

Experimental

Where possible, dry solvents were obtained from MBraun MB-SPS dry solvent machines. Where this was not possible, solvents were pre-dried according to procedures described in "Purification of Laboratory Chemicals" (D. D. Perrin and W. L. F. Armarego, 3rd edition, 1988). Anhydrous N,N-dimethylformamide (DMF) and N,N-dimethylacetamide (DMA) were purchased from Aldrich Chemical company and were supplied under argon in Sure/Seal bottles. Thin Layer Chromatography was used to monitor reactions by TLC using Polygram® SIL G/UV₂₅₄ precoated plastic sheets with a 0.2 mm layer of silica gel containing fluorescent indicator UV₂₅₄. Plates were visualised using a 254nm UV lamp and a potassium permanganate stain. Flash column chromatography was carried out using Sorbisil® C60 silica gel (40-60 µm mesh). Petroleum ether 40-60°C (pet. ether), diethyl ether, ethyl acetate, dichloromethane and methanol were used as eluents. NMR Spectra were recorded on a Bruker DPX 300 or a Bruker DRX 500 spectrometer. Samples were dissolved in deuterated chloroform with tetramethylsilane as a reference. Chemical shift values (δ) are given in ppm. IR Spectra were recorded using Perkin Elmer RX 1 FT-IR spectrophotometer. Melting points were recorded on a Mettler Toledo FF62 melting point apparatus. Mass spectra: EI-MS and CI-MS experiments were carried out on a VG Autospec spectrometer. Elemental analyses were carried out by ASEP (Queen's University Belfast) with a precision of 0.3%. Optical rotations were measured on a Perkin Elmer polarimeter (Na lamp (589 nm) at 20°C).

2-[(*tert*-Butyldimethylsilyloxy)methyl]-cyclohex-2-enone (4)

Cyclohex-2-enone **3** (11.16 g, 116 mmol, 1eq.), 37% aq. formaldehyde (18.9 ml, 232 mmol, 2eq.), DMAP (1.35g, 11.6 mmol, 10 mol%) and THF (25 ml) were stirred at room temperature. for 15 h. The reaction mixture was acidified with 1M HCl (until a pH of ca. 2). The product was extracted several times with DCM. The combined organic phases were washed successively with saturated sodium bicarbonate and brine solutions, dried over MgSO₄ and concentrated under reduced pressure to give a crude brown oil. Purified by flash chromatography (25% dichloromethane-75% diethyl ether) provided 2-hydroxymethyl-cyclohex-2-enone as a colourless oil (9.25g, 63% yield).

ν_{max} / cm^{-1} : 3410, 2927, 1668, 1394, 1172, 1054, 1036; δ_{H} (CDCl_3 , 500 MHz): 2.02-2.05 (2H, m, H-5), 2.42-2.48 (4H, m, H-4 and H-6), 2.61 (1H, d, $J = 6.0$ Hz, OH), 4.26 (2H, s, H-7), 6.96 (1H, br. s, H-3); δ_{C} (CDCl_3 , 125 MHz): 21.98 (CH_2 , C-5), 24.90 (CH_2 , C-4), 37.48 (CH_2 , C-6), 61.44 (CH_2 , C-7), 137.48 (C, C-2), 146.32 (CH, C-3), 199.99 (C, C-1); m/z (EI): 126 (M^+ , 100%), 111 (39), 98 (65), 84 (23), 79 (32), 70 (58), 65 (17); $\text{C}_7\text{H}_{10}\text{O}_2$ [M^+] required 126.0681, found 126.0695]

2-Hydroxymethyl-cyclohex-2-enone (8.46g, 67.0 mmol, 1eq.), *tert*-butyldimethylsilyl chloride (20.20g, 134 mmol, 2eq.) and imidazole (10.96g, 161 mmol, 2.4 eq.) were stirred in anhydrous DMF (300ml) overnight at room temperature under nitrogen. The reaction was quenched with water and the product taken up with diethyl ether. The combined organic phases were washed with brine, dried over MgSO_4 and concentrated under reduced pressure to give a crude yellow oil. Purification by flash chromatography (15% Et_2O –pet. ether) yielded the pure product **4** as a colourless oil (11.97g, 74%).

ν_{max} / cm^{-1} : 2930, 2858, 1674, 1472, 1400, 1255, 1141, 1067, 875, 837, 777; δ_{H} (CDCl_3 , 500 MHz): 0.08 (6H, s, $(\text{CH}_3)_2\text{Si}$), 0.91 (9H, s, $(\text{CH}_3)_3\text{CSi}$), 2.00-2.02 (2H, m, H-5), 2.38-2.43 (4H, m, H-4 and H-6), 4.34-4.36 (2H, m, H-7), 6.99-7.02 (1H, m, H-3); δ_{C} (CDCl_3 , 125 MHz): -5.20 (2 CH_3 , $(\text{CH}_3)_2\text{Si}$), 23.17 (CH_2 , C-5), 25.84 (CH_2 , C-4), 26.17 (3 CH_3 , $(\text{CH}_3)_3\text{CSi}$), 38.63 (CH_2 , C-6), 60.26 (CH_2 , C-7), 138.60 (C, C-2), 144.22 (CH, C-3), 199.35 (C, C-1); m/z (EI): 240 (M^+ , 3%), 225 (10), 183 (100), 151 (15), 75 (74); $\text{C}_{13}\text{H}_{24}\text{O}_2\text{Si}$ [M^+] required 240.1546, found 240.1535.

6-[(3-Bromo-6-methoxy-2-pyridin-2-yl)methyl]-2-[(*tert*-butyldimethylsilyloxy)methyl]-cyclohex-2-enone (6)

Sodium hexamethyldisilazide (7.78 ml of 2M solution, 15.55 mmol, 1.7eq.) was slowly added dropwise via syringe to a stirred solution of 2-[(*tert*-butyldimethylsilyloxy)methyl]-cyclohex-2-enone **4** (2.60g, 11.00 mmol, 1.2eq.) in dry THF (100 ml) at -78°C under argon. The reaction mixture was warmed to -50°C over 1.5 h. A solution of 2-(iodomethyl)-3-bromo-6-methoxypyridine (3.00g, 9.15 mmol, 1eq.) **5** in dry THF (5ml) was then added via syringe and the reaction mixture was stirred at -50°C for 3 h, then warmed to room temperature overnight. The reaction mixture was

quenched with 100 ml of saturated aqueous ammonium chloride solution and the organic phase taken up with diethyl ether. The combined organic phases were then washed with water and brine, dried over MgSO₄ and concentrated under reduced pressure to give a crude brown oil. Purification by flash chromatography yielded the pure ketone **6** as a yellow oil (2.51g, 64% yield).

ν_{max}/cm^{-1} : 2929, 2857, 1673, 1576, 1461, 1418, 1298, 1258, 1178, 1116, 1074, 1039, 1012, 890, 837, 777; δ_{H} (CDCl₃, 500 MHz): 0.00 (6H, s, (CH₃)₂Si), 0.84 (9H, s, (CH₃)₃CSi), 1.71-1.79 (1H, m, H-5), 1.90-1.95 (1H, m, H-5), 2.28-2.36 (1H, m, H-4), 2.37-2.44 (1H, m, H-4), 2.74 (1H, dd, $J = 15.0, 9.0$ Hz, H-8), 2.95-3.01 (1H, m, H-6), 3.37 (1H, dd, $J = 15.0, 4.5$ Hz, H-8), 3.76 (3H, s, OCH₃), 4.25-4.34 (2H, m, H-7), 6.38 (1H, d, $J = 8.5$ Hz, H-5'), 6.86-6.90 (1H, m, H-3), 7.53 (1H, d, $J = 8.5$ Hz, H-4'); δ_{C} (CDCl₃, 125 MHz): -4.96 (2CH₃, (CH₃)₂Si), 18.82 (C, (CH₃)₃C), 25.63 (CH₂, C-4), 26.40 (3CH₃, (CH₃)₃C), 28.50 (CH₂, C-5), 36.49 (CH₂, C-8), 46.28 (CH, C-6), 53.99 (CH₃, OCH₃), 60.71 (CH₂, C-7), 110.23 (CH, C-5'), 112.78 (C, C-3'), 138.30 (C, C-2), 142.77 (CH, C-4'), 143.49 (CH, C-3), 155.74 (C, C-6'), 162.66 (C, C-2'), 200.57 (C, C-1); m/z (EI): 440 (M⁺, 10%), 384 (100), 382 (96), 366 (15), 204 (29), 202 (38), 181 (35), 167 (10), 151 (45), 123 (12), 75 (23), 69 (29); C₂₀H₃₀O₃SiNBr [M⁺, Br⁷⁹] required 439.1173, found 439.1174; CHN Analysis required C 54.54, H 6.86, N 3.18 %, found C 54.78, H 6.61, N 3.52 %

6-[(3-Bromo-6-methoxypyridin-2-yl)methyl]-2-[(*tert*-butyldimethylsilyloxy)methyl]-cyclohex-2-en-1-ol (7)

6-[(3-Bromo-6-methoxy-2-pyridin-2-yl)methyl]-2-[(*tert*-butyl-dimethylsilyloxy)methyl]-cyclohex-2-enone **6** (4.28 g, 9.72 mmol, 1 eq.) and cerium (III) chloride heptahydrate (3.98 g, 10.7 mmol, 1.1 eq.) were dissolved in a stirred DCM-methanol mixture (80 ml-80 ml) at room temperature. Sodium borohydride (0.40 g, 10.7 mmol) was added in 1.1 eq. aliquots, 5 in total, and the reaction mixture stirred for 30 mins after each addition until all of the starting material had been consumed. The reaction mixture was concentrated under reduced pressure. DCM (80 ml) was added to the residue followed by water (80 ml) and the mixture stirred for 10 mins. The two phases were then separated and the aqueous phase washed with DCM (2 x 20 ml) Combined organic phases were

washed with brine, dried over MgSO₄ and concentrated under reduced pressure to give the crude product as a mixture of diastereomeric alcohols. Separation by flash chromatography (20% Et₂O–pet. ether) yielded the *syn*-isomer **7a** (3.54 g, 82%) and the *anti*-isomer **7b** (0.31 g, 7%), both as colourless oils.

Syn-isomer **7a**: ν_{max} / cm⁻¹: 3441, 2951, 2928, 2856, 1571, 1462, 1417, 1321, 1258, 836; δ_H (CDCl₃, 500 MHz): 0.00 (3H, s, (CH₃)₂Si), 0.01 (3H, s, (CH₃)₂Si), 0.82 (9H, s, (CH₃)₃CSi), 1.51-1.54 (1H, m, H-5), 1.62-1.71 (1H, m, H-5), 1.99-2.09 (2H, m, H-4 and H-6), 2.13-2.18 (1H, m, H-4), 2.86 (1H, dd, J = 13.4, 10.1 Hz, H-8), 2.86 (1H, dd, J = 13.4, 5.8 Hz, H-8), 3.64 (1H, d, J = 3.8 Hz, O-H), 3.79-3.80 (1H, m, H-1), 3.88 (3H, s, OCH₃), 4.10 (1H, dd, J = 12.1, 1.0 Hz, H-7), 4.18 (1H, dd, J = 12.1, 1.5 Hz, H-7), 5.80-5.81 (1H, m, H-3), 6.49 (1H, d, J = 8.7 Hz, H-5'), 7.64 (1H, d, J = 8.7 Hz, H-4'); δ_C (CDCl₃, 125 MHz): -5.02 (CH₃, (CH₃)₂Si), -4.86 (CH₃, (CH₃)₂Si), 18.78 (C, (CH₃)₃C), 23.78 (CH₂, C-5), 26.14 (CH₂, C-4), 26.33 (3CH₃, (CH₃)₃CSi), 39.39 (CH, C-6), 39.72 (CH₂, C-8), 54.08 (CH₃, OCH₃), 64.84 (C, C-1), 66.22 (CH₂, C-7), 110.82 (CH, C-5'), 112.40 (C, C-3'), 126.96 (CH, C-3), 138.22 (C, C-2), 143.38 (CH, C-4'), 156.51 (C, C-6'), 162.70 (C, C-2'); m/z (EI): 442 (M⁺, 46%), 440 (39), 427 (45), 425 (70), 424 (77), 423 (100), 422 (75), 421 (69), 407 (22), 383 (27), 293 (100), 201 (40), 91 (30), 75 (89); C₂₀H₃₂O₃SiNBr [M⁺, Br⁷⁹] required 441.1335, found 441.1350.

Anti-isomer **7b**: ν_{max} / cm⁻¹: 3434, 2928, 2856, 1575, 1460, 1417, 1307, 1256, 1038, 836; δ_H (CDCl₃, 500 MHz): 0.00 (6H, s, (CH₃)₂Si), 0.82 (9H, s, (CH₃)₃CSi), 1.31-1.37 (1H, m, H-5), 1.74-1.80 (1H, m, H-5), 1.94-2.09 (2H, m, H-4), 2.25-2.30 (1H, m, H-6), 2.67 (1H, dd, J = 14.2, 7.8 Hz, H-8), 2.90 (1H, dd, J = 14.2, 6.3 Hz, H-8), 3.13 (1H, d, J = 3.3 Hz, O-H), 3.80 (3H, s, OCH₃), 3.99 (1H, br. s, H-1), 4.10 (1H, d, J = 12.1 Hz, H-7), 4.19 (1H, dd, J = 12.1, 1.3 Hz, H-7), 5.68 (1H, t, J = 3.5 Hz, H-3), 6.37 (1H, d, J = 8.6 Hz, H-5'), 7.52 (1H, d, J = 8.6 Hz, H-4'); δ_C (CDCl₃, 125 MHz): -4.91 (2CH₃, (CH₃)₂Si), 18.72 (C, (CH₃)₃C), 23.71 (CH₂, C-4), 24.72 (CH₂, C-5), 26.25 (3CH₃, (CH₃)₃CSi), 39.07 (CH₂, C-8), 40.21 (CH, C-6), 54.02 (CH₃, OCH₃), 66.27 (CH₂, C-7), 67.56 (C, C-1), 110.28 (CH, C-5'), 112.68 (C, C-3'), 126.13 (CH, C-3), 137.70 (C, C-2), 142.84 (CH, C-4'), 156.77 (C, C-6'), 162.72 (C, C-2'); m/z (EI): 442 (M⁺, 7%), 424 (9), 384 (35), 382 (32), 310

(15), 308 (15), 213 (10), 211 (18), 202 (38), 200 (35), 123 (18), 105 (8), 91 (34), 79 (12), 75 (100); C₂₀H₃₂O₃SiNBr [M⁺, Br⁷⁹] required 441.1335, found 441.1395.

Intramolecular Heck cyclisation: The experimental procedures described below for the Heck reaction, using either standard heating conditions or microwave radiation, are general and can be applied for different Heck substrates, catalysts, ligands, bases and solvents (for more details see results and discussion).

(13R)*-1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6-azatricyclo[7.3.1.0^{2,7}]trideca-2(7),3,5,11-tetraen-13-ol (9)

Standard heating: Freshly distilled triethylamine (14.55 ml, 104 mmol, 12 eq.) was added via syringe to a stirred solution of *syn*-6-[(3-bromo-6-methoxypyridin-2-yl)methyl]-2-[(*tert*-butyl-dimethylsilyloxy)methyl]-cyclohex-2-en-1-ol **7a** (3.85 g, 8.70 mmol, 1 eq.), triphenyl phosphine (1.37 g, 5.22 mmol, 0.6 eq.) and palladium (II) acetate (0.20 g, 0.87 mmol, 10 mol%) in anhydrous DMA (250 ml) under argon. The reaction mixture was heated to reflux and stirred at this temperature for 24 h. After cooling to room temperature, the reaction was quenched with saturated aqueous sodium bicarbonate solution (200 ml). The organic layer was taken up with diethyl ether, washed with water and brine, dried over MgSO₄ and concentrated under reduced pressure to give a crude brown oil. Purification by flash chromatography (40% Et₂O–pet. ether) yielded the pure Heck product **9** as a white solid (2.31 g, 73% yield), m.p. = 96.5°C.

Microwave Heck reaction: *Syn*-6-[(3-bromo-6-methoxypyridin-2-yl)methyl]-2-[(*tert*-butyl-dimethylsilyloxy) methyl]-cyclohex-2-en-1-ol **7a** (0.10 g, 0.23 mmol, 1 eq.) in anhydrous DMA (2 ml), followed by freshly distilled triethylamine (0.38 ml, 2.72 mmol, 12 eq.) was added via syringe to a mixture of palladium (II) acetate (0.005 g, 0.02 mmol, 10 mol%) and triphenylphosphine (0.04 g, 0.14 mmol, 0.6 eq.) in a sealed, inert microwave tube, which also contained a magnetic stirring bar. The reaction mixture was then heated rapidly to 167°C under microwave radiation (200W) and maintained at this temperature for 20 mins. On cooling to room temperature, the reaction mixture was diluted with diethyl ether (3 ml), washed successively with sodium bicarbonate, water

and brine, dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (40% Et₂O–pet. ether) gave the Heck product **9** (0.04 g, 54% yield).

ν_{max} / cm⁻¹: 3480, 3054, 2956, 2930, 2859, 2305, 1594, 1447, 1427, 1307, 1265, 1102, 1069, 1044, 837, 738; δ_H (CDCl₃, 500 MHz): 0.00 (3H, s, (CH₃)Si), 0.02 (3H, s, (CH₃)Si), 0.72 (9H, s, (CH₃)₃CSi), 1.99 (1H, dd, J = 18.0, 4.5 Hz, H-10), 2.37-2.45 (2H, m, H-9 and H-10), 2.42 (1H, d, J = 19.0 Hz, H-8), 3.24 (1H, dd, J = 19.0, 8.0 Hz, H-8), 3.75 (3H, s, OCH₃), 3.78 (1H, d, J = 10.5 Hz, H-14), 4.05 (1H, d, J = 3.5 Hz, H-13), 4.17 (1H, d, J = 10.5 Hz, H-14), 5.06-5.09 (1H, m, H-12), 5.47-5.50 (1H, m, H-11), 6.34 (1H, d, J = 8.5 Hz, H-4), 7.23 (1H, d, J = 8.5 Hz, H-3); δ_C (CDCl₃, 125 MHz): -5.66 (2CH₃, (CH₃)₂Si), 18.05 (C, (CH₃)₃C), 25.75 (3CH₃, (CH₃)₃CSi), 31.71 (CH, C-9), 35.03 (CH₂, C-10), 36.94 (CH₂, C-8), 43.74 (C, C-1), 53.26 (CH₃, OCH₃), 68.38 (CH₂, C-14), 74.65 (CH, C-13), 106.75 (CH, C-4), 125.32 (C, C-2), 126.51 (CH, C-11), 130.78 (CH, C-12), 135.49 (CH, C-3), 156.78 (C, C-7), 161.50 (C, C-5); m/z (EI): 362 (M⁺, 74%), 361 (43), 347 (25), 346 (100), 328 (41), 316 (17), 305 (16), 304 (69), 274 (29), 212 (57), 200 (41), 105 (56), 75 (100); CHN Analysis required C 66.44, H 8.64, N 3.87 %, found C 66.22, H 8.57, N 3.79 %.

(13S)*-1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6-azatricyclo[7.3.1.0^{2,7}]trideca-2(7),3,5,11-tetraen-13-ol (8**)**

Freshly distilled triethylamine (0.47ml, 3.36 mmol, 12 eq.) was added via syringe to a stirred solution of **7b** (0.12g, 0.28 mmol, 1 eq.), triphenyl phosphine (0.04 g, 0.17 mmol, 0.6 eq.) and palladium (II) acetate (0.01 g, 0.03 mmol, 10 mol%) in dry DMA (11 ml) under argon. The reaction mixture was heated to reflux and stirred at this temperature overnight. After cooling to room temperature, the reaction was quenched with saturated aqueous sodium bicarbonate solution. The organic layer was taken up with diethyl ether, washed with water and brine, dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (30% diethyl ether–pet. ether) yielded the pure Heck product **8** as a yellow oil (0.05g, 53% yield).

ν_{max} / cm⁻¹: 3423, 2928, 2857, 1601, 1579, 1468, 1437, 1260, 1067, 1033, 837, 778; δ_H (CDCl₃, 500 MHz): -0.01 (3H, s, (CH₃)Si), 0.00 (3H, s, (CH₃)Si), 0.75 (9H, s,

(CH₃)₃CSi), 1.83-1.87 (1H, m, H-10), 2.45-2.49 (1H, m, H-9), 2.52-2.58 (1H, m, H-10), 2.67 (1H, d, *J* = 18.8 Hz, H-8), 3.07 (1H, d, *J* = 4.9 Hz, O-H), 3.16 (1H, dd, *J* = 18.8, 7.6 Hz, H-8), 3.74 (3H, s, OCH₃), 3.92 (1H, d, *J* = 10.0 Hz, H-14), 4.07-4.09 (1H, m, H-13), 4.08 (1H, d, *J* = 10.0 Hz, H-14), 5.32 (1H, dq, *J* = 10.0, 2.0 Hz, H-12), 5.66 (1H, dt, *J* = 10.0, 3.5 Hz, H-11), 6.33 (1H, d, *J* = 8.6 Hz, H-4), 7.24 (1H, d, *J* = 8.6 Hz, H-3); δ_C (CDCl₃, 125 MHz): -5.64 (2CH₃, (CH₃)₂Si), 18.12 (C, (CH₃)₃C), 25.71 (3CH₃, (CH₃)₃CSi), 30.25 (CH₂, C-10), 31.69 (CH, C-9), 40.71 (CH₂, C-8), 42.65 (C, C-1), 53.16 (CH₃, OCH₃), 65.73 (CH₂, C-14), 70.49 (CH, C-13), 107.13 (CH, C-4), 127.59 (CH, C-11), 128.50 (CH, C-12), 129.94 (C, C-2), 134.88 (CH, C-3), 154.16 (C, C-7), 161.54 (C, C-5); *m/z* (EI): 362 (M⁺, 70%), 361 (70), 360 (25), 347 (18), 346 (68), 343 (100), 304 (40), 200 (18), 157 (100), 105 (19), 75 (89); C₂₀H₃₁O₃SiN [M⁺] required 361.2073, found 361.2112; CHN analysis required C 66.44, H 8.64, N 3.87 %, found C 66.44, H 8.35, N 3.77 %.

(13R)*-1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6-aza-13-(*tert*-butyldimethylsilyloxy)-tricyclo[7.3.1.0^{2,7}]trideca-2(7),3,5,11-tetraene (10)

To a stirred solution of 4-dimethylaminopyridine (0.10 g, 0.79 mmol, 10 mol%), freshly distilled triethylamine (2.75 ml, 19.72 mmol, 2.5 eq.) and **9** (2.85 g, 7.89 mmol, 1 eq.) in dry DCM (200 ml) at 0°C under argon, was added *tert*-butyldimethylsilyl triflate (2.72 ml, 11.83 mmol, 1.5 eq) dropwise via syringe. The reaction solution was stirred at 0°C for 3 h and then allowed warm to room temperature overnight. The reaction was quenched with water (200 ml) and the two layers separated. The aqueous layer was washed with 2 x 50 ml portions of DCM. The combined organic layers were washed with brine, dried over MgSO₄ and concentrated under reduced pressure to yield a crude colourless oil. Purification by flash chromatography (1% diethyl ether - pet. ether) yielded the pure product **10** as a white solid (3.48 g, 93% yield). m.p. = 149.5°C.

*v*_{max} / cm⁻¹: 2954, 2928, 2857, 1594, 1475, 1306, 1253, 1099, 875, 837, 775; δ_H (CDCl₃, 500 MHz): -0.06 (3H, s, (CH₃)Si), -0.03 (3H, s, (CH₃)Si), 0.00 (3H, s, (CH₃)Si), 0.02 (3H, s, (CH₃)Si), 0.62 (9H, s, (CH₃)₃CSi), 0.84 (9H, s, (CH₃)₃CSi), 2.02 (1H, dd, *J* = 18.2, 4.3 Hz, H-10), 2.34-2.38 (1H, m, H-9), 2.42-2.44 (1H, m, H-10), 2.46 (1H, d, *J* = 18.6 Hz, H-8), 3.17 (1H, dd, *J* = 18.6, 8.2 Hz, H-8), 3.75 (1H, d, *J* = 9.5 Hz, H-14), 3.77

(1H, s, OCH₃), 3.99 (1H, d, *J* = 9.5 Hz, H-14), 4.11 (1H, d, *J* = 3.5 Hz, H-13), 5.43-5.46 (1H, m, H-11), 5.54-5.56 (1H, m, H-12), 6.31 (1H, d, *J* = 8.5 Hz, H-4), 7.35 (1H, d, *J* = 8.5 Hz, H-3); δ_C (CDCl₃, 125 MHz): -4.99 (CH₃, (CH₃)₃Si), -4.76 (CH₃, (CH₃)₃Si), -4.56 (CH₃, (CH₃)₃Si), -3.81 (CH₃, (CH₃)₃Si), 18.38 (C, (CH₃)₃C), 18.79 (C, (CH₃)₃C), 26.07 (3CH₃, (CH₃)₃CSi), 26.41 (3CH₃, (CH₃)₃CSi), 33.54 (CH, C-9), 35.65 (CH₂, C-10), 37.4 (CH₂, C-8), 45.45 (C, C-1), 53.63 (CH₃, OCH₃), 66.48 (CH₂, C-14), 70.66 (CH, C-13), 106.60 (CH, C-4), 125.26 (CH, C-11), 128.91 (C, C-2), 134.57 (CH, C-12), 135.25 (CH, C-3), 156.00 (C, C-7), 161.37 (C, C-5); *m/z* (EI): 476 (27%, M⁺), 475 (45), 462 (9), 461 (40), 460 (100), 420 (6), 418 (54), 364 (17), 288 (10), 212 (36), 198 (17), 160 (21), 147 (63), 133 (17), 73 (100); C₂₆H₄₅O₃Si₂N [M⁺] required 475.2938, found 475.2915; CHN analysis required C 65.63, H 9.53, N 2.94 %, found C 65.52, H 9.26, N 2.50 %

(13R)*-1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6-aza-13-(*tert*-butyldimethylsilyloxy)-tricyclo[7.3.1.0^{2,7}]trideca-2(7),3,5-trien-11-one (11)

Borane.dimethyl sulphide (3.64 ml of a 2 M solution, 7.276 mmol, 1 eq.) was added slowly via syringe to a stirred solution of **10** (3.46 g, 7.28 mmol, 1 eq.) in dry diethyl ether (70 ml) at room temperature and under argon. The reaction mixture was heated to a gentle reflux and refluxed for 1 h. After cooling to room temperature, dry DCM (70 ml) was added followed by crushed 4Å molecular sieves (ca. 0.5 g) and N-methylmorpholine N-oxide (8.52 g, 72.76 mmol, 10 eq.). The reaction mixture was stirred under argon at room temperature for 1 h. Tetra-*n*-butylammonium perchlorate (0.13 g, 0.364 mmol, 5 mol%) was then added and the reaction mixture stirred overnight. The following morning activated charcoal was added and the reaction mixture filtered through celite. The celite was then rinsed with ethyl acetate and the reaction mixture concentrated under reduced pressure. The crude product was purified by flash chromatography (35% diethyl ether - pet. ether) to give the pure ketone **11** as a white solid (2.13 g, 60% yield), m.p. = 128.4°C.

ν_{max} / cm⁻¹: 2953, 2928, 2856, 1720, 1598, 1577, 1478, 1428, 1313, 1257, 1096, 1028, 872, 834, 776; δ_H (CDCl₃, 500 MHz): 0.11 (3H, s, (CH₃)₃Si), 0.12 (3H, s, (CH₃)₃Si), 0.14 (3H, s, (CH₃)₃Si), 0.15 (3H, s, (CH₃)₃Si), 0.81 (9H, s, (CH₃)₃CSi), 0.96 (9H, s, (CH₃)₃CSi), 2.20 (1H, dd, *J* = 14.5, 3.0 Hz, H-12), 2.38 (1H, dd, *J* = 13.5, 3.0 Hz, H-10), 2.58 (1H,

d, $J = 18.0$ Hz, H-8), 2.65-2.70 (2H, m, H-9 and H-10), 2.58 (1H, d, $J = 14.5$ Hz, H-12), 3.33 (1H, dd, $J = 18.0, 6.5$ Hz, H-8), 3.80 (1H, d, $J = 10.0$ Hz, H-14), 3.87 (3H, s, OCH₃), 3.89 (1H, d, $J = 10.0$ Hz, H-14), 4.49 (1H, d, $J = 3.5$ Hz, H-13), 6.50 (1H, d, $J = 8.5$ Hz, H-4), 7.41 (1H, d, $J = 8.5$ Hz, H-3); δ_C (CDCl₃, 125 MHz): -5.05 (CH₃, (CH₃)Si), -4.68 (CH₃, (CH₃)Si), -4.50 (CH₃, (CH₃)Si), -3.80 (CH₃, (CH₃)Si), 18.52 (C, (CH₃)₃C), 18.87 (C, (CH₃)₃C), 26.18 (3CH₃, (CH₃)₃CSi), 26.52 (3CH₃, (CH₃)₃CSi), 35.32 (CH₂, C-8), 36.46 (CH, C-9), 46.14 (C, C-1), 47.31 (CH₂, C-10), 50.73 (CH₂, C-12), 53.64 (CH₃, OCH₃), 66.44 (CH₂, C-14), 70.82 (CH, C-13), 109.15 (CH, C-4), 125.77 (C, C-2), 136.60 (CH, C-3), 152.10 (C, C-7), 162.42 (C, C-5), 210.04 (C=O, C-11); m/z (EI): 492 (56%, M⁺), 435 (42), 434 (100), 302 (15), 228 (24), 200 (22), 186 (28), 160 (26), 147 (66), 74 (59); C₂₆H₄₅O₄Si₂N [M⁺] required 491.2887, found 491.2882.

(13R)*-1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6-aza-11-methyl-13-(*tert*-butyldimethylsilyloxy)-tricyclo[7.3.1.0^{2,7}]trideca-2(7),3,5-trien-11-ol (12)

Freshly prepared methylmagnesium iodide in diethyl ether (0.16 ml of 1.47 M solution, 0.24 mmol, 1.2 eq.) was added dropwise to a solution of ketone **11** (0.097 g, 0.20 mmol) in dry diethyl ether at room temperature under argon. The reaction mixture was stirred at room temperature for 3 h. A further 1 eq. of methyl magnesium iodide (0.13 ml of 1.47 M solution, 0.20 mmol) was then added and the reaction mixture stirred at room temperature overnight. In the morning, a further 2 eq. of the Grignard reagent was added. The reaction mixture was heated to gentle reflux and stirred at this temperature for 24 h. The reaction was quenched with a saturated aqueous solution of ammonium chloride. The two phases were separated and the aqueous phase washed with diethyl ether. The combined organic phases were washed with water and brine, dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (40% diethyl ether - pet. ether) gave the pure tertiary alcohol **12** as a colourless oil (0.06 g, 55% yield) and also recovered starting ketone **11** (0.03 g, 36%).

ν_{max} / cm⁻¹: 3445 (br.), 2955, 2929, 2857, 1596, 1477, 1426, 1306, 1256, 1094, 1037, 836, 775; δ_H (CDCl₃, 500 MHz): 0.05 (3H, s, (CH₃)Si), 0.08 (3H, s, (CH₃)Si), 0.10 (3H, s, (CH₃)Si), 0.12 (3H, s, (CH₃)Si), 0.75 (9H, s, (CH₃)₃CSi), 0.95 (9H, s, (CH₃)₃CSi), 1.11 (3H, s, CH₃), 1.69 (1H, dd, $J = 14.4, 3.2$ Hz, H-12), 1.83 (1H, dd, $J = 14.7, 4.8$ Hz, H-10),

1.90 (1H, d, $J = 14.4$ Hz, H-12), 1.92-1.96 (1H, m, H-10), 2.29-2.33 (1H, m, H-9), 2.77 (1H, d, $J = 18.1$ Hz, H-8), 3.24 (1H, dd, $J = 18.1, 7.9$ Hz, H-8), 3.73 (1H, d, $J = 9.5$ Hz, H-14), 3.84 (1H, d, $J = 9.5$ Hz, H-14), 3.87 (3H, s, OCH₃), 3.89 (1H, d, $J = 3.9$ Hz, H-13), 6.48 (1H, d, $J = 8.5$ Hz, H-4), 7.57 (1H, d, $J = 8.5$ Hz, H-3); δ_C (CDCl₃, 125 MHz): -5.06 (CH₃, (CH₃)₃Si), -4.74 (CH₃, (CH₃)₃Si), -4.56 (CH₃, (CH₃)₃Si), -3.81 (CH₃, (CH₃)₃Si), 18.47 (C, (CH₃)₃C), 18.88 (C, (CH₃)₃C), 26.15 (3CH₃, (CH₃)₃CSi), 26.52 (3CH₃, (CH₃)₃CSi), 33.14 (CH₃, C-15), 34.66 (CH, C-9), 35.03 (CH₂, C-8), 42.98 (C, C-1), 45.02 (CH₂, C-10), 47.90 (CH₂, C-12), 53.70 (CH₃, OCH₃), 68.31 (CH₂, C-14), 70.10 (C, C-11), 72.94 (CH, C-13), 107.73 (CH, C-4), 128.00 (C, C-2), 136.58 (CH, C-3), 155.52 (C, C-7), 162.04 (C, C-5); m/z (EI): 507 (11%, M⁺), 490 (12), 475 (13), 474 (31), 452 (14), 451 (34), 450 (100), 432 (61), 244 (16), 226 (100), 212 (19), 160 (12), 147 (55), 73 (68); C₂₇H₄₉O₄Si₂N [M⁺] required 507.3200, found 507.3206.

(13R)*-1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6-aza-11-methyl-13-(*tert*-butyldimethylsilyloxy)-tricyclo[7.3.1.0^{2,7}]trideca-2(7),3,5,10-tetraene (14)

Thionyl chloride (0.27 ml, 3.72 mmol, 6 eq.) was added dropwise via syringe to a solution of **12** (0.32 g, 0.62 mmol, 1 eq.) in dry pyridine (0.6 ml) at 0°C under argon. The reaction mixture was stirred at 0°C for 3 h. It was then poured onto ice and the organic layer taken up with diethyl ether. Combined organic extracts were washed with brine, dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (5% diethyl ether - pet. ether) gave the pure desired alkene **14** (0.09 g, 28% yield) as colourless oil, and also a mixture of **14** and its isomer **13** as a colourless oil, present in a 3:1 ratio respectively (0.14 g, 46% yield).

Olefin **13**: ν_{max} / cm⁻¹: 2929, 2857, 1597, 1477, 1307, 1253, 1097, 1033, 835, 775; δ_H (CDCl₃, 500 MHz): 0.07 (3H, s, (CH₃)₃Si), 0.10 (3H, s, (CH₃)₃Si), 0.11 (3H, s, (CH₃)₃Si), 0.13 (3H, s, (CH₃)₃Si), 0.82 (9H, s, (CH₃)₃CSi), 0.97 (9H, s, (CH₃)₃CSi), 1.53 (3H, s, CH₃), 1.83 (1H, d, $J = 17.4$ Hz, H-12), 2.50 (1H, d, $J = 17.0$ Hz, H-8), 2.53-2.56 (2H, m, H-9 and H-12), 3.21 (1H, dd, $J = 17.0, 5.2$ Hz, H-8), 3.78 (1H, d, $J = 9.6$ Hz, H-14), 3.87 (4H, m, OCH₃ and H-14), 4.04 (1H, d, $J = 4.6$ Hz, H-13), 5.35-5.37 (1H, m, H-10), 6.50 (1H, d, $J = 8.5$ Hz, H-4), 7.73 (1H, d, $J = 8.5$ Hz, H-3); δ_C (CDCl₃, 125 MHz): -4.99 (CH₃, (CH₃)₃Si), -4.78 (CH₃, (CH₃)₃Si), -4.52 (CH₃, (CH₃)₃Si), -3.68 (CH₃, (CH₃)₃Si), 18.56

(C, (CH₃)₃C), 18.95 (C, (CH₃)₃C), 23.49 (CH₃, C-15), 26.29 (3CH₃, (CH₃)₃CSi), 26.57 (3CH₃, (CH₃)₃CSi), 34.28 (CH₂, C-8), 36.72 (CH, C-9), 42.86 (C, C-1), 42.98 (CH₂, C-12), 53.60 (CH₃, OCH₃), 68.36 (CH₂, C-14), 71.35 (CH, C-13), 108.02 (CH, C-4), 124.57 (CH, C-10), 129.57 (C, C-2), 133.40 (C, C-11), 137.71 (CH, C-3), 153.88 (C, C-7), 162.09 (C, C-5); *m/z* (EI): 489 (51%, M⁺), 488 (26), 476 (15), 475 (37), 474 (100), 466 (12), 432 (37), 227 (20), 226 (100), 212 (13), 147 (44), 73 (55); C₂₇H₄₇O₃Si₂N [M⁺] required 489.3095, found 489.3108; CHN Analysis required C 66.20, H 9.67, N 2.86 %, found C 65.90, H 9.75, N 2.49 %.

(13R)*-1-Hydroxymethyl-5-methoxy-6-aza-11-methyl-tricyclo[7.3.1.0^{2,7}]trideca-2(7),3,5,10-tetraen-13-ol (15)

A 1M solution of TBAF (0.7 ml, 0.7 mmol, 2.3 eq.) was added dropwise via syringe to a solution of **13** (0.15g, 0.3 mmol, 1 eq.) in dry THF (2 ml) at room temperature. The reaction mixture was stirred at room temperature for 15 h before being quenched with a saturated aqueous solution of ammonium chloride. The organic layer was taken up with ethyl acetate. The combined organic layers were then washed with water and brine, dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (80% ethyl acetate – 20% pet. ether) gave the pure diol **15** as a white solid (0.07 g, 90% yield). m.p. = 160.1°C.

ν_{max} / cm⁻¹: 3367 (br.), 2915, 1596, 1476, 1423, 1310, 1031; δ_H (CDCl₃, 500 MHz): 1.52 (3H, s, CH₃), 1.69 (1H, d, *J* = 17.2 Hz, H-12), 2.13 (1H, d, *J* = 17.2 Hz, H-12), 2.61 (1H, d, *J* = 17.4 Hz, H-8), 2.64-2.66 (1H, m, H-9), 3.24 (1H, dd, *J* = 17.4, 5.5 Hz, H-8), 3.90 (3H, s, OCH₃), 3.98 (1H, d, *J* = 11.5 Hz, H-14), 4.00 (1H, d, *J* = 11.5 Hz, H-14), 4.17 (1H, d, *J* = 4.6 Hz, H-13), 5.43 (1H, d, *J* = 5.5 Hz, H-10), 6.60 (1H, d, *J* = 8.5 Hz, H-4), 7.47 (1H, d, *J* = 8.5 Hz, H-3); δ_C (CDCl₃, 125 MHz): 23.12 (CH₃, C-15), 33.76 (CH₂, C-8), 36.43 (CH, C-9), 42.22 (C, C-1), 43.33 (CH₂, C-12), 53.77 (CH₃, OCH₃), 69.35 (CH₂, C-14), 74.64 (CH, C-13), 109.11 (CH, C-4), 124.94 (CH, C-10), 125.50 (C, C-2), 132.13 (C, C-11), 137.64 (CH, C-3), 154.62 (C, C-7), 162.65 (C, C-5); *m/z* (EI): 261 (M⁺, 41%), 260 (15), 242 (18), 224 (22), 213 (18), 212 (100); C₁₅H₁₉O₃N [M⁺] required 261.1365, found 261.1361.

5-Methoxy-6-aza-11-methyl-13-keto-tricyclo[7.3.1.0^{2,7}]trideca-2(7),3,5,10-tetraen-14-acid (16)

To a solution of **15** (0.04 g, 0.17 mmol, 1 eq.) in DMF was added 0.62 g of pyridinium dichromate (1.65 mmol, 10 eq.). The reaction mixture was stirred at room temperature for 20 h. 10 ml of water was added followed by extraction of the product several times with ethyl acetate. The combined organic phases were then washed with brine, dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (40% ethyl acetate – pet. ether) gave the acid **16** as a colourless oil (0.03g, 53% yield).

ν_{max} / cm⁻¹: 3600-3100 (br), 2919, 2850, 1738 (br), 1601, 1478, 1424, 1326, 1268, 1032; δ_H (CDCl₃, 500 MHz): 1.55 (3H, s, CH₃), 2.50 (1H, d, J = 17.5 Hz, H-12), 3.12-3.16 (1H, m, H-9), 3.12 (1H, d, J = 17.5 Hz, H-8), 3.27 (1H, d, J = 17.5 Hz, H-12), 3.32 (1H, dd, J = 17.5, 5.3 Hz, H-8), 3.85 (3H, s, OCH₃), 5.36-5.38 (1H, m, H-10), 6.58 (1H, d, J = 8.7 Hz, H-4), 7.27 (1H, d, J = 8.7 Hz, H-3); δ_C (CDCl₃, 125 MHz): 19.81 (CH₃, C-15), 39.73 (CH₂, C-8), 44.99 (CH, C-9), 45.88 (CH₂, C-12), 52.59 (CH₃, OCH₃), 58.46 (C, C-1), 108.71 (CH, C-4), 122.65 (CH, C-10), 124.83 (C, C-2), 132.48 (C, C-11), 137.08 (CH, C-3), 149.74 (C, C-7), 162.44 (C, C-5), 173.42 (CO₂H, C-14), 207.32 (C=O, C-13); m/z (EI): 273 (M⁺, 30%), 230 (25), 229 (100), 214 (40), 212 (53), 200 (62), 184 (20), 170 (13), 149 (14), 128 (14), 115 (16), 85 (24), 77 (15), 69 (43), 63 (13), 58 (22); C₁₅H₁₆O₄N (ES) [M⁺H] required 274.1074, found 274.1074.

5-Methoxy-6-aza-11-methyl-13-keto-tricyclo[7.3.1.0^{2,7}]trideca-2(7),3,5,10-tetraen-14-methoxy ester (2)

A solution of **16** (0.02 g, 0.07 mmol) in 1 ml of a diethyl ether/DCM mixture (1:1) was cooled to 0°C and stirred at this temperature for 20 mins before the dropwise addition of a dilute ethereal solution of diazomethane, which had been previously prepared and stored at 0-4°C until use. The reaction mixture was stirred at 0°C for 1 h. 3 – 4 drops of acetic acid were then carefully added. Ethyl acetate (3 ml) was added followed by 1 ml of water. The two phases were separated and the organic phase dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (30% diethyl ether – pet. ether) yielded keto ester **2** as a colourless oil (0.017g, 80% yield).

ν_{max} / cm^{-1} : 2917, 2849, 1745, 1731, 1602, 1576, 1478, 1424, 1326, 1262, 1025, 831; δ_{H} (CDCl_3 , 500 MHz): 1.62 (3H, s, CH_3), 2.51 (1H, d, $J = 17.5$ Hz, H-12), 3.12-3.20 (2H, m, H-8 and H-9), 3.36-3.43 (2H, m, H-8 and H-12), 3.76 (3H, s, OCH_3 , CO_2Me), 3.92 (3H, s, OCH_3), 5.42-5.44 (1H, m, H-10), 6.61 (1H, d, $J = 8.5$ Hz, H-4), 7.10 (1H, d, $J = 8.5$ Hz, H-3); δ_{C} (CDCl_3 , 125 MHz): 22.74 (CH_3 , C-15), 40.87 (CH_2 , C-8), 46.46 (CH , C-9), 47.34 (CH_2 , C-12), 53.01 (CH_3 , OCH_3 , CO_2Me), 53.90 (CH_3 , OCH_3), 60.60 (C, C-1), 110.08 (CH , C-4), 124.24 (CH , C-10), 126.85 (C, C-2), 134.01 (C, C-11), 138.13 (CH , C-3), 151.15 (C, C-7), 163.68 (C, C-5), 171.84 (CO_2Me , C-14), 207.88 (C=O, C-13); m/z (EI): 287 (M^+ , 83%), 255 (86), 244 (16), 228 (65), 226 (16), 212 (15), 200 (100), 184 (43), 170 (25), 156 (18), 128 (20), 91 (12), 77 (16), 65 (15); $\text{C}_{16}\text{H}_{17}\text{O}_4\text{N}$ [M^+] required 287.1158, found 287.1139.

1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6-aza-13-(*tert*-butyldimethylsilyloxy)-tricyclo[7.3.1.0^{2,7}]trideca-2(7),3,5-trien-11-one oxime mesylates (17a) and (17b)

A solution of 1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6-aza-13-(*tert*-butyldimethylsilyloxy)-tricyclo[7.3.1.0^{2,7}]trideca-2(7),3,5-trien-11-one **11** (1.09g, 2.22 mmol, 1 eq.) in pyridine (12 ml) was added to a solution of hydroxylamine hydrochloride (0.19g, 2.67 mmol, 1.2 eq.) in an ethanol-water mixture (6 ml-6 ml). The reaction mixture was then heated to reflux and maintained at this temperature for 3 h. On cooling to room temperature, 1-2 ml of a saturated sodium bicarbonate solution was added dropwise. The reaction mixture was then concentrated under reduced pressure. The residue was dissolved in ethyl acetate, washed with water and brine, dried over MgSO_4 and concentrated under reduced pressure. The crude product contained a mixture of oxime isomers, oxime **A** and oxime **B**, which were separated by flash chromatography (40% Et_2O -pet. ether) to give 0.45 g (40% yield) and 0.57 g (51% yield) respectively, both as white solids. m.p. = 71.4°C and 80.6°C respectively.

[Oxime **A**: ν_{max} / cm^{-1} : 3234, 2955, 2929, 2857, 1599, 1479, 1427, 1311, 1256, 1098, 836, 775; δ_{H} (CDCl_3 , 500 MHz): 0.10 (3H, s, $(\text{CH}_3)\text{Si}$), 0.11 (3H, s, $(\text{CH}_3)\text{Si}$), 0.12 (3H, s, $(\text{CH}_3)\text{Si}$), 0.13 (3H, s, $(\text{CH}_3)\text{Si}$), 0.77 (9H, s, $(\text{CH}_3)_3\text{CSi}$), 0.95 (9H, s, $(\text{CH}_3)_3\text{CSi}$), 2.01

(1H, dd, $J = 15.5, 5.5$ Hz, H-10), 2.16 (1H, dd, $J = 14.5, 2.5$ Hz, H-12), 2.42-2.47 (1H, m, H-9), 2.53-2.57 (2H, m, H-8 and H-12), 3.22 (1H, dd, $J = 18.0, 7.0$ Hz, H-8), 3.36 (1H, dt, $J = 15.5, 2.5$ Hz, H-10), 3.87 (1H, s, OCH₃), 3.90 (1H, d, $J = 4.5$ Hz, H-14), 4.19 (1H, d, $J = 3.5$ Hz, H-13), 6.47 (1H, d, $J = 8.5$ Hz, H-4), 7.45 (1H, d, $J = 8.5$ Hz, H-3); δ_C (CDCl₃, 125 MHz): -5.06 (CH₃, (CH₃)₃Si), -4.73 (CH₃, (CH₃)₃Si), -4.52 (CH₃, (CH₃)₃Si), -3.79 (CH₃, (CH₃)₃Si), 18.47 (C, (CH₃)₃C), 18.87 (C, (CH₃)₃C), 26.15 (3CH₃, (CH₃)₃CSi), 26.53 (3CH₃, (CH₃)₃CSi), 30.33 (CH₂, C-10), 35.23 (CH₂, C-8), 35.38 (CH, C-9), 41.47 (CH₂, C-12), 45.45 (C, C-1), 53.65 (CH₃, OCH₃), 66.87 (CH₂, C-14), 71.89 (CH, C-13), 108.24 (CH, C-4), 126.27 (C, C-2), 136.40 (CH, C-3), 152.32 (C, C-7), 162.10 (C=NOH, C-11), 162.52 (C, C-5).

Oxime **B**: $\nu_{max} / \text{cm}^{-1}$: 3248, 2955, 2929, 2857, 1599, 1479, 1427, 1311, 1255, 1097, 836, 775; δ_H (CDCl₃, 500 MHz): 0.09 (3H, s, (CH₃)₃Si), 0.11 (3H, s, (CH₃)₃Si), 0.12 (3H, s, (CH₃)₃Si), 0.14 (3H, s, (CH₃)₃Si), 0.77 (9H, s, (CH₃)₃CSi), 0.97 (9H, s, (CH₃)₃CSi), 2.13 (1H, d, $J = 14.0$ Hz, H-12), 2.34 (1H, dt, $J = 14.0, 2.0$ Hz, H-10), 2.41-2.49 (2H, m, H-9 and H-10), 2.56 (1H, d, $J = 18.0$, H-8), 3.10 (1H, dd, $J = 14.0, 2.0$ Hz, H-12), 3.24 (1H, dd, $J = 18.0, 7.0$ Hz, H-8), 3.86 (1H, s, OCH₃), 3.90 (1H, d, $J = 4.5$ Hz, H-14), 4.23 (1H, d, $J = 4.0$ Hz, H-13), 6.46 (1H, d, $J = 8.5$ Hz, H-4), 7.43 (1H, d, $J = 8.5$ Hz, H-3); δ_C (CDCl₃, 125 MHz): -4.99 (CH₃, (CH₃)₃Si), -4.67 (CH₃, (CH₃)₃Si), -4.51 (CH₃, (CH₃)₃Si), -3.77 (CH₃, (CH₃)₃Si), 18.46 (C, (CH₃)₃C), 18.88 (C, (CH₃)₃C), 26.17 (3CH₃, (CH₃)₃CSi), 26.57 (3CH₃, (CH₃)₃CSi), 33.89 (CH₂, C-12), 34.81 (CH₂, C-8), 36.03 (CH, C-9), 38.13 (CH₂, C-10), 45.04 (C, C-1), 53.61 (CH₃, OCH₃), 66.33 (CH₂, C-14), 71.33 (CH, C-13), 108.01 (CH, C-4), 126.18 (C, C-2), 136.25 (CH, C-3), 153.61 (C, C-7), 157.08 (C=NOH, C-11), 162.02 (C, C-5)]

Oxime **A** could be converted into mesylate **17a** (94% yield, white solid, m.p. = 98.4°C) or Oxime **B** could be converted into mesylate **17b** (72% yield, sticky colourless oil) using the following procedure:

Methanesulphonyl chloride (4 eq.) was added dropwise via syringe to a stirred solution of either oxime in dry pyridine and dry DCM at -10°C (salt/ice-water bath) and under argon. The reaction mixture was then allowed warm to room temperature overnight. The reaction was then quenched with water and the two phases separated. The aqueous phase

was washed with DCM and the combined organic phases were washed with brine, dried over MgSO_4 and concentrated under reduced pressure. Purification by flash chromatography (40% Et_2O -pet. ether) yielded the pure product.

Meslyate **17a**: $\nu_{\text{max}} / \text{cm}^{-1}$: 2954, 2929, 2857, 1644, 1472, 1326, 1252, 1192, 1059, 836, 776; δ_{H} (CDCl_3 , 500 MHz): -0.02 (3H, s, $(\text{CH}_3)\text{Si}$), -0.01 (3H, s, $(\text{CH}_3)\text{Si}$), 0.00 (3H, s, $(\text{CH}_3)\text{Si}$), 0.01 (3H, s, $(\text{CH}_3)\text{Si}$), 0.66 (9H, s, $(\text{CH}_3)_3\text{CSi}$), 0.83 (9H, s, $(\text{CH}_3)_3\text{CSi}$), 2.09 (1H, dd, $J = 14.2, 5.5$ Hz, H-10), 2.22 (1H, dd, $J = 14.0, 2.5$ Hz, H-12), 2.39-2.44 (1H, m, H-9), 2.41 (1H, d, $J = 18.1$ Hz, H-8), 2.52 (1H, d, $J = 14.0$ Hz, H-12), 2.53 (3H, s, CH_3SO_2^-), 3.15-3.20 (2H, m, H-8 and H-10), 3.72 (3H, s, OCH_3), 3.81 (2H, s, H-14), 4.11 (1H, d, $J = 4.2$ Hz, H-13), 6.37 (1H, d, $J = 8.7$ Hz, H-4), 7.35 (1H, d, $J = 8.7$ Hz, H-3); δ_{C} (CDCl_3 , 125 MHz): -6.50 (CH_3 , $(\text{CH}_3)\text{Si}$), -6.13 (CH_3 , $(\text{CH}_3)\text{Si}$), -5.94 (CH_3 , $(\text{CH}_3)\text{Si}$), -5.21 (CH_3 , $(\text{CH}_3)\text{Si}$), 17.05 (C, $(\text{CH}_3)_3\text{C}$), 17.46 (C, $(\text{CH}_3)_3\text{C}$), 24.72 (3CH_3 , $(\text{CH}_3)_3\text{CSi}$), 25.10 (3CH_3 , $(\text{CH}_3)_3\text{CSi}$), 31.34 (CH_2 , C-10), 33.55 (CH_2 , C-8), 34.60 (CH, C-9), 35.02 (CH_3 , $\text{CH}_3\text{OSO}_2^-$), 40.03 (CH_2 , C-12), 44.93 (C, C-1), 52.30 (CH_3 , OCH_3), 65.01 (CH_2 , C-14), 69.78 (CH, C-13), 107.43 (CH, C-4), 124.23 (C, C-2), 135.34 (CH, C-3), 151.50 (C, C-7), 160.85 (C, C-5), 165.91 (C= NOSO_2CH_3 , C-11); m/z (EI): 584 (M^+ , 30%), 569 (15), 565 (23), 564 (50), 563 (100), 546 (10), 449 (10), 243 (8), 186 (8), 153 (12), 147 (25), 85 (8), 78 (100); $\text{C}_{27}\text{H}_{48}\text{O}_6\text{Si}_2\text{N}_2\text{S}$ [M^+] required 584.2772, found 584.2825; CHN Analysis required C 55.44, H 8.27, N 4.79 %, found C 55.67, H 8.50, N 4.33 %.

Meslyate **17b**: $\nu_{\text{max}} / \text{cm}^{-1}$: 2954, 2929, 2857, 1650, 1478, 1370, 1312, 1255, 1191, 1096, 1058, 837, 776, 526; δ_{H} (CDCl_3 , 500 MHz): -0.05 (3H, s, $(\text{CH}_3)\text{Si}$), -0.03 (3H, s, $(\text{CH}_3)\text{Si}$), -0.02 (3H, s, $(\text{CH}_3)\text{Si}$), 0.00 (3H, s, $(\text{CH}_3)\text{Si}$), 0.62 (9H, s, $(\text{CH}_3)_3\text{CSi}$), 0.81 (9H, s, $(\text{CH}_3)_3\text{CSi}$), 2.23 (1H, d, $J = 13.8$ Hz, H-12), 2.39 (3H, s, CH_3SO_2^-), 2.42-2.49 (3H, m, H-9 and H-10), 2.46 (1H, d, $J = 18.1$ Hz, H-8), 2.83 (1H, d, $J = 13.8$ Hz, H-12), 3.13 (1H, dd, $J = 18.1, 6.9$ Hz, H-8), 3.69 (3H, s, OCH_3), 3.71 (1H, d, $J = 9.4$ Hz, H-14), 3.79 (1H, d, $J = 9.4$ Hz, H-14), 4.15 (1H, d, $J = 4.1$ Hz, H-13), 6.36 (1H, d, $J = 8.5$ Hz, H-4), 7.25 (1H, d, $J = 8.5$ Hz, H-3); δ_{C} (CDCl_3 , 125 MHz): -5.95 (CH_3 , $(\text{CH}_3)\text{Si}$), -5.57 (CH_3 , $(\text{CH}_3)\text{Si}$), -5.52 (CH_3 , $(\text{CH}_3)\text{Si}$), -4.76 (CH_3 , $(\text{CH}_3)\text{Si}$), 17.45 (C, $(\text{CH}_3)_3\text{C}$), 17.85 (C, $(\text{CH}_3)_3\text{C}$), 25.13 (3CH_3 , $(\text{CH}_3)_3\text{CSi}$), 25.55 (3CH_3 , $(\text{CH}_3)_3\text{CSi}$), 33.68 (CH_2 , C-8),

35.17 (CH₃, CH₃OSO₂-), 35.44 (CH₂, C-12), 35.71 (CH, C-9), 37.00 (CH₂, C-10), 45.17 (C, C-1), 52.74 (CH₃, OCH₃), 64.52 (CH₂, C-14), 69.35 (CH, C-13), 107.52 (CH, C-4), 124.34 (C, C-2), 135.40 (CH, C-3), 152.52 (C, C-7), 161.38 (C, C-5), 166.11 (C=NOSO₂CH₃, C-11); *m/z* (EI): 584 (M⁺, 8%), 450 (23), 449 (85), 335 (35), 317 (15), 256 (24), 213 (18), 185 (27), 147 (30), 129 (48), 98 (22), 73 (100); C₂₇H₄₈O₆Si₂N₂S [M⁺] required 584.2772, found 584.2561; CHN Analysis required C 55.44, H 8.27, N 4.79 %, found C 55.11, H 8.18, N 4.27 %.

(13R)-1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6,12-diaza-13-(*tert*-butyldimethylsilyloxy)-tricyclo[7.4.1.0^{2,7}]trideca-2(7),3,5-trien-11-one (18)

Aqueous buffered (pH 7.4) KH₂PO₄ solution (9 ml) was added to a stirred solution of oxime mesylate **17a** (0.32 g, 0.54 mmol) in THF (7 ml). The reaction mixture was then heated to reflux and stirred at this temperature overnight. On cooling to room temperature, the product was taken up with ethyl acetate and the combined organic phases washed with brine, dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (85% EtOAc-15% pet. ether) yielded the pure lactam **18** as a white solid (0.23g, 83% yield). m.p.= 154.1°C.

ν_{max} / cm⁻¹: 3427, 2955, 2930, 2857, 1672, 1600, 1479, 1317, 1253, 1091, 835, 776; δ_H (CDCl₃, 500 MHz): -0.02 (3H, s, (CH₃)Si), 0.00 (3H, s, (CH₃)Si), 0.01 (3H, s, (CH₃)Si), 0.02 (3H, s, (CH₃)Si), 0.67 (9H, s, (CH₃)₃CSi), 0.85 (9H, s, (CH₃)₃CSi), 2.29-2.32 (1H, m, H-9), 2.42-2.50 (2H, m, H-10), 2.66 (1H, d, *J* = 18.6 Hz, H-8), 3.08 (1H, dd, *J* = 18.6, 8.0 Hz, H-8), 3.14 (1H, dd, *J* = 15.4, 7.8 Hz, H-13), 3.22 (1H, dd, *J* = 15.4, 5.5 Hz, H-13), 3.72 (1H, d, *J* = 10.1 Hz, H-15), 3.76 (3H, s, OCH₃), 3.82 (1H, d, *J* = 3.7 Hz, H-14), 3.96 (1H, d, *J* = 10.1 Hz, H-15), 5.06 (1H, t, *J* = 6.4 Hz, N-H), 6.36 (1H, d, *J* = 8.7 Hz, H-4), 7.50 (1H, d, *J* = 8.7 Hz, H-3); δ_C (CDCl₃, 125 MHz): -6.08 (CH₃, (CH₃)Si), -5.86 (CH₃, (CH₃)Si), -5.46 (CH₃, (CH₃)Si), -4.71 (CH₃, (CH₃)Si), 17.48 (C, (CH₃)₃C), 17.80 (C, (CH₃)₃C), 25.16 (3CH₃, (CH₃)₃CSi), 25.48 (3CH₃, (CH₃)₃CSi), 30.97 (CH₂, C-8), 32.51 (CH, C-9), 38.03 (CH₂, C-10), 45.46 (CH₂, C-13), 47.42 (C, C-1), 52.61 (CH₃, OCH₃), 66.79 (CH₂, C-15), 76.20 (CH, C-14), 107.58 (CH, C-4), 123.10 (C, C-2), 135.60 (CH, C-3), 153.43 (C, C-7), 161.32 (C, C-5), 174.52 (C(O)NH, C-11); *m/z* (EI): 506 (M⁺, 33%), 493 (15), 492 (37), 491 (100), 450 (25), 449 (100), 420 (24), 378 (20), 317 (18),

243 (19), 172 (15), 147 (32), 73 (34); C₂₆H₄₆O₄Si₂N₂ [M⁺] required 506.2996, found 506.3052. CHN Analysis required C 61.61, H 9.15, N 5.53 %, found C 61.53, H 8.93, N 5.36 %.

(13R)-1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6,11-diaza-13-(*tert*-butyldimethylsilyloxy)-tricyclo[7.4.1.0^{2,7}]trideca-2(7),3,5-trien-12-one (19)

Aqueous buffered (pH 7.4) KH₂PO₄ solution (9 ml) was added to a stirred solution of oxime mesylate **17b** (0.30 g, 0.51 mmol) in THF (7 ml). The reaction mixture was then heated to reflux and stirred at this temperature overnight. On cooling to room temperature, the product was taken up with ethyl acetate and the combined organic phases washed with brine, dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (90% EtOAc-10% pet. ether) yielded the pure lactam **19** as a white solid (0.22g, 84% yield). m.p.= 183.7°C.

ν_{max} / cm⁻¹: 3243, 2955, 2929, 2857, 1674, 1598, 1478, 1311, 1250, 1093, 837, 775; δ_H (CDCl₃, 500 MHz): 0.00 (3H, s, (CH₃)Si), 0.01 (3H, s, (CH₃)Si), 0.02 (3H, s, (CH₃)Si), 0.04 (3H, s, (CH₃)Si), 0.69 (9H, s, (CH₃)₃CSi), 0.86 (9H, s, (CH₃)₃CSi), 2.22-2.25 (1H, m, H-9), 2.41 (1H, dd, J = 14.6, 2.1 Hz, H-13), 2.49 (1H, d, J = 18.1 Hz, H-8), 2.64 (1H, d, J = 14.7 Hz, H-13), 3.00-3.06 (1H, m, H-10), 3.15 (1H, dd, J = 18.1, 7.8 Hz, H-8), 3.30 (1H, dd, J = 15.1, 3.7 Hz, H-10), 3.77 (3H, s, OCH₃), 3.80 (1H, d, J = 9.2 Hz, H-15), 3.83 (1H, d, J = 9.2 Hz, H-15), 3.98 (1H, d, J = 3.7 Hz, H-14), 5.85-5.88 (1H, m, N-H), 6.38 (1H, d, J = 8.5 Hz, H-4), 7.44 (1H, d, J = 8.5 Hz, H-3); δ_C (CDCl₃, 125 MHz): -5.07 (CH₃, (CH₃)Si), -5.25 (CH₃, (CH₃)Si), -5.15 (CH₃, (CH₃)Si), -4.54 (CH₃, (CH₃)Si), 17.78 (C, (CH₃)₃C), 18.10 (C, (CH₃)₃C), 25.49 (3CH₃, (CH₃)₃CSi), 25.84 (3CH₃, (CH₃)₃CSi), 31.25 (CH₂, C-8), 36.74 (CH, C-9), 42.30 (C, C-1), 43.77 (CH₂, C-10), 44.15 (CH₂, C-13), 52.90 (CH₃, OCH₃), 67.44 (CH₂, C-15), 74.63 (CH, C-14), 107.25 (CH, C-4), 123.44 (C, C-2), 136.46 (CH, C-3), 153.38 (C, C-7), 161.44 (C, C-5), 175.19 (C(O)NH, C-11); m/z (EI): 506 (M⁺, 21%), 492 (25), 491 (100), 451 (20), 450 (64), 449 (100), 317 (40), 243 (33), 201 (20), 172 (41), 147 (25), 75 (16), 73 (73); C₂₆H₄₆O₄Si₂N₂ [M⁺] required 506.2996, found 506.3033; CHN Analysis required C 61.61, H 9.15, N 5.53 %, found C 61.34, H 9.48, N 5.36 %.

Synthesis and resolution of the (-)- ω -camphanic esters (+)-**20** and (-)-**20**

(1S)-(-)-Camphanic chloride (0.32 g, 1.49 mmol, 1.5 eq.) was added portionwise to a solution of (\pm)-**9** (0.36 g, 0.99 mmol, 1 eq.) and 4-dimethylaminopyridine (1.21 g, 9.93 mmol, 10 eq.) in dry DCM (8 ml) at 0°C under argon. The reaction mixture was stirred at 0°C for 1 h then allowed warm to room temperature overnight. 8 ml of a saturated aqueous sodium bicarbonate solution was then added to the reaction mixture and the organic and aqueous phases separated. The aqueous phase was washed with DCM (2 x 5 ml) and the combined organic phases washed with water, then brine, dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (50% diethyl ether – pet. ether) yielded 0.18 g (34% yield) of the pure (+)-diastereomeric ester, (+)-**20**, and 0.20 g (37% yield) of the pure (-)-diastereomeric ester, (-)-**20**, both as white solids, m.p. = 165.3°C and 142.9°C respectively.

(+)-**20**: ν_{max} / cm⁻¹: 2956, 2931, 2857, 1792, 1750, 1595, 1476, 1428, 1309, 1261, 1171, 1154, 1105, 1061, 861, 838, 778, 733; δ_H (CDCl₃, 500 MHz): -0.03 (3H, s, (CH₃)Si), 0.00 (3H, s, (CH₃)Si), 0.56 (3H, s, C²⁵H₃), 0.78 (3H, s, C²⁴H₃), 0.82 (9H, s, (CH₃)₃CSi), 0.93 (3H, s, C²⁶H₃), 1.47-1.51 (1H, m, H-21), 1.64-1.70 (1H, m, H-21), 1.79-1.84 (1H, m, H-22), 1.94-2.00 (1H, m, H-22), 2.09-2.13 (1H, m, H-10), 2.61-2.65 (1H, m, H-10), 2.61 (1H, d, J = 19.0 Hz, H-8), 2.75-2.78 (1H, m, H-9), 3.09 (1H, dd, J = 19.0, 8.5 Hz, H-8), 3.70 (1H, d, J = 9.5 Hz, H-14), 3.77 (3H, s, OCH₃), 3.98 (1H, d, J = 9.5 Hz, H-14), 5.44 (1H, d, J = 3.5 Hz, H-13), 5.56 (2H, s, H-11 and H-12), 6.37 (1H, d, J = 8.5 Hz, H-4), 7.30 (1H, d, J = 8.5 Hz, H-3); δ_C (CDCl₃, 125 MHz): -5.08 (CH₃, (CH₃)Si), -5.02 (CH₃, (CH₃)Si), 9.96 (CH₃, C-26), 16.73 (CH₃, C-25), 17.00 (CH₃, C-24), 18.61 (C, (CH₃)₃C), 26.21 (3CH₃, (CH₃)₃CSi), 29.33 (CH₂, C-21), 29.95 (CH, C-9), 31.10 (CH₂, C-22), 35.62 (CH₂, C-10), 37.23 (CH₂, C-8), 43.95 (C, C-1), 53.68 (CH₃, OCH₃), 54.20 (C, C-23), 55.03 (C, C-20), 65.65 (CH₂, C-14), 74.53 (CH, C-13), 91.44 (C, C-17), 107.66 (CH, C-4), 125.79 (CH, C-11), 127.52 (C, C-2), 133.94 (CH, C-12), 134.74 (CH, C-3), 154.98 (C, C-7), 161.91 (C, C-5), 166.87 (C=O, C-16), 178.28 (C=O, C-19); m/z (EI): 543 (37%), 542 (100%), 541 (M⁺, 60%), 540 (37), 485 (42), 484 (100), 213 (61), 212 (100), 183 (93), 109 (15), 83 (20), 75 (31); C₃₀H₄₃O₆SiN [M⁺] required 541.2860, found

541.2905; CHN Analysis required C 66.51, H 8.00, N 2.59 %, found C 66.55, H 8.08, N 2.34 %; $[\alpha]_D^{20} = +47.2^\circ$ ($c = 1.3$ g / 100 ml, CHCl_3).

(-)-20: ν_{\max} / cm^{-1} : 2956, 2930, 2857, 1792, 1750, 1595, 1476, 1428, 1309, 1260, 1171, 1154, 1105, 1062, 861, 838, 778, 733; δ_{H} (CDCl_3 , 500 MHz): -0.03 (3H, s, $(\text{CH}_3)\text{Si}$), 0.00 (3H, s, $(\text{CH}_3)\text{Si}$), 0.64 (3H, s, C^{25}H_3), 0.73 (3H, s, C^{24}H_3), 0.81 (9H, s, $(\text{CH}_3)_3\text{CSi}$), 0.93 (3H, s, C^{26}H_3), 1.47-1.52 (1H, m, H-21), 1.66-1.71 (1H, m, H-21), 1.79-1.85 (1H, m, H-22), 2.02-2.07 (1H, m, H-22), 2.08-2.13 (1H, m, H-10), 2.58-2.65 (1H, m, H-10), 2.58 (1H, d, $J = 19.0$ Hz, H-8), 2.69-2.73 (1H, m, H-9), 3.06 (1H, dd, $J = 19.0, 8.5$ Hz, H-8), 3.76-3.77 (1H, m, H-14), 3.77 (3H, s, OCH_3), 4.00 (1H, d, $J = 9.5$ Hz, H-14), 5.49 (1H, d, $J = 3.5$ Hz, H-13), 5.52-5.59 (2H, m, H-11 and H-12), 6.37 (1H, d, $J = 8.5$ Hz, H-4), 7.31 (1H, d, $J = 8.5$ Hz, H-3); δ_{C} (CDCl_3 , 125 MHz): -5.45 (CH_3 , $(\text{CH}_3)\text{Si}$), -5.38 (CH_3 , $(\text{CH}_3)\text{Si}$), 9.64 (CH_3 , C-26), 16.47 (CH_3 , C-25), 16.66 (CH_3 , C-24), 18.23 (C, $(\text{CH}_3)_3\text{C}$), 25.83 (3 CH_3 , $(\text{CH}_3)_3\text{CSi}$), 28.87 (CH_2 , C-21), 29.72 (CH, C-9), 30.62 (CH_2 , C-22), 35.18 (CH_2 , C-10), 36.87 (CH_2 , C-8), 43.49 (C, C-1), 53.32 (CH_3 , OCH_3), 53.70 (C, C-23), 54.71 (C, C-20), 65.33 (CH_2 , C-14), 73.97 (CH, C-13), 91.20 (C, C-17), 107.24 (CH, C-4), 125.39 (CH, C-11), 127.15 (C, C-2), 133.73 (CH, C-12), 134.50 (CH, C-3), 154.55 (C, C-7), 161.54 (C, C-5), 166.60 (C=O, C-16), 178.02 (C=O, C-19); m/z (EI): 543 (38%), 542 (100%), 541 (M^+ , 51%), 540 (35), 485 (46), 484 (100), 213 (77), 212 (100), 183 (98), 109 (20), 83 (23), 75 (36); $\text{C}_{30}\text{H}_{43}\text{O}_6\text{SiN}$ [M^+] required 541.2860, found 541.2906; CHN Analysis required C 66.51, H 8.00, N 2.59 %, found C 66.41, H 8.14, N 2.33 %; $[\alpha]_D^{20} = -51.2^\circ$ ($c = 1.3$ g / 100 ml, CHCl_3).

(+)-1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6-aza-tricyclo [7.3.1.0^{2,7}] trideca-2(7),3,5,11-tetraen-13-ol ((+)-9)

Potassium carbonate (0.12 g, 0.86 mmol, 3 eq.) was added to a solution of **(+)-20** (0.16 g, 0.29 mmol, 1 eq.) in methanol (6 ml) and the reaction mixture stirred at room temperature overnight. The following morning, TLC analysis indicated some remaining starting material so a further 1 eq. of potassium carbonate was added and the reaction mixture stirred for a further 4 h until all starting material had been consumed. The reaction mixture was then concentrated under reduced pressure and the residue redissolved in

ethyl acetate (5 ml). Water (5 ml) was then added and the two phases separated. The aqueous phase was washed several times with ethyl acetate and combined organic extracts were then washed with brine, dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (40% diethyl ether – pet. ether) yielded **(+)-9** (0.05 g, 49% yield) as a white solid, m.p. = 74.9°C.

ν_{max} / cm⁻¹: 3500, 2928, 1594, 1474, 1427, 1307, 1261, 1102, 1046, 837, 780, 682; δ_H (CDCl₃, 500 MHz): 0.00 (3H, s, (CH₃)Si), 0.02 (3H, s, (CH₃)Si), 0.72 (9H, s, (CH₃)₃CSi), 1.99 (1H, dd, J = 18.1, 4.6 Hz, H-10), 2.37-2.46 (2H, m, H-9 and H-10), 2.42 (1H, d, J = 19.0 Hz, H-8), 3.24 (1H, dd, J = 19.0, 8.5 Hz, H-8), 3.74 (3H, s, OCH₃), 3.78 (1H, d, J = 10.5 Hz, H-14), 4.05 (1H, d, J = 3.2 Hz, H-13), 4.17 (1H, d, J = 10.5 Hz, H-14), 5.06-5.08 (1H, m, H-12), 5.47-5.50 (1H, m, H-11), 6.34 (1H, d, J = 8.5 Hz, H-4), 7.23 (1H, d, J = 8.5 Hz, H-3), δ_C (CDCl₃, 125 MHz): -5.69 (2CH₃, (CH₃)₂Si), 18.02 (C, (CH₃)₃C), 25.72 (3CH₃, (CH₃)₃CSi), 31.67 (CH, C-9), 35.00 (CH, C-10), 36.91 (CH₂, C-8), 43.71 (C, C-1), 53.23 (CH₃, OCH₃), 68.35 (CH₂, C-14), 74.63 (CH, C-13), 106.73 (CH, C-4), 125.29 (CH₂, C-2), 126.50 (C, C-11), 130.75 (CH₂, C-12), 135.46 (CH, C-3), 156.76 (C, C-7), 161.48 (C, C-5); m/z (ES): 362 (MH⁺, 100%), 259 (5), 258 (28), 196 (21); C₂₀H₃₂O₃SiN [MH⁺] required 362.2151, found 362.2155; CHN Analysis required C 66.44, H 8.64, N 3.87 %, found C 66.39, H 8.94, N 3.66 %; $[\alpha]_D^{20}$ = + 134.1° (c = 0.92 g / 100 ml, CHCl₃).

(-)-1-[(*tert*-Butyldimethylsilyloxy)methyl]-5-methoxy-6-aza-tricyclo [7.3.1.0^{2,7}] trideca-2(7),3,5,11-tetraen-13-ol ((-)-9)

Potassium carbonate (0.08 g, 0.61 mmol, 3 eq.) was added to a solution of **(-)-20** (0.11 g, 0.20 mmol, 1 eq.) in methanol (5 ml) and the reaction mixture stirred at room temperature overnight. The reaction mixture was concentrated under reduced pressure and the residue redissolved in ethyl acetate (5 ml). Water (5 ml) was then added and the two phases separated. The aqueous phase was washed several times with ethyl acetate and combined organic extracts were then washed with brine, dried over MgSO₄ and concentrated under reduced pressure. Purification by flash chromatography (40% diethyl ether – pet. ether) yielded **(-)-9** (0.03 g, 41% yield) as a white solid, m.p. = 73.5°C.

ν_{max} / cm^{-1} : 3500, 2928, 1594, 1474, 1427, 1307, 1261, 1102, 1069, 837, 779, 682; δ_{H} (CDCl_3 , 500 MHz): 0.00 (3H, s, $(\text{CH}_3)\text{Si}$), 0.02 (3H, s, $(\text{CH}_3)\text{Si}$), 0.72 (9H, s, $(\text{CH}_3)_3\text{CSi}$), 2.00 (1H, dd, $J = 18.1, 4.6$ Hz, H-10), 2.37-2.46 (2H, m, H-9 and H-10), 2.42 (1H, d, $J = 19.0$ Hz, H-8), 3.24 (1H, dd, $J = 19.0, 8.5$ Hz, H-8), 3.75 (3H, s, OCH_3), 3.78 (1H, d, $J = 10.3$ Hz, H-14), 4.05 (1H, d, $J = 3.2$ Hz, H-13), 4.17 (1H, d, $J = 10.3$ Hz, H-14), 5.06-5.08 (1H, m, H-12), 5.47-5.50 (1H, m, H-11), 6.34 (1H, d, $J = 8.5$ Hz, H-4), 7.23 (1H, d, $J = 8.5$ Hz, H-3); δ_{C} (CDCl_3 , 125 MHz): -5.30 (2CH_3 , $(\text{CH}_3)_2\text{Si}$), 18.41 (C, $(\text{CH}_3)_3\text{C}$), 26.12 (3CH_3 , $(\text{CH}_3)_3\text{CSi}$), 32.06 (CH, C-9), 35.39 (CH, C-10), 37.30 (CH_2 , C-8), 44.09 (C, C-1), 53.65 (CH_3 , OCH_3), 68.75 (CH_2 , C-14), 75.04 (CH, C-13), 107.12 (CH, C-4), 125.69 (CH_2 , C-2), 126.90 (C, C-11), 131.14 (CH_2 , C-12), 135.87 (CH, C-3), 157.17 (C, C-7), 161.88 (C, C-5); m/z (ES): 362 (MH^+ , 100%), 259 (5), 258 (22), 196 (19); $\text{C}_{20}\text{H}_{32}\text{O}_3\text{SiN}$ [MH^+] required 362.2151, found 362.2161; CHN Analysis required C 66.44, H 8.64, N 3.87 %, found C 66.61, H 8.69, N 3.62 %; $[\alpha]_{\text{D}}^{20} = -132.3^\circ$ ($c = 0.70$ g / 100 ml, CHCl_3).

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