Supporting Information

First Total Synthesis of (±)-Strychnine via a [4+2]-Cycloaddition/Rearrangement Cascade

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Experimental Section

General Experimental Section. Melting points are uncorrected. Mass spectra were determined at an ionizing voltage of 70eV. Unless otherwise noted, all reactions were performed in flame dried glassware under an atmosphere of dry nitrogen. Solutions were evaporated under reduced pressure with a rotary evaporator and the residue was chromatographed on a silica gel column using an ethyl acetate-hexane mixture as the eluent unless specified otherwise.

2-(1-Acetyl-1*H*-indol-3-yl)-*N*-furan-2-yl-*N*-(2-methyl-benzyl)acetamide (7). To a solution containing 5.7 g (20 mmol) of 2-(1-acetyl-1*H*-indol-3-yl)-*N*-furan-2-ylacetamide[1] in 100 mL of DMF at 0 ^{o}C was added 0.8 g (20 mmol) of NaH. The mixture was stirred for 2 h at 0 ^{o}C, and then a solution of 5.6 g (24 mmol) of 1-iodomethyl-2-methylbenzene[2] in 30 mL of DMF at 0 ^{o}C was added. The mixture was stirred for 3 h, quenched with water and extracted with EtOAc. The combined organic layer was dried over Na_2SO_4 and the solvent was removed under reduced pressure. The crude residue was purified by flash silica gel column chromatography to give 4.7 g (84%) of the titled compound **7** as a pale yellow solid: mp 96-97 ^{o}C; IR (neat) 1695, 1674, 1601, 1442, 1368, 1258 and 739 cm^{-1}; ^{1}H-NMR (400 MHz, $CDCl_3$) δ 2.11 (s, 3H), 2.58 (s, 3H), 3.65 (s, 2H), 4.90 (s, 2H), 5.63 (d, 1H, 2.4 Hz), 6.32 (dd, 1H, J = 3.6 and 2.4 Hz), 7.14-7.44 (m, 10H) and 8.43 (d, 1H, J = 7.6 Hz); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 18.9, 23.9, 30.6, 49.4, 105.5, 111.2, 115.5, 116.5, 118.7, 123.4, 123.6, 125.3, 125.8, 127.6, 128.9, 130.0, 130.2, 134.3, 135.5, 136.5, 140.1, 147.6, 168.4 and 170.9; Anal. Calcd. for $C_{24}H_{22}N_2O_3$: C, 74.59; H, 5.74; N, 7.25. Found: C, 74.35; H, 5.81, N, 7.11.

7-Acetyl-3-(2-methylbenzyl)-3,5,6*a*,7-tetrahydropyrrolo[2,3-*d*]carbazole-2,6-dione (8). To a solution containing 300 mg (0.8 mmol) of indoyl furan **7** in 4 mL of toluene in a 10 mL microwave tube equipped with a magnetic stir bar was added 0.007 g (0.16 mmol) of MgI_2. The mixture was charged with N_2 and then

sealed with a microwave rubber cap. The sample was placed in the microwave reactor and irradiated at 200 W at 150 ^{o}C for 3 h. After cooling to rt, the solution was concentrated under reduced pressure and the resulting residue was purified by flash silica gel chromatography to give 285 mg (95%) of the titled compound **8** as a pale yellow solid: 184-186 ^{o}C; IR (thin film) 1716, 1657, 1594, 1467, 1384, 1353 and 749 cm^{-1}; ^{1}H-NMR (400 MHz, $CDCl_3$) δ 2.34 (s, 3H), 2.42 (s, 3H), 2.71 (d, 1H, *J* = 16.4 Hz), 2.81 (dd, 1H, *J* = 20.4 and 2.4 Hz), 2.94 (dd, 1H, *J* = 20.4 and 5.6 Hz), 3.10 (d, 1H, J = 16.4 Hz), 4.57(s, 1H), 4.79 (d, 1H, *J* = 16.0 Hz), 4.89 (d, 1H, *J* = 16.0 Hz), 4.98 (dd, 1H, *J* = 5.6 and 2.4 Hz), 6.92-7.05 (m, 2H), 7.12 - 7.28 (m, 5H) and 8.15 (d, 1H, 8.4 Hz); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 19.3, 23.8, 36.6, 42.1, 45.7, 49.9, 71.2, 94.7, 117.9, 120.8, 125.1, 126.2, 126.7, 127.7, 129.5, 130.8, 132.7, 134.2, 135.5, 140.7, 140.9, 169.6, 171.9 and 202.9; HRMS Calcd. for [($C_{24}H_{22}N_2O_3$)+H^+]: 387.1703. Found: 387.1715.

3-(2-Methylbenzyl)-2,3,3*a*,4,5,6,6*a*,7-octahydro-1*H*-pyrrolo[2,3-*d*]carbazol-6-ol (13). To a solution containing 1.0 g (2.6 mmol) of the above enamide **8** in 24 mL of a 1:1-mixture of EtOH/THF at 0 ^{o}C was added 0.098 g (2.6 mmol) of $NaBH_4$ in one portion. The mixture was stirred for 30 min at 0 ^{o}C, quenched with an aqueous $NaHCO_3$ solution and extracted with EtOAc. The combined organic layer was dried over Na_2SO_4 and the solvent was removed under reduced pressure. The crude residue was taken up in 50 mL of THF and 5.2 mL (2.6 mmol) of 0.1 M NaOMe in MeOH solution was added. After stirring for 15 min, the solution was quenched with an aqueous NH_4Cl solution and extracted with EtOAc. The combined organic layer was dried over Na_2SO_4 and the solvent was removed under reduced pressure. The crude residue was taken up in 50 mL of THF and 7.8 mL of a 1M $LiAlH_4$ in THF solution was added dropwise. The mixture was heated at reflux for 3 h, cooled to 0 ^{o}C, and 0.29 mL of water was slowly added followed by 0.29 mL of a 15% aqueous NaOH solution and 0.87 mL

of water. The resulting mixture was filtered through Celite and was washed with EtOAc. The filtrate was dried over Na_2SO_4 and the solvent was removed under reduced pressure. The crude residue was taken up in 50 mL of 1,2- dichloro-ethane, cooled to -20 ^oC and 2.2 g (10.4 mmol) of $NaBH(OAc)_3$ was gradually added over a period of 1 h. The reaction mixture was stirred for an additional 2 h, diluted with $CHCl_3$, quenched with an aqueous $NaHCO_3$ solution, and extracted with $CHCl_3$. The combined organic layer was dried over Na_2SO_4 and the solvent was removed under reduced pressure. The crude residue was purified by flash silica gel chromatography to give 0.56 g (65%) of the titled compound **13** as a pale yellow oil: IR (thin film) 3367, 3293, 1720, 1650, 1605, 1401 and 739 cm^{-1}; ^{1}H-NMR (400 MHz, $CDCl_3$) δ 1.46-2.00 (m, 6H), 2.21 (ddd, 1H, *J* = 13.6, 9.4 and 4.0 Hz), 2.42-2.50 (m, 1H), 2.81 (td, 1H, *J* = 9.4 and 4.0 Hz), 3.42 (d, 1H, J = 12.8 Hz), 3.78 (d, 1H, *J* = 12.8 Hz), 3.82 (d, 1H, *J* = 4.0 Hz), 4.16-4.23 (m, 1H), 6.67 (d, 1H, *J* = 8.0 Hz), 6.78 (t, 1H, *J* = 7.6 Hz), 7.07 (td, 1H, *J* = 7.6 and 1.2 Hz), 7.12-7.18 (m, 4H), and 7.26-7.28 (m, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 19.1, 19.6, 25.9, 35.9, 50.9, 54.4, 54.7, 67.8, 68.6, 69.1, 109.5, 119.0, 123.3, 125.5, 126.8, 127.6, 129.2, 130.0, 137.1, 137.6, 137.7 and 149.4; HRMS Calcd. for [($C_{22}H_{26}N_2O$)+H^+]: 335.2118. Found: 335.2114.

2,3,3*a*,4,5,6,6*a*,7-Octahydro-1*H*-pyrrolo[2,3-*d*]carbazol-6-ol (14). To a sample of 0.06 g (0.09 mmol) of 20% Pd on $Pd(OH)_2$/C (Pearlman's catalyst) in a sealed tube was added a solution of 0.1 g (0.3 mmol) of the above amine **13** in 1 mL of MeOH. The mixture was repeatedly flushed with hydrogen gas and was then stirred at rt under 60 psi of hydrogen for 2 days. At the end of this time, the mixture was filtered through Celite and washed with 30 mL of MeOH, 30 mL of a 1:1-mixture of MeOH/CH_2CH_2 and 30 mL of Et_3N/MeOH/CH_2Cl_2 (5:25:70), respectively. The organic solvent was removed under reduced pressure and the crude residue was purified by flash silica gel chromatography to give 0.56 g (70%)

of the titled compound **14** as a pale yellow oil: IR (thin film) 3321, 3045, 1602, 1487, 1467, 1057 and 726 cm^{-1}; ^{1}H-NMR (400 MHz, CD_3OD) δ 1.38-1.51 (m, 1H), 1.65-1.74 (m, 1H), 1.79-1.90 (m, 2H), 2.14-2.32 (m, 2H), 3.04-3.12 (m, 1H), 3.36-3.46 (m, 1H), 3.55 (ddd, 1H, *J* = 12.0, 9.2 and 8.0 Hz), 3.80 (d, 1H, *J* = 4.4 Hz), 3.88 (dt, 1H, *J* = 10.8 and 4.4 Hz), 6.64 (d, 1H, *J* = 8.0 Hz), 6.66 (t, 1H, *J* = 7.2 Hz), 6.99 (td, 1H, *J* = 8.0 and 1.2 Hz), and 7.03 (d, 1H *J* = 7.2 Hz); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 26.2, 27.1, 32.5, 44.2, 56.4, 64.6, 68.5, 69.0, 111.3, 120.1, 122.6, 129.7, 136.7 and 151.1.

1-Bromo-2-iodo-4-methoxymethoxy-but-2-ene. To a solution of 1.0 g (3.4 mmol) of (*Z*)-3-iodo-4-(tetrahydro-2*H*-pyran-2-yloxy)but-2-en-1-ol[3] in 13 mL of CH_2Cl_2 at 0 °C was added 0.13 mL (0.8 mmol) of di-isopropylethylamine followed with 0.06 mL (0.8 mmol) of chloromethyl methyl ether. The mixture was stirred at 0 °C for 5 h, diluted with CH_2Cl_2 and washed with an aqueous $NaHCO_3$ solution. The combined organic layer was dried over Na_2SO_4 and the solvent was removed under reduced pressure. The crude residue was purified by flash silica gel chromatography to give 0.95 g (82%) of 2-(2-iodo-4-methoxymethoxy-but-2-enyloxy)tetrahydropyran as a colorless oil; IR (thin film) 1654, 1450, 1447, 1201 and 1021 cm^{-1}; ^{1}H-NMR (400 MHz, $CDCl_3$) δ 1.45 – 1.90 (m, 5 H), 3.71 (s, 3H), 3.48 – 3.55 (m, 1H), 3.86 (ddd, 1H, *J* = 12.4, 9.2 and 3.2 Hz), 4.16 – 4.21 (m, 3H), 4.64 (s, 2H), 4.68 (t, 1H, *J* = 3.2 Hz) and 6.22 (tt, 1H, *J* = 5.6 and 1.6 Hz); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 18.7, 25.3, 30.3, 55.4, 62.0, 71.1, 74.2, 96.1, 97.1, 104.6 and 133.3.

To a solution of 1.7 g (4.9 mmol) of the above iodo-alkene in 50 mL of MeOH at 0 °C was added 0.09 g (0.49 mmol) of *p*-toluenesulfoic acid. The mixture was stirred for 0 °C for 1 h, and was then quenched with an aqueous $NaHCO_3$ solution. The mixture was extracted with EtOAc and the combined organic layer was dried over Na_2SO_4. The solvent was removed under reduced

pressure and the crude residue was purified by flash silica gel chromatography to give 0.76 g (60%) of 2-iodo-4-methoxymethoxy-but-2-en-1-ol as a colorless oil; IR (thin film) 3403, 2934, 1655, 1446 and 1037 cm^{-1}; ^{1}H-NMR (400 MHz, $CDCl_3$) δ 2.91 (t, 1H, *J* = 6.8 Hz), 3.38 (s, 3H), 4.17 (dt, 2H, *J* = 5.6 and 1.2 Hz), 4.23 (dd, 2H, *J* = 6.8 and 1.2 Hz), 4.62 (s, 2H), 6.21 (tt, 1H, *J* = 5.6 and 1.2 Hz); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 55.4, 70.9, 71.0, 96.0, 108.9 and 131.5.

To a solution of 0.48 g (1.9 mmol) of the above compound in 28 mL of CH_2Cl_2 at -30 ^{o}C was added 0.6 g (2.2 mmol) of triphenyl phosphine followed with 0.46 g (2.6 mmol) of *N*-bromosuccinimide. The reaction mixture was maintained at -30 ^{o}C for 1 h, diluted with Et_2O and extracted with an aqueous $NaHCO_3$ solution. The combined organic layer was dried over Na_2SO_4 and the solvent was removed under reduced pressure. The crude residue was purified by flash silica gel column chromatography to give 0.47 g (79%) of the titled comound as a colorless oil; IR (thin film) 2929, 1633, 1448, 1211, 1037 cm^{-1}; ^{1}H-NMR (400 MHz, $CDCl_3$) δ 3.38 (s, 3H), 4.14 (d, 2H, *J* = 5.2 Hz), 4.33 (s, 1H), 4.64 (s, 1H), 6.28 (t, 1H, *J* = 5.6 Hz); ^{13}C-NMR (100 MHz, $CDCl_3$) δ 42.1, 55.5, 71.4, 96.2, 101.6 and 137.1.

7-(2,4-Dimethoxybenzyl)-3-(2-iodo-4-methoxymethoxy-but-2-enyl)-2,3,3*a*,4,5,6,6*a*,7-octahydro-1*H*-pyrrolo[2,3-*d*]carbazol-6-ol. To a solution of 0.12 g (0.54 mmol) of tetracyclic amine **14** in 5 mL of DMF at room temperature was added 1.2 mL of H_2O and 0.37 g (2.7 mmol) of K_2CO_3. The mixture was cooled to 0 ^{o}C and and a solution of 0.21 g (0.65 mmol) of 1-bromo-2-iodo-4-methoxymethoxy-but-2-ene in 1.0 mL of DMF was added. The solution was stirred at 0 ^{o}C for 12 h and was then quenched with H_2O. The organic layer was separated and the aqueous layer was extracted with Et_2O. The combined organic extracts were washed with H_2O, brine, and dried over $MgSO_4$. After concentration under reduced pressure, the residue was subjected to flash silica

gel chromatography to provide 0.2 g (80%) of the expected *N*-alkylated product as a pale yellow oil which was immediately used in the next step.

To a flask containing 54 mg (0.11 mmol) of the above oil was added 3 mL of 1,2-dichloroethane. To this solution at 0 ^{o}C was added 23 mg (0.14 mmol) of 2,4-methoxybenzaldehyde and 61 mg (0.29 mmol) of $NaBH(OAc)_3$, followed by the addition of 20 μL (0.34 mmol) of CH_3COOH. The mixture was stirred at 0 ^{o}C for 10 min and then at rt for 12 h. The solution was quenched with a saturated K_2CO_3 solution and extracted with CH_2Cl_2. The combined organic layer was washed with H_2O, brine, and dried over $MgSO_4$. After concentration under reduced pressure, the residue was subjected to flash silica gel chromatography to give 61 mg (86%) of the titled compound as a colorless oil; IR (neat) 3456, 1673, 1606, and 1485 cm^{-1}; ^{1}H-NMR ($CDCl_3$, 600 MHz) δ 1.54-1.62 (m, 2H), 1.68 (d, 1H, *J* = 6.0 Hz), 1.74-1.79 (m, 1H), 1.93-2.06 (m, 3H), 2.38 (td, 1H, *J* = 9.0 and 6.6 Hz), 2.80 (t, 1H, *J* = 0.6 Hz), 3.06 (d, 1H, *J* = 13.8 Hz), 3.11 (td, 1H, *J* = 9.0 and 5.1 Hz), 3.40 (s, 3H), 3.46 (d, 1H, *J* = 3.6 Hz), 3.62 (d, 1H, *J* = 13.8 Hz), 3.81 (s, 3H), 3.82 (s, 3H), 4.19 (d, 1H, *J* = 5.4 Hz), 4.24-4.28 (m, 1H), 4.32 (d, 1H, *J* = 16.2 Hz), 4.50 (d, 1H, *J* = 16.2 Hz), 4.66 (s, 1H), 6.14 (t, 1H, *J* = 5.4 Hz), 6.43-6.46 (m, 2H), 6.49 (d, 1H, *J* = 1.8 Hz), 6.68 (t, 1H, *J* = 7.5 Hz), 7.02-7.05 (m, 2H), and 7.24(d, 1H, *J* = 7.8 Hz); ^{13}C-NMR ($CDCl_3$, 100 MHz) δ 18.8, 24.7, 39.8, 48.0, 51.3, 53.5, 55.5, 55.6, 55.7, 65.4, 65.6, 68.1, 71.7, 73.6, 96.3, 98.7, 104.1, 107.1, 109.9, 118.0, 119.7, 121.7, 128.2, 129.1, 132.7, 135.2, 152.8, 158.2, and 160.2; HRMS Calcd for $[(C_{29}H_{37}N_2O_5I) + H]^{+}$: 621.1820. Found: 621.1797.

7-(2,4-Dimethoxybenzyl)-3-(2-iodo-4-methoxymethoxy-but-2-enyl)-2,3,3*a*,4,5,6,6*a*,7-octahydro-pyrrolo[2,3-*d*]carbazol-6-one (9). To a flask containing 0.9 g (1.4 mmol) of the above alcohol and 0.7 g of 4Å of molecular sieves in 50 mL of CH_3CN at 0 ^{o}C was added 0.26 g (2.2 mmol) of NMO (*N*-methyl morpholine-*N*-oxide) followed by the addition of 0.15 g (0.43 mmol) of TPAP (tetra-*n*-propyl-

ammonium perruthenate) in several portions. After stirring at 0 °C for 20 min, the cooling bath was removed and the reaction mixture was stirred at room temperature for an additional 2 h. The mixture was filtered through celite and the filtrate was concentrated under reduced pressure. The residue was subjected to flash silica gel chromatography to give 0.72 g (80%) of ketone **9** as a yellow oil; IR (neat) 1707, 1601, 1479, 1209, and 1037 cm^{-1}; ^{1}H-NMR ($CDCl_3$, 400 MHz) δ 1.83-1.98 (m, 2H), 2.13-2.23 (m, 2H), 2.30-2.53 (m, 3H), 2.54 (d, 1H, *J* = 2.8 Hz), 2.99 (d, 1H, *J* = 14.0 Hz), 3.15-3.20 (m, 1H), 3.39 (s, 3H), 3.59 (dd, 1H, *J* = 14.0 and 1.6 Hz), 3.60 (s, 1H), 3.78 (s, 3H), 3.79 (s, 3H), 4.12 (d, 1H, *J* = 16.4 Hz), 4.15-4.18 (m, 1H), 4.25 (d, 1H, *J* = 16.4 Hz), 4.65 (s, 2H), 6.10 (t, 1H, *J* = 4.2 Hz), 6.40 (dd, 1H, *J* = 8.2 and 2.4 Hz), 6.43 (d, 1H, *J* = 2.4 Hz), 6.55 (d, 1H, *J* = 8.2 Hz), 6.77 (td, 1H, *J* = 7.6 and 0.8 Hz), and 7.03-7.13 (m, 3H); ^{13}C-NMR ($CDCl_3$, 100 MHz) δ 20.4, 32.5, 37.8, 47.8, 51.8, 55.4, 55.5, 55.7, 59.0, 64.5, 67.9, 71.6, 81.7, 96.4, 98.6, 103.9, 107.2, 108.8, 118.4, 118.7, 122.8, 128.8, 129.5, 132.7, 133.3, 152.7, 158.4, 160.3, and 210.3.

Pentacyclic Ketone 16. To a solution of 0.35 g (0.57 mmol) of the above ketone **9** in 6 mL of THF at room temperature was added 0.13 g (0.11 mmol) of $Pd(PPh_3)_4$ followed by a solution of PhOK in THF (prepared from the addition of 0.74 mL of 1M *t*-BuOK in *t*-BuOH into a solution containing 80 mg (0.85 mmol) of phenol in 8 mL of THF). The reaction mixture was heated at reflux under argon for 2 h, cooled to room temperature, diluted with a 1*N* NaOH solution and extracted with CH_2Cl_2. The combined organic extracts were washed with 1*N* NaOH, H_2O, brine, and dried over $MgSO_4$. After concentration under reduced pressure, the residue was subjected to silica gel chromatography to give 0.15 g (56%) of the enolate coupling product **16** as a yellow oil; IR (neat) 1711, 1607, 1484, and 1038 cm^{-1}; ^{1}H-NMR ($CDCl_3$, 400 MHz) δ 1.93 (dd, 1H, *J* = 12.8, and 5.0 Hz); 2.14-2.34 (m, 3H), 2.66-2.74 (m, 1H), 3.05 (d, 1H, *J* = 16.0 Hz), 3.20 (t,

1H, *J* = 8.4 Hz), 3.33 (s, 1H), 3.35 (s, 3H), 3.65 (brs, 2H), 3.77 (s, 3H), 3.78 (s, 3H), 3.79 (d, 1H, *J* = 16.0 Hz), 4.10 (dd, 1H, *J* = 13.2 and 4.4 Hz), 4.22-4.37 (m, 3H), 4.61 (s, 2H), 5.57 (dd, 1H, *J* = 8.4 and 4.4 Hz), 6.40 (dd, 1H, *J* = 7.8 and 2.2 Hz), 6.44 (d, 1H, *J* = 2.2 Hz), 6.49 (d, 1H, *J* = 7.8 Hz), 6.74 (td, 1H, *J* = 7.4 and 0.6 Hz), and 7.03-7.11 (m, 3H); ^{13}C-NMR ($CDCl_3$, 100 MHz) δ 23.3, 38.7, 43.8, 46.9, 51.8, 52.6, 55.4, 55.5, 55.6, 58.3, 62.3, 63.6, 76.8, 96.1, 98.6, 103.8, 108.5, 118.6, 118.7, 122.3, 125.8, 128.9, 129.3, 130.9, 137.5, 151.9, 158.4, 160.2, and 209.5; HRMS Calcd for $[(C_{29}H_{34}N_2O_5) + H]^+$: 491.2540. Found: 491.2534.

Pentacyclic Enol Ether 10. To a flask containing 0.2 mL (1.5 mmol) of diisopropyl amine in 2.0 mL of THF at 0 °C was slowly added 0.6 mL (1.4 mmol) of *n*-BuLi (2.5 M in hexane). The resulting LDA solution was added dropwise into a suspension of 0.39 g (1.6 mmol) of $Ph_2P(O)CH_2OMe$ in 1.2 mL of THF at 0 °C. The reaction mixture was stirred at this temperature for 20 min and then the resulting red solution was added to a solution containing 0.11 g (0.2 mmol) of pentacyclic ketone **16** in 2.0 mL of THF at 0 °C. After stirring at 0 °C for 20 min, the cooling bath was removed and the reaction mixture was stirred at room temperature for 24 h. The mixture was quenched with a saturated NH_4Cl solution and extracted with CH_2Cl_2. The combined organic extracts were washed with brine, dried over $MgSO_4$, and concentrated under reduced pressure. The residue was subjected to flash silica gel chromatography to give 76 mg (72 %) of enol ether **10** as a yellow oil; IR (neat) 1607, 1485, 1121, and 1038 cm^{-1}; ^{1}H-NMR ($CDCl_3$, 600 MHz) δ 1.79-1.84 (m, 1H), 2.20-2.25 (m, 1H), 2.45-2.53 (m, 2H), 3.00-3.08 (m, 1H), 3.17-3.28 (m, 2H), 3.35 (s, 3H), 3.35-3.42 (m, 1H), 3.47-3.53 (m, 6H), 3.80 (s, 3H), 3.83 (s, 3H), 4.08 (dd, 1H, *J* = 12.0 and 6.0 Hz), 4.11 (d, 1H, *J* = 16.8 Hz), 4.18-4.21 (m, 2H), 4.58 (s, 1H), 4.63 (d, 1H, *J* = 6.6 Hz), 4.65 (d, 1H, *J* = 6.6 Hz), 5.38 (t, 1H, *J* = 6.0 Hz), 6.14 (s, 1H) 6.23 (d, 1H, *J* = 8.1 Hz), 6.41 (dd, 1H, *J* = 8.1 and 2.4 Hz), 6.47 (d, 1H, *J* = 2.4 Hz), 6.71 (t, 1H, *J* =

7.5 Hz), 6.99 (t, 1H, *J* = 7.5 Hz), 7.06 (d, 1H, *J* = 7.5 Hz), and 7.07 (d, 1H, *J* = 7.5 Hz); ^{13}C-NMR ($CDCl_3$, 100 MHz) δ 25.2, 29.9, 39.2, 45.6, 52.1, 54.0, 55.1, 55.4, 55.5, 55.6, 59.9, 62.7, 66.9, 67.5, 95.7, 98.4, 103.8, 108.0, 112.4, 118.3, 120.3, 122.1, 128.0, 128.4, 128.6, 132.0, 151.4, 151.9, 157.7, and 159.6; HRMS Calcd for $[(C_{31}H_{38}N_2O_5) + H]^+$: 591.2853. Found: 591.2847.

Strychnine (4). To a solution containing 8 mg (0.015 mmol) of the pentacyclic enol ether **10** in 1.5 ml of THF was added 1.5 ml of 4*N* HCl. The reaction mixture was heated at 55 °C for 10 h, cooled to 0 °C, neutralized with a saturated NH_4OH solution, and extracted with EtOAc. The organic extracts were washed with brine, dried over $MgSO_4$ and concentrated under reduced pressure. The residue was heated at 60 °C under vacuum overnight to remove the 1,4-diol derived from the acidic hydrolysis of THF under the reaction conditions. The resulting crude residue consisted primarily of the Wieland-Gumlich aldehyde[4]; ^{1}H-NMR ($CDCl_3$, 600 MHz) δ 1.54 (d, 1H, *J* = 14.4 Hz), 1.57-1.62 (m, 1H), 1.82 (d, 1H, *J* = 10.8 Hz), 2.06 (dd, 1H, *J* = 12.6 and 6.6 Hz), 2.26-2.30 (m, 1H), 2.66 (s, 1H), 2.67 (d, 1H, *J* = 14.4 Hz), 2.80-2.84 (m, 1H), 3.26 (dd, 1H, *J* = 8.0 and 8.0 Hz), 3.75 (d, 1H, *J* = 14.4 Hz), 3.82 (d, 1H, *J* = 10.8 Hz), 3.92-2.99 (m, 2H), 4.23 (dd, 1H, *J* = 14.4 and 7.2 Hz), 5.00 (s, 1H), 5.81 (brs, 1H), 6.80 (d, 1H, *J* = 7.5 Hz), 6.88 (t, 1H, *J* = 7.5 Hz), 7.04 (d, 1H, *J* = 7.5 Hz), 7.10 (d, 1H, *J* = 7.5 Hz).

To the crude residue was added 0.5 ml of CH_3COOH, 48 mg of malonic acid, 48 mg of NaOAc, and 10 μL acetic anhydride, and the resulting mixture was heated at 120 °C for 2 h.[5] The reaction mixture was cooled to rt, diluted with H_2O, basified with a 50% NaOH solution, and extracted with EtOAc. The combined organic layer was washed with brine, dried over $MgSO_4$, and concentrated under reduced pressure. The residue was subjected to preparative TLC to give 2.3 mg (43%) of strychnine as a white solid; mp 278-283 °C (lit [6] mp 275-285 °C) for the two step sequence; ^{1}H-NMR ($CDCl_3$, 400 MHz) δ 1.28 (dt, 1H, *J* = 10.4 and 3.2

Hz), 1.48 (d, 1H, *J* = 14.0 Hz), 1.89-1.93 (m, 2H), 2.37 (dt, 1H, *J* = 14.0 and 4.4 Hz), 2.67 (dd, 1H, *J* = 17.2 and 3.2 Hz), 2.76 (d, 1H, *J* = 15.2 Hz), 2.89 (dd, 1H, *J* = 18.4, and 10.0 Hz), 3.14 (dd, 1H, *J* = 17.2 and 8.4 Hz), 3.15-3.17 (m, 1H), 3.22-3.28 (m, 1H), 3.73 (dd, 1H, *J* = 15.2 and 1.2 Hz), 3.86 (d, 1H, *J* = 10.4 Hz), 3.99 (brs, 1H), 4.06 (dd, 1H, *J* = 13.6 and 5.6 Hz), 4.16 (dd, 1H, *J* = 13.6 and 7.4 Hz), 4.29 (dt, 1H, J = 8.4 and 3.2 Hz), 5.94 (t, 1H, *J* = 5.6 Hz), 7.10 (td, 1H, *J* = 7.6 and 1.2 Hz), 7.17 (dd, 1H, *J* = 7.6 and 1.2 Hz), 7.26 (td, 1H, *J* = 7.6 and 1.2 Hz), 8.09 (dd, 1H, *J* = 7.6 and 1.2 Hz).

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