The First Transformation of Aliphatic α,β-Epoxyamides into α-Hydroxyamides.

José M. Concellón,* and Eva Bardales

SUPPORTING INFORMATION

SPECTROSCOPIC DATA OF COMPOUNDS 1

General Procedure for the Synthesis of 2,3-Epoxyamide 1a: Disubstituted epoxyamide, compound **1a** was prepared from Sharpless epoxidation of the corresponding allyl alcohol,[16] further oxidation[17] and conversion into the amide.[18]

(2*S*,3*R*)-2,3-Epoxy-*N*-methyldecanamide (1a)

^{1}H NMR (200 MHz, $CDCl_3$): δ = 6.30 (br, NH), 3.14 (d, *J* = 2.1 Hz, 1 H), 2.90-2.84 (m, 1 H), 2.72 (d, *J* = 5.1 Hz, 3 H), 1.68-0.95 (m, 12 H), 0.80 (t, *J* = 6.7 Hz, 3 H); ^{13}C NMR (50 MHz, $CDCl_3$): δ = 169.1 (C), 59.4 (CH), 55.1 (CH), 30.7 (CH_2), 28.9 (CH_2), 28.8 (CH_2), 25.4 (CH_2), 25.2 (CH_2), 22.3 (CH_3), 13.1 (CH_3); IR (neat): $\tilde{\nu}$ = 3275, 1663, 1461, 1280 cm^{-1}; R_f = 0.1 (hexane/AcOEt 1/1); $[\alpha]^{25}_D$ = +15.7 (*c* = 0.09 in $CHCl_3$).

General Procedure for the Synthesis of 2,3-Epoxyamides 1b-c: To a -78 ºC stirred solution of the corresponding 2-chloroamide (4.5 mmol) in dry THF (4 mL) was added dropwise lithium diisopropylamide [prepared from MeLi (3.2 mL of 1.5 M

solution in diethyl ether, 5 mmol) and diisopropylamine (0.8 ml, 5 mmol) in THF 25 mL at 0 ºC]. After stirring for 10 min, a solution of the corresponding aldehyde (3.5 mmol) in dry THF (4.5 mL) was added dropwise at -78 ºC and the mixture was stirred stirring for 1 h. Then, the reaction mixture was quenched with aqueous saturated solution of NH_4Cl (20 mL) usual workup provided crude 2-halo-3-hydroxyamides, which were diluted with CH_2Cl_2 (20mL) and treatmented with sodium hydride (1g, 45 mmol) at 25ºC. The mixture was stirred for 2,5 hours at this temperature. Then quenched with H_2O and extracted with CH_2Cl_2 (3 x 10 mL). The combined organic layers were dried (Na_2SO_4), filtered, and concentrated in vacuo. The crudes 2,3-epoxyamides **1b-d** were purified by flash column chromatography on silica gel (hexane/AcOEt) provided pure compounds.

2,3-Epoxy-*N,N*-diethyldecanamide (1b)

^{1}H NMR (300 MHz, $CDCl_3$): δ = 3.51 (d, *J* = 4.4 Hz, 1 H), 3.49-3.05 (m, 11 H), 1.63-1.14 (m, 30 H), 1.19-0.98 (m, 6 H), 0.82-0.69 (m, 6 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 166.4 (C), 165.5 (C), 57.8 (CH), 56.8 (CH), 53.7 (CH), 53.1 (CH), 41.1 (CH_2), 40.7 (CH_2), 40.4 (CH_2), 39.7 (CH_2), 31.4 (CH_2), 29.0 (CH_2), 28.9 (CH_2), 28.8 (CH_2), 27.9 (CH_2), 25.9 (CH_2), 25.6 (CH_2), 22.2 (CH_2), 14.5 (CH_3), 14.0 (CH_3), 13.7 (CH_3), 12.6

(CH_3); IR (neat): $\tilde{\nu}$ = 2929, 1657, 1468, 1265 cm^{-1}; R_f = 0.1 (hexane/AcOEt 3/1).

3-Cyclohexyl-2,3-epoxy-*N,N*-diisopropylpropanamide (1c)

^1H NMR (200 MHz, $CDCl_3$): δ = 4.34-4.21 (m, 1 H), 3.53 (d, *J* = 4.4 Hz, 1 H), 3.53-3.37 (m, 1 H), 2.93-2.86 (m, 1 H), 2.06-1.57 (m, 11 H), 1.42 (d, *J* = 6.7 Hz, 6 H), 1.25 (d, *J* = 6.7 Hz, 3 H), 1.23 (d, *J* = 6.7 Hz, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 164.2 (C), 60.0 (CH), 53.5 (CH), 46.6 (CH), 44.6 (CH), 35.5 (CH), 29.1 (CH_2), 27.5 (CH_2), 25.0 (CH_2), 24.2 (CH_2), 24.1 (CH_2), 19.7 (CH_3), 19.4 (CH_3), 19.1 (CH_3), 18.8 (CH_3); IR (neat): $\tilde{\nu}$ = 2953, 1651, 1454, 1372, 1136 cm^{-1}; R_f = 0.2 (hexane/AcOEt 3/1).

2,3-Epoxy-*N,N*-diethyl-5,9-dimethyldecanamide (1d)

^1H NMR (200 MHz, $CDCl_3$): δ = 5.05-4.88 (m, 2 H), 4.00-3.97 (m, 2 H), 3.54-2.99 (m, 10 H), 2.01-0.82 (m, 32 H), 1.55 (s, 6 H), 1.47 (s, 6 H); ^{13}C NMR (50 MHz, $CDCl_3$): δ = 166.3 (C), 165.4 (C), 130.8 (C), 124.1 (CH), 124.0 (CH), 55.7 (CH), 55.5 (CH), 53.4 (CH), 53.0 (CH), 40.6 (CH_2), 39.6 (CH_2), 36.6 (CH_2), 34.7 (CH_2), 30.7 (CH), 30.2 (CH), 25.3 (CH_3), 25.0 (CH_2), 19.3 (CH_3), 19.0 (CH_3), 17.2 (CH_3), 14.5 (CH_3), 13.9 (CH_3), 12.5 (CH_3), 12.2 (CH_3); IR (neat): $\tilde{\nu}$ = 2973, 1649, 1463, 1381, 1147 cm^{-1}; R_f = 0.4 (hexane/AcOEt 1/1).

General Procedure for the Synthesis of 2,3-Epoxyamides 1e-i: To a -78 ºC stirred solution of the corresponding 2-chloroamide (2.5 mmol) in dry THF (4 mL) was added dropwise potassium hexamethyldisilazide (6.5 mL of 0.5 M solution in tolueno, 3.25 mmol). After stirring for 10 min, a solution of the corresponding aldehyde (2.5 mmol) in dry THF (4 mL) was added dropwise at -78 ºC and the mixture was allowed to warm to room temperature. The resulting solution was quenched with aqueous saturated solution of NH_4Cl (20 mL). The usual workup provided crude 2,3-epoxyamides **1e-i**, which were purified by column flash chromatography over silica gel (hexane/ethyl acetate) provided pure compound.

2,3-Epoxy-*N,N*-diethyl-2,5-dimethylhexanamide (1e)

^{1}H NMR (200 MHz, $CDCl_3$): δ = 3.59-3.12 (m, 8 H), 3.02-2.96 (m, 2 H), 1.87-1.24 (m, 6 H), 1.43 (s, 6 H), 1.15 (t, *J* = 7.1 Hz, 6 H), 1.07 (t, *J* = 7.1 Hz, 6 H), 0.96 (d, *J* = 6.7 Hz, 12 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 170.0 (C), 62.7 (C), 61.0 (CH), 60.6 (C), 41.0 (CH_2), 39.1 (CH_2), 36.5 (CH), 26.4 (CH_2), 22.6 (CH_3), 22.2 (CH_3), 15.6 (CH_3), 14.0 (CH_3), 12.4 (CH_3); IR (neat): $\tilde{\nu}$ = 2959, 1639, 1467, 1382, 1073 cm^{-1}; R_f = 0.2 (hexane/AcOEt 3/1).

2,3-Epoxy-*N,N*-diethyl-2-methyldecanamide (1f)

^{1}H NMR (200 MHz, $CDCl_3$): δ = 3.56-2.96 (m, 10 H), 1.50 (s, 3 H), 1.45 (s, 3 H), 1.42-1.20 (m, 24 H), 1.15 (t, *J* = 7.1 Hz, 6 H), 1.08 (t, *J* = 7.1 Hz, 6 H), 0.89-0.79 (m, 6 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 169.9 (C), 168.5 (C), 63.9 (C), 61.9 (C), 61.2 (CH), 60.8 (CH), 41.3 (CH_2), 41.0 (CH_2), 39.2 (CH_2), 39.1 (CH_2), 31.5 (CH_2), 30.0 (CH_2), 29.1 (CH_2), 29.0 (CH_2), 27.8 (CH_2), 26.1 (CH_2), 22.4 (CH_2), 20.5 (CH_2), 15.4 (CH_3), 14.1 (CH_3), 14.0 (CH_3), 13.9 (CH_3), 12.4 (CH_3), 12.3 (CH_3); IR (neat): $\tilde{\nu}$ = 2927, 1644, 1464, 1380, 1079 cm^{-1}; R_f = 0.1 (hexane/AcOEt 5/1).

3-Cyclohexyl-2,3-epoxy-*N,N*-diethyl-2-methylpropanamide (1g)

^{1}H NMR (200 MHz, $CDCl_3$): δ = 3.69-3.20 (m, 8 H), 2.75 (d, *J* = 7.4 Hz, 1 H), 2.57 (d, *J* = 8.2 Hz, 1 H), 2.01-1.39 (m, 22 H), 1.53 (s, 3 H), 1.51 (s, 3 H), 1.19 (t, *J* = 6.9 Hz, 6 H), 1.11 (t, *J* = 6.9 Hz, 6 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 169.8 (C), 67.6 (C), 65.8 (C), 61.8 (CH), 60.9 (CH), 41.6 (CH_2), 40.9 (CH_2), 39.0 (CH_2), 38.6 (CH_2), 36.8 (CH), 30.0 (CH_2), 29.8 (CH_2), 28.3 (CH_2), 28.2 (CH_2), 26.0 (CH_2), 25.9 (CH_2), 25.2 (CH_2), 25.1 (CH_2), 15.5 (CH_3), 14.2 (CH_3), 14.0 (CH_3), 12.4 (CH_3), 12.3 (CH_3); IR (neat): $\tilde{\nu}$ = 2930, 1636, 1450, 1381, 1074 cm^{-1}; R_f = 0.2, 0.3 (hexane/AcOEt 3/1).

2-Butyl-3-cyclohexyl-2,3-epoxy-*N,N*-diethylpropanamide (1h)

^{1}H NMR (200 MHz, $CDCl_3$): δ = 3.61-3.68 (m, 4 H), 2.16 (d, *J* = 6.4 Hz, 1 H), 2.02-1.03 (m, 23 H), 0.86 (t, *J* = 6.4 Hz, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 169.2 (C), 66.2 (CH), 64.1 (C), 40.9 (CH_2), 39.2 (CH_2), 36.5 (CH), 30.2 (CH_2), 29.7 (CH_2), 28.6 (CH_2), 27.2 (CH_2), 25.9 (CH_2), 25.2 (CH_2), 22.8 (CH_2), 14.1 (CH_3), 13.7 (CH_3), 12.4 (CH_3); IR (neat): $\tilde{\nu}$ = 2960, 1644, 1460, 1381, 1131 cm^{-1}; R_f = 0.3 (hexane/AcOEt 3/1).

2,3-Epoxy-*N,N*-diethyl-2,5,9-trimethyldecan-8-enamide (1i)

^{1}H NMR (200 MHz, $CDCl_3$): δ = 5.13-5.05 (m, 2 H), 3.68-3.03 (m, 10 H), 2.10-1.31 (m, 14 H), 1.68 (s, 6 H), 1.60 (s, 6 H), 1.49 (s, 6 H), 1.20 (t, *J* = 7.1 Hz, 6 H), 1.15 (t, *J* = 7.2 Hz, 6 H), 1.01 (d, *J* = 6.4 Hz, 6 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 169.7 (C), 168.2 (C), 130.6 (C), 124.1 (CH), 124.0 (CH), 60.7 (CH), 60.6 (CH), 59.9 (C), 41.1 (CH_2), 40.7 (CH_2), 39.1 (CH_2), 38.8 (CH_2), 36.6 (CH_2), 36.4 (CH_2), 34.5 (CH_2), 34.4 (CH_2), 30.6 (CH), 30.2 (CH), 25.2 (CH_2), 24.9 (CH_3), 20.1 (CH_3), 19.2 (CH_3), 18.8 (CH_3), 17.1 (CH_3), 15.3 (CH_3), 15.2 (CH_3), 13.7 (CH_3), 12.0 (CH_3); IR (neat): $\tilde{\nu}$ = 2968, 1644, 1635, 1434, 1380, 1076 cm^{-1}; R_f = 0.3 (hexane/AcOEt 5/1).

SPECTROSCOPIC DATA OF COMPOUNDS 2

(2*S*)-2-Hydroxy-*N*-methyldecanamide (2a)

^{1}H NMR (200 MHz, $CDCl_3$): δ = 6.57 (br, NH), 4.21-4.05 (m, 1 H), 2.86 (d, *J* = 3.6, 3 H), 1.99-1.17 (m, 14 H), 0.88 (t, *J* = 6.4, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 174.5 (C), 72.2 (CH), 34.9 (CH_2), 31.8 (CH_2), 29.4 (CH_2), 29.3 (CH_2), 29.2 (CH_2), 25.7 (CH_3), 25.0 (CH_2), 22.6 (CH_2), 14.0 (CH_3); MS (70 eV): *m/z* (%): 201 $[M]^+$ (4), 102 (25), 88 (37), 58 (85); IR (neat): $\tilde{\nu}$ = 3054, 1668 cm^{-1}; R_f = 0.1 (hexane/AcOEt 1/1); $[\alpha]^{25}_D$ = +24.0 (*c* = 0.05 in $CHCl_3$).

***N,N*-Diethyl-2-hydroxydecanamide (2b)**

^{1}H NMR (400 MHz, DMSO): δ = 4.21 (dd, *J* = 7.1, 4.7 Hz, 1 H), 3.87-3.26 (m, 4 H), 1.72-1.34 (m, 14 H), 1.32 (t, *J* = 7.1, 3 H), 1.25 (t, *J* = 7.1, 3 H), 0.98 (t, *J* = 7.1, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 173.6 (C), 67.8 (CH), 40.7 (CH_2), 40.0 (CH_2), 35.3 (CH_2), 31.7 (CH_2), 29.3 (CH_2), 29.0 (CH_2), 24.8 (CH_2), 22.5 (CH_2), 13.9 (CH_3), 12.6 (CH_3); MS (70 eV): *m/z* (%): 243 $[M]^+$ (3), 226 (2), 130 (43), 100 (100); HRMS calcd for $C_{14}H_{29}NO_2$ 243.2198, found 243.2185; IR (neat): $\tilde{\nu}$ = 3418, 1638 cm^{-1}; R_f = 0.2 (hexane/AcOEt 3/1).

3-Cyclohexyl-2-hydroxy-*N,N*-Diisopropyldecanamide (2c)

^{1}H NMR (400 MHz, DMSO): δ = 4.32-3.35 (m, 6 H), 1.77-0.86 (m, 11 H), 1.26 (d, *J* = 6.9, 6 H), 1.25 (d, *J* = 6.9, 6 H),; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 173.5 (C), 66.1 (CH), 47.4 (CH), 45.9 (CH), 43.2 (CH_2), 34.3 (CH_2), 33.8 (CH), 32.1 (CH_2), 26.3 (CH_2), 26.1 (CH_2), 25.8 (CH_2), 20.7 (CH_3), 20.4 (CH_3), 19.3 (CH_3); MS (70 eV): *m/z* (%): 255 $[M]^+$ (<1), 212 (5), 158 (11), 128 (65), 83 (25); HRMS calcd for $C_{15}H_{29}NO_2$ 255.2198, found 255.2189; IR (neat): $\tilde{\nu}$ = 3365, 1702 cm^{-1}; R_f = 0.4 (hexane/AcOEt 3/1).

***N,N*-Diethyl-2-hydroxy-5,9-dimethyldecan-8-enamide (2d)**

^{1}H NMR (300 MHz, DMSO): δ = 5.09-4.98 (m, 4 H), 4.26-4.08 (m, 4 H), 3.33-3.15 (m, 8 H), 1.97-0.92 (m, 36 H), 1.58 (s, 12

H), 1.51 (s, 12 H), 1.02 (t, *J* = 7.1 Hz, 24 H), 0.83-0.74 (m, 12 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 173.6 (C), 130.9 (C), 124.6 (CH), 68.2 (CH), 68.1 (CH), 40.7 (CH_2), 40.0 (CH_2), 37.0 (CH_2), 36.5 (CH_2), 32.8 (CH_2), 32.1 (CH), 31.9 (CH_2), 31.8 (CH_2), 25.5 (CH_3), 25.4 (CH_2), 25.3 (CH_2), 19.5 (CH_3), 19.2 (CH_3), 17.5 (CH_3), 13.0 (CH_3), 12.7 (CH_3); MS (70 eV): *m/z* (%): 269 $[M]^+$ (29), 200 (100), 130 (32), 100 (100), 69 (54); IR (neat): $\tilde{\nu}$ = 3417, 1640 cm^{-1}; R_f = 0.3 (hexane/AcOEt 5/1).

***N,N*-Diethyl-2-hydroxy-2,5-dimethylhexanamide (2e)**

^{1}H NMR (300 MHz, DMSO): δ = 4.75 (br, 1 H), 3.49-3.28 (m, 4 H), 1.74-1.11 (m, 5 H), 1.31 (s, 3 H), 1.08 (t, *J* = 6.6, 6 H), 0.85 (d, *J* = 6.4, 6 H); ^{13}C NMR (50 MHz, $CDCl_3$): δ = 174.9 (C), 73.6 (C), 42.0 (CH_2), 41.5 (CH_2), 38.3 (CH_2), 32.4 (CH_2), 28.1 (CH), 26.6 (CH_3), 22.5 (CH_3), 13.9 (CH_3), 12.4 (CH_3); MS (70 eV): *m/z* (%): 215 $[M]^+$ (<1), 144 (23), 100 (35), 71 (16), 43 (100); IR (neat): $\tilde{\nu}$ = 3385, 1613 cm^{-1}; R_f = 0.3 (hexane/AcOEt 3/1).

***N,N*-Diethyl-2-hydroxy-2-methyldecanamide (2f)**

^{1}H NMR (300 MHz, DMSO): δ = 3.53-3.40 (m, 4 H), 1.80-1.22 (m, 14 H), 1.34 (s, 3 H), 1.11 (t, *J* = 7.0, 6 H), 0.88 (t, *J* = 6.7, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 174.9 (C), 73.6 (C), 42.1 (CH_2), 41.5 (CH_2), 40.5 (CH_2), 31.7 (CH_2), 29.7 (CH_2), 29.6 (CH_2), 29.3 (CH_2), 26.5 (CH_3), 23.5 (CH_2), 22.5 (CH_2),

14.0 (CH_3), 13.9 (CH_3), 12.4 (CH_3); MS (70 eV): *m/z* (%): 257 [*M*]$^+$ (<1), 157 (95), 144 (87), 72 (86), 43 (83); HRMS calcd for $C_{15}H_{31}NO_2$ 257.2355, found 257.2361; IR (neat): $\tilde{\nu}$ = 3388, 1622 cm^{-1}; R_f = 0.3 (hexane/AcOEt 3/1).

3-Cyclohexyl-*N,N*-diethyl-2-hydroxy-2-methylpropanamide (2g)

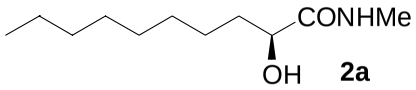
^{1}H NMR (300 MHz, DMSO): δ = 3.57-3.40 (m, 4 H), 1.76-0.87 (m, 13 H), 1.38 (s, 3 H), 1.13 (t, *J* = 7.0, 6 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 175.3 (C), 73.4 (C), 47.7 (CH_2), 42.1 (CH_2), 41.3 (CH_2), 34.5 (CH_2), 33.9 (CH_2), 33.6 (CH), 27.5 (CH_3), 26.1 (CH_2), 26.0 (CH_2), 13.7 (CH_3), 12.0 (CH_3); MS (70 eV): *m/z* (%): 241 [*M*]$^+$ (<1), 100 (62), 97 (13), 83 (73), 72 (95); IR (neat): $\tilde{\nu}$ = 3383, 1614 cm^{-1}; R_f = 0.3 (hexane/AcOEt 3/1).

2-Butyl-3-cyclohexyl-*N,N*-diethyl-2-hydroxypropanamide (2h)

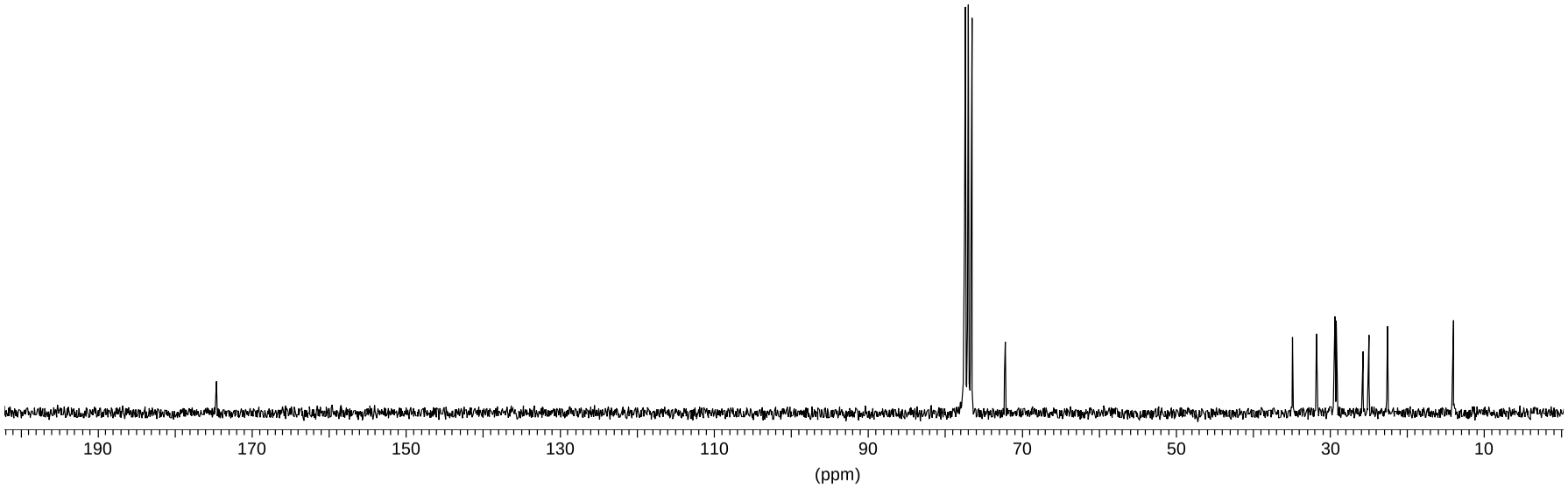
^{1}H NMR (300 MHz, DMSO): δ = 3.49-3.42 (m, 4 H), 1.79-0.91 (m, 19 H), 1.22 (t, *J* = 6.9, 6 H), 0.86 (t, *J* = 7.3, 3 H); ^{13}C NMR (50 MHz, $CDCl_3$): δ = 174.6 (C), 76.6 (C), 47.3 (CH_2), 42.1 (CH_2), 41.3 (CH_2), 40.3 (CH_2), 34.6 (CH_2), 34.2 (CH_2), 33.7 (CH), 26.2 (CH_2), 25.4 (CH_2), 22.8 (CH_2), 22.5 (CH_2), 13.9 (CH_3), 13.5 (CH_3), 12.1 (CH_3); MS (70 eV): *m/z* (%): 283 [*M*]$^+$ (<1), 186 (18), 183 (100), 97 (66), 83 (95); HRMS calcd for $C_{17}H_{33}NO_2$ 283.2511, found 283.2505 ;IR (neat): $\tilde{\nu}$ = 3375, 1625 cm^{-1}; R_f = 0.3 (hexane/AcOEt 3/1)

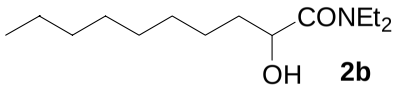
***N,N*-Diethyl-2-hydroxy-2,5,9-trimethyldec-8-enamide (2i).**

^{1}H NMR (300 MHz, DMSO): δ = 5.14-5.08 (m, 2 H), 3.54-3.41 (m, 8 H), 2.02-0.98 (m, 18 H), 1.66 (s, 3 H), 1.59 (s, 3 H), 1.34 (s, 12 H), 1.11 (t, *J* = 7.0, 12 H), 0.87 (d, *J* = 5.1, 6 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ = 174.9 (C), 131.0 (C), 124.7 (CH), 73.6 (C), 42.0 (CH_2), 41.4 (CH_2), 37.9 (CH_2), 36.9 (CH_2), 36.8 (CH_2), 32.5 (CH), 30.5 (CH_2), 30.4 (CH_2), 26.6 (CH_3), 25.6 (CH_3), 25.3 (CH_2), 19.4 (CH_3), 17.5 (CH_3), 13.9 (CH_3), 12.4 (CH_3); MS (70 eV): *m/z* (%): 283 [*M*]$^+$ (10), 183 (5), 144 (12), 83 (16), 69 (58); HRMS calcd for $C_{17}H_{33}NO_2$ 283.2511, found 283.2507; IR (neat): $\tilde{\nu}$ = 3387, 1614 cm^{-1}; R_f = 0.5 (hexane/AcOEt 1/1).

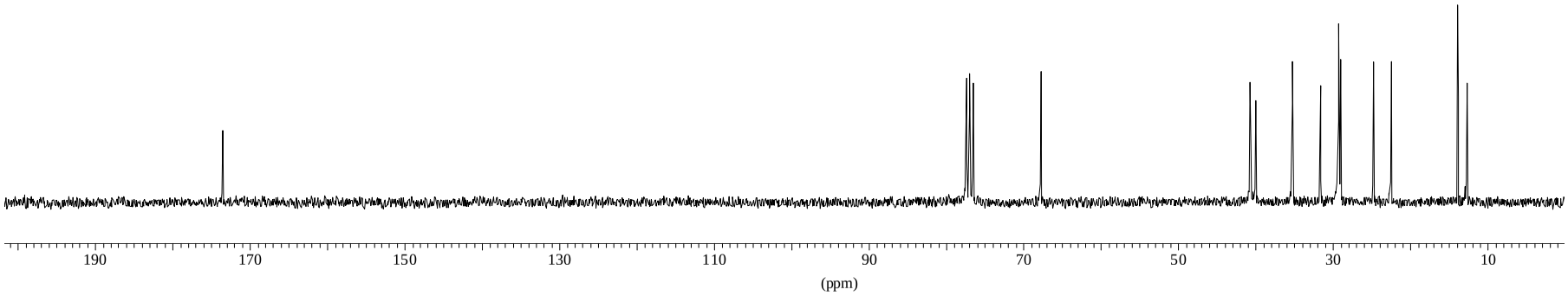


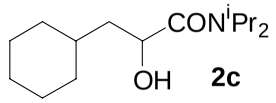
2a



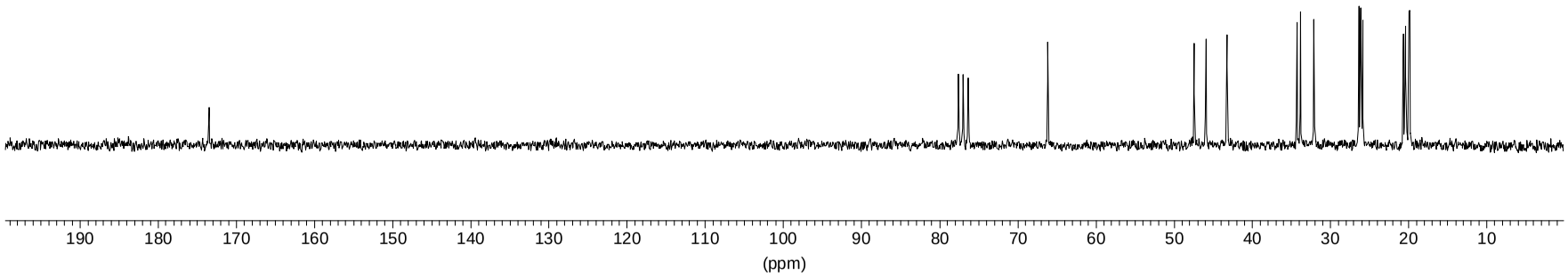


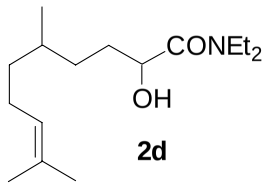
2b



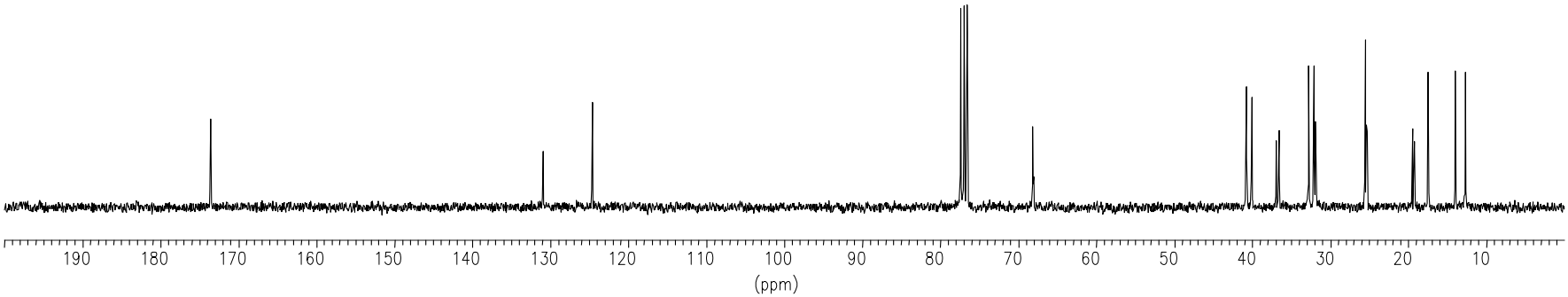

CONiPr2
OH

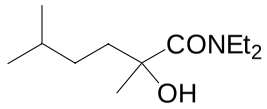
2c


190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
(ppm)

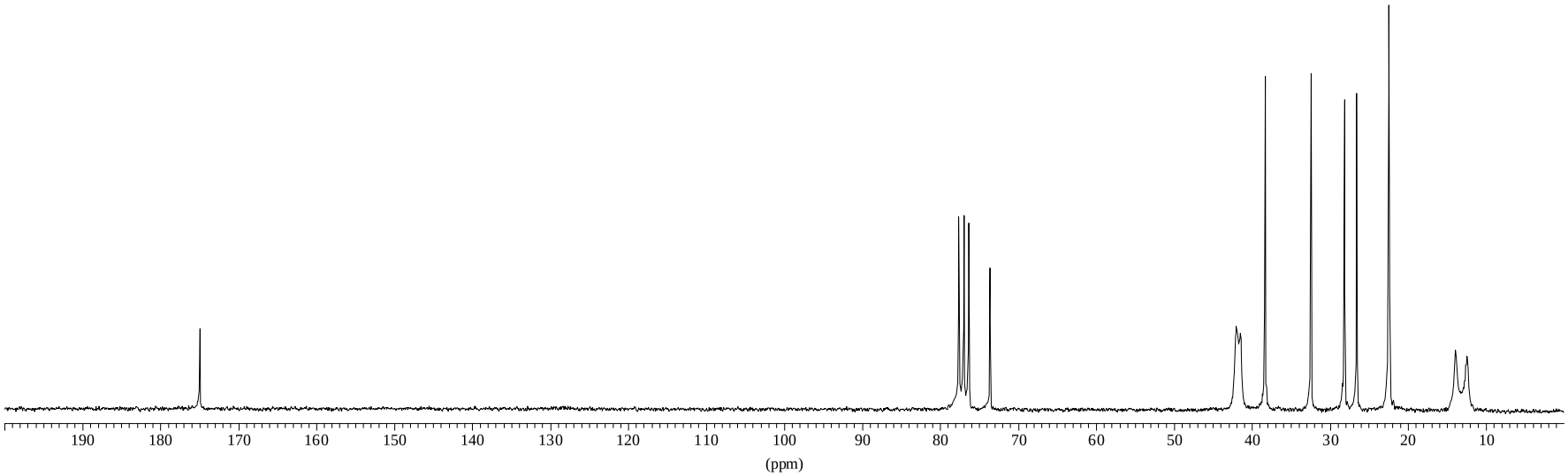

CONEt2
OH

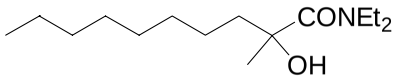
2d


190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
(ppm)

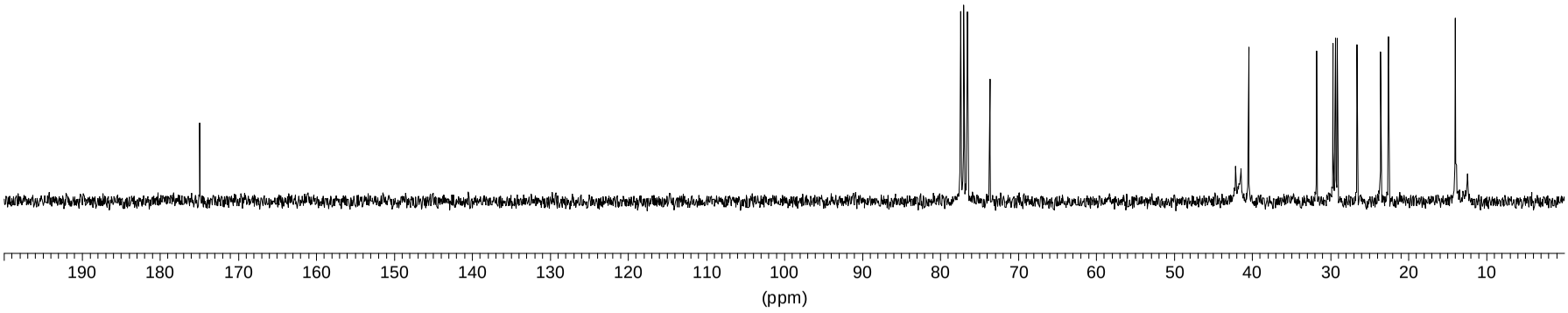

CONEt2
OH

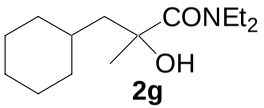
2e


190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
(ppm)

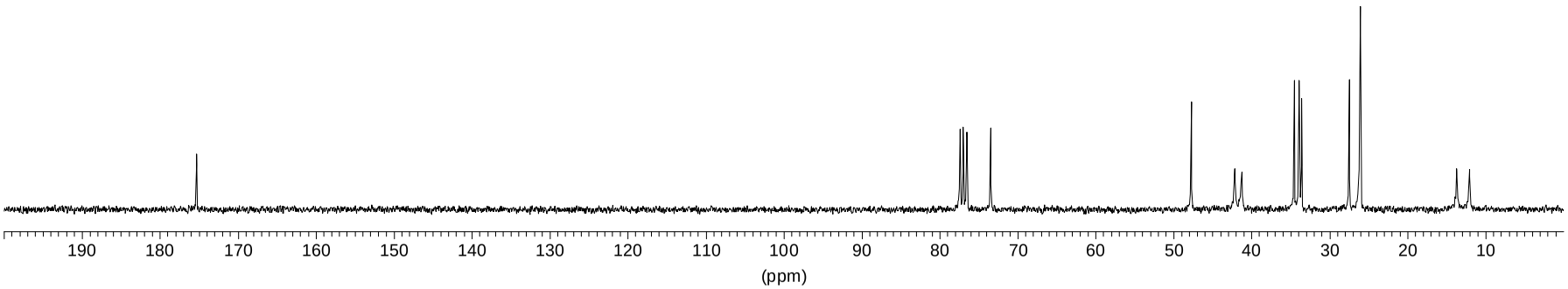

CONEt2
OH

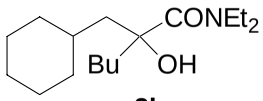
2f


190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
(ppm)

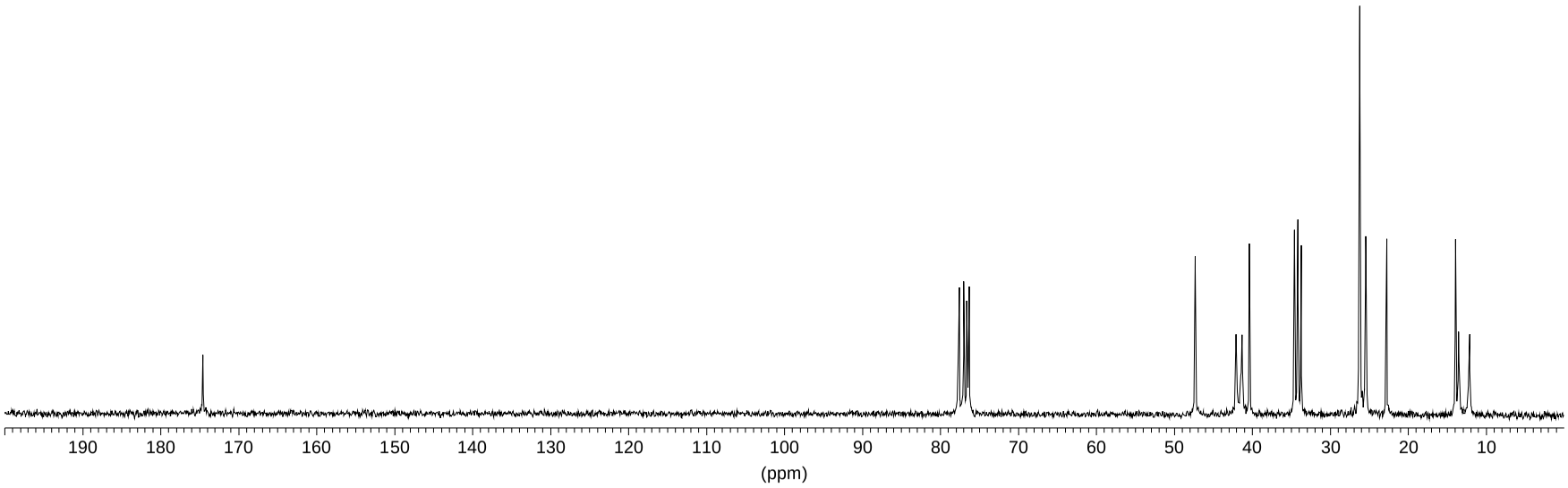

CONEt2
OH

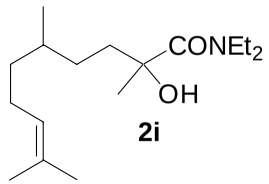
2g


190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
(ppm)

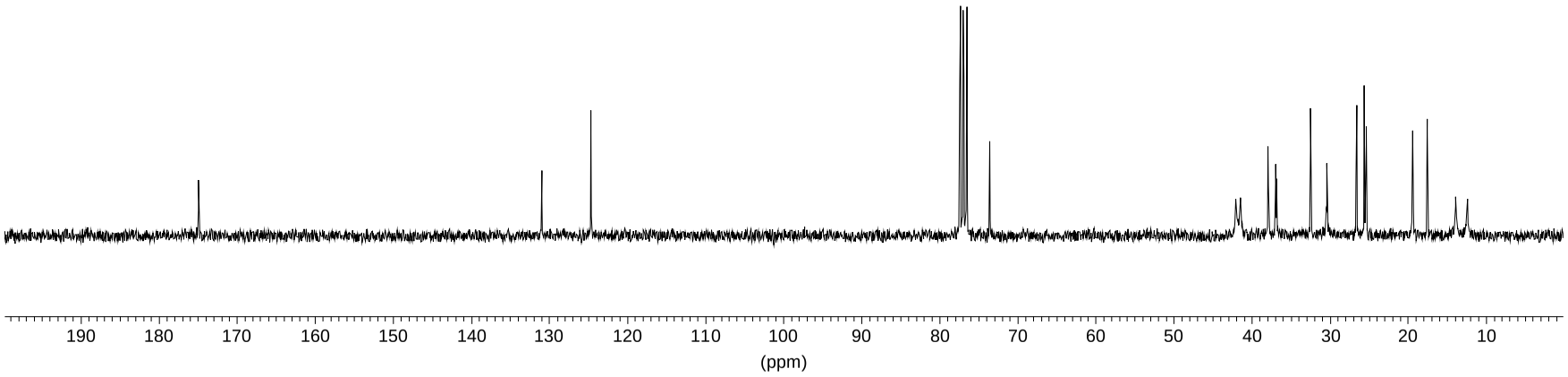

CONEt2
Bu
OH

2h


190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
(ppm)


CONEt2
OH

2i


190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
(ppm)