



Supporting Information

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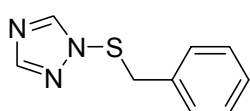
# Enantioselective Organocatalyzed $\alpha$ -Sulfenylation of Aldehydes

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**General.** The  $^1\text{H}$  NMR and  $^{13}\text{C}$  NMR spectra were recorded at 400 MHz and 100 MHz, respectively. The chemical shifts are reported in ppm relative to  $\text{CHCl}_3$  ( $\delta = 7.26$ ) for  $^1\text{H}$  NMR and relative to the central  $\text{CDCl}_3$  resonance ( $\delta = 77.0$ ) for  $^{13}\text{C}$  NMR. Flash chromatography (FC) was carried out using Merck silica gel 60 (230-400 mesh). Optical rotation values were measured on a Perkin-Elmer 241 polarimeter. NMR data of known compounds are in agreement with literature values.

**Materials.** Commercially available aldehydes and organocatalysts were used without further purifications. The catalysts **4c,d** were synthesized according to literature procedures. All solvents were of p.a. quality and used without further purification.

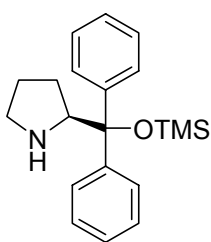


**1-Benzylsulfanyl-[1,2,4]triazole 2e:** 20 mmol of sulfuryl chloride were added dropwise to a solution of dibenzyl disulfide (20 mmol) in  $\text{CH}_2\text{Cl}_2$  (20 mL) of

After 15 min the resulting solution was added dropwise to a second solution of 1,2,4-triazole (50 mmol) and  $\text{NEt}_3$  (44 mmol) in  $\text{CH}_2\text{Cl}_2$  (20 mL). The solvent was removed *in vacuo* at  $20^\circ\text{C}$  and the product

was extracted from the crude mixture using pentane (2 × 100 mL) and pentane/CH<sub>2</sub>Cl<sub>2</sub> 30 vol% (100 mL). The product was isolated in 62% yield by quick FC (gradient pentane/Et<sub>2</sub>O 1/1 to Et<sub>2</sub>O) in order to minimize decomposition. The product was stored under inert atmosphere at 0°C. <sup>1</sup>H NMR δ 8.03 (s, 1H, CH), 7.63 (s, 1H, CH), 7.27 (m, 3H, ArH), 7.03 (m, 2H, ArH), 4.22 (s, 2H, SCH<sub>2</sub>Ph); <sup>13</sup>C NMR δ 154.1, 151.4, 134.2, 128.9, 128.8, 128.1, 45.2.

**General procedure for the preparation of catalysts 4e-h:** TMSOTf (10 mmol, 1.3 eq.) was added at 0°C to a solution of the appropriate amino alcohol (7.6 mmol) and NEt<sub>3</sub> (10 mmol, 1.3 eq.) in CH<sub>2</sub>Cl<sub>2</sub> (50 mL). The reaction was then allowed to reach ambient temperature and was stirred for 1 h until full conversion of the starting material was confirmed by TLC analysis. The reaction was quenched with water. The product was extracted 3 times with CH<sub>2</sub>Cl<sub>2</sub> and dried over Na<sub>2</sub>SO<sub>4</sub>. After evaporation of the solvent the catalysts were isolated by FC in near quantitative yields.

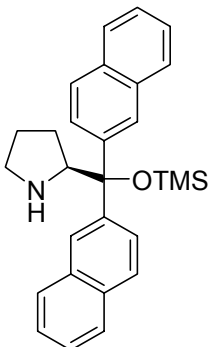


**(S)-2-(Diphenyl-trimethylsilyloxy-methyl)-pyrrolidine**

**4e:** The title compound was prepared following the

general procedure. <sup>1</sup>H NMR δ 7.36-7.30 (m, 10H, ArH), 4.86 (br, 1H, NH), 4.50 (t, 1H, J = 7.2, NCH), 3.10 (dt, 1H, J = 10.7, 6.7, NCH<sub>2</sub>), 2.84 (dt, 1H, J = 10.7,

7.0, NCH<sub>2</sub>), 2.05-1.99 (m, 1H, CH<sub>2</sub>), 1.96-1.82 (m, 2H, CH<sub>2</sub>), 1.58-1.51 (m, 1H, CH<sub>2</sub>), -0.01 (s, 9H, Si(CH<sub>3</sub>)<sub>3</sub>); <sup>13</sup>C NMR δ 143.7, 143.7, 128.3, 128.1, 128.0, 127.9, 127.8, 127.7, 82.4, 66.4, 47.1, 27.3, 24.6, 1.8; [α]<sub>D</sub> = -30.0 (c = 1.0, CH<sub>2</sub>Cl<sub>2</sub>).

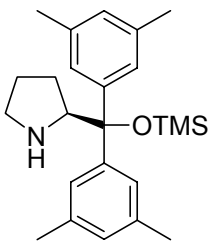


**(S)-2-(Dinaphthalen-2-yl-trimethylsilanyloxy-methyl)-pyrrolidine 4f:**

The title compound was isolated following the general procedure.  $^1\text{H}$  NMR  $\delta$  8.07 (s, 1H, ArH), 8.01 (s, 1H, ArH), 7.97-7.66 (m, 6H, ArH), 7.54-7.24 (m, 6H, ArH), 4.51 (br, 1H, NCH), 2.96 (br, 1H, NCH<sub>2</sub>), 2.75 (br, 1H, NCH<sub>2</sub>), 2.05-1.55 (m, 5H, CH<sub>2</sub>, NH), -0.05 (s, 9H, Si(CH<sub>3</sub>)<sub>3</sub>);  $^{13}\text{C}$  NMR  $\delta$  142.2, 141.9, 132.7, 132.5, 128.8, 128.4, 127.6, 127.5, 127.4, 126.8,

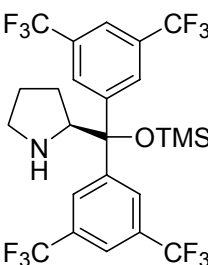
126.5, 126.3, 126.2, 126.1, 125.9, 83.1, 65.8, 47.0, 27.5, 24.9, 2.2;  $[\alpha]_{\text{D}}$  = -62.6 (c = 0.9, CH<sub>2</sub>Cl<sub>2</sub>).

**(S)-2-[Bis-(3-5-dimethyl-phenyl)-trimethylsilanyloxy-methyl]-pyrrolidine 4g:**



The title compound was prepared following the general procedure.  $^1\text{H}$  NMR  $\delta$  7.00 (s, 2H, ArH), 6.94 (s, 2H, ArH), 6.84 (s, 1H, ArH), 6.81 (s, 1H, ArH), 3.97 (t, 1H,  $J$  = 7.6, NCH), 2.88-2.76 (m, 2H, NCH<sub>2</sub>), 2.27 (s, 6H, CH<sub>3</sub>), 2.26 (s, 6H, CH<sub>3</sub>), 1.90 (br, 1H, NH), 1.61-1.52 (m, 3H, CH<sub>2</sub>), 1.48-1.39 (m, 1H, CH<sub>2</sub>), -0.10 (s, 9H, Si(CH<sub>3</sub>)<sub>3</sub>);  $^{13}\text{C}$  NMR  $\delta$  146.6, 145.7, 136.8, 136.8, 128.4, 128.2, 125.9, 125.3, 83.2, 65.4, 47.1, 27.5, 25.1, 21.5, 21.5, 2.2;  $[\alpha]_{\text{D}}$  = -73.3 (c = 1.5, CH<sub>2</sub>Cl<sub>2</sub>).

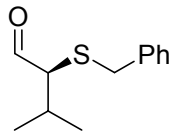
**(S)-2-[Bis-(3-5-bis(trifluoromethyl)-phenyl)-trimethylsilanyloxy-methyl]-pyrrolidine 4h:**

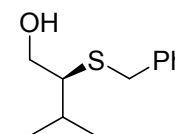


The title compound was prepared following the general procedure.  $^1\text{H}$  NMR  $\delta$  8.04 (s, 2H, ArH), 7.84 (s, 1H, ArH), 7.83 (s, 1H, ArH), 7.79 (s, 2H, ArH), 4.25 (t, 1H,  $J$  = 7.2, NCH), 2.93 (dt, 1H,  $J$  = 10.0, 6.8, NCH<sub>2</sub>), 2.59 (dt,  $J$  = 10.0, 6.0, NCH<sub>2</sub>), 1.75 (br, 1H, NH), 1.75-1.68 (m, 1H, CH<sub>2</sub>), 1.60-1.42 (m, 2H, CH<sub>2</sub>), 1.17-1.08 (m, 1H, CH<sub>2</sub>), -0.08 (s, 9H, Si(CH<sub>3</sub>)<sub>3</sub>);  $^{13}\text{C}$  NMR  $\delta$  148.7, 146.7, 131.8 (q,  $^2J_{\text{C,F}}$  = 33.4), 131.1 (q,  $^2J_{\text{C,F}}$  = 33.4), 128.9 (q,

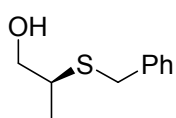
$^3J_{C,F} = 3.1$ ), 128.3 (q,  $^3J_{C,F} = 3.1$ ), 123.6 (q,  $^1J_{C,F} = 271$ ), 128.1 (q,  $^1J_{C,F} = 271$ ), 121.9 (hept,  $^3J_{C,F} = 3.8$ ), 121.7 (hept,  $^3J_{C,F} = 3.8$ ), 82.6, 64.5, 47.5, 27.8, 25.5, 2.0;  $[\alpha]_D = -6.8$  (c = 1.2,  $\text{CH}_2\text{Cl}_2$ ).

**General procedure for the organocatalytic  $\alpha$ -sulfenylation of aldehydes and reduction to the corresponding alcohols.** The catalyst (0.05 mmol, 10 mol%) and the aldehyde (0.5 mmol) were stirred at ambient temperature in toluene (1.0 mL) for 5 min before the addition of 1-benzylsulfanyl-1,2,4-triazole (115 mg, 0.60 mmol, 1.2 eq.). The reaction mixture was then stirred for 3 h. After dilution of the reaction mixture with MeOH (4.0 mL),  $\text{NaBH}_4$  (0.6 mmol) was added at ambient temperature. After 20 min, the reaction was quenched with 1 M aqueous  $\text{KHSO}_4$  (3 mL). After standard aqueous workup, the products were purified by FC.

 **(2S)-Benzylsulfanyl-3-methylbutyraldehyde 3a:** The title compound was prepared according to the general procedure without subsequent reduction by  $\text{NaBH}_4$ .  $^1\text{H}$  NMR  $\delta$  9.20 (d, 1H,  $J = 5.8$ , CHO), 7.36-7.25 (m, 5H, ArH), 3.61 (d, 1H,  $J = 3.4$ ,  $\text{CH}_2\text{Ph}$ ), 3.48 (d, 1H,  $J = 3.4$ ,  $\text{CH}_2\text{Ph}$ ), 2.70 (dd, 1H,  $J = 9.0$ ,  $J = 5.7$ , CHS), 1.95 (m, 1H,  $\text{CH}(\text{CH}_3)_2$ ), 0.99 (d, 3H,  $J = 6.3$ ,  $\text{CH}(\text{CH}_3)_2$ ), 0.98 (d, 3H,  $J = 6.3$ ,  $\text{CH}(\text{CH}_3)_2$ );  $^{13}\text{C}$  NMR  $\delta$  193.1, 137.1, 129.1, 128.5, 127.2, 59.8, 34.7, 27.1, 20.8, 19.8. The ee of **3a** in crude reaction mixtures was determined by GC on a Chrompak CP-Chirasil Dex CB-column. Temperature program: 140°C isotherm for 10 min followed by a temperature ramp 140°C to 200°C at a rate of 10°C/min,  $R_t$  (min): 12.91 ((S)-enantiomer), 12.99 ((R)-enantiomer).

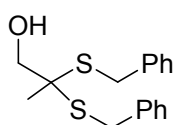
 **(2S)-Benzylsulfanyl-3-methylbutan-1-ol 5a:** The title compound was isolated following the general procedure. The spectroscopic data were in agreement with

literature values.<sup>[1]</sup> The ee was determined by HPLC on a Daicel Chiralpak AD column with hexane/*i*-PrOH (99:1) as the eluent.  $R_t$  (min): 12.1 (major enantiomer), 13.2 (minor enantiomer);  $[\alpha]_D = -26.0$  ( $c = 2.1$ ,  $\text{CH}_2\text{Cl}_2$ , 98% ee). The absolute configuration was determined by optical rotation and compared with literature values.<sup>[1]</sup>



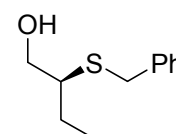
**(2S)-2-Benzylsulfanyl-propan-1-ol 5b:** The title compound

was isolated following the general procedure.  $^1\text{H}$  NMR  $\delta$  7.36–7.25 (m, 5H, ArH), 3.79 (d, 1H,  $J = 7.4$ ,  $\text{CH}_2\text{Ph}$ ), 3.73 (d, 1H,  $J = 7.4$ ,  $\text{CH}_2\text{Ph}$ ), 3.61 (m, 1H,  $\text{CH}_2\text{OH}$ ), 3.48 (m, 1H,  $\text{CH}_2\text{OH}$ ), 2.85 (m, 1H, CHS), 2.17 (br, 1H,  $\text{CH}_2\text{OH}$ ), 1.26 (d, 3H,  $J = 7.0$ ,  $\text{CHCH}_3$ );  $^{13}\text{C}$  NMR  $\delta$  138.2, 128.7, 128.5, 127.1, 65.4, 42.8, 34.6, 17.8. The ee was determined by HPLC on a Daicel Chiralpak AD column with hexane/*i*-PrOH (98:2) as the eluent.  $R_t$  (min): 13.9 (minor enantiomer), 14.9 (major enantiomer);  $[\alpha]_D = -32.3$  ( $c = 1.6$ ,  $\text{CHCl}_3$ , 95% ee). The absolute configuration was determined by optical rotation and compared with literature values.<sup>[2]</sup>



**2,2-Bis-benzylsulfanyl-propan-1-ol:** The title compound

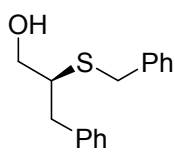
was isolated as a by-product following the general procedure.  $^1\text{H}$  NMR  $\delta$  7.36–7.25 (m, 10H, ArH), 3.91 (d, 2H,  $J = 2.6$ ,  $\text{CH}_2\text{Ph}$ ), 3.87 (d, 2H,  $J = 2.6$ ,  $\text{CH}_2\text{Ph}$ ), 3.50 (s, 2H,  $\text{CH}_2\text{OH}$ ), 2.10 (br, 1H,  $\text{CH}_2\text{OH}$ ), 1.62 (s, 3H,  $\text{CCH}_3$ );  $^{13}\text{C}$  NMR  $\delta$  137.5, 129.0, 128.7, 127.2, 67.7, 63.2, 33.9, 25.2.

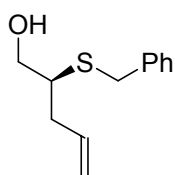


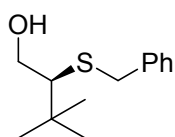
**2-Benzylsulfanyl-butan-1-ol 5c:** The title compound was

isolated following the general procedure.  $^1\text{H}$  NMR  $\delta$  7.36–7.25 (m, 5H, ArH), 3.79 (d, 1H,  $J = 7.4$ ,  $\text{CH}_2\text{Ph}$ ), 3.74 (d, 1H,  $J = 7.4$ ,  $\text{CH}_2\text{Ph}$ ), 3.67 (m, 1H,  $\text{CH}_2\text{OH}$ ), 3.48 (m, 1H,  $\text{CH}_2\text{OH}$ ), 2.63 (m, 1H, CHS), 2.17 (br, 1H,  $\text{CH}_2\text{OH}$ ), 1.63 (m, 1H,  $\text{CH}_2\text{CH}_3$ ), 1.52 (m, 1H,  $\text{CH}_2\text{CH}_3$ ), 0.97 (m, 3H,  $\text{CH}_2\text{CH}_3$ );  $^{13}\text{C}$  NMR  $\delta$  138.3, 128.7, 128.5,

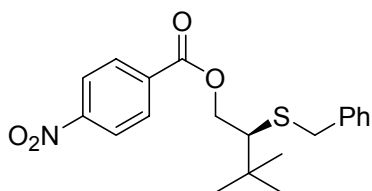
127.1, 63.4, 50.5, 34.8, 24.5, 11.6. The ee was determined by HPLC on 2 Daicel Chiralpak AS columns in a row with hexane/*i*-PrOH (99:1) as the eluent.  $R_t$  (min): 19.9 (minor enantiomer), 21.2 (major enantiomer).

**2-Benzylsulfanyl-3-phenyl-propan-1-ol 5d:** The title compound was isolated following the general procedure.   $^1\text{H NMR } \delta$  7.36-7.25 (m, 8H, ArH), 7.15 (d, 2H,  $J = 6.8$ , ArH), 3.65 (m, 3H, SCH<sub>2</sub>Ph and CH<sub>2</sub>OH), 3.45 (m, 1H, CH<sub>2</sub>OH), 2.85 (m, 3H, CHS and CCH<sub>2</sub>Ph), 2.08 (br, 1H, CH<sub>2</sub>OH);  $^{13}\text{C NMR } \delta$  138.7, 138.0, 129.2, 128.8, 128.6, 128.4, 127.2, 126.5, 62.9, 49.9, 38.3, 35.4. The ee was determined by HPLC on a Daicel Chiralpak AD column with hexane/*i*-PrOH (99:1) as the eluent.  $R_t$  (min): 23.4 (major enantiomer), 25.6 (minor enantiomer);  $[\alpha]_D = -9.0$  (c = 2.3, CH<sub>2</sub>Cl<sub>2</sub>, 97% ee).

**2-Benzylsulfanyl-pent-4-en-1-ol 5e:** The title compound was isolated following the general procedure.   $^1\text{H NMR } \delta$  7.36-7.25 (m, 5H, ArH), 5.77 (m, 1H, CH=CH<sub>2</sub>), 5.08 (m, 2H, CH=CH<sub>2</sub>), 3.78 (d, 1H,  $J = 6.2$ , CH<sub>2</sub>Ph), 3.75 (d, 1H,  $J = 6.2$ , CH<sub>2</sub>Ph), 3.64 (m, 1H, CH<sub>2</sub>OH), 3.52 (m, 1H, CH<sub>2</sub>OH), 2.76 (m, 1H, CHS), 2.32 (m, 2H, CH<sub>2</sub>), 2.05 (br, 1H, CH<sub>2</sub>OH);  $^{13}\text{C NMR } \delta$  138.1, 135.0, 128.8, 128.6, 127.2, 117.3, 63.3, 47.9, 36.2, 35.1. The ee was determined by HPLC on 2 Daicel Chiralpak AD columns in a row with hexane/*i*-PrOH (99:1) as the eluent.  $R_t$  (min): 32.0 (major enantiomer), 30.6 (minor enantiomer);  $[\alpha]_D = -18.4$  (c = 1.1, CH<sub>2</sub>Cl<sub>2</sub>, 96% ee).

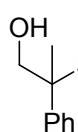
**2-Benzylsulfanyl-3,3-dimethyl-butan-1-ol 5f:** The title compound was isolated following the general procedure.   $^1\text{H NMR } \delta$  7.36-7.25 (m, 5H, ArH), 3.80-3.65 (m, 3H, SCH<sub>2</sub>Ph and CH<sub>2</sub>OH), 3.36 (ddd, 1H,  $J = 11.3$ ,  $J = 9.1$ ,  $J = 3.9$ , CH<sub>2</sub>OH), 2.41

(dd, 1H,  $J = 9.1$ ,  $J = 4.1$ , **CHS**), 2.22 (dd, 1H,  $J = 9.5$ ,  $J = 3.9$ , **CH<sub>2</sub>OH**), 0.91 (s, 9H, **C(CH<sub>3</sub>)<sub>3</sub>**);  $^{13}\text{C}$  NMR  $\delta$  138.4, 129.0, 128.6, 127.2, 61.9, 61.5, 38.5, 34.5, 27.9. The ee was determined by HPLC after conversion to 4-nitro-benzoic acid 2-benzylsulfanyl-3,3-dimethyl-butyl ester (see below);  $[\alpha]_{\text{D}} = +18.8$  ( $c = 1.9$ ,  $\text{CH}_2\text{Cl}_2$ , 95% ee).



**4-Nitro-benzoic acid 2-benzylsulfanyl-3,3-dimethyl-butyl ester:** The title compound was prepared by adding an excess of 4-nitro benzoyl chloride and  $\text{NEt}_3$  to an aliquot of **5f**

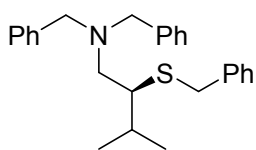
in  $\text{CH}_2\text{Cl}_2$  and was purified by column chromatography.  $^1\text{H}$  NMR  $\delta$  8.29 (d,  $J = 8.9$ , 2H, **ArH**), 8.14 (d,  $J = 8.9$ , 2H, **ArH**), 7.33-7.17 (m, 5H, **ArH**), 4.62 (dd, 1H,  $J = 11.7$ ,  $J = 5.4$ , **CH<sub>2</sub>O**), 4.50 (dd, 1H,  $J = 11.7$ ,  $J = 5.4$ , **CH<sub>2</sub>O**), 3.73 (s, 2H, **CH<sub>2</sub>Ph**), 2.62 (app. t,  $J = 5.9$ , 1H, **CHS**), 1.04 (s, 9H, **C(CH<sub>3</sub>)<sub>3</sub>**);  $^{13}\text{C}$  NMR  $\delta$  164.6, 150.5, 138.2, 135.5, 130.7, 129.0, 128.4, 127.1, 123.6, 66.7, 54.9, 37.7, 34.8, 28.0. The ee was determined on a Daicel Chiralpak AD column with hexane/*i*-PrOH (98:2) as the eluent.  $R_t$  (min): 8.1 (major enantiomer); 8.9 (minor enantiomer);  $[\alpha]_{\text{D}} = -67.1$  ( $c = 1.1$ ,  $\text{CH}_2\text{Cl}_2$ , 96% ee).



**2-Benzylsulfanyl-2-phenyl-propan-1-ol 5g:** The title compound was isolated following the general procedure.

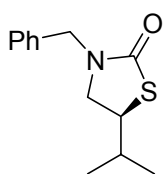
$^1\text{H}$  NMR  $\delta$  7.55 (dd, 2H,  $J = 8.1$ ,  $J = 1.5$ , **ArH**), 7.42-7.36 (m, 2H, **ArH**), 7.31-7.10 (m, 6H, **ArH**), 3.87 (d, 2H,  $J = 7.0$ , **CH<sub>2</sub>OH**), 3.43 (d, 1H,  $J = 12.1$ , **CH<sub>2</sub>Ph**), 3.39 (d, 1H,  $J = 12.1$ , **CH<sub>2</sub>Ph**), 2.20 (t, 1H,  $J = 7.0$ , **CH<sub>2</sub>OH**), 1.70 (s, 3H, **CH<sub>3</sub>**);  $^{13}\text{C}$  NMR  $\delta$  142.5, 137.7, 128.7, 128.5, 128.4, 127.1, 127.0, 127.0, 68.0, 55.1, 33.7, 25.4. The ee was determined by HPLC on 2 Daicel Chiralpak AS columns in a row with hexane/*i*-PrOH (99:1) as the eluent.  $R_t$  (min): 21.1 (minor enantiomer), 29.5 (major enantiomer);  $[\alpha]_{\text{D}} = -25.2$  ( $c = 1.0$ ,  $\text{CH}_2\text{Cl}_2$ , 61% ee).





**Dibenzy-(2-benzylsulfanyl-3-methyl-butyl-amine 6:**

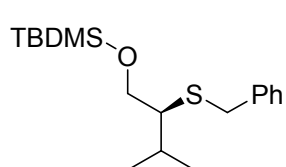
The catalyst (0.05 mmol, 10 mol%) and the aldehyde **1a** were stirred at ambient temperature in toluene (1.0 mL) for 5 min before the addition of 1-benzylsulfanyl-1,2,4-triazole (115 mg, 0.60 mmol, 1.2 eq.). The reaction mixture was then stirred for 3 h. The reaction mixture was quenched by filtration through a plug of silica using CH<sub>2</sub>Cl<sub>2</sub> as the solvent. The solvent was removed *in vacuo* and the crude product was transferred using CH<sub>2</sub>Cl<sub>2</sub> (1 mL) to a vial containing dibenzylamine (193 μL, 1.0 mmol) and sodium triacetoxyborohydride (212 mg, 1.0 mmol) in CH<sub>2</sub>Cl<sub>2</sub> (3 mL). After stirring for 6 h, the resulting solution was quenched with saturated aq. NaHCO<sub>3</sub>, extracted with EtOAc (3 × 10 mL), dried over Na<sub>2</sub>SO<sub>4</sub>, filtered, concentrated *in vacuo* and purified by FC (5% EtOAc/pentane). <sup>1</sup>H NMR δ 7.39–7.28 (m, 15H, ArH), 3.70–3.56 (m, 4H, CH<sub>2</sub>Ph), 3.27 (d, 2H, *J* = 13.6, CH<sub>2</sub>Ph), 2.69 (dd, 1H, *J* = 12.8, *J* = 10.4, CH<sub>2</sub>N), 2.58 (m, 1H, CHS), 2.55 (dd, 1H, *J* = 12.8, *J* = 4.8, CH<sub>2</sub>N), 2.29 (m, 1H, CH(CH<sub>3</sub>)<sub>2</sub>), 0.86 (d, 3H, *J* = 6.8, CH(CH<sub>3</sub>)<sub>2</sub>), 0.49 (d, 3H, *J* = 6.8, CH(CH<sub>3</sub>)<sub>2</sub>). <sup>13</sup>C NMR δ 139.5, 138.8, 129.0, 128.3, 128.1, 126.9, 59.0, 57.3, 50.4, 36.5, 28.0, 20.8, 16.3. The ee was determined by HPLC after conversion to 3-benzyl-5-isopropyl-thiazolidin-2-one (see below).



**3-Benzyl-5-isopropyl-thiazolidin-2-one:**

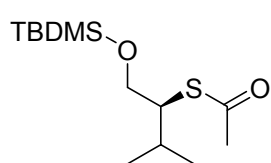
Sodium metal was added in small portions to **6** in liquid NH<sub>3</sub> at -35°C until a blue color remained for 6 h. Then NH<sub>4</sub>Cl (aq.) was added to decompose excess sodium, and the reaction mixture was allowed to warm up for removal NH<sub>3</sub>. Toluene (2 mL) and K<sub>2</sub>CO<sub>3</sub> (2 eq.) were added and the remaining NH<sub>3</sub> was removed by gentle heating. The reaction mixture was cooled to 0°C and a 2M solution of phosgene in toluene (1 mL, 2 eq.) was added. After being

stirred vigorously for 30 min the reaction was extracted with EtOAc, dried on Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The compound was purified by FC (gradient from CH<sub>2</sub>Cl<sub>2</sub> to 5% Et<sub>2</sub>O in CH<sub>2</sub>Cl<sub>2</sub>). <sup>1</sup>H NMR δ 7.38-7.25 (m, 5H, ArH), 4.50 (d, 1H, *J* = 14.8, CH<sub>2</sub>Ph), 4.43 (d, 1H, *J* = 14.8, CH<sub>2</sub>Ph), 3.50 (m, 2H, CH<sub>2</sub>N), 3.20 (m, 1H, CHS), 1.82 (m, 1H, CH(CH<sub>3</sub>)<sub>3</sub>), 0.96 (d, 3H, *J* = 6.7, CH(CH<sub>3</sub>)<sub>3</sub>), 0.90 (d, 3H, *J* = 6.7, CH(CH<sub>3</sub>)<sub>3</sub>); <sup>13</sup>C NMR δ 171.9, 135.9, 128.7, 128.1, 127.8, 51.9, 49.0, 48.4, 33.2, 20.1, 19.6. The ee was determined by HPLC on Daicel Chiralpak AS column with hexane/*i*-PrOH (95:5) as the eluent. R<sub>t</sub> (min): 19.9 (major enantiomer); 22.8 (minor enantiomer).



**(2S)-(2-Benzylsulfanyl-3-methyl-butoxy)-tert-butyl-dimethyl-silane 7:** NEt<sub>3</sub> (1.2 eq) and TBDMSOTf (1.2 eq) were added to a solution of **5a** (0.5 mmol) in CH<sub>2</sub>Cl<sub>2</sub> and stirred overnight. After standard aqueous

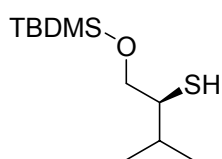
workup, the product was isolated by FC. <sup>1</sup>H NMR δ 7.28-7.17 (m, 5H, ArH), 3.69 (s, 2H, CH<sub>2</sub>Ph), 3.59 (m, 2H, CH<sub>2</sub>O), 2.46 (m, 1H, CHS), 2.06 (m, 1H, CH(CH<sub>3</sub>)<sub>2</sub>), 0.89-0.77 (m, 15H, CH(CH<sub>3</sub>)<sub>2</sub> and Si(C(CH<sub>3</sub>)<sub>3</sub>), -0.02 (s, 6H, Si(CH<sub>3</sub>)<sub>2</sub>); <sup>13</sup>C NMR δ 138.9, 128.9, 128.3, 126.8, 65.1, 54.1, 36.9, 27.8, 25.9, 20.6, 18.2, 17.3, -5.3, -5.4.



**Thioacetic acid S-[1-(tert-butyl-dimethyl-silanyloxymethyl)-2-methyl-propyl] ester:** Sodium metal was added in small portions to a solution of (2S)-(2-benzylsulfanyl-3-methyl-butoxy)-tert-butyl-

dimethyl-silane (0.25 mmol) (see above) in liquid NH<sub>3</sub> at -35°C until a blue colour persisted for 1 h. Then NH<sub>4</sub>Cl was added to decompose the excess sodium, and the reaction mixture was allowed to warm up to room temperature for removal of NH<sub>3</sub>. CH<sub>2</sub>Cl<sub>2</sub> (2 mL) was added to the solid residue. Pyridine (3 eq) and acetyl chloride (3 eq) were added to this solution at RT. The mixture was stirred overnight. The resulting suspension was filtered and the

solvents were removed *in vacuo*. The title compound was purified by FC (65% yield).  $^1\text{H}$  NMR  $\delta$  3.71 (dd, 1H,  $J = 10.0$ ,  $J = 4.9$ ,  $\text{CH}_2\text{O}$ ), 3.64-3.54 (m, 2H,  $\text{CH}_2\text{O}$  and  $\text{CHS}$ ), 2.33 (s, 3H,  $\text{CH}_3\text{CO}$ ), 2.19 (m, 1H,  $\text{CH}(\text{CH}_3)_2$ ), 0.97 (d, 3H,  $J = 6.8$ ,  $\text{CH}(\text{CH}_3)_2$ ), 0.93-0.85 (m, 12H,  $\text{CH}(\text{CH}_3)_2$  and  $\text{Si}(\text{C}(\text{CH}_3)_3)$ ), 0.06 (s, 3H,  $\text{Si}(\text{CH}_3)_2$ ), 0.05 (s, 3H,  $\text{Si}(\text{CH}_3)_2$ );  $^{13}\text{C}$  NMR  $\delta$  195.7, 63.7, 52.5, 30.9, 27.5, 25.8, 20.6, 18.6, 18.2, -5.4, -5.5.



**(2S)-1-(tert-Butyl-dimethyl-silyloxy)-3-methyl-**

**butane-2-thiol 8:** An analytical sample of the title compound was isolated prior to acetylation of the thioacetic acid ester (see above) and purified by

repeated FC.<sup>[3]</sup>  $^1\text{H}$  NMR  $\delta$  3.64 (d, 2H,  $J = 5.5$ ,  $\text{CH}_2\text{O}$ ), 2.83 (m, 1H,  $\text{CHS}$ ), 2.04 (m, 1H,  $\text{CH}(\text{CH}_3)_2$ ), 1.39 (d, 1H,  $J = 7.4$ ,  $\text{SH}$ ), 0.98 (d, 3H,  $J = 6.9$ ,  $\text{CH}(\text{CH}_3)_2$ ), 0.91-0.88 (m, 12H,  $\text{CH}(\text{CH}_3)_2$  and  $\text{Si}(\text{C}(\text{CH}_3)_3)$ ), 0.05 (s, 6H,  $\text{Si}(\text{CH}_3)_2$ );  $^{13}\text{C}$  NMR  $\delta$  66.7, 49.3, 29.2, 25.8, 20.8, 18.2, 17.3, -5.3, -5.4.

**References**

- [1] D. A. Evans, K. R. Campos, J. S. Tedrow, F. E. Michael, M. R. Gagné, *J. Am. Chem. Soc.* **2000**, *122*, 7905.
- [2] L. N. Owen, M. B. Rahman, *J. Chem. Soc. C* **1971**, 2432.
- [3]) In order to facilitate workup and purification procedures, **8** was acetylated *in situ*.