Supporting Information

Total Synthesis of the Putative Structure of Stemonidine: The Definitive Proof of Misassignment

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General Procedures. Commercially available reagents were used as received. The solvents were dried by distillation over the appropriate drying agents. All reactions were performed avoiding moisture by standard procedures and under nitrogen atmosphere and monitored by analytical thin-layer chromatography (TLC) using silica gel 60 F₂₅₄ pre-coated aluminum plates (0.25 mm thickness). Flash column chromatography was performed using silica gel 60 Å, particle size 35-70 µm. ¹HNMR spectra were recorded on Bruker DPX250 (250 MHz), Bruker DPX360 (360 MHz), Bruker ARX400 (400 MHz), and Bruker AVANCE500 (500 MHz) spectrometers. Proton chemical shifts are reported in ppm (δ) (CDCl₃, δ 7.26 ppm). ¹³CNMR spectra were recorded on Bruker DPX250 (62.5 MHz), Bruker DPX360 (90 MHz), Bruker ARX400 (100 MHz) and Bruker AVANCE500 (125 MHz) spectrometers with complete proton decoupling. Carbon chemical shifts are reported in ppm (δ) (CDCl₃, δ 77.0). NMR signals were assigned with the help of PENDANT, COSY, HSQC, HMBC, and NOESY experiments. Infrared spectra were recorded on a Sapphire-ATR Spectrophotometer; peaks are reported in cm⁻¹. Optical rotation values were measured on an UV-vis Jasco J-175. High resolution mass spectra (HRMS) were recorded at Micromass-AutoSpec using (CI+). Enantiomeric purity of compound **4** was determined by CHPLC on a Waters 2690 chromatograph using a Daicel Chiralpak AD-H 4.6 x 250 mm column (iPrOH/hexanes, 1/99; 0.8 mL·min⁻¹).

(S)-2-*tert*-Butyldiphenylsilyloxymethyl-3,4-dihydro-2*H*-pyrrole 1-oxide (6)

NaHCO₃ (5.70 g, 67.9 mmol) was added to a stirred solution of amine **9** (4.60 g, 13.6 mmol) in a mixture of acetonitrile-THF (4:1, 25 mL) and Na₂EDTA (0.01 M, 19 mL). The mixture was then cooled in an ice bath and Oxone® (8.76 g, 14.3 mmol) was added portionwise over 2 h. The mixture was stirred at 0 °C for 20 min and then diluted with EtOAc (25 mL). The two phases were separated and the aqueous one was extracted with CH₂Cl₂ (3x40 mL). The combined organic extracts were dried over anhydrous MgSO₄ and concentrated under reduced pressure to afford a yellow oil identified as a 1.3:1 mixture of nitrones **6** and **10** (4.30 g, 12.2 mmol, 90% yield). The

ratio **6:10** was determined by ^1H -NMR. Pure samples of both nitrones **10** (first eluted) and **6** (second eluted) can be obtained by flash chromatography ($\text{CHCl}_3/\text{MeOH}$ 40:1).

10: ^1H NMR (250 MHz, CDCl_3): δ 7.62 (m, 4H), 7.38 (m, 6H), 4.67 (m, 2H:2H_{1'}), 3.94 (m, 2H:2H₂), 2.86 (m, 2H:2H₄), 2.08 (m, 2H:2H₃), 1.07 (s, 9H:C(CH₃)₃); ^{13}C -NMR (62.5 MHz, CDCl_3): δ 148.6 (C₅), 135.4 (C_{Ph}), 132.4 (C_{Ph}), 129.9 (C_{Ph}), 127.7 (C_{Ph}), 62.6 (C_{1'}), 59.7 (C₂), 29.5 (C₄), 26.7 (C(CH₃)₃), 19.1 (C(CH₃)₃), 17.0 (C₃).

6: $[\alpha]_{\text{D}}^{20} = -13$ (c 1.56, CH_2Cl_2), IR (ATR): 3070, 3048, 2930, 2856, 1587, 1471, 1462, 1427, 1245, 1205, 1111, 1082, 1034, 1009; ^1H NMR (250 MHz, CDCl_3): δ 7.66 (m, 4H), 7.40 (m, 6H), 6.98 (bs, 1H:H₅), 4.41 (dd, $J = 10.8, 2.3$ Hz, 1H:H_{1'}), 3.99 (m, 1H:H₂), 3.69 (bd, $J = 10.8$ Hz, 1H:H_{1'}), 2.70 (m, 2H:2H₄), 2.33 (m, 2H:2H₃), 1.04 (s, 9H:C(CH₃)₃); ^{13}C -NMR (62.5 MHz, CDCl_3): δ 135.5 (C₅), 135.3 (C_{Ph}), 133.1 (C_{Ph}), 132.4 (C_{Ph}), 129.6 (C_{Ph}), 127.6 (C_{Ph}), 73.6 (C₂), 62.0 (C_{1'}), 27.3 (C₄), 26.6 (C(CH₃)₃), 21.2 (C₃), 19.1 (C(CH₃)₃); HRMS (CI⁺): calcd for C₂₁H₂₇NNaO₂Si: 376.1703 [M+Na]⁺; found 376.1691.

Methyl (2*S*,3*R*,3*aS*,6*S*)-6-(*tert*-butyldiphenylsilyloxy)methyl-2-(2-methoxycarbonyl)ethyl-perhydropyrrolo[1,2-*b*]isoxazole-3-carboxylate (4**) and its (2*R*,3*S*,3*aS*,6*S*) isomer (**11**)**

A solution of nitrone **6** (1.00 g, 2.83 mmol) and olefin **5** (536 mg, 3.12 mmol) in toluene (15 mL) was heated at reflux for 10 h. Removal of the solvent and flash chromatography of the crude material (hexanes/EtOAc 4:1) afforded the following fractions: i) recovered **5** (31 mg, 0.18 mmol) as an oil; ii) exo adduct **11** (71 mg, 0.14 mmol, 5% yield) as an oil; and iii) endo adduct **4** (1.160 g, 2.21 mmol, 78% yield) as an oil.

11: $[\alpha]_{\text{D}}^{20} = -48$ (c 1.60, CH_2Cl_2), IR (ATR): 3071, 3049, 2951, 2931, 2857, 1736, 1461, 1428, 1360, 1262, 1198, 1169, 1110, 1007; ^1H NMR (360 MHz, CDCl_3): δ 7.66 (m, 4H), 7.39 (m, 6H), 4.13 (dt, $J = 8.4, 4.0$ Hz, 1H:H₂), 3.97 (q, $J \approx 6.4$ Hz, 1H:H_{3a}), 3.77 (dd, $J = 9.8, 4.5$ Hz, 1H:H_{1''}), 3.71 (s, 3H:OCH₃), 3.66 (s, 3H:OCH₃), 3.54 (dd, $J = 9.8, 7.2$ Hz, 1H:H_{1''}), 3.47 (m, 1H:H₆), 2.76 (dd, $J = 8.7, 5.9$ Hz, 1H:H₃), 2.44 (m, 2H:2H_{2'}), 2.13 (m, 3H:H₄, H₅, H_{1'}), 1.82 (m, 3H:H₄, H₅, H_{1'}),

1.05 (s, 9H:C(CH₃)₃); ¹³C NMR (90 MHz, CDCl₃): δ 173.4 (CO₂CH₃), 171.6 (CO₂CH₃), 135.6 (C_{Ph}), 133.5 (C_{Ph}), 133.4 (C_{Ph}), 129.6 (C_{Ph}), 127.6 (C_{Ph}), 80.4 (C₂), 69.4 (C_{3a}), 69.1 (C₆), 65.5 (C_{1''}), 58.7 (C₃), 52.2 (CO₂CH₃), 51.6 (CO₂CH₃), 30.6 (C_{2'}), 30.0 (C₄), 28.6 (C_{1'}), 26.9 (C₅), 26.8 (C(CH₃)₃), 19.2 (C(CH₃)₃); HRMS (CI⁺): calcd for C₂₉H₃₉NNaO₆Si: 548.2439 [M+Na]⁺; found 548.2428.

4: [α]_D²⁰ = -90 (c 2.06, CH₂Cl₂); IR (ATR): 3070, 3048, 2951, 2878, 1737, 1429, 1362, 1173, 1112; ¹H NMR (360 MHz, CDCl₃): δ 7.66 (m, 4H), 7.42 (m, 6H), 4.18 (ddd, *J* = 9.3, 8.2, 3.8 Hz, 1H:H₂), 3.98 (bq, *J* ≈ 8.1 Hz, 1H:H_{3a}), 3.86 (dd, *J* = 10.1, 4.8 Hz, 1H:H_{1''}), 3.70 (s, 3H:CO₂CH₃), 3.65 (s, 3H:CO₂CH₃), 3.60 (dd, *J* = 10.1, *J* = 7.3 Hz, 1H:H_{1''}), 3.25 (m, 1H:H₆), 3.13 (t, *J* = 9.3 Hz, 1H:H₃), 2.42 (m, 2H:2H_{2'}), 2.05 (m, 2H:H₅, H_{1'}), 1.85 (m, 2H:H₄, H_{1'}), 1.53 (m, 2H:H₄, H₅), 1.05 (s, 9H:C(CH₃)₃); ¹³C NMR (90 MHz, CDCl₃): δ 173.5 (CO₂CH₃), 170.7 (CO₂CH₃), 135.60 (C_{Ph}), 135.58 (C_{Ph}), 133.7 (C_{Ph}), 133.6 (C_{Ph}), 129.58 (C_{Ph}), 129.56 (C_{Ph}), 127.59 (C_{Ph}), 127.58 (C_{Ph}), 75.4 (C₂), 68.8 (C₆), 66.6 (C_{1''}), 66.2 (C_{3a}), 56.1 (C₃), 51.9 (CO₂CH₃), 51.6 (CO₂CH₃), 30.5 (C_{2'}), 27.34 (C₅/C_{1'}), 27.33 (C₅/C_{1'}), 27.0 (C₆), 26.8 (C(CH₃)₃), 19.2 (C(CH₃)₃); HRMS (CI⁺): calcd for C₂₉H₃₉NNaO₆Si: 548.2439 [M+Na]⁺; found 548.2424.

Methyl (3*S*,8*S*,9*R*,9*aS*)-3-(*tert*-butyldiphenylsilyloxy)methyl-8-hydroxy-5-oxoperhydro-1*H*-pyrrolo[1,2-*a*]azepine-9-carboxylate (3**)**

To a solution of **4** (7.95 g, 15.12 mmol) in AcOH (40 mL), Zn (21.39 g, 0.33 mol) was added. After 1.5 h, the reaction mixture was filtered through Celite®. The organic solvent was evaporated under vacuum. The resulting oil was dissolved in CHCl₃ (30 mL) and washed with aqueous NH₃. The aqueous layer was extracted with CHCl₃ (2x15 mL). The combined organic extracts were dried over anhydrous MgSO₄ and concentrated. The residue was dissolved in toluene (40 mL) and the solution was heated at reflux for 16 h. Then, the solution was concentrated *in vacuo* and the crude product was purified by flash column chromatography on silica gel (EtOAc:hexanes 4:1) to furnish alcohol **3** (6.29 g, 12.69 mmol, 84% yield): *R*_f = 0.25 (EtOAc); [α]_D²⁰ = -57 (c 0.95, CH₂Cl₂); IR

(ATR): 3370, 3070, 3049, 2951, 2931, 2857, 1731, 1620, 1450, 1427, 1391, 1289, 1265, 1107; **¹H NMR** (360 MHz, CDCl₃): δ 7.61 (m, 4H), 7.38 (m, 6H), 4.21 (dt, $J = 8.4, 4.1$ Hz, 1H:H₃), 3.92 (d, $J = 9.3$ Hz, 1H:H_{9a}), 3.81 (m, 1H:H₈), 3.77 (m, 2H:2H₁₀), 3.70 (s, 3H:OCH₃), 2.96 (d, $J = 4.9$ Hz, 1H:H₉), 2.51 (m, 3H:H₁, H₆, OH), 2.26 (m, 2H:H₆, H₇), 1.92 (m, 3H:H₁, H₂, H₇), 1.73 (m, 1H:H₂), 1.04 (s, 9H:C(CH₃)₃); **¹³C NMR** (90 MHz, CDCl₃): δ 171.8 (C₅), 171.3 (CO₂CH₃), 135.6 (C_{Ph}), 135.5 (C_{Ph}), 133.7 (C_{Ph}), 133.5 (C_{Ph}), 129.69 (C_{Ph}), 129.65 (C_{Ph}), 127.69 (C_{Ph}), 127.66 (C_{Ph}), 73.8 (C₈), 63.6 (C₁₀), 60.1 (C₃), 57.0 (C_{9a}), 54.9 (C₉), 52.0 (OCH₃), 33.9 (C₆), 31.7 (C₁), 27.6 (C₇), 26.9 (C(CH₃)₃), 25.5 (C₂), 19.2 (C(CH₃)₃); HRMS (CI⁺): calcd for C₂₈H₃₈NO₅Si: 496.2514 [M+H]⁺; found 496.2512.

Methyl (3*S*,9*aS*)-3-(*tert*-butyldiphenylsilyloxy)methyl-5-oxo-2,3,5,6,7,9*a*-hexahydro-1*H*-pyrrolo[1,2-*a*]azepine-9-carboxylate (12**)**

To a solution of alcohol **3** (1.67 g, 3.37 mmol), PPh₃ (1.15 g, 4.39 mmol), and benzoic acid (0.54 g, 4.39 mmol) in anhydrous THF (30 mL), DIAD (0.86 mL, 4.39 mmol) was slowly added. TLC analysis of the reaction mixture (EtOAc) showed that starting **2** was consumed after 1.5 h. The organic solvent was removed under vacuum and the resulting oil was purified by flash column chromatography on silica gel (EtOAc:hexanes 2:1) to afford **12** (1.42 g, 2.97 mmol, 88% yield): $R_f = 0.58$ (EtOAc); $[\alpha]_D^{20} = -159$ (c 0.78, CH₂Cl₂); **IR** (ATR): 2931, 2856, 1714, 1644, 1427, 1254, 1216, 1105; **¹H NMR** (250 MHz, CDCl₃): δ 7.63 (m, 4H), 7.37 (m, 6H), 6.68 (m, 1H:H₈), 4.86 (m, 1H:H_{9a}), 4.30 (m, 1H:H₃), 3.86 (m, 2H:2H₁₀), 3.73 (s, 3H: CO₂CH₃), 2.67 (qd, $J = 13.6, 4.4$ Hz, 1H:H₆), 2.48 (m, 4H:H₁, H₆, 2H₇), 1.91 (m, 3H:H₁, 2H₂), 1.06 (s, 9H:C(CH₃)₃); **¹³C NMR** (62.5 MHz, CDCl₃): δ 172.2 (CO₂CH₃), 168.7 (C₅), 139.2 (C₈), 135.5 (C_{Ph}), 135.0 (C₉), 133.6 (C_{Ph}), 133.5 (C_{Ph}), 129.6 (C_{Ph}), 127.6 (C_{Ph}), 63.6 (C₁₀), 60.2 (C₃), 56.9 (C_{9a}), 51.8 (CO₂CH₃), 34.6 (C₆), 31.2 (C₁), 26.9 (C(CH₃)₃), 25.2 (C₂), 24.7 (C₇), 19.2 (C(CH₃)₃); HRMS (CI⁺): calcd for C₂₈H₃₇NO₄Si: 478.2408 [M+H]⁺; found, 478.2403.

Methyl (3*S*,8*R*,9*S*,9*aS*)-3-(*tert*-butyldiphenylsilyloxy)methyl-8,9-dihydroxy-5-oxooctahydro-1*H*-pyrrolo[1,2-*a*]azepine-9-carboxylate (13**)**

NMO (400 mg, 3.42 mmol) and OsO₄ (2.5% in ^tBuOH, 1.3 mL, 0.11 mmol) were added to a solution of olefin **12** (1.26 g, 2.63 mmol) in acetone:water (9:1, 25 mL) at 60 °C. TLC analysis of the reaction mixture showed that starting **12** was consumed after 1.5 h. The reaction mixture was quenched by addition of NaHSO₃, the organic solvent was evaporated under vacuum, and the aqueous layer was extracted with CH₂Cl₂ (4x7 mL). The combined organic extracts were dried over anhydrous MgSO₄ and concentrated. The yellowish oily residue was purified by flash column chromatography on silica gel to furnish **13** (1.24 g, 2.42 mmol, 92% yield) as a colorless oil: *R*_f = 0.33 (EtOAc); [α]_D²⁰ = -59 (*c* 2.06, CH₂Cl₂); IR (ATR): 3323, 2930, 2856, 1728, 1616, 1427, 1237, 1105; ¹H NMR (360 MHz, CDCl₃): δ 7.60 (m, 4H), 7.37 (m, 6H), 4.34 (d, *J* = 8.8 Hz, 1H:H_{9a}), 4.09 (m, 1H:H₃), 3.97 (s, 1H:OH), 3.86 (m, 1H:H₈), 3.82 (dd, *J* = 9.9, 3.1 Hz, 1H:H₁₀), 3.80 (s, 3H:CO₂CH₃), 3.73 (dd, *J* = 9.9, 5.9 Hz, 1H:H₁₀), 2.95 (m, 2H:H₆, OH), 2.21 (m, 3H:H₁, H₆, H₇), 1.98 (m, 3H:H₁, H₂, H₇), 1.46 (m, 1H:H₂), 1.04 (s, 9H:C(CH₃)₃); ¹³C NMR (90 MHz, CDCl₃): δ 174.2 (CO₂CH₃), 173.1 (C₅), 135.6 (C_{Ph}), 135.56 (C_{Ph}), 135.54 (C_{Ph}), 133.53 (C_{Ph}), 133.51 (C_{Ph}), 129.7 (C_{Ph}), 127.7 (C_{Ph}), 81.7 (C₉), 71.8 (C₈), 63.3 (C₁₀), 60.0 (C₃), 58.8 (C_{9a}), 53.9 (CO₂CH₃), 30.6 (C₆), 26.9 (C(CH₃)₃), 26.1 (C₇), 25.6 (C₁), 25.0 (C₂), 19.3 (C(CH₃)₃); MS (ESI, MeCN) *m/z* 534 (MNa⁺); Anal. Calcd for C₂₈H₃₇NO₆Si: C, 65.72; H, 7.29; N, 2.74. Found: C, 65.44; H, 7.39; N, 2.66.

Methyl (3*S*,8*R*,9*S*,9*aS*)-3-(*tert*-butyldiphenylsilyloxy)methyl-9-hydroxy-8-methoxy-5-oxooctahydro-1*H*-pyrrolo[1,2-*a*]azepine-9-carboxylate (15**)**

To a solution of diol **13** (1.24 g, 2.42 mmol) in dry THF (25 mL) at 0 °C, was added NaH (291 mg, 7.27 mmol) in small portions and over 30 min. After stirring 30 min at 0 °C, Me₂SO₄ (230 μL, 2.42 mmol) was added, the reaction mixture was slowly warmed up to room temperature, and then

stirred overnight. The organic layer was washed with NH_4Cl (aqueous saturated solution) and the aqueous layer was then extracted with EtOAc (2x10 mL). The combined organic phases were dried over anhydrous MgSO_4 and concentrated under vacuum. Flash column chromatography of the resulting oil on silica gel (EtOAc:hexanes 4:1 to EtOAc) gave starting diol **13** (142 mg, 0.28 mmol, 11% yield) and **15** (940 mg, 1.79 mmol, 74% yield, 84% yield from unrecovered **13**). **15**: $R_f = 0.44$ (EtOAc); $[\alpha]_D^{20} = -76$ (c 1.95, CH_2Cl_2); $^1\text{H NMR}$ (360 MHz, CDCl_3): δ 7.63 (m, 4H), 7.40 (m, 6H), 4.16 (m, 2H: H_3 , H_{9a}), 3.80 (s, 3H: CO_2CH_3), 3.80 (m, 2H: 2H_{10}), 3.61 (dd, $J = 7.6, 2.6$ Hz, 1H: H_8), 3.54 (s, 1H: OH), 3.37 (s, 3H: OCH_3), 2.75 (ddd, $J = 14.4, 9.7, 6.0$ Hz, 1H: H_6), 2.24 (m, 4H: 2H_1 , H_6 , H_7), 1.98 (m, 2H: H_2 , H_7), 1.64 (m, 1H: H_2), 1.06 (s, 9H: $\text{C}(\text{CH}_3)_3$); $^{13}\text{C NMR}$ (90 MHz, CDCl_3): δ 172.8 (CO_2CH_3), 171.8 (C_5), 135.5 (C_{Ph}), 133.52 (C_{Ph}), 133.49 (C_{Ph}), 129.6 (C_{Ph}), 127.62 (C_{Ph}), 127.61 (C_{Ph}), 81.1 (C_8), 78.0 (C_9), 63.2 (C_{10}), 61.3 (C_{9a}), 59.9 (C_3), 57.6 (OCH_3), 52.9 (CO_2CH_3), 31.3 (C_6), 26.9 ($\text{C}(\text{CH}_3)_3$), 26.1 (C_1), 25.3 (C_2), 20.8 (C_7), 19.2 ($\text{C}(\text{CH}_3)_3$); HRMS (CI $^+$): calcd for $\text{C}_{29}\text{H}_{40}\text{NO}_6\text{Si}$: 526.2619 $[\text{M}+\text{H}]^+$; found 526.2613.

(3*S*,8*R*,9*S*,9*aS*)-3-(*tert*-Butyldiphenylsilyloxy)methyl-9-hydroxy-9-hydroxymethyl-8-methoxy-octahydro-5*H*-pyrrolo[1,2-*a*]azepin-5-one (16**)**

A recently opened solution of LiBH_4 in THF (2M, 4.00 mL, 8.00 mmol) was added to a stirred solution of ester **15** (1.05 g, 2.00 mmol) in dry THF (20 mL) at room temperature. After 18 h, TLC analysis (EtOAc) of the reaction mixture showed no starting material. The excess of LiBH_4 was quenched with NH_4Cl saturated solution (CAUTION! To avoid a vigorous effervescence, NH_4Cl must be added very slowly). Then EtOAc was added, and the aqueous phase was extracted with CH_2Cl_2 (2x10 mL). The combined organic extracts were dried over anhydrous Na_2SO_4 and concentrated *in vacuo*. Flash column chromatography purification (EtOAc) afforded **16** (0.965 g, 1.97 mmol, 97% yield): $R_f = 0.24$ (EtOAc); $[\alpha]_D^{20} = -68$ (c 1.32, CH_2Cl_2); **IR** (ATR): 3389, 2930, 2856, 1619, 1446, 1426, 1359, 1257, 1173, 1096; $^1\text{H NMR}$ (360 MHz, CDCl_3): δ 7.62 (m, 4H), 7.39 (m, 6H), 4.19 (m, 2H: H_3 , H_{9a}), 3.79 (dd, $J = 9.9, 3.2$ Hz, 1H: H_{10}), 3.75 (dd, $J = 9.9, 5.6$ Hz, 1H: H_{10}), 3.71 (m, 1H: H_8), 3.64 (d, $J = 11.8$ Hz, 1H: H_{11}), 3.45 (m, 1H: H_{11}), 3.39 (s, 3H: OCH_3), 3.21

(d, $J = 1.7$ Hz, 1H:OH), 2.71 (bt, $J = 12.7$ Hz, 1H:H₆), 2.32 (m, 1H:H₂), 2.17 (m, 3H:H₂, H₆, H₇), 2.05 (m, 1H:PH), 1.98 (dd, $J = 13.1, 8.2$ Hz, 1H:H₁), 1.83 (m, 2H:H₁, H₇), 1.05 (s, 9H:C(CH₃)₃); ¹³C NMR (90 MHz, CDCl₃): δ 173.1 (C₅), 135.51 (C_{Ph}), 135.49 (C_{Ph}), 133.6 (C_{Ph}), 133.4 (C_{Ph}), 129.62 (C_{Ph}), 129.58 (C_{Ph}), 127.63 (C_{Ph}), 127.60 (C_{Ph}), 79.3 (C₈), 75.6 (C₉), 63.0 (C₁₀), 61.3 (C₁₁), 60.1 (C₃), 58.7 (C_{9a}), 56.7 (OCH₃), 29.8 (C₆), 26.9 (C(CH₃)₃), 26.2 (C₂), 25.3 (C₁), 21.3 (C₇), 19.2 (C(CH₃)₃); HRMS (CI⁺): calcd for C₂₈H₄₀NO₅Si: 498.2670 [M+H]⁺; found 498.2671.

(3*S*,8*R*,9*aS*)-3-(*tert*-Butyldiphenylsilyloxy)methyl-8-methoxytetrahydro-1*H*-pyrrolo[1,2-*a*]azepine-5,9(6*H*,9*aH*)-dione (14**)**

A solution of diol **16** (1.28 g, 2.56 mmol) in dry THF (25 mL) was added to stirred suspension of Pb(OAc)₄ (1.71 g, 3.85 mmol) in dry THF (38 mL) at room temperature. After 1.5 h TLC analysis (EtOAc) of the reaction mixture revealed the absence of diol **16**. The mixture was filtered through Celite®, the organic solvent was removed under vacuum and the resulting colorless oil was purified by flash column chromatography on silica gel (EtOAc:hexanes 1:1) to give ketone **14** (1.09 g, 2.35 mmol, 92% yield): $R_f = 0.52$ (EtOAc); $[\alpha]_D^{20} = -81$ (c 1.35, CH₂Cl₂); IR (ATR): 2931, 2857, 1731, 1620, 1427, 1189, 1105; ¹H NMR (360 MHz, CDCl₃): δ 7.61 (m, 4H), 7.35 (m, 6H), 4.43 (dd, $J = 8.7, 3.1$ Hz, 1H:H_{9a}), 4.27 (m, 1H:H₃), 4.04 (dd, $J = 8.1, 6.5$ Hz, 1H:H₈), 3.90 (dd, $J = 10.2, 5.2$ Hz, 1H:H₁₀), 3.78 (dd, $J = 10.2, 2.8$ Hz, 1H:H₁₀), 3.31 (s, 3H:OCH₃), 2.60 (m, 1H:H₆), 2.36 (m, 3H:H₁, H₆, H₇), 2.07 (m, 3H:H₁, 2H₂), 1.91 (m, 1H:H₇), 1.05 (s, 9H:C(CH₃)₃); ¹³C NMR (90 MHz, CDCl₃): δ 208.4 (C₉), 170.9 (C₅), 135.51 (C_{Ph}), 135.48 (C_{Ph}), 133.3 (C_{Ph}), 133.2 (C_{Ph}), 129.7 (C_{Ph}), 127.7 (C_{Ph}), 82.5 (C₈), 64.0 (C_{9a}), 63.4 (C₁₀), 59.5 (C₃), 57.7 (OCH₃), 31.7 (C₆), 28.6 (C₁), 28.2 (C₇), 26.9 (C(CH₃)₃), 26.6 (C₂), 19.2 (C(CH₃)₃); HRMS (CI⁺): calcd for C₂₇H₃₆NO₄Si: 466.2408 [M+H]⁺; found 466.2404.

(2*R*,3'*S*,8'*R*,9*a*'*S*)-3'-(*tert*-Butyldiphenylsilyloxy)methyl-8'-methoxy-4-methylenehexahydro-3*H*-spiro{furan-2,9'-pyrrolo[1,2-*a*]azepin}-5,5'(4*H*,6'*H*)-dione (18)

To a stirred solution of ketone **14** (1.09 g, 2.35 mmol) in dry THF (25 mL) under N₂ atmosphere, Zn (460 mg, 7.04 mmol) was added. The mixture was heated up and, when reflux started, a solution of ethyl 2-(bromomethyl)acrylate, **17**, (486 μL, 3.52 mmol) in dry THF (12 mL) was added. After 1 h of heating at reflux, TLC analysis (Et₂O) revealed the absence of **14** in the reaction mixture. The mixture was filtered through Celite® and the organic solvent evaporated under vacuum. The remaining colorless oil was dissolved in CH₂Cl₂ (10 mL) and washed with NH₄Cl saturated solution. The aqueous phase was extracted with CH₂Cl₂ (2x5 mL). The combined organic layers were dried over anhydrous MgSO₄ and concentrated *in vacuo*. Purification of the crude material by flash column chromatography on silica gel (Et₂O) furnished lactone **18** (1.08 g, 2.01 mmol, 86% yield): *R*_f = 0.18 (Et₂O); [α]_D²⁰ = -46 (*c* 0.5, CH₂Cl₂); ¹H NMR (360 MHz, CDCl₃): δ 7.60 (m, 4H), 7.38 (m, 6H), 6.26 (t, *J* = 2.9 Hz, 1H:H₆), 5.64 (t, *J* = 2.5 Hz, 1H:H₆), 4.26 (m, 1H:H_{3'}), 4.02 (d, *J* = 9.0 Hz, 1H:H_{9a'}), 3.87 (dd, *J* = 10.0, 5.3 Hz, 1H:H_{1''}), 3.80 (dd, *J* = 10.0, 3.0 Hz, 1H:H_{1''}), 3.34 (s, 3H:OCH₃), 3.30 (dd, *J* = 8.2, 2.7 Hz, 1H:H_{8'}), 2.94 (dt, *J* = 18.1, 2.8 Hz, 1H:H₃), 2.65 (m, 2H:H₃, H_{6'}), 2.32 (m, 2H:H_{1'}, H_{6'}), 1.99 (m, 3H:2H_{2'}, H_{7'}), 1.78 (m, 2H:H_{1'}, H_{7'}), 1.04 (s, 9H:C(CH₃)₃); ¹³C NMR (90 MHz, CDCl₃): δ 171.4 (C₅), 169.4 (C_{5'}), 135.53 (C_{Ph}), 135.51 (C_{Ph}), 134.4 (C₄), 133.6 (C_{Ph}), 133.5 (C_{Ph}), 129.7 (C_{Ph}), 129.6 (C_{Ph}), 127.7 (C_{Ph}), 127.6 (C_{Ph}), 122.2 (C₆), 85.4 (C₂), 82.8 (C_{8'}), 63.3 (C_{1''}), 61.1 (C_{9a'}), 59.9 (C_{3'}), 57.6 (OCH₃), 34.5 (C₃), 30.8 (C_{6'}), 26.9 (C(CH₃)₃), 26.4 (C_{2'}), 26.1 (C_{1'}), 20.6 (C_{7'}), 19.3 (C(CH₃)₃); HRMS (CI⁺): calcd for C₃₁H₄₀NO₅Si: 534.2670 [M+H]⁺; found 534.2668.

(2*R*,3'*S*,8'*R*,9*a*'*S*)-3'-Hydroxymethyl-8'-methoxy-4-methylenehexahydro-3*H*-spiro{furan-2,9'-pyrrolo[1,2-*a*]azepine}-5,5'-(4*H*,6'*H*)-dione (19)

A solution of Et₃N·3HF (6.6 mL, 40.3 mmol) was added to a stirred solution of **18** (1.08 g, 2.01 mmol) in dry THF (34 mL). The reaction mixture was heated at the reflux temperature for 4 h, when TLC analysis showed no starting material. The solution was concentrated under vacuum and the resulting oil was purified by flash column chromatography on silica gel (EtOAc to EtOAc:EtOH 1:1) to furnish alcohol **19** (515 mg, 1.74 mmol, 87% yield): $[\alpha]_D^{20} = -115$ (*c* 0.22, EtOH); ¹H NMR (360 MHz, CDCl₃): δ 6.26 (t, *J* = 3.0 Hz, 1H:H₆), 5.67 (t, *J* = 2.6 Hz, 1H:H₆), 4.55 (m, 1H:OH), 4.23 (m, 2H:H_{3'}, H_{9a'}), 3.64 (m, 2H:2H_{1''}), 3.34 (s, 3H:OCH₃), 3.27 (dd, *J* = 7.0, 2.5 Hz, 1H:H_{8'}), 2.92 (dt, *J* = 18.3, 2.9 Hz, 1H:H₃), 2.80 (ddd, *J* = 15.0, 10.5, 5.0 Hz, 1H:H_{6'}), 2.73 (dt, *J* = 18.3, 2.5 Hz, 1H:H₃), 2.39 (ddd, *J* = 14.4, 5.8, 4.9 Hz, 1H:H_{6'}), 2.02 (m, 4H: H_{1'}, H_{2'}, 2H_{7'}), 1.77 (m, 1H:H_{1'}), 1.56 (m, 1H:H_{2'}); ¹³C NMR (90 MHz, CDCl₃): δ 174.2 (C_{5'}), 169.2 (C₅), 133.9 (C₄), 122.9 (C₆), 84.3 (C₂), 82.5 (C_{8'}), 66.7 (C_{1''}), 62.5 (C_{3'}), 61.0 (C_{9a'}), 57.4 (OCH₃), 35.0 (C₃), 30.5 (C_{6'}), 27.3 (C_{2'}), 26.0 (C_{1'}), 20.5 (C_{7'}); HRMS (CI⁺): calcd for C₁₅H₂₂NO₅: 296.1492 [M+H]⁺; found 296.1497.

(2*R*,3'*S*,8'*R*,9*a*'*S*)-3'-Hydroxymethyl-5,5'-dioxo-8'-methoxy-4-methylenehexahydro-3*H*-spiro{furan-2,9'-pyrrolo[1,2-*a*]azepine}-(4*H*,6'*H*)-carbaldehyde (20)

A commercially available solution of the Dess-Martin periodinane in CH₂Cl₂ (15% wt, 1.85 mL, 0.89 mmol) was added *via* syringe to a solution of alcohol **19** (219 mg, 0.74 mmol) in dry CH₂Cl₂ (6.1 mL). After 2 h of stirring at room temperature, TLC analysis indicates the complete consumption of the starting material. The solution was washed with NaHCO₃ saturated solution

containing a sevenfold excess of $\text{Na}_2\text{S}_2\text{O}_3$, the aqueous phase was extracted with CH_2Cl_2 (2x5 mL), the combined organic extracts were dried over anhydrous Na_2SO_4 and concentrated *in vacuo*. Flash column chromatography on silica gel (EtOAc) of the resulting oil provided aldehyde **20** (200 mg, 0.68 mmol, 92% yield): R_f 0.43 (EtOAc:MeOH 9:1); $[\alpha]_D^{20} = -149$ (c 0.65, CH_2Cl_2); $^1\text{H NMR}$ (500 MHz, CDCl_3): δ 9.54 (d, $J = 1.5$ Hz, 1H:H_{1''}), 6.30 (t, $J = 3.0$ Hz, 1H:H₆), 5.71 (t, $J = 2.6$ Hz, 1H:H₆), 4.58 (m, 1H:H_{3'}), 4.34 (bd, $J = 8.24$ Hz, 1H:H_{9a'}), 3.37 (s, 3H:OCH₃), 3.33 (dd, $J = 6.3, 2.4$ Hz, 1H:H_{8'}), 2.96 (dt, $J = 18.4, 2.9$ Hz, 1H:H₃), 2.88 (ddd, $J = 14.9, 10.5, 4.5$ Hz, 1H:H_{6'}), 2.76 (bd, $J = 18.4$ Hz, 1H:H₃), 2.40 (m, 1H:H_{6'}), 2.04 (m, 4H:H_{1'}, H_{2'}, 2H_{7'}), 1.85 (m, 2H:H_{1'}, H_{2'}); $^{13}\text{C NMR}$ (125 MHz, CDCl_3): δ 198.1 (C_{1''}), 172.5 (C_{5'}), 169.1 (C₅), 133.7 (C₄), 123.4 (C₆), 83.7 (C₂), 82.5 (C_{8'}), 66.1 (C_{3'}), 59.8 (C_{9a'}), 57.3 (OCH₃), 35.2 (C₃), 29.2 (C_{6'}), 26.2/24.1 (C_{1'/}C_{2'}), 20.7 (C_{7'}); HRMS (CI⁺): calcd for $\text{C}_{15}\text{H}_{20}\text{NO}_5$: 294.1336 $[\text{M}+\text{H}]^+$; found 294.1334.

(2R,3'S,8'R,9a'S,2''R)- and (2R,3'S,8'R,9a'S)-8'-Methoxy-4-methylene-3'-[(2S)-4-methylene-5-oxotetrahydrofuran-2-yl]hexahydro-3H-spiro{furan-2,9'-pyrrolo[1,2-a]azepine}-5,5'(4H, 6'H)-dione (21 and 22)

To a stirred solution of aldehyde **20** (460 mg, 1.57 mmol) in dry THF (16 mL) under N_2 atmosphere, Zn (308 mg, 4.71 mmol) was added. The solution was heated up and, when reflux started, a solution of ethyl 2-(bromomethyl)acrylate, **17**, (325 μL , 2.35 mmol) in dry THF (8 mL) was added. After 1 h TLC analysis of the reaction mixture (EtOAc:MeOH 9:1) revealed the absence of starting aldehyde. The reaction mixture was filtered through Celite® and the organic solvent was evaporated under vacuum. The remaining colorless oil was purified by flash column chromatography on silica gel (EtOAc to EtOAc:MeOH 95:5) to provide the following fractions: i) bislactone erythro **21** (214 mg, 0.59 mmol, 38% yield); a mixture of **21** and its threo isomer **22** (46 mg, 0.13 mmol, 8% yield); iii) bislactone **21** (151 mg, 0.42 mmol, 27% yield).

21 (erythro): $^1\text{H NMR}$ (360 MHz, CDCl_3): δ 6.25 (t, $J = 3.0$ Hz, 1H:H₆/H_{6''}), 6.24 (t, $J = 3.0$ Hz, 1H:H₆/H_{6''}), 5.66 (t, $J = 2.5$, 2H: H₆, H_{6''}), 5.36 (ddd, $J = 8.0, 6.2, 1.4$ Hz, 1H:H_{2''}), 4.24 (m, 2H:H_{3'},

H_{9a'}), 3.34 (s, 3H:OCH₃), 3.29 (dd, $J = 7.7, 2.6$ Hz, 1H:H_{8'}), 3.08 (ddt, $J = 17.8, 8.5, 2.7$ Hz, 1H:H_{3''}), 2.94 (dt, $J = 18.2, 2.9$ Hz, 1H:H₃), 2.81 (ddd, $J = 14.5, 10.0, 5.8$ Hz, 1H:H_{6'}), 2.70 (dt, $J = 18.2, 2.3$ Hz, 1H:H₃), 2.51 (ddt, $J = 17.9, 6.0, 2.9$ Hz, 1H:H_{3''}), 2.42 (dt, $J = 14.3, 5.7$ Hz, 1H:H_{6'}), 2.30 (tt, $J = 13.4, 8.1$ Hz, 1H:H_{1'}), 2.04 (dddd, $J = 15.1, 10.0, 5.6, 2.6$ Hz, 1H:H_{7'}), 1.91 (m, 2H:H_{2'}, H_{7'}), 1.74 (dd, $J = 13.3, 7.7$ Hz, 1H:H_{1'}), 1.57 (dd, $J = 13.3, 8.1$ Hz, 1H:H_{2'}); ¹³C NMR (125 MHz, CDCl₃): δ 172.5 (C_{5'}), 170.2 (C₅/C_{5''}), 169.3 (C₅/C_{5''}), 133.8 (C₄/C_{4''}), 133.6 (C₄/C_{4''}), 122.9 (C₆/C_{6''}), 122.8 (C₆/C_{6''}), 84.9 (C₂), 82.7 (C_{8'}), 75.5 (C_{2''}), 62.0 (C_{3'} and C_{9a'}), 57.4 (OCH₃), 34.8 (C₃), 30.7 (C_{6'}), 30.2 (C_{3''}), 26.5 (C_{1'}), 22.7 (C_{2'}), 20.5 (C_{7'}); HRMS (CI⁺): calcd for C₁₉H₂₃NNaO₆: 384.1418 [M+Na]⁺; found 384.1419.

22 (threo): ¹H NMR (360 MHz, CDCl₃): δ 6.25 (t, $J = 3.0$ Hz, 1H:H₆), 6.13 (t, $J = 2.9$ Hz, 1H:H_{6''}), 5.67 (t, $J = 2.6$ Hz, 1H:H₆), 5.55 (t, $J = 2.5$ Hz, 1H:H_{6''}), 4.98 (ddd, $J = 8.5, 5.1, 3.5$ Hz, 1H:H_{2''}), 4.51 (dt, $J = 8.6, 3.0$ Hz, 1H:H_{3'}), 4.18 (dd, $J = 8.9, 1.9$ Hz, 1H:H_{9a'}), 3.32 (s, 3H:OCH₃), 3.25 (dd, $J = 7.1, 2.6$ Hz, 1H:H_{8'}), 3.01 (ddt, $J = 17.3, 5.1, 2.6$ Hz, 1H:H_{3''}), 2.91 (dt, $J = 18.3, 3.0$ Hz, 1H:H₃), 2.84 (ddt, $J = 17.3, 8.4, 2.8$ Hz, 1H:H_{3''}), 2.70 (dt, $J = 18.3, 2.6$ Hz, 1H:H₃), 2.68 (m, 1H:H_{6'}), 2.29 (m, 2H:H_{1'}, H_{6'}), 2.02 (m, 2H:H_{2'}, H_{7'}), 1.88 (m, 1H:H_{7'}), 1.77 (m, 1H:H_{1'}), 1.67 (m, 1H:H_{2'}); ¹³C NMR (125 MHz, CDCl₃): δ 173.2 (C_{5'}), 170.2 (C_{5''}), 169.1 (C₅), 134.2 (C_{4''}), 133.7 (C₄), 123.0 (C₆), 121.5 (C_{6'}), 84.6 (C₂), 82.6 (C_{8'}), 78.4 (C_{2''}), 61.0 (C_{9a'}), 60.4 (C_{3'}), 57.3 (OCH₃), 35.4 (C₃), 30.6 (C_{3''}), 30.2 (C_{6'}), 26.5 (C_{2'}), 26.4 (C_{1'}), 20.3 (C_{7'}); HRMS (CI⁺): calcd for C₁₉H₂₃NNaO₆: 384.1418 [M+Na]⁺; found 384.1408.

(2*R*,4*S*,3'*S*,8'*R*,9a'*S*,2''*R*,4''*R*)- (23) and (2*R*,4*R*,3'*S*,8'*R*,9a'*S*)-8'-Methoxy-4-methyl-3'-[(2*R*,4*R*)-4-methyl-5-oxotetrahydrofuran-2-yl]hexahydro-3*H*-spiro{furan-2,9'-pyrrolo[1,2-*a*]azepine}-5(4*H*,6'*H*)-one (24)

A solution of lactam **21** (21 mg, 58.1 μ mol) in dry THF (2 mL) was added to a flask containing Lawesson's reagent (26 mg, 63.9 μ mol) and the mixture was heated at reflux for 4.5 h. At this time, TLC analysis (EtOAc) of the reaction mixture showed no starting material. The solvent was

removed under vacuum and the resulting oil was filtered through Al₂O₃ Brockman I using EtOAc as eluent. Evaporation under reduced pressure of the organic solvent afforded a whitish solid (16 mg, *R*_f: 0.58). Raney-Ni (400 mg) was added to a solution of this solid in EtOH (2 mL) and the mixture was heated at reflux for 2 h. Then, the mixture was filtered through Celite® and the solvent was evaporated *in vacuo*. The residue was purified by flash column chromatography on silica gel (EtOAc:hexanes 1:4 to 1:1) to give a mixture of the amines **23** and **24** (11 mg, 31.3 μmol, 54% yield). By repeated chromatographies an enriched sample of **24** was isolated.

24: ¹H NMR (500 MHz, CDCl₃): δ 4.71 (ddd, *J* = 10.7, 5.9, 2.1 Hz, 1H:H_{2''}), 3.54 (d, *J* = 9.9 Hz, 1H:H_{8'}), 3.30 (s, 3H:OCH₃), 3.27 (bd, *J* = 7.5 Hz, 1H:H_{3'}), 3.19 (ddd, *J* = 12.2, 5.6, 2.2 Hz, 1H:H_{5'}), 2.98 (dd, *J* = 9.7, 2.3 Hz, 1H:H_{9a'}), 2.88 (tq, *J* = 10.0, 7.4 Hz, 1H:H₄), 2.66 (m, 1H:H_{4''}), 2.59 (td, *J* = 12.2, 3.8 Hz, 1H:H_{5'}), 2.48 (dd, *J* = 13.0, 10.1, 1H:H₃), 2.35 (ddd, *J* = 12.7, 9.0, 5.9 Hz, 1H:H_{3''}), 2.13 (m, 1H:H_{1'}), 2.00 (m, 1H:H_{2'}), 1.82 (m, 2H:H_{6'}, H_{7'}), 1.70 (m, 2H:H_{2'}, H_{6'}), 1.55 (m, 3H:H_{1'}, H_{7'}, H_{3''}), 1.28 (d, *J* = 7.1 Hz, 3H:3H_{6''}), 1.26 (m, 1H:H₃), 1.20 (d, *J* = 7.4 Hz, 3H:3H₆); ¹³C NMR (125 MHz, CDCl₃) δ 181.0 (C₅), 179.2 (C_{5''}), 91.0 (C₂), 87.6 (C_{8'}), 76.9 (C_{2''}), 70.0 (C_{9a'}), 66.5 (C_{3'}), 57.5 (OCH₃), 51.1 (C_{5'}), 35.8 (C₄), 35.5 (C_{4''}), 35.3 (C₃), 34.2 (C_{3''}), 28.7 (C_{6'}), 26.8 (C_{7'}), 25.6 (C_{1'}), 25.3 (C_{2'}), 16.8 (C₆), 15.2 (C_{6''}).

23: ¹H-NMR (500 MHz, CDCl₃, mixture of **23** and **24**): see Figure below; ¹³C NMR (125 MHz, CDCl₃, data extracted from a mixture of **23** and **24**) δ 180.8, 179.3, 91.4, 86.2, 69.9, 66.2, 57.3, 50.9, 35.4, 35.0, 34.1, 33.5, 27.8, 26.7, 25.6, 25.4, 16.4, 15.2.

(2*R*,4*S*,3'*S*,8'*R*,9a'*S*,2''*S*,4''*R*)- (25) and (2*R*,4*R*,3'*S*,8'*R*,9a'*S*)-8'-Methoxy-4-methyl-3'-[(2*S*,4*R*)-4-methyl-5-oxotetrahydrofuran-2-yl]hexahydro-3*H*-spiro{furan-2,9'-pyrrolo[1,2-*a*]-azepine}-5,5'(4*H*,6'*H*)-dione (26)

To a solution of bislactone **22** (39 mg, 0.108 mmol) in a 9:1 mixture of EtOH and 2M HCl (3 mL), Pd/C (40 mg) was added. The reaction was stirred in a 6 bar atmosphere of H₂ for 23 h. Then, it was filtered through Celite® and the filtrate was washed with saturated solution of NaHCO₃. The

aqueous layer was extracted with CH_2Cl_2 (3x5 mL). The combined organic extracts were dried over anhydrous Na_2SO_4 and concentrated under reduced pressure. The residue was purified by flash column chromatography (EtOAc:hexanes 1:1 to 5:1) to give a mixture of lactones **25** and **26** (27 mg, 73.9 μmol , 68% yield): ^1H NMR (500 MHz, CDCl_3): see Figure below.

(2*R*,4*R*,3'*S*,8'*R*,9*a*'*S*)-8'-Methoxy-4-methyl-3'-[(2*S*,4*S*)-4-methyl-5-oxotetrahydrofuran-2-yl]hexahydro-3*H*-spiro{furan-2,9'-pyrrolo[1,2-*a*]azepine}-5(4*H*,6'*H*)-one (2) and its (4*S*) epimer (*epi*-2)

Lawesson's reagent (30 mg, 73.9 μmol) was added to a solution of a mixture of **25** and **26** (27 mg, 73.9 μmol) in dry THF (3 mL) and the mixture was heated at the reflux temperature for 4.5 h. At this time, TLC analysis (EtOAc) of the reaction mixture showed no starting lactam. The solvent was removed under vacuum and the residue was filtered through Al_2O_3 Brockman I using EtOAc as eluent. Evaporation of the solvent under vacuum afforded a white solid (20 mg), which was dissolved in EtOH (3 mL). Then Raney-Ni (400 mg) was added and the reaction mixture was heated at reflux for 2 h. Then, it was filtered through Celite® and the solvent was evaporated *in vacuo*. Purification of the residue by flash column chromatography on silica gel (EtOAc:hexanes 2:1) furnished a mixture of **2** and *epi*-2 (11 mg, 31.3 μmol , 45% yield for the two steps). Repeated column chromatography provided analytical samples of each diastereomer.

2: first eluted; $[\alpha]_{\text{D}}^{20} = -16$ (*c* 0.25, acetone), $[\alpha]_{\text{D}}^{20} = -30$ (*c* 0.25, CH_2Cl_2); **IR** (ATR): 2960, 2958, 2924, 2886, 2855, 2825, 1750, 1453, 1441, 1256, 1230, 1222, 1172, 1111, 1088, 1008; ^1H NMR (500 MHz, CDCl_3): δ 4.31 (ddd, $J = 10.9, 8.2, 5.4$ Hz, 1H:H_{2''}), 3.57 (m, 1H:H_{5'}), 3.55 (d, $J = 9.8$ Hz, 1H:H_{8'}), 3.31 (s, 3H:OCH₃), 3.28 (m, 1H:H_{3'}), 2.90 (m, 2H:H₄, H_{9a'}), 2.59 (m, 2H:H_{5'}, H_{4''}), 2.52 (dd, $J = 12.9, 10.1$ Hz, 1H:H₃), 2.38 (ddd, $J = 12.8, 8.3, 5.4$ Hz, 1H:H_{3''}), 2.05 (tt, $J = 12.4, 7.2$ Hz, 1H:H₂), 1.74 (m, 5H:2H_{1'}, 2H_{6'}, H_{7'}), 1.50 (m, 3H:H_{2'}, H_{7'}, H_{3''}), 1.26 (d, $J = 7.0$ Hz, 3H:3H_{6''}), 1.26 (m, 1H:H₃), 1.22 (d, $J = 7.4$ Hz, 3H:3H₆); ^{13}C NMR (125 MHz, CDCl_3) δ 180.8 (C₅), 179.5 (C_{5''}), 90.8 (C₂), 87.2 (C_{8'}), 79.1 (C_{2''}), 69.3 (C₄), 68.5 (C_{3'}), 57.5 (OCH₃), 52.1 (C_{5'}), 35.69

(C₃/C_{9a}/C_{3''}), 35.67 (C₃/C_{9a}/C_{3''}), 35.60 (C₃/C_{9a}/C_{3''}), 34.8 (C_{4''}), 28.3 (C_{6'}), 26.9 (C_{2'}, C_{7'}), 25.3 (C_{1'}), 16.8 (C₆), 14.8 (C_{6''}); HRMS (CI⁺): calcd for C₁₉H₃₀NO₅: 352.2118 [M+H]⁺; found 352.2124.

Epi-2: second eluted; $[\alpha]_D^{20} = -60$ (*c* 0.09, acetone); **IR** (ATR): 2959, 2928, 2851, 2823, 1757, 1450, 1375, 1334, 1320, 1260, 1236, 1155, 1115, 1008; **¹H NMR** (500 MHz, CDCl₃): δ 4.30 (ddd, *J* = 10.8, 8.2, 5.4 Hz, 1H:H_{2''}), 3.52 (m, 1H:H_{5'}), 3.48 (dd, *J* = 9.7, 1.1 Hz, 1H:H_{8'}), 3.34 (s, 3H:OCH₃), 3.27 (dt, *J* = 7.6, 2.4 Hz, 1H:H_{3'}), 3.04 (dd, *J* = 9.0, 2.7 Hz, 1H:H_{9a'}), 2.70 (m, 2H:H₄, H₅), 2.58 (m, 1H:H_{4''}), 2.37 (ddd, *J* = 12.7, 8.4, 5.4 Hz, 1H:H_{3''}), 2.05 (dd, *J* = 13.2, 6.3 Hz, 1H:H₃), 2.01 (m, 1H:H_{2'}), 1.92 (dd, *J* = 13.3, 12.0 Hz, 1H:H₃), 1.84 (m, 2H:H_{1'}, H_{7'}), 1.73 (m, 2H:2H₆), 1.61 (m, 1H:H_{1'}), 1.49 (m, 3H:H_{2'}, H_{7'}, H_{3''}), 1.30 (d, *J* = 7.3 Hz, 3H:3H₆), 1.26 (d, *J* = 7.0 Hz, 3H:3H_{6''}); **¹³C NMR** (125 MHz, CDCl₃) δ 180.6 (C₅/C_{5''}), 179.5 (C₅/C_{5''}), 91.3 (C₂), 85.9 (C_{8'}), 79.6 (C_{2''}), 69.3 (C_{9a'}), 68.1 (C_{3'}), 57.4 (OCH₃), 51.8 (C_{5'}), 35.5 (C_{3''}), 35.0 (C₄/C_{4''}), 34.9 (C₄/C_{4''}), 33.9 (C₃), 27.4 (C_{6'}), 26.83 (C₂/C_{7'}), 26.79 (C₂/C_{7'}), 25.4 (C_{1'}), 16.4 (C₆), 14.8 (C_{6''}); HRMS (CI⁺): calcd for C₁₉H₃₀NO₅: 352.2118 [M+H]⁺; found 352.2117.

¹H-NMR (CDCl₃, 360 MHz) ¹³C-NMR (CDCl₃, 90 MHz)

$^1\text{H-NMR}$ (CDCl_3 , 360 MHz) $^{13}\text{C-NMR}$ (CDCl_3 , 90 MHz)

^1H -NMR (CDCl₃, 360 MHz) ^{13}C -NMR (CDCl₃, 90 MHz)

$^1\text{H-NMR}$ (CDCl₃, 360 MHz) $^{13}\text{C-NMR}$ (CDCl₃, 90 MHz)

$^1\text{H-NMR}$ (CDCl₃, 360 MHz) $^{13}\text{C-NMR}$ (CDCl₃, 90 MHz)

¹H-NMR (CDCl₃, 360 MHz) ¹³C-NMR (CDCl₃, 125 MHz)