SUPPORTING INFORMATION

Total Syntheses of the Phytotoxic Lactones Herbarumin I and II and a Synthesis-Based Solution of the Pinolidoxin Puzzle

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General. All reactions were carried out under Ar. The solvents used were purified by distillation over the drying agents indicated and were transferred under Ar: THF, Et_2O (Mg-anthracene), CH_2Cl_2 (P_4O_{10}), MeCN, Et_3N, pyridine, DMF (CaH_2), MeOH (Mg), hexane, toluene (Na/K). Flash chromatography: Merck silica gel 60 (230-400 mesh). NMR: Spectra were recorded on a DPX 300, AV 400 or DMX 600 spectrometer (Bruker) in the solvents indicated; chemical shifts (δ) are given in ppm relative to TMS, coupling constants (J) in Hz. IR: Nicolet FT-7199 spectrometer, wavenumbers in cm^{-1}. MS (EI): Finnigan MAT 8200 (70 eV), HRMS: Finnigan MAT 95. Melting points: Büchi melting point apparatus (uncorrected). Elemental analyses: H. Kolbe, Mülheim/Ruhr. All commercially available compounds (Lancaster, Fluka, Aldrich) were used as received.

Compilation and Analysis of NMR Data of Selected Compounds. The NMR spectra were measured on a Bruker DMX-600 NMR spectrometer at 303 K. The chemical shifts were recorded relative to the solvent signals and the chemical shifts converted to the TMS scale (Conversion factors: CD_2Cl_2, δ_C = 53.8, δ_H = 5.32; d_6-DMSO, δ_C = 39.5, δ_H = 2.49; d_5-pyridine, $\delta_C(\alpha\text{-CD})$ = 149.9, δ_H (α-CH) = 8.71; d_4-methanol, $\delta_C(CD_3)$ = 49.0, $\delta_H(CHD_2)$ = 4.78). Although the ^{13}C chemical shifts are accurate to no better than ±0.1 ppm, they have been given to two decimal places in order to show better the relative differences between different conformers in the same sample.

Where indicated, the signal assignments are unambiguous; the numbering scheme is arbitrary and is shown in the inserts. The assignments are based upon 1D and 2D spectra recorded using the following pulse sequences from the Bruker standard pulse program library: DEPT; COSY (*cosygs* and *cosydqtp*); HSQC (*invietgssi*) optimized for $^1J(C,H)$ = 145 Hz; HMBC (*inv4gslplrnd*) for correlations via $^nJ(C,H)$; HSQC-TOCSY (*invietgsml*) using an MLEV17 mixing time of 120 ms.

Compound 10. To a solution of compound **9** (8.35 g, 44.37 mmol) in pyridine (20 mL) is added in portions tosyl chloride (16.90 g, 88.64 mmol) at –25°C and the resulting mixture is stirred at that temperature for 16 h. For work-up, the reaction mixture is poored into chilled water (1.8 L), the precipitate is filtered off and dried in vacuo. The crude product thus obtained is recrystallized from MeOH (ca. 20 mL) to give compound **10** as colorless crystals (11.64 g, 77%). The analytical and spectroscopic data are in full agreement with those reported in the literature.[26]

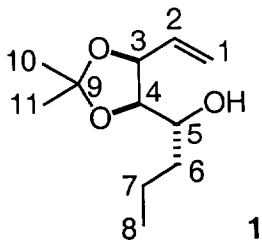
Compound 11. A solution of tosylate **10** (2.80 g, 8.18 mmol) in THF (7 mL) is slowly added to a solution of NaOMe (420 mg, 7.77 mmol) in THF (14 mL) at 0°C and the resulting mixture is stirred for 24 h at ambient temperature. Insoluble residues are then filtered off through a short pad of Kieselgur and are carefully washed with Et_2O (100 mL), the filtrate is concentrated and adsorped on the minimum amount of Celite which is deposited on top of a silica gel column. Flash chromatography (pentane/Et_2O, 2:1) affords epoxide **11** as a colorless syrup (1.02 g, 62%) and allows to recover some unreacted strating material **10** (795 mg, 28%). The analytical and spectroscopic data of compound **11** are in full agreement with those previously reported in the literature.[27]

Compound 12. A solution of EtMgBr (3M in Et_2O, 7.5 mL, 22.5 mmol, diluted with 20 mL of THF) is added over a period of 30 min to a suspension of CuBr·Me_2S (4.62 g, 22.47 mmol) in THF (20 mL) at –78°C. The resulting mixture is stirred at that temperature for 90 min before a solution of epoxide **11** (1.51 g, 7.47 mmol) in THF (15 mL) is added dropwise over a period of 90 min. Once the addition is complete, stirring is continued for 24 h while the mixture is slowly allowed to warm to room temperature. For work-up, the reaction is carefully quenched with aq. sat. NH_4Cl (40 mL). After stirring for 30 min, all insoluble residues are filtered off and are carefully washed with EtOAc (50 mL), the aqueous layer is separated and extracted with EtOAc (4×30 mL), the combined organic phases are washed with brine and then dried over Na_2SO_4, the solvent is evaporated and the residue is purified by flash chromatography (pentane/Et_2O, 4:1) to afford lactone **12** as a colorless syrup (890 mg, 60%). $[\alpha]_D^{20} = -43.0$ (c 0.94, CH_2Cl_2). IR: 1785 cm^{-1}. ^1H NMR (300 MHz, CD_2Cl_2) δ 4.72 (d, J = 5.6 Hz, 1H), 4.53 (dd, J = 5.7, 7.7 Hz, 2H), 1.65-1.55 (m, 2H), 1.53-1.42 (m, 2H), 1.44 (s, 3H), 1.36 (s, 3H), 0.97 (t, J = 7.2 Hz, 3H); ^{13}C NMR (75 MHz, CD_2Cl_2) δ 174.1, 114.0, 83.0, 79.9, 75.2, 36.1, 26.9, 25.7, 18.5, 13.7; MS *m/z* (rel. intensity): 185 (66), 85 (12), 83 (13), 59 (55), 43 (100). Anal. *calcd.* for $C_{10}H_{16}O_4$ (200.24) C 59.98, H 8.05; *found* C 59.85, H 7.88.

Compound 13. A solution of Dibal-H (1 M in toluene, 4.5 mL, 4.5 mmol) is added over a period of 45 min to a solution of lactone **12** (695 mg, 3.47 mmol) in CH_2Cl_2 (15 mL) at –78°C and stirring is continued at that temperature for 2h after the addition is complete. For work-up, the reaction is quenched by careful addition of MeOH (0.9 mL) followed by water (30 mL) and EtOAc (30 mL), the aqueous layer is acidified with conc. HCl (1.6 mL) and extracted with EtOAc (3×20 mL), the combined organic layers are washed with brine and then dried over Na_2SO_4, and the solvent is evaporated to afford lactol **13** as a colorless syrup

which is used in the next step without any further purification (679 mg, 97%). IR: 3433 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$, mixture of anomers, characteristic signals): δ 5.43 (br. s), 5.26 (dd, J = 4.1, 9.2 Hz), 4.63 (m), 4.57 (dd, J = 1.0, 6.0 Hz), 4.43 (dd, J = 2.8, 6.8 Hz), 4.17 (m), 4.04 (m), 3.90 (d, J = 9.3 Hz), 2.91 (br. s), 1.67 (m), 1.57 (s), 1.49 (s), 1.42 (m), 1.39 (s), 1.32 (s), 0.94 (v.t); ^{13}C NMR (75 MHz, $CDCl_3$) δ 114.7, 112.3, 103.1, 95.5, 87.1, 86.1, 84.4, 84.0, 80.2, 79.5, 37.6, 34.7, 26.5, 26.3, 24.9, 19.2, 18.8, 13.8, 13.7. MS *m/z* (rel. intensity): 187 (15), 98 (20), 59 (100), 55 (14), 43 (57), 41 (12); Anal. *calcd.* for $C_{10}H_{18}O_4$ (202.26) C 59.39, H 8.97; *found* C 59.28, H 9.06.

Compound 14. To a solution of methylenetriphenyl phosphorane (1.87 g, 6.77 mmol) in THF (7 mL) is added quinuclidine (75 mg, 0.675 mmol) followed by a solution of lactol **13** (670 mg, 3.31 mmol) in THF (7 mL) and the resulting mixture is refluxed for 30 min. All volatiles are removed in vacuo and the residue is purified by flash chromatography (pentane/Et_2O, 4:1) to give product **14** as a colorless syrup (410 mg, 62%). $[\alpha]_D^{20}$ = +8.7 (c 1.2, CH_2Cl_2). IR: 3466, 1643 cm^{-1}. ^1H NMR (600 MHz, $CDCl_3$): δ 6.04 (ddd, J = 17.2, 10.4, 7.6 Hz, 1H, H-2), 5.42 (ddd, J = 17.2, 1.5, 1.4 Hz, 1H, H-1(Z)), 5.30 (ddd, J = 10.4, 1.6, 1.0 Hz, 1H, H-1(*E*)), 4.64 (ddt, J = 7.5, 6.4, 1.0 Hz, 1H, H-3), 3.97 (dd, J = 8.2, 6.4 Hz, 1H, H-4), 3.66 (dt, J = 8.6, 2.7 Hz, 1H, H-5), 1.81 (br. s, 1H, -OH), 1.69 (m, 1H, H-6a), 1.56 (m, 1H, H-7a), 1.48 (s, 3H, H-11), 1.45 (m, 1H, H-6b), 1.37 (s, 3H, H-10), 1.37 (m, 1H, H-7b), 0.94 (t, J = 7.2 Hz, 3H, H-8); ^{13}C NMR (150 MHz, $CDCl_3$) δ 134.8, 118.4, 108.7, 80.8, 79.0, 69.8, 35.9, 27.8, 25.4, 18.4, 14.1. MS *m/z* (rel. intensity): 185 (17), 127 (33), 113 (13), 99 (12), 98 (72), 83 (20), 71 (22), 70 (29), 69 (56), 59 (58), 55 (26), 43 (100). Anal. *calcd.* for $C_{11}H_{20}O_3$ (200.28) C 65.97, H 10.07; found C 65.90, H 9.94.



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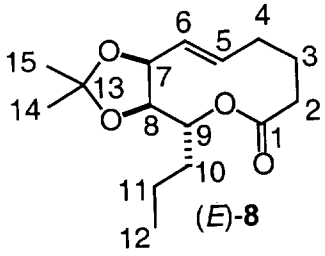
Compound 15. To a solution of alcohol **14** (460 mg, 2.30 mmol), DMAP (140 mg, 1.15 mmol) and DCC (570 mg, 2.76 mmol) in CH_2Cl_2 (45 mL) is added 5-hexenoic acid (288.8 mg, 2.53 mmol) and the resulting mixture is stirred at ambient temperature for 4 d. The mixture is then filtered through a short pad of Kieselgur, the insoluble residues are carefully washed with Et_2O (20 mL), the combined filtrates are concentrated and adsorbed on the minimum amount of Celite which is and deposited on top of a silica gel column. Flash chromatography (pentane/Et_2O, 10:1) affords ester **15** as a colorless syrup (575 mg, 84%). $[\alpha]_D^{20}$ = +25.9 (c 0.54, CH_2Cl_2). IR: 3079, 1739, 1642 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$): δ 5.67-5.84 (m, 2H), 5.29 (ddd, J = 17.1, 1.6, 1.2 Hz, 1H), 5.18 (ddd, J = 10.3, 1.6, 1.0 Hz, 1H), 5.02 (m, 1H), 4.96 (m, 1H), 4.90 (dt, J = 7.5, 3.7 Hz, 1H), 4.57 (ddt, J = 7.5, 6.5, 1.0 Hz, 1H), 4.15 (dd, J = 7.5, 6.5 Hz, 1H), 2.23 (dt, J = 7.5, 3.6 Hz, 2H), 2.05 (m, 2H), 1.64 (m, 3H), 1.45 (s, 3H), 1.34 (s, 3H), 1.32 (m, 3H), 0.88 (t, J = 7.3 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 172.5 (s), 137.6 (d), 133.3 (d), 118.4 (t), 115.3 (t), 108.7 (s), 78.9 (d), 78.4 (d), 71.6 (d), 33.7 (t), 33.4 (t), 33.0 (t), 27.5 (q), 25.2 (q), 23.9 (t), 17.9 (t), 14.0 (q). MS (ESI-pos) *m/z* 319

([M+Na)]$^+$), 297 ([M+H)]$^+$). Anal. *calcd.* for $C_{17}H_{28}O_4$ (296.41) C 68.89, H 9.52; *found* C 69.05, H 9.43.

Compound (*E*)-8. A solution of diene **15** (210.6 mg, 0.71 mmol) and the ruthenium indenylidene complex **16** (64.6 mg, 0.07 mmol) in CH_2Cl_2 (400 mL) is refluxed for 8 h until TLC shows complete conversion of the substrate. The reaction is quenched with ethyl vinyl ether (1 mL), the solvent is evaporated and the residue is purified by flash chromatography (pentane/Et_2O, 10:1) to give product (*E*)-**8** as a colorless syrup (132 mg, 69%). A second fraction contains (*Z*)-**8** (16.8 mg, 8.8%). Analytical and spectroscopic data of (*E*)-**8**: $[\alpha]_D^{20}$ = +78.0 (c 0.5, CH_2Cl_2). IR: 3040, 1731, 1202, 983 cm^{-1}. MS *m/z* (rel. intensity): 268 ([M$^+$], 2), 253 (13), 210 (7), 183 (18), 165 (10), 139 (29), 138 (35), 126 (32), 125 (18), 123 (21), 121 (13), 110 (35), 109 (34), 97 (100). Anal. *calcd.* for $C_{15}H_{24}O_4$ (268.36) C 67.14, H 9.02; *found* 67.02, H 8.93. The full set of NMR data is compiled in Table S-1.

Table S-1. NMR data (Bruker DMX-600 spectrometer) of compound (*E*)-**8** in $CDCl_3$ at 303 K. Arbitrary numbering scheme as shown. Ratio of conformers ≈ 3: 1. The multiplicity in the ^{13}C NMR refers to the DEPT spectrum.

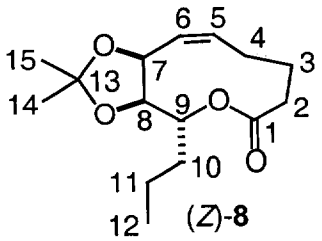


Position	Major conformer		Minor conformer	
	δ ^{1}H (ppm)[a]	δ ^{13}C (ppm)	δ ^{1}H (ppm)[b]	δ ^{13}C (ppm)
1		176.00 (s)		173.84 (s)
2	2.298/1.997	34.25 (t)	2.251/2.251	33.75 (t)
3	1.942/1.730	25.62 (t)	1.890/1.690	22.46 (t)
4	2.331/1.942	33.48 (t)	2.235/2.143	29.82 (t)
5	5.647	124.59 (d)	5.62	132.31 (d)
6	5.646	127.16 (d)	5.46	128.24 (d)
7	4.60	75.99 (d)	4.69	78.13 (d)
8	3.89	78.14 (d)	4.03	78.32 (d)
9	4.88	70.42 (d)	4.72	72.56 (d)
10	1.730/1.428	34.18 (t)	1.730/1.517	34.11 (t)
11	1.289	17.80 (t)	1.319	17.97 (t)
12	0.881	13.85 (q)	0.881	13.89 (q)
13		108.88 (s)		108.72 (s)
14	1.496	28.43 (q)	1.415	27.82 (q)
15	1.330	26.16 (q)	1.311	25.08 (q)

[a] Coupling constants for the major conformer: $J_{7,8}$ = 4.6 Hz, $J_{6,7}$ = 3.4 Hz, $J_{5,7}$ = 1.6 Hz, $J_{8,9}$ = 10.2 Hz, $J_{9,10}$ = 8.9 and 2.8 Hz, $J_{11,12}$ = 7.4 Hz. [b] Coupling constants for the minor isomer: $J_{5,6}$ = 16.2 Hz, $J_{6,7}$ = 8.4 Hz, $J_{7,8}$ = 4.6 Hz, $J_{8,9}$ = 10.1 Hz, $J_{9,10}$ = 9.8 and 2.7 Hz, $J_{11,12}$ = 7.4 Hz.

Compound (*Z*)-8. A solution of diene **15** (68.4 mg, 0.231 mmol) and the ruthenium complex **17** (19.5 mg, 0.023 mmol) in CH_2Cl_2 (100 mL) is refluxed for 8 h until TLC shows complete conversion of the substrate. After quenching the reaction with ethyl vinyl ether (0.5 mL), all volatiles are removed in vacuo and the residue is purified by flash chromatography (pentane/Et_2O, 10:1) to afford compound (*Z*)-**8** as a colorless syrup (53 mg, 86%). $[\alpha]_D^{20} = -83.3$ (c 0.6, CH_2Cl_2). IR: 3018, 1743, 1659, 1210 cm^{-1}. MS *m/z* (rel. intensity): 268 ([M^+], 23), 253 (10), 183 (24), 165 (12), 139 (19), 138 (30), 126 (22), 125 (33), 123 (12), 110 (16), 109 (13), 98 (11), 97 (100). For the full set of NMR data see Table S-2.

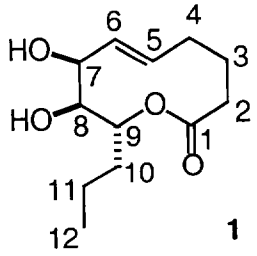
Table S-2. NMR data (Bruker DMX-600 spectrometer) of compound (*Z*)-**8** in $CDCl_3$ at 303 K. Arbitrary numbering scheme as shown. The multiplicity in the ^{13}C NMR refers to the DEPT spectrum.



Position	δ ^{1}H (ppm)	$J_{H,H}$ (Hz)	δ ^{13}C (ppm)	$J_{C,H}$ (Hz)
1			173.22 (s)	
2	2.28 / 2.13	J = 11.7, 4.5, 3.5, 0.6 Hz	34.96 (t)	J = 131 Hz
3	1.91 / 1.76		25.72 (t)	J = 130 Hz
4	2.23 / 2.15	J = 13.7, 11.5, 1.4 Hz	26.97 (t)	J = 130 Hz
5	5.40	J = 11.6, 4.2, 1.0 Hz	133.59 (d)	J = 155 Hz
6	5.34	J = 11.4, 9.5, 2.0 Hz	127.87 (d)	J = 157 Hz
7	4.92	J = 9.5, 6.2 Hz	74.61 (d)	J = 150 Hz
8	4.18	J = 9.9, 6.1 Hz	79.02 (d)	J = 147 Hz
9	4.64	J = 9.9, 7.7, 3.6 Hz	72.35 (d)	J = 149 Hz
10	1.75 / 1.56		35.69 (t)	J = 125 Hz
11	1.37		17.89 (t)	J = 126 Hz
12	0.89	J = 7.3 Hz	14.08 (q)	J = 125 Hz
13			110.02 (s)	
14	1.33		25.76 (q)	J = 126 Hz
15	1.45		28.21 (q)	J = 127 Hz

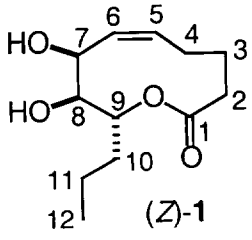
Herbarumin I ((*E*)-1). A solution of compound (*E*)-**8** (50.0 mg, 0.186 mmol) in THF (3 mL) and aq. HCl (1M, 0.25 mL) is stirred at 50°C for 8h until TLC shows complete conversion. The reaction mixture is diluted with Et_2O before it is neutralized with aq. NaOH. The organic layer is dried (Na_2SO_4) and evaporated and the residue is purified by flash chromatography

(pentane/Et_2O, 1:1) to afford the title compound as a colorless solid (38.1 mg, 90%). $[\alpha]_D^{20}$= +10.8 (c 0.51, EtOH). IR: 3450, 3033, 2960, 2929, 2872, 1716, 1631, 1203, 1058, 982 cm^{-1}; ^1H NMR (600 MHz, $CDCl_3$) δ 5.58 (ddd, 1H, J = 15.9, 1.7, 1.0 Hz, H-6), 5.49 (dddd, 1H, J = 15.9, 10.3, 4.0, 2.3 Hz, H-5), 4.92 (td, 1H, J = 9.6, 2.6 Hz, H-9), 4.40 (quint., 1H, J = 2.3 Hz, H-7), 3.48 (dd, 1H, J = 9.8, 2.3 Hz, H-8), 2.39 (br. s, 1H, -OH), 2.38 (br. d, 1H, J = 12.3 Hz, H-4a), 2.30 (ddd, 1H, J = 14.0, 5.8, 2.4 Hz, H-2a), 2.14 (br. s, 1H, -OH), 1.98 (ddd, 1H, J = 14.0, 12.9, 2.0 Hz, H-2b), 1.92 (m, 1H, H-4b), 1.87 (m, 1H, H-3a), 1.86 (m, 1H, H-10a), 1.71 (m, 1H, H-3b), 1.54 (ddt, 1H, J = 14.4, 9.7, 4.8 Hz, H-10b), 1.35 (m, 1H, H-11a), 1.27 (m, 1H, H-11b), 0.89 (t, 3H, J = 7.3 Hz, -Me); ^{13}C NMR (75 MHz, $CDCl_3$) δ 176.3, 130.7, 124.7, 73.6, 73.3, 70.2, 34.4, 33.7, 33.3, 24.6, 18.0, 13.8; MS (EI): *m/z* (rel. intensity): 228 (3, [M^+]), 200 (5), 144 (10), 143 (40), 126 (16), 125 (100), 97 (33), 95 (12), 86 (29), 84 (11), 83 (24), 81 (12), 79 (19), 70 (19), 69 (14), 57 (52), 55 (28); MS (ESI): 251 ([M+Na]$^+$), 479 ([2M+Na]$^+$). These data in in agreement with those reported in the literature.[1]



1

Compound (Z)-1. Prepared as described above from compound (*Z*)-**8** (50.0 mg, 0.186 mmol). Colorless solid (19.8 mg, 47%). $[\alpha]_D^{20}$= –96.8 (c 0.48, EtOH); IR: 3398, 2960, 1734, 1654, 1210 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 5.50-5.70 (m, 2H, H-5,6), 4.69 (m, 1H, J = 4.1, 9.7 Hz, H-7), 4.54 (ddd, 1H, J = 9.3, 7.9, 3.6 Hz, H-9), 3.90 (dd, 1H, J = 9.3, 4.1 Hz, H-8), 2.34 (m, 2H, H-2a,4a), 2.21 (m, 1H, H-4b), 2.15 (m, 1H, H-2b), 1.91 (m, 1H, H-3a), 1.80 (m, 1H, H-3b), 1.76 (m, 1H, H-10a), 1.56 (m, 1H, H-10b), 1.35 (m, 2H, H-11), 0.89 (t, 3H, J = 7.4 Hz, H-12); ^{13}C NMR (75 MHz, $CDCl_3$) δ 173.81 (s, C-1), 35.45^ (t, C-2), 25.50 (t, C-3), 27.61 (t, C-4), 134.45 (d, C-5), 126.30 (d, C-6), 74.30* (d, C-7), 74.07* (d, C-8), 66.84 (d, C-9), 35.62^ (t, C-10), 18.11 (t, C-11), 14.09 (q, C-12); the assignment of the signals marked * and ^ might be mutually interchanged. MS (EI): *m/z* (rel. intensity): 228 (1, [M^+]), 210 (5), 200 (10), 157 (25), 143 (28), 126 (26), 125 (100), 107 (13), 98 (31), 97 (51), 95 (18), 86 (27), 81 (16) 80 (16), 79 (25).



(*Z*)-**1**

Compound 19. To a solution of NHMDS (403 mg, 2.20 mmol) in THF (2.2 mL) at –78°C is added a solution of the oxazolidinone derivative **18** (500 mg, 1.83 mmol)[47] in THF (6 mL) over a period of 30 min and stirring is continued for 30 min at that temperature before a solution of trans-3-phenyl-2(phenylsulfonyl)oxaziridine (720 mg, 2.76 mmol)[48] in THF (5 mL) is introduced. After stirring for another 30 min, the reaction is quenched by addition of a solution of camphorsulfonic acid (2.12 g) in THF (18.5 mL), the cooling bath is removed, the mixture is diluted with water, the THF is removed in vacuo and the remaining aqueous phase is repeatedly extracted with ethyl acetate (60 mL in several portions). The combined organic

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[47] Boeckmann, R. K.; Charette, A. B.; Asberom, T.; Johnston, B. H. *J. Am. Chem. Soc.* **1991**, *113*, 5337.

[48] Davis, F. A.; Stringer, O. D. *J. Org. Chem.* **1982**, *47*, 1774.

layers are successively washed with sat. aq. $NaHCO_3$ and brine, dried over Na_2SO_4 and evaporated. The crude product is purified by flash chromatography (pentane/Et_2O, 5:1) to afford compound **19** as a colorless syrup (470 mg, 89%). $[\alpha]_D^{20}$ = +19.3 (c 0.59, CH_2Cl_2); IR: 3496, 1784, 1700, 1641 cm^{-1}; MS (EI): *m/z* (rel. intensity): 289 (3, [M^+]), 235 (11), 205 (5), 177 (7), 176 (4), 134 (12), 119 (11), 118 (100), 107 (41), 91 (18), 79 (13); Anal. *calcd.* for $C_{16}H_{19}NO_4$ (289.33) C 66.42, H 6.62; *found* C 66.27, H 6.56. For the full set of NMR data see Table S-3.

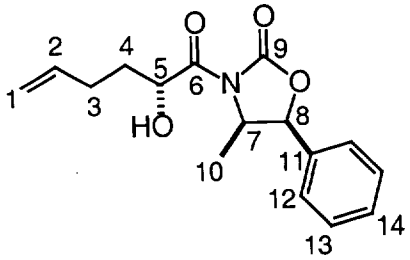


Table S-3. NMR data (Bruker DMX-600 spectrometer) of compound **19** in $CDCl_3$ at 303 K. Arbitrary numbering scheme as shown. The multiplicity in the ^{13}C NMR refers to the DEPT spectrum.

Position	δ ^{1}H (ppm)	multiplicity	$J_{H,H}$ (Hz)	δ ^{13}C (ppm)
1	5.07	dq	J = 17.1, 1.8 Hz	115.40 (t)
	5.00	ddt	J = 10.2, 1.8, 1.3 Hz	
2	5.84	ddt	J = 17.1, 10.3, 6.7 Hz	137.54 (d)
3	2.28	m		29.40 (t)
4	1.93 / 1.68	m		33.58 (t)
5	5.03	dd	J = 8.5, 3.3 Hz	70.38 (d)
6				174.86 (s)
7	4.73	quint.	J = 7.3, 6.7 Hz	55.46 (d)
8	5.72	d	J = 7.1 Hz	79.90 (d)
9				152.74 (s)
10	0.93	d	J = 6.7 Hz	14.29 (q)
11				132.71 (s)
12	7.29	m		125.61 (d)
13	7.42	m		128.83 (d)
14	7.37	m		129.01 (d)

5-OH: 3.38 ppm (br. s, 1H, -OH).

Compound 20. P_4O_{10} (331 mg, 2.33 mmol) is added to a solution of alcohol **19** (450 mg, 1.56 mmol) in dimethoxymethane (16 mL) and the reaction is stirred for 2 h at ambient temperature. It is advisable to monitor the progress of the reaction by HPLC as prolonged stirring leads to the formation of unidentified by-products. The solution is decanted from the insoluble residues which are rinsed with EtOAc. The combined organic phases are neutralized with sat. aq. $NaHCO_3$ and washed with brine, dried over Na_2SO_4 and evaporated, and the

residue is purified by flash chromatography (pentane/Et_2O, 4:1) to afford product **20** as a viscous syrup which slowly solidifies on standing in a freezer (405 mg, 78%). $[\alpha]_D^{20} = +48.1$ (c 1.28, CH_2Cl_2); IR: 1775, 1707, 1643 cm^{-1}; MS (EI): *m/z* (rel. intensity): 249 (27), 134 (16), 118 (25), 117 (11), 107 (10), 91 (10), 55 (13), 45 (100); Anal. *calcd.* for $C_{18}H_{23}NO_5$ (333.39) C 64.85, H 6.95; *found* C 64.82, H 6.90. For the full set of NMR data see Table S-4.

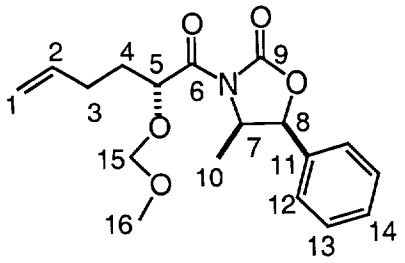


Table S-4. NMR data (Bruker DMX-600 spectrometer) of compound **20** in $CDCl_3$ at 303 K. Arbitrary numbering scheme as shown. The multiplicity in the ^{13}C NMR refers to the DEPT spectrum.

Position	δ ^1H (ppm)	$J_{H,H}$ (Hz)	δ ^{13}C (ppm)
1	4.98	J = 10.3 Hz	115.33 (t)
	5.04	J = 17.1, 1.7 Hz	
2	5.82	J = 17.1, 10.3, 6.7 Hz	137.39 (d)
3	2.27		29.62 (t)
4	1.83		32.28 (t)
5	5.27	J = 8.5, 3.8 Hz	75.23 (d)
6			173.05 (s)
7	4.73	J = 7.3, 6.6 Hz	54.93 (d)
8	5.66	J = 7.2 Hz	79.34 (d)
9			152.63 (s)
10	0.90	J = 6.6 Hz	14.23 (q)
11			133.06 (s)
12	7.27		125.60 (d)
13	7.40		128.71 (d)
14	7.35		128.81 (d)
15	4.62/4.71	J = 6.9 Hz	97.15 (t)
16	3.33		56.13 (q)

Compound 21. To a solution of compound **20** (400 mg, 1.20 mmol) in THF (4.8 mL) and water (1.2 mL) are successively added H_2O_2 (30% w/w, 0.49 mL) and aq. LiOH (47.5 mg, 1.98 mmol, in 2.4 mL) via syringe at 0°C and stirring is continued for 1 h. The reaction is quenched with aq. Na_2SO_3 (605 mg in 3.6 mL of H_2O) and the THF is evaporated. The remaining aqueous phase is repeatedly extracted with CH_2Cl_2 (15 mL) before it is acidified with HCl (5 N, 0.25 mL) and extracted again with EtOAc (4×5 mL). The combined EtOAc layers are washed with brine, dried over Na_2SO_4 and evaporated to give acid **21** as a colorless

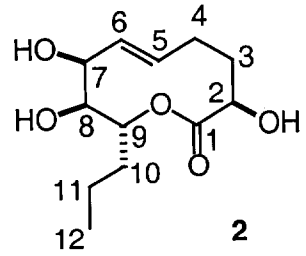
syrup (185 mg, 89%). $[\alpha]_D^{20}$= +47.0 (c 0.81, CH_2Cl_2); IR: 3660-2650, 1728, 1642 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 10 ppm (br s, 1H, -COOH), 5.79 (m, 1H), 5.03 (m, 2H), 4.71 (d, J = 6.9 Hz, 1H), 4.66 (d, J = 6.9 Hz, 1H), 4.15 (dd, J = 6.3, 5.9 Hz, 1H), 3.39 (s, 3H), 2.20 (m, 2H), 1.87 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.9, 137.1, 115.7, 96.4, 74.9, 56.2, 31.9, 29.2; MS (EI): *m/z* (rel. intensity): 97 (10), 71 (14), 45 (100); Anal. *calcd.* for $C_8H_{14}O_4$ (174.20) C 55.16, H 8.10; *found* C 55.02, H 8.10.

Compound 22. To a solution of compound **14** (150 mg, 0.75 mmol), DMAP (47 mg, 0.38 mmol) and DCC (192 mg, 0.93 mmol) in CH_2Cl_2 (15 mL) is added a solution of acid **21** (150 mg, 0.86 mmol) in CH_2Cl_2 (1 mL) and the resulting mixture is stirred overnight at ambient temperature. For work up, the mixture is filtered through a short pad of Kieselgur which is washed with Et_2O (40 mL), the filtrates is evaporated and the residue is purified by flash chromatography (pentane/Et_2O, 7:1→2:1) to afford ester **22** as a colorless syrup (125 mg, 47%). A second fraction contains unreacted alcohol **14** (46 mg, 31%). Spectroscopic and analytical data of compound **22**: $[\alpha]_D^{20}$= +66.5 (c 0.48, CH_2Cl_2); IR: 1751, 1642 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 5.85-5.71 (m, 2H), 5.35-5.19 (m, 2H), 5.06-4.96 (m, 3H), 4.65 (d, J = 7.0 Hz, 1H), 4.61 (d, J = 7.0 Hz, 1H), 4.56 (ddt, J = 7.4, 6.4 Hz, 1H), 4.16 (dd, J = 7.2, 6.4 Hz, 1H), 4.03 (dd, J = 7.6, 5.3 Hz, 1H), 3.35 (s, 3H), 2.23-2.12 (m, 2H), 1.81-1.73 (m, 2H), 1.67-1.57 (m, 2H), 1.45 (s, 3H), 1.39-1.22 (m, 2H), 1.33 (s, 3H), 0.88 (t, J = 7.2 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 171.6, 137.3, 133.1, 119.1, 115.5, 108.7, 96.3, 78.7, 78.1, 74.9, 72.3, 56.1, 33.2, 31.9, 29.4, 27.5, 25.2, 17.8, 14.0; MS (EI): *m/z* (rel. intensity): 341 (13), 127 (22), 125 (14), 98 (57), 97 (12), 83 (16), 71 (19), 69 (28), 59 (16), 55 (24), 45 (100); Anal. *calcd.* for $C_{19}H_{32}O_6$ (356.47) C 64.02, H 9.05; *found* C 63.98, H 8.99.

Compound (*E*)-23. A solution of diene **22** (110 mg, 0.309 mmol) and complex **16** (28.0 mg, 0.0303 mol) in CH_2Cl_2 (150 mL) is refluxed for 9 h until TLC shows complete conversion. For work-up, the reaction is quenched with ethyl vinyl ether (0.5 mL), all volatile components are removed in vacuo and the crude product is purified by flash chromatography (pentane/Et_2O, 10:1) to afford compound (*E*)-**23** as a viscous syrup which solidifies upon standing in a freezer (80 mg, 79%). $[\alpha]_D^{20}$= +118.7 (c 0.75, CH_2Cl_2); IR: 1741, 1669 cm^{-1}; ^1H NMR (600 MHz, mixture of two conformers, [resolved signals of minor conformer], CD_2Cl_2) δ 5.64 (ddd, J = 15.8, 3.2, 0.6 Hz), [5.42 (dd, J = 16.3, 8.2 Hz)], 5.62-5.55 (m), 4.90 (br. t, J = 9.3 Hz), [4.83 (ddd, J = 10.2, 8.3, 3.0 Hz)], 4.72 (ddd, J = 8.0, 6.3, 1.0 Hz), [4.63 (overlapped)], 4.63 (d, J = 7.0 Hz), 4.61 (d, J = 7.0 Hz), [4.61 (d), 4.56 (d, J = 6.9 Hz)], 4.10 (t, J = 4.9 Hz), [3.95 and 3.81 (dd, J = 10.8, 2.7 Hz)], 3.32 (s), [3.27 (s)], 2.24-2.37 (m, 2H), 2.00-2.23 (m, 4H), 1.73-1.92 (m, 4H), 1.46-1.56 (m, 2H), 1.50 (s), 1.34 (s), [1.43, 1.32 (s)], 1.26-1.41 (m, 2H), 0.92 (t, J = 7.4 Hz), [0.91 (t, J = 7.4 Hz)]; ^{13}C NMR (75 MHz, two conformers, $CDCl_3$): δ 174.8, 172.1, 132.8, 127.7, 127.6, 124.2, 109.3, 96.4, 96.0, 78.8, 78.4, 78.3, 78.1, 76.3, 73.8, 72.6, 71.6, 55.9, 55.8, 34.6, 34.3, 33.2, 30.8, 30.0, 28.6, 28.1, 26.6, 26.3, 25.4, 18.2, 18.0, 14.1, 14.0; MS (EI): *m/z* (rel. intensity): 328 (4, [M^+]), 284 (10), 283

(58), 181 (11), 123 (15), 110 (11), 97 (15), 95 (10), 81 (12), 71 (12), 59 (10), 55 (17), 45 (100); Anal. *calcd.* for $C_{17}H_{28}O_6$ (328.41) C 62.18, H 8.59; *found* C 62.05, H 8.65.

Herbarumin II (2). A solution of compound (*E*)-**23** (75 mg, 0.228 mmol) in MeOH (9 mL), water (4.5 mL) and aq. HCl (1N, 2 mL) is stirred at 60°C for 3h. The mixture is then neutralized with aq. NaOH (1M), the MeOH is evaporated, the remaining aqueous solution is repeatedly extracted with EtOAc (40 mL), the combined organic layers are washed with brine, dried (Na_2SO_4) and evaporated and the crude product is purified by flash chromatography (pentane/Et_2O 1:1→1:2, then pentane/EtOAc, 1:2; all eluents contained 0.1% of Et_3N) to give herbarumin II (**2**) as a colorless solid (47.0 mg, 84%). Mp = 101.5-102.1°C; $[\alpha]_D^{20}$ = +17.3 (c 0.63, MeOH); IR: 3381, 2959, 2927, 2873, 1736, 1640, 1466, 1445, 1364, 1249, 1218, 1193, 1169, 1138, 1119, 1093, 1069, 1045, 985, 942, 866, 776, 717 cm^{-1}; MS (EI): *m/z* (rel. intensity): 244 (5, [M^+]), 160 (11), 159 (24), 142 (15), 141 (93), 115 (82), 114 (15), 113 (76), 95 (30), 86 (64), 85 (19), 113 (76), 95 (30), 86 (64), 85 (19), 83 (30), 81 (14), 71 (17), 70 (80), 69 (24), 68 (13), 67 (80), 57 (100). For a compilation of the NMR data see Tables S-5 – S-7.



2

Table S-5. NMR data (Bruker DMX-600 spectrometer) of herbarumin II (**2**) in MeOH-d_4 at 303 K. In this solvent only one conformer is detected. Arbitrary numbering scheme as shown. The multiplicity in the ^{13}C NMR refers to the DEPT spectrum.

Position	δ ^1H (ppm)	multiplicity	$J_{H,H}$ (Hz)	δ ^{13}C (ppm)
1				176.90 (s)
2	3.84	dd	J = 10.6, 3.0 Hz	73.56 (d)
3a	1.89	m		34.99 (t)
3b	1.79	m		
4a	2.29	dm	J = 13.1 Hz	29.71 (t)
4b	2.09	m		
5	5.49	dddd	J = 15.6, 10.3, 4.3, 2.2 Hz	123.47 (d)
6	5.55	ddd	J = 15.6, 2.1, 0.8 Hz	134.06 (d)
7	4.34	quint.	J = 2.1 Hz	73.93 (d)
8	3.51	dd	J = 9.7, 2.5 Hz	74.11 (d)
9	5.15	td	J = 9.3, 2.8 Hz	71.90 (d)
10a	1.82	m		35.17 (t)
10b	1.52	m		
11a	1.41	m		18.66 (t)
11b	1.32	m		
12	0.92	t	J = 7.4 Hz	14.41 (q)

Table S-6. ^{13}C NMR data (Bruker DMX-600 spectrometer) of herbarumin II (**2**) in $CDCl_3$ at 303 K. In this solvent two different conformers (ca. 85 : 15) are detected. Arbitrary numbering scheme as shown above. The multiplicity refers to the DEPT spectrum.

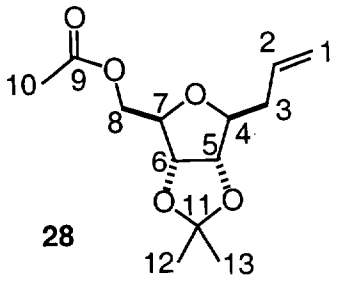
Position	Major conformer		Minor conformer	
	δ ^{13}C (ppm)	multiplicity	δ ^{13}C (ppm)	multiplicity
1	177.07	s	177.44	s
2	70.61	d	68.23	d
3	34.54	t	30.48	t
4	25.11	t	25.77	t
5	122.51	d	133.21	d
6	131.92	d	130.31	d
7	73.22	d	72.61	d
8	73.00	d	74.82	d
9	71.89	d	78.71	d
10	33.85	t	33.97	t
11	17.87	t	18.69	t
12	13.85	q	13.68	q

Table S-7. ^{1}H NMR data (Bruker DMX-600 spectrometer) of herbarumin II (**2**) in $CDCl_3$ at 303 K. In this solvent two different conformers (ca. 85 : 15) are detected. Arbitrary numbering scheme as shown above.

Position	Major conformer		Minor conformer	
	δ ^{1}H (ppm)	J (Hz)	δ ^{1}H (ppm)	J (Hz)
2	3.99 (dd)	J = 8.0, 2.9 Hz	4.25 (dd)	J = 3.9, 3.2 Hz
3	2.02/1.95 (m)		2.15-2.05/1.81 (m)	
4	2.30/2.10 (m)		2.25/2.15-2.05 (m)	
5	5.56 (dddd)	J = 16.3, 7.6, 5.5, 2.1 Hz	5.48 (dddd)	J = 16.4, 10.7, 4.1, 1.0 Hz
6	5.61 (dd)	J = 16.3, 1.8 Hz	5.37 (ddd)	J = 16.4, 6.9, 1.2 Hz
7	4.47 (m)		4.32 (ddt)	J = 6.8, 3.1, 1 Hz
8	3.54 (dd)	J = 9.8, 2.7 Hz	3.72 (dd)	J = 5.1, 3.2 Hz
9	5.04 (td)	J = 9.5, 2.6 Hz	5.00 (dt)	J = 9.0, 4.5 Hz
10	1.88/1.58 (m)		1.78-1.70 (m)	
11	1.36/1.28 (m)		1.42/1.32 (m)	
12	0.90 (t)	J = 7.4 Hz	0.92 (t)	J = 7.4 Hz

Compound 28. To a solution of compound **27** (1.23 g, 4.48 mmol)[38] and allyltrimethylsilane (2.62 g, 22.93 mmol) in MeCN (9 mL) is added TMSOTf (475 mg, 2.14 mmol) at 0°C and the resulting solution is kept at that temperature for 24 h. For work up, the reaction mixture is poured into chilled aq. sat. $NaHCO_3$, the aqueous phase is extracted with EtOAc (3×20 mL), the combined organic phases are washed with brine and dried, the solvent is evaporated and the residue is purified by flash chromatography (pentane/Et_2O, 9:2) to afford compound **28** admixed with a small amount of the corresponding α-anomer (726 mg). This mixture is directly used in the next step. For analytical purposes, a sample of the pure β-anomer **28** was obtained by preparative HPLC (125 mm BIAX, ∅ 25 mm, Nucleosil 7-120-C18/A, eluent: MeOH/H_2O = 1/1, 9.1 MPa, flow rate 15.0 mL/min) which exhibits the following spectroscopic and analytical data: $[\alpha]_D^{20}$ = +10.6 (c 0.89, CH_2Cl_2); IR: 3078, 2987, 2938, 1745, 1643, 1456, 1436, 1382, 1373, 1240, 1159, 1080, 1046, 992, 919, 865 cm^{-1}; MS (EI): *m/z* (rel. intensity): 241 (28), 215 (62), 157 (9), 121 (33), 97 (12), 69 (25), 68 (17), 59 (22), 55 (20), 43 (100). For a compilation of the NMR data see Table S-8.

Table S-8. NMR data (Bruker DMX-600 spectrometer) of compound **28** in $CDCl_3$ at 303 K. Arbitrary numbering scheme as shown. The multiplicity in the ^{13}C NMR refers to the DEPT spectrum.



28

Position	δ ^1H (ppm)	$J_{H,H}$ (Hz)	δ ^{13}C (ppm)	$J_{C,H}$ (Hz)
1(E)	5.08	J = 10.3, 1.8, 1.3 Hz	117.88 (t)	J = 158 Hz
1(Z)	5.11	J = 17.2, 1.8 Hz		
2	5.77	J = 17.2, 10.3, 6.9 Hz	133.21 (d)	J = 154 Hz
3	2.34		37.70 (t)	J = 127 Hz
4	3.96	J = 6.4, 4.5 Hz	83.69 (d)	J = 148 Hz
5	4.35	J = 6.9, 4.5 Hz	83.87 (d)	J = 156 Hz
6	4.40	J = 4.4 Hz	81.88 (d)	J = 155 Hz
7	4.05		81.59 (d)	J = 148 Hz
8	4.06/4.23		64.31 (t)	J = 147 Hz
9			170.60 (s)	
10	2.05		20.76 (q)	J = 130 Hz
11			114.61 (s)	
12	1.49		27.34 (q)	J = 127 Hz
13	1.29		25.46 (q)	J = 127 Hz

Compound 30. A suspension of compound **28** (mixture with <5% α-anomer, 530 mg, 2.07 mmol) and Pd on charcoal (5% w/w, 220 mg) in CH_2Cl_2 (50 mL) is stirred under an atmosphere of H_2 (1 atm) for 3h at ambient temperature. The catalyst is then filtered off through a short pad of Kieselgur and the filtrate is evaporated to give crude **29** which is used in the next step without further characterization. This compound is dissolved in MeOH (9 mL) and treated with MeONa (36 mg) for 4 h at ambient temperature. For work up, the solution is adsorped on Celite which is deposited on top of a silica gel column. Flash chromatography (pentane/Et_2O, 2:1) affords product **30** as a colorless syrup (380 mg, 85%, only β-anomer). $[\alpha]_D^{20} = -2.5$ (c 0.70, CH_2Cl_2); IR: 3462, 2986, 2959, 2935, 2874, 1458, 1382, 1373, 1246, 1212, 1159, 1077, 864 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 4.55 (dd, J = 7.0, 4.6 Hz, 1H), 4.25 (dd, J = 7.0, 5.1 Hz, 1H), 3.92 (m, 1H), 3.83 (m, 1H), 3.77 (dd, J = 11.9, 3.5 Hz, 1H), 3.62 (dd, J = 11.8, 4.5 Hz, 1H), 2.13 (br. s, 1H, -OH), 1.50 (s, 3H), 1.30 (s, 3H), 1.33-1.59 (m, 4H), 0.92 (t, J = 7.3 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 114.6, 85.0, 84.2, 83.9, 81.3, 62.7, 35.7, 27.3, 25.4, 18.8, 14.0; MS (EI): *m/z* (rel. intensity): 216 (0.1, $[M^+]$), 202 (12), 201 (100), 185 (11), 141 (19), 127 (13), 111 (28), 86 (10), 85 (14), 71 (12), 69 (14), 68 (19), 59 (54), 57 (29), 55 (21), 43 (41); Anal. *calcd.* for $C_{11}H_{20}O_4$ (216.28) C 61.09, H 9.32; *found* C 60.96, H 9.40.

Compound 31. To a rapidly stirred solution of alcohol **30** (350 mg, 1.62 mmol) in CH_2Cl_2 (10 mL) are successively added PPh_3 (572 mg, 2.18 mmol), imidazole (331 mg, 4.86 mmol) and iodine (555 mg, 2.19 mmol) and the resulting mixture is stirred for 20h at ambient temperature. Insoluble residues are filtered off through a short pad of Kieselgur which is then carefully rinsed with EtOAc, the combined filtrates are evaporated and the residue is purified by flash chromatography (pentane/Et_2O, 5:1) to afford iodide **31** as a colorless syrup (471 mg, 89%). $[\alpha]_D^{20} = -6.5$ (c 0.69, CH_2Cl_2); IR: 2986, 2959, 2933, 2872, 1457, 1381, 1373, 1242, 1212, 1158, 1077, 969, 865; ^1H NMR (300 MHz, $CDCl_3$) δ 4.41 (dd, J = 6.9, 4.0 Hz, 1H), 4.33 (dd, J = 6.9, 4.6 Hz, 1H), 3.88 (m, 2H), 3.26 (m, 2H), 1.50 (s, 3H), 1.31 (s, 3H), 1.38-1.62 (m, 4H), 0.92 (t, J = 7.3 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 114.6, 85.2, 85.1, 84.5, 82.5, 35.8, 27.3, 25.5, 18.8, 14.0, 7.3; MS (EI): *m/z* (rel. intensity): 326 (0.3, $[M^+]$), 311 (35), 251 (10), 199 (60), 141 (70), 127 (18), 124 (36), 123 (12), 99 (12), 97 (23), 95 (21), 85 (18), 81 (15), 71 (22), 69 (100); Anal. *calcd.* for $C_{11}H_{19}IO_3$ (326.18) C 40.51, H 5.87; *found* C 40.44, H 6.08.

Compound 32. To a suspension of C_8K (554 mg, 4.10 mmol)[42] in THF (7 mL) is added $ZnCl_2$ (275 mg, 2.02 mmol) and AgOAc (27.5 mg, 0.165 mmol) in solid form causing an immediate color change from bronze to black. The resulting mixture is refluxed for 30 min to ensure complete reduction of the salts. The suspension is allowed to reach ambient temperature before a solution of iodide **31** (436 mg, 1.34 mmol) in THF (2 mL) is introduced and the resulting mixture is stirred for 30 min. The activated metal is then carefully destroyed by acidifying the reaction mixture to pH ≈ 4 using aq. HOAc, insoluble residues are filtered off through a short pad of Kieselgur which is rinsed with Et_2O (100 mL) and EtOAc (20 mL),

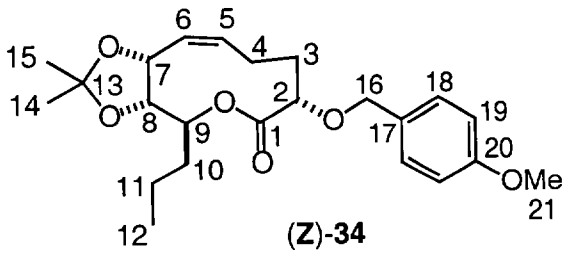
the combined filtrates are successively washed with aq. sat. $NaHCO_3$ and brine, they are dried over Na_2SO_4 and evaporated, and the residue is purified by flash chromatography (pentane/Et_2O, 5:1→4:1) to afford alcohol **32** as a colorless syrup (230 mg, 86%). $[\alpha]_D^{20}$ = –6.9 (c 0.70, CH_2Cl_2); IR: 3456, 2987, 2959, 2936, 2874, 1643, 1458, 1380, 1372, 1254, 1217, 1169, 1100, 1068, 1033, 1017, 926, 874; ^{1}H NMR (300 MHz, $CDCl_3$) δ 6.01 (ddd, J = 17.6, 10.4, 7.6 Hz, 1H), 5.38 (d(m), J = 17.3 Hz, 1H), 5.27 (d(m), J = 10.2 Hz, 1H), 4.60 (ddt, J = 7.4, 6.5, 1.0 Hz, 1H), 3.93 (dd, J = 8.2, 6.3 Hz, 1H), 3.63 (m, 1H), 1.73 (br. s, 1H, -OH), 1.44 (s, 3H), 1.33 (s, 3H), 1.28-1.73 (m, 4H), 0.91 (t, J = 7.3 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 134.7, 118.4, 108.6, 80.7, 78.9, 69.8, 35.9, 27.8, 25.3, 18.3, 14.0; MS (EI): *m/z* (rel. intensity): 200 (0.2, [M^+]), 185 (31), 127 (48), 113 (21), 98 (99), 83 (30), 71 (23), 70 (37), 69 (80), 59 (70), 57 (16), 55 (40), 43 (100); Anal. *calcd.* for $C_{11}H_{20}O_3$ (200.28) C 65.97, H 10.07; *found* C 66.15, H 10.11.

Compound 33. A solution of acid **41** (210 mg, 0.84 mmol) in CH_2Cl_2 (3 mL) is added to a stirred solution of alcohol **32** (156 mg, 0.78 mmol), DCC (205 mg, 0.99 mmol) and DMAP (48 mg, 0.39 mmol) in CH_2Cl_2 (10 mL). The resulting mixture is stirred at ambient temperature for 28h before it is filtered trough a short pad of Kieselgur which is carefully rinsed with Et_2O (30 mL) and EtOAc (20 mL). The combined filtrates are evaporated and the residue is purified by flash chromatography (pentane/Et_2O, 8:1) to afford ester **33** as a viscous syrup which slowly solidifies in the freezer (293 mg, 87%). $[\alpha]_D^{20}$ = –65.9 (c 0.86, CH_2Cl_2); IR: 3077, 2960, 2935, 2874, 1748, 1641, 1613, 1514, 1465, 1381, 1372, 1302, 1249, 1213, 1174, 1108, 1037, 995, 929, 872, 822 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 (m, 2H), 6.88 (m, 2H), 5.70-5.88 (m, 2H), 5.35 (d(m), J = 17.0 Hz, 1H), 5.24 (d(m), J = 10.4 Hz, 1H), 4.95-5.08 (m, 3H), 4.64 (d, J = 11.2 Hz, 1H), 4.60 (ddt, J = 7.4, 6.5, 1.2 Hz, 1H), 4.31 (d, J = 11.2 Hz, 1H), 4.20 (dd, J = 7.1, 6.6 Hz, 1H), 3.87 (dd, J = 7.1, 5.8 Hz, 1H), 3.80 (s, 3H), 2.09-2.25 (m, 2H), 1.76-1.82 (m, 2H), 1.63-1.75 (m, 2H), 1.49 (s, 3H), 1.37 (s, 3H), 1.30-1.43 (m, 2H), 0.93 (t, J = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 171.8, 159.4, 137.4, 133.2, 129.7, 129.6, 119.1, 115.4, 113.8, 108.7, 78.7, 78.2, 76.8, 72.3, 71.9, 55.2, 33.3, 32.0, 29.5, 27.5, 25.2, 18.0, 14.0; MS (EI): *m/z* (rel. intensity): 432 (0.6, [M^+]), 417 (7), 249 (12), 238 (10), 197 (31), 137 (15), 127 (12), 125 (16), 121 (100), 98 (25), 69 (19), 55 (12); Anal. *calcd.* for $C_{25}H_{36}O_6$ (432.57) C 69.42, H 8.39; *found* C 69.58, H 8.45.

Compound 34. A solution of diene **33** (230 mg, 0.53 mmol) and the ruthenium indenylidene complex **16** (49 mg, 0.053 mmol) in CH_2Cl_2 (350 mL) is refluxed for 4 h. Quenching of the reaction with ethyl vinyl ether (0.5 mL) and evaporation of the solvent followed by flash chromatography (pentane/Et_2O, 8:1) of the residue provides product **34** as a colorless syrup which solidifies in the freezer (175 mg, 82%). A second fraction contains the corresponding (Z)-isomer (10%). Spectroscopic and analytical data of (*E*)-**34**: $[\alpha]_D^{20}$ = –120.4 (c 0.55, CH_2Cl_2); IR: 2982, 2964, 2933, 2864, 1741, 1615, 1515, 1469, 1382, 1244, 1221, 1196, 1111, 1098, 1044, 1033, 983, 825, 804 cm^{-1}; ^{1}H NMR (400 MHz, two conformers, $CDCl_3$) δ 7.22-7.28 (m, 2H), 6.86-6.89 (m, 2H), 5.61 (m, 2H), 5.55-5.58 (m), 5.46 (dd, J = 16.5, 8.0 Hz),

4.89-4.98 (m, 1H), 4.73 (m), 4.63 (m), 4.58 (d, J = 11.2), 4.42 (d, J = 11.2), 4.30 (d, J = 11.2), 4.28 (d, J = 11.2), 3.90-3.99 (m), 3.73-3.76 (m), 3.80 (s), 2.25-2.35 (m), 2.00-2.22 (m), 1.90-1.78 (m), 1.49-1.62 (m), 1.52 (s), 1.45 (s), 1.35 (s), 1.34 (s), 1.28-1.42 (m), 0.96 (t, J = 7.3 Hz), 0.95 (t, J = 7.3 Hz); ^{13}C NMR (100 MHz, conformers, $CDCl_3$): δ 175.0, 172.2, 158.9, 159.8, 133.0, 130.4, 130.1, 129.9, 127.6, 127.5, 124.5, 114.1, 109.4, 109.3, 79.9, 78.9, 78.5, 78.4, 76.4, 76.3, 72.7, 71.7, 71.6, 71.3, 55.6, 34.8, 34.3, 33.3, 31.0, 29.9, 28.7, 28.2, 26.7, 26.3, 25.4, 18.6, 18.5, 14.2, 14.1; MS (EI): *m/z* (rel. intensity): 404 (3, [M^+]), 283 (5), 138 (11), 137 (17), 121 (100); Anal. *calcd.* for $C_{23}H_{32}O_6$ (404.51) C 68.29, H 7.97; *found* C 68.11, H 8.06. For a compilation of the NMR data of the (*Z*)-isomer see Table S-9.

Table S-9. NMR data (Bruker DMX-600 spectrometer) of compound (*Z*)-**34** in CD_2Cl_2 at 303 K. Arbitrary numbering scheme as shown. The multiplicity in the ^{13}C NMR refers to the DEPT spectrum.



(Z)-34

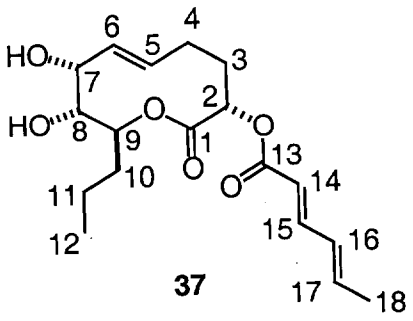
Position	δ ^{1}H (ppm)	$J_{H,H}$ (Hz)	δ ^{13}C (ppm)	$J_{C,H}$ (Hz)
1			172.43 (s)	
2	3.81 (dd)	J = 10.7, 5.9 Hz	78.01 (d)	J = 147 Hz
3	2.14/1.68 (m)		32.91 (t)	J = 132 Hz
4	2.22/2.12 (m)		23.33 (t)	J = 126 Hz
5	5.346 (m)	J = 11.5, 3.8, 1 Hz	133.10 (d)	J = 155 Hz
6	5.345 (m)	J = 11.5, 9.5, 2 Hz	128.80 (d)	J = 158 Hz
7	4.89 (m)		74.96 (d)	J =149 Hz
8	4.21 (ddd)	J = 9.9, 6.4 Hz	79.05 (d)	J = 148 Hz
9	4.69 (ddd)	J = 10.0, 7.5, 3.9 Hz	73.91 (d)	J = 149 Hz
10	1.81/1.63 (m)		36.20 (t)	J = 125 Hz
11	1.43 (m)		18.50 (t)	J = 129 Hz
12	0.96 (t)	J = 7.3 Hz	14.39 (q)	J = 125 Hz
13			110.28 (s)	
14	1.46 (s)		28.23 (q)	J = 127 Hz
15	1.34 (s)		25.77 (q)	J = 126 Hz
16	4.25/4.45 (d)	J = 11.2 Hz	71.37 (t)	J = 143 Hz
17			129.93 (s)	
18	7.24 (m)		130.00 (d)	J = 158 Hz
19	6.87 (m)		114.08 (d)	J = 158 Hz
20			159.88 (s)	
21	3.79 (s)		55.58 (q)	J = 144 Hz

Compound 35. A solution of compound **34** (160 mg, 0.396 mmol) and DDQ (94.4 mg, 0.416 mmol) in CH_2Cl_2 (14.5 mL) and water (0.8 mL) is stirred for 2 d at ambient temperature. Evaporation of the solvent followed by flash chromatography (pentane/EtOAc, 5:1→2:1) affords alcohol **35** as a colorless solid (95 mg, 84%). Mp = 76.9-77.8 °C. $[\alpha]_D^{20} = -50.0$ (c 0.8, CH_2Cl_2); IR: 3417, 2987, 2963, 2936, 2875, 1732, 1713, 1671, 1457, 1383, 1367, 1251, 1219, 1202, 1108, 1056, 1040, 1024, 986, 868 cm^{-1}; ^1H NMR (400 MHz, CD_2Cl_2) δ 5.56-5.69 (m, 1H), 5.34 (dd, J = 16.5, 7.7 Hz, 1H), 5.08 (dt, J = 9.8, 2.6 Hz, 1H), 4.77 (m, 1H), 4.21-4.24 (m, 1H), 3.88 (dd, J = 10.2, 6.1 Hz, 1H), 3.23 (dd, J = 4.1, 0.9 Hz, 1H), 2.05-2.20 (m), 1.96-2.02 (m), 1.77-1.85 (m), 1.66-1.74 (m), 1.46-1.55 (m), 1.43 (s, 3H), 1.33 (s, 3H), 1.21-1.31 (m), 0.91 (t, J = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, CD_2Cl_2): δ 175.5, 134.3, 126.0, 109.6, 78.7, 78.3, 73.4, 68.6, 34.1, 31.6, 28.3, 25.6, 25.3, 18.1, 14.1; MS (EI): *m/z* (rel. intensity): 284 (20, [M^+]), 269 (21), 226 (12), 199 (11), 181 (21), 173 (21), 163 (12), 160 (15), 137 (54), 127 (14), 126 (27), 125 (20), 113 (28), 112 (14), 111 (15), 110 (17), 109 (12), 103 (11), 98 (12), 97 (100), 95 (19), 93 (12), 86 (30), 85 (23), 83 (35), 82 (11), 81 (26), 79 (22), 71 (32), 70 (22), 69 (15), 68 (12), 67 (30), 59 (50), 43 (66).

Compound 36. A solution of sorbic acid chloride (19.0 mg, 0.146 mmol) in CH_2Cl_2 (0.2 mL) is added to a solution of alcohol **35** (32.0 mg, 0.113 mmol) in CH_2Cl_2 (1.5 mL) and pyridine (0.03 mL) at 0°C and the mixture is stirred at ambient temperature for 20 h. Dilution with pentane and Et_2O (1 mL each), filtration trough a short pad of Kieselgur, evaporation of the filtrate and flash chromatography of the residue (pentane/Et_2O, 5:1) affords ester **36** as a colorless syrup (36.0 mg, 84%). $[\alpha]_D^{20} = -18.7$ (c 0.63, CH_2Cl_2); IR: 3019, 2985, 2962, 2935, 2873, 1749, 1717, 1644, 1617, 1446, 1380, 1331, 1245, 1202, 1181, 1135, 1095, 1059, 1024, 1000, 945, 868 cm^{-1}; MS (EI): *m/z* (rel. intensity): 378 (1.3, [M^+]), 320 (5), 283 (7), 235 (10), 110 (32), 95 (100). The NMR spectra of this compound show the presence of several conformers; therefore a full analysis has been carried out after cleavage of the acetal ring, see below.

Compound 37. A solution of compound **36** (36.0 mg, 0.095 mmol) in MeOH (3 mL) and H_2O (1.5 mL) is reacted with aq. HCl (1M, 0.6 mL) for 1h at 60°C. Neutralization of the mixture with aq. NaOH (1M), evaporation of the organic solvent, extraction of the remaining aqueous phase with EtOAc (3×5 mL), washing of the combined organic layers with brine followed by drying over Na_2SO_4 and evaporation affords a residue which is purified by flash chromatography (pentane/Et_2O, 1:2) to give compound **37** as a colorless solid (18.0 mg, 56%). $[\alpha]_D^{20} = -42.5$ (c 0.51, CH_2Cl_2); IR: 3553, 3500, 3006, 2962, 2932, 2874, 1730, 1719, 1641, 1615, 1441, 1379, 1350, 1333, 1248, 1220, 1205, 1188, 1174, 1139, 1101, 1052, 1019, 1006, 992, 935, 867 cm^{-1}; MS (EI): *m/z* (rel. intensity): 338 (1.3, [M^+]), 253 (4), 225 (2), 141 (9), 113 (5), 95 (100), 67 (9). For a compilation of the NMR data of this compound see Table S-10.

Table S-10. NMR data (Bruker DMX-600 spectrometer) of compound **37** in $CDCl_3$ at 303 K. Arbitrary numbering scheme as shown. The multiplicity in the ^{13}C NMR refers to the DEPT spectrum.



37

Position	δ ^{1}H (ppm)	multiplicity	$J_{H,H}$ (Hz)	δ ^{13}C (ppm)
1				172.09 (s)
2	4.84	dd	J = 10.0, 3.3 Hz	73.10 (d)
3a	2.01	m		30.99 (t)
3b	1.97	m		
4a	2.37	m		27.75 (t)
4b	2.17	m		
5	5.54	dddd	J = 16.1, 9.5, 4.6, 2.1 Hz	122.57 (d)
6	5.62	dd	J = 16.1, 1.8 Hz	131.97 (d)
7	4.45	m		73.04 (d)
8	3.58	td	J = 9.5, 2.1 Hz	73.16 (d)
9	5.00	td	J = 9.5, 2.8 Hz	71.46 (d)
10a	1.86	m		33.88 (t)
10b	1.59	m		
11a	1.38	m		17.67 (t)
11b	1.28	m		
12	0.88	q	J = 7.3 Hz	13.94 (q)
13				166.03 (s)
14	5.76	d	J = 15.4 Hz	117.80 (d)
15	7.25	m		146.25 (d)
16	6.15	m		129.68 (d)
17	6.15	m		140.24 (d)
18	1.83	d	J = 5.3 Hz	18.66 (q)

^{1}H NMR: δ 2.19 (br. d, J = 7.0 Hz, 1H, 7-OH), 2.44 (br. d, J = 9.5 Hz, 1H, 8-OH).

Compound 39. A solution of compound **38** (562 mg, 2.50 mmol)[47] in THF (8 mL) is added over a period of 1 h to a solution of $NaN(SiMe_3)_2$ (549 mg, 2.99 mmol) in THF (3 mL) at –78°C. After stirring for 50 min at that temperature, a solution of trans-3-phenyl-2(phenylsulfonyl)oxaziridine (982 mg, 3.76 mmol)[48] in THF (8 mL) is introduced and stirring is continued for another 40 min. Extractive work-up as described above for compound **19**

followed by flash chromatography (pentane/Et_2O, 5:1) furnishes product **39** as a colorless solid (500 mg, 83%). $[\alpha]_D^{20}$= +82.7 (c 0.6, CH_2Cl_2); IR: 3503, 3077, 2966, 2929, 2877, 1783, 1700, 1641, 1389, 1373, 1366, 1304, 1255, 1206, 1161, 1142, 1121, 1104, 1056, 1018, 993, 970, 916 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 5.80 (ddt, J = 16.9, 10.2, 6.6 Hz, 1H), 4.99 (m, 3H), 4.32 (m, 3H), 3.51 (d, J = 7.9 Hz, 1H), 2.40 (m, 1H), 2.23 (m, 2H), 1.86 (m, 1H), 1.62 (m, 1H), 0.90 (d, J = 7.1 Hz, 3H), 0.86 (d, J = 6.9 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 174.6, 153.9, 137.5, 115.3, 70.1, 64.1, 58.9, 33.1, 29.3, 28.2, 17.9, 14.5; MS (EI): *m/z* (rel. intensity): 241 (2, [M^+]), 198 (5), 130 (31), 129 (14), 86 (100), 85 (25), 55 (12), 43 (13), 41 (23); Anal. *calcd.* for $C_{12}H_{19}NO_4$ (241.29) C 59.74, H 7.94; *found* C 59.79, H 7.89.

Compound 40. To a solution of alcohol **39** (500 mg, 2.07 mmol) in Et_2O (20 mL) are successively added 4-methoxybenzyl trichloroacetimidate (1.31 g, 4.64 mmol) and trifluoromethanesulfonic acid (0.5 μL) and the resulting mixture is stirred for 30 min at ambient temperature. It is advisable to carefully monitor the course of the reaction by HPLC. The reaction is then quenched with aq. sat. $NaHCO_3$ (3 mL), the aqueous phase is repeatedly extracted with Et_2O (40 mL), the combined organic layers are washed with brine, dried over Na_2SO_4 and evaporated. Flash chromatography of the residue affords product **40** as a colorless syrup (357 mg, 48%). $[\alpha]_D^{20}$= +8.9 (c 0.88, CH_2Cl_2); IR: 3075, 2963, 2935, 2875, 2838, 1780, 1709, 1640, 1613, 1514, 1486, 1465, 1388, 1373, 1365, 1301, 1249, 1206, 1104, 1056, 1034, 993, 916, 822, 773, 755, 716 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$) δ 7.26 (m, 2H), 6.84 (m, 2H), 5.78 (ddt, J = 17.1, 10.2, 6.9 Hz, 1H), 5.09 (dd, J = 7.9, 4.1 Hz, 1H), 5.00 (dq, J = 17.1, 1H), 4.93 (m, 1H), 4.49 (d, J = 11.1 Hz, 1H), 4.36 (d, J = 11.2 Hz, 1H), 4.19-4.40 (m, 3H), 3.77 (s, 3H), 2.37 (m, 1H), 2.13-2.28 (m, 2H), 1.71-1.79 (m, 2H), 0.90 (d, J = 7.1 Hz, 3H), 0.82 (d, J = 7.1 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 173.0, 159.3, 153.6, 137.6, 129.8, 129.6, 115.2, 113.7, 76.6, 72.1, 63.7, 58.7, 55.2, 32.2, 29.7, 28.2, 17.9, 14.5; MS (EI): *m/z* (rel. intensity): 361 (0.6, [M^+]), 225 (13), 184 (60), 148 (18), 137 (11), 130 (13), 121 (100); Anal. *calcd.* for $C_{20}H_{27}NO_5$ (361.44) C 66.46, H 7.53; *found* C 66.34, H 7.46.

Compound 41. To a solution of compound **40** (345 mg, 0.955 mmol) in THF (4 mL) and H_2O (1 mL) at 0°C are successively added aq. H_2O_2 (30%, w/w, 382 μL, 3.82 mmol) and aq. LiOH (36.6 mg, 1.53 mmol in 1.9 mL of H_2O) and the resulting mixture is stirred for 1 h at 0°C. The reaction is quenched with aq. Na_2SO_3 (480 mg in 2.9 mL of H_2O), the THF is removed in vacuo, the remaining aqueous phase is extracted with CH_2Cl_2 (3×5 mL, discarded) before it is acidified with aq. HCl (5M, 0.5 mL). Extraction with EtOAc (4×10 mL), washing of the combined EtOAc phases with brine, drying over Na_2SO_4 and evaporation of the solvent affords acid **41** as a colorless solid (224 mg, 94%). $[\alpha]_D^{20}$= −29.3 (c 0.9, CH_2Cl_2); IR: 3430, 3068, 3005, 2980, 2943, 2889, 2835, 1746, 1731, 1639, 1614, 1306, 1250, 1215, 1182, 1103, 1086, 1031, 1021, 996, 927, 912, 826, 675 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 11.01 (br. s, 1H), 7.22 (d, J = 8.4 Hz, 2H), 6.82 (d, J = 8.3 Hz, 2H), 5.70 (m, 1H), 4.92 (m, 2H), 4.59 (d, J = 11.5 Hz, 1H), 4.35 (d, J = 11.4 Hz, 1H), 3.90 (m, 1H), 3.75 (s, 3H), 2.11 (m, 2H), 1.81 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 178.0, 159.4, 137.4, 129.7, 129.3, 115.3, 113.9, 76.9,

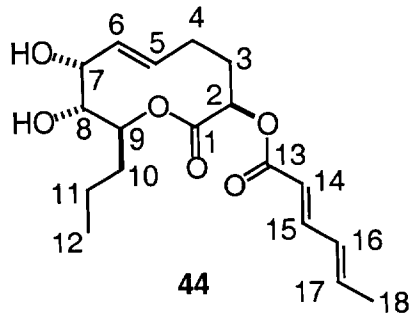
71.7, 55.2, 31.7, 29.2; MS (EI): *m/z* (rel. intensity): 250 (6, [M^+]), 137 (36), 121 (100); Anal. *calcd.* for $C_{14}H_{18}O_4$ (250.30) C 67.18, H 7.25; *found* C 66.96, H 7.22.

Compound 42. To a solution of alcohol **35** (34.0 mg, 0.120 mmol) in CH_2Cl_2 (2 mL) and pyridine (0.05 mL) is added triflic anhydride (24 μL, 0.14 mmol) at 0°C and stirring is continued at that temperature for 15 min. The reaction is quenched with aq. sat. $NaHCO_3$ (0.15 mL) and water (1 mL), the aqueous layer is extracted with CH_2Cl_2 (3×0.5 mL), the combined organic phases are dried over Na_2SO_4 and evaporated, and the residue is purified by flash chromatography (pentane/Et_2O, 5:1) to give triflate **42** as a colorless solid (40.0 mg, 80%). This compound is used in the next step without further characterization.

Compound 43. A solution of triflate **42** (40 mg, 0.096 mmol) in DMF (1 mL) is added to a suspension of potassium sorbinate [formed from sorbic acid (60.8 mg, 0.54 mmol) and KH (21.7 mg, 0.54 mmol)] in DMF (1 mL) and the resulting mixture is stirred at ambient temperature for 20 h and for another 2 h at 40°C. The reaction is then quenched with H_2O (2 mL), the solution is extracted with Et_2O (3× 5mL), the combined organic layers are washed with brine, dried over Na_2SO_4, and evaporated. The residue is purified by flash chromatography (pentane/EtOAc, 15:1) to five ester **43** as a colorless syrup (23 mg, 63%). $[\alpha]_D^{20} = -158.9$ (c 0.54, CH_2Cl_2); IR: 3019, 2985, 2960, 2935, 2873, 1722, 1645, 1617, 1450, 1435, 1381, 1351, 1327, 1301, 1257, 1241, 1220, 1185, 1160, 1135, 1106, 1049, 1000, 971, 951, 867 cm^{-1}; ^1H NMR (300 MHz, 2 conformers, CD_2Cl_2) δ 7.33 (m), 7.27 (m), 6.25 (m), 5.88 (d, J = 15.6 Hz), 5.81 (dd, J = 15.7, 3.2 Hz), 5.60 (m), 5.22 (dd, J = 6.1, 1.6 Hz), 5.07 (m), 4.91 (ddd, J = 10.0, 8.6, 2.8 Hz), 4.79 (dt), 4.72 (m), 4.63 (m), 4.03 (dd, J = 10.0, 6.5 Hz), 3.91 (dd, J = 10.0, 4.6 Hz), 2.10-2.50 (m), 1.95-2.08 (m), 1.88 (m), 1.65-1.80 (m), 1.50 (s), 1.42 (s), 1.34 (s), 1.32 (s),1.13-1.50 (m), 0.88 (t, J = 7.3 Hz); ^{13}C NMR (75 MHz, 2 conformers, CD_2Cl_2): δ 172.4, 170.7, 166.4, 166.2, 146.2, 146.0, 140.7, 140.6, 131.7, 130.0, 129.5, 129.3, 123.1, 118.6, 118.3, 109.4, 109.1, 78.4, 78.3, 76.5, 73.6, 72.0, 71.7, 70.5, 34.4, 34.1, 31.0, 29.0, 28.7, 27.9, 26.3, 26.2, 25.1, 18.8, 18.0, 14.0; MS (EI): *m/z* (rel. intensity): 378 (1.3, [M^+]), 320 (13), 283 (7), 235 (10), 110 (31), 95 (100), 67 (18), 41 (12).

Compound 44. A solution of compound **43** (20.0 mg, 0.053 mmol) in MeOH (1.5 mL) and H_2O (0.75 mL) is reacted with aq. HCl (1M, 0.3 mL) for 75 min at 65°C. The mixture is then neutralized with aq. NaOH (1M), the organic solvent is evaporated, the remaining aqueous layer is extracted with EtOAc (3×2mL), the combined organic phases are washed with brine, dried (Na_2SO_4) and evaporated to give compound **44** as a colorless syrup (17.0 mg, 95%). $[\alpha]_D^{20} = -114.4$ (c 0.54, CH_2Cl_2); IR: 3469, 3027, 2960, 2931, 2873, 1718, 1645, 1618, 1433, 1352, 1327, 1299, 1260, 1244, 1202, 1184, 1136, 1102, 1077, 1056, 1028, 999, 956, 942, 868, 801, 737 cm^{-1}; MS (EI): *m/z* (rel. intensity): 338 (2.5, [M^+]), 253 (6), 141 (10), 113 (5), 95 (100), 67 (13). For the compilation of the NMR spectra of this compound see Table S-11.

Table S-11. NMR data (Bruker DMX-300 spectrometer) of compound **44** in $CDCl_3$ at 303 K. Arbitrary numbering scheme as shown.



44

Position	δ ^{1}H (ppm)	multiplicity	$J_{H,H}$ (Hz)	δ ^{13}C (ppm)
1				171.9
2	5.26	dd	J = 5.5, 1.9 Hz	69.8
3a	2.22	m		29.9
3b	2.00	m		
4a	2.42	m		27.4
4b	2.22	m		
5	5.55	dddd	J = 15.5, 10.6, 4.0, 2.3 Hz	123.0
6	5.67	ddd	J = 15.8, 2.0, 0.6 Hz	132.4
7	4.44	ddd	J = 2.6, 2.3, 2.0 Hz	73.1
8	3.52	dd	J = 9.9, 2.7 Hz	73.2
9	5.04	ddd	J = 9.8, 9.4, 2.7 Hz	71.3
10a	1.80	m		33.6
10b	1.51	m		
11a	1.33	m		17.5
11b	1.22	m		
12	0.87	t	J = 7.3 Hz	13.9
13				166.1
14	5.87	d	J = 15.5 Hz	118.2
15	7.32	dd	J = 15.5, 9.8 Hz	145.9
16	6.23	m		129.7
17	6.23	m		140.3
18	1.89	d	J = 5.3 Hz	18.7

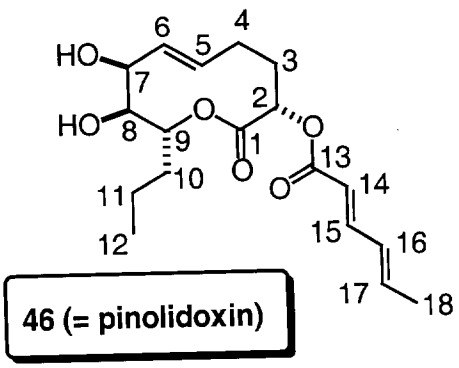
Compound 46 (Pinolidoxin). A solution of compound (*E*)-**8** (120 mg, 0.447 mmol) in THF (2 mL) is added over a period of 12 min to a solution of KHMDS (141 mg, 0.707 mmol) in THF (1.5 mL) at –50°C. After stirring the mixture for 20 min at that temperature, a solution of trans-3-phenyl-2-(phenylsulfonyl)oxaziridine (180 mg, 0.69 mmol) in THF (2 mL) is introduced at –78°C and stirring is continued for 90 min. The reaction is quenched at low temperature with aq. sat. NH_4Cl (0.5 mL) and water (5 mL), the THF is evaporated, the

remaining aqueous phase is extracted with EtOAc (3×3 mL), the combined organic layers are washed with brine, dried over Na_2SO_4 and evaporated, and the residue is purified by flash chromatography (pentane/Et_2O, 10:1→2:1) to give alcohol **24** (18 mg, 37% based on recovered starting material) as a pale yellow syrup as well as recovered starting material (75 mg, 62%). Product **24** thus obtained was directly used in the next step. Sorbic acid chloride (9 μL) is added to a solution of compound **24** (18 mg, 0.063 mmol) in CH_2Cl_2 (1.5 mL) and pyridine (15 μL) at 0°C and the resulting mixture is stirred at ambient temperature for 24 h. Dilution of the mixture with pentane and Et_2O (1 mL each), filtration through a short pad of Kieselgur, evaporation of the filtrate and flash chromatogrpahy of the residue (pentane/Et_2O, 5:1) provides product **45** as a pale yellow syrup (18.0 mg, 76%). A solution of this product in MeOH (1.5 mL) and H_2O (0.75 mL) is reacted with aq. HCl (0.3 mL) for 90 min at 60°C. Neutralization of the mixture with aq. NaOH (1M) followed by a standard extractive work-up and flash chromatography (pentane/Et_2O, 1:2) provides product **46** as a colorless syrup (13 mg, 80%). $[\alpha]_D^{25}$ = +143.2, (*c* = 0.25, $CHCl_3$) [ref.[2]: $[\alpha]_D^{25}$ = +142.9, (*c* = 0.31, $CHCl_3$)]. For a comparison of the spectral data of this compound with those of pinolidoxin published in ref.[2] see Tables S-12 and S-13.

Compound 47. A solution of *n*-propylmagnesium chloride (2M in THF, 2.5 mL, 5.0 mmol) is added to a solution of lactol **5** (265 mg, 1.65 mmol) in THF (5 mL) at 0°C and the resulting mixture is stirred at ambient temperature for 28h. For work-up, the reaction is diluted with Et_2O (5 mL) and quenched with aq. sat. NH_4Cl (5 mL), the aqueous phase is extracted with Et_2O (3×5 mL), the combined organic layers are dried (Na_2SO_4) and evaporated, and the residue is purified by flash chromatography (hexane/EtOAc, 3:1) to give product **47** as a colorless syrup (277 mg, 82%). $[\alpha]_D^{20}$ = −1.16 (c 0.95, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.26 (ddd, J = 8.0, 5.4, 4.7 Hz, 1H), 3.95 (dd, J = 8.7, 5.7 Hz, 1H), 3.81 (m, 1H), 3.70 (dd, J = 11.3, 4.4 Hz, 2H), 2.96 (br. s, 2H), 1.69-1.74 (m), 1.51-1.57 (m), 1.30-1.48 (m), 1.38 (s, 3H), 1.32 (s, 3H), 0.94 (t, J = 7.3 Hz); ^{13}C NMR (100 MHz, $CDCl_3$): δ 108.2, 80.1, 77.3, 69.5, 61.1, 36.3, 28.0, 25.4, 18.3, 14.0.

Compound 48. A solution of diol **47** (97 mg, 0.475 mmol) and 4-bromobenzoyl chloride (295 mg, 1.34 mmol) in CH_2Cl_2 (5 mL) and pyridine (0.4 mL) is stirred for 3h at ambient temperature. For work-up the reaction is diluted with pentane, insoluble residues are filtered off through a short pad of Kieselgur which is then rinsed with Et_2O, the combined filtrates are evaporated and the residue is purified by flash chromoatography (hexane/EtOAc, 4:1) to give product **48** as a colorless solid. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.76 (m, 4H), 7.48 (m, 4H), 5.34 (dd, J = 7.5, 4.1 Hz, 1H), 4.26-4.54 (m, 4H), 1.83 (m, 2H), 1.45 (s, 3H), 1.38 (s, 3H), 0.90 (t, J = 7.3 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 165.5, 164.8, 131.7, 131.6, 131.1, 128.6, 128.5, 128.4, 128.2, 109.1, 77.1, 75.1, 72.0, 63.5, 33.9, 27.7, 25.4, 17.8, 14.0.

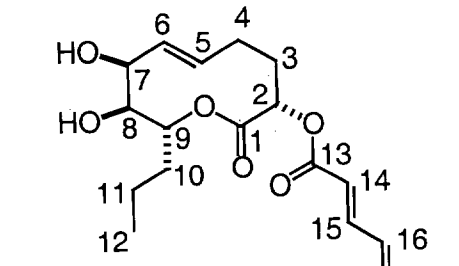
Table S-12. Comparison of the ^{1}H NMR data ($CDCl_3$) reported for pinolidoxin **3** (400 MHz)[2] with those of compound **46** recorded on a Bruker AV-400 spectrometer (400 MHz), showing the excellent agreement of these sets of data. Arbitrary numbering of the skeleton as shown in the insert.



46 (= pinolidoxin)

Position	Pinolidoxin		Compound 46	
	δ	multiplicity, J	δ	multiplicity, J
15	7.32	dd, J = 9.8, 15.4 Hz	7.32	dd, J = 9.8, 15.5 Hz
16	6.30	m	6.23	m
17	6.20	m		
14	5.87	d, J = 15.4 Hz	5.87	d, J = 15.5 Hz
6	5.66	dd, J = 1.4, 15.8 Hz	5.67	dd, J = 1.2, 15.8 Hz
5	5.53	m, J = 1.4, 15.8, 15.8 Hz	5.54	dddd, J = 2.3, 4.0, 10.6, 15.5 Hz
2	5.25	dd, J = 1.7, 5.6 Hz	5.27	dd, J = 1.9, 5.5 Hz
9	5.05	td, J = 2.6, 9.4 Hz	5.04	td, J = 2.7, 9.4 Hz
7	4.44	br. s, J = 1.4, 2.5 Hz	4.44	br.s
8	3.52	dd, J = 2.5, 9.4 Hz	3.52	br.s
4a	2.41	m	2.44	m
3a/4b	2.20	m	2.23	m
3b	2.00	m	2.03	m
18	1.89	d, J = 5 Hz	1.89	d, J = 5.3 Hz
10a	1.78	m	1.77	m
10b	1.50	m	1.51	m
11a	1.33	m	1.31	m
11b	1.22	m	1.22	m
12	0.87	t, J = 7.3 Hz	0.87	t, J = 7.3 Hz

Table S-12. Comparison of the ^{13}C NMR data ($CDCl_3$) reported for pinolidoxin **3** (100 MHz)[2] with those of compound **46** recorded on a Bruker AV-400 spectrometer (100 MHz), showing the excellent agreement of these sets of data.



46 (= pinolidoxin)

Position	Pinolidoxin	46
1	171.9	171.9
13	166.1	166.1
15	145.9	145.9
17	140.3	140.2
6	132.6	132.4
16	129.7	129.7
5	122.8	123.0
14	118.1	118.2
8	73.0	73.2
7	72.9	73.1
9	71.3	71.3
2	69.8	69.8
10	33.6	33.7
3	29.8	29.9
4	27.4	27.4
18	18.7	18.7
11	17.4	17.4
12	13.9	13.9