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Total Synthesis of 7-Deoxy-6-*O*-methylfusarentin Featuring a Chelation-Controlled 1,3-Reetz–Keck-Type Allylation

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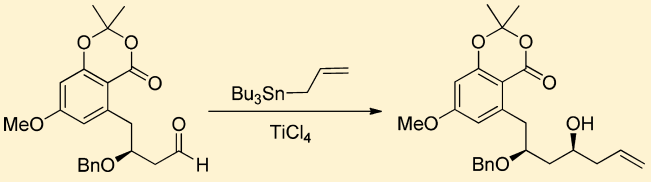
Supporting Information

ABSTRACT: The total synthesis of 7-deoxy-6-*O*-methylfusarentin (**1**) and a formal synthesis of 7-deoxy-6,8-*O*-dimethylfusarentin (**2**) has been successfully achieved in 10 steps. The described tactic underscores a diastereoselective strategy which incorporates a single acyclic reaction based on the initial stereocenter by means of a 1,3-chelation-controlled Reetz–Keck-type allylation.



Biologically active and structurally intriguing natural products have been isolated from a diverse set of both marine- and terrestrial-based organisms and plant sources.[1] Along this line, Isaka and co-workers isolated in 2010 an antimycobacterial cyclodepsipeptide, termed cordycommunin, along with two unnamed dihydroisocoumarin natural products from the extracts of the entomopathogenic fungus *Ophiocordyceps communis* BCC 16475.[2] While the two dihydroisocoumarins are known in the literature via a synthetic approach to fusaretin methyl ethers by Simpson, the Isaka disclosure represents the first time they have been isolated as natural products.[3] Recently, Reddy reported a synthetic approach to compounds **1** and **2** but incorrectly named the molecules with respect to the fusarentin family.[4] After an agreeable discussion with the isolation chemist and in an effort to facilitate communication of the given structures, we have renamed natural products **1** and **2** as 7-deoxy-6-*O*-methylfusarentin and 7-deoxy-6,8-*O*-dimethylfusarentin, respectively, in accordance with the parent fusarentin skeleton as shown in Figure 1.

We were drawn to the structures based on our previous interest in both the aigialomycin and pochonin families of similar compounds.[5] As shown in Figure 1, compounds **1** and **2** add to a significant family of such smaller natural products that have varied biologically relevant profiles. For example, fusarentin methyl ethers have shown antifungal, insecticidal, and phytotoxic activities.[6] In addition, both cladosporin and isocladosporin have exhibited significant activity as antifungal antibiotics and plant growth inhibitors.[7,8] Although **1** and **2** have not shown considerable biological activity, it is worth noting that they have only been tested against a few cancer cell lines.[2] On the basis of the structural similarity to that of both cladosporin and fusarentin, one might anticipate that **1** and **2** will indeed possess biological activity.

As shown in Scheme 1, our initial approach to the syntheses of both **1** and **2** was based on a late-stage lactonization under basic conditions from diol **3**. In turn, compound **3** was envisaged to be derived from **4** via concomitant olefin reduction and hydrogenolysis of the benzyl ether protecting group. As the key stereochemical sequence leading to **4**, we

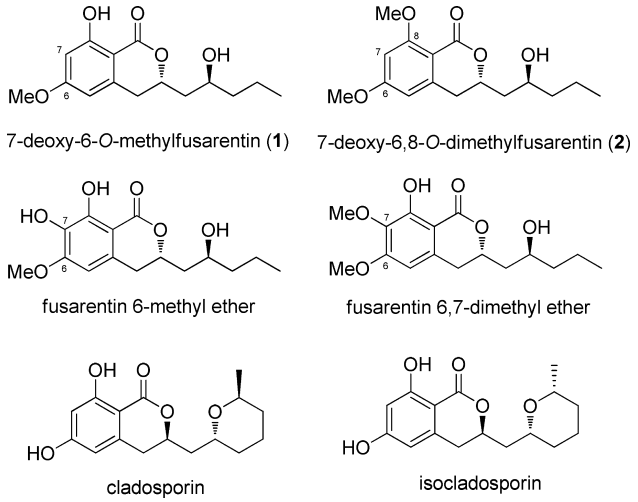


Figure 1. Structural similarities between a selected series of isocoumarin natural products.

envisioned a chelation controlled 1,3-*anti* allylation by means of Lewis acid activation of the aldehyde resident in compound **5**. Lastly, oxidative cleavage of the terminal alkene of the previously reported compound **6** should readily afford aldehyde **5**.

With this general synthetic blueprint in hand, the first order of business was the completion of homoallylic alcohol **11** as described in Scheme 2. Thus, the synthesis of olefin **6** started from commercially available 5,7-dihydroxy-2,2-dimethyl-4*H*-1,3-benzodioxin-4-one (**7**). The hydroxy group *para* to the carbonyl moiety resident in **7** was chemoselectively protected under Mitsunobu conditions[9] using DIAD and PPh_3 in the presence of methanol and afforded **8** in 88% yield. Ensuing treatment of **8** with Tf_2O and pyridine readily provided the corresponding triflate **9** in 80% yield.[9] The resulting triflate **9**

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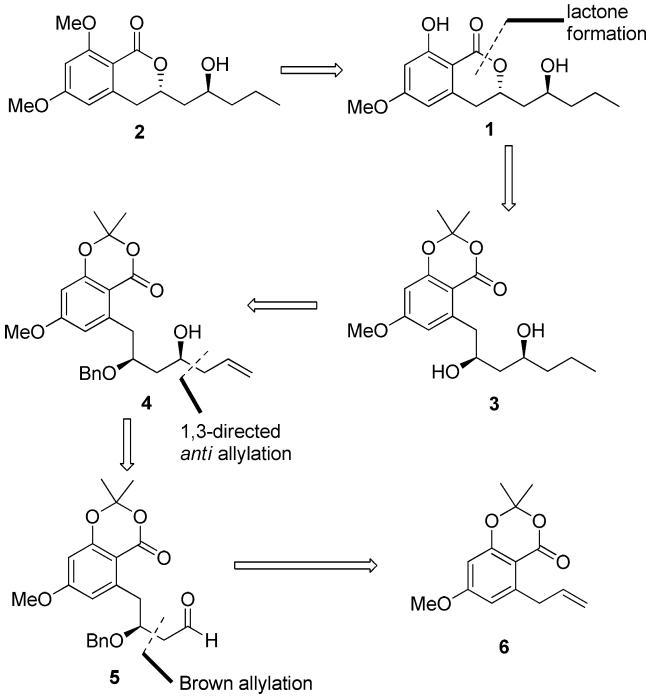
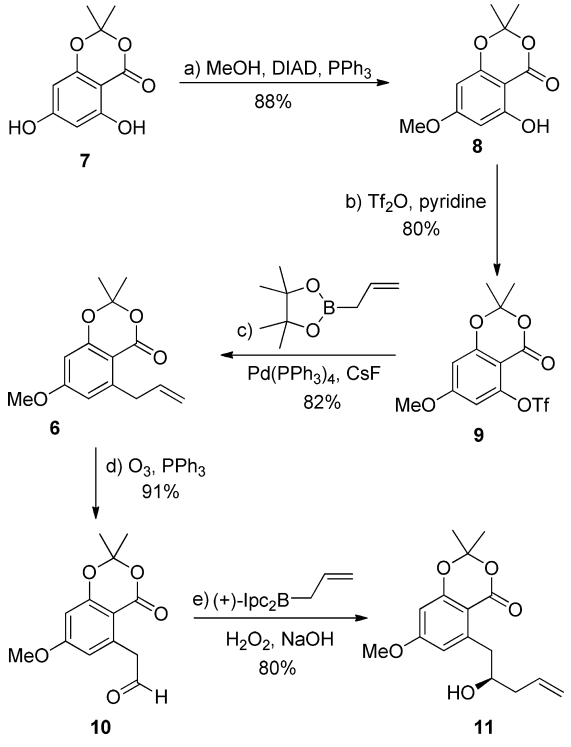
Scheme 1. Retrosynthetic Analysis of 7-Deoxy-6-*O*-methylfusarentin and 7-Deoxy-6,8-*O*-dimethylfusarentin



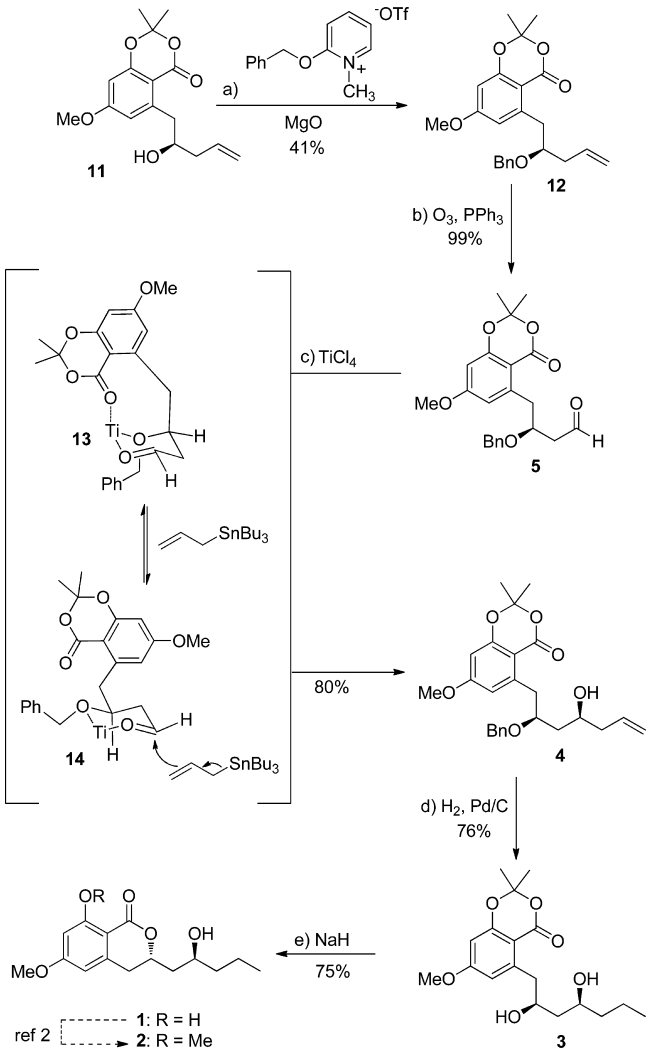
Scheme 2. Synthesis of Homoallylic Alcohol 11



smoothly underwent a Suzuki cross-coupling reaction with the allyl pinacol boronate reagent in the presence of $Pd(PPh_3)_4$ and CsF to furnish the substituted allyl benzene derivative **6** in 82% yield.[10] Subsequent oxidative cleavage of the terminal alkene of **6** by means of O_3 followed by a reductive quench of the ozonide intermediate with PPh_3 provided aldehyde **10** in 91% yield. With aldehyde **10** in hand, asymmetric allylboration with (+)-Ipc_2Ballyl under the reported Brown procedure afforded the homoallylic alcohol **11**(as a 7.3:1 er based on ^{19}F NMR analysis of the crude Mosher esters, see the Supporting Information) after basic oxidation with the standard reagents (NaOH and H_2O_2) in 80% yield.[11]

With the initial chiral center in place, the stage was set for the key diastereoselective chelation-controlled 1,3-*anti*-allylation in hopes of providing the final stereocenter en route to **1** and **2** as delineated in Scheme 3. In order to investigate such a directed

Scheme 3. Completion of 7-Deoxy-6-*O*-methylfusarentin and 7-Deoxy-6,8-*O*-dimethylfusarentin



reaction process, we required protection of the secondary alcohol **11** as a benzyl ether as noted by Reetz and Keck.[12,13] Unfortunately, benzylation under basic conditions (BnBr, NaI, and NaH) did not provide the desired compound **12** but instead furnished the δ lactone via an intramolecular *trans*-esterfication. In addition, attempted etherification under acidic conditions with the benzyl trichloroacetimidate reagent $[CCl_3C(=NH)OCH_2C_6H_5]$ failed to provide the desired benzyl ether **12** and led to the decomposition of homoallylic alcohol **11**. Much to our delight, treatment of **11** with the Dudley reagent coupled with MgO afforded the benzyl ether **12** albeit with a modest yield of 41% with the remaining material balance as the undesired lactone.[14] With **12** in hand, an ensuing oxidative cleavage of the terminal alkene was accomplished with

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O_3 followed by a reductive workup of the intermediate ozonide with PPh_3 furnished aldehyde **5** in 99% yield and set the stage for the chelation controlled allylation. Thus, pretreatment of aldehyde **5** with the oxophilic Lewis acid $TiCl_4$ presumably formed the six-membered chelated intermediates **13** and **14** followed by an ensuing addition of the allylstannane reagent ($Bu_3Snallyl$) led to the formation of the *anti*-1,3-homoallylic alcohol **4** with a diastereomeric ratio of 4.5:1 for the desired stereochemistry in 80% yield.

Based on the final product ratio of **4**, one might suggest that two potential reactive conformations **13** and **14** were in operation (assuming that the allylation process proceeds through a chelated six-membered chairlike transition state). The data suggest that conformer **14** was preferred as all substituents were placed into equatorial positions and readily allowed for the axial approach of the nucleophilic allylstannane reagent en route to the 1,3-*anti* adduct (i.e., compound **4**). On the other hand, conformer **13** would have placed both the benzyl moiety and large aromatic group 1,2-diaxial to one another, which would presumably lead to a higher energy conformation. It is worth noting that within conformer **13** a third chelation between the Ti metal and the carbonyl resident within the aromatic portion would be possible. One could suggest that chelation might help to stabilize the conformer; however, axial approach of the allylstannane would be severely hindered. Ultimately, **13** would not be preferred which we presume furnished the minor amount of the 1,3-*syn* product. With the requisite stereochemistry in place, concomitant hydrogenation/hydrogenolysis of both the terminal alkene and benzyl ether resident in compound **4** with 1 atm of H_2 and 10% $Pd(OH)_2$ in MeOH readily proceeded to afford diol **3** in 76% yield. Subsequent treatment of **3** with NaH in a 1:1 DMF/THF solution furnished 7-deoxy-6-*O*-methylfusarentin (**1**) via an intramolecular *trans*-esterification in 75% yield. The spectral data (^{1}H NMR, 500 MHz; ^{13}C NMR, 125 MHz), optical rotation ($[\alpha]^{23}_D$ −18.3, *c* 0.060 $CHCl_3$, lit. value $[\alpha]^{26}_D$ −14, *c* 0.13 $CHCl_3$) and HRMS data of synthetic **1** was in agreement with the natural sample.[2] In addition, the completion of **1** also constitutes a formal synthesis of **2** as previously described by Isaka and co-workers.[2]

In summary, the total synthesis of 7-deoxy-6-*O*-methylfusarentin (**1**) and a formal synthesis of 7-deoxy-6,8-*O*-dimethylfusarentin (**2**) has been successfully achieved in 10 steps from the commercially available compound **7**. The described tactic underscores a diastereoselective strategy which incorporates a single acyclic reaction with modest dr based on the initial stereocenter of alcohol **11**. The prospect of a late stage addition to the terminal alkene of **4** can also allow for the synthesis of additional natural products that possess the dihydroisocoumarin substructure, such as *ent*-cladosporin and isocladosporin.

EXPERIMENTAL SECTION

5-Hydroxy-7-methoxy-2,2-dimethyl-4*H*-benzo[*d*][1,3]-dioxin-4-one (8). To a solution of **7** (4.13 g, 19.1 mmol) in THF (40.1 mL) were added MeOH (0.850 mL) and Ph_3P (5.51 g, 21.0 mmol) sequentially at 0 °C. After being stirred for 5 min at the same temperature, DIAD (4.25 g, 21.0 mmol) was added dropwise to the reaction mixture and stirred for an additional 4 h at 0 °C. The reaction mixture was concentrated in vacuo and chromatographed on silica gel (10% EtOAc in hexane) to give **8** as a white amorphous solid (3.75 g, 88%): ^{1}H NMR (500 MHz, $CDCl_3$) δ 10.45 (s, 1H), 6.15 (d, J = 2.2 Hz, 1H), 6.00 (d, J = 2.5 Hz, 1H), 3.82 (s, 3H), 1.73 (s, 6H).[9]

7-Methoxy-2,2-dimethyl-4-oxo-4*H*-benzo[*d*][1,3]dioxin-5-yl Trifluoromethanesulfonate (9). To a solution of **8** (1.00 g, 4.46 mmol) in pyridine (9.00 mL) was added Tf_2O (1.86 g, 6.60 mmol, 1.09 mL) at 0 °C and the reaction was allowed to stir for 24 h at the same temperature. The reaction mixture was then diluted with EtOAc, washed with saturated aqueous $CuSO_4$, water, and brine, dried over anhydrous Na_2SO_4, concentrated in vacuo, and purified on silica (10% EtOAc in Hexane) to yield **9** as a yellow amorphous solid (1.3 g, 80%): ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.53 (d, J = 2.2 Hz, 1H), 6.48 (d, J = 2.5 Hz, 1H), 3.88 (s, 3H), 1.74 (s, 6H).[9]

5-Allyl-7-methoxy-2,2-dimethyl-4*H*-benzo[*d*][1,3]dioxin-4-one (6). A two-necked round-bottom flask was charged with **9** (1.50 g, 4.21 mmol), CsF (2.47 g, 16.3 mmol), and $Pd(PPh_3)_4$ (0.486 g, 0.421 mmol) in THF (260 mL) and stirred for 30 min. Allyl boronic acid pinacol ester (15.1 mmol, 2.83 mL) was added, and the resulting reaction mixture was heated to reflux for 24 h. Upon completion of the reaction, the mixture was diluted with petroleum ether, followed by H_2O. The layers were extracted with petroleum ether. The combined organic layers were washed with H_2O and brine and dried with Na_2SO_4. The crude product was purified on silica (5% EtOAc in hexane) to yield **6** as a white amorphous solid (0.860 g, 82%): ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.51 (d, J = 2.5 Hz, 1H), 6.32 (d, J = 2.2 Hz, 1H), 6.02 (m, 1H), 5.07 (m, 2H), 3.86 (d, J = 6.6 Hz), 3.83 (s, 3H), 1.69 (s, 6H).[10]

2-(7-Methoxy-2,2-dimethyl-4-oxo-4*H*-benzo[*d*][1,3]dioxin-5-yl)acetaldehyde (10). A solution of **6** (0.860 g, 3.46 mmol) dissolved in CH_2Cl_2 (28.0 mL) and MeOH (10.0 mL) was cooled to −78 °C, and O_3 was bubbled through the solution until the starting material was consumed as indicated by TLC. The solution was then sparged with O_2, and the reaction was quenched via portionwise addition of PPh_3 (2.73 g, 10.4 mmol) and stirred for 4 h. The resulting mixture was concentrated in vacuo and purified by flash chromatography (25% EtOAc in hexane) to yield **10** as a white amorphous solid (0.791 g, 91%): TLC R_f = 0.12 in 15% EtOAc/hexane; ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.80 (t, J = 0.9 Hz, 1H), 6.44 (d, J = 2.5 Hz, 1H), 6.40 (d, J = 2.5 Hz, 1H), 4.14 (bs, 2H), 3.84 (s, 3H), 1.72 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 198.1, 165.2, 159.2, 138.9, 114.2, 105.6, 105.2, 100.7, 55.7, 49.2, 25.6; IR (neat) 3425, 2943, 1719, 1612, 1578, 1285, 1201, 1160 cm^{-1}; HRMS (EI) calcd for $C_{13}H_{16}O_4$ [M − CH_3] 221.0184 found 221.0185.

(*R*)-5-(2-Hydroxypent-4-en-1-yl)-7-methoxy-2,2-dimethyl-4*H*-benzo[*d*][1,3]dioxin-4-one (11). To a flame-dried round-bottom flask under argon was added allylmagnesium bromide (1.0 M solution in ether, 4.08 mL) dropwise into a solution of (+)-Ipc_2BOMe (1.38 g, 4.35 mmol) in anhydrous ether (6.80 mL) at 0 °C. The reaction mixture was allowed to stir for 1 h at room temperature before being cooled to −78 °C. A solution of **10** (681 mg, 2.88 mmol) in ether (2.0 mL) was added dropwise into the borane solution and allowed to stir for 1 h at −78 °C and then warmed slowly to room temperature during 1 h. An aqueous solution of pH 7 buffer (1.94 mL) was added, followed by slow addition of a 30% H_2O_2 solution (3.63 mL). The mixture was allowed to stir overnight. The biphasic solution was separated, and the aqueous layer was extracted with EtOAc (3 × 20 mL). The organic layers were combined, dried over $MgSO_4$, concentrated in vacuo, and purified on silica (27% EtOAc/hexane) to yield **11** as a white amorphous solid (639 mg, 80%): TLC R_f = 0.09 in 15% EtOAc/hexane; $[\alpha]^{23}_D$= −14.2 (*c* 0.491, CH_2Cl_2); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.52 (d, J = 2.5 Hz, 1H), 6.34 (d, J = 2.5 Hz, 1H), 5.92 (m, 1H), 5.16 (m, 2H), 3.92 (m, 1H), 3.83 (s, 3H), 3.30 (dd, J = 13.2, 3.8 Hz, 1H), 3.12 (dd, J = 12.9, 8.5 Hz 1H), 2.41 (m, 1H) 2.34 (m, 1H), 1.70 (s, 3H), 1.68 (s, 3H); ^{13}C NMR (125 Hz, $CDCl_3$) δ 164.9, 159.4, 145.9, 134.9, 117.8, 113.7, 105.1, 100.1, 72.1, 55.6, 42.1, 41.3, 25.8, 25.3; IR (neat) 3452, 3075, 2935, 1723, 1609, 1578, 1282, 1206, 1159, 1065, 913 cm^{-1}; HRMS (EI) calcd for $C_{16}H_{20}O_5$ [M − H_2O] 274.1205, found 274.1204.

(*R*)-5-(2-(Benzyloxy)pent-4-en-1-yl)-7-methoxy-2,2-dimethyl-4*H*-benzo[*d*][1,3]dioxin-4-one (12). A mixture of 2-benzyloxy-1-methylpyridinium triflate (823 mg, 2.36 mmol), benzene (2.40 mL), MgO (95.1 mg, 2.36 mmol), and **11** (333 mg, 1.14 mmol) was heated to 83 °C for 24 h. The reaction mixture was allowed to cool to rt and filtered through Celite. The filtrate was concentrated under vacuum pressure and purified on silica (7% EtOAc/hexane) to yield **12** as a

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colorless oil (161 mg, 41%): TLC R_f = 0.78 in 30% EtOAc/hexane; $[\alpha]^{23}_D$ = −50.7 (*c* 1.610, CH_2Cl_2); ^1H NMR (500 MHz, $CDCl_3$) δ 7.21 (m, 5H), 6.56 (d, *J* = 2.5 Hz, 1H), 6.34 (d, *J* = 2.5 Hz, 1H), 5.95 (m, 1H), 5.10 (m, 2H), 4.52 (d, *J* = 11.7 Hz, 1H), 4.33 (d, *J* = 11.7 Hz, 1H), 3.79 (s, 3H), 3.40 (dd, *J* = 12.9, 4.7 Hz, 1H), 3.14 (dd, *J* = 12.9, 7.8 Hz, 1H), 2.39 (m, 2H), 1.65 (s, 3H), 1.64 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 164.5, 160.3, 158.9, 146.2, 138.8, 135.0, 128.1, 127.6, 127.3, 117.0, 113.0, 104.9, 100.2, 79.1, 71.7, 55.5, 40.0, 39.1, 25.8, 25.4; IR (neat) 2938, 1725, 1612, 1577, 1434, 1282, 1205, 1159, 1062, 914 cm^{-1}; HRMS (EI) calcd for $C_{23}H_{26}O_5$ [M] 382.1780, found 382.1794.

(*S*)-3-(Benzyloxy)-4-(7-methoxy-2,2-dimethyl-4-oxo-4*H*-benzo[*d*][1,3]dioxin-5-yl)butanal (5). A solution of **12** (161 mg, 0.421 mmol) dissolved in CH_2Cl_2 (3.50 mL) and MeOH (1.00 mL) was cooled to −78 °C, and O_3 was bubbled through the solution until the starting material was consumed as indicated by TLC. The solution was then sparged with O_2, and the reaction was quenched via portionwise addition of PPh_3 (331 mg, 1.26 mmol) and stirred for 4 h. The resulting mixture was concentrated in vacuo and purified by flash chromatography (24% EtOAc/hexane) to yield **5** as a colorless oil (160 mg, 99%): TLC R_f = 0.13 in 20% EtOAc/hexane; $[\alpha]^{23}_D$ = −3.4 (*c* 0.460, CH_2Cl_2); ^1H NMR (500 MHz, $CDCl_3$) δ 9.76 (dd, *J* = 2.8, 1.9 Hz, 1H), 7.28 (m, 5H), 6.54 (d, *J* = 2.5 Hz, 1H), 6.38 (d, *J* =.5 Hz, 1H), 4.60 (d, *J* = 11.4 Hz, 1H), 4.54 (d, *J* = 11.7 Hz, 1H), 4.31 (m, 1H); 3.82 (s, 3H), 3.56 (dd, *J* = 12.6, 6.6 Hz, 1H), 3.24 (dd, *J* = 12.6, 5.9 Hz, 1H), 2.69 (ddd, *J* = 16.1, 7.9, 2.8 Hz, 1H), 2.60 (ddd, *J* = 16.1, 4.4, 1.9 Hz, 1H), 1.70 (s, 3H), 1.69 (s, 3H), ^{13}C NMR (125 MHz, $CDCl_3$) δ 201.4, 164.7, 159.2, 144.5, 138.2, 128.2, 127.8, 127.6, 114.2, 105.1, 104.9, 100.4, 74.8, 71.8, 55.5, 48.5, 39.9, 25.7, 25.4; IR (neat) 2940, 2848, 1718, 1610, 1576, 1281, 1203, 1162, 1061 cm^{-1}; HRMS (EI) calcd for $C_{22}H_{24}O_6$ [M] 384.1573, found 384.1568.

5-((2*S*,4*S*)-2-(Benzyloxy)-4-hydroxyhept-6-en-1-yl)-7-methoxy-2,2-dimethyl-4*H*-benzo[*d*][1,3]dioxin-4-one (4). To a stirring solution of **5** (45.0 mg, 0.117 mmol) in CH_2Cl_2 (0.600 mL) at −78 °C was added $TiCl_4$ (0.141 mL, 0.141 mmol, 1 M in CH_2Cl_2), and the resulting yellow solution was allowed to stir for 10 min. To this solution was added allyltributylstannae (77.6 mg, 0.0720 mL, 0.234 mmol) dissolved in CH_2Cl_2 (0.200 mL) over a period of 15 min. The resulting solution was allowed to stir until completion (~3 h). The reaction was then quenched with saturated $NaHCO_3$ (0.418 mL) and allowed to warm to room temperature. The reaction was diluted with CH_3CN (1.90 mL), and KF (90.0 mg) was added. The reaction was then allowed to stir for 24 h. The reaction mixture was extracted with CH_2Cl_2 (3 × 5 mL). The combined organic layers were washed with brine, dried over Na_2SO_4, filtered, and concentrated in vacuo. The crude product was purified by flash chromatography (20% EtOAc/hexanes) to give **4** as a pale yellow oil (39.9 mg, 80%): TLC R_f = 0.19 in 20% EtOAc/hexane; $[\alpha]^{23}_D$ = −2.0 (*c* 0.390, CH_2Cl_2); ^1H NMR (500 MHz, $CDCl_3$) δ 7.25 (m, 5H), 6.52 (d, *J* = 2.5 Hz, 1H), 6.34 (d, *J* = 2.5 Hz, 1H), 5.81 (m, 1H), 5.06 (m, 2H), 4.56 (d, *J* = 11.4 Hz, 1H), 4.46 (d, *J* = 11.6 Hz, 1H), 3.99 (m, 2H), 3.80 (s, 3H), 3.44 (dd, *J* = 12.6, 7.3 Hz, 1H), 3.26 (dd, *J* = 12.6, 5.7 Hz, 1H), 2.21 (m, 2H), 1.70 (m, 2H), 1.66 (s, 6H), 1.32 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 164.6, 160.4, 159.1, 145.6, 138.4, 135.0, 128.3, 127.9, 117.3, 114.2, 104.9, 104.8, 100.2, 71.7, 68.0, 55.5, 42.1, 39.9, 25.9, 25.3; IR (neat) 3414, 2929, 1724, 1612, 1577, 1282, 1205, 1160, 1062 cm^{-1}; HRMS (EI) calcd for $C_{25}H_{30}O_6$ [M] 426.2042, found 426.2029; calcd for $C_{25}H_{30}O_6$ [M − H_2O] 408.1937, found 408.1937.

5-((2*S*,4*S*)-2,4-Dihydroxyheptyl-7-methoxy-2,2-dimethyl-4*H*-benzo[*d*][1,3]dioxin-4-one (3). To a solution of **4** (39.9 mg, 0.0940 mmol) in EtOH (1.00 mL) was added $Pd(OH)_2$ (39.9 mg) in one portion. The reaction vessel was evacuated under vacuum and placed under atmospheric H_2 balloon pressure. The reaction mixture was allowed to stir at rt for 3 h until complete consumption of the starting material as indicated by TLC. The reaction was filtered through Celite and concentrated in vacuo. Purification by flash chromatography (35% EtOAc/hexane) yielded **3** as a colorless oil (23.6 mg, 76%): TLC R_f = 0.23 in 40% EtOAc/hexane; $[\alpha]^{23}_D$ = −5.4 (*c* 0.160, CH_2Cl_2); ^1H NMR (500 MHz, $CDCl_3$) δ 6.52 (d, *J* = 2.2 Hz, 1H), 6.34 (d, *J* = 2.5 Hz, 1H), 4.16 (m, 1H), 3.98 (m, 1H), 3.83 (s, 3H), 3.26 (dd, *J* = 12.9, 4.1 Hz, 1H), 3.18 (dd, *J* = 13.2, 8.2 Hz, 1H), 1.74 (m, 2H), 1.70 (s, 3H), 1.69 (s, 3H), 1.52 (m, 1H), 1.44 (m, 2H), 1.36 (m, 1H), 0.92 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 164.9, 161.5, 159.2, 145.8, 113.7, 105.4, 105.2, 100.1, 70.7, 69.1, 55.6, 43.0, 42.3, 39.7, 25.7, 25.4, 18.9,14.4; IR (neat) 3403, 2927, 1723, 1612, 1578, 1281, 1205, 1160, 1061 cm^{-1}; HRMS (EI) calcd for $C_{18}H_{26}O_6$ [M] 338.1729, found 338.1717; calcd for $C_{18}H_{26}O_6$ [M − H_2O] 320.1624, found 320.1633.

7-Deoxy-6-*O*-methylfusarentin (1). To a solution of **3** (10.0 mg, 0.0209 mmol) in THF (0.600 mL) and DMF (0.600 mL) at 0 °C was added sodium hydride (0.700 mg, 0.0290 mmol). The solution was allowed to stir at 0 °C until complete consumption of starting material as indicated by TLC (3 h). The reaction mixture was quenched with 5% HCl (5 mL) and extracted with EtOAc (3 × 5 mL). The combined organic layers were washed with $NaHCO_3$ and brine, dried over Na_2SO_4, filtered, and concentrated in vacuo. The crude product was purified by flash chromatography (25% EtOAc/hexanes) to give **1** as a white amorphous solid (6 mg, 75%): TLC R_f = 0.20 in 25% EtOAc/hexane; $[\alpha]^{23}_D$ = −18.3 (*c* 0.060, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$) δ 11.19 (s, 1H), 6.37 (d, *J* = 2.2 Hz, 1H), 6.25 (m, 1H), 4.84 (m, 1H), 4.05 (bs, 1H), 3.82 (s, 3H), 1.97 (ddd, *J* = 14.5, 9.5, 2.2 Hz, 1H), 1.69 (ddd, *J* = 14.5, 10.4, 3.2 Hz, 1H), 1.48 (m, 3H), 0.95 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 169.7, 165.8, 164.6, 141.1, 106.2, 101.7, 99.5, 76.2, 67.2, 55.5, 42.3, 40.2, 33.8, 18.7, 13.9; IR (neat) $^{cm-1}$ 3425, 3205, 1639, 1373, 1255, 1198; HRMS (EI) calcd for $C_{15}H_{20}O_5$ [M] 280.1311, found 280.1308.

■ ASSOCIATED CONTENT

Ⓢ Supporting Information

Full spectroscopic data for all new compounds. This material is available free of charge via the Internet at http://pubs.acs.org.

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Notes

The authors declare no competing financial interest.

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