Metallophosphites as Umpolung Catalysts: The Enantioselective Cross Silyl Benzoin Reaction

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Supporting Information

Experimental Section

Materials and Methods: General. Infrared (IR) spectra were obtained using a Nicolet 560-E.S.P. infrared spectrometer. Optical rotations were measured using a JASCO P-1010 polarimeter. Proton and carbon nuclear magnetic resonance spectra (^1H , ^{13}C and ^{31}P NMR) were recorded on the following instruments: Bruker model Avance 400 (^1H NMR at 400 MHz, ^{13}C NMR at 100 MHz, and ^{31}P NMR at 162 MHz) and Varian Gemini 300 (^1H NMR at 300 MHz and ^{13}C at 75 MHz) spectrometers with solvent resonance as the internal standard (^1H NMR: CDCl_3 at 7.26 ppm, and ^{13}C NMR: CDCl_3 at 77.0 ppm) or with phosphoric acid as external standard (^{31}P NMR: phosphoric acid at 0 ppm). ^1H NMR data are reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, sep = septet, m = multiplet), coupling constants (Hz), and integration. Enantiomeric excesses (ee) were obtained using a Berger Supercritical Fluid Chromatograph (SFC) model FCM 1100/1200 equipped with an Agilent 1100 series UV-Vis detector using one of the four following chiral HPLC columns: Chiralpak AD (250 x 4.6 mm), Chiralpak AS (250 x 4.6 mm) columns, Chiralcel OD-H (250 x 4.6 mm) or Regis Pirkle (*S,S*)-Whelk-O1 (250 x 4.6 mm). Samples were eluted with SFC grade CO_2 and the indicated percentage of MeOH. Analytical thin layer chromatography (TLC) was performed on Silicycle 0.25 mm silica gel 60 plates. Visualization was accomplished with UV light and aqueous ceric ammonium nitrate molybdate solution followed by heating. Purification of the reaction products was carried out by flash chromatography using Silicycle silica gel 60 (32-63 μm). All reactions were carried out under an atmosphere of argon in flame-dried glassware with magnetic stirring. Diethyl ether and toluene were dried by passage through a column of neutral alumina under nitrogen prior to use.¹ Tetrahydrofuran was distilled over sodium and benzophenone under nitrogen prior to use. Unless otherwise noted, reagents were obtained from commercial sources and used without further purification. Yield refers to isolated yield of analytically pure material. Yields and enantiomeric excesses are reported for a specific experiment and as a result may differ slightly from those found in the tables, which are averages of at least two experiments. Acylsilanes were prepared through 3 steps from the corresponding aldehydes.² (*R,R*)-TADDOLs were prepared in 2 steps from the commercially available *L*-(+)-diethyl tartrate.^{3,4} Racemic standards of compounds **3a-3m** were prepared as described in a previous communication.⁵

General Procedure (A) for the synthesis of chiral phosphites. To a dry round-bottom flask with magnetic stir bar was added 4 mL dry THF, PCl_3 (2.0 equiv), and triethylamine (3.0 equiv) at 0 °C *via* an ice bath. To this solution was added a solution of diol (0.8 mmol, 1 equiv.) in 4 mL THF *via* cannula, dropwise, under argon at 0 °C. The reaction was allowed to stir at the same temperature for 1 h. To the resulting solution was added triethylamine (1.0 equiv) and H_2O (1.0

equiv) *via* a syringe at 0 °C. The reaction mixture was allowed to warm to 25 °C and stir for 1 h. Solid triethylammonium chloride was removed by filtration through a pad of MgSO₄ and the solvent was removed with a rotary evaporator. The crude product was purified by flash chromatography eluting with the indicated solvent system to afford the pure phosphite.

(*R*)-2,2'-binaphthyl phosphite (4b). The title compound was prepared according to General Procedure A using 1.14 g (4.0 mmol) of (*R*)-BINOL in 8 mL of toluene, 0.7 mL (8.0 mmol) of PCl₃, 1.7 mL (12 mmol) of triethylamine, and 8 mL of toluene. After 1 h at 0 °C, 0.6 mL triethylamine and 72 μL of H₂O were added to the resulting mixture. The crude product was purified by recrystallization from toluene to afford 730 mg (55%) of the product as white crystals (The product was decomposed on the silica gel column back to BINOL). Analytical data for title compound:⁶ ¹H NMR (400 MHz, CDCl₃) δ 8.05 (d, *J* = 8.8 Hz, 2H), 7.97 (d, *J* = 8.0 Hz, 2H), 7.70-7.30 (m, 8H), 7.30 (d, *J*_{H-P} = 732 Hz, 1H); TLC (5:1 hexanes/EtOAc) *R*_f 0.19. For ¹H NMR spectrum, see Appendix.

(1*R*,7*R*)-9,9-dimethyl-4-hydrido-4-oxo-2,2,6,6-tetraphenyl-3,5,8,10-tetraoxa-4-phosphabicyclo[5.3.0]decane (4c). The title compound was prepared according to General Procedure A using 467 mg (1.0 mmol) of (*4R*,*5R*)-2,2-dimethyl-tetraphenyl-TADDOL in 5 mL of THF, 0.20 mL (2.2 mmol) of PCl₃, 0.42 mL (3.0 mmol) of triethylamine, and 5 mL of THF. After 1 h at 0 °C, 0.2 mL triethylamine and 0.1 mL of H₂O were added to the resulting mixture. The crude product was purified by flash chromatography with 3:1 hexanes/EtOAc to afford 454 mg (89%) of the product as white crystals. Analytical data for title compound:⁷ ¹H NMR (400 MHz, CDCl₃) δ 7.60 (t, *J* = 7.6 Hz, 4H), 7.50-7.00 (m, 16H), 7.08 (d, *J*_{H-P} = 724 Hz, 1H), 5.36 (d, *J* = 8.0 Hz, 1H), 5.21 (d, *J* = 8.0 Hz, 1H), 0.76 (s, 3H), 0.57 (s, 3H); ³¹P NMR (162 MHz, CDCl₃) δ -4.01 (*J*_{H-P} = 724 Hz); TLC (3:1 hexanes/EtOAc) *R*_f 0.20. For ¹H NMR spectrum, see Appendix.

(1*R*,7*R*)-9,9-dimethyl-4-hydrido-4-oxo-2,2,6,6-tetra(2-methylphenyl)-3,5,8,10-tetraoxa-4-phosphabicyclo[5.3.0]decane (4d). The title compound was prepared according to General Procedure A using 278 mg (0.53 mmol) of (*4R*,*5R*)-2,2-dimethyl-tetra(2-methylphenyl)-TADDOL in 3 mL of THF, 92 μL (1.0 mmol) of PCl₃, 0.18 mL (1.3 mmol) of triethylamine, and 3 mL of THF. After 1 h at 0 °C, 0.1 mL triethylamine and 15 μL of H₂O were added to the resulting mixture. The crude product was purified by flash chromatography with 4:1 hexanes/EtOAc to

afford 265 mg (88%) of the product as white crystals. Analytical data for title compound: ^1H NMR (400 MHz, CDCl_3) δ 8.17 (broad singlet 1H), 8.00-6.80 (broad multiplet, 15H), 6.78 (d, $J_{\text{H-P}} = 720$ Hz, 1H), 5.90 (broad singlet 1H), 5.82 (broad singlet 1H), 1.97 (broad singlet 12H), 1.56 (broad singlet 3H), 0.46 (broad singlet 3H); peaks were noticeably broadened and difficult to integrate, likely due to slow rotation; ^{31}P NMR (162 MHz, CDCl_3) δ -5.99 ($J_{\text{H-P}} = 720$ Hz); TLC (3:1 hexanes/EtOAc) R_f 0.38. For ^1H NMR spectrum, see Appendix.

(1*R*,7*R*)-9,9-dimethyl-4-hydrido-4-oxo-2,2,6,6-tetra(2-naphthyl)-3,5,8,10-tetraoxa-4-phosphabicyclo[5.3.0]decane (4e). The title compound was prepared according to General Procedure **A** using 688 mg (1.0 mmol) of (4*R*,5*R*)-2,2-dimethyl-tetra(2-naphthyl)-TADDOL in 5 mL of THF, 0.2 mL (2.1 mmol) of PCl_3 , 0.45 mL (3.1 mmol) of triethylamine, and 5 mL of THF. After 1 h at 0 °C, 0.15 mL triethylamine and 20 μL of H_2O were added to the resulting mixture. The crude product was purified by flash chromatography with 2:1 hexanes/EtOAc to afford 400 mg (65%) of the product as white crystals. Analytical data for title compound: ^1H NMR (400 MHz, CDCl_3) δ 9.00-6.80 (m, 28H), 6.59 (broad doublet, 1H), 6.44 (broad doublet, 1H), 5.66 (one peak of doublet for H-P with the other obscured in the aromatic region, 1H), 1.21 (broad singlet, 3H), -0.19 (broad singlet, 3H); peaks were noticeably broadened and difficult to integrate, likely due to slow rotation; TLC (2:1 hexanes/EtOAc) R_f 0.30. For ^1H NMR spectrum, see Appendix.

(-)-(1*R*,7*R*)-9,9-dimethyl-4-hydrido-4-oxo-2,2,6,6-tetra(2-fluorophenyl)-3,5,8,10-tetraoxa-4-phosphabicyclo[5.3.0]decane (4f). The title compound was prepared according to General Procedure **A** using 2.6 g (4.8 mmol) of (4*R*,5*R*)-2,2-dimethyl-tetra(2-fluorophenyl)-TADDOL in 30 mL of THF, 0.85 mL (9.6 mmol) of PCl_3 , 2.0 mL (14 mmol) of triethylamine, and 30 mL of THF. After 1 h at 0 °C, 0.7 mL triethylamine and 0.1 mL of H_2O were added to the resulting mixture. The crude product was purified by flash chromatography with 2:1 hexanes/EtOAc to afford 2.2 g (79%) of the product as white crystals. Analytical data for title compound: **IR** (Nujol mull, cm^{-1}) 2939, 2902, 2855, 1608, 1583, 1456, 1377, 1279, 1228, 1171, 1122, 1103, 1082, 1020, 950, 920, 810, 762, 750, 721; ^1H NMR (400 MHz, CDCl_3) δ 8.11 (t, $J = 7.6$ Hz, 1H), 7.76 (t, $J = 7.6$ Hz, 1H), 7.70-7.55 (m, 2H), 7.50-7.15 (m, 8H), 7.15-6.80 (m, 4H), 6.98 (d, $J_{\text{H-P}} = 748$ Hz, 1H), 5.71 (d, $J = 8.0$ Hz, 1H), 5.51 (d, $J = 8.0$ Hz, 1H), 0.78 (s, 3H), 0.71 (s, 3H); ^{31}P NMR (162 MHz, CDCl_3) δ -3.23 ($J_{\text{H-P}} = 748$ Hz); TLC (2:1 hexanes/EtOAc) R_f 0.29; mp 210-211 °C; $[\alpha]_{\text{D}}^{25}$ -215 ($c = 0.81$, CH_2Cl_2); **Anal.** Calcd. for $\text{C}_{31}\text{H}_{25}\text{F}_4\text{O}_5\text{P}$: C, 63.70; H, 4.31. Found: C, 63.55; H, 4.35; For ^1H NMR spectrum, see Appendix.

(1*R*,7*R*)-9,9-dimethyl-4-hydroxy-4-oxo-2,2,6,6-tetra(2,6-difluorophenyl)-3,5,8,10-tetraoxa-4-phosphabicyclo[5.3.0]decane (4g). The title compound was prepared according to General Procedure A using 210 mg (0.34 mmol) of (4*R*,5*R*)-2,2-dimethyl-tetra(2,6-difluorophenyl)-TADDOL in 3 mL of THF, 60 μ L (0.69 mmol) of PCl_3 , 0.15 mL (1.0 mmol) of triethylamine, and 3 mL of THF. After 1 h at 0 $^\circ\text{C}$, 50 μ L triethylamine and 10 μ L of H_2O were added to the resulting mixture. The crude product was purified by flash chromatography with 1.5:1 hexanes/EtOAc to afford 120 mg (55%) of the product as white crystals. Analytical data for title compound: ^1H NMR (400 MHz, CDCl_3) δ 7.40-7.20 (m, 4H), 7.10-6.80 (m, 8H), 6.82 (d, $J_{\text{H-P}} = 740$ Hz, 1H), 6.16 (d, $J = 7.2$ Hz, 1H), 5.89 (d, $J = 7.2$ Hz, 1H), 0.78 (s, 3H), 0.71 (s, 3H); ^{31}P NMR (162 MHz, CDCl_3) δ -7.60 ($J_{\text{H-P}} = 740$ Hz); TLC (1.5:1 hexanes/EtOAc) R_f 0.30. For ^1H NMR spectrum, see Appendix.

(1*R*,7*R*)-9,9-dimethyl-4-hydroxy-4-oxo-2,2,6,6-tetra(pentafluorophenyl)-3,5,8,10-tetraoxa-4-phosphabicyclo[5.3.0]decane (4h). The title compound was prepared according to General Procedure A using 205 mg (0.24 mmol) of (4*R*,5*R*)-2,2-dimethyl-tetra(pentafluorophenyl)-TADDOL in 3 mL of THF, 42 μ L (0.47 mmol) of PCl_3 , 0.10 mL (0.71 mmol) of triethylamine, and 3 mL of THF. After 1 h at 0 $^\circ\text{C}$, 40 μ L triethylamine and 6 μ L of H_2O were added to the resulting mixture. Crude **4h** was used directly in the next reaction since it decomposed upon attempted purification. Analytical data for title compound: ^1H NMR (400 MHz, CDCl_3) δ 6.98 (d, $J_{\text{H-P}} = 772$ Hz, 1H), 6.03 (d, $J = 8.0$ Hz, 1H), 5.26 (d, $J = 8.0$ Hz, 1H), 1.24 (s, 3H), 0.73 (s, 3H) (doublet at δ 1.42 was a non-phosphorous-containing impurity); ^{31}P NMR (162 MHz, CDCl_3) δ -2.69 ($J_{\text{H-P}} = 772$ Hz). For ^1H NMR spectrum, see Appendix.

(1*R*,7*R*)-9,9-dimethyl-4-hydroxy-4-oxo-2,2,6,6-tetra(2-trifluoromethylphenyl)-3,5,8,10-tetraoxa-4-phosphabicyclo[5.3.0]decane (4i). The title compound was prepared according to General Procedure A using 254 mg (0.34 mmol) of (4*R*,5*R*)-2,2-dimethyl-tetra(2-trifluoromethylphenyl)-TADDOL in 3 mL of THF, 60 μ L (0.69 mmol) of PCl_3 , 0.15 mL (1.0 mmol) of triethylamine, and 3 mL of THF. After 1 h at 0 $^\circ\text{C}$, 90 μ L triethylamine and 10 μ L of H_2O were added to the resulting mixture. The crude product was purified by flash chromatography with 3:1 hexanes/EtOAc to afford 218 mg (81%) of the product as white crystals. Analytical data for title compound: ^1H NMR (400 MHz, CDCl_3) δ 8.54 (d, $J = 8.0$ Hz, 1H), 8.35 (d, $J = 8.4$ Hz, 1H), 7.96 (d, $J = 8.8$ Hz, 1H), 7.89 (d, $J = 8.0$ Hz, 1H), 7.80-7.60 (m, 6H),

7.55-7.20 (m, 6H), 7.01 (d, $J_{\text{H-P}} = 740$ Hz, 1H), 6.19 (d, $J = 7.6$ Hz, 1H), 5.21 (d, $J = 7.6$ Hz, 1H), 0.05 (s, 6H); ^{31}P NMR (162 MHz, CDCl_3) δ 3.71 ($J_{\text{H-P}} = 740$ Hz); TLC (3:1 hexanes/EtOAc) R_f 0.21. For ^1H NMR spectrum, see Appendix.

(1*R*,7*R*)-9-methyl-9-phenyl-4-hydroxy-4-oxo-2,2,6,6-tetra(2-fluorophenyl)-3,5,8,10-tetraoxa-4-phosphabicyclo[5.3.0]decane (4j). The title compound was prepared according to General Procedure A using 100 mg (0.17 mmol) (4*R*,5*R*)-2-methyl-2-phenyl-tetra-(2-fluoro-phenyl)-TADDOL in 0.6 mL THF, 29 μL (0.33 mmol) PCl_3 , 93 μL (0.67 mmol) triethylamine and 0.9 mL of THF. After 1 h at 0 °C, 0.024 mL triethylamine and 3 μL H_2O were added to the resulting mixture. The crude product was purified by flash chromatography with 10:3 hexanes/EtOAc to afford 45 mg (42 %) of the product as white crystals. Analytical data for title compound: ^1H NMR (400 MHz, CDCl_3) δ 8.14 (dt, $J = 7.7$ Hz, $J = 1.8$ Hz, 1H), 7.86-7.75 (m, 4H), 7.74-7.68 (m, 2H), 7.63 (t, $J = 7.7$ Hz, 1H), 7.48-7.22 (m, 12 H), 7.19-6.85 (m, 20 H), 6.97 (d, $J_{\text{H-P}} = 748.5$ Hz, 1H), 6.93 (d, $J_{\text{H-P}} = 744.4$ Hz, 1H), 6.62-6.57 (m, 1H), 6.54-6.49 (m, 1H), 5.84-5.79 (m, 2H), 5.63-5.60 (m, 2H), 0.99 (s, 3H), 0.93 (s, 3H); ^{31}P NMR (162 MHz, CDCl_3) δ -2.25, -3.45; TLC (7:3 hexanes/EtOAc) R_f 0.21. For ^1H NMR spectrum, see Appendix.

(2*R*,3*R*)-(2,3-Di-(1,1-di-(2-fluorophenyl)meth-1-yl)-1,4-dioxaspiro[4.4]nonane)phosphite (4k). The title compound was prepared according to General Procedure A using 305 mg (0.48 mmol) of {(2*R*,3*R*)-3-[bis-(2-fluorophenyl)-hydroxymethyl]-1,4-dioxaspiro[4.4]non-2-yl}-bis-(2-fluorophenyl)-methanol in 6 mL of THF, 78 μL (0.89 mmol) of PCl_3 , 0.19 mL (1.34 mmol) of triethylamine, and 6 mL of THF. After 1 h at 0 °C, 70 μL triethylamine and 10 μL of H_2O were added to the resulting mixture. The crude product was purified by flash chromatography with 2.5:1 hexanes/EtOAc to afford 236 mg (72%) of the product as white crystals. Analytical data for title compound: ^1H NMR (400 MHz, CDCl_3) δ 8.07 (dt, $J = 7.6$ Hz, $J = 1.6$ Hz, 1H), 7.75 (dt, $J = 8.0$ Hz, $J = 1.6$ Hz, 1H), 7.63-7.56 (m, 2H), 7.45-7.18 (m, 8H), 7.12-6.87 (m, 4H), 6.98 (d, $J_{\text{H-P}} = 748$ Hz, 1H), 5.67 (d, $J = 8.0$ Hz, 1H), 5.41 (d, $J = 8.0$ Hz, 1H), 1.50-1.33 (m, 4H), 1.33-1.20 (m, 1H), 1.11-0.95 (m, 2H), 0.93-0.82 (m, 1H); ^{31}P NMR (162 MHz, CDCl_3) δ -2.78 ($J_{\text{H-P}} = 748$ Hz); TLC (3:1 hexanes/EtOAc) R_f 0.21. For ^1H NMR spectrum, see Appendix.

(2*R*,3*R*)-(2,3-Di-(1,1-di-(2-fluorophenyl)meth-1-yl)-1,4-dioxaspiro[4.5]decane)phosphite (4l). The title compound was prepared according to General Procedure A using 200 mg (0.35

mmol) $\{(2R,3R)\text{-}3\text{-}[\text{Bis-(2-fluorophenyl)-hydroxymethyl}]\text{-}1,4\text{-dioxaspiro}[4.5]\text{dec-2-yl}\}\text{-bis-(2-fluorophenyl)-methanol}$ in 1.5 mL THF, 60 μL (0.7 mmol) PCl_3 , 0.2 mL (1.4 mmol) triethylamine, and 2.0 mL of THF. After 1 h at 0 $^\circ\text{C}$, 96 μL triethylamine and 6 μL H_2O were added to the resulting mixture. The crude product was purified by flash chromatography with 10:3 hexanes/EtOAc to afford 86 mg (40 %) of the product as a pale yellow crystal. Analytical data for title compound: $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.10 (dt, $J = 7.9$ Hz, $J = 1.8$ Hz, 1H), 7.76 (broad triplet, $J = 7.8$ Hz, 1H), 7.67 (dt, $J = 7.7$ Hz, $J = 1.2$ Hz, 1H), 7.60 (broad triplet, $J = 6.6$ Hz, 1H), 7.45-7.24 (m, 8H), 7.09-7.02 (m, 2H), 6.96 (d, $J_{\text{H-P}} = 747.8$ Hz, 1H), 6.93-6.85 (m, 2H), 5.63 (d, $J = 8.0$ Hz, 1H), 5.46 (d, $J = 8.0$ Hz, 1H), 1.31-1.26 (m, 4H), 1.19-1.16 (m, 2H), 0.88-0.68 (m, 4H); $^{31}\text{P NMR}$ (162 MHz, CDCl_3) δ -3.39; TLC (7:3 hexanes/EtOAc) R_f 0.29. For $^1\text{H NMR}$ spectrum, see Appendix.

(1*R*,7*R*,9*R*,10*R*)-9,10-diethoxy-9,10-dimethyl-4-hydrido-4-oxo-2,2,6,6-tetraphenyl-3,5,8,11-tetraoxa-4-phosphabicyclo[5.4.0]undecane (4m). The title compound was prepared according to General Procedure A using 200 mg (0.32 mmol) (2*R*,3*R*,5*R*,6*R*)-5,6-diethoxy-2,3-bis(hydroxydiphenylmethyl)-5,6-dimethyl-1,4-dioxane^{8,9} in 1.5 mL toluene, 37 μL (0.42 mmol) PCl_3 , 0.11 mL (0.77 mmol) triethylamine, and 1.0 mL of toluene. After 2 h at 0 $^\circ\text{C}$, 50 μL triethylamine and 6 μL H_2O were added to the resulting mixture. The crude product was purified by flash chromatography with 10:3 hexanes/EtOAc to afford 124 mg (64 %) of the product as white crystals. Analytical data for title compound: $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.15-8.12 (m, 2H), 8.01-7.98 (m, 2H), 7.42-7.40 (m, 6H), 7.20-7.15 (m, 6H), 7.07-7.02 (m, 4H), 6.78 (d, $J_{\text{H-P}} = 733.5$ Hz, 1H), 4.92 (AB, $J_{\text{AB}} = 10.6$ Hz, 2H), 2.95 (ABX, $J_{\text{AB}} = 8.9$ Hz, $J_{\text{AX}} = 7.0$ Hz, 2H), 2.15 (dq, $J = 8.8$ Hz, $J = 7.1$ Hz, 1H), 1.97 (dq, $J = 8.8$ Hz, $J = 7.1$ Hz, 1H), 1.11 (s, 3H), 1.10 (s, 3H), 1.08 (t, $J = 7.0$ Hz, 3H), 0.96 (t, $J = 7.0$ Hz, 3H); $^{31}\text{P NMR}$ (162 MHz, CDCl_3) δ -2.41; TLC (7:3 hexanes/EtOAc) R_f 0.14. For $^1\text{H NMR}$ spectrum, see Appendix.

(1*R*,7*R*),(9*R*,10*R*)-9,10-diethoxy-9,10-dimethyl-4-hydrido-4-oxo-2,2,6,6-tetra(2-fluorophenyl)-3,5,8,11-tetraoxa-4-phosphabicyclo[5.4.0]undecane (4n): The title compound was prepared according to General Procedure A using 150 mg (0.14 mmol) (2*R*,3*R*,5*R*,6*R*)-5,6-diethoxy-2,3-bis[hydroxydi(2-fluoro-phenyl)methyl]-5,6-dimethyl-1,4-dioxane^{8,9} in 1.5 mL toluene, 41 μL (0.47 mmol) PCl_3 , 0.131 mL (0.94 mmol) triethylamine and 1.0 mL of toluene. After 1 h at 0 $^\circ\text{C}$, 30 μL triethylamine and 4 μL H_2O were added to the resulting mixture. The crude product was purified by flash chromatography with 7:3 hexanes/EtOAc to afford 83 mg (52 %) of product as white crystals. Analytical data for title compound: $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.70-8.64 (m, 1H) 8.60 (broad triplet, $J = 8.0$ Hz, 1H) 7.59-6.40 (m, 14 H) 6.68 (d, $J_{\text{H-P}} = 737.8$ Hz, 1H) 5.70-4.60 (m, 2H) 3.07-2.98 (m, 2H) 2.30-1.95 (m, 2H) 1.25-0.88 (m, 12 H)

peaks were noticeably broadened and difficult to integrate, likely due to slow rotation; ^{31}P NMR (162 MHz, CDCl_3) δ -3.61; TLC (7:3 hexanes/EtOAc) R_f 0.11. For ^1H NMR spectrum, see Appendix.

Enantioselective catalyst screen for the reaction between benzoyl triethylsilane and *p*-anisaldehyde. All subsequent manipulations were performed in a dry box to exclude moisture. A flame-dried vial with a magnetic stir bar was charged with 0.1 mmol of acylsilane, aldehyde (1.2 equiv), phosphite (0.05 equiv) and 2 mL of solvent (THF, Et_2O , toluene or dioxane). After the mixture was cooled to $-30\text{ }^\circ\text{C}$ in the freezer, *n*-BuLi (0.05-0.2 equiv) was added dropwise *via* a syringe. The reaction was allowed to warm to $25\text{ }^\circ\text{C}$ and stir for 1 h. After the reaction vial was taken out of the dry box, the solvent was removed with a rotary evaporator. The conversion of each reaction was checked by ^1H NMR analysis of the crude product. Each reaction was filtered through a pad of SiO_2 with the aid of 5:1 hexanes/EtOAc and the combined portions were concentrated. Enantiomeric excesses were determined by CSP-SFC analysis ((*S,S*)-Whelk-O1, 1.0% MeOH, 2.0 mL/min, 200 psi, $40\text{ }^\circ\text{C}$, 240 nm, $t_{\text{r-major}}$ 11.8 min, $t_{\text{r-minor}}$ 10.3 min).

General procedure (B) for the reaction of acylsilanes with aldehydes. A flame-dried round-bottom flask with a magnetic stir bar was charged with 0.5 mmol of acylsilane, aldehyde (1.5 equiv) and phosphite **4f** (0.05-0.2 equiv) in the dry box. The flask was sealed with a septum and was brought out of the dry box. Under Ar, 8 mL of THF was added *via* a syringe. At $0\text{ }^\circ\text{C}$ *n*-BuLi (0.2-0.4 equiv) was added dropwise *via* a syringe. After the ice-bath was removed, the reaction was stirred under Ar for 0.5 h (monitored by TLC). The solvent was removed with a rotary evaporator and the crude product was purified by flash chromatography, eluting with the indicated solvent system to afford the pure silyl-protected benzoin product.

Deprotection of silyloxy ketones to corresponding hydroxy ketones. A round-bottom flask with a magnetic stir bar was charged with 0.2 mmol of the pure silyloxy ketone. 10 mL of MeOH and 10 mL HCl (1M aqueous solution) were added and the mixture was stirred for 10 min at $25\text{ }^\circ\text{C}$ before 15 mL Et_2O was added to the flask. The organic layer was separated and the aqueous layer was extracted with two 15 mL portions of Et_2O . The organic extracts were combined, dried (MgSO_4), and the solvent was removed with a rotary evaporator. The product was purified by flash chromatography, eluting with the indicated solvent system to afford the pure benzoin product.

***S*-(*-*)-1,2-diphenyl-2-triethylsilyloxy-ethanone (**3a**).** The title compound was prepared according to General Procedure **B** using 107 mg (0.49 mmol) of acylsilane, 78 μL (0.77 mmol) of benzaldehyde, 22 mg (0.036 mmol) of phosphite **4f**, 120 μL (0.19 mmol) of *n*-BuLi (1.6 M in hexanes), and 8 mL of THF. After 0.5 h from $0\text{ }^\circ\text{C}$ to $25\text{ }^\circ\text{C}$, the crude product was purified by

flash chromatography with 35:1 hexanes/EtOAc to afford 140 mg (89%) of the product as a clear oil in 85% ee as determined by CSP-SFC analysis (Chiralpak AD, 0.5% MeOH, 1.5 mL/min, 150 psi, 40 °C, 240 nm, $t_{r-major}$ 18.2 min, $t_{r-minor}$ 17.0 min). Spectral data matched that reported previously.⁵ $[\alpha]_D^{25}$ -8.7 ($c = 1.5$, CH₂Cl₂). CSP-SFC chromatograms for both racemic and 85% ee samples are shown below:

Deprotection of 3a. 15 mL of MeOH and 15 mL HCl (1M aqueous solution) were added to a flask containing 177 mg pure silyloxy ketone and the mixture was stirred for 10 min at 25 °C. The crude product was purified by flash chromatography with 4:1 hexanes/EtOAc to afford 107 mg (93%) of the corresponding hydroxy ketone product as white crystals. Analytical data for *S*-(+)-1,2-diphenyl-2-hydroxy-ethanone: ¹H NMR (400 MHz, CDCl₃) δ 7.92 (dd, $J = 8.4$ Hz, 1.2 Hz, 2H), 7.52 (dt, $J = 7.6$ Hz, 0.8 Hz, 1H), 7.39 (t, $J = 8.0$ Hz, 2H), 7.36-7.24 (m, 5H), 5.96 (d, $J = 6.0$ Hz, 1H), 4.56 (d, $J = 6.0$ Hz, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 198.9, 139.0, 133.8, 133.6, 129.1, 129.1, 128.6, 128.5, 127.7, 76.2; TLC (5:1 hexanes/EtOAc) R_f 0.19; mp 122-124 °C; $[\alpha]_D^{25}$ +86 ($c = 1.0$, Me₂CO) (Lit.: $[\alpha]_D^{25}$ +49 ($c = 0.91$, Me₂CO, 43% ee) for (*S*) configuration).¹⁰

***S*-(−)-1-phenyl-2-(4-chlorophenyl)-2-triethylsilyloxy-ethanone (3b).** The title compound was prepared according to General Procedure **B** using 107 mg (0.49 mmol) of acylsilane, 103 mg (0.73 mmol) of *p*-chlorobenzaldehyde, 22 mg (0.036 mmol) of phosphite **4f**, 91 μ L (0.14 mmol) of *n*-BuLi (1.6 M in hexanes), and 8 mL of THF. After 0.5 h from 0 °C to 25 °C, the crude product was purified by flash chromatography with 40:1 hexanes/EtOAc to afford 138 mg (79%) of the product as a clear oil in 79% ee as determined by CSP-SFC analysis (Chiralcel OD-H, 0.5% MeOH, 1.5 mL/min, 150 psi, 40 °C, 240 nm, $t_{r-major}$ 17.8 min, $t_{r-minor}$ 15.8 min). Spectral data matched that reported previously.⁵ $[\alpha]_D^{25}$ -33 ($c = 2.5$, CH₂Cl₂). CSP-SFC chromatograms for both racemic and 79% ee samples are shown below:

***S*-(-)-1-(4-chlorophenyl)-2-phenyl-2-triethylsilyloxy-ethanone (3c).** The title compound was prepared according to General Procedure **B** using 105 mg (0.41 mmol) of acylsilane, 63 μ L (0.62 mmol) of benzaldehyde, 18 mg (0.031 mmol) of phosphite **4f**, 80 μ L (0.12 mmol) of *n*-BuLi (1.6 M in hexanes), and 8 mL of THF. After 0.5 h from 0 °C to 25 °C, the crude product was purified by flash chromatography with 40:1 hexanes/EtOAc to afford 128 mg (86%) of the product as a clear oil in 89% ee as determined by CSP-SFC analysis (Chiralcel OD-H, 0.5% MeOH, 1.5 mL/min, 150 psi, 40 °C, 240 nm, $t_{r-major}$ 14.2 min, $t_{r-minor}$ 16.1 min). Spectral data matched that reported previously.⁵ $[\alpha]_D^{25}$ -33 (c = 0.45, CH₂Cl₂). CSP-SFC chromatograms for both racemic and 89% ee samples are shown below:

Deprotection of 3c. 10 mL of MeOH and 10 mL HCl (1M aqueous solution) were added to a flask containing 110 mg pure silyloxy ketone and the mixture was stirred for 10 min at 25 °C. The crude product was purified by flash chromatography with 4:1 hexanes/EtOAc to afford 70 mg (93%) of the corresponding hydroxy ketone product as white crystals. Analytical data for *S*-(+)-1-(4-chlorophenyl)-2-hydroxy-2-phenyl-ethanone: ¹H NMR (400 MHz, CDCl₃) δ 7.88-7.80 (m, 2H), 7.40-7.20 (m, 7H), 5.90 (d, J = 6.0 Hz, 1H), 4.55 (d, J = 6.0 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 197.7, 140.3, 138.6, 131.7, 130.4, 129.2, 129.0, 128.7, 127.7, 76.2; TLC (3:1 hexanes/EtOAc) R_f 0.40; mp 97-100 °C; $[\alpha]_D^{25}$ +42 (c = 1.0, EtOH) (Lit.: $[\alpha]_D^{25}$ +10 (c = 1.1, EtOH, 22% ee) for (*S*) configuration).¹⁰

***S*-(+)-1-phenyl-2-(4-methoxyphenyl)-2-triethylsilyloxy-ethanone (3d).** The title compound was prepared according to General Procedure **B** using 108 mg (0.45 mmol) of acylsilane, 72 μ L (0.59 mmol) of *p*-anisaldehyde, 14 mg (0.022 mmol) of phosphite **4f**, 56 μ L (0.088 mmol) of *n*-BuLi (1.6 M in hexanes), and 8 mL of THF. After 0.5 h from 0 °C to 25 °C, the crude product was purified by flash chromatography with 35:1 hexanes/EtOAc to afford 146 mg (91%) of the product as a clear oil in 91% ee as determined by CSP-SFC analysis ((*S,S*)-Whelk-O1, 1.0% MeOH, 2.0 mL/min, 200 psi, 40 °C, 240 nm, $t_{R-major}$ 11.8 min, $t_{R-minor}$ 10.3 min). Spectral data matched that reported previously.⁵ $[\alpha]_D^{25} +2.4$ ($c = 0.35$, CH₂Cl₂). CSP-SFC chromatograms for both racemic and 91% ee samples are shown below:

Deprotection of 3d. 10 mL of MeOH and 10 mL HCl (3M aqueous solution) were added to a flask containing 83 mg pure silyloxy ketone and the mixture was stirred for 10 min at 25 °C. The crude product was purified by flash chromatography with 7:3 hexanes/EtOAc to afford 48 mg (86%) of the corresponding hydroxy ketone product as white crystals. Analytical data for *S*-(+)-1-phenyl-2-(4-methoxyphenyl)-2-hydroxy-ethanone: ¹H NMR (400 MHz, CDCl₃) δ 7.90-7.87 (m, 2H) 7.51-7.47 (m, 1H) 7.38-7.36 (m, 2H) 7.24-7.22 (m, 2H) 6.83-6.81 (m, 2H) 5.90 (d, $J = 5.8$ Hz, 1H) 4.49 (d, $J = 6.0$ Hz, 1H) 3.72 (s, 3H); TLC (7:3 hexanes/EtOAc) R_f 0.26; mp 81-84 °C; $[\alpha]_D^{25} +111$ ($c = 1.1$, acetone).

Determination of Absolute Configuration of 3d. To a stirred solution of 0.9 mmol phenyl magnesium bromide (0.5 M in Et₂O) was added dropwise a solution of 100 mg (0.43 mmol) silylcyanohydrin¹¹ in 1 mL Et₂O under Ar. The reaction mixture was heated under reflux for 2 h and then poured into a mixture of ice (2 g) and conc. H₂SO₄ (0.075 mL) and stirred for 12 h. The crude product was extracted with Et₂O (3 x 10 mL), dried (MgSO₄) and purified by flash chromatography with 7:3 hexanes/EtOAc to afford 73 mg (71%) of the product as a pale yellow oil. Analytical data for *S*-(+)-1-phenyl-2-(4-methoxyphenyl)-2-hydroxy-ethanone: ¹H NMR (400 MHz, CDCl₃) δ 7.92-7.89 (m, 2H) 7.52-7.49 (m, 1H) 7.41-7.39 (m, 2H) 7.26-7.24 (m, 2H)

6.86-6.83 (m, 2H) 5.91 (d, $J = 5.8$ Hz, 1H) 4.47 (d, $J = 6.0$ Hz, 1H), 3.76 (s, 3H); TLC (7:3 hexanes/EtOAc) R_f 0.25; $[\alpha]_D^{25} +100$ ($c = 1.1$, acetone).

***S*-(-)-1-(4-methoxyphenyl)-2-phenyl-2-triethylsilyloxy-ethanone (3e).** The title compound was prepared according to General Procedure **B** using 80 mg (0.32 mmol) of acylsilane, 39 μ L (0.38 mmol) of benzaldehyde, 19 mg (0.032 mmol) of phosphite **4f**, 60 μ L (0.096 mmol) of *n*-BuLi (1.6 M in hexanes), and 6 mL of THF. After 0.5 h from 0 °C to 25 °C, the crude product was purified by flash chromatography with 20:1 hexanes/EtOAc to afford 94 mg (83%) of the product as a clear oil in 88% ee as determined by CSP-SFC analysis ((*S,S*)-Whelk-O1, 1.0% MeOH, 2.0 mL/min, 200 psi, 40 °C, 240 nm, $t_{r-major}$ 11.2 min, $t_{r-minor}$ 10.2 min). Spectral data matched that reported previously.⁵ $[\alpha]_D^{25} -41$ ($c = 1.95$, CH₂Cl₂). CSP-SFC chromatograms for both racemic and 88% ee samples are shown below:

Deprotection of 3e. 10 mL of MeOH and 10 mL HCl (1M aqueous solution) were added to a flask containing 72 mg pure silyloxy ketone and the mixture was stirred for 10 min at 25 °C. The crude product was purified by flash chromatography with 2:1 hexanes/EtOAc to afford 47 mg (95%) of the corresponding hydroxy ketone product as white crystals. Analytical data for *S*-(+)-1-(4-methoxyphenyl)-2-hydroxy-2-phenyl-ethanone: ¹H NMR (400 MHz, CDCl₃) δ 7.91 (d, $J = 8.4$ Hz, 2H), 7.40-7.20 (m, 5H), 6.86 (d, $J = 8.4$ Hz, 2H), 5.89 (d, $J = 6.0$ Hz, 1H), 4.63 (d, $J = 6.0$ Hz, 1H), 3.82 (s, 3H); TLC (2:1 hexanes/EtOAc) R_f 0.3; mp 100-102 °C; $[\alpha]_D^{25} +57$ ($c = 1.1$, EtOH) (Lit.: $[\alpha]_D^{25} +19$ ($c = 0.66$, EtOH, 24% ee) for (*S*) configuration).¹⁰

***S*-(-)-1-(4-chlorophenyl)-2-(4-methoxyphenyl)-2-triethylsilyloxy-ethanone (3f).** The title compound was prepared according to General Procedure **B** using 119 mg (0.47 mmol) of acylsilane, 86 μ L (0.70 mmol) of *p*-anisaldehyde, 21 mg (0.035 mmol) of phosphite **4f**, 90 μ L (0.14 mmol) of *n*-BuLi (1.6 M in hexanes), and 8 mL of THF. After 0.5 h from 0 °C to 25 °C, the crude product was purified by flash chromatography with 35:1 hexanes/EtOAc to afford 153 mg (84%) of the product as a clear oil in 90% ee as determined by CSP-SFC analysis

((*S,S*)-Whelk-O1, 1.0% MeOH, 2.0 mL/min, 200 psi, 40 °C, 240 nm, $t_{R-major}$ 9.7 min, $t_{R-minor}$ 8.2 min). Spectral data matched that reported previously.⁵ $[\alpha]_D^{25}$ -11 ($c = 0.55$, CH₂Cl₂). CSP-SFC chromatograms for both racemic and 90% ee samples are shown below:

***S*-(+)-1-(4-methoxyphenyl)-2-(4-chlorophenyl)-2-hydroxy-ethanone (3g).** The title compound was prepared according to General Procedure **B** using 120 mg (0.48 mmol) of acylsilane, 101 mg (0.72 mmol) of *p*-chlorobenzaldehyde, 35 mg (0.06 mmol) of phosphite **4f**, 90 μ L (0.14 mmol) of *n*-BuLi (1.6 M in hexanes), and 8 mL of THF. After 0.5 h from 0 °C to 25 °C, the solvent was removed with a rotary evaporator. 15 mL of MeOH and 15 mL HCl (1M aqueous solution) were added and the mixture was stirred for 10 min at 25 °C before 15 mL Et₂O was added to the flask. The organic layer was separated and the aqueous layer was extracted with two 15 mL portions of Et₂O. The organic extracts were combined, dried (MgSO₄), and the solvent was removed with a rotary evaporator. The crude product was purified by flash chromatography with 2:1 hexanes/EtOAc to afford 105 mg (79%, 2 steps) of the product as a waxy solid in 83% ee as determined by CSP-SFC analysis ((*S,S*)-Whelk-O1, 2.0% MeOH, 2.0 mL/min, 200 psi, 40 °C, 240 nm, $t_{R-major}$ 12.8 min, $t_{R-minor}$ 23.3 min). Analytical data for *S*-(+)-1-(4-methoxyphenyl)-2-(4-chlorophenyl)-2-hydroxy-ethanone: **IR** (thin film, cm⁻¹) 3750-3100 (br), 3070, 3010, 2966, 2935, 2841, 1668, 1599, 1574, 1500, 1490, 1463, 1410, 1311, 1261, 1174, 1082, 1028, 975, 910, 856, 827, 735, 615; **¹H NMR** (400 MHz, CDCl₃) δ 7.85 (d, $J = 8.8$ Hz, 2H), 7.24 (s, 4H), 6.84 (d, $J = 8.8$ Hz, 2H), 5.85 (s, 1H), 4.80-4.40 (broad, 1H), 3.78 (s, 3H); **¹³C NMR** (100 MHz, CDCl₃) δ 196.7, 164.1, 138.0, 134.2, 131.4, 129.1, 129.0, 125.9, 113.9, 74.8, 55.4; TLC (3:1 hexanes/EtOAc) R_f 0.17; For ¹H NMR spectrum, see Appendix; $[\alpha]_D^{25}$ +33 ($c = 0.53$, CH₂Cl₂). CSP-SFC chromatograms for both racemic and 83% ee samples are shown below:

***S*-(+)-1-phenyl-2-(4-dimethylaminophenyl)-2-hydroxy-ethanone (3h).** The title compound was prepared according to General Procedure **B** using 150 mg (0.68 mmol) of acylsilane, 152 mg (1.02 mmol) of *p*-dimethylaminobenzaldehyde, 20 mg (0.034 mmol) of phosphite **4f**, 130 μ L (0.20 mmol) of *n*-BuLi (1.6 M in hexanes), and 10 mL of THF. After 0.5 h from 0 °C to 25 °C, the solvent was removed with a rotary evaporator. 10 mL of MeOH and 10 mL HCl (1M aqueous solution) were added and the mixture was stirred for 10 min at 25 °C. Saturated aqueous NaHCO₃ was added until pH > 10, and 15 mL Et₂O was added to the flask. The organic layer was separated and the aqueous layer was extracted with two 15 mL portions of Et₂O. The organic extracts were combined, dried (MgSO₄), and the solvent was removed with a rotary evaporator. The crude product was purified by flash chromatography with 2:1 hexanes/EtOAc to afford 135 mg (79%, 2 steps) of the product as a waxy solid in 84% ee as determined by CSP-SFC analysis (Chiralpak AS, 2.0% MeOH, 2.0 mL/min, 200 psi, 40 °C, 240 nm, *t*_{r-major} 27.1 min, *t*_{r-minor} 31.2 min). Analytical data for *S*-(+)-1-phenyl-2-(4-dimethylaminophenyl)-2-hydroxy-ethanone: **IR** (Nujol mull, cm⁻¹) 3413, 2918, 2856, 1678, 1616, 1525, 1460, 1377, 1263, 1167, 1084, 974, 812, 727; **¹H NMR** (300 MHz, CDCl₃) δ 7.93 (d, *J* = 7.5 Hz, 2H), 7.50 (dt, *J* = 7.5 Hz, *J* = 2.1 Hz, 1H), 7.38 (t, *J* = 7.5 Hz, 2H), 7.17 (dt, *J* = 8.7 Hz, *J* = 2.1 Hz, 2H), 6.65 (d, *J* = 8.4 Hz, 2H), 5.88 (d, *J* = 6.0 Hz, 1H), 4.41 (d, *J* = 6.0 Hz, 1H), 2.90 (s, 6H); **¹³C NMR** (100 MHz, CDCl₃) δ 199.2, 150.5, 133.8, 133.5, 129.1, 128.7, 128.6, 126.5, 112.7, 75.9, 40.3; TLC (3:1 hexanes/EtOAc) *R*_f 0.24; For ¹H NMR spectrum, see Appendix; mp 148-152 °C; [α]_D²⁵ +187 (c = 0.75, CH₂Cl₂). CSP-SFC chromatograms for both racemic and 84% ee samples are shown below:

***S*-(-)-1-(4-dimethylaminophenyl)-2-phenyl-2-triethylsilyloxy-ethanone (3i).** The title compound was prepared according to General Procedure **B** using 114 mg (0.44 mmol) of acylsilane, 66 μ L (0.65 mmol) of benzaldehyde, 38 mg (0.066 mmol) of phosphite **4f**, 100 μ L (0.16 mmol) of *n*-BuLi (1.6 M in hexanes), and 8 mL of THF. After 0.5 h from 0 °C to 25 °C, the crude product was purified by flash chromatography with 16:1 hexanes/EtOAc to afford 139 mg (86%) of the product as a clear oil in 86% ee as determined by CSP-SFC analysis (Chiralcel OD-H, 1.5% MeOH, 2.0 mL/min, 200 psi, 40 °C, 240 nm, $t_{r-major}$ 23.4 min, $t_{r-minor}$ 26.3 min). Spectral data matched that reported previously.⁵ $[\alpha]_D^{25}$ -40 (c = 1.2, CH₂Cl₂). CSP-SFC chromatograms for both racemic and 86% ee samples are shown below:

***S*-(+)-1-phenyl-2-(2-furyl)-2-triethylsilyloxy-ethanone (3j).** The title compound was prepared according to General Procedure **B** using 110 mg (0.50 mmol) of acylsilane, 62 μ L (0.75 mmol) of 2-furaldehyde, 22 mg (0.037 mmol) of phosphite **4f**, 94 μ L (0.15 mmol) of *n*-BuLi (1.6 M in hexanes), and 8 mL of THF. After 0.5 h from 0 °C to 25 °C, the crude product was purified by flash chromatography with 35:1 hexanes/EtOAc to afford 105 mg (66%) of the product as a

clear oil. Spectral data matched that reported previously.⁵ $[\alpha]_D^{25} +49$ ($c = 0.46$, CH_2Cl_2).

Deprotection of 3j. 10 mL of MeOH and 10 mL HCl (1M aqueous solution) were added to a flask containing 82 mg of **3j** and the mixture was stirred for 10 min at 25 °C. After workup, the crude product was purified by flash chromatography with 3:1 hexanes/EtOAc to afford 46 mg (87%) of the corresponding hydroxy ketone product as white crystals in 88% ee as determined by CSP-SFC analysis (Chiralpak AS, 2.0% MeOH, 2.0 mL/min, 200 psi, 40 °C, 240 nm, $t_{r\text{-major}}$ 6.4 min, $t_{r\text{-minor}}$ 7.4 min). Analytical data for *S*-(+)-1-phenyl-2-(2-furyl)-2-hydroxy-ethanone: **IR** (Nujol mull, cm^{-1}) 3423, 3377, 2951, 2910, 2850, 1678, 1597, 1578, 1462, 1377, 1300, 1230, 1217, 1151, 1068, 1016, 972, 915, 845, 746, 684, 669; **¹H NMR** (400 MHz, CDCl_3) δ 7.95 (d, $J = 8.0$ Hz, 2H), 7.57 (t, $J = 7.6$ Hz, 1H), 7.43 (t, $J = 8.0$ Hz, 2H), 7.34 (s, 1H), 6.33 (dt, $J = 7.6$ Hz, $J = 3.2$ Hz, 2H), 6.02 (d, $J = 6.4$ Hz, 1H), 4.41 (d, $J = 6.4$ Hz, 1H); **¹³C NMR** (100 MHz, CDCl_3) δ 195.9, 151.6, 143.1, 134.1, 133.2, 128.9, 128.7, 110.8, 109.1, 69.3; TLC (5:1 hexanes/EtOAc) R_f 0.18; mp 130-133 °C; For ¹H NMR spectra, see Appendix; $[\alpha]_D^{25} +90$ ($c = 0.81$, CH_2Cl_2). CSP-SFC chromatograms for both racemic and 88% ee samples are shown below:

***S,S*-1-phenyl-2-triethylsilyloxy-3-methyl-butanone (3k).** The title compound was prepared according to General Procedure **B** using 100 mg (0.45 mmol) of acylsilane, 65 μL (0.73 mmol) of isobutyraldehyde, 40 mg (0.068 mmol) of phosphite **4f**, 140 μL (0.23 mmol) of *n*-BuLi (1.6 M in hexanes), and 8 mL of THF. After 0.5 h from 0 °C to 25 °C, the crude product was purified by flash chromatography with 45:1 hexanes/EtOAc to afford 105 mg (79%) of the product as a clear oil in 73% ee as determined by CSP-SFC analysis ((*S,S*)-Whelk-O1, 0.5% MeOH, 1.5 mL/min, 150 psi, 40 °C, 254 nm, $t_{r\text{-major}}$ 5.5 min, $t_{r\text{-minor}}$ 6.5 min). Spectral data matched that reported previously.⁵ $[\alpha]_D^{25} -27$ ($c = 0.35$, CH_2Cl_2). CSP-SFC chromatograms for both racemic and 73% ee samples are shown below:

Deprotection of 3k. 10 mL of MeOH and 10 mL HCl (3M aqueous solution) were added to a flask containing 130 mg pure silyloxy ketone and the mixture was stirred for 1 h at 25 °C. The crude product was purified by flash chromatography with 4:1 hexanes/EtOAc to afford 28 mg (35%) of the corresponding hydroxy ketone product as a clear oil. Analytical data for *S*-(+)-1-phenyl-2-hydroxy-3-methylbutanone: $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.91-7.88 (m, 2H) 7.62-7.60 (m, 1H) 7.52-7.48 (m, 2H) 4.98 (dd, $J = 6.4$ Hz, $J = 2.4$ Hz, 1H), 3.60 (d, $J = 6.4$ Hz, 1H) 2.13 (dsept, $J = 6.9$ Hz, $J = 2.5$ Hz, 1H) 1.17 (d, $J = 6.9$ Hz, 3H) 0.65 (d, $J = 6.8$ Hz, 3H); TLC (4:1 hexanes/EtOAc) R_f 0.36; $[\alpha]_D^{25} +13$ ($c = 1.4$, EtOH) (Lit.: $[\alpha]_{546}^{25} +20$ ($c = 2.2$, EtOH), 100% ee for (*S*) configuration).¹²

As a second check of absolute configuration, *S*-(+)-1-phenyl-2-hydroxy-3-methylbutanone was independently prepared by addition of PhMgBr to (*S*)-3-methyl-2-trimethylsilyloxybutanenitrile and subsequent hydrolysis. The (silyloxy)nitrile starting material (64% ee) was synthesized by Belokon's method.¹¹ Observed optical rotation for *S*-(+)-1-phenyl-2-hydroxy-3-methylbutanone prepared in this way: $[\alpha]_D^{25} +12$ ($c = 1.1$, EtOH).

(-)-1-phenyl-2-triethylsilyloxy-octanone (3l). The title compound was prepared according to General Procedure **B** using 124 mg (0.56 mmol) of acylsilane, 120 μL (0.84 mmol) of heptanal, 66 mg (0.11 mmol) of phosphite **4f**, 140 μL (0.23 mmol) of *n*-BuLi (1.6 M in hexanes), and 9 mL of THF. After 0.5 h from 0 °C to 25 °C, the crude product was purified by flash chromatography with 50:1 hexanes/EtOAc to afford 158 mg (84%) of the product as a clear oil in 41% ee as determined by CSP-SFC analysis ((*S,S*)-Whelk-O1, 0.5% MeOH, 1.5 mL/min, 150 psi, 40 °C, 254 nm, $t_{R\text{-major}}$ 8.2 min, $t_{R\text{-minor}}$ 9.8 min). Spectral data matched that reported previously.⁵ $[\alpha]_D^{25} -13$ ($c = 0.93$, CH_2Cl_2). CSP-SFC chromatograms for both racemic and 41% ee samples are shown below:

(-)-(1-(triethylsilyloxy)-benzyl-hexyl-ketone (3m). The title compound was prepared according to General Procedure **B** using 100 mg (0.44 mmol) of acylsilane, 67 μL (0.66 mmol) of benzaldehyde, 51 mg (0.088 mmol) of phosphite **4f**, 82 μL (0.13 mmol) of *n*-BuLi (1.6 M in hexanes), and 8 mL of THF. After 0.5 h from 0 $^\circ\text{C}$ to 25 $^\circ\text{C}$, the crude product was purified by flash chromatography with 4:1 petroleum ether/ CH_2Cl_2 to afford 108 mg (74%) of the product as a clear oil in 67% ee as determined by CSP-SFC analysis ((*S,S*)-Whelk-O1, 0.5% MeOH, 1.5 mL/min, 150 psi, 40 $^\circ\text{C}$, 254 nm, $t_{\text{r-major}}$ 13.1 min, $t_{\text{r-minor}}$ 7.0 min). Spectral data matched that reported previously.⁵ $[\alpha]_{\text{D}}^{25}$ -10 ($c = 1.2$, CH_2Cl_2). CSP-SFC chromatograms for both racemic and 67% ee samples are shown below:

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S19

4b

Ar = 2-MePh

4d

Ar = 2-naphthyl

4e

Ar = 2,6-F₂Ph

4g

4h

Ar = 2-CF₃Ph

4i

Ar = 2-FPh

4j

4m

Ar = 4-FPh

4n

Name: 1-phenyl-2-(furan-2-yl)ethan-1-one
 MW: 176.15
 C: 10, H: 8, O: 2
 1H NMR (400 MHz, CDCl3):
 7.958 (d, 2H, J = 7.5 Hz, H-7, H-8), 7.590 (d, 2H, J = 7.5 Hz, H-5, H-6), 7.572 (t, 1H, J = 7.5 Hz, H-5), 7.457 (t, 1H, J = 7.5 Hz, H-7), 7.438 (t, 1H, J = 7.5 Hz, H-8), 7.342 (t, 1H, J = 7.5 Hz, H-5), 7.260 (t, 1H, J = 7.5 Hz, H-7), 6.344 (d, 2H, J = 2.1 Hz, H-3, H-4), 6.336 (d, 2H, J = 2.1 Hz, H-3, H-4), 6.318 (d, 2H, J = 2.1 Hz, H-3, H-4), 6.030 (d, 2H, J = 2.1 Hz, H-3, H-4), 6.015 (d, 2H, J = 2.1 Hz, H-3, H-4), 4.413 (d, 2H, J = 2.1 Hz, H-3, H-4), 4.397 (d, 2H, J = 2.1 Hz, H-3, H-4), 1.256 (s, 3H, H-1)

1.256

4.413
4.397

7.958
7.590
7.572
7.457
7.438
7.342
7.260
6.344
6.336
6.318
6.030
6.015