow oil. $[\alpha]_D^{20}$: –8.7 (c = 0.06, $CHCl_3$). ^{1}H NMR (C_6D_6, 360 MHz): δ 0.44–0.48 (m, 1H), 0.62 (d, J = 6.8 Hz, 1H), 0.69 (d, J = 6.6 Hz, 3H), 0.83 (t, J = 7.3 Hz, 3H), 1.02 (d, J = 6.6 Hz, 3H),

1.14–1.28 (m, 3H), 1.29–1.36 (m, 1H), 1.40–1.49 (m, 1H), 1.77–1.88 (m, 1H), 1.90 (s, 3H), 2.54 (t, J = 6.8 Hz, 1H), 3.28–3.33 (m, 1H), 3.41 (iso(AB)quadruplet, J_{AB} = 15.4 Hz, Δ = 276.0 Hz, 2H), 6.78–6.86 (m, 2H), 7.01–7.07 (m, 1H), 7.08–7.14 (m, 2H), 7.32–7.40 (m, 2H), 7.81–7.88 (m, 2H); $^{13}C\{1H\}$ NMR (C_6D_6, 90 MHz): δ 14.6, 17.1, 18.7, 20.7, 21.4, 23.4, 23.8, 30.3, 30.8, 32.0, 32.3, 42.1, 55.6, 77.7, 128.3, 129.0, 129.2, 130.1, 136.5, 138.5, 143.6. IR (neat): 3516 (OH), 2956, 1603, 1456, 1160, 1093, 1042, 815 cm^{-1}; HRMS-CI: m/z 430.2420 [$(M + H)^+$; calculated for $C_{25}H_{36}NO_3S$: 430.2416].

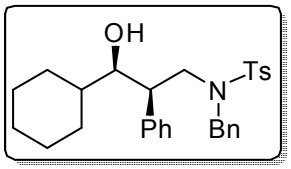
General Procedure C. Diastereoselective Hydrogenation of *β*-Hydroxy Enamines with Aliphatic Substituents in 3-Position:



_N_-Benzyl-_N_-(3-hydroxy-4-methyl-2-phenylpentyl)-4-methylbenzenesulfonamide (3a).

In a 10 × 75 mm glass test tube was dissolved (*E*)-*N*-benzyl-*N*-(3-hydroxy-4-methyl-2-phenylpent-1-enyl)-4-methylbenzenesulfonamide (44 mg, 0.1 mmol) in methanol (4 mL) at room temperature. The space above solution was purged with nitrogen to remove most of the air. 10% Palladium on carbon (8 mg, 7 mol %) was added and the test tube was placed in a Parr hydrogenator. Good stirring was confirmed before closing apparatus. After flushing three times with hydrogen, the system was pressured with 9.65 MPa (1400 psi) of hydrogen and the reaction was stirred for 12 h at room temperature. After opening the apparatus, the palladium catalyst was removed *via* filtration through a plug of Celite. The filtrate was concentrated under reduced pressure and the residue was chromatographed on silica gel (10% ethyl acetate in hexanes) to afford 39 mg (90% yield) of **3a** as an amorphous solid. ^1H NMR

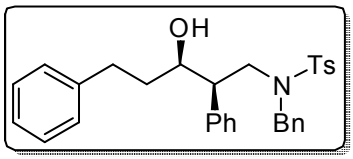
($CDCl_3$, 360 MHz): δ 0.30 (d, J = 6.6 Hz, 3H), 0.80 (d, J = 6.6 Hz, 3H), 1.05-1.15 (m, 1H), 2.35 (s, 3H), 2.67 (dd, J_1 = 14.7 Hz, J_2 = 4.5 Hz, 1H), 3.01 (d, J = 5.4 Hz, 1H), 3.35-3.46 (m, 1H), 3.90 (dd, J_1 = 14.1 Hz, J_2 = 11.4 Hz, 1H), 4.18 (iso(AB)quadruplet, J_{AB} = 14.1 Hz, Δ = 352.0 Hz, 2H), 7.00-7.19 (m, 5H), 7.19-7.32 (m, 7H), 7.60-7.67 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 18.8, 20.2, 21.8, 31.1, 46.7, 53.5, 55.2, 75.2, 127.0, 127.4, 128.4, 128.5, 129.0, 129.2, 129.6, 130.1, 136.8, 139.6, 143.9. IR (neat): 3532 (OH), 2924, 1599, 1494, 1330, 1156, 1094, 925, 814 cm^{-1}; HRMS-CI: m/z 438.2103 [$(M + H)^+$; calculated for $C_{26}H_{32}NO_3S$: 438.2103].



_N_-Benzyl-_N_-((2_R_,3_R_)-3-cyclohexyl-3-hydroxy-2-phenylpropyl)-4-methylbenzenesulfonamide (3b).

Title compound **3b** was prepared by General Procedure C using **1b** (48 mg, 0.1 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 38 mg (80% yield) of **3b** as an yellow oil. $[\alpha]_D^{20}$: –39.9 (c = 0.08, $CHCl_3$). ^1H NMR ($CDCl_3$, 360 MHz): δ 0.36–0.51 (m, 1H), 0.77–0.86 (m, 1H), 0.86–0.95 (m, 2H), 1.10–1.19 (m, 2H), 1.20–1.35 (m, 1H), 1.44–1.56 (m, 2H), 1.58–1.67 (m, 1H), 1.92–2.02 (m, 1H), 2.42 (s, 3H), 2.77 (dd, J_1 = 14.3 Hz, J_2 = 4.6 Hz, 1H), 2.88–2.94 (m, 1H), 3.54–3.62 (m, 1H), 3.96 (dd, J_1 = 13.4 Hz, J_2 = 11.4 Hz, 1H), 4.25 (iso(AB)quadruplet, J_{AB} = 14.2 Hz, Δ = 320.0 Hz, 2H), 7.08–7.15 (m, 2H), 7.15–7.23 (m, 3H), 7.30–7.40 (m, 7H), 7.68–7.75 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 21.7, 25.9, 26.0, 26.7, 28.9, 30.1, 40.3, 46.1, 53.1, 55.0, 74.0, 126.9, 127.4, 128.4, 129.0, 129.2, 129.6, 130.1, 136.1, 136.7, 139.6, 143.9. Dr > 20:1 from ^1H NMR of crude reaction mixture. IR (neat): 3532 (OH), 2925, 2870, 1600, 1495,

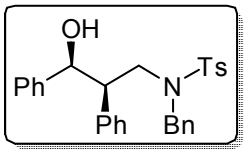
1454, 1330, 1157, 1096, 925, 900, 814 cm^{-1}; HRMS-CI: m/z 500.2237 $[(M + Na)^+$; calculated for $C_{29}H_{35}NO_3SNa$: 500. 2352].



_N_-Benzyl-_N_-((2_R_,3_R_)-3-hydroxy-2,5-diphenylpentyl)-4-methylbenzenesulfonamide (3c).

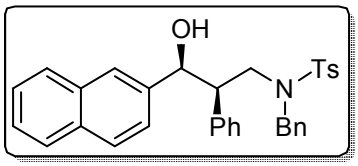
Title compound **3c** was prepared by General Procedure C using **1c** (48 mg, 0.1 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 40 mg (80% yield) of **3c** as an yellow oil. $[\alpha]_D^{20}$: –9.1 (c = 0.1, $CHCl_3$). ^1H NMR ($CDCl_3$, 360 MHz): δ 1.05–1.16 (m, 1H), 1.27–1.40 (m, 1H), 2.09–2.17 (m, 1H), 2.42 (s, 3H), 2.51–2.62 (m, 1H), 2.78 (dd, J_1 = 14.3 Hz, J_2 = 4.7 Hz, 1H), 3.04 (d, J = 5.0 Hz, 1H), 3.97 (dd, J_1 = 14.2 Hz, J_2 = 11.5 Hz, 1H), 4.00–4.06 (m, 1H), 4.23 (iso(AB)quadruplet, J_{AB} = 14.1 Hz, Δ = 317.8 Hz, 2H), 7.00–7.08 (m, 4H), 7.11–7.19 (m, 4H), 7.19–7.25 (m, 4H), 7.25–7.33 (m, 5H), 7.33–7.54 (m, 5H), 7.68–7.73 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 21.8, 32.8, 36.7, 49.4, 52.6, 54.9, 68.8, 125.9, 127.2, 127.4, 128.4, 128.5, 128.7, 129.0, 129.1, 129.5, 130.1, 136.1, 136.7, 138.9, 142.6, 144.0. Dr > 20:1 from ^1H NMR of crude reaction mixture. IR (neat): 3533 (OH), 2924, 2871, 1599, 1497, 1454, 1330, 1154, 1095, 924, 900, 814 cm^{-1}; HRMS-CI: m/z 522.2128 $[(M + Na)^+$; calculated for $C_{31}H_{33}NO_3SNa$: 522. 2079] and 500.2252 $[(M + H)^+$; calculated for $C_{31}H_{34}NO_3S$: 500. 2259].

General Procedure D. Diastereoselective Hydrogenation of *β*-Hydroxy Enamines with Aromatic Substituents in 3-Position:



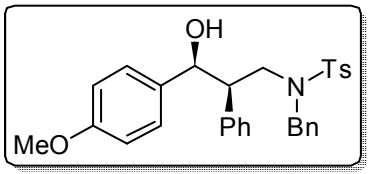
***N*-Benzyl-*N*-((2*R*,3*S*)-3-hydroxy-2,3-diphenylpropyl)-4-methylbenzenesulfonamide (3e).**

In a 10 × 75 mm glass test tube was dissolved (*E*)-*N*-benzyl-*N*-(3-hydroxy-2,3-diphenylprop-1-enyl)-4-methylbenzenesulfonamide (47 mg, 0.1 mmol) in ethyl acetate (3 mL) at room temperature. 10% Palladium on carbon (8 mg, 7 mol %) was added and the test tube was placed in a Parr hydrogenator. Good stirring was confirmed before closing the apparatus. After flushing three times with hydrogen, the system was pressured with 9.65 MPa (1400 psi) of hydrogen and the reaction was stirred for 12 h at room temperature. After opening the apparatus, the palladium catalyst was removed *via* filtration through a plug of Celite. The filtrate was concentrated in vacuo and the residue was chromatographed on silica gel (10% ethyl acetate in hexanes) to afford 43 mg (92% yield) of **3d** as an amorphous solid. ^{1}H NMR ($CDCl_3$, 360 MHz): δ 2.42 (s, 3H), 2.65 (m, 1H), 2.79 (d, 1H, J = 4.3 Hz), 2.99 (dd, 1H, J = 14.3 Hz, 6.1 Hz), 3.88 (d, 1H, J = 14.5 Hz), 4.55 (d, 1H, J = 14.5 Hz), 4.96 (t, 1H, J = 4.3 Hz), 6.59–6.70 (m, 4H), 6.82–6.89 (m, 2H), 7.04–7.13 (m, 3H), 7.25–7.36 (m, 8H), 7.61–7.66 (m, 2H). ^{13}C{^{1}H} NMR ($CDCl_3$, 75 MHz): δ 21.78, 52.15, 54.66, 55.36, 72.28, 127.09, 127.32, 127.53, 128.16, 128.33, 129.03, 129.10, 129.62, 130.05, 134.51, 136.12, 136.79, 138.21, 143.83, 158.61. IR (neat): 3519 (OH), 2919, 1611, 1513, 1454, 1331, 1246, 1156, 1103, 1034, 928 cm^{-1}. HRMS-CI: *m*/*z* 494.1760 [(M + Na)$^{+}$; calcd for $C_{29}H_{29}NO_3SNa$: 494.1766].



***N*-Benzyl-*N*-((2*R*,3*S*)-3-hydroxy-3-(naphthalen-2-yl)-2-phenylpropyl)-4-methylbenzenesulfonamide (3f).**

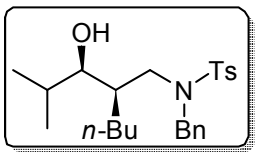
Title compound **3f** was prepared by General Procedure D using **1f** (52 mg, 0.1 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 45 mg (86% yield) of **3f** as an yellow oil. The enantiomeric excess was determined by HPLC with a Chiralcel OD-H column (hexanes:2-propanol = 9:1, flow rate = 0.8 mL/min), t_r (1) = 28.8 min, t_r (2) = 31.5 min, $[\alpha]_D^{20}$: –79.2 (c = 0.1, $CHCl_3$, 91% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 2.42 (s, 3H), 2.70–2.76 (m, 1H), 3.03 (dd, J_1 = 14.6 Hz, J_2 = 6.7 Hz, 1H), 3.76 (dd, J_1 = 14.3 Hz, J_2 = 9.2 Hz, 1H), 4.19 (iso(AB)quadruplet, J_{AB} = 14.4 Hz, Δ = 214.5 Hz, 2H), 4.88 (t, J = 4.3 Hz, 1H), 6.43–6.48 (m, 1H), 6.48–6.58 (m, 1H), 6.75–6.82 (m, 1H), 6.86–6.94 (m, 2H), 7.07–7.20 (m, 4H), 7.23–7.45 (m, 5H), 7.58–7.67 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 23.5, 29.3, 51.9, 54.4, 73.0, 123.5, 127.0, 127.1, 127.5, 128.2, 128.3, 128.7, 129.0, 129.1, 129.6, 130.0, 131.3, 132.7, 136.2, 136.3, 136.8, 143.7. Dr > 20:1 from ^{1}H NMR of crude reaction mixture. IR (neat): 3555 (OH), 2922, 2870, 1602, 1499, 1449, 1330, 1154, 1095, 922, 900, 814 cm^{-1}; HRMS-CI: m/z 544.1925 [$(M + Na)^+$; calculated for $C_{33}H_{31}NO_3SNa$: 544.1922].



***N*-Benzyl-*N*-((2*R*,3*S*)-3-hydroxy-3-(4-methoxyphenyl)-2-phenylpropyl)-4-methylbenzenesulfonamide (3g).**

Title compound **3g** was prepared by General Procedure D using **1g** (50 mg, 0.1 mmol). The product was purified by column chromatography on deactivated

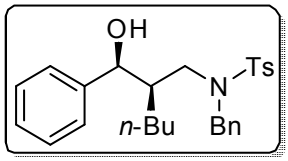
silica gel (10% ethyl acetate in hexanes) to afford 45 mg (90% yield) of **3f** as an yellow oil. $[\alpha]_D^{20}$: –45.8 (c = 0.06, $CHCl_3$). ^1H NMR ($CDCl_3$, 360 MHz): δ 2.42 (s, 3H), 2.62–2.69 (m, 1H), 2.80 (d, J = 4.4 Hz, 1H), 2.99 (dd, J_1 = 14.5 Hz, J_2 = 6.2 Hz, 1H), 3.70 (s, 3H), 3.82 (dd, J_1 = 13.7 Hz, J_2 = 9.5 Hz, 1H), 4.21 (iso(AB)quadruplet, J_{AB} = 14.4 Hz, Δ = 240.0 Hz, 2H), 6.59–6.70 (m, 4H), 6.82–6.90 (m, 2H), 7.04–7.13 (m, 3H), 7.25–7.38 (m, 7H), 7.60–7.67 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 21.8, 52.0, 52.1, 54.6, 55.4, 72.3, 113.3, 127.1, 127.3, 127.5, 128.2, 128.3, 129.1, 129.6, 130.1, 134.5, 136.1, 136.8, 138.2, 143.8, 158.6. Dr > 20:1 from ^1H NMR of crude reaction mixture. IR (neat): 3535 (OH), 2925, 2870, 1599, 1497, 1452, 1330, 1154, 1095, 924, 900, 814 cm^{-1}; HRMS-CI: m/z 524.1871 $[(M + Na)^+$; calculated for $C_{30}H_{31}NO_3SNa$: 524. 1871].



_N_-Benzyl-_N_-((_R_)-2-((_R_)-1-hydroxy-2-methylpropyl)hexyl)-4-methylbenzenesulfonamide (3k).

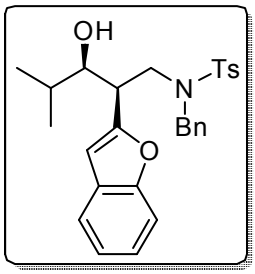
Title compound **3k** was prepared by General Procedure C using **1k** (42 mg, 0.1 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 35 mg (85% yield) of **3k** as an yellow oil. $[\alpha]_D^{20}$: –8.7 (c = 0.07, $CHCl_3$). ^1H NMR ($CDCl_3$, 360 MHz): δ 0.35 (d, J = 6.7 Hz, 3H), 0.80 (t, J = 7.2 Hz, 3H), 0.84–0.92 (m, 3H), 0.96 (d, J = 6.7 Hz, 3H), 1.04–1.17 (m, 4H), 1.20–1.23 (m, 1H), 2.46 (s, 3H), 2.62–2.67 (m, 1H), 3.25 (dd, J_1 = 9.9 Hz, J_2 = 5.4 Hz, 1H), 3.46 (dd, J_1 = 14.9 Hz, J_2 = 12.1 Hz, 1H), 4.25 (iso(AB)quadruplet, J_{AB} = 14.3 Hz, Δ = 327.0 Hz, 2H), 7.27–7.31 (m, 5H), 7.33–7.37 (m, 2H), 7.71–7.77 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 15.1, 18.8, 20.2, 21.8, 23.2, 24.4, 29.2, 31.1, 36.0, 46.6, 53.5, 76.6, 127.0, 128.4, 128.5, 129.0, 129.6, 136.8, 139.6, 143.9. Dr = 3.2:1

from ^{1}H NMR of crude reaction mixture. IR (neat): 3530 (OH), 2925, 2870, 1599, 1494, 1453, 1330, 1156, 1094, 925, 900, 814 cm^{-1}; HRMS-CI: m/z 440.2240 [(M + Na)$^+$; calculated for $C_{26}H_{31}NO_3SNa$: 440.2235].



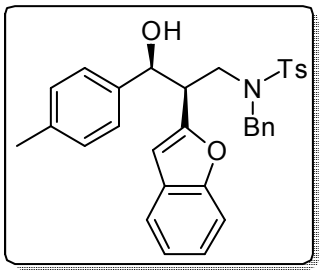
_N_-Benzyl-_N_-((_R_)-2-((_S_)-hydroxy(phenyl)methyl)hexyl)-4-methylbenzenesulfonamide (3l).

Title compound **3l** was prepared by General Procedure D using **1l** (45 mg, 0.1 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 41 mg (90% yield) of **3l** as an yellow oil. $[\alpha]_D^{20}$: –12.6 (c = 0.04, $CHCl_3$). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.81 (t, J = 7.2 Hz, 3H), 0.85–0.95 (m, 2H), 1.06–1.20 (m, 4H), 1.23–1.26 (m, 1H), 2.43 (s, 3H), 2.72–2.77 (m, 1H), 3.31 (dd, J_1 = 9.7 Hz, J_2 = 5.2 Hz, 1H), 3.62 (dd, J_1 = 13.8 Hz, J_2 = 11.1 Hz, 1H), 4.36 (iso(AB)quadruplet, J_{AB} = 14.2 Hz, Δ = 195.6 Hz, 2H), 7.22–7.32 (m, 6H), 7.33–7.45 (m, 4H), 7.54–7.60 (m, 2H), 7.70–7.75 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 15.2, 21.8, 23.2, 25.0, 29.8, 39.2, 46.3, 53.7, 77.9, 127.0, 127.3, 128.4, 128.5, 128.6, 128.8, 129.0, 129.6, 134.5, 136.8, 139.6, 143.9. Dr = 4.1:1 from ^{1}H NMR of crude reaction mixture. IR (neat): 3542 (OH), 2925, 2870, 1599, 1492, 1453, 1330, 1156, 1094, 925, 900, 815 cm^{-1}; HRMS-CI: m/z 452.2238 [(M + H)$^+$; calculated for $C_{27}H_{34}NO_3S$: 452.2259].



***N*-((2*R*,3*R*)-2-(Benzofuran-2-yl)-3-hydroxy-4-methylpentyl)-*N*-benzyl-4-methylbenzenesulfonamide (3i).**

Title compound **3i** was prepared by General Procedure C using **1i** (48 mg, 0.1 mmol). The product was purified by column chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 42 mg (88% yield) of **3i** as an yellow oil. $[\alpha]_D^{20}$: –39.0 (c = 0.08, $CHCl_3$). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 0.50 (d, J = 6.7 Hz, 3H), 0.89 (d, J = 6.7 Hz, 3H), 1.29-1.37 (m, 1H), 2.43 (s, 3H), 2.70 (d, J = 7.1 Hz, 1H), 2.95-3.01 (m, 1H), 3.15 (dd, J_1 = 14.3 Hz, J_2 = 5.8 Hz, 1H), 3.38–3.46 (m, 1H), 3.87 (dd, J_1 = 14.0 Hz, J_2 = 9.6 Hz, 1H), 4.27 (iso(AB)quadruplet, J_{AB} = 14.4 Hz, Δ = 222.0 Hz, 2H), 6.43 (s, 1H), 7.13–7.23 (m, 2H), 7.28–7.32 (m, 6H), 7.33–7.47 (m, 1H), 7.41–7.48 (m, 1H), 7.69–7.75 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 19.0, 19.9, 21.8, 30.6, 41.7, 51.2, 54.7, 75.3, 105.4, 111.2, 120.8, 122.8, 123.7, 125.7, 127.4, 128.4, 128.6, 129.0, 130.1, 136.2, 136.5, 143.9, 154.5, 156.2. Dr > 20:1 from ^{1}H NMR of crude reaction mixture. IR (neat): 3448 (OH), 2925, 2107, 1648, 1495, 1455, 1332, 1254, 1159, 1093, 928, 901, 814 cm^{-1}; HRMS–CI: m/z 500.1848 [$(M + Na)^+$; calculated for $C_{28}H_{31}NO_3SNa$: 500.1871] and 478.2038 [$(M + H)^+$; calculated for $C_{28}H_{32}NO_3S$: 478.2052].

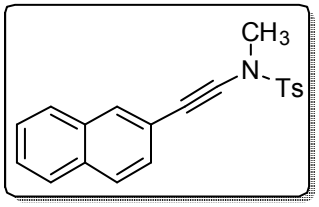


***N*-((2*R*,3*S*)-2-(Benzofuran-2-yl)-3-hydroxy-3-(*p*-tolyl)propyl)-*N*-benzyl-4-methylbenzenesulfonamide (3j).**

Title compound **3j** was prepared by General Procedure D using **1j** (52 mg, 0.1 mmol). The product was purified by column

chromatography on deactivated silica gel (10% ethyl acetate in hexanes) to afford 43 mg (82% yield) of **3j** as a white solid (mp = 78.6–83.0 °C). $[\alpha]_D^{20}$: –65.5 (c = 0.1, $CHCl_3$). ^1H NMR ($CDCl_3$, 360 MHz): δ 2.42 (s, 3H), 2.44 (s, 3H), 2.95–3.02 (m, 1H), 3.19 (dd, J_1 = 13.5 Hz, J_2 = 9.3 Hz, 1H), 4.09 (iso(AB)quadruplet, J_{AB} = 14.7 Hz, Δ = 44.3 Hz, 2H), 4.14 (m, overlapped with AB-quadruplet, 1H), 4.56–4.54 (m, 1H), 4.65–4.72 (m, 1H), 7.15–7.21 (m, 5H), 7.23–7.25 (m, 3H), 7.27–7.34 (m, 6H), 7.54–7.59 (m, 2H), 7.74–7.78 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 21.7, 23.0, 35.4, 44.1, 54.2, 74.1, 104.8, 111.8, 126.1, 127.3, 127.4, 127.6, 127.9, 128.1, 128.2, 128.4, 128.6, 128.88, 128.93, 129.8, 130.0, 136.1, 136.9, 137.0, 139.6, 143.3, 156.4, 156.6. Dr > 20:1 from ^1H NMR of crude reaction mixture. IR (neat): 3450 (OH), 2924, 2105, 1645, 1495, 1456, 1330, 1254, 1159, 1093, 928, 900, 815 cm^{-1}; HRMS–CI: m/z 548.1877 [$(M + Na)^+$; calculated for $C_{32}H_{31}NO_3SNa$: 548.1871].

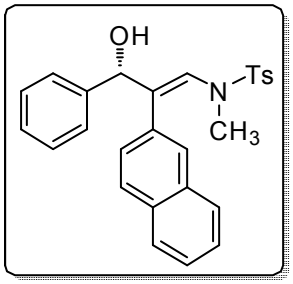
Synthesis of PRC200-SS and derivatives



***N*,4-Dimethyl-*N*-(naphthalen-2-ylethynyl)benzenesulfonamide (5).**

Title compound **5** was prepared by the method of Stahl and co-workers.[1] In a 500 ml Schlenk flask equipped with a stir-bar, $CuCl_2$ (1.4 mmol, 191 mg), *N*,4-dimethylbenzenesulfonamide (35.5 mmol, 6.58 g) and Na_2CO_3 (14.2 mmol, 1.51 g) were combined. The reaction flask was purged with oxygen gas for 10 minutes. A solution of pyridine (14.2 mmol, 1150 μL) in 36 ml dry toluene was added to the reaction flask via a syringe. A

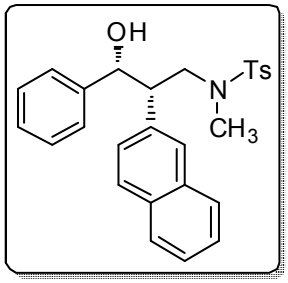
balloon filled with oxygen gas was connected to the reaction flask via a needle. The flask was placed in an oil-bath and heated to 70 °C. A solution of 2-naphtylacetylene (7.1 mmol, 1.08 g) in 36.0 ml dry toluene was added to the flask over 5 h by using a syringe pump. After the addition of 2-naphtylacetylene/toluene solution, the reaction mixture was allowed to stir at 70 ºC for another 16 h and then cooled to room temperature. After the crude mixture was concentrated under vacuum, the reaction mixture was purified by column chromatography on silica gel with 5% ethyl acetate in hexanes to yield the ynamide **5** (2.07 g, 87% yield) as a a white solid (mp = 117.7–119.3 °C). ^{1}H NMR ($CDCl_3$, 300 MHz): δ 2.32 (s, 3H), 2.07 (s, 3H), 7.21–7.30 (m, 2H), 7.30–7.43 (m, 3H), 7.59–7.73 (m, 3H), 7.73–7.84 (m, 3H); ^{13}C{1H} NMR ($CDCl_3$, 75 MHz): δ 21.8, 39.5, 69.7, 84.5, 120.2, 126.6, 126.7, 127.7, 127.9, 128.0, 128.1, 128.4, 130.0, 131.0, 132.7, 133.1, 133.4, 145.0. IR (neat): 2234, 1922, 1625, 1597, 1451, 1365, 1240, 1166, 1090, 982, 939, 861, 816 cm^{-1}; HRMS-CI: m/z 358.0888 [$(M + Na)^+$; calculated for $C_{20}H_{17}NO_2SNa$: 358.0878].



(*S*,*E*)-*N*-(3-Hydroxy-2-(naphthalen-2-yl)-3-phenylprop-1-en-1-yl)-*N*,4-dimethylbenzenesulfonamide (6).

In a flame dried 25 mL Schlenk flask **6** (1.49 mmol, 500 mg) was dissolved in 2 mL dry toluene. Solution of diethylborane (1.45 mL, 1.0 M in toluene, 1.45 mmol) was added dropwise. The resulting solution was stirred at room temperature for 30 min. The reaction flask was then cooled to –78 °C and Et_2Zn (1.49 mL, 2.0 M in toluene, 2.98 mmol) was added and the reaction mixture was stirred for 20 min. (+)-MIB (14.3 mg, 0.06 mmol, 5 mol %) was added followed by dropwise addition of (121 μL, 1.19 mmol) at this temperature. The reaction flask was placed in a –30 °C IPA/dry ice cold bath and

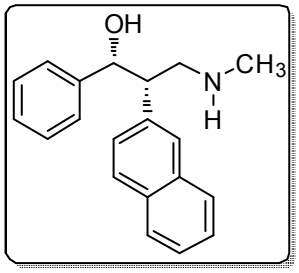
allowed to warm to 0 °C over several hours. The solution was stirred at 0 °C until vinyl addition was complete by TLC (typically 12 h). The reaction was then quenched by addition of brine (10 mL). The organic and aqueous layers were separated, and the aqueous layer was extracted with 3 × 50 mL of diethyl ether. The combined organic layers were then washed with 50 mL of water and dried over $MgSO_4$. The filtrate was concentrated in vacuo and the residue was chromatographed on deactivated silica gel (10% ethyl acetate in hexanes) to afford 486 mg (92% yield) of **6** as a white solid (mp = 129.8–131.2 °C). The enantiomeric excess was determined by HPLC with a Chiralcel AS-H column (hexanes:2-propanol = 9:1, flow rate = 1.0 mL/min), t_r (1) = 56.2 min, t_r (2) = 71.3 min, $[\alpha]_D^{20}$: +80.2 (c = 0. 3, $CHCl_3$, 97% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 2.39 (s, 3H), 2.46 (s, 3H), 5.49 (s, 1H), 6.83 (dd, J_1 = 8.5 Hz, J_2 = 1.4 Hz, 1H), 6.91 (s, 1H), 7.02 (s, 1H), 7.21–7.29 (m, 3H), 7.29–7.35 (m, 3H), 7.36–7.41 (m, 2H), 7.51–7.56 (m, 1H), 7.56–7.63 (m, 1H), 7.63–7.67 (m, 2H), 7.67–7.74 (m, 2H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 21.8, 36.6, 77.8, 126.3, 126.7, 127.2, 127.5, 127.56, 127.59, 127.7, 127.8, 128.0, 128.4, 128.7, 130.0, 132.3, 132.7, 132.8, 133.4, 138.9, 141.9, 144.0. IR (neat): 3501 (OH), 3057, 1649, 1597, 1492, 1450, 1347, 1166, 1088, 971, 941, 867, 814 cm^{-1}; HRMS-CI: m/z 466.1452 $[(M + Na)^+$; calculated for $C_{27}H_{25}NO_3SNa$: 466.1453] and 426.1525 $[(M – OH)^+$; calculated for $C_{27}H_{24}NO_2S$: 426.1522].



***N*-((2*S*,3*R*)-3-Hydroxy-2-(naphthalen-2-yl)-3-phenylpropyl)-*N*,4-dimethylbenzenesulfonamide (7).**

In a 100 mL Schlenk tube was dissolved **6** (500 mg, 1.13 mmol) in

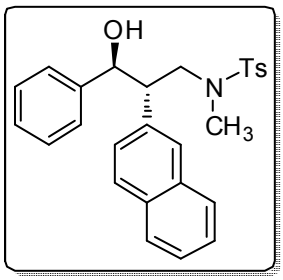
methanol (10 mL). The space above solution was purged with nitrogen to remove most of the air. 20 wt. % palladium hydroxide on carbon (50 mg, 6 mol %) was added and a balloon with hydrogen was plugged through the rubber septa. Reaction mixture was vigorously stirred until the hydrogenation was complete by TLC (30 h). The palladium catalyst was removed *via* filtration through a plug of Celite. The filtrate was concentrated under reduced pressure and the residue was chromatographed on silica gel (10% ethyl acetate in hexanes) to afford 326 mg (65% yield) of **7** as a white solid. The enantiomeric excess was determined by HPLC with a Chiralcel AD-H column (hexanes:2-propanol = 9:1, flow rate = 1.0 mL/min), t_r (1) = 32.7 min, t_r (2) = 44.1 min, $[\alpha]_D^{20}$: +39.6 (c = 0.08, $CHCl_3$, 95% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 2.42 (s, 3H), 2.72 (s, 3H), 3.09 (q, J = 6.9 Hz, 1H), 3.32–3.42 (m, 1H), 3.74 (dd, J_1 = 13.4 Hz, J_2 = 8.8 Hz, 1H), 4.29–4.42 (m, 1H), 5.23–5.33 (m, 1H), 7.13–7.27 (m, 6H), 7.30–7.35 (m, 2H), 7.42–7.48 (m, 2H), 7.55–7.62 (m, 2H), 7.71–7.79 (m, 4H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 21.7, 36.1, 52.3, 52.8, 73.8, 125.9, 126.1, 126.5, 127.5, 127.6, 127.8, 127.9, 128.0, 128.3, 128.7, 129.89, 129.93, 132.8, 133.5, 134.6, 135.5, 142.3, 143.7. Dr = 10.8:1 from ^{1}H NMR of crude reaction mixture. IR (neat): 3523 (OH), 2927, 1598, 1494, 1338, 1160, 1089, 931, 815 cm^{-1}; HRMS-CI: m/z 468.1627 [$(M + Na)^+$; calculated for $C_{27}H_{27}NO_3SNa$: 468.1609].



(1*R*,2*S*)-3-(Methylamino)-2-(naphthalen-2-yl)-1-phenylpropan-1-ol (8).

In a flame dried two-neck round bottom flask was mixed 75 mg of sodium metal, 525 mg of naphthalene and 2.5 mL of dry glyme and let stirred for 2 h. In a flame dried 10 mL Schlenk flask was dissolved **7** (50 mg, 0.11 mmol) in dry

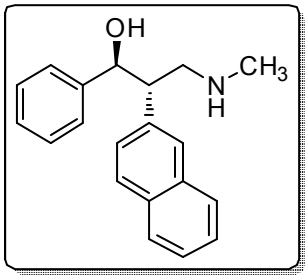
glyme (1.0 mL). The solution of sodium naphtalenide was added dropwise until the dark-green color persisted. The reaction was quenched with couple drops of water and concentrated in vacuo. The residue was chromatographed on silica gel with 1 to 5% methanol in dichloromethane to afford 28 mg (89% yield) of **8** as a white solid (mp = 180.4–184.2 °C). $[\alpha]_D^{20}$: –66.9 (c = 0.13, $CHCl_3$). ^1H NMR ($CDCl_3$, 360 MHz): δ 2.53 (s, 3H), 3.16 (dd, J_1 = 12.1 Hz, J_2 = 3.0 Hz, 1H), 3.37 (td, J_1 = 9.0 Hz, J_2 = 2.6 Hz, 1H), 3.49–3.55 (m, 1H), 5.14 (d, J = 8.6 Hz, 1H), 7.06–7.09 (m, 1H), 7.09–7.13 (m, 2H), 7.14–7.17 (m, 2H), 7.17–7.21 (m, 1H), 7.29–7.36 (m, 2H), 7.61–7.66 (m, 1H), 7.67–7.70 (m, 1H), 7.71–7.76 (m, 2H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 35.6, 47.1, 51.1, 80.5, 125.9, 126.2, 126.3, 126.6, 127.0, 127.2, 127.5, 127.8, 127.9, 128.2, 128.3, 129.2, 132.6, 133.6, 137.3, 143.3. IR (neat): 3354 (OH), 2925, 2774, 1585, 1450, 1388, 1348, 1093, 1060, 913, 813 cm^{-1}; HRMS-CI: m/z 292.1798 $[(M + H)^+$; calculated for $C_{20}H_{22}NO$: 292.1701].



***N*-((2S,3S)-3-Hydroxy-2-(naphthalen-2-yl)-3-phenylpropyl)-N,4-dimethylbenzenesulfonamide (9).**

In a dry 10 mL Schlenk flask **7** (0.14 mmol, 50 mg), triphenyl phosphine (0.16 mmol, 42 mg) and benzoic acid (0.16 mmol, 20 mg) were dissolved in 1 mL dry THF. DIAD (0.16 mmol, 30 μL) was added dropwise. The resulting solution was stirred at room temperature for 48 h. The reaction was quenched with 5 mL aqueous $NaHCO_3$. The organic and aqueous layers were separated, and the aqueous layer was extracted with 3 × 20 mL of diethyl ether. The combined organic layers were then washed with 20 mL of water and dried over $MgSO_4$. The filtrate was concentrated in vacuo and the residue

was chromatographed on deactivated silica gel (10% ethyl acetate in hexanes) to afford 67 mg (88% yield) of benzoate. 67 mg of benzoate and 150 mg of KOH were dissolved in 1 mL methanol and the reaction mixture was stirred for 15 h. The organic and aqueous layers were separated, and the aqueous layer was extracted with 3 × 20 mL of diethyl ether. The combined organic layers were then washed with 20 mL of water and dried over $MgSO_4$. The filtrate was concentrated in vacuo and the residue was chromatographed on deactivated silica gel (10% ethyl acetate in hexanes) to afford 67 mg (88% yield) of benzoate. The enantiomeric excess was determined by HPLC with a Chiralcel AS-H column (hexanes:2-propanol = 9:1, flow rate = 1.0 mL/min), t_r (1) = 48.9 min, t_r (2) = 56.3 min, $[\alpha]_D^{20}$: –1.8 (c = 0. 53, $CHCl_3$, 95% ee). ^{1}H NMR ($CDCl_3$, 360 MHz): δ 2.39 (s, 3H), 2.44 (s, 3H), 3.43–3.51 (m, 1H), 3.53–3.69 (m, 2H), 5.09 (dd, J_1 = 7.1 Hz, J_2 = 3.9 Hz, 1H), 7.14–7.25 (m, 5H), 7.27–7.36 (m, 3H), 7.39–7.49 (m, 2H), 7.50–7.60 (m, 3H), 7.68–7.80 (m, 3H); ^{13}C{1H} NMR ($CDCl_3$, 90 MHz): δ 21.7, 36.4, 52.1, 52.5, 76.7, 125.9, 126.2, 126.7, 127.0, 127.5, 127.7, 128.1, 128.2, 128.4, 129.8, 130.0, 132.7, 133.5, 134.3, 137.1, 142.3, 143.6. IR (neat): 3501 (OH), 3057, 1649, 1597, 1492, 1450, 1347, 1166, 1088, 971, 941, 867, 814 cm^{-1}; HRMS-CI: m/z 468.1619 $[(M + Na)^+$; calculated for $C_{27}H_{27}NO_3SNa$: 468.1609].



(1S,2S)-3-(Methylamino)-2-(naphthalen-2-yl)-1-phenylpropan-1-ol (PRC200-SS).

In a flame dried two-neck round bottom flask was mixed 75 mg of sodium metal, 525 mg of naphthalene and 2.5 mL of dry glyme and let stirred for 2 h. In a flame dried 10 mL Schlenk flask was dissolved **9** (50 mg, 0.11 mmol) in dry

glyme (1.0 mL). The solution of sodium naphtalenide was added dropwise until the dark-green color persisted. The reaction was quenched with couple drops of water and concentrated in vacuo. The residue was chromatographed on silica gel with 1 to 5% methanol in dichloromethane to afford 24 mg (76% yield) of **PRC200-SS** as a white solid. $[\alpha]_D^{20}$: –4.28 (c = 0.5, $CHCl_3$). ^1H NMR ($CDCl_3$, 360 MHz): δ 2.64 (s, 3H), 3.08–3.14 (m, 1H), 3.23–3.28 (m, 1H), 3.56–3.61 (m, 1H), 5.16 (d, J = 5.8 Hz, 1H), 7.08–7.16 (m, 5H), 7.22–7.25 (m, 2H), 7.43–7.48 (m, 2H), 7.71–7.76 (m, 3H); $^{13}C\{1H\}$ NMR ($CDCl_3$, 90 MHz): δ 36.1, 51.5, 53.2, 80.2, 126.0, 126.2, 126.5, 127.0, 127.5, 127.8, 128.1, 128.3, 128.5, 129.2, 129.9, 132.8, 133.4, 134.2, 141.8. IR (neat): 3354 (OH), 2925, 2774, 1585, 1450, 1388, 1348, 1093, 1060, 913, 813 cm^{-1}; HRMS-CI: m/z 292.1764 [$(M + H)^+$; calculated for $C_{20}H_{22}NO$: 292.1701].

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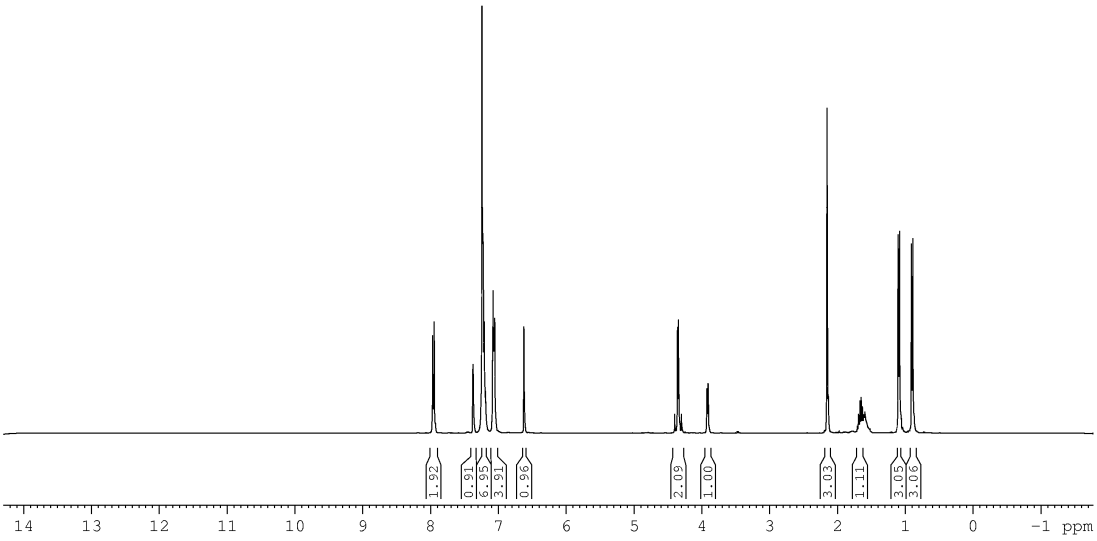
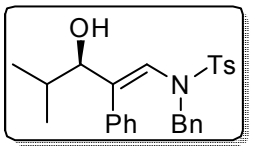
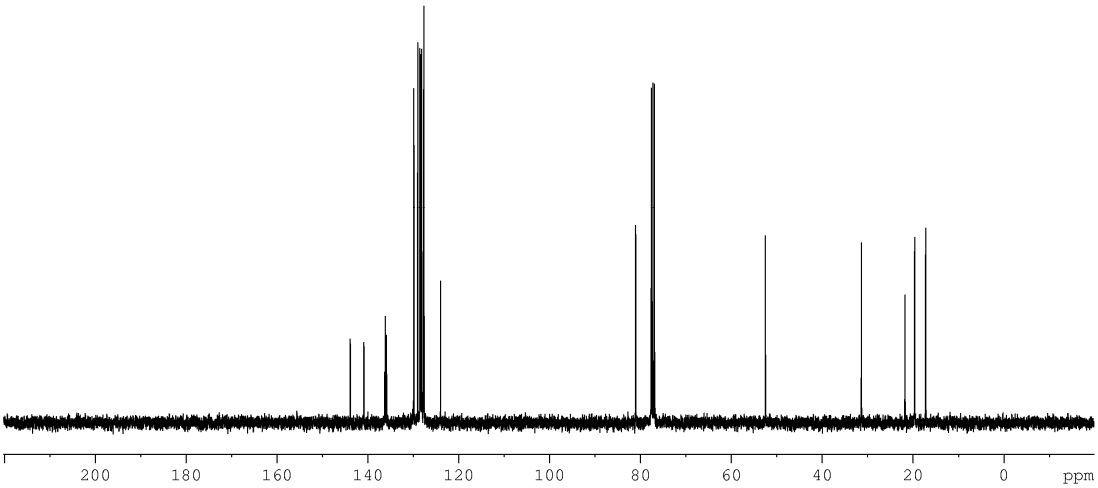
2. Bruckner, D. *Tetrahedron* **2006**, *62*, 3809.

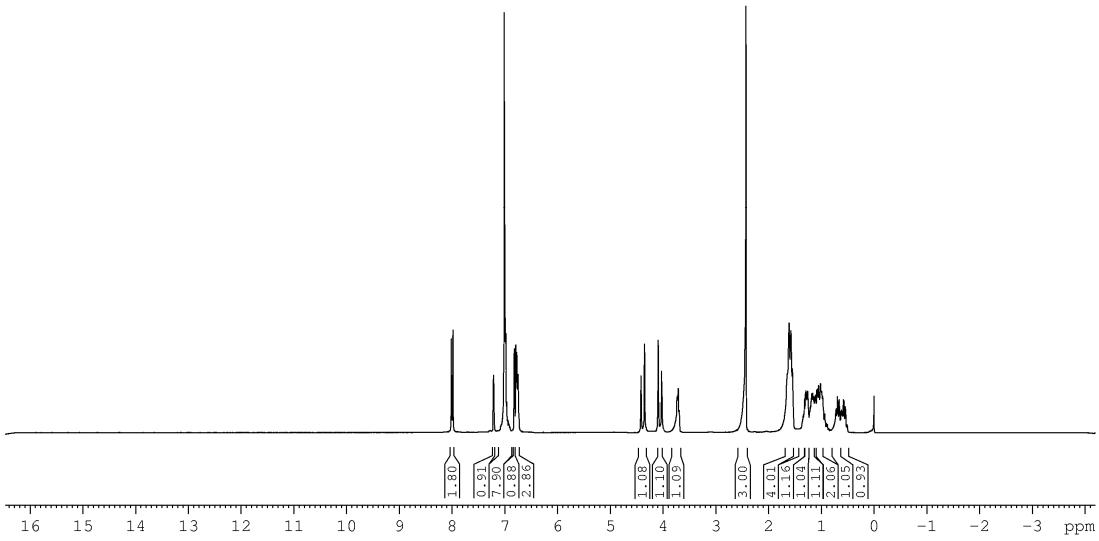
3. Corey, E. J.; Fuchs, P. L. *Tetrahedron Lett.* **1972**, 3769.

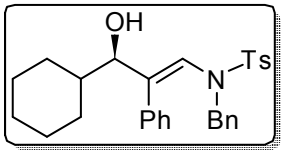




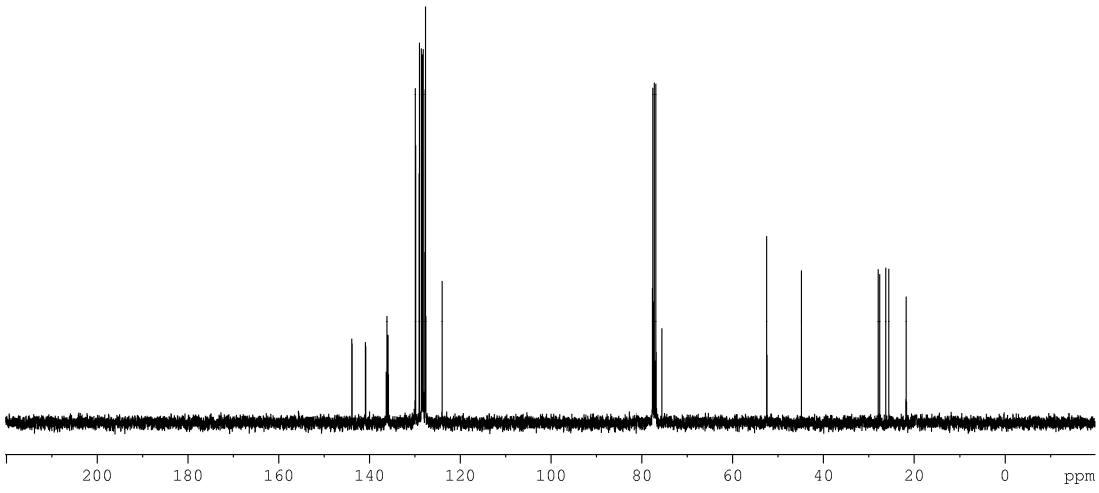
(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-4-methyl-2-phenylpent-1-en-1-yl)-4-methylbenzenesulfonamide (1a)

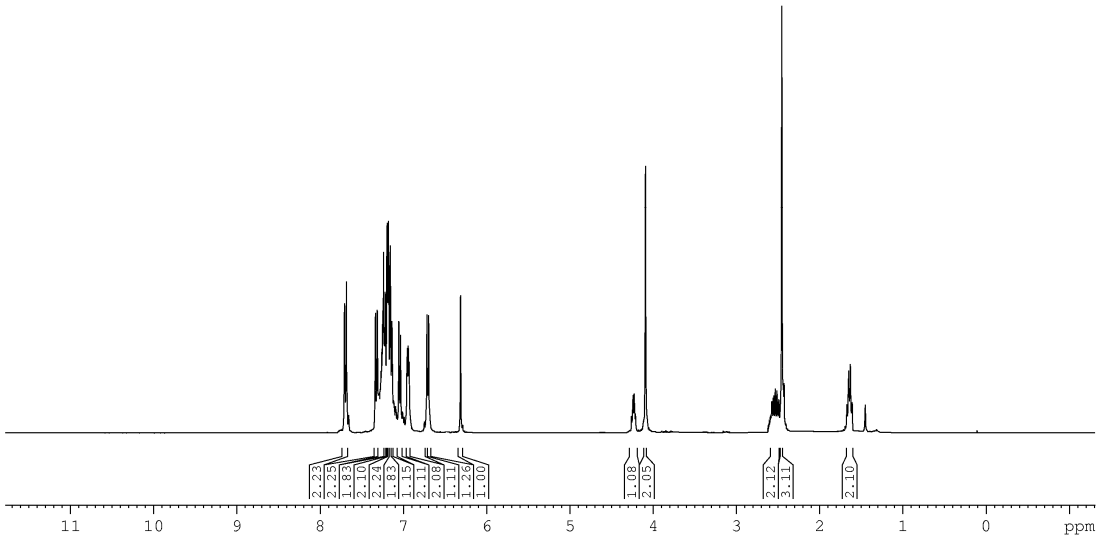


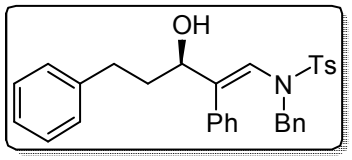




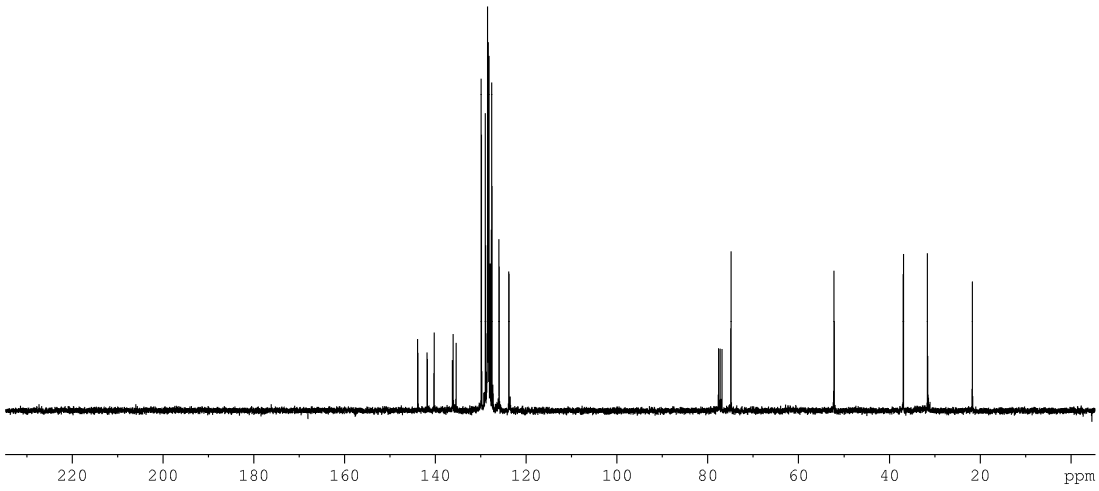
(*R*, *E*)-*N*-Benzyl-*N*-(3-cyclohexyl-3-hydroxy-2-phenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1b)

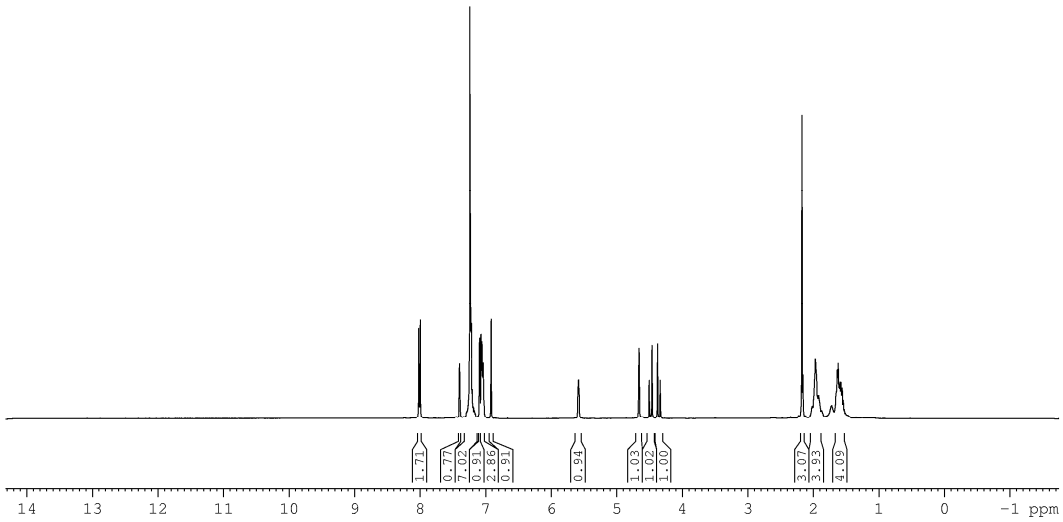


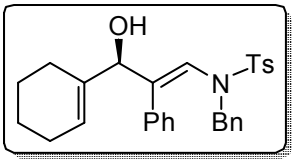




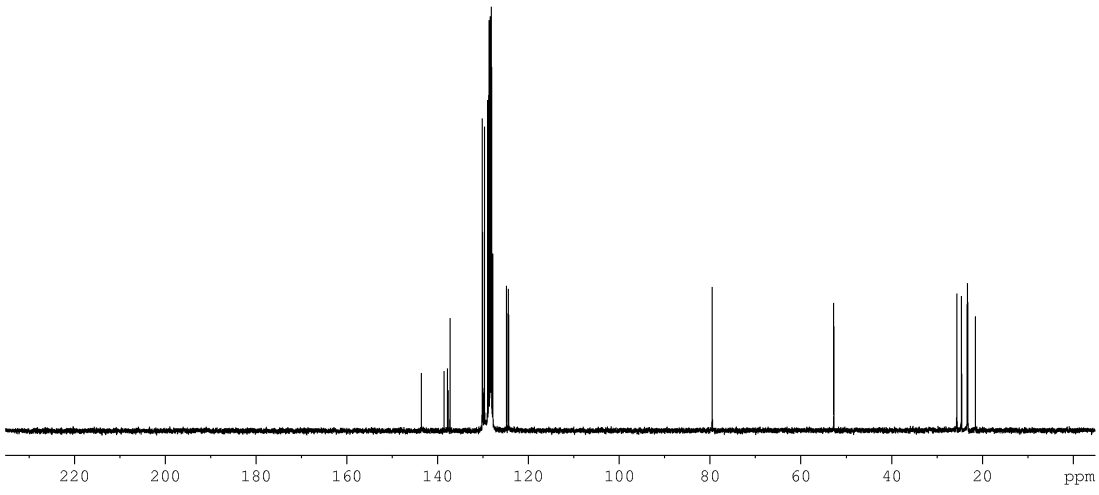
(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-2,5-diphenylpent-1-en-1-yl)-4-methylbenzenesulfonamide (1c)

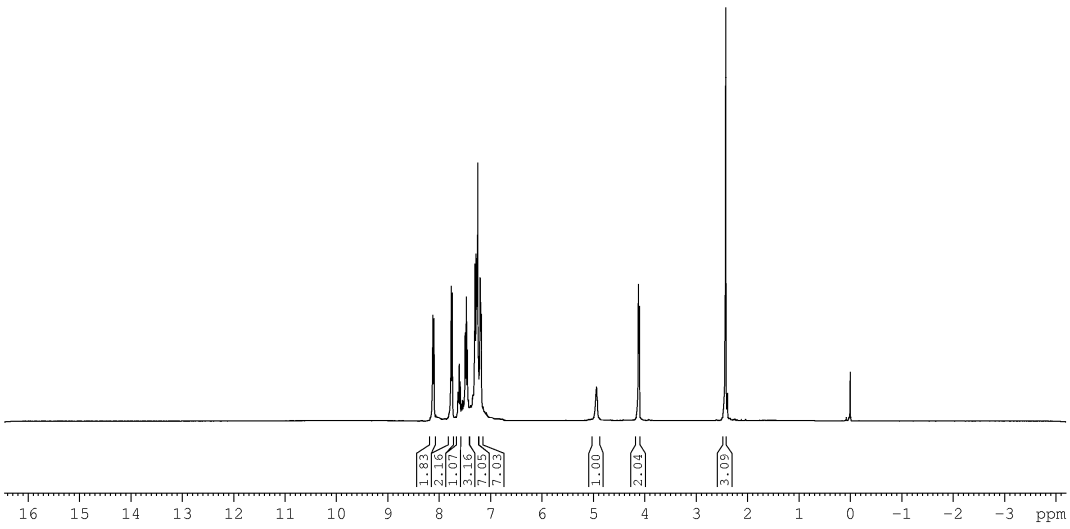


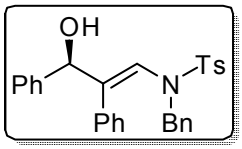




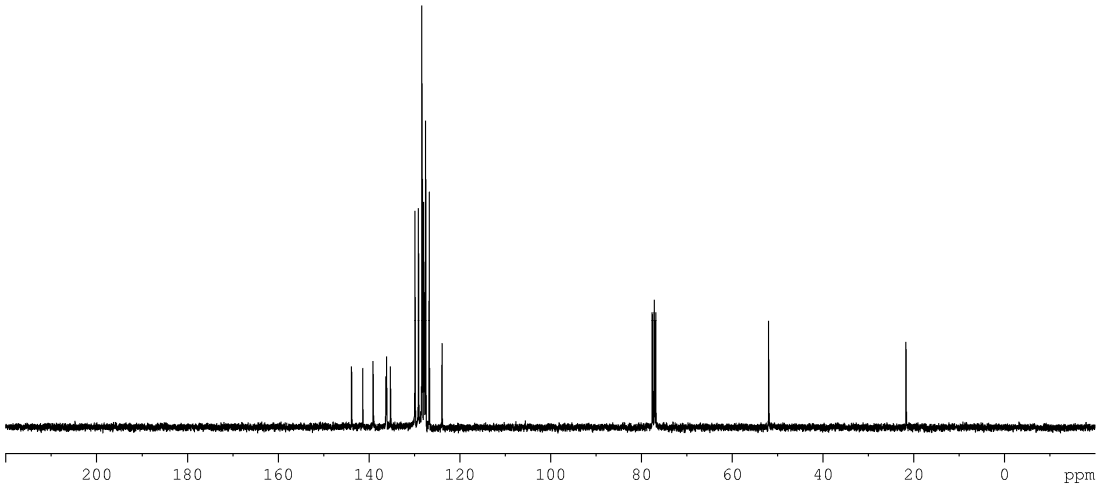
(*R*,*E*)-*N*-Benzyl-*N*-(3-(cyclohex-1-en-1-yl)-3-hydroxy-2-phenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1d)

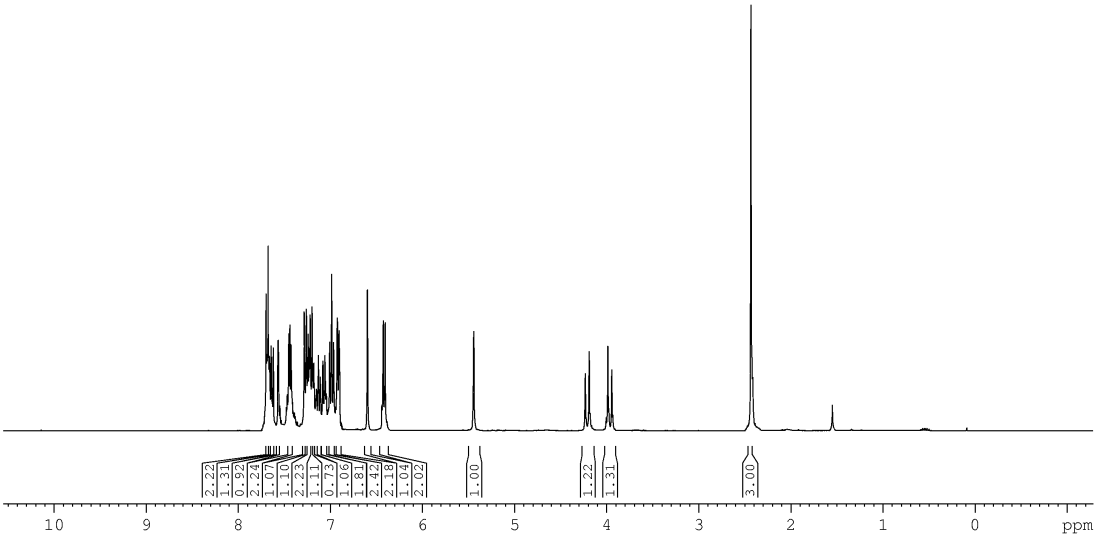


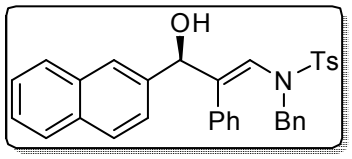




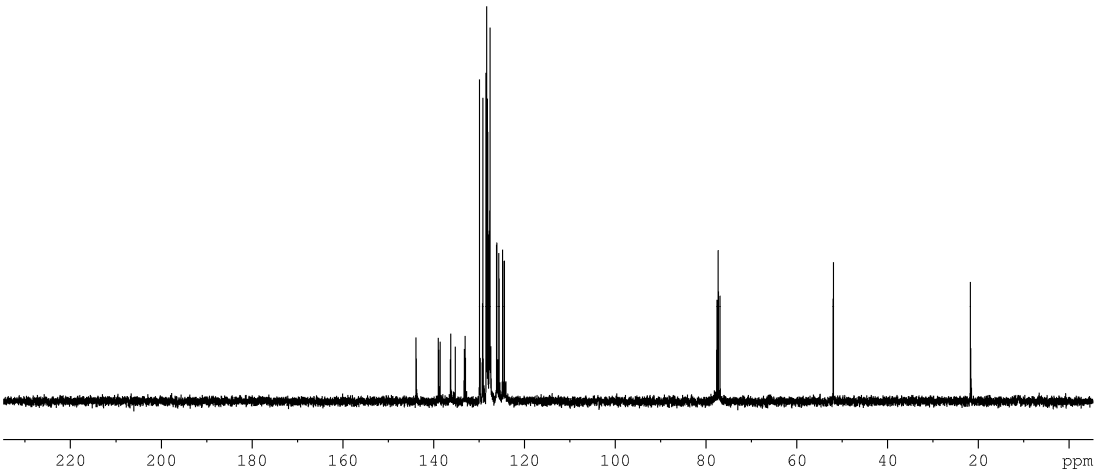
(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-2,3-diphenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1e)

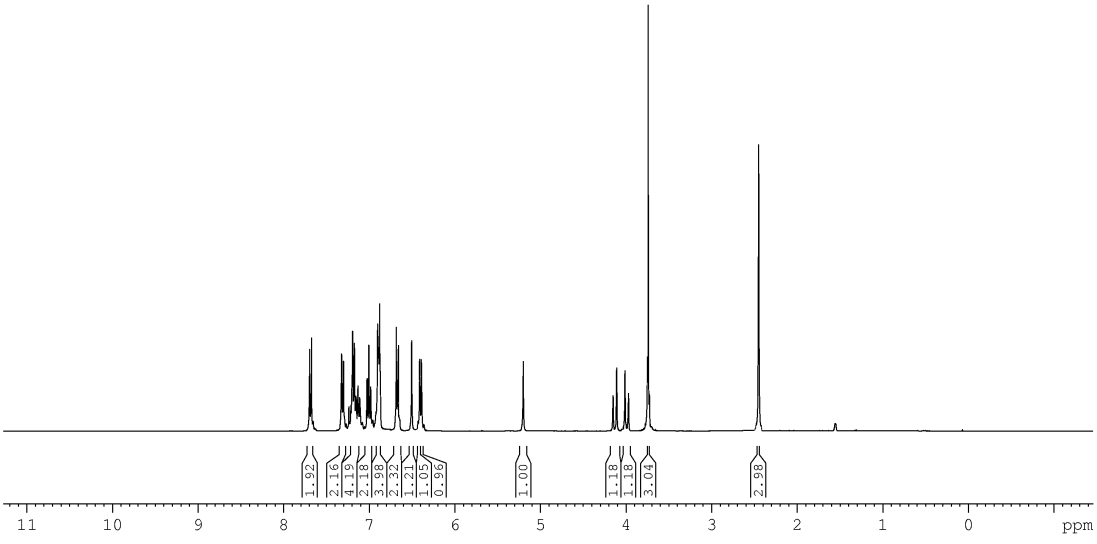




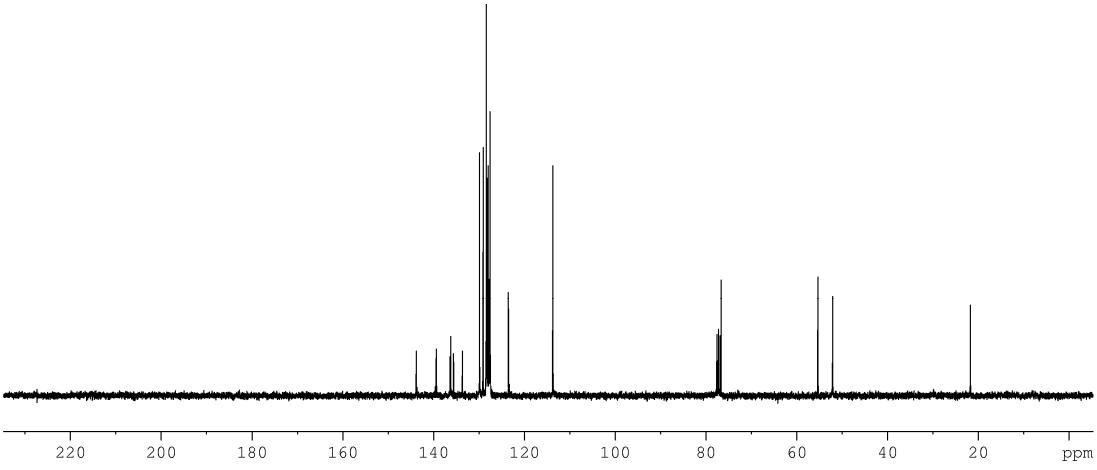


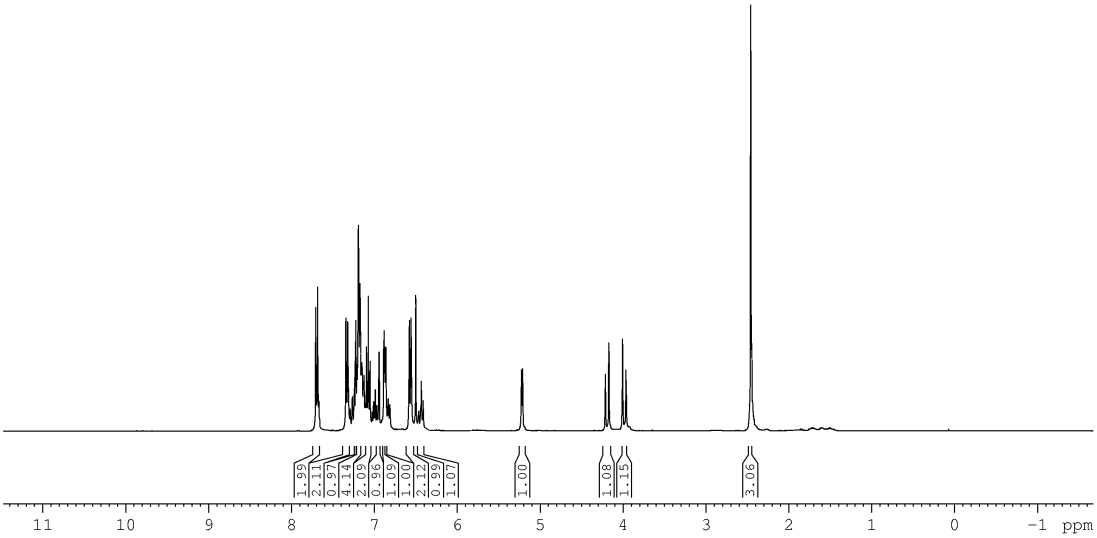
(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-3-(naphthalen-2-yl)-2-phenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1f)

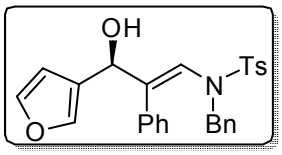




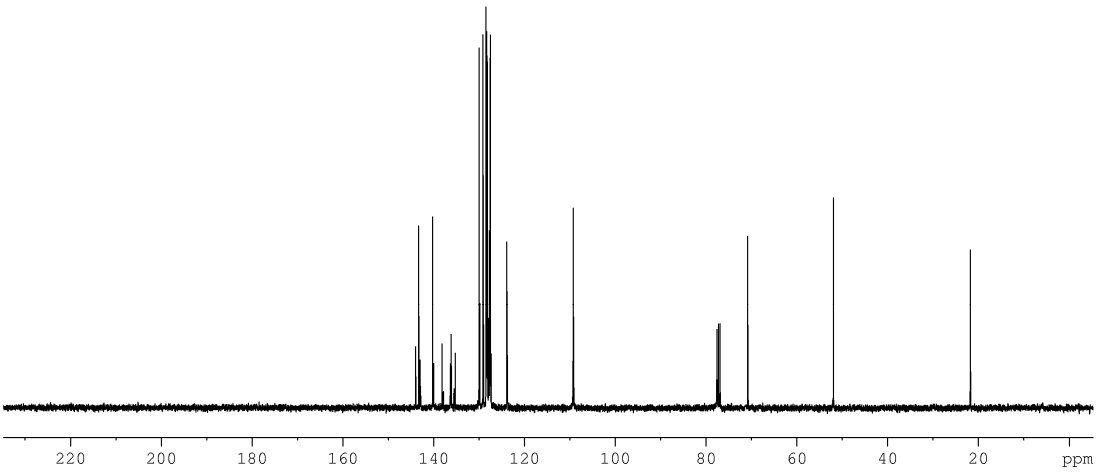
(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-3-(4-methoxyphenyl)-2-phenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1g)

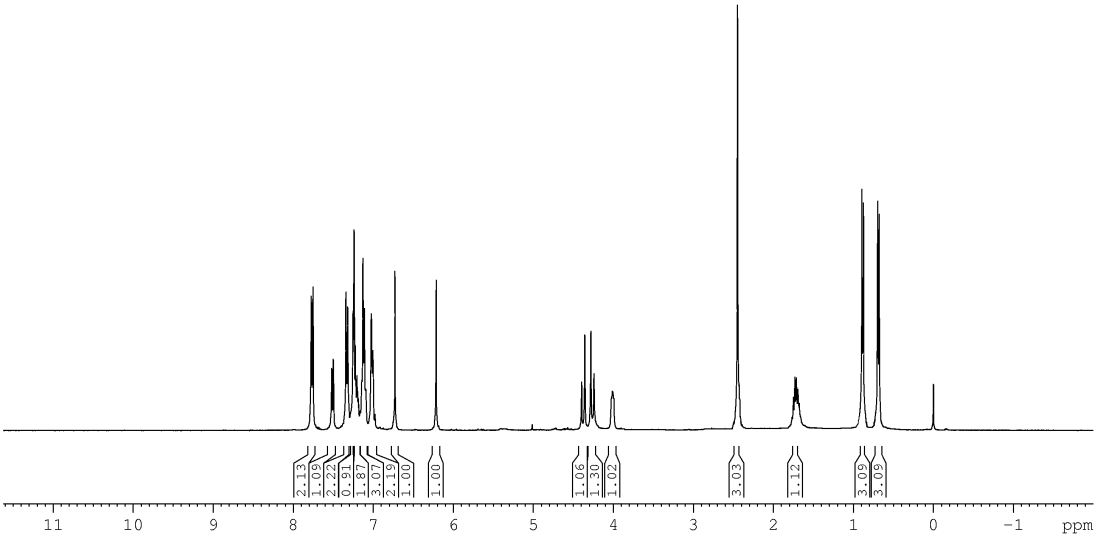


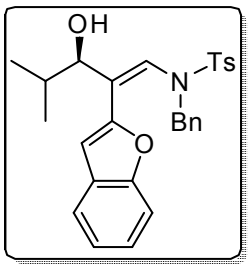




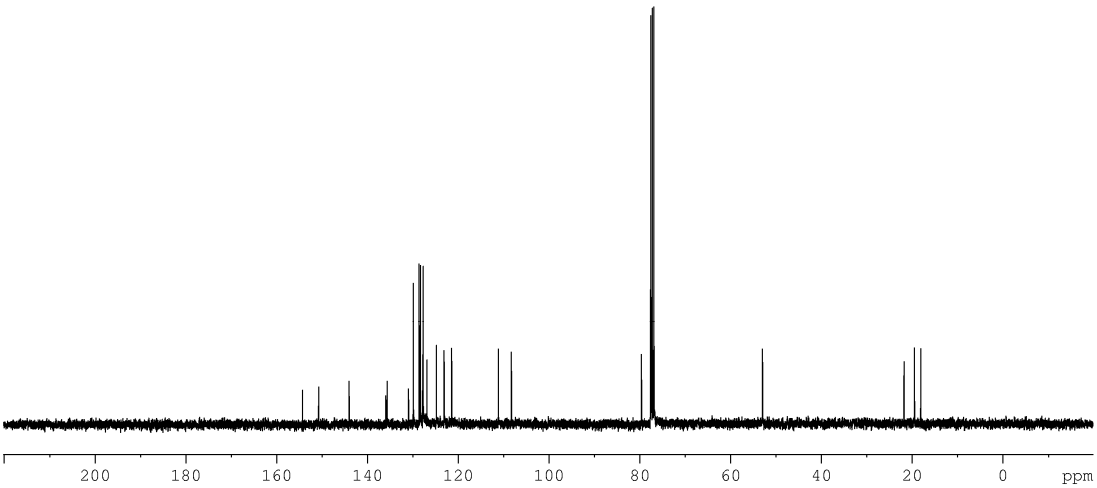
(*S*,*E*)-*N*-Benzyl-*N*-(3-(furan-3-yl)-3-hydroxy-2-phenylprop-1-en-1-yl)-4-methylbenzenesulfonamide (1h)

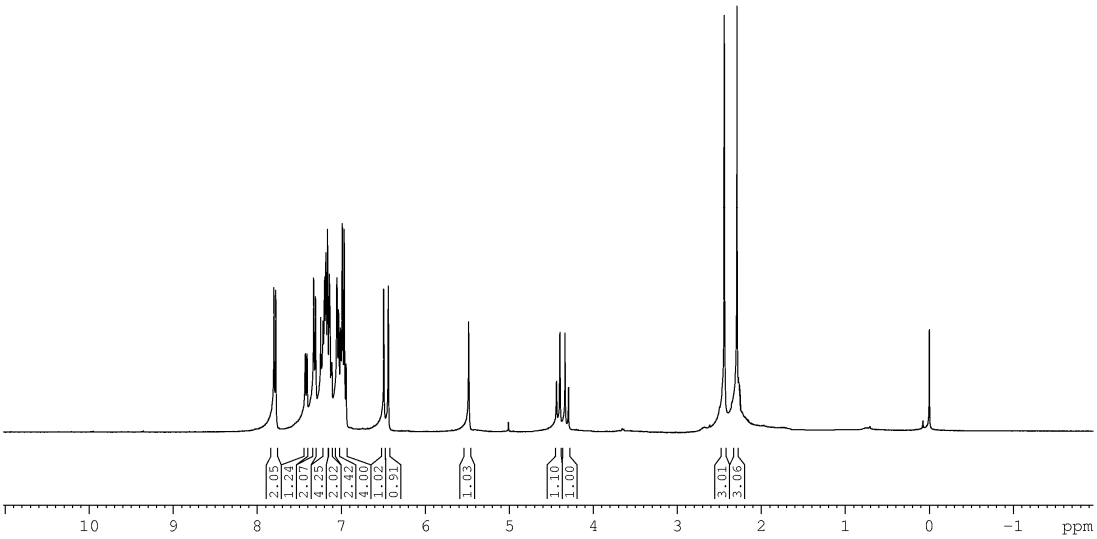


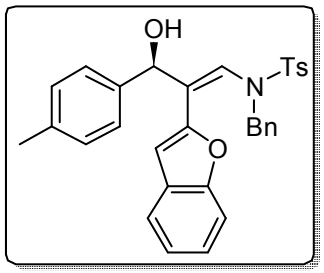




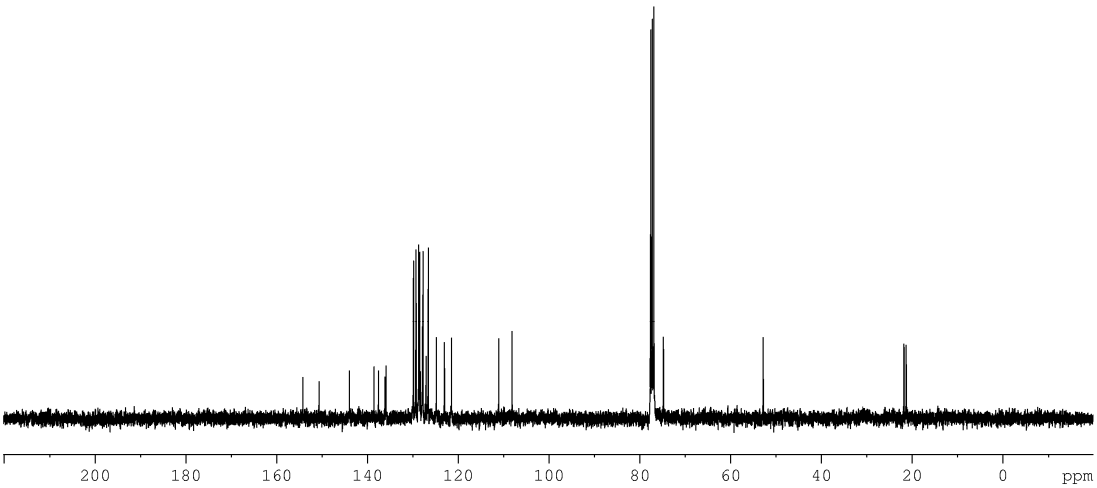
(*R*,*Z*)-*N*-(2-(Benzofuran-2-yl)-3-hydroxy-4-methylpent-1-en-1-yl)-*N*-benzyl-4-methylbenzenesulfonamide (1i)

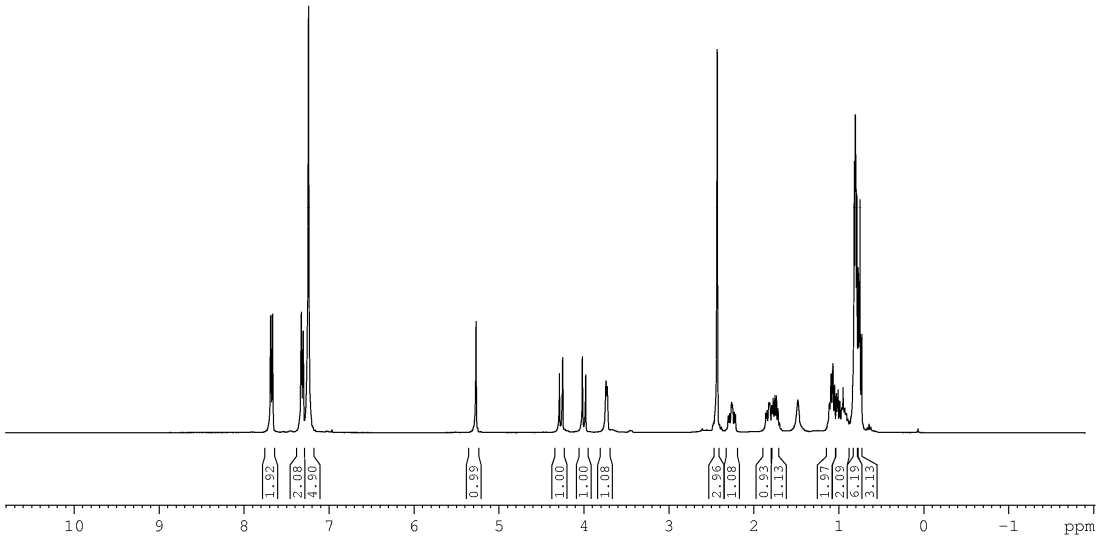


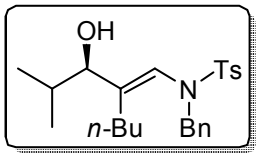




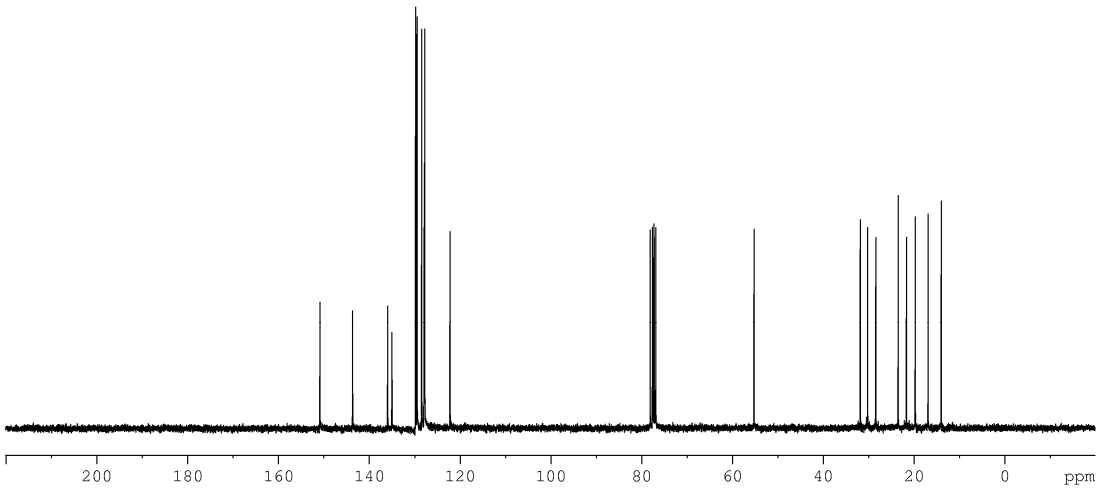
(*R*,*Z*)-*N*-(2-(Benzofuran-2-yl)-3-hydroxy-3-(p-tolyl)prop-1-en-1-yl)-*N*-benzyl-4-methylbenzenesulfonamide (1j)

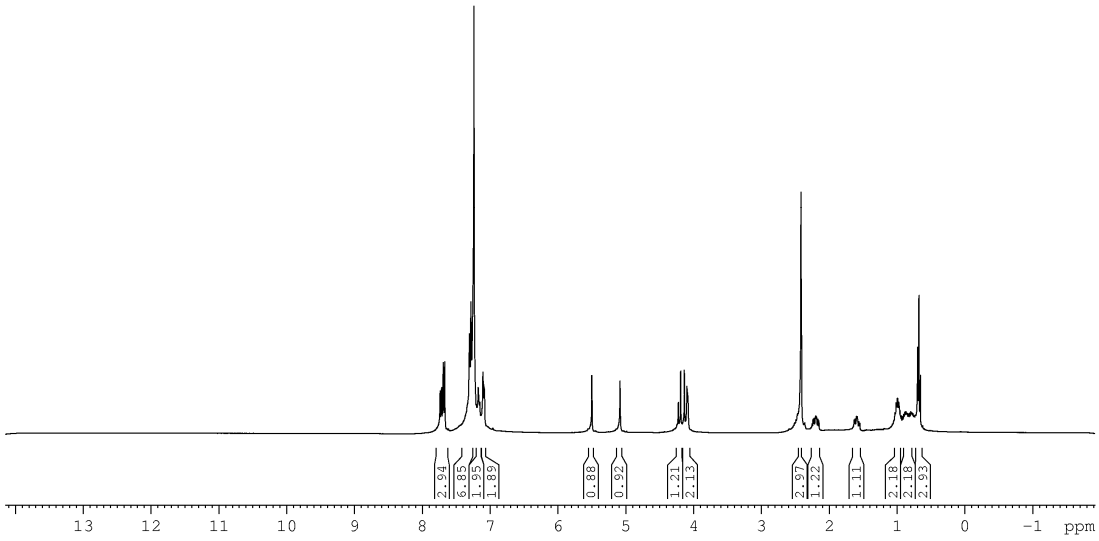


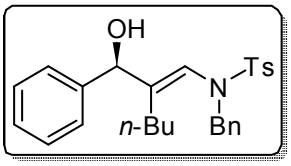




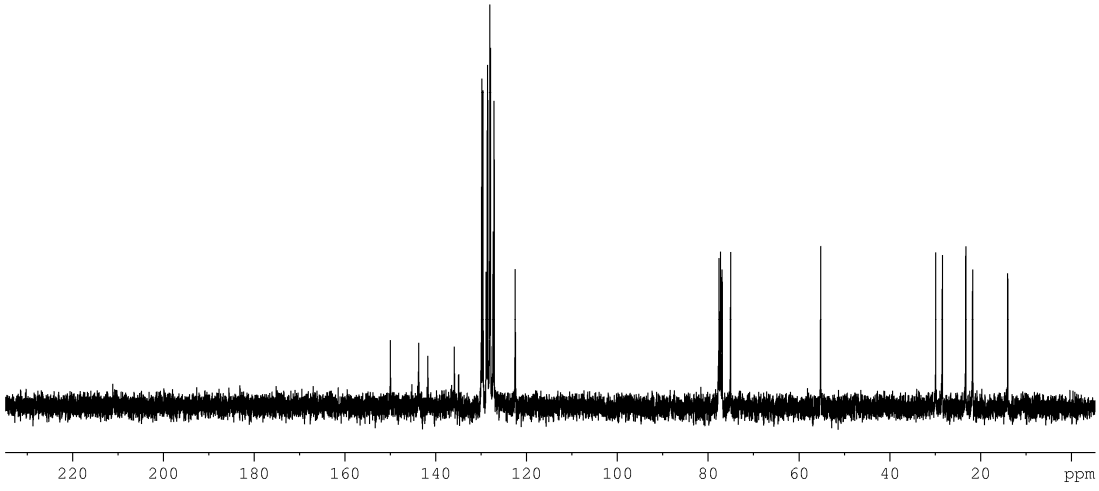
(*R*,*E*)-*N*-Benzyl-*N*-(2-(1-hydroxy-2-methylpropyl)hex-1-en-1-yl)-4-methylbenzenesulfonamide (1k)

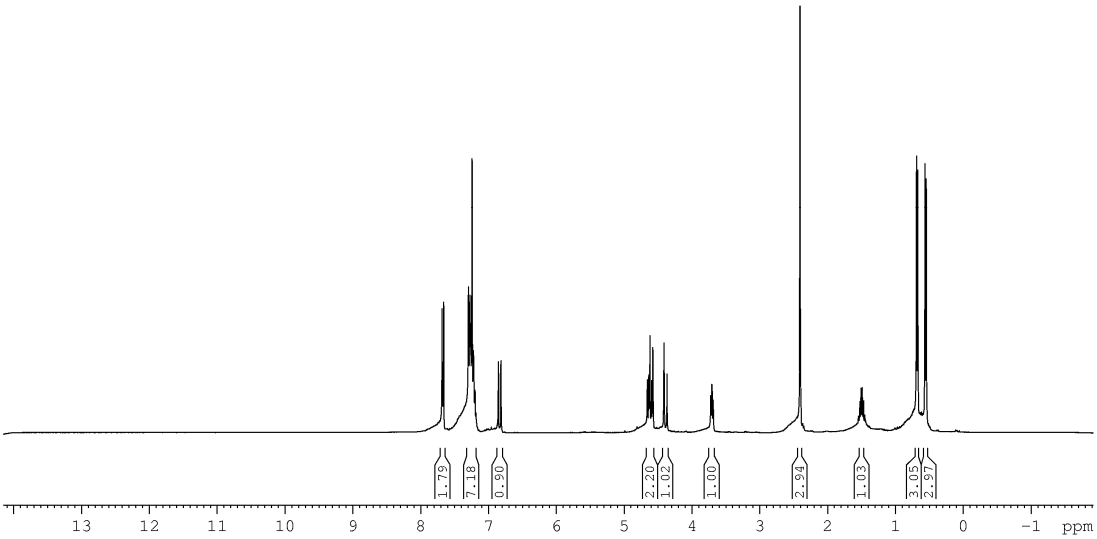


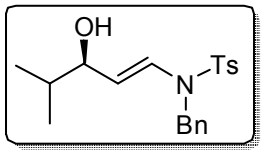




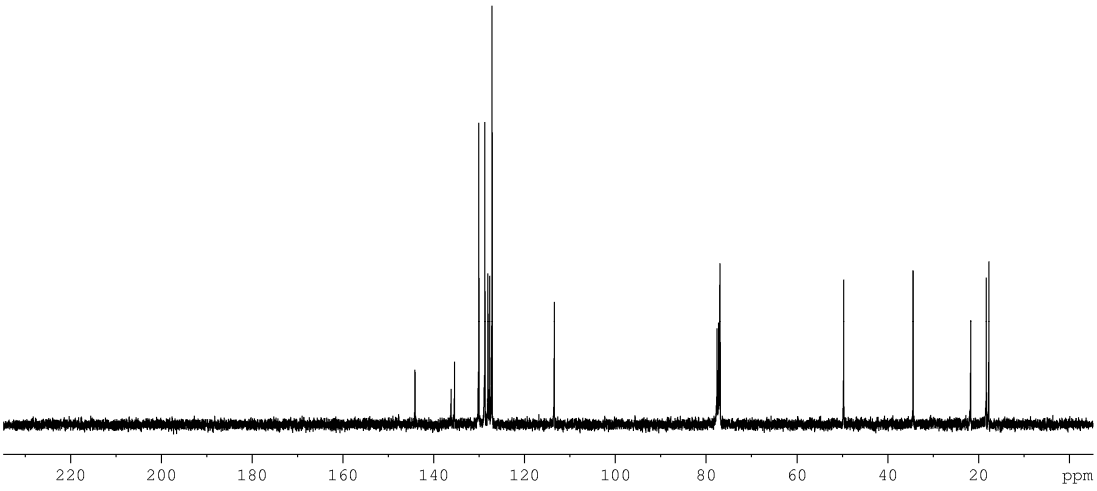
(*R*,*E*)-*N*-Benzyl-*N*-(2-(hydroxy(phenyl)methyl)hex-1-en-1-yl)-4-methylbenzenesulfonamide (1l)

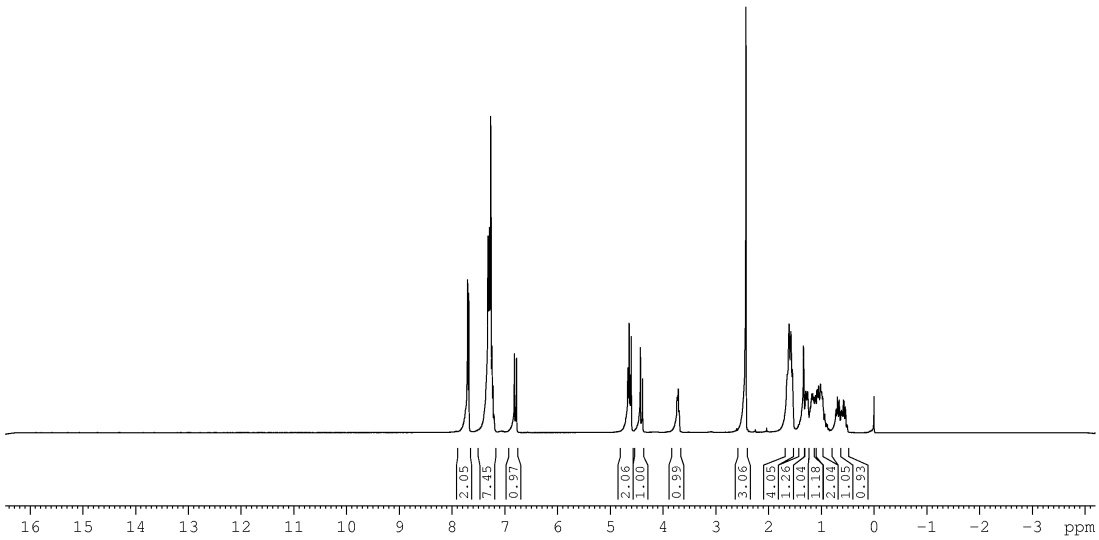


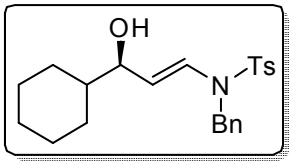




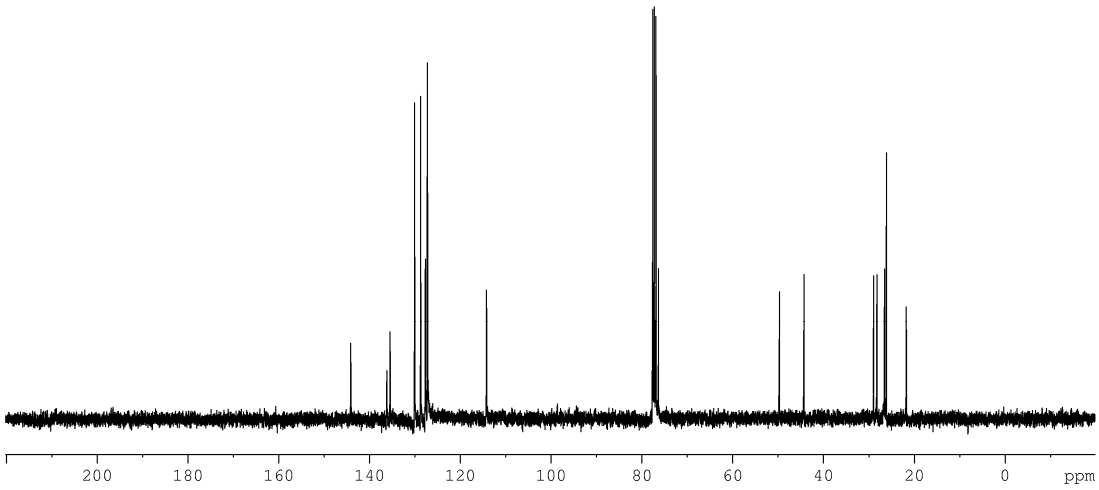
(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-4-methylpent-1-en-1-yl)-4-methylbenzenesulfonamide (1m)

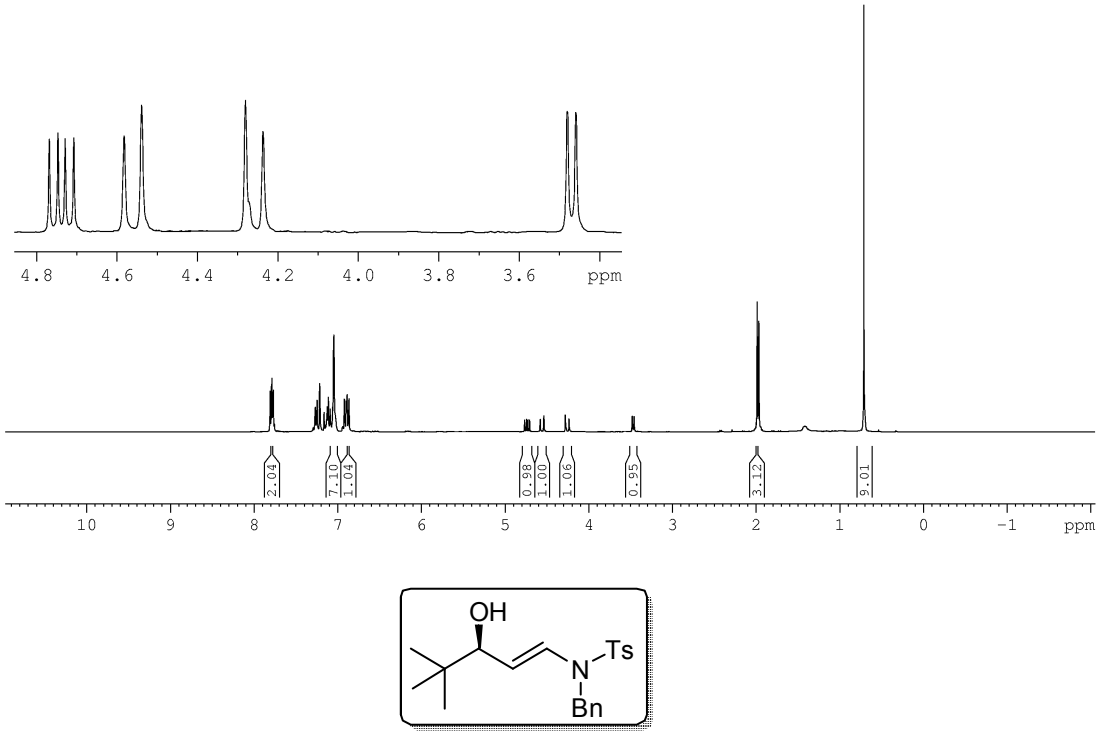




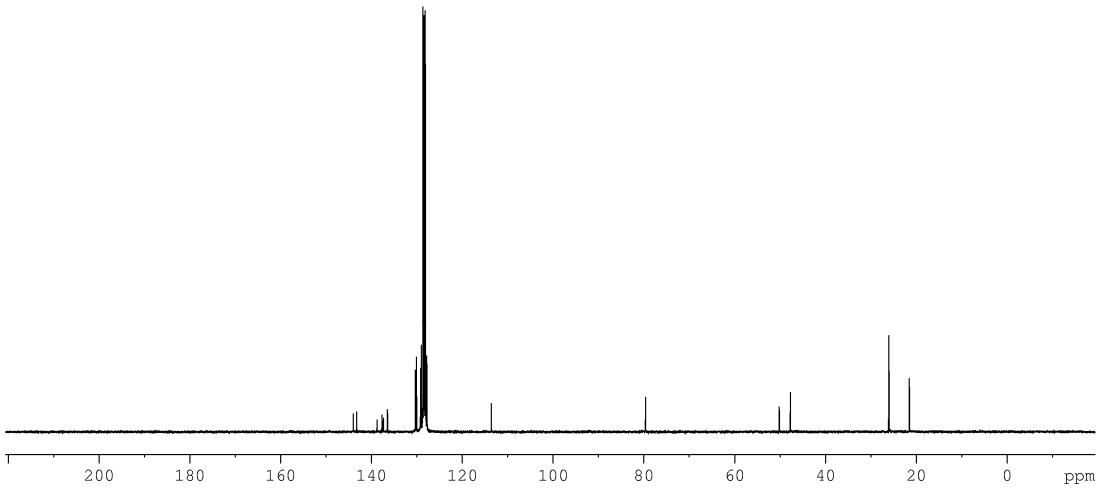


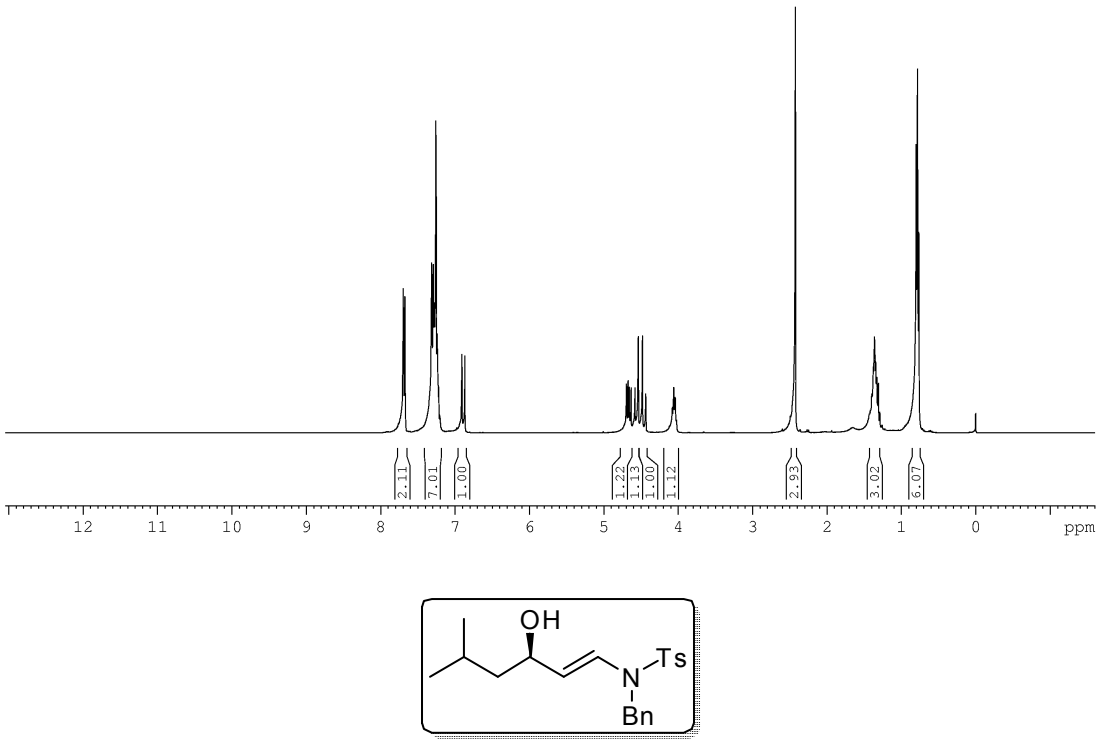
(*R*,*E*)-*N*-Benzyl-*N*-(3-cyclohexyl-3-hydroxyprop-1-en-1-yl)-4-methylbenzenesulfonamide (1n)



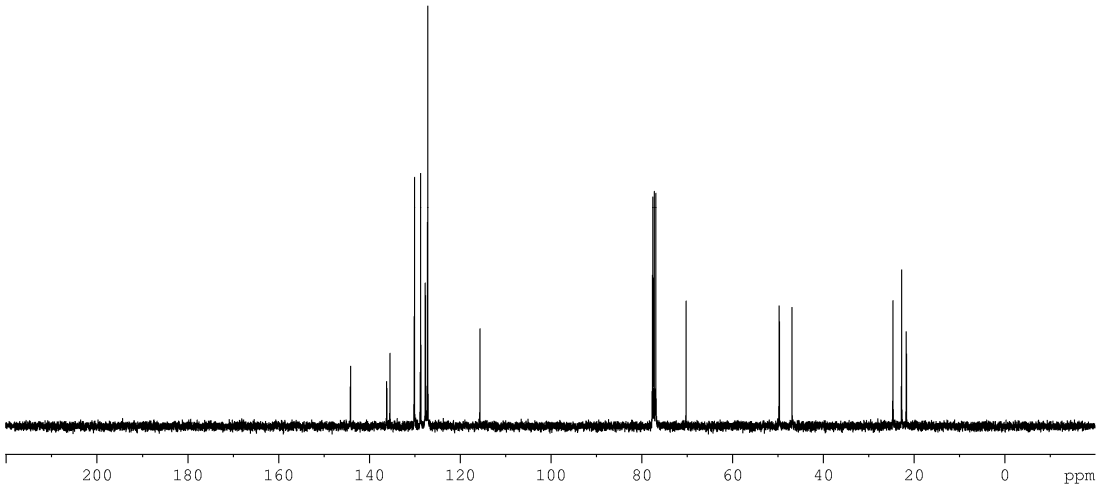


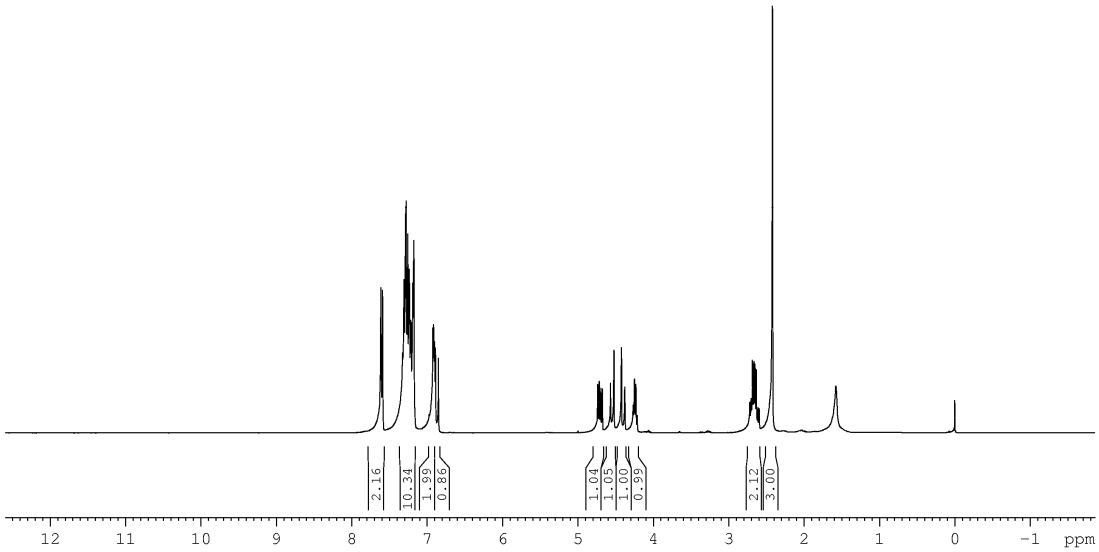
(*S*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-4,4-dimethylpent-1-en-1-yl)-4-methylbenzenesulfonamide (1o)

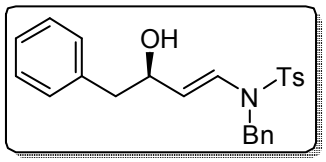




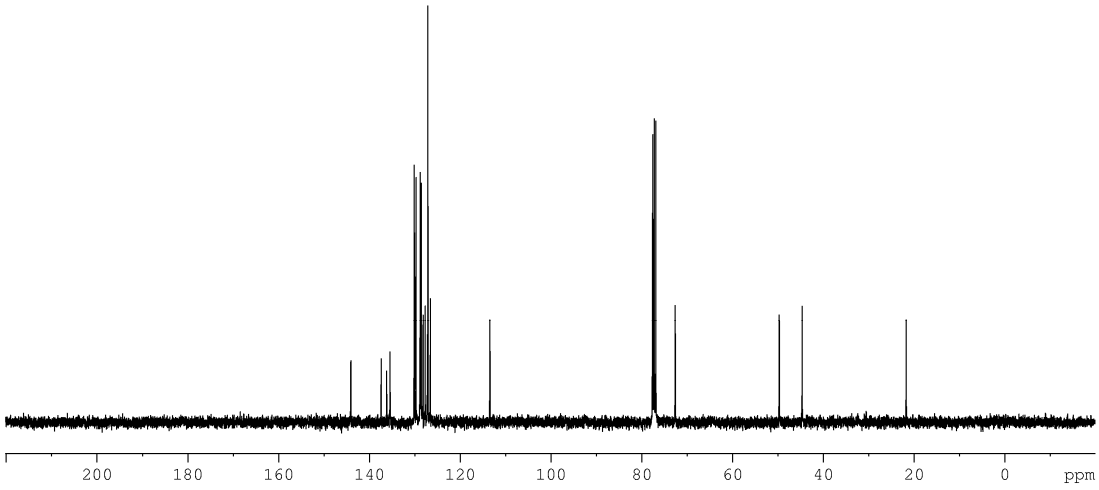
(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-5-methylhex-1-en-1-yl)-4-methylbenzenesulfonamide (1p)

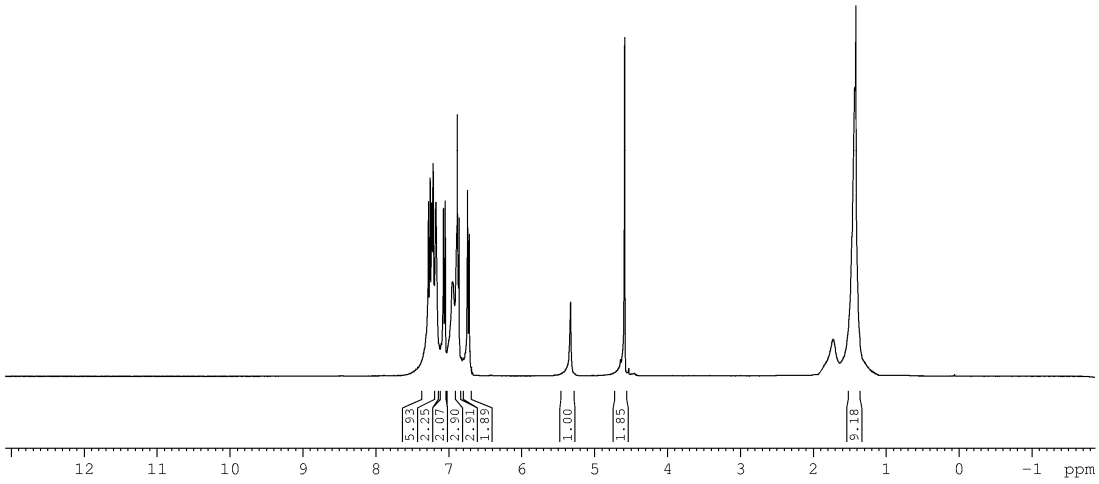


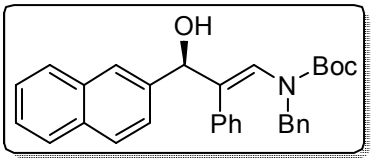




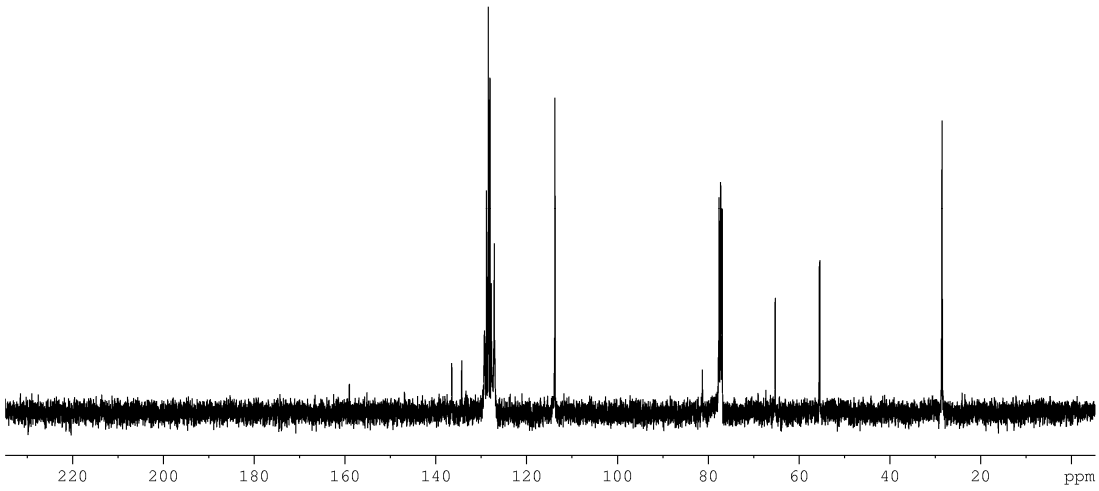
(*R*,*E*)-*N*-Benzyl-*N*-(3-hydroxy-4-phenylbut-1-en-1-yl)-4-methylbenzenesulfonamide (1q)

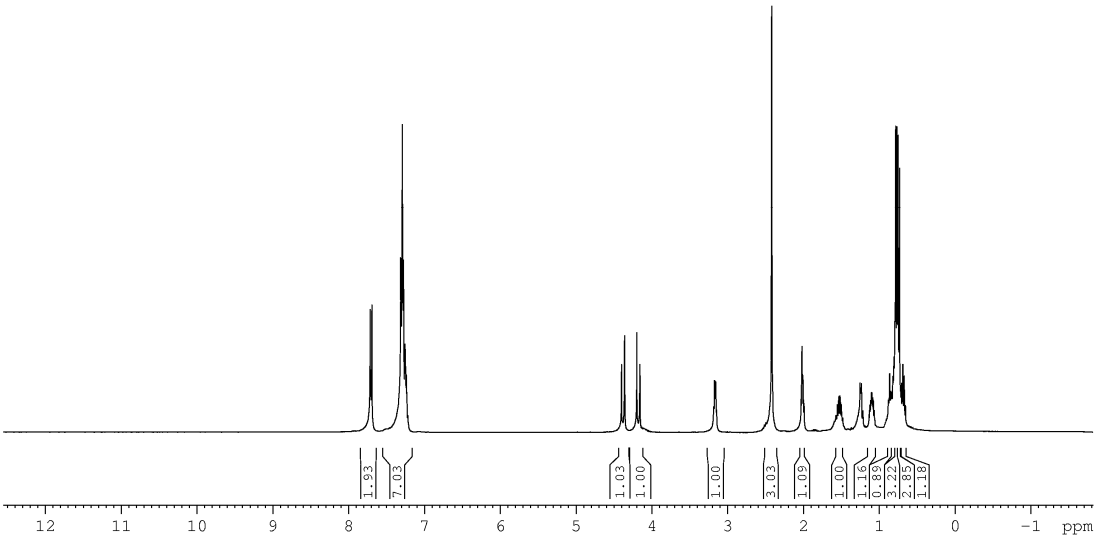




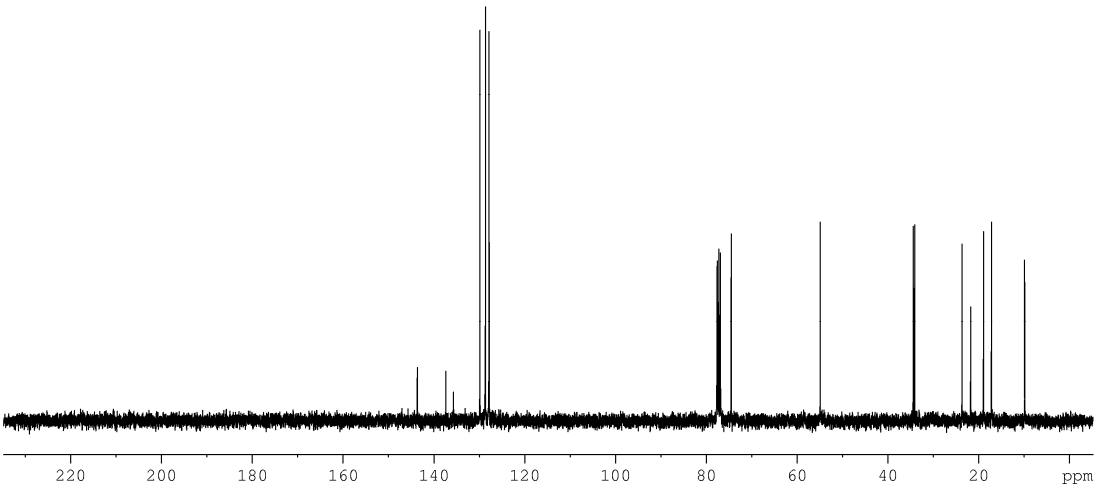


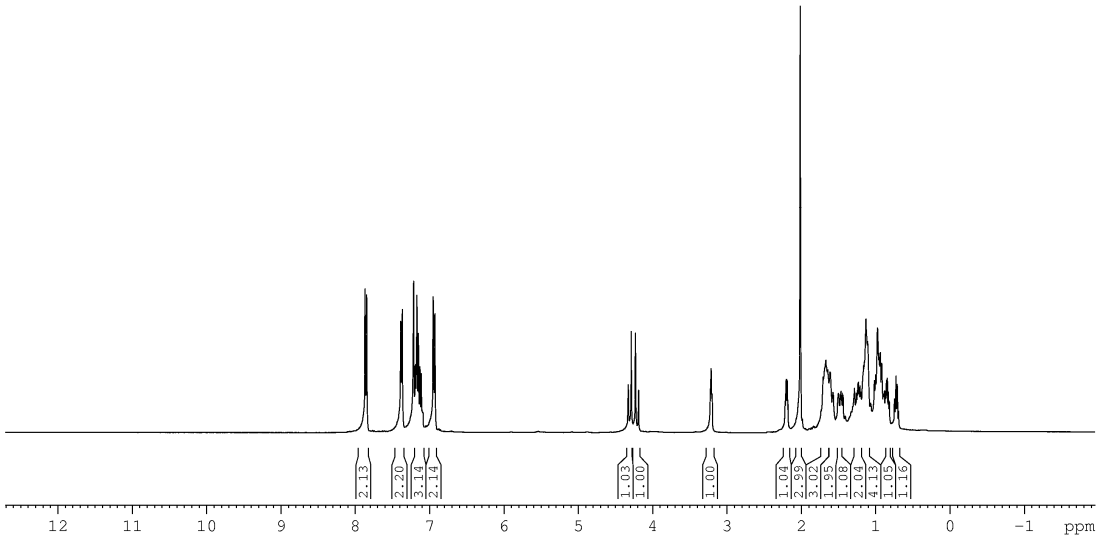
(*R*,*E*)-Tert-butyl benzyl(3-hydroxy-3-(naphthalen-2-yl)-2-phenylprop-1-en-1-yl)carbamate (1r)

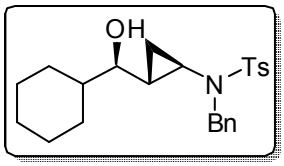




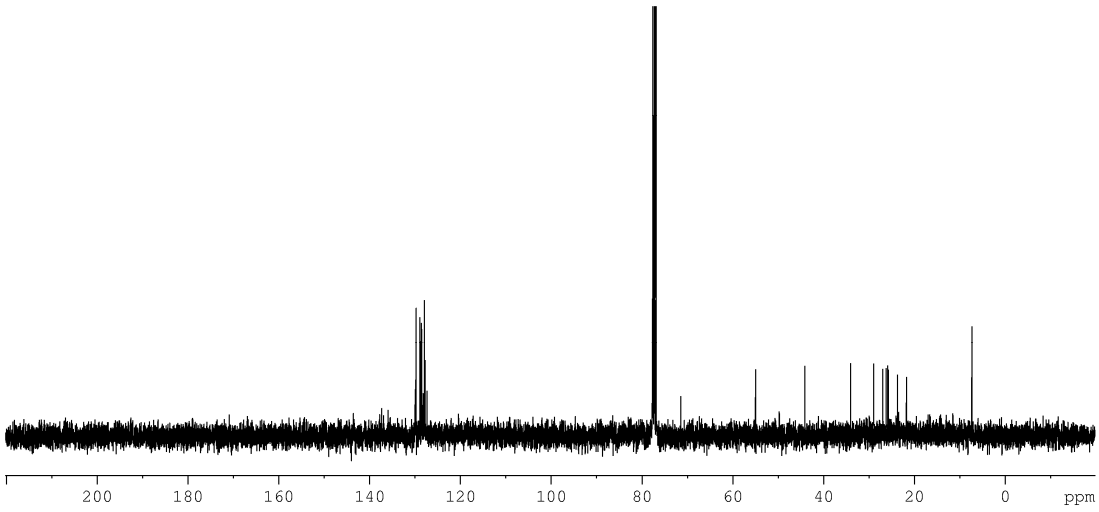
_N_-Benzyl-_N_-((1_R_,2_R_)-2-((_R_)-1-hydroxy-2-methylpropyl)cyclopropyl)-4-methylbenzenesulfonamide (2a)

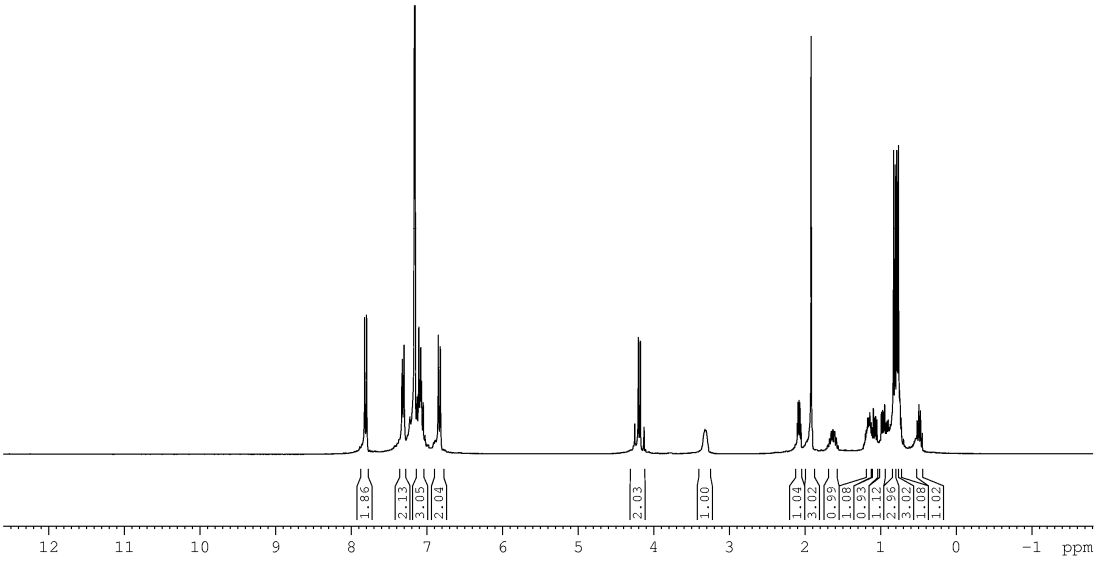


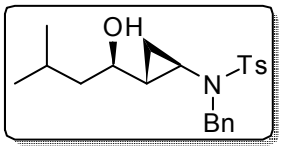




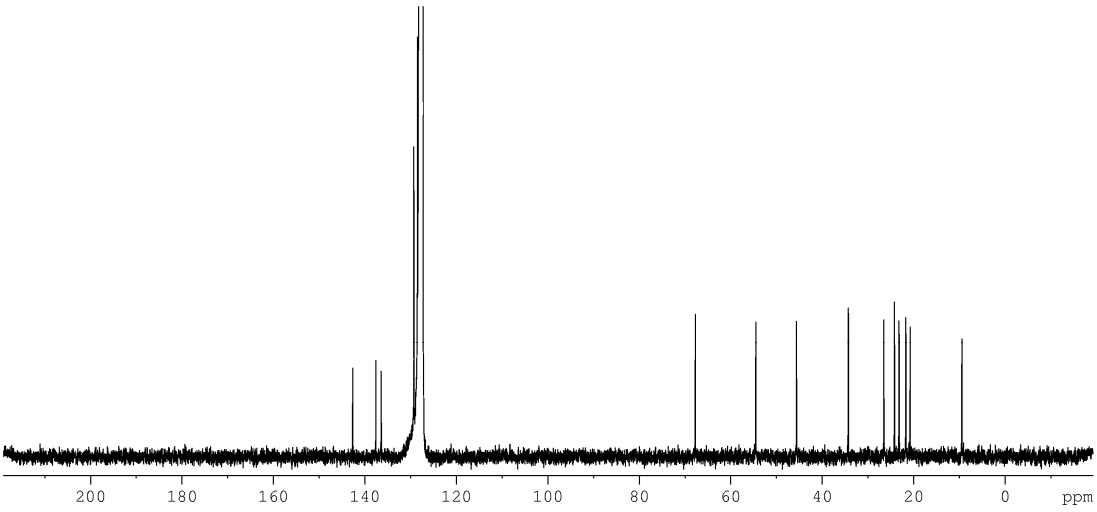
_N_-Benzyl-_N_-((1_R_,2_R_)-2-((_R_)-cyclohexyl(hydroxy)methyl)cyclopropyl)-4-methylbenzenesulfonamide (2b)

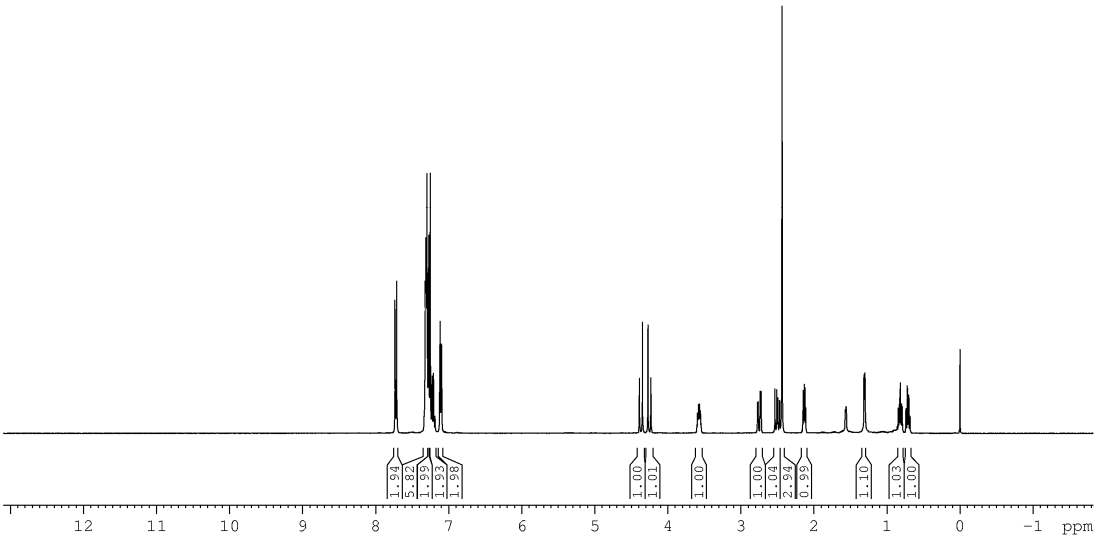


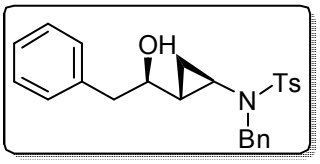




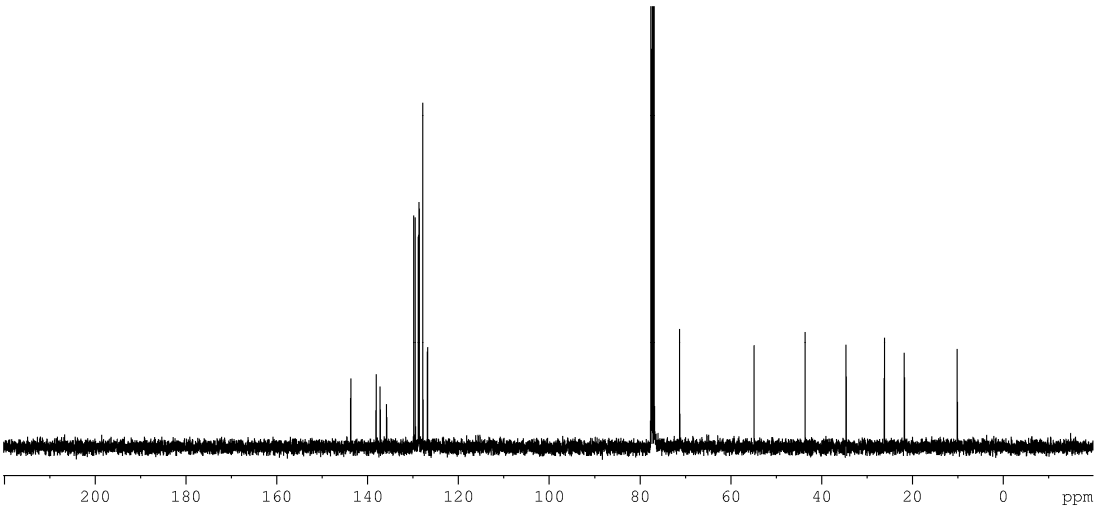
_N_-Benzyl-_N_-((1_R_,2_R_)-2-((_R_)-1-hydroxy-3-methylbutyl)cyclopropyl)-4-methylbenzenesulfonamide (2c)

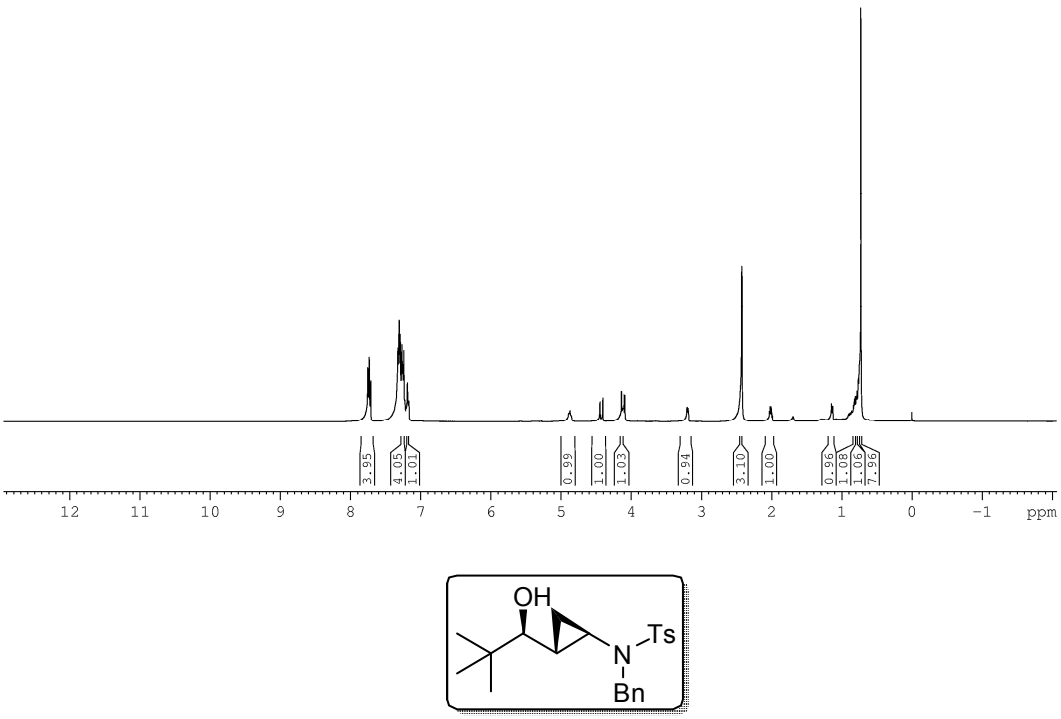




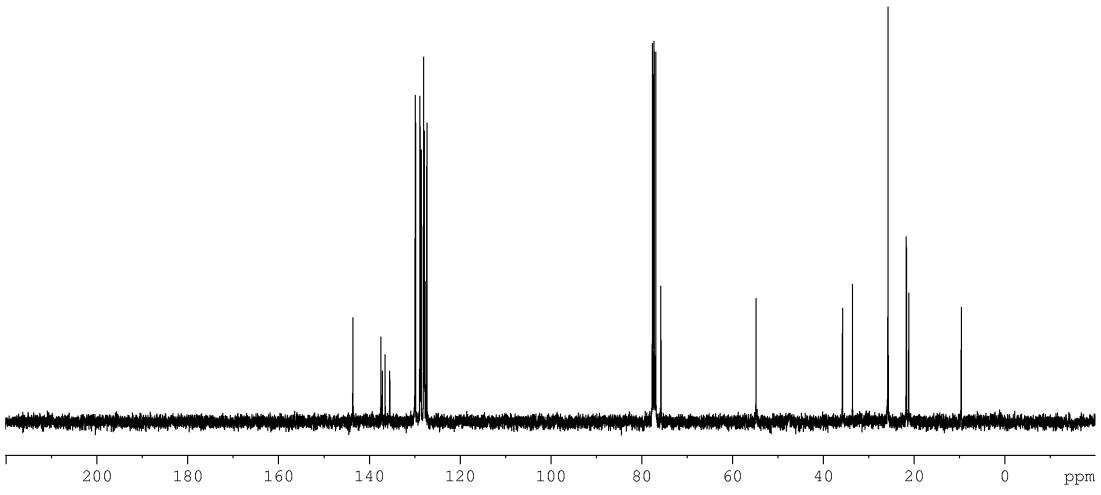


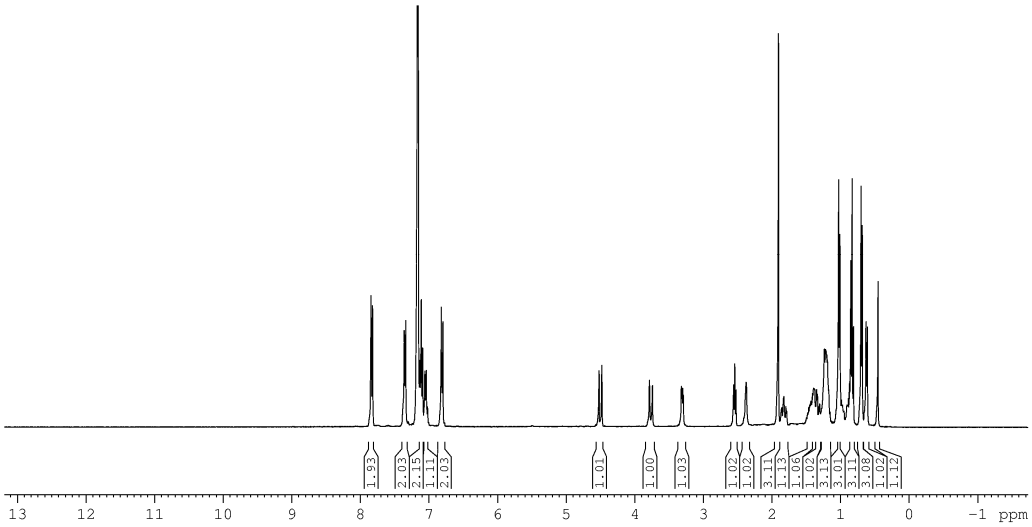
_N_-Benzyl-_N_-((1_R_,2_R_)-2-((_R_)-1-hydroxy-2-phenylethyl)cyclopropyl)-4-methylbenzenesulfonamide (2d)

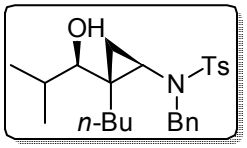




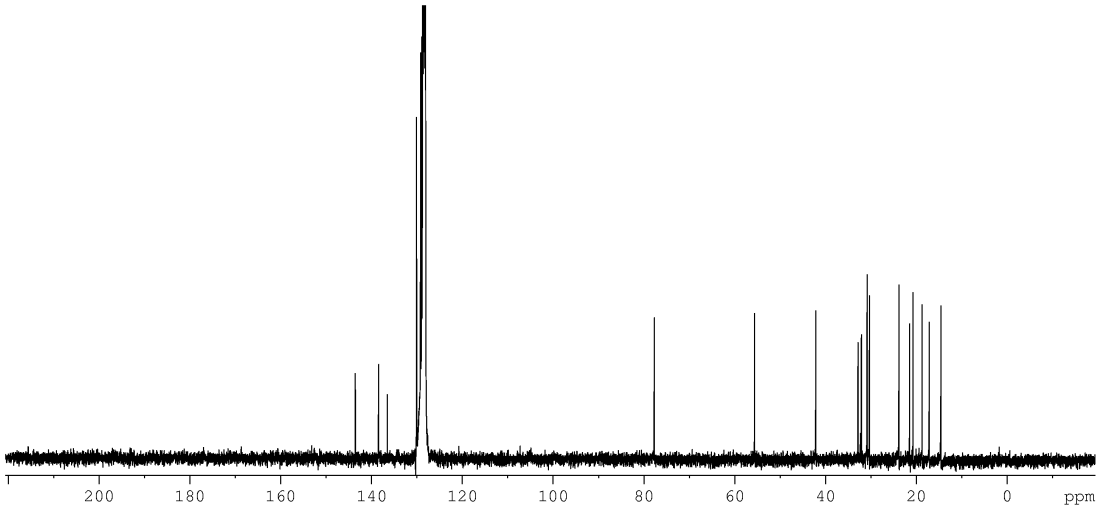
_N_-Benzyl-_N_-((1_R_,2_R_)-2-((_S_)-1-hydroxy-2,2-dimethylpropyl)cyclopropyl)-4-methylbenzenesulfonamide (2e)

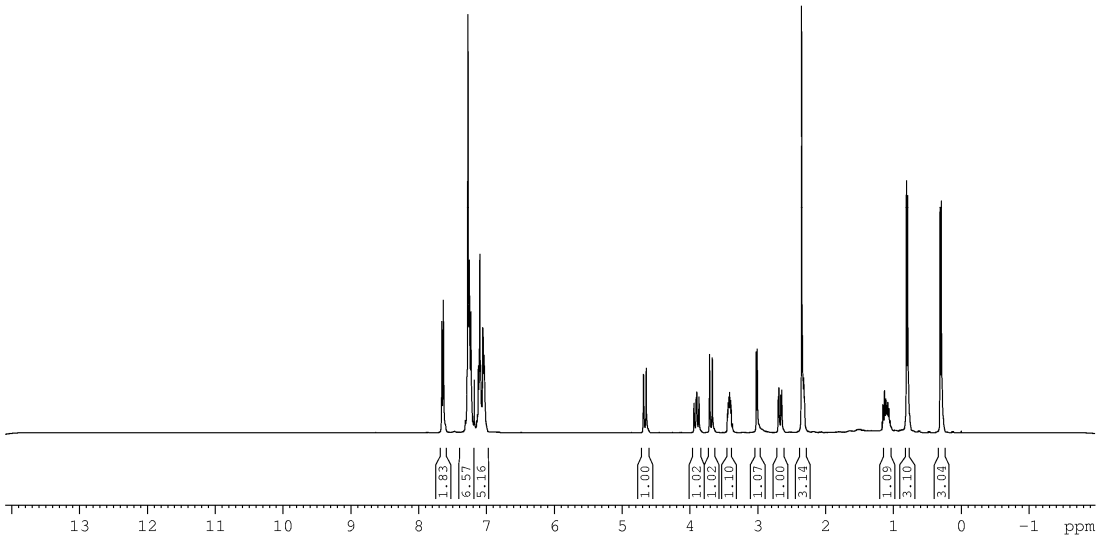




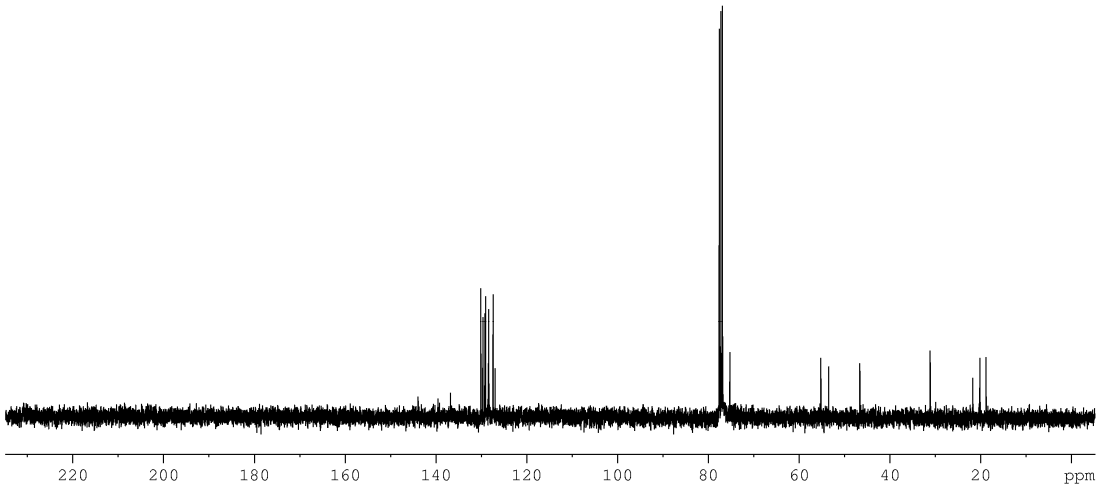


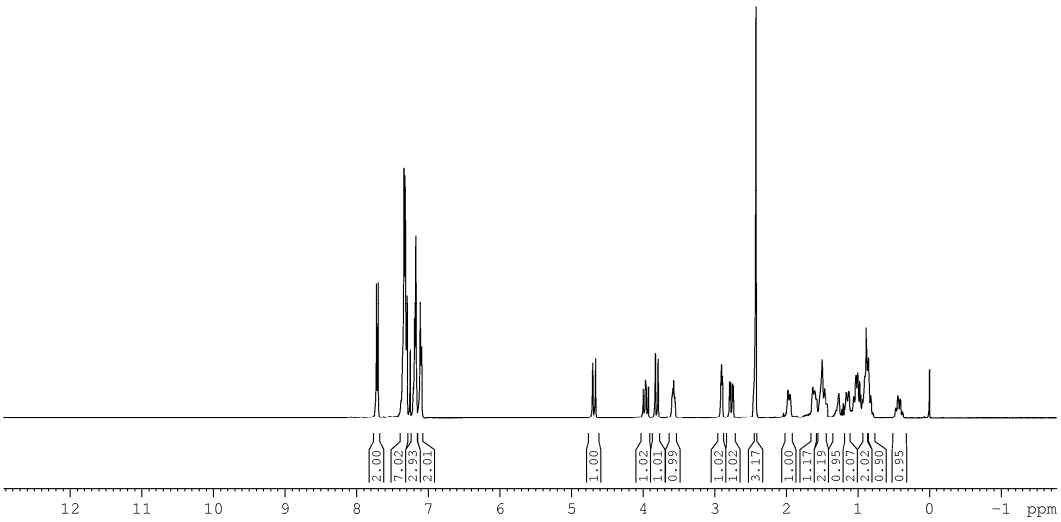
_N_-Benzyl-_N_-((1_R_,2_R_)-2-butyl-2-((_R_)-1-hydroxy-2-methylpropyl)cyclopropyl)-4-methylbenzenesulfonamide (2f)

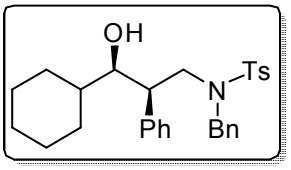




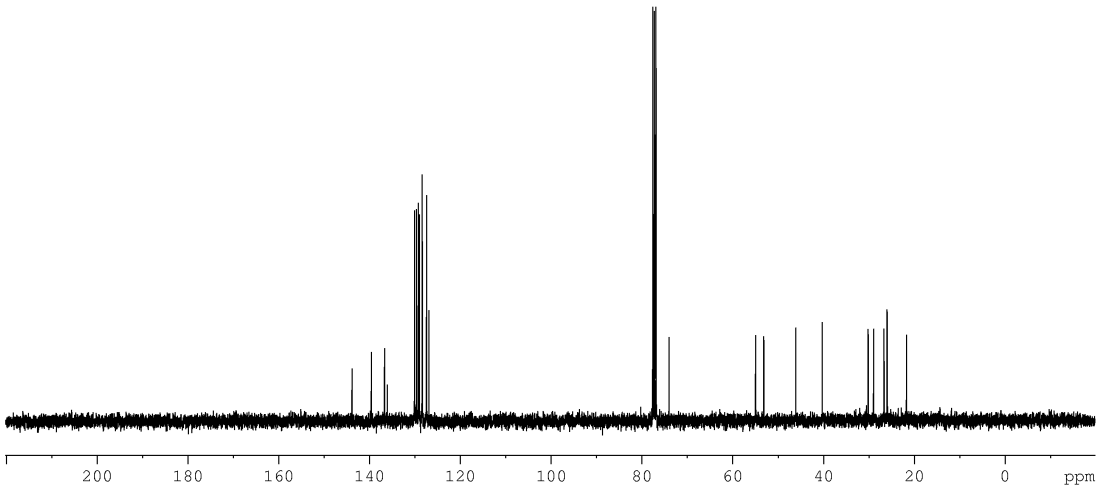
***N*-Benzyl-*N*-(3-hydroxy-4-methyl-2-phenylpentyl)-4-methylbenzenesulfonamide (3a)**

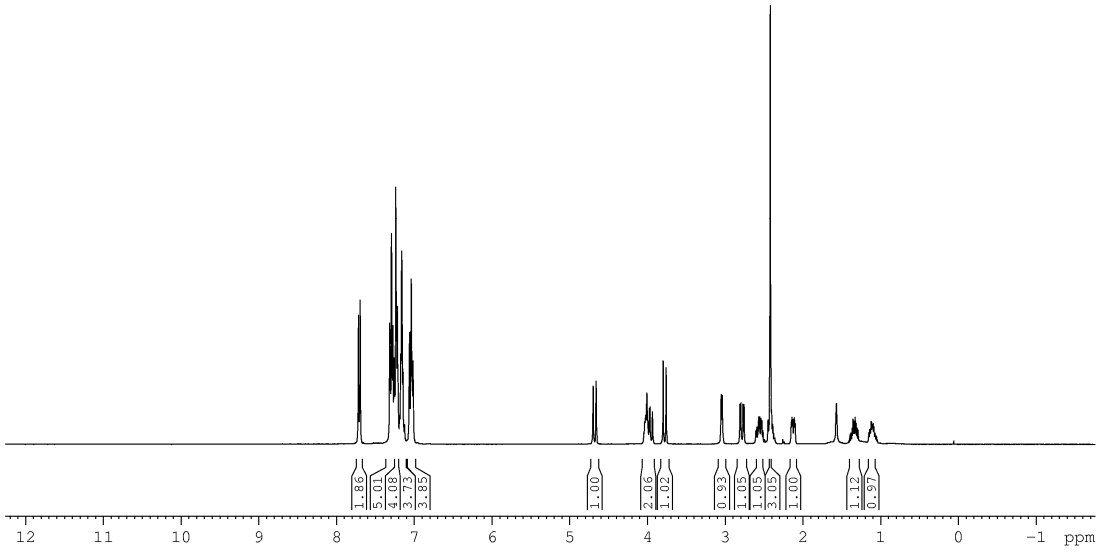


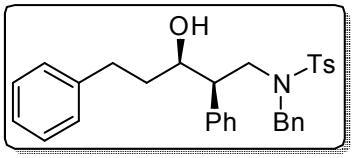




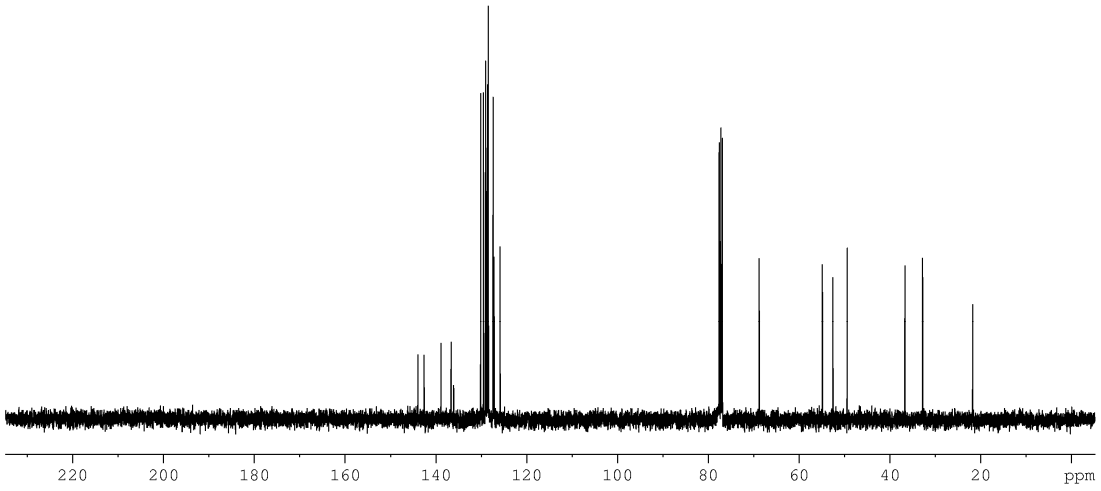
_N_-Benzyl-_N_-((2_R_,3_R_)-3-cyclohexyl-3-hydroxy-2-phenylpropyl)-4-methylbenzenesulfonamide (3b)

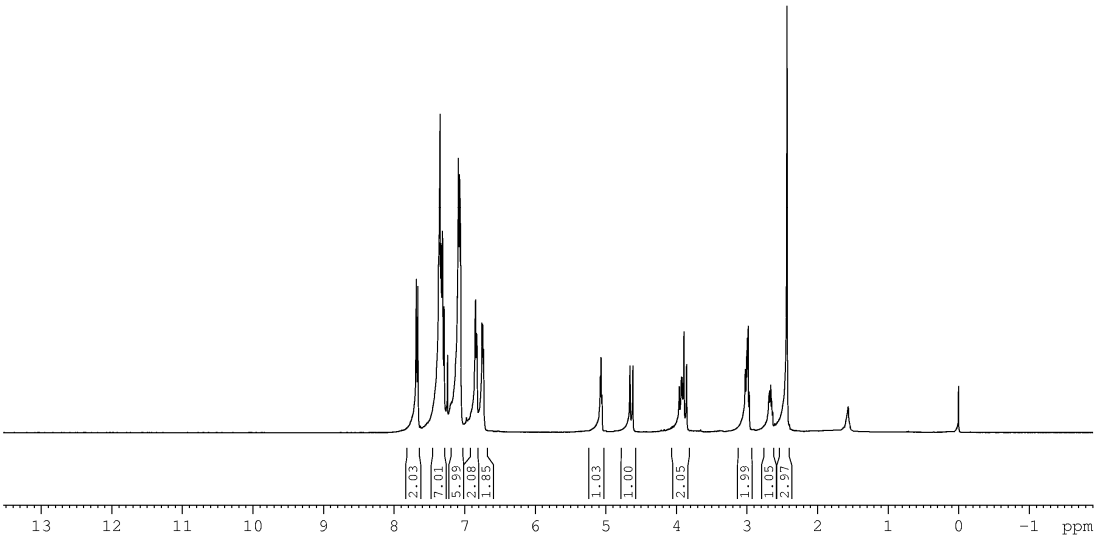


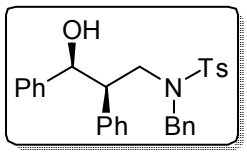




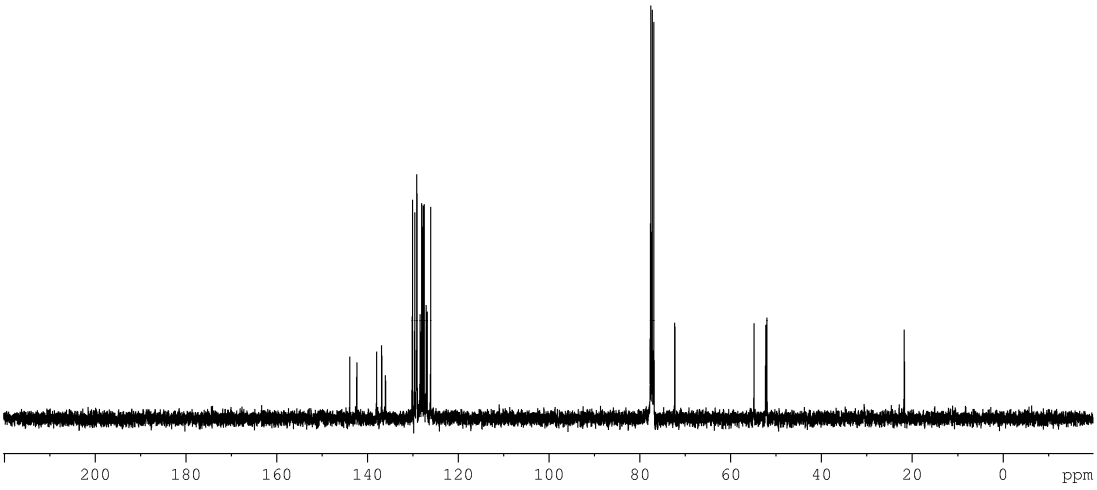
***N*-Benzyl-*N*-((2*R*,3*R*)-3-hydroxy-2,5-diphenylpentyl)-4-methylbenzenesulfonamide (3c)**

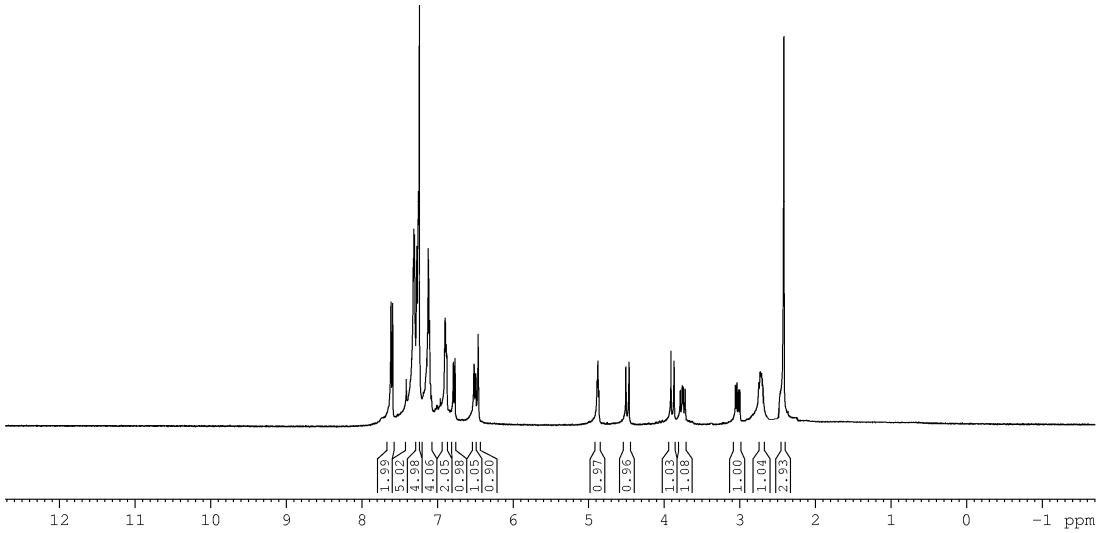


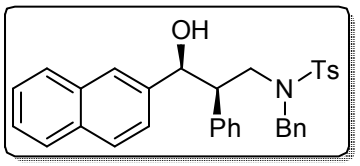




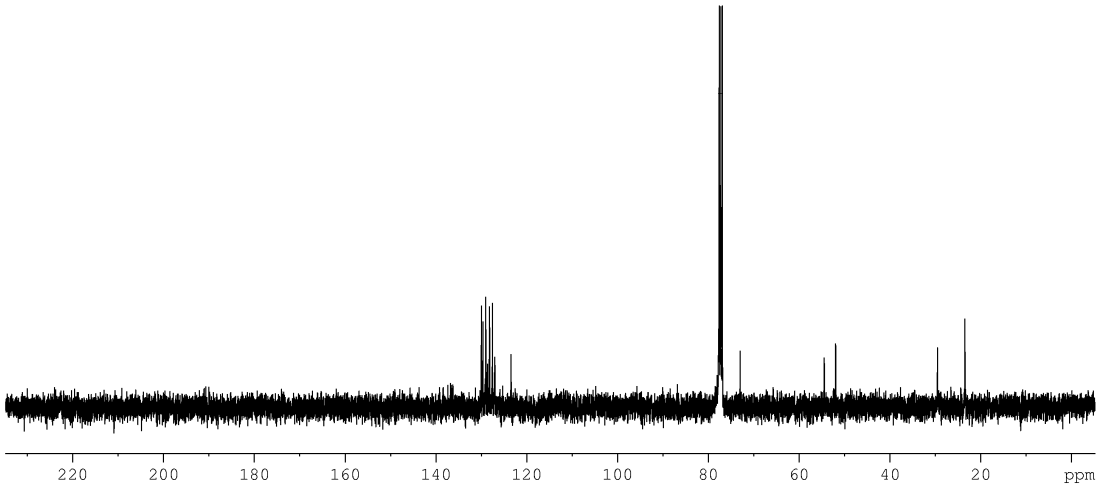
_N_-Benzyl-_N_-((2_R_,3_S_)-3-hydroxy-2,3-diphenylpropyl)-4-methylbenzenesulfonamide (3d)

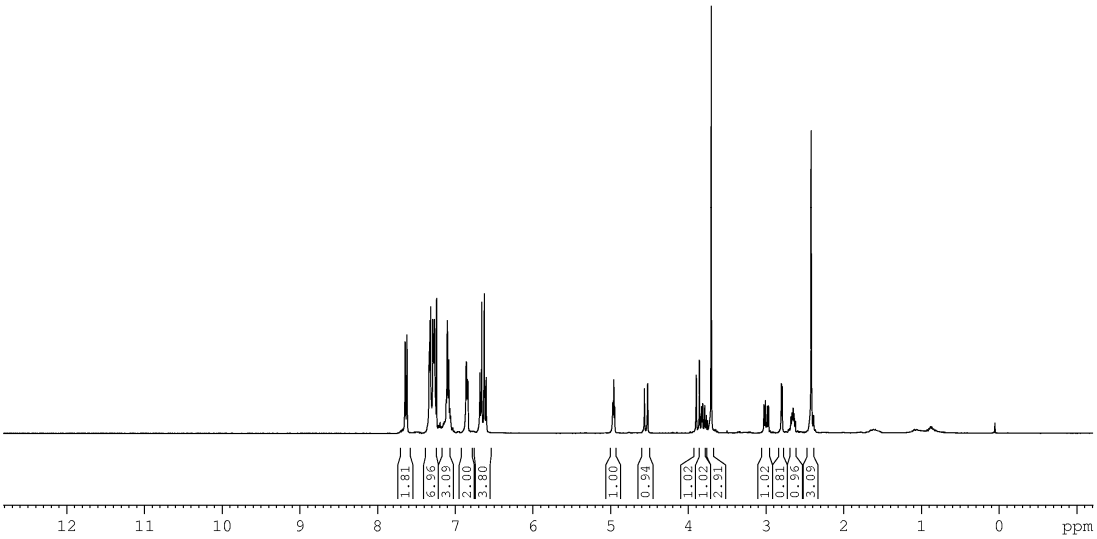


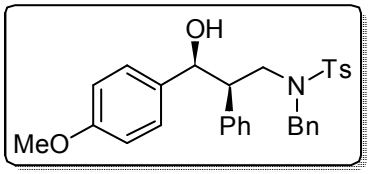




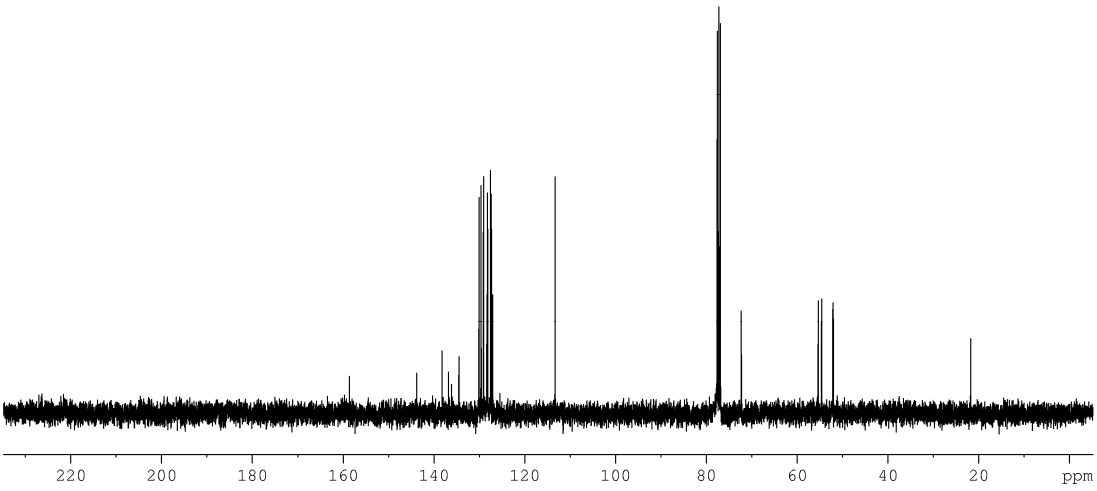
_N_-Benzyl-_N_-((2_R_,3_S_)-3-hydroxy-3-(naphthalen-2-yl)-2-phenylpropyl)-4-methylbenzenesulfonamide (3e)

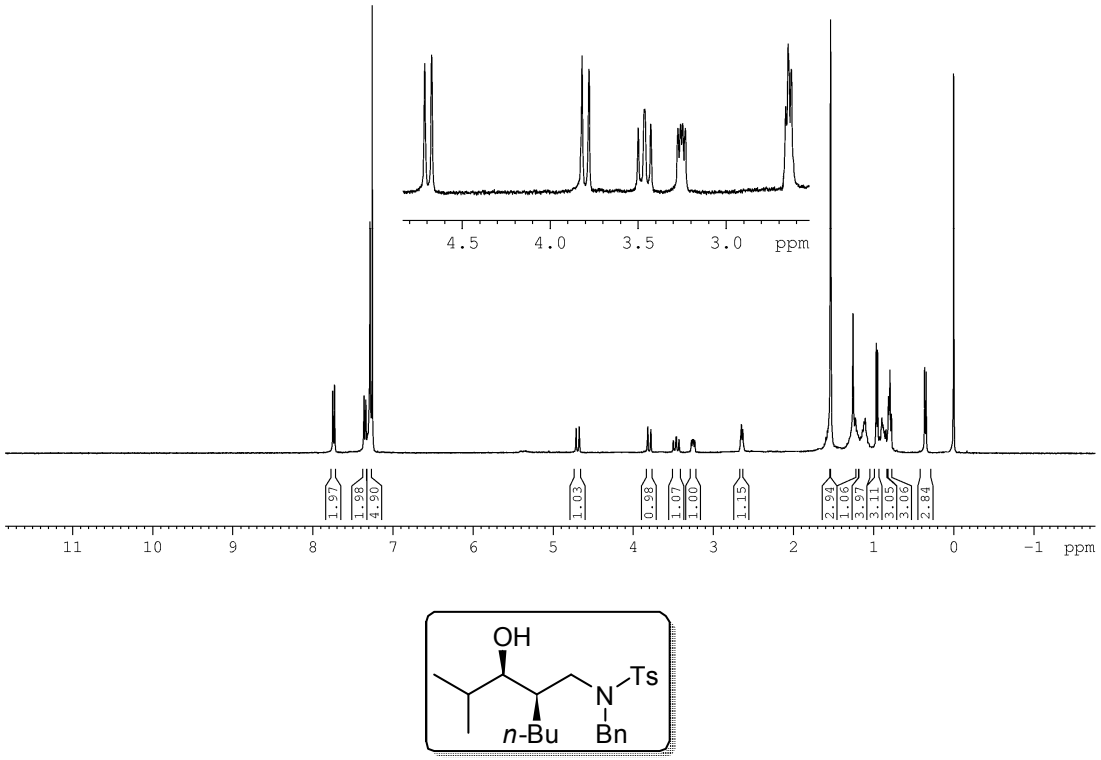




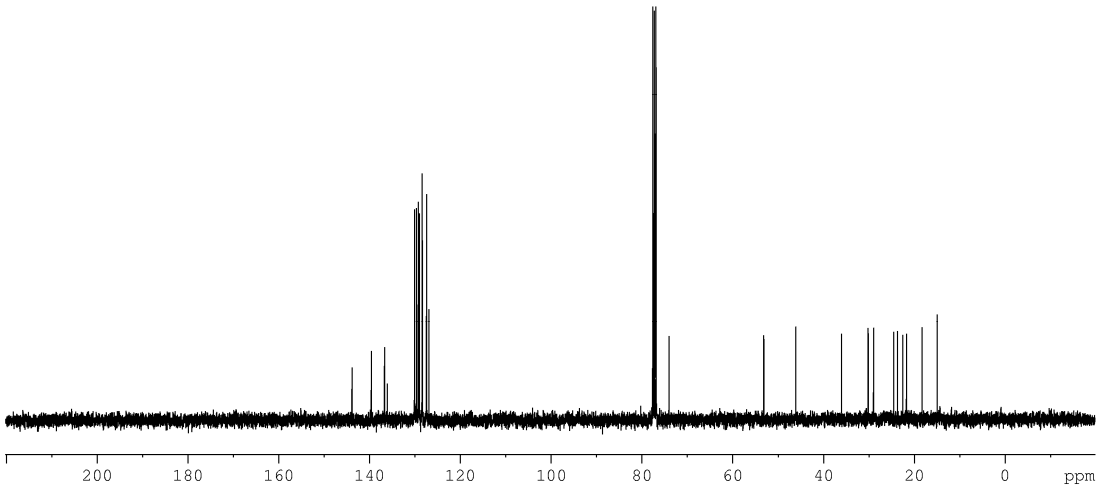


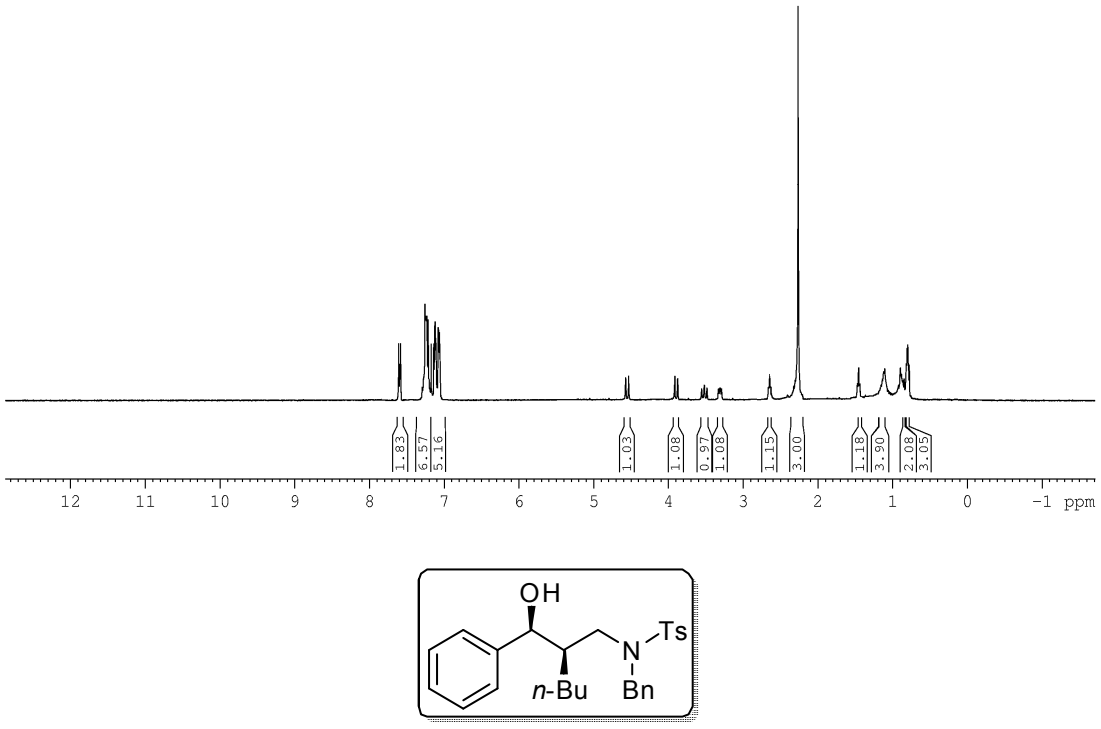
_N_-Benzyl-_N_-((2_R_,3_S_)-3-hydroxy-3-(4-methoxyphenyl)-2-phenylpropyl)-4-methylbenzenesulfonamide (3f)



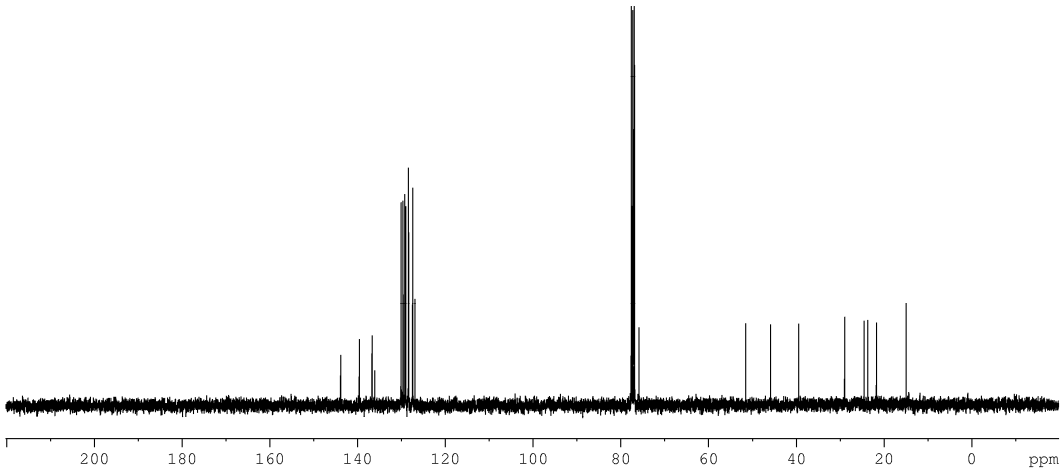


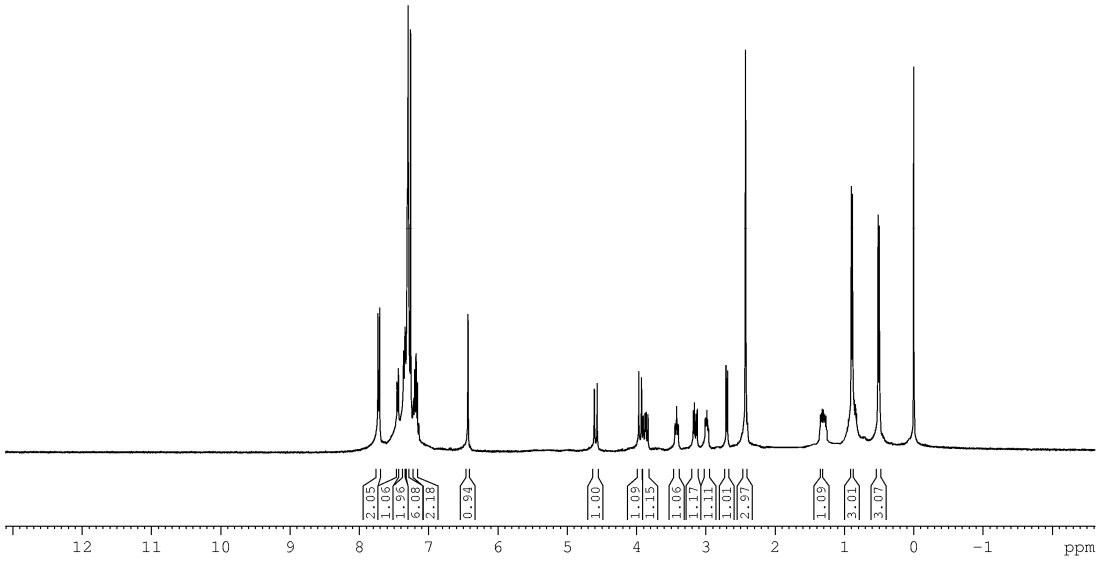
_N_-Benzyl-_N_-((_R_)-2-((_R_)-1-hydroxy-2-methylpropyl)hexyl)-4-methylbenzenesulfonamide (3g)

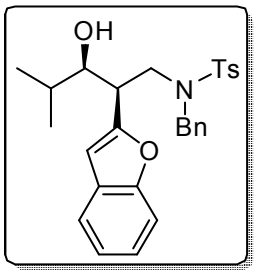




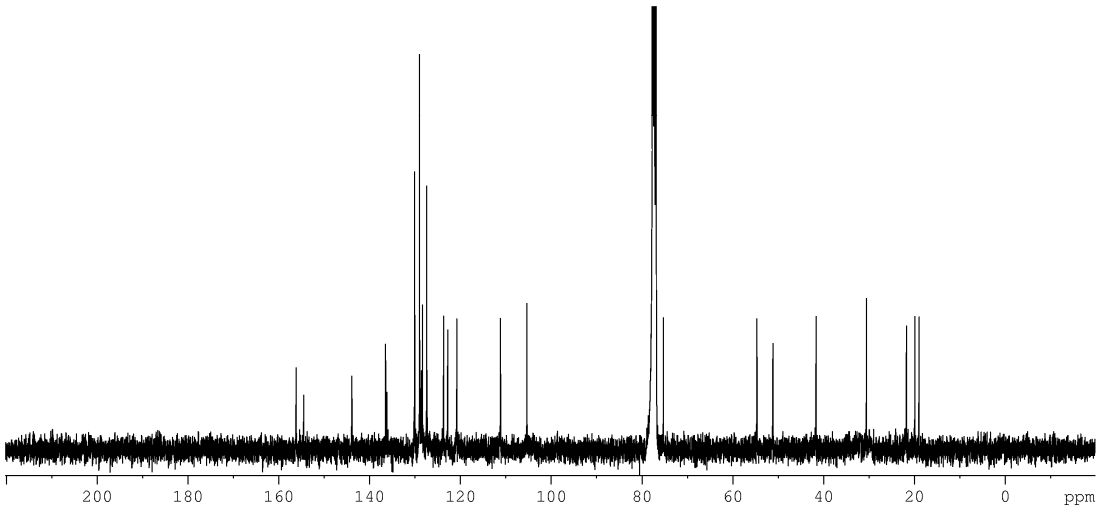
***N*-Benzyl-*N*-((*R*)-2-((*S*)-hydroxy(phenyl)methyl)hexyl)-4-methylbenzenesulfonamide (3h)**

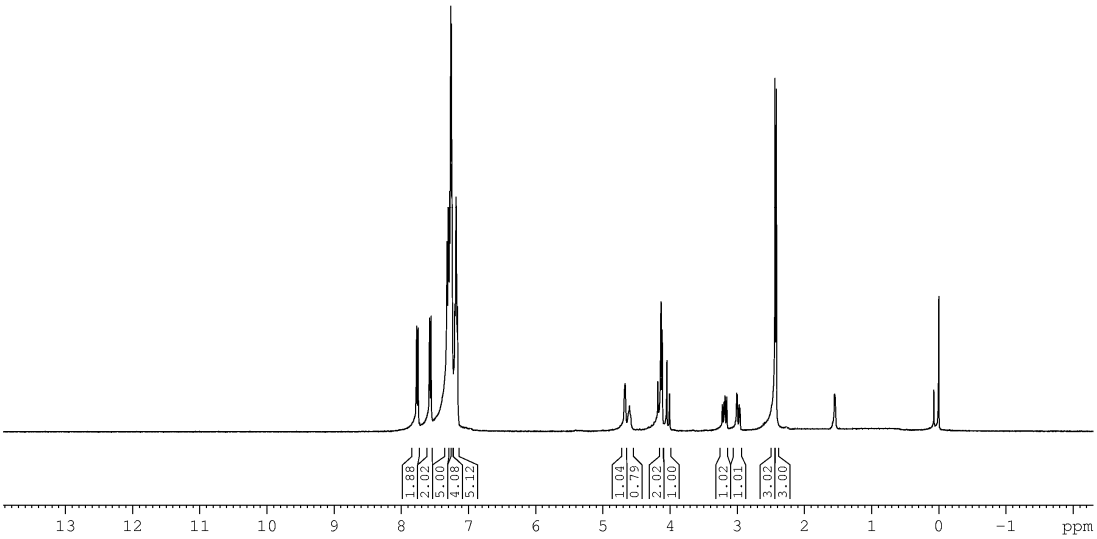


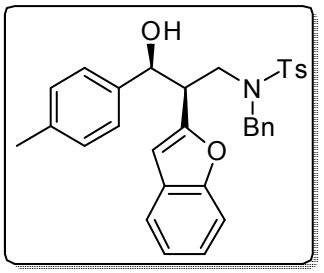




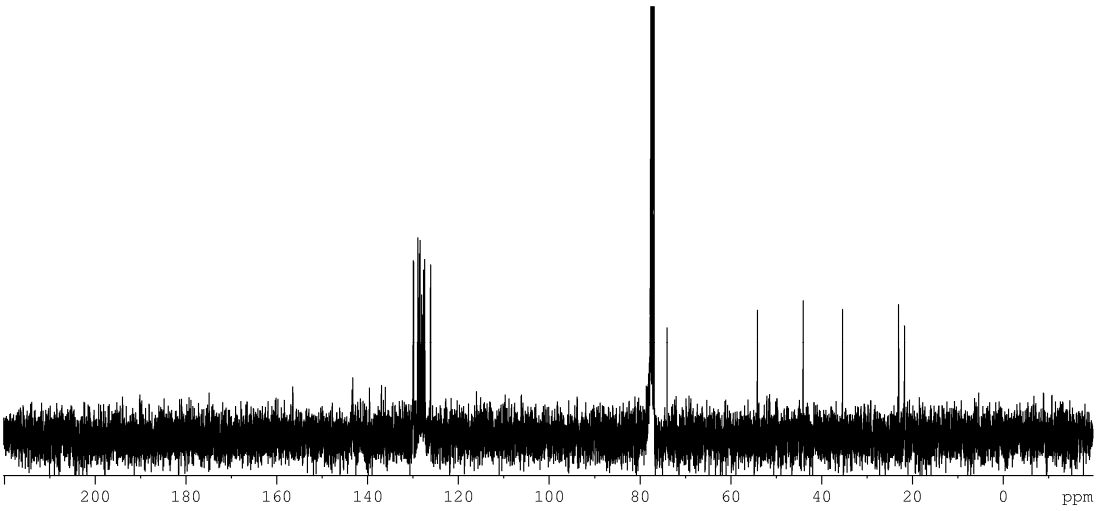
_N_-((2_R_,3_R_)-2-(Benzofuran-2-yl)-3-hydroxy-4-methylpentyl)-_N_-benzyl-4-methylbenzenesulfonamide (3i)

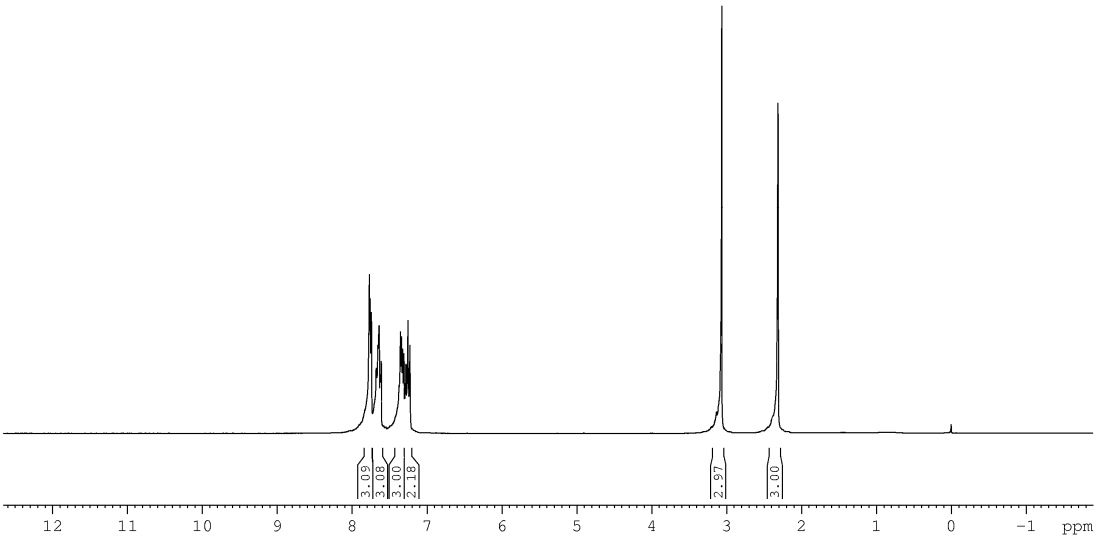


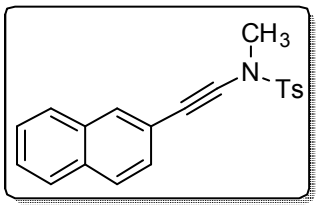




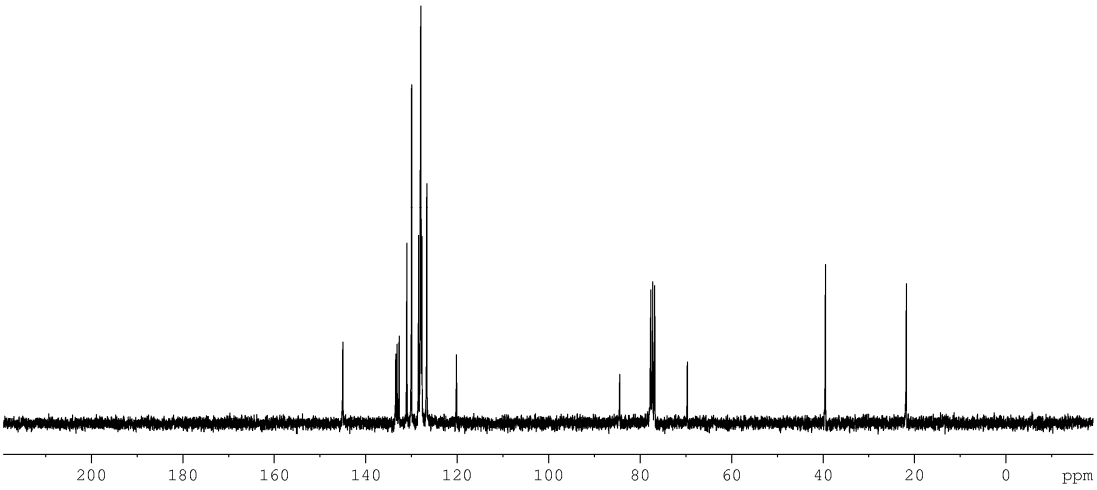
_N_-((2_R_,3_S_)-2-(Benzofuran-2-yl)-3-hydroxy-3-(_p_-tolyl)propyl)-_N_-benzyl-4-methylbenzenesulfonamide (3j)

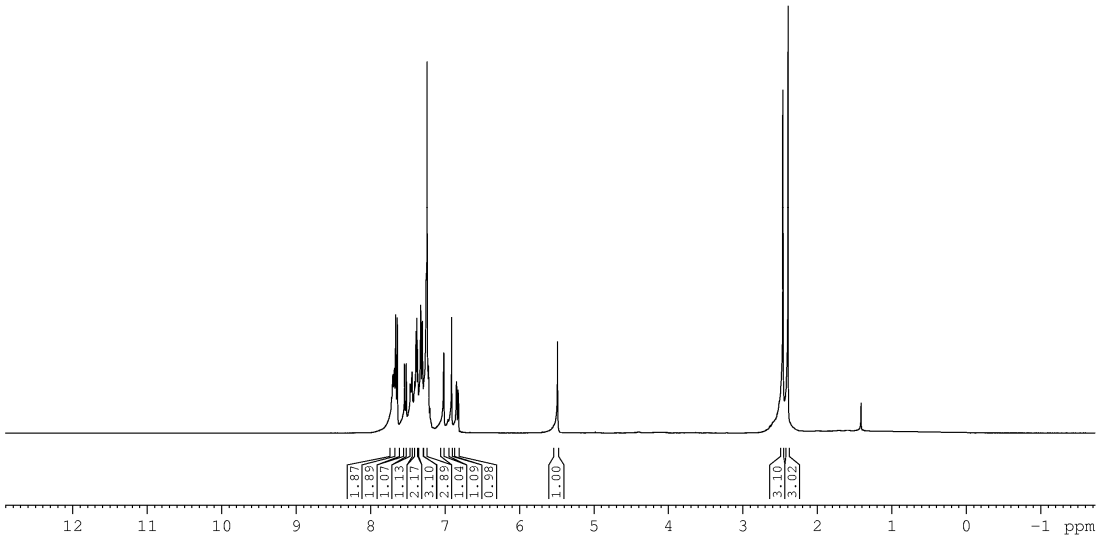


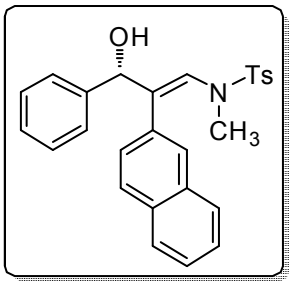




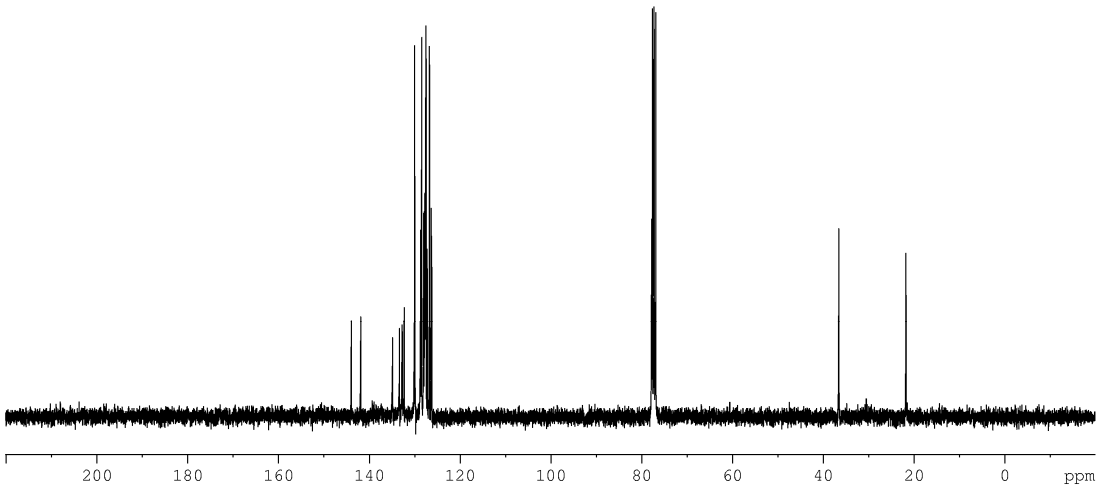
_N_,4-Dimethyl-_N_-(naphthalen-2-ylethynyl)benzenesulfonamide (5)

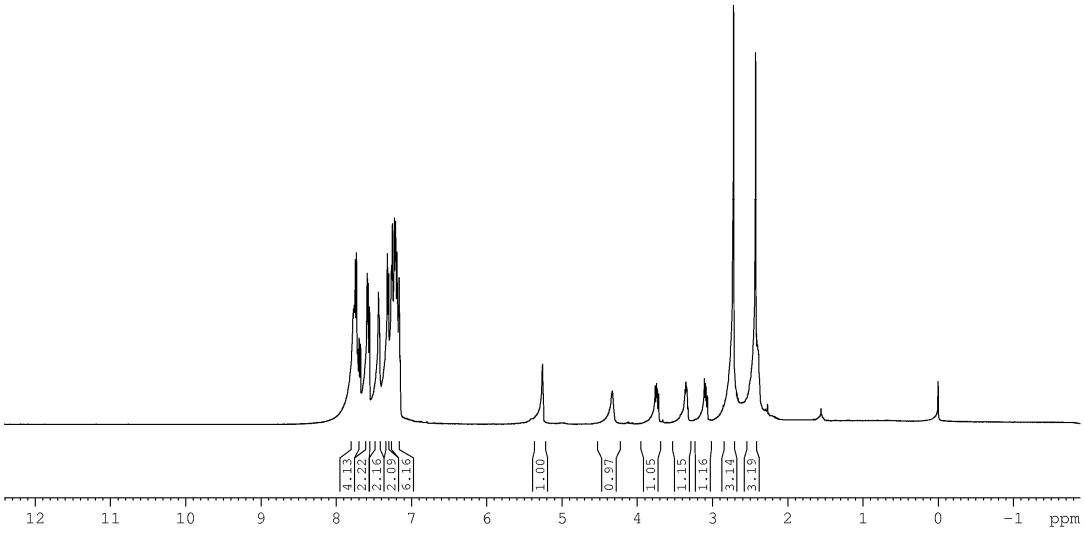


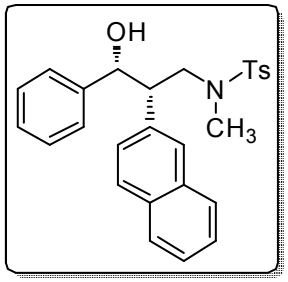




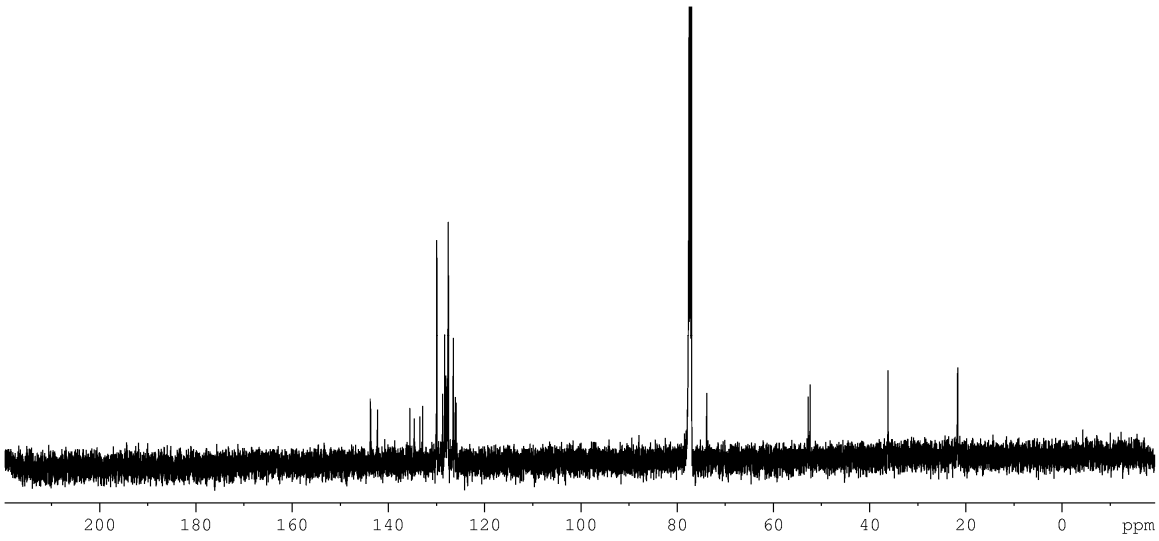
(*S*,*E*)-*N*-(3-Hydroxy-2-(naphthalen-2-yl)-3-phenylprop-1-en-1-yl)-*N*,4-dimethylbenzenesulfonamide (6)

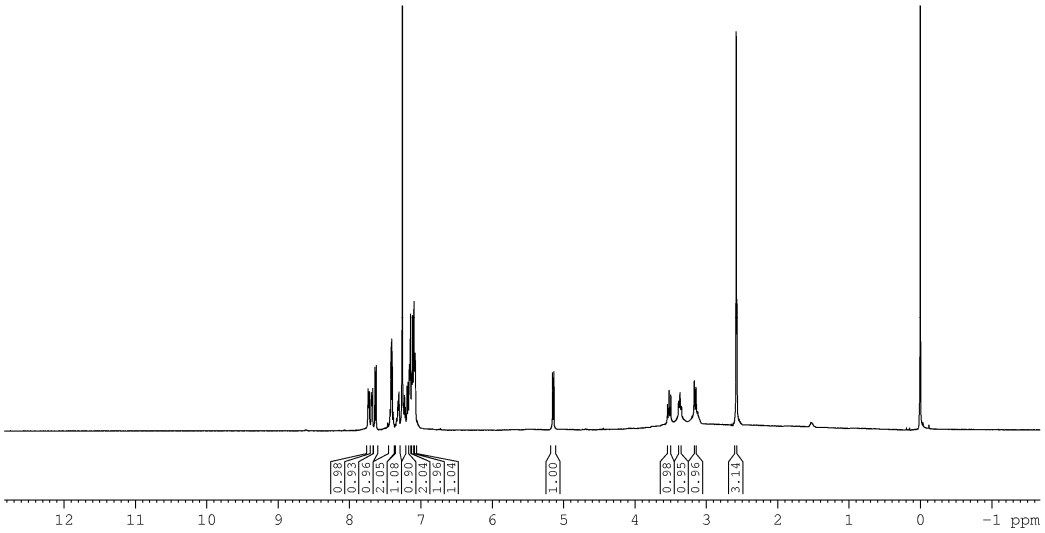


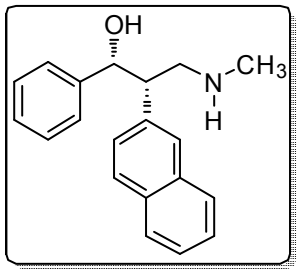




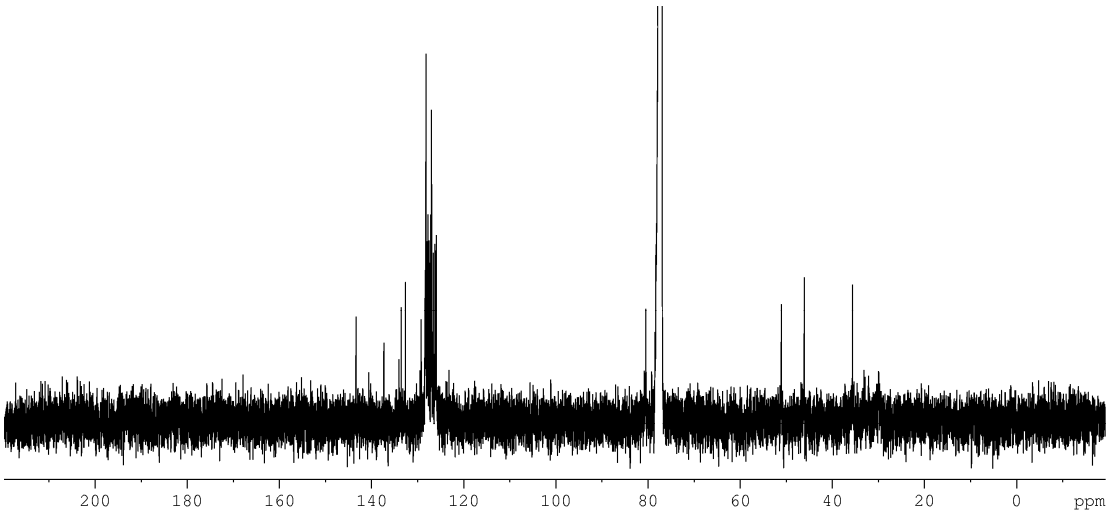
_N_-((2_S_,3_R_)-3-Hydroxy-2-(naphthalen-2-yl)-3-phenylpropyl)-_N_,4-dimethylbenzenesulfonamide (7)

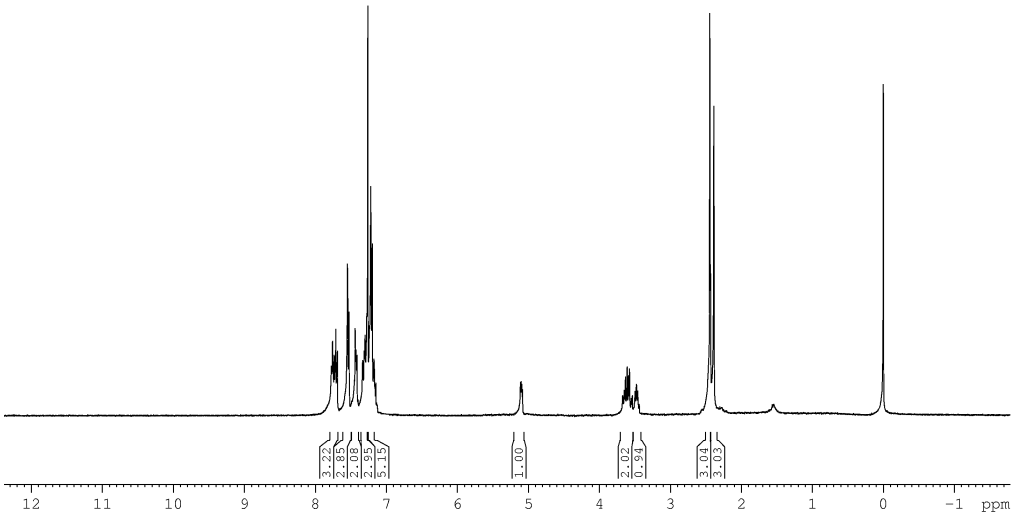


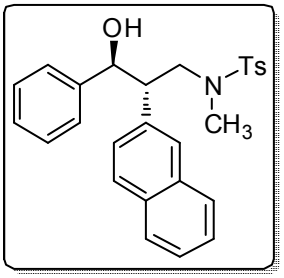




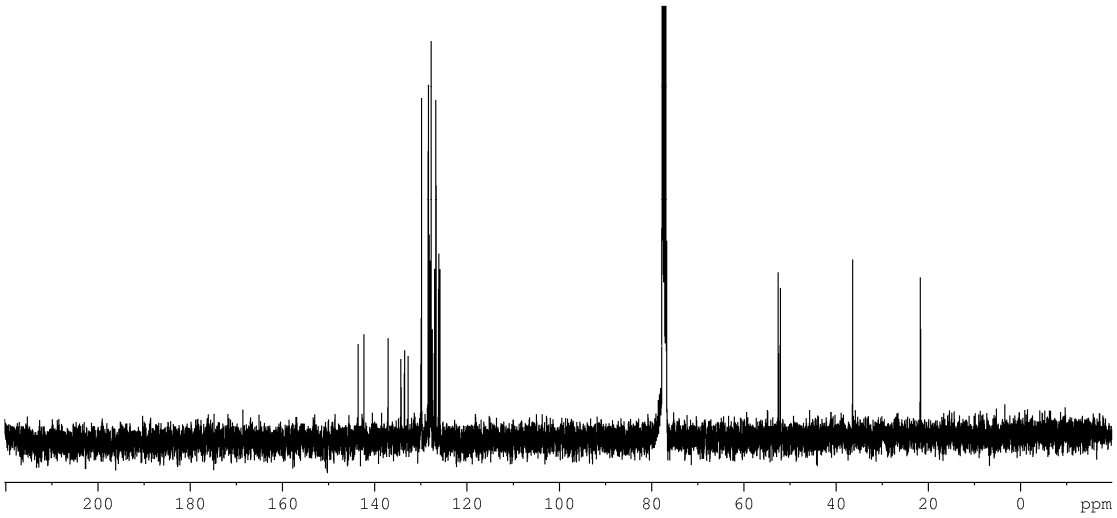
(1*R*,2*S*)-3-(Methylamino)-2-(naphthalen-2-yl)-1-phenylpropan-1-ol (8)

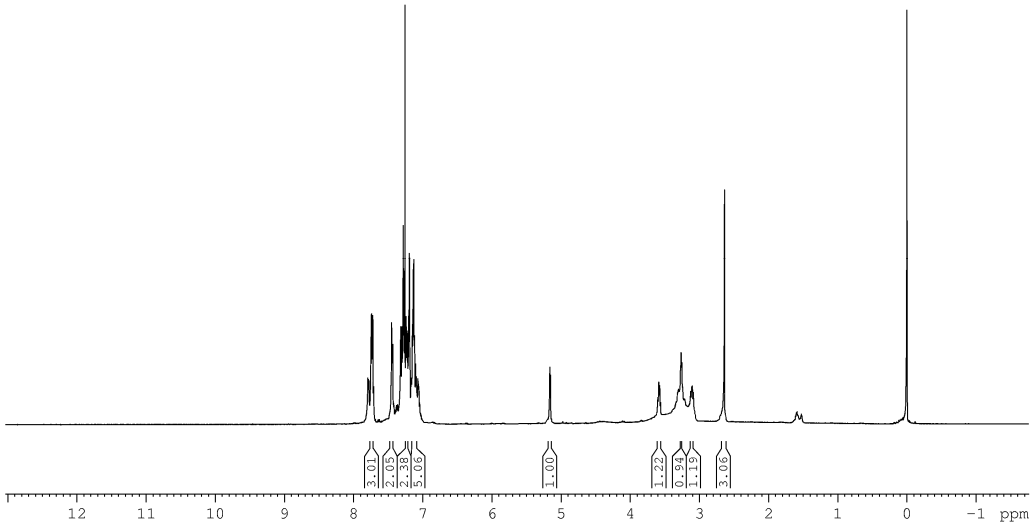


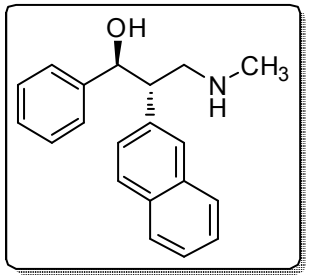




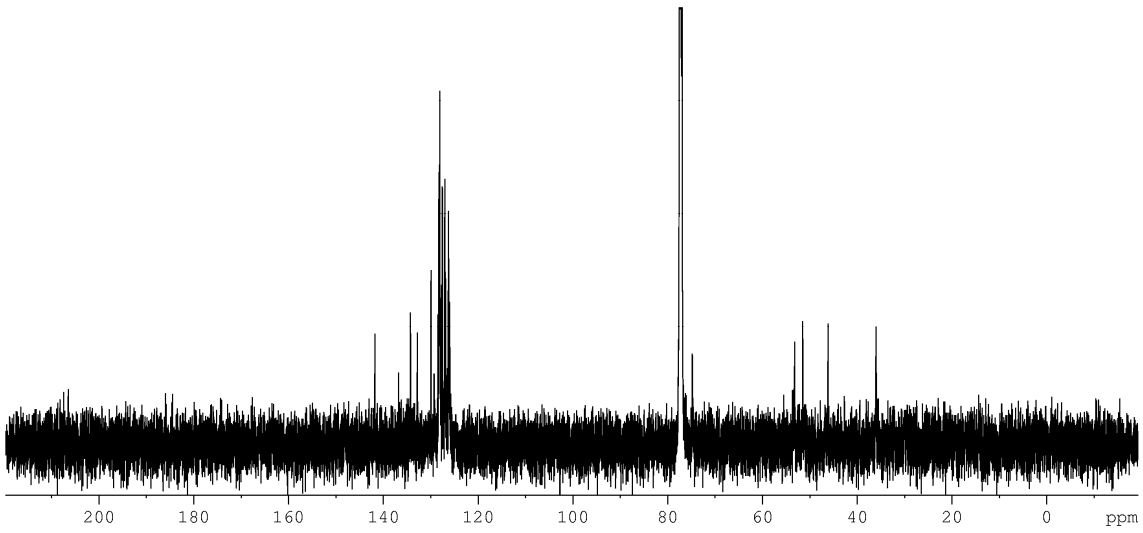
_N_-((2S,3S)-3-Hydroxy-2-(naphthalen-2-yl)-3-phenylpropyl)-N,4-dimethylbenzenesulfonamide (9)

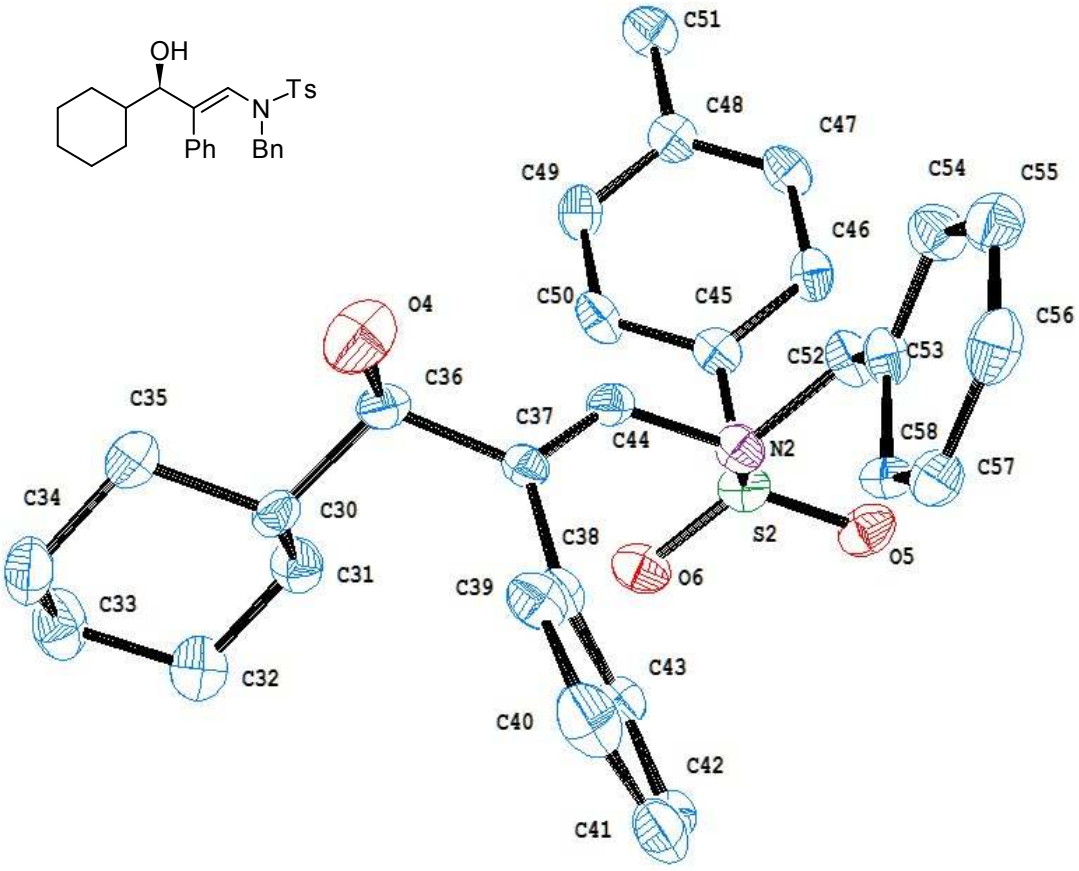




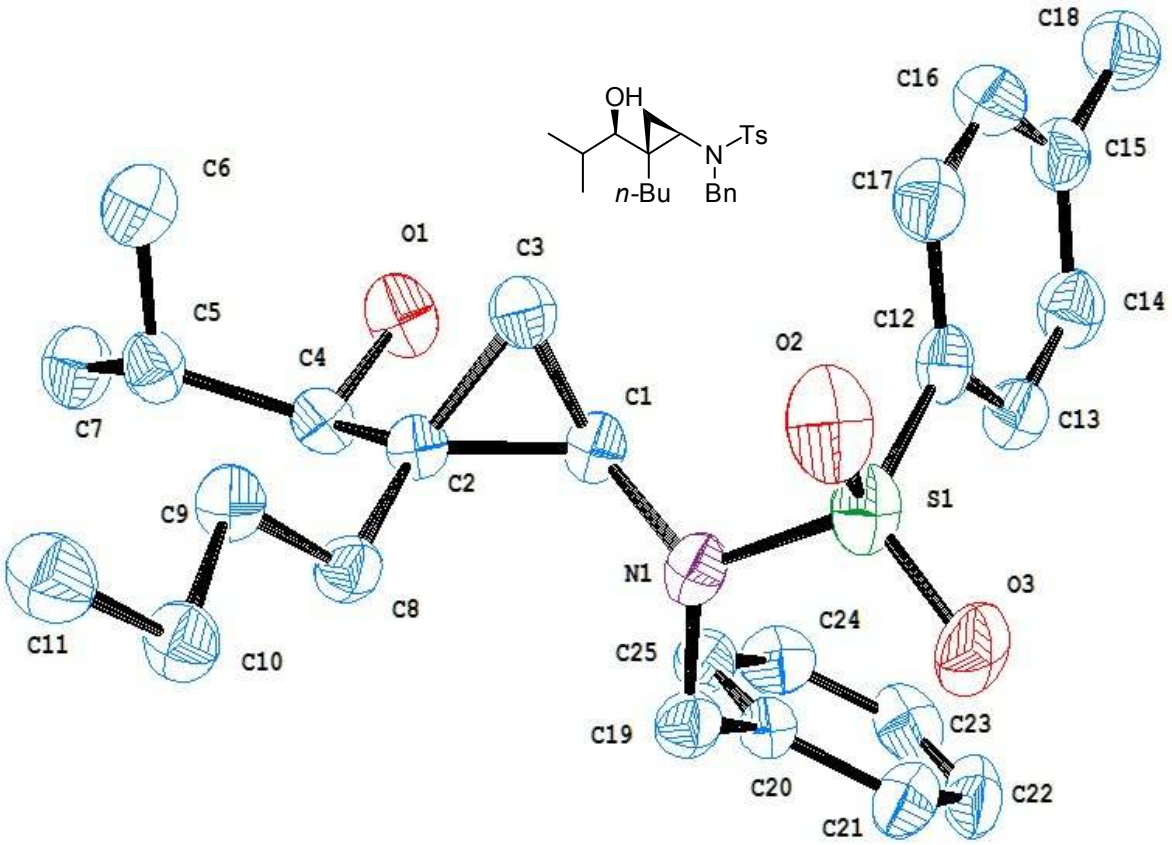


(1S,2S)-3-(Methylamino)-2-(naphthalen-2-yl)-1-phenylpropan-1-ol (PRC200-SS)

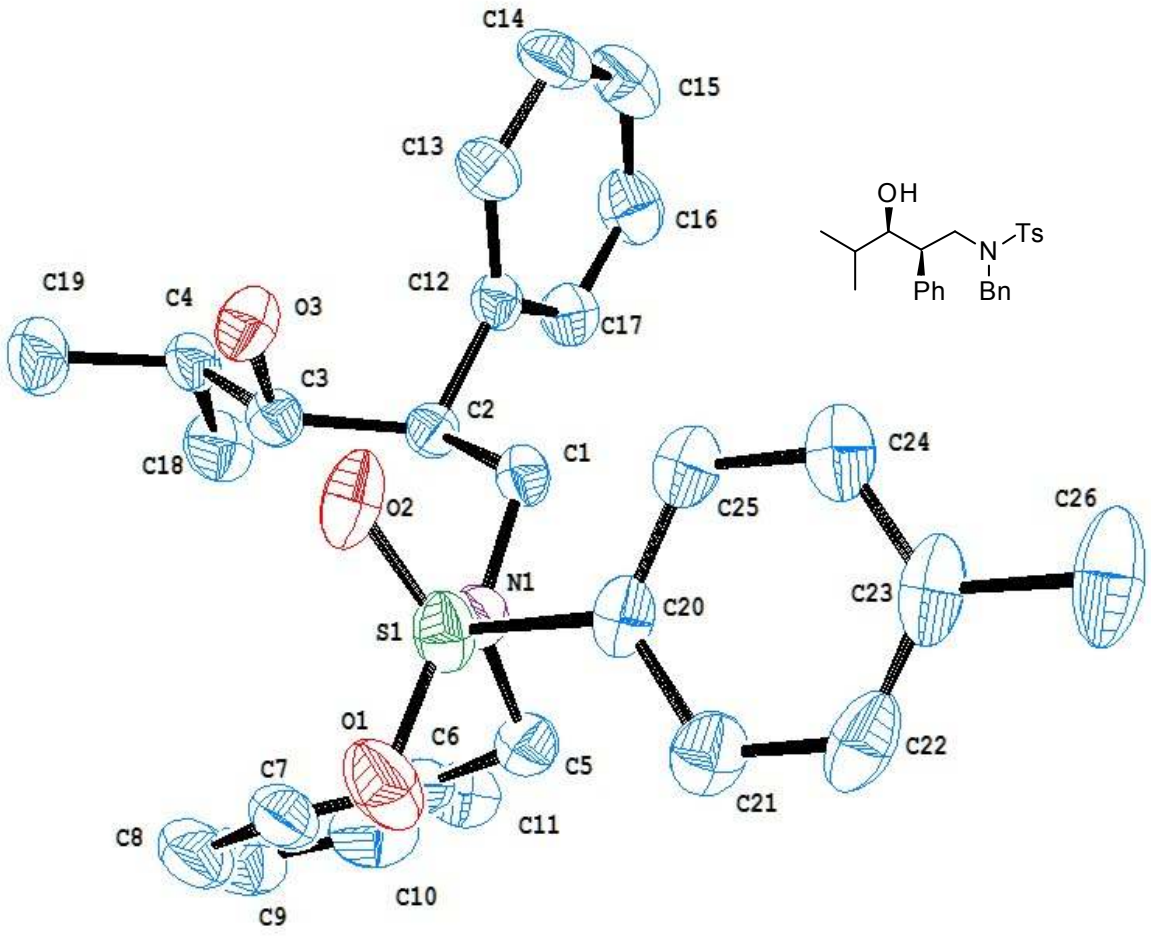




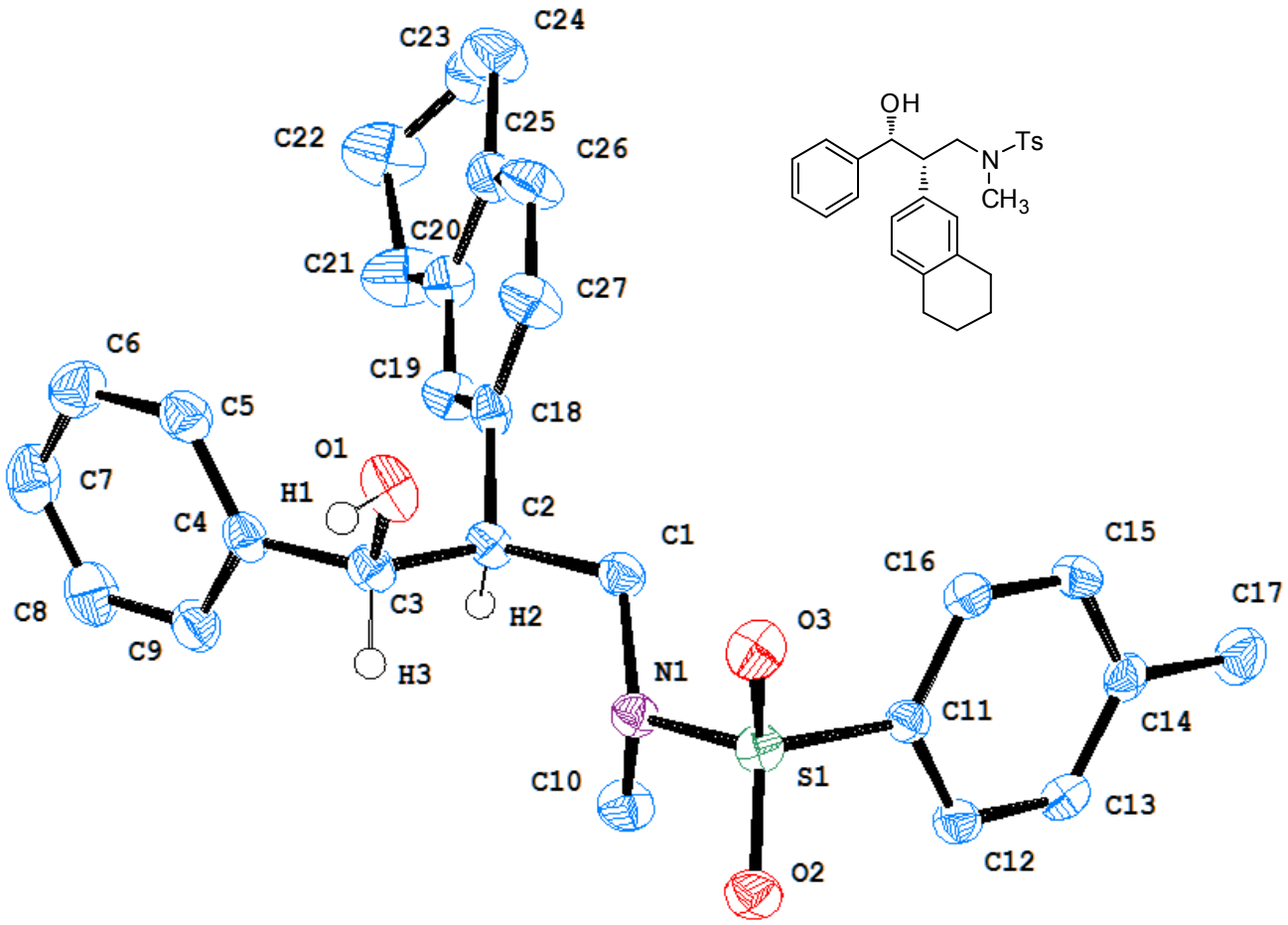
ORTEP diagram of **1b**.



ORTEP diagram of **2f**.



ORTEP diagram of **3a**.



ORTEP diagram of **7'**.