SUPPORTING INFORMATION

Synthesis of Medium-Sized Cyclic Amines by Selective Ring Cleavage of Sulfonylated Bicyclic Amines

Fátima Iradier, Ramón Gómez Arrayás, Juan Carlos Carretero*

Departamento de Química Orgánica. Facultad de Ciencias. Universidad Autónoma de Madrid. 28049 Madrid. Spain.

juancarlos.carretero@uam.es

Experimental Section

Reagents obtained from commercial source were used without further purification. THF was distilled from Na/benzophenone and CH_2Cl_2 was distilled from P_2O_5. All reactions were performed under inert Ar atmosphere. Column chromatography was carried out using Merck 60 230-400 mesh silica gel. ^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz) spectra were recorded at room temperature. Chemical shifts are reported in parts per million from the solvent resonance as the internal standard. The NOESY experiments of **5** and **6** were recorded on a 500 MHz spectrometer. Mass spectra (MS) were recorded using FAB technique. Mass data are reported in mass units (*m/z*) and values in brackets show the relative intensity from the base peak (as 100%). Compounds **1**, **2**, **3**, **10**, **12** and **14** were prepared as indicated in reference 5.

Synthesis of the starting aldehyde: 4-[N,N-Bis(*tert*-butoxycarbonyl)]butyraldehyde. To a solution of commercially available 4-aminobutyraldehyde diethyl acetal (10.0 g, 62.0 mmol) in CH_2Cl_2 (100 mL), cooled at 0ºC, was added BOC_2O (15 mL, 65 mmol). The solution was allowed to reach rt and stirred for 30 min. The solvent was evaporated, and the residue was dissolved in THF (130 mL), cooled at 0ºC, and treated with 2.5 M *n*-BuLi in hexane (26 mL, 65 mmol) for 15 min. Then, BOC_2O (15 mL, 65 mmol) was slowly added and the reaction mixture was kept at 0ºC for 30 min. Saturated aqueous NH_4Cl was added, the organic layer was separated, and the aqueous layer was extracted with CH_2Cl_2. The combined organic layers were dried over $MgSO_4$, filtered and concentrated. The residue was dissolved in a 2:1 mixture of AcOH/H_2O (150 mL) and stirred at rt for 6 h. The mixture was neutralized with saturated aqueous $NaHCO_3$ and extracted twice with CH_2Cl_2 (2 x 150 mL). The combined organic layers were dried over $MgSO_4$, filtered and concentrated to afford 4-[N,N-Bis(*tert*-butoxycarbonyl)]butyraldehyde (16.0 g, 90%) as a colorless oil: 1H NMR ($CDCl_3$) δ 9.72 (m, 1H), 3.56 (t, J = 7.0 Hz, 2H), 2.41 (t, J = 7.0 Hz, 2 H), 1.84 (quint, J = 7.0 Hz, 2H), 1.45 (s, 18H); ^{13}C NMR ($CDCl_3$) 201.0, 152.0, 152.3, 82.1, 45.1, 40.7, 27.8 (6C), 21.3.

General procedure for the reduction of esters 3 and 14. To a solution of the ester (1 mmol) in anhydrous THF (10 mL) at 0 ^{o}C, $LiAlH_4$ (1.1 mmol) was added. The reaction mixture was stirred for 30 min. Excess of $LiAlH_4$ was quenched by dropwise addition of saturated aqueous solution of potasium tartrate. The aqueous layer was extracted with CH_2Cl_2. The combined organic layers were dried over $MgSO_4$, filtered and concentrated to yield the desired alcohols.

(2*S, 3*R**)-1-[2'-(Hydroxy)ethyl]-2-[(phenylsulfonyl)methyl]-3-[(triisopropylsilyl)oxy]pyrrolidine (*cis*-4).** Following the general procedure, starting from

pyrrolidine *cis*-**3** (245 mg, 0.51 mmol), alcohol *cis*-**4** (206 mg, 92 %) was obtained as a colorless oil. ^{1}H NMR ($CDCl_3$) δ 1.01 (s, 21 H), 1.72 (dq, 1 H, *J*= 8.1, 12.9 Hz), 2.09 (m, 1 H), 2.42 (dt, 1 H, *J*= 8.1, 9.7 Hz), 2.60 (dt, 1 H, *J*= 3.6, 12.9 Hz), 2.92 (bs, 1 H), 2.97-3.10 (m, 2 H), 3.16 (dt, 1 H, *J*= 3.6, 9.7 Hz), 3.41 (dt, 1 H, *J*= 3.6, 6.9 Hz), 3.58-3.60 (m, 2 H), 3.68 (dd, 1 H, *J*= 3.6, 14.2 Hz), 4.48 (q, 1 H, *J*= 6.9 Hz), 7.54 (t, 2 H, *J*= 7.7 Hz), 7.63 (t, 1 H, *J*= 7.3 Hz), 7.90 (d, 2 H, *J*= 8.1 Hz). ^{13}C NMR ($CDCl_3$) δ 12.0, 17.8, 33.1, 49.6, 55.4, 57.1, 59.6, 62.1, 72.0, 127.5, 129.1, 133.4, 140.1. MS *m/z* 442.0 (M^++H, 100), 410.0 (53), 286.1 (12). Anal. Calcd for $C_{22}H_{39}NO_4SSi$: C, 59.82; H, 8.90; N, 3.17; S, 7.26. Found: C, 60.05; H, 9.10; N, 2.99; S, 7.58.

(2*R, 3*R**)-1-[2'-(Hydroxy)ethyl]-2-[(phenylsulfonyl)methyl]-3-[(triisopropylsilyl)oxy]pyrrolidine (*trans*-4).** Following the general procedure, starting from pyrrolidine *trans*-**3** (904 mg, 1.87 mmol), alcohol *trans*-**4** (800 mg, 97 %) was obtained as a colorless oil. ^{1}H NMR ($CDCl_3$) δ 1.05 (s, 21 H), 1.86-1.95 (m, 2 H), 2.66-2.77 (m, 2 H), 2.99-3.16 (m, 4 H), 3.22-3.26 (m, 1 H), 3.48-3.63 (m, 2 H), 4.46-4.48 (m, 1 H), 7.56 (t, 2 H, *J*= 6.9 Hz), 7.65 (t, 1 H, *J*= 7.3 Hz), 7.92 (d, 2 H, *J*= 6.9 Hz). ^{13}C NMR ($CDCl_3$) δ 11.8, 17.8, 33.7, 51.0, 58.3, 59.5, 59.8, 68.7, 76.4, 127.5, 129.1, 133.4, 140.1. MS *m/z* 442.1 (M^++H, 100), 410.1 (50), 286.2 (14). Anal. Calcd for $C_{22}H_{39}NO_4SSi$: C, 59.82; H, 8.90; N, 3.17; S, 7.26. Found: C, 60.06; H, 9.27; N, 3.16; S, 7.56.

(2*R, 3*R**)-2-[(Phenylsulfonyl)methyl]-3[(triisopropylsilyl)oxy]-1-[3'-(hydroxy)propyl]piperidine (15)**. Following the general procedure, starting from **14** (219 mg, 0.44 mmol), alcohol **15** (198 mg, 96 %) was obtained. ^{1}H NMR ($CDCl_3$) δ 1.09 (s, 21 H), 1.32-1.40 (m, 2 H), 1.52-1.79 (m, 3 H), 1.93 (tt, 1 H, *J*= 4.0, 12.5 Hz), 2.06 (dq, 1 H, *J*= 2.4, 12.1 Hz), 2.35 (ddd, 1 H, *J*= 3.2, 10.5, 12.5 Hz), 2.57 (dt, 1 H, *J*= 4.4, 12.5 Hz), 2.79 (dt, 1 H, *J*= 4.0, 11.7 Hz), 3.06 (dd, 1 H, *J*= 8.5, 14.5 Hz), 3.24 (dd, 1 H, *J*= 2.4, 14.5 Hz), 3.46 (dt, 1 H, *J*= 2.4, 8.5 Hz), 3.62-3.73 (m, 2 H), 4.12-4.15 (m, 1 H),

7.59 (t, 2 H, *J*= 7.3 Hz), 7.68 (t, 1 H, *J*= 7.3 Hz), 7.93 (d, 2 H, *J*= 6.9 Hz). ^{13}C NMR ($CDCl_3$) δ 12.1, 18.0, 19.2, 26.7, 27.5, 45.4, 51.2, 55.1, 60.6, 64.2, 68.4, 127.8, 129.4, 133.8, 139.5. MS *m/z* 470.2 (M^++H, 100), 328.2 (55). Anal. Calcd for $C_{24}H_{43}NO_4SSi$: C, 61.36; H, 9.23; N, 2.98; S, 6.83. Found: C, 61.49; H, 9.57; N, 2.93; S, 7.18.

General procedure for cyclization of alcohols 4 and 15. To a solution of the alcohol (1 mmol) in CH_2Cl_2 (10 mL) cooled to 0 ^{o}C, Et_3N (1.2 mmol) and MsCl (1.2 mmol) were added. The reaction mixture was stirred for 20 min and then quenched with saturated aqueous solution of NH_4Cl. The aqueous layer was extracted with CH_2Cl_2 and the combined organic layers were dried over $MgSO_4$, filtered and concentrated at reduced pressure. The residue was dissolved in THF (10 mL), at 0 ^{o}C, and a solution of LHMDS 0.5 M in THF (1.3 mmol) was added. The mixture was stirred at 0 ^{o}C for 1.5 h and quenched with saturated aqueous solution of NH_4Cl. The aqueous layer was extracted with CH_2Cl_2. The combined organic layers were dried over $MgSO_4$, filtered and evaporated under reduced pressure. The residue was purified by flash chromatography using the eluent indicated in each case.

(1*R, 7*R**, 7a*S**)-1-(Phenylsulfonyl)-7-[(triisopropylsilyl)oxy]pyrrolizidine (5)**. Following the general procedure, starting from *cis*-**4** (70 mg, 0.16 mmol), pyrrolizidine **5** (58 mg, 86 %) was obtained after column chromatography (AcOEt: Hex 5:1) as a colorless oil. ^{1}H NMR ($CDCl_3$) δ 1.03 (s, 21 H, TIPS), 1.61-1.74 (m, 1 H, H-6), 2.05-2.15 (m, 1 H, H-6'), 2.49 (dt, 1 H, *J*= 7.3, 9.3 Hz, H-5), 2.83 (dt, 1 H, *J*= 6.5, 12.9 Hz, H-3), 3.00-3.15 (m, 3 H, H-2, H-2', H-5'), 3.44 (dt, 1 H, *J*= 3.6, 6.5 Hz, H-7a), 3.50 (t, 1 H, *J*= 6.5 Hz, H-3'), 3.77 (dd, 1 H, *J*= 3.6, 14.5 Hz, H-1), 4.46 (q, 1 H, *J*= 6.9 Hz, H-7), 7.56 (t, 2 H, *J*= 7.3 Hz, Ph), 7.64 (t, 1 H, *J*= 7.3 Hz, Ph), 7.92 (d, 2 H, *J*= 6.9 Hz, Ph). ^{13}C NMR ($CDCl_3$) δ 12.2, 18.0, 33.6, 42.3, 50.0, 55.9, 56.4, 61.6, 72.1, 127.7, 129.2, 133.4, 140.6. MS *m/z* 424.0 (M^++H, 16.2), 55 (100). Anal. Calcd for

$C_{22}H_{37}NO_3SSi$: C, 62.37; H, 8.80; N, 3.31; S, 7.57. Found: C, 62.70; H, 8.90; N, 3.10; S, 7.93.

(1*S, 7*R**, 7a*R**)-1-(Phenylsulfonyl)-7-[(triisopropylsilyl)oxy]pyrrolizidine (6)**. Following the general procedure, from alcohol *trans*-**4** (1.47 g, 3.33 mmol), pyrrolizidine **6** (985 mg, 70 %) was obtained after column chromatography (AcOEt) as a white solid. Mp 47-48 ºC. ^{1}H NMR ($CDCl_3$) δ 1.06 (s, 21 H, TIPS), 1.75-1.90 (m, 2 H, H-6), 1.97 (dq, 1 H, *J*= 6.9, 14.1 Hz, H-2), 2.16 (dq, 1 H, *J*= 6.9, 14.1 Hz, H-2'), 2.54-2.63 (m, 2 H, H-3, H-5), 3.11-3.15 (m, 1 H, H-1), 3.18 (d, 1 H, *J*= 6.9 Hz, H-3'), 3.26 (ddd, 1 H, *J*= 6.5, 8.9, 15.0 Hz, H-5'), 3.71 (dd, 1 H, *J*= 2.0, 6.9 Hz, H-7a), 4.37 (quint, 1 H, *J*= 2.0 Hz, H-7), 7.56 (t, 2 H, *J*= 7.3 Hz, Ph), 7.66 (t, 1 H, *J*= 7.3 Hz, Ph), 7.92 (d, 2 H, *J*= 6.9 Hz, Ph). ^{13}C NMR ($CDCl_3$) δ 12.2, 18.1, 28.0, 33.6, 52.8, 54.0, 67.4, 73.3, 77.7, 128.9, 129.2, 133.8, 138.0. MS *m/z* 424.0 (M^++H, 100), 282.0 (8). Anal. Calcd for $C_{22}H_{37}NO_3SSi$: C, 62.37; H, 8.80; N, 3.31; S, 7.57. Found: C, 62.23; H, 8.70; N, 3.07; S, 7.67.

(1*R, 9*R**, 9a*R**)-1-(Phenylsulfonyl)-9-[(triisopropylsilyl)oxy]quinolizidine (16)**. Following the general procedure, from alcohol **15** (159 mg, 0.34 mmol) quinolizidine **16** (82 mg, 54 %) was obtained after flash chromatography (Hex: AcOEt 2:1) as a colorless oil. ^{1}H NMR ($CDCl_3$) δ 0.99 (s, 21 H), 1.41-1.76 (m, 5 H), 2.06-2.11 (m, 3 H), 2.58-2.63 (m, 1 H), 2.82-2.93 (m, 3 H), 3.32 (dd, 1 H, *J*= 2.4, 8.9 Hz), 3.66-3.68 (m, 1 H), 4.10 (dt, 1 H, *J*= 3.2, 8.9 Hz), 7.50 (t, 2 H, *J*= 6.9 Hz), 7.60 (t, 1 H, *J*= 7.3 Hz), 7.89 (d, 2 H, *J*= 7.3 Hz). ^{13}C NMR ($CDCl_3$) δ 12.7, 18.1, 19.8, 20.2, 20.6, 34.9, 47.1, 53.1, 57.9, 60.9, 63.6, 128.6, 128.8, 133.2, 139.2. MS *m/z* 452.1 (M^++H, 100), 310.2 (71), 136.1 (45). Anal. Calcd for $C_{24}H_{41}NO_3SSi$: C, 63.81; H, 9.15; N, 3.10; S, 7.10. Found: C, 63.94; H, 9.28; N, 3.10; S, 7.36.

(1*S*, 7*R***, 7a*R***)-1-(Hydroxymethyl)-1-(phenylsulfonyl)-7-[(triisopropyl-silyl)oxy]pyrrolizidine and (1*R***, 7*R***, 7a*R***)-1-(hydroxymethyl)-1-(phenylsulfo-nyl)-7-[(triisopropyl-silyl)oxy]pyrrolizidine (8)**. To a solution of pyrrolizidine **6** (80 mg, 0.19 mmol) in THF (2.0 mL) at 0 ^{o}C *n*-BuLi 2.0 M in hexane (0.28 mmol, 142 μL) was added. The solution was stirred for 15 min and then dry formaldehyde (generated from paraformaldehyde) was bubbled through the reaction mixture. After 2 h saturated aqueous solution of NH_4Cl was added. The aqueous layer was extracted with CH_2Cl_2 and the combined organic layers were dried over $MgSO_4$, filtered and evaporated in *vacuo*. The residue was purified by column chromatography (AcOEt: acetone 50:1) to afford pyrrolizidines **8** as a colorless oil (5:1 mixture of epimers at C-1, 55 mg, 64 %). Spectroscopical data for the major isomer: ^{1}H NMR ($CDCl_3$) δ 1.01 (s, 21 H), 1.86 (dt, 1 H, *J*= 6.9, 12.5 Hz), 1.96-2.11 (m, 2 H), 2.41 (dt, 1 H, *J*= 6.9, 13.7 Hz), 2.64 (dq, 2 H, *J*= 6.9, 10.5 Hz), 3.14 (dt, 1 H, *J*= 6.9, 10.5 Hz), 3.25 (dt, 1 H, *J*= 6.9, 10.5 Hz), 3.78 (d, 1 H, *J*= 4.4 Hz), 3.80 (d, 1 H, *J*= 12.9 Hz), 4.11 (d, 1 H, *J*= 12.9 Hz), 4.50 (q, 1 H, *J*= 5.7 Hz), 7.56 (t, 2 H, *J*= 7.3 Hz), 7.66 (t, 1 H, *J*= 7.3 Hz), 7.98 (d, 2 H, *J*= 7.3 Hz). ^{13}C NMR ($CDCl_3$) δ 12.5, 18.0, 31.0, 35.4, 52.5, 52.9, 62.2, 73.1, 74.3, 75.4, 129.1, 130.5, 134.2, 135.5. MS *m/z* 454.2 1 (M^++H, 100), 312.2 (10), 112.1 (94). Anal. Calcd for $C_{23}H_{39}NO_4SSi$: C, 60.89; H, 8.66; N, 3.09; S, 7.07. Found: C, 60.72; H, 8.24; N, 2.93; S, 6.65.

General procedure for the ring cleavage reaction. To a solution of the corresponding bicyclic amine (1 mmol) in CH_2Cl_2 or CH_3CN (10 mL), the alkylating reagent [MeI (5 mmol), MeOTf (2 mmol) or BnBr (2 mmol)] was added. The reaction mixture was stirred at room temperature or at reflux (in the case of BnBr) for the time indicated in each case (until complete disappearance of the starting amine by tlc control). The solvent was evaporated *in vacuo* to give the crude ammonium salt. A

solution of this ammonium salt (1 mmol) in MeOH (10 mL) was added to a mixture of Na-Hg 6% (2.5 g/mmol of amine) and Na_2HPO_4 (14 mmol). The reaction mixture was stirred for the time indicated in each case. The reaction was quenched by addition of NaOH 1% and the aqueous layer was extracted with CH_2Cl_2. The combined organic layers were dried over $MgSO_4$, filtered and evaporated under reduced pressure. The residue was purified by flash chromatography using the eluent indicated in each case.

(*Z*)-1-Methyl-4-[(triisopropylsilyl)oxy]-1-azacyclooct-5-ene (7).

Method A: Reaction of sulfone **5** (40 mg, 0.095 mmol) with MeI (0.48 mmol) in CH_2Cl_2 overnight afforded the ammonium salt. The reaction of this salt with Na-Hg for 6 h gave **7** (20 mg, 70 %) after column chromatography (AcOEt).

Method B: Reaction of sulfone **6** (50 mg, 0.12 mmol) with MeOTf (0.24 mmol) in CH_2Cl_2 for 4 h yielded the ammonium salt. The reaction of this salt with Na-Hg for 6 h gave **7** (25 mg, 71 %) after column chromatography (AcOEt).

^{1}H NMR (C_6D_6) δ 1.22 (s, 21 H), 1.48 (ddt, 1 H, *J*= 3.2, 10.5, 12.9 Hz), 1.81-1.89 (m, 1 H), 2.17-2.34 (m, 3 H), 2.28 (s, 3 H), 2.42-2.51 (m, 3 H), 5.01 (m, 1 H), 5.58 (ddt, 1 H, *J*= 1.6, 7.7, 10.9 Hz) 5.77 (ddd, 1 H, *J*= 1.6, 7.3, 10.9 Hz). ^{13}C NMR (C_6D_6) δ 12.6, 18.3, 29.3, 39.4, 46.6, 53.8, 58.5, 69.5, 126.4, 136.9. MS *m/z* 298.3 (M^++H, 100), 124.1 (48). Anal. Calcd for $C_{17}H_{35}NOSi$: C, 68.62; H, 11.86; N, 4.71. Found: C, 68.93; H, 11.88; N, 4.67.

(*E*)-6-(Hydroxymethyl)-1-methyl-4-[(triisopropylsilyl)oxy]-1-azacyclooct-5-ene (9). Reaction of **8** (46 mg, 0.10 mmol) with MeI (0.50 mmol) overnight produced the ammonium salt. Treatment of this salt with Na-Hg for 6 h afforded **9** (22 mg, 67 %) after column chromatography (AcOEt:acetone 1:1). ^{1}H NMR ($CDCl_3$) δ 1.03 (s, 21 H), 1.35-1.55 (m, 2 H), 1.95-2.18 (m, 2 H), 2.40 (s, 3 H), 2.45-2.73 (m, 4 H), 3.84 (d, 1 H,

J= 11.8 Hz), 3.92 (d, 1 H, *J*= 12.4 Hz), 4.46 (m, 1 H), 5.30 (m, 1 H). ^{13}C NMR ($CDCl_3$) δ 12.2, 18.0, 28.1, 39.0, 46.1, 52.8, 58.0, 69.3, 72.3, 125.9, 136.8.

(*Z*)-1-Benzyl-8-methylen-4-[(triisopropylsilyl)oxy]-1-azacyclonon-5-ene (11). Reaction of **10** (60 mg, 0.13 mmol) with benzyl bromide (0.26 mmol) in CH_3CN at reflux for 6 h afforded the ammonium salt. The reaction of this salt with Na-Hg for 5 h gave **11** (40 mg, 75 %) after column chromatography (Hex:AcOEt 1:10). ^{1}H NMR ($CDCl_3$) δ 1.07 (s, 21 H), 2.08 (tt, 2 H, *J*= 4.0, 12.9 Hz), 2.30 (dq, 1 H, *J*= 2.4, 13.3 Hz), 2.52 (dt, 2 H, *J*= 4.0, 13.3 Hz), 2.76 (d, 1 H, *J*= 13.7 Hz), 3.04 (t, 1 H, *J*= 11.3 Hz), 3.14 (d, 1 H, *J*= 13.7 Hz), 3.28 (d, 1 H, *J*= 13.3 Hz), 3.90 (d, 1 H, *J*= 13.3 Hz), 4.80 (d, 1 H, *J*= 1.6 Hz), 4.88 (d, 1 H, *J*= 1.2 Hz), 5.22-5.33 (m, 2 H), 5.53 (q, 1 H, *J*= 10.1 Hz). ^{13}C NMR ($CDCl_3$) δ 12.4, 18.1, 30.7, 34.6, 49.0, 59.2, 60.5, 68.3, 112.5, 126.9, 128.2, 128.8, 133.6, 139.7, 147.9. MS *m/z* 400.3 (M^++H, 44), 226.2 (22.2), 91.0 (100). Anal. Calcd for $C_{25}H_{41}NOSi$: C, 75.13; H, 10.34; N, 3.50. Found: C, 75.31; H, 10.45; N, 3.48.

(3*R, 7*R**)-(*Z*)-1-Methyl-7-[(triisopropylsilyl)oxy]-1-azacyclonon-5-en-3-ol [(*Z*)-13] and (3*R**, 7*R**)-(*E*)-1-methyl-7-[(triisopropylsilyl)oxy]-1-azacyclonon-5-en-3-ol [(*E*)-13]**. Reaction of **12** (100 mg, 0.22 mmol) with MeI (1.1 mmol) in CH_2Cl_2 overnight afforded the ammonium salt. This salt reacted with Na-Hg for 5 h to yield (*Z*)-**13** (14 mg, 44 %) and (*E*)-**13** (12 mg, 38 %) after column chromatography (Hex:AcOEt 1:5).

(*Z*)-**13**: ^{1}H NMR ($CDCl_3$) δ 1.06 (s, 21 H), 1.78-1.94 (m, 2 H), 2.11-2.18 (m, 1 H), 2.23-2.24 (m, 1 H), 2.28 (s, 3 H), 2.42 (d, 1 H, *J*= 10.9 Hz), 2.48-2.68 (m, 2 H), 2.79 (dt, 1 H, *J*= 2.8, 10.5 Hz), 3.96 (m, 1 H), 4.88 (t, 1 H, *J*= 8.1 Hz), 5.39 (dt, 1 H, *J*= 6.1, 10.9 Hz), 5.71 (dd, 1 H, *J*= 8.1, 10.9 Hz). ^{13}C NMR ($CDCl_3$) δ 12.2, 18.0, 32.2, 37.4, 43.6, 55.8, 58.0, 67.3, 68.8, 120.1, 140.2. MS *m/z* 328.3 (M^++H, 31), 154.1 (49), 58.0 (100). Anal.

Calcd for $C_{18}H_{37}NO_2Si$: C, 66.00; H, 11.38; N, 4.28. Found: C, 66.28; H, 11.57; N, 4.68.

(*E*)-**13**: ^{1}H NMR ($CDCl_3$) δ 1.06 (s, 21 H), 1.47 (dt, 1 H, *J*= 10.1, 13.3 Hz), 1.82 (dt, 1 H, *J*= 5.2, 13.3 Hz), 2.13-2.22 (m, 2 H), 2.30 (s, 3 H), 2.42 (dd, 1 H, *J*= 9.7, 14.1 Hz), 2.57-2.64 (m, 2 H), 2.71 (dd, 1 H, *J*= 6.5, 14.1 Hz), 3.67-3.72 (m, 1 H), 4.18 (dt, 1 H, *J*= 5.7, 8.5 Hz), 5.35 (td, 1 H, *J*= 7.7, 16.2 Hz), 5.71 (dd, 1 H, *J*= 8.5, 16.6 Hz). ^{13}C NMR ($CDCl_3$) δ 12.2, 18.0, 37.2, 38.6, 46.4, 57.0, 62.2, 65.7, 76.4, 121.0, 136.7. MS *m/z* 328.3 (M^++H, 100), 154.1 (12). Anal. Calcd for $C_{18}H_{37}NO_2Si$: C, 66.00; H, 11.38; N, 4.28. Found: C, 66.04; H, 11.17; N, 4.46.

(*E*)-1-Methyl-5-[(triisopropylsilyl)oxy]-1-azacyclodec-6-ene (17). Reaction of **16** (70 mg, 0.16 mmol) with MeOTf (0.32 mmol) overnight gave the ammonium salt. Treatment of this salt with Na-Hg for 8 h afforded **17** (32 mg, 64 %) after flash chromatography (AcOEt). ^{1}H NMR ($CDCl_3$) δ 0.98 (s, 21 H), 1.24-1.38 (m, 2 H), 1.62-1.89 (m, 5 H), 1.96-2.08 (m, 1 H), 2.10 (s, 3 H), 2.28 (dd, 2 H, *J*= 2.7, 8.1 Hz), 2.42-2.68 (m, 2 H), 4.22-4.30 (m, 1 H), 5.40 (dd, 1 H, *J*= 8.1, 15.8 Hz), 5.58-5.71 (m, 1 H). ^{13}C NMR ($CDCl_3$) δ 12.2, 18.0, 26.0. 29.2, 31.7, 33.6, 40.8, 51.9, 53.7, 72.2, 115.4, 140.1.