Supporting Information
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Supporting Information

Synthesis of C1-C17 Segment of Bafilomycin N

Haruka Sato and Seijiro Hosokawa*
Department of Applied Chemistry, Faculty of Science and Engineering, Waseda University
3-4-1 Ohkubo, Shinjuku-ku, Tokyo, 169-8955, Japan.

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1. General information

$^1$H NMR spectra were recorded at 400 MHz with JEOL ECS-400 instruments or 600 MHz with Bruker AVANCE-600 instruments. Coupling constants ($J$) are reported in Hz. $^{13}$C NMR spectra were recorded at 100 MHz with JEOL ECS-400 instruments or 150 MHz with Bruker AVANCE-600 instruments. Chemical shifts ($\delta$) are quoted in parts per million (ppm) and referenced to the residual solvent peak (CDCl$_3$ 7.26 ppm for $^1$H, 77.00 ppm for $^{13}$C). The following abbreviations were used for multiplicities (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet). Melting point (mp) determinations were performed by using a Yanaco MP-S3 instrument. FT-IR spectra were recorded with ThermoFisher SCIENTIFIC NICOLET 6700 FT-IR. HR-MS and MS were obtained with a ThermoFisher EXACTIVE PLUS and JEOL JMS-GC MATII, respectively. Optical rotations were measured with a JASCO P-2200 and JASCO P-1010. X-ray crystallographic analysis was performed with Rigaku XtaLAB Synergy-S. All reactions were monitored by TLC (silica gel 60 F254, Merck). THF was distilled from LAH before use. CH$_2$Cl$_2$ was distilled from P$_2$O$_5$ before use.
2. Experimental Data

2.1. Synthesis of C1-C11 segment (6)

(R)-3-((S,E)-5-iodo-2,4-dimethylpent-4-enoyl)-4-isopropyl-oxazolidin-2-one (13)

To a solution of compound 11 (213 mg, 1.15 mmol, 2.0 eq.) in THF (1.15 mL, 1.0 M) was slowly added LiHMDS (1.21 mL, 1.21 mmol, 2.1 eq.) at −78 °C. After stirring for 10 min, (E)-3-bromo-1-iodo-2-methylprop-1-ene 12 (150 mg, 0.575 mmol) was added to the reaction mixture, and the solution was warmed to −40 °C. After stirring for 6 h, the reaction mixture was quenched with sat. NH₄Cl aq. (3.0 mL) and H₂O (1.0 mL). The resulting mixture was concentrated under reduced pressure. The aqueous residue was extracted with EtOAc (3×1.00 mL). The combined organic layer was dried over Na₂SO₄ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane/EtOAc = 5:1) to give the imide 13 as a white solid (155 mg, 0.74 mmol, 74%, single isomer).

*RF value:* 0.33 (n-hexane/EtOAc = 4:1); *m.p.*: 41 °C; *Optical Rotation* [α]D²³⁻33.1 (c 0.87, CHCl₃); ¹H NMR (CDCl₃, 400 MHz) δ (ppm) 5.97 (1H, q, J = 1.0 Hz), 4.45 (1H, ddd, J = 8.5, 3.5, 3.5 Hz), 4.27 (1H, dd, J = 9.0, 8.5 Hz), 4.20 (1H, dd, J = 9.0, 3.0 Hz), 4.08 (1H, dq, J = 7.5, 7.5, 7.0 Hz), 2.73 (1H, ddd, J = 13.5, 7.5, 1.0 Hz), 2.29 (1H, qdd, J = 7.0, 7.0, 3.5 Hz), 2.22 (1H, ddd, J = 13.5, 7.5, 7.0 Hz), 1.88 (3H, d, J = 1.0 Hz), 1.11 (3H, d, J = 7.0 Hz), 0.91 (3H, d, J = 7.0 Hz), 0.86 (3H, d, J = 7.0 Hz); ¹³C NMR (100 MHz, CDCl₃) δ (ppm) 176.0, 153.7, 145.1, 77.3, 63.1, 58.4, 43.5, 35.6, 28.4, 23.5, 17.9, 16.5, 14.7; HRMS(ESI) (m/z): found 388.0373 [M+Na]⁺; calcd for C₁₃H₂₁O₃NINa: 388.0380; IR (ATR): 3078, 2960, 1761, 1694, 1371, 1296, 1274, 1200, 1053, 989, 774, 756, 704 cm⁻¹.
(S,E)-5-iodo-2,4-dimethylpent-4-enal (9)

To a solution of imide 13 (20 mg, 0.0548 mmol) in CH₂Cl₂ (1.2 mL) at −78 °C was added DIBAL in hexane (1.02 M, 107 µL, 0.110 mmol, 2.0 eq.). The reaction was stirred at −78 °C for 30 min, and the reaction mixture was quenched with sat. NH₄Cl aq. (1.2 mL). The resulting two-phase mixture was extracted with Et₂O (5×0.5 mL). The combined organic layer was dried over Na₂SO₄ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane/EtOAc = 4 : 1) to give aldehyde 9 as a clear yellowish oil (12.0 mg, 0.0504 mmol, 92%). Aldehyde 9 was used immediately in the following step.

R_f value : 0.52 (n-hexane / EOAc = 4 : 1); Optical Rotation [α]_D^{21}-24.6 (c 0.72, CHCl₃); ¹H NMR (400 MHz, CDCl₃) δ (ppm) 9.64 (1H, d, J = 2.0 Hz), 5.99 (1H, q, J = 1.0 Hz), 2.66 (1H, ddd, J = 14.0, 6.0, 1.0 Hz), 2.61-2.50 (1H, m), 2.21 (1H, ddd, J = 14.0, 8.0, 1.0 Hz), 1.84 (3H, d, J = 1.0 Hz), 1.07 (3H, d, J = 7.0 Hz); ¹³C NMR (100 MHz, CDCl₃) δ (ppm) 203.7, 144.5, 77.1, 44.2, 40.1 23.7, 13.1; IR (ATR) : 2932, 2811, 2715, 1722, 1616, 1455, 1377, 1273, 1144, 928, 893, 761, 669 cm⁻¹.
(R)-3-((2E,4R,5S,6S,8E)-5-hydroxy-9-iodo-2,4,6,8-tetramethylnona-2,8-dienoyl)-4-isopropyloxazolidin-2-one (14)

To a solution of aldehyde 9 (100 mg, 0.420 mmol) and vinylketene N,O-acetal 8 (171.2 mg, 0.504 mmol, 1.2 eq.) in dichloromethane (5.0 mL, 1.0 M) was added H2O (1.0 μL, 0.0504 mmol, 0.1 eq.) at room temperature. After stirring vigorously for 15 min, the solution of was cooled to -78 °C. Then TiCl4 (55.3 μL, 0.504 mmol, 1.2 eq.) was added to the mixture, and the reaction mixture was warmed to -30 °C. After stirring for 16 h and confirming the disappearance of compound 8, the reaction was quenched with pyridine (163 μL, 2.02 mmol, 4.8 eq.) and a 1:1 mixture of saturated NaHCO3 aq. and saturated Rochelle salt aq. The resulting two phase mixture was stirred vigorously for 1 h, and layers were separated. The aqueous layer was extracted with ethyl acetate (3×3.0 mL). The combined organic layer was dried over Na2SO4 and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane / EtOAc = 8 : 1) to give the adduct 14 as a colorless oil (99.3 mg, 0.2142 mmol, 51%, dr = 1 : 7). Aldehyde 9 could be recovered in 38% yield.

Rf value: 0.22 (n-hexane/ethyl acetate = 3 : 1); Optical Rotation [α]D20 +7.7 (c 0.85, CHCl3); 1H NMR (CDCl3, 400 MHz) δ (ppm) 5.91 (1H, s), 5.78 (1H, dq, J = 10.0, 1.5 Hz), 4.58 (1H, ddd, J = 9.0, 6.0, 5.0 Hz), 4.35 (1H, dd, J = 9.0, 9.0 Hz), 4.19 (1H, dd, J = 9.0, 6.0 Hz), 3.31-3.24 (1H, m), 3.10 (1H, dd, J = 3.0, 1.0 Hz), 2.82-2.69 (1H, m), 2.43 (1H, dd, J = 14.0, 3.0 Hz), 2.39-2.29 (1H, m), 2.20 (1H, dd, J = 14.0, 11.0 Hz), 1.94 (3H, d, J = 1.0 Hz), 1.83 (3H, s), 0.99 (3H, d, J = 7.0 Hz), 0.94 (3H, d, J = 7.0 Hz), 0.93 (3H, d, J = 7.0 Hz), 0.92 (3H, d, J = 7.0 Hz); 13C NMR (150 MHz, CDCl3) δ (ppm) 171.5, 154.5, 116.9, 141.7, 131.3, 79.1, 75.5, 53.5, 58.1, 39.6, 37.0, 32.3, 28.4, 23.7, 17.9, 17.4, 16.0, 15.2, 14.0; HRMS(ESI) (m/z): found 464.1291 [M+H]+; calc'd for C19H31O4NI: 464.12921; IR (KBr film): 3521, 2965, 2931, 2874, 1771, 1715, 1683, 1390, 1366, 1300, 1278, 1210, 755, 690 cm⁻¹.
(R)-3-((2E,4R,5S,6S,8E)-5-((tert-butyldimethylsilyl)oxy)-9-iodo-2,4,6,8-tetramethylnona-2,8-dienoyl)-4-isopropylloxazolidin-2-one (15)

To a solution of diol alchol 14 (10 mg, 0.0216 mmol) in CH$_2$Cl$_2$ (0.2 mL) was added 2,6-lutidine (7.5 µL, 0.0647 mmol, 3.0 eq.) and TBSOTf (10 µL, 0.0432 mmol, 2.0 eq.) at 0 °C, then warmed to room temperature. After stirring for 4.5 h, the reaction mixture was quenched with sat. NaHCO$_3$ aq. The resulting two-phase mixture was extracted with ethyl acetate (3×0.2 mL). The combined organic layer was dried over Na$_2$SO$_4$ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane/EtOAc = 5 : 1) to give TBS ether 15 as a colorless oil (11.7 mg, 0.0203 mmol, 94%).

$R_f$ value : 0.39 (n-hexane/ethyl acetate = 5 : 1); Optical Rotation $[\alpha]_{D}^{20}$ -1.8 (c 0.94, CHCl$_3$); $^1$H NMR (CDCl$_3$, 400 MHz) $\delta$ (ppm) 6.19(1H, d, $J = 10.0$), 5.84(1H, s), 4.49(1H, ddd, $J = 9.0$, 5.0, 4.0 Hz), 4.30(1H, dd, $J = 9.0$, 9.0 Hz), 4.16(1H, dd, $J = 9.0$, 5.0 Hz), 3.41(1H, d, $J = 6.0$, 2.5 Hz), 2.71(1H, dqd, $J = 10.0$, 7.0, 2.5 Hz), 2.43(1H, dd, $J = 12.0$, 3.0 Hz), 2.41-2.32(1H, m), 1.91(3H, d, $J = 1.5$ Hz), 1.95-1.87 (1H, m), 1.87-1.81(1H, m), 1.79(3H, s), 1.02(3H, d, $J = 7.0$ Hz), 0.90(9H, s), 0.78(3H, d, $J = 6.5$ Hz), 0.06(3H, s), 0.05(3H, s); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 172.1, 153.4, 147.1, 140.5, 129.7, 79.7, 75.2, 63.3, 58.3, 43.6, 36.2, 35.9, 28.1, 26.1, 23.5, 18.3, 18.2, 17.8, 15.6, 14.9, 13.7, -3.7, -3.8; HRMS(ESI) (m/z) : found 600.1964 [M+Na]$^+$; calsd for C$_{25}$H$_{44}$O$_4$NINaSi : 600.1976; IR (ATR) : 2959, 2929, 2856, 1783, 1681, 1364, 1299, 1254, 1205, 1034, 835, 752 cm$^{-1}$. 

S 6
To a solution of imide **15** (72.0 mg, 0.125 mmol) in toluene (1.5 mL) at −78 °C was added DIBAL in hexane (1.02 M, 488 µL, 0.498 mmol, 4.0 eq.). The reaction was stirred at −78 °C for 1.5 h, and then the reaction mixture was quenched with AcOH (31.4 µL, 0.548 mmol, 4.4 eq.) and warmed to room temperature. After stirring for 1.5 h, the resulting mixture was added saturated NaHCO₃ aq. (1.5 mL). The resulting two-phase mixture was extracted with Et₂O (5×0.5 mL). The combined organic layer was dried over Na₂SO₄ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane/EtOAc = 5 : 1) to give aldehyde **16** as a colorless oil (47.8 mg, 0.106 mmol, 85%).

**Rᶠ value**: 0.63 (n-hexane/ethyl acetate = 5 : 1); **Optical Rotation** [α]_D²¹ +10.2 (c 0.45, CHCl₃); **¹H NMR** (400 MHz, CDCl₃) δ (ppm) 9.40 (1H, s), 6.68 (1H, dq, J = 10.0, 1.0 Hz), 5.87 (1H, s), 3.51 (1H, dq, J = 5.0, 3.0 Hz), 2.92-2.83 (1H, m), 2.36 (1H, dd, J = 14.0, 5.0 Hz), 1.98 (1H, dd, J = 14.0, 10.0 Hz), 1.81-1.73 (1H, m), 1.79 (3H, s), 1.76 (3H, d, J = 1.0 Hz), 1.06 (3H, d, J = 7.0 Hz), 0.93 (9H, s), 0.75 (3H, d, J = 7.0 Hz), 0.08 (3H, s), 0.07 (3H, s); **¹³C NMR** (100 MHz, CDCl₃) δ (ppm) 195.6, 157.1, 146.3, 137.6, 79.3, 75.7, 43.3, 36.7, 36.3, 26.0, 23.6, 18.5, 18.3, 15.4, 9.4; **HRMS (ESI) (m/z)**: found 473.1338 [M+Na]⁺; calcd for C₁₉H₃₅O₂NaSi : 473.1343; **IR (ATR)**: 2956, 2928, 2856, 1685, 1461, 1379, 1252, 1091, 1030, 834, 772, 733 cm⁻¹.
Determination of the configuration of aldehyde 16

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<td>1H NMR (400 MHz, CDCl(_3)) δ (ppm)</td>
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<td>9.40 (s)</td>
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<td>1.81–1.73 (m)</td>
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<td>1.05 (d)</td>
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<td>0.92 (s)</td>
<td>0.93 (s)</td>
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<tr>
<td>0.75 (d)</td>
<td>0.75 (d)</td>
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<tr>
<td>0.073 (s)</td>
<td>0.08 (s)</td>
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<tr>
<td>0.070 (s)</td>
<td>0.07 (s)</td>
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<tr>
<td>(\left[\alpha\right]_{D}^{23}) 8.7 (c 1.0, CHCl(_3))</td>
<td>(\left[\alpha\right]_{D}^{21}) 10.2 (c 0.45, CHCl(_3))</td>
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</tbody>
</table>

To a solution of phosphonate 17 (51.0 mg, 0.212 mmol, 2.0 eq.) in THF (0.38 mL) was added NaH (55%, 10.7 mg, 0.223 mmol, 2.1 eq.) at 0 °C. After stirring for 1 h, aldehyde 16 (47.8 mg, 0.106 mmol) was added to the reaction mixture via cannula. After stirring for 30 min, the mixture was warmed to room temperature. After stirring 3 h, the resulting mixture was quenched by NH₄Cl aq. (1.0 mL), and was concentrated under reduced pressure. The aqueous residue was extracted with Et₂O (5×0.5 mL). The combined organic layer was dried over Na₂SO₄ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane/Et₂O = 10 : 1) to give C1-C11 segment (6) as a colorless oil (47.8 mg, 0.0880 mmol, 83%).

Rf value: 0.70 (n-hexane/ethyl acetate = 5 : 1); Optical Rotation [α]D⁺30.4 (c 0.85, CHCl₃); H NMR (400 MHz, CDCl₃) δ (ppm) 7.10 (1H, s), 5.84 (1H, s), 5.76 (1H, d, J = 10.0 Hz), 3.76 (3H, s), 3.39 (1H, dd, J = 5.0, 3.0 Hz), 2.70-2.63 (1H, m), 2.43 (1H, dd, J = 13.0, 4.0 Hz), 2.00 (3H, d, J = 1.5 Hz), 1.93 (1H, dd, J = 14.0, 11.0), 1.87-1.83 (1H, m), 1.83 (3H, d, J = 1.5 Hz), 1.78 (3H, s), 1.00 (3H, d, J = 7.0 Hz), 0.90 (9H, s), 0.76 (3H, d, J = 7.0 Hz), 0.04 (6H, s); C NMR (100 MHz, CDCl₃) δ (ppm) 169.7, 146.9, 143.4, 138.8, 130.4, 125.0, 79.9, 75.3, 51.9, 43.4, 36.3, 36.1, 26.1, 23.5, 19.2, 18.4, 16.6, 15.9, 14.1, -3.7, -3.8; HRMS(ESI) (m/z) : found 543.1761 [M+Na]+; calcd for C₂₃H₄₁O₃INaSi : 543.1762; IR (ATR) : 2956, 2928, 2856, 1708, 1247, 1113, 1033, 834, 772, 749, 670 cm⁻¹.
2.2. Synthesis of C12-C17 segment (7)

(R)-4-isopropyl-3-((4R, 5S, E)-6,6,6-trichloro-5-hydroxy-2,4-dimethylhex-2-enoyl)oxazolidin-2-one (18)

To a solution of vinylketene silyl N,O-acetal 8 (1.5 g, 4.42 mmol) and freshly distilled chloral 10 (0.86 mL, 8.84 mmol, 2.0 eq.) in CH₂Cl₂ (45 mL) was slowly added TiCl₄ (0.48 mL, 4.42 mmol, 1.0 eq.) at −78 °C. After stirring for 30 min, the reaction mixture was warmed to −40 °C. After stirring for 20 h, the reaction was quenched with pyridine (1.43 mL, 17.7 mmol, 4.0 eq.) and warmed to room temperature. Then, a 1:1 mixture of sat. NaHCO₃ aq. and Rochelle salt aq. (45 mL) was added to the reaction mixture. The resulting two-phase mixture was stirred vigorously for 1 h. The resulting mixture was filtered through a pad of celite and layers were separated. The aqueous layer was extracted with ethyl acetate (3×15 mL). The mixed organic layer was concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane / EtOAc = 6 : 1) to give the syn adduct 18 as a colorless oil (1.25 g, 3.35 mmol, 76%, syn : anti > 20 : 1)

\[ R_f \text{ value : } 0.40 \text{ (n-hexane / EtOAc = 2 : 1)}; \text{ Optical Rotation } [\alpha]_D^{22} -45.3 \text{ (c 1.12, CHCl}_3) \]; \text{ H NMR (400 MHz, CDCl}_3) \delta \text{ ppm } 5.99 \text{ (1H, dq, } J = 10.0, 1.5 \text{ Hz), 4.53 (1H, ddd, } J = 9.0, 5.0, 6.0 \text{ Hz), 4.33 (1H, dd, } J = 9.0, 9.0 \text{ Hz), 4.20 (1H, dd, } J = 9.0, 5.0 \text{ Hz), 4.20 (1H, dd, } J = 6.0, 3.0 \text{ Hz), 3.38-3.28 (1H, m), 3.25 (1H (OH), d, } J = 6.0 \text{ Hz), 2.43-2.30 (1H, m), 1.96 (3H, d, } J = 1.5 \text{ Hz), 1.25 (3H, d, } J = 7.0 \text{ Hz), 0.93 (3H, d, } J = 7.0 \text{ Hz), 0.91 (3H, d, } J = 7.0 \text{ Hz); C NMR (100 MHz, CDCl}_3) \delta \text{ ppm } 171.6, 153.9, 140.3, 129.6, 102.9, 83.4, 63.5, 58.1, 35.0, 28.3, 17.8, 15.0, 13.7, 13.6; \text{ HRMS(ESI) (m/z) : found } 394.0350 [M+Na]^+; \text{ calcd for C}_{14}H_{20}O_3NCl}_3Na : 394.0347; \text{ IR (ATR) : 3444, 2966, 1778, 1681, 1388, 1365, 1296, 1204, 1013, 809, 750 cm}^{-1}.}
(4R, 5S, E)-6,6,6-trichloro-2,4-dimethylhex-2-ene-1,5-diol (19)

To a solution of aldol adduct 18 (400 mg, 1.21 mmol) in THF (3.0 mL) was added NaBH₄ (228 mg, 6.04 mmol, 5.0 eq.) at 0 °C. After stirring for 15 min, H₂O (1.5 mL) was added to the reaction and the resulting mixture was warmed to room temperature. After stirring for 12 h, the reaction mixture was quenched with sat. NH₄Cl aq. (3.0 mL) and H₂O (1.0 mL). The resulting mixture was concentrated under reduced pressure. The aqueous residue was extracted with EtOAc (8×1.0 mL). The combined organic layer was dried over Na₂SO₄ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane / EtOAc = 4 : 1) to give the diol 19 as a colorless solid (254 mg, 1.03 mmol, 85%).

Rₜ value: 0.22 (n-hexane / EOAc = 2 : 1); ¹H NMR (400 MHz, CDCl₃) δ (ppm) 5.50 (1H, dq, J = 10.0, 1.0 Hz), 4.02 (1H, br d, J = 5.0 Hz), 4.00 (1H, dd, J = 6.0, 4.0 Hz), 3.18 (1H, dqd, J = 10.0, 7.0, 4.0 Hz), 2.82 (1H (OH), d, J = 6.0 Hz), 1.71 (3H, d, J = 1.0 Hz), 1.18 (3H, d, J = 7.0 Hz); HRMS(ESI) (m/z): found 268.9874 [M+Na]⁺; calcd for C₈H₁₃O₂Cl₃Na: 268.9873.
(2S, 3S)-1,1,1-trichloro-3-((2S, 3S)-3-(hydroxymethyl)-3-methyloxiran-2-yl)butan-2-ol (20)

To a solution of diol 19 (1.35 g, 5.43 mmol) in CH$_2$Cl$_2$ (26.9 mL) was added VO(acac)$_2$ (144 mg, 0.543 mmol, 0.1 eq.) and 80% t-BuOOH in H$_2$O (0.80 mL, 7.06 mmol, 1.3 eq.) at −40 °C. The reaction mixture was slowly warmed to −15 °C. After stirring for 2 h, additional 80% t-BuOOH in H$_2$O (0.80 mL, 7.06 mmol, 1.3 eq.) was added. Then after stirring for 12 h, saturated aqueous solution of Na$_2$CO$_3$ (5.00 mL) and saturated aqueous solution of Na$_2$S$_2$O$_3$ (5.0 mL) were added. The resulting mixture was stirred for 1 h. After separation of the layers, the aqueous layer was extracted with ethyl acetate (3×10.0 mL). The combined organic layer was concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane / EtOAc = 2 : 1) to give the epoxy alcohol 20 as a colorless oil (1.06 g, 4.02 mmol, 74%, dr = 6:1).

**R$_f$ value**: 0.23 (n-hexane/ethyl acetate = 1 : 1); **Optical Rotation** $\left[\alpha\right]_{D}^{23}$ -36.3 (c 0.09, CHCl$_3$); $^1$H NMR (400 MHz, CDCl$_3$) δ (ppm) 4.39 (1H, dd, $J$ = 5.0, 1.5 Hz), 3.73 (1H, d, $J$ = 13.0 Hz), 3.63 (1H, dd, $J$ = 13.0, 5.0 Hz), 3.18 (1H, d, $J$ = 13.0 Hz), 3.15 (1H (OH), br s), 2.30 (1H, dqq, $J$ = 10.0, 7.0, 1.5 Hz), 1.78 (1H (OH), br s), 1.36 (3H, s), 1.18 (3H, d, $J$ = 7.0 Hz); $^{13}$C NMR (100 MHz, CDCl$_3$) δ (ppm) 103.3, 81.9, 65.0, 62.8, 62.1, 34.5, 14.2, 9.9; **HRMS(ESI)** (m/z) : found 284.9823 [M+Na]$^+$ ; calcd for C$_8$H$_{13}$O$_3$Cl$_3$Na : 284.9822 ; **IR (ATR)** : 3382, 2935, 1456, 1386, 1134, 1067, 1022, 889, 808, 773, 756 cm$^{-1}$. 
(2S,3S)-3-((2S,3S)-3-(((tert-butyldimethylsilyl)oxy)methyl)-3-methyloxiran-2-yl)-1,1,1-trichlorobutan-2-ol (21)

To a solution of epoxy alcohol 20 (1.43 g, 5.43 mmol) in DMF (14.3 mL) was added TBSCI (0.98 g, 6.51 mmol, 1.2 eq.) and imidazole (0.44 g, 6.51 mmol, 1.2 eq.) at 0 °C, then warmed to 60 °C. After stirring for 2 h, the reaction was cooled to room temperature, and diluted with n-hexane (7.0 mL) and H2O (14.3 mL) and warmed to room temperature. The resulting two-phase mixture was extracted with toluene (5×5.0 mL). The combined organic layer was dried over Na2SO4 and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane/EtOAc = 10 : 1) to give mono TBS ether 21 as a white solid (1.89 g, 4.99 mmol, 92%). Diastereomer of epoxide can be separated at this stage.

\[ \text{Rf value : 0.46 (n-hexane/ethyl acetate = 5 : 1); m.p. : 95 °C (decomposed); Optical Rotation } [\alpha]_D^{23} \]

\[ \text{IR (ATR) : 3400, 2951, 2930, 2858, 1470, 1361, 1249, 1099, 1035, 837, 775 cm}^{-1}. \]

\[ \text{HRMS(ESI) (m/z) : found 399.0685 [M+Na]^+; calcd for } \text{C}_{14}\text{H}_{27}\text{O}_{3}\text{Cl}_{3}\text{NaSi : 399.0687} \]

\[ \text{^1H NMR (400 MHz, CDCl}_3) \quad \delta (ppm) 4.40 (1H, dd, } J = 5.5, 1.5 \text{ Hz), 3.60 (1H, s), 2.99 (1H, dd, } J = 6.0, 1.0 \text{ Hz), 2.98 (1H, d, } J = 10.0 \text{ Hz), 2.31-2.22 (1H, m), 1.34 (3H, s), 1.17 (3H, d, } J = 7.0 \text{ Hz), 0.90 (9H, s), 0.07 (3H, s), 0.05 (3H, s); } \text{^13C NMR (100 MHz, CDCl}_3) } \quad \delta (ppm) \text{ 103.5, 82.0, 67.5, 63.1, 62.6, 34.5, 25.8, 18.3, 14.2, 10.0; } \text{IR (ATR) : 3400, 2951, 2930, 2858, 1470, 1361, 1249, 1099, 1035, 837, 775 cm}^{-1}. \]
**CCDC reference number**

CCDC 1892179

**Crystal data and structure refinement.**

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(2S, 3R)-3-((2S, 3S)-3-(((tert-butyldimethylsilyl)oxy)methyl)-3-methyloxiran-2-yl)-1,1,1-trichlorobut-2-yl methanesulfonate (22)

To a solution of mono TBS ether 20 (1.11 g, 2.94 mmol) and DABCO (1.35 g, 12.0 mmol, 4.1 eq.) in THF (11.1 mL) was slowly added methanesulfonyl chloride (0.57 mL, 7.35 mmol, 2.5 eq.) at 0 °C, and the mixture was warmed to room temperature. After stirring for 1 h, the reaction was quenched with saturated NaHCO$_3$ aq. (10.0 mL). The resulting mixture was concentrated under reduced pressure. The aqueous residue was extracted with EtOAc (3x2.0 mL). The combined organic layer was dried over Na$_2$SO$_4$ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane/EtOAc = 10 : 1) to give mesylate 21 as a colorless oil (1.32 g, 2.90 mmol, 98%).

$R_f$ value: 0.40 (n-hexane/ethyl acetate = 5 : 1); Optical Rotation $[\alpha]_D^{21}$ -11.1 (c 1.45, CHCl$_3$); $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ (ppm) 5.35 (1H, d, $J = 1.5$ Hz), 3.63 (1H, d, $J = 11.5$ Hz), 3.59 (1H, d, $J = 11.5$ Hz), 3.26 (3H, s), 3.02 (1H, d, $J = 9.5$ Hz), 2.46-2.36 (1H, m), 1.35 (3H, s), 1.24 (3H, d, $J = 7.0$ Hz), 0.89 (9H, s), 0.06 (3H, s), 0.05 (3H, s); $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ (ppm) 98.7, 87.5, 67.3, 62.9, 61.8, 39.1, 35.0, 25.8, 18.2, 14.2, 11.7; HRMS (ESI) (m/z): found 477.0461 [M+Na]$^+$; calc'd for C$_{15}$H$_{29}$O$_5$Cl$_3$NaSSi: 477.0463; IR (ATR): 2930, 2857, 1472, 1463, 1362, 1253, 1180, 956, 836, 777, 732 cm$^{-1}$. 

S 15
**((2S,3S)-3-((S)-but-3-yn-2-yl)-2-methyloxiran-2-yl)methoxy)(tert-butyl)dimethylsilane (23)**

To a solution of mesylate 21 (1.2 g, 2.63 mmol) in THF (13.2 mL) was slowly added n-BuLi (2.12 M in n-hexane, 5.59 mL, 11.9 mmol, 4.5 eq.) at −78°C. After stirring for 30 min, the reaction was quenched with saturated NH₄Cl aq. (7.0 mL) and warmed to room temperature. After addition of H₂O (2.0 mL), the resulting two-phase mixture was concentrated under reduced pressure. The aqueous residue was extracted with EtOAc (3×3.0 mL). The combined organic layer was dried over Na₂SO₄ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane/EtOAc = 30 : 1) to give alkyne 23 as a colorless oil (0.55 g, 2.18 mmol, 83%).

- **Rf value**: 0.66 (n-hexane/ethyl acetate = 10 : 1); **Optical Rotation** [α]D₂₂ −31.6 (c 0.63, CHCl₃); ¹H NMR (400 MHz, CDCl₃) δ (ppm) 3.60 (1H, d, J = 11.0 Hz), 3.54 (1H, d, J = 11.0 Hz), 2.88 (1H, d, J = 9.0 Hz), 2.37 (1H, dqd, J = 9.0, 7.0, 2.0 Hz), 2.14 (1H, d, J = 2.0 Hz), 1.30 (3H, s), 1.24 (3H, d, J = 7.0 Hz), 0.89 (3H, s), 0.06 (3H, s), 0.05 (3H, s); ¹³C NMR (100 MHz, CDCl₃) δ (ppm) 85.4, 69.5, 67.5, 63.8, 61.5, 26.2, 25.8, 18.2, 17.3, 13.9; **HRMS (ESI) (m/z)**: found 277.1596 [M+Na]+; calcld for C₁₄H₂₆O₃NaSi : 277.1594; **IR (ATR)**: 2954, 2930, 2857, 1472, 1252, 1096, 902, 835, 776 cm⁻¹.
tert-butyl(dimethyl)(((2S,3S)-2-methyl-3-((S,E)-4-(tributylstanny1)but-3-en-2-yl)oxiran-2-yl)methoxy)silane (24)

To a solution of alkyne 23 (40 mg, 0.157 mmol) in THF (0.79 mL, 0.2 M) was added Pd(PPh3)2Cl2 (11 mg, 0.0157 mmol, 0.1 eq.) at room temperature. After stirring for 15 min, n-BuSnH (50 µl, 0.189 mmol, 1.2 eq.) was added to the reaction at −78°C. After stirring for 2 h, the reaction mixture was concentrated under reduced pressure. The residue was purified by flash column chromatography on silica gel (n-hexane/EtOAc = 4 : 1) to give the (E)-vinylstannane 24 as a colorless oil. Since this compound was easily isomerized on silica gel to (Z)-isomer, the crude mixture was used immediately in the following step.
(2S, 3S, 4S, E)-2,4-dimethyl-6-((tributylstannyl)-3-((trimethylsilyl)oxy) hex-5-en-1-ol (7)

To a solution of (E)-vinylstannane 24 in CH₂Cl₂ (2.6 mL) was added Hunig base (64.2 µL, 0.377 mmol, 2.4 eq.), and cold to −78°C. After stirring for 15 min, the reaction was added TMSOTf (56.8 µL, 0.314 mmol, 2.0 eq.). After stirring for 20 min, the reaction mixture was added MeOH (89.2 µL) and NaBH₄ (8.9 mg, 0.236 mmol, 1.5 eq.), and warmed to room temperature. After stirring for 1.5 h, the resulting mixture was quenched by AcOH (13.5 µL, 0.236 mmol, 1.5 eq.), and NaHCO₃ aq. (1.0 mL). After the layers were separated, the aqueous layer was extracted with EtOAc (3×0.5 mL). The combined organic layer was dried over Na₂SO₄ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane/EtOAc = 20 : 1) to give the C12-C17 segment (7) as a colorless oil (53.4 mg, 0.128 mmol, 82% (from compound 23)).

R<sub>f</sub> value : 0.45 (n-hexane/ethyl acetate = 5 : 1); Optical Rotation [α]<sub>D</sub><sup>25</sup> -0.8 (c 1.16, CHCl₃); <sup>1</sup>H NMR (400 MHz, CDCl₃) δ (ppm) 6.00 (1H, dd, J = 19.0, 7.0 Hz), 5.92 (1H, d, J = 19.0 Hz), 3.64 (1H, dd, J = 6.0, 4.0 Hz), 3.60 (1H, ddd, J = 11.0, 7.0, 5.5 Hz), 3.48 (1H, ddd, J = 11.0, 5.5, 5.5 Hz), 2.36 (1H, dqd, J = 7.0, 7.0, 6.0 Hz), 1.90-1.79 (1H, m), 1.54-1.42 (6H, m), 1.35-1.25 (6H, m), 0.98 (3H, d, J = 7.0 Hz), 0.91-0.84 (18H, m), 0.11 (9H, s, TMS); <sup>13</sup>C NMR (150 MHz, CDCl₃) δ (ppm) 152.4, 127.4, 77.5, 66.0, 45.6, 39.2, 29.1, 27.3, 18.1, 13.7, 11.5, 9.4, 0.8; HRMS(ESI) (m/z) : found 507.2673 [M+H]<sup>+</sup>; calcd for C₂₃H₅₁O₂SiSn : 507.2675; IR (ATR) : 3346, 2956, 2925, 1463, 1376, 1249, 1025, 996, 876, 836, 749 cm⁻¹.
2.3. Synthesis of C1-C17 segment of Bafilomycin N

To a solution of C1-C11 segment 6 (9.6 mg, 0.0184 mmol) and C12-C17 segment 7 (7.7 mg, 0.0184 mmol) in NMP (0.2 mL) was added LiCl (2.4 mg, 0.0553 mmol, 3.0 eq.) and Pd(dba)3•CHCl3 at room temperature. After stirring for 4 h, the reaction was diluted with Et2O (0.2 mL) and H2O (0.2 mL). The resulting two-phase mixture was filtered through a pad of celite. After the layers were separated, the aqueous layer was extracted with Et2O (5×0.1 mL). The combined organic layer was dried over Na2SO4 and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane/EtOAc = 15 : 1) to give the C1-C17 segment 4 as a yellowish oil (9.4 mg, 0.0154 mmol, 84%).

**Rf value**: 0.21 (n-hexane/ethyl acetate = 5 : 1); **Optical Rotation** [α]D20 +46.6 (c 0.28, CHCl3); 1H NMR (400 MHz, CDCl3) δ (ppm) 7.11 (1H, s), 6.22 (1H, ddd, J = 15.0, 11.0, 1.0 Hz), 5.80 (1H, d, J = 10.0 Hz), 5.76 (1H, d, J = 11.0 Hz), 5.50 (1H, dd, J = 15.0, 9.0 Hz), 3.76 (3H, s), 3.60 (1H, dd, J = 6.5, 3.0 Hz), 3.58 (1H, ddd, J = 11.0, 7.0, 5.5 Hz), 3.49 (1H, ddd, J = 11.0, 5.5, 5.5 Hz), 3.41 (1H, d, J = 5.0, 3.0 Hz), 2.73-2.65 (1H, m), 2.40-2.33 (1H, m), 2.31-2.25 (1H, m), 2.01 (3H, d, J = 1.0 Hz), 1.91-1.85 (1H, m), 1.84 (3H, d, J = 1.0 Hz), 1.80-1.68 (2H, m), 1.67 (3H, s), 1.00 (3H, d, J = 6.0 Hz), 0.98 (3H, d, J = 6.5 Hz), 0.91 (9H, s), 0.87 (3H, d, J = 7.0 Hz), 0.74 (3H, d, J = 6.5 Hz), 0.08 (9H, s, TMS), 0.05 (3H, s, TBS), 0.04 (3H, s, TBS); 13C NMR (150 MHz, CDCl3) δ (ppm) 169.8, 143.6, 139.4, 135.5, 135.4, 130.1, 126.7, 126.6, 134.8, 80.2, 77.5, 66.1, 51.8, 43.9, 41.2, 38.8, 36.6, 35.8, 26.12, 26.10, 19.3, 18.4, 18.2, 16.6, 16.3, 15.6, 14.1, 11.0, 0.8, 0.7, -3.77, -3.80; HRMS(ESI) (m/z) : found 631.4179 [M+Na]+ ; calcd for C34H64O5NaSi2 : 631.4184; IR (KBr film) : 3469, 2958, 2929, 2857, 1712, 1250, 1117, 1033, 837, 773, 750 cm⁻¹.
3. Determination of the stereochemistry of C1-C11 segment (6)
4. Determination of the configuration of C16 position of C12-C17 segment (7)

To a solution of 7 (3.2 mg, 7.69 µmol) and benzaldehyde dimethyl acetal (1.38 µL, 9.22 µmol, 1.2 eq.) in CH$_2$Cl$_2$ (0.07 mL) was added p-toluenesulfonic acid monohydrate (0.15 mg, 0.769 µmol, 0.1 eq.) at 0 °C. After stirring for 30 min, the reaction was warmed to room temperature. After additional stirring for 1 h, the reaction mixture was diluted with CH$_2$Cl$_2$ (0.1 mL), and the was quenched by saturated NaHCO$_3$ aq. (0.2 mL). After the layers were separated, the aqueous layer was extracted with EtOAc (3×0.1 mL). The combined organic layer was dried over Na$_2$SO$_4$ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (n-hexane/EtOAc = 8 : 1) to give the compound 26 as a colorless oil (1.3 mg, 5.60 µmol, 73%).

$^1$H NMR (400 MHz, CDCl$_3$) δ (ppm) 7.53-7.47 (2H, m), 7.39-7.28 (3H, m), 5.99 (1H, ddd, J = 18.0, 11.0, 7.0 Hz), 5.48 (1H, s), 5.09 (1H, ddd, J = 18.0, 1.5, 1.5 Hz), 5.03 (1H, ddd, J = 11.0, 1.5, 1.5 Hz), 4.09 (1H, dd, J = 11.0, 2.5 Hz), 4.05 (1H, dd, J = 11.0, 2.5 Hz), 3.59 (1H, dd, J = 10.0, 2.0 Hz), 2.46-2.35 (1H, m), 1.70 (1H, qddd, J = 7.0, 2.5, 2.0, 2.0 Hz), 1.19 (3H, d, J = 7.0 Hz), 0.98 (3H, d, J = 7.0 Hz); $^{13}$C NMR (150 MHz, CDCl$_3$) δ (ppm) 141.5, 139.0, 128.5, 128.1, 125.9, 113.9, 101.5, 83.7, 73.9, 38.5, 30.1, 14.3, 10.9.
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The document contains a spectrum chart and a table with chemical shifts. The spectrum is labeled with various chemical groups and their corresponding peak values.
Carbon with power-gate dec.
X : parts per Million : 13C : parts per Million

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