Supporting Information
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Supporting Information

Diastereoselective Synthesis of N-tert-butanesulfinyl-Homopropargylic Amines

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I. **General information**

The progress of all reactions was monitored by thin-layer chromatography to ensure the reactions had reached completion.

Acetone cooled by liquid nitrogen was used as cryoscopic fluid.

A three-neck round bottomed flask equipped with an internal thermometer, a septum cap, an argon inlet and a magnetic stirred was used. Experiments involving organometallics were carried out dried glassware under argon. The glassware was flame-dried and then allowed cooling under argon before use.

The solvents were purified by distillation and transferred under argon (Et₂O, THF, CH₂Cl₂). All other reagents and solvents were of commercial quality and were used without further purification. Zinc bromide was purchased from Aldrich, melted under dry nitrogen and immediately after cooling to room temperature dissolved in anhydrous THF or Et₂O.

The t-BuLi and s-BuLi solutions in pentane purchased from Acros were titrated with a s-BuOH solution (1 M in toluene) in presence of phenantroline from Acros.

Flash chromatography: Merck silica gel 60 (0.015-0.040 µm). NMR: spectra were recorded with a Brucker ARX 400 spectrometer in the solvent indicated; chemical shifts (δ) are given in ppm relative to TMS, coupling constant (J) in Hertz. The solvents signals were used as references and the chemical shifts converted to the TMS scale (CDCl₃: δC= 77.16 ppm; δH= 7.27 ppm). IR was recorded with an ATR diamant spectrophotometer (υmax in cm⁻¹). Optical rotations were measured on a Perkin-Elmer 343 polarimeter with [α]D values reported in degrees and recorded at +20 °C; concentration (c) is in g/100 mL. High resolution mass spectra (HRMS) were obtained on a Finnigan MAT 95.

**tert**-butane Sulfinylimines 2a-e¹, 2f² and 2g³ were prepared according to literature procedures.

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II. Synthesis and Spectroscopical Characterization of 3a-h

General procedure A for the preparation of 3a-h from addition of Zn-I to the corresponding optically pure tert-butane sulfinylimine (Table 2)

To a solution of TMS propyne (296 µL, 2 mmol) in THF (7 mL) was added s-BuLi (1.3 M in pentane, 1.54 mL, 2 mmol) at such a rate that the internal temperature did not exceed −45 °C. Once the addition was complete the reaction mixture was allowed to warm to −20 °C over a period of 20 min. After 45 min stirring at −20 °C the color of reaction mixture turned bright yellow. The reaction mixture was cooled to −35 °C before adding a solution of ZnBr₂ (1 M in THF, 2 mL, 2 mmol) over a period of 5 min. After 30 min stirring at −35 °C the colorless mixture was allowed to warm to room temperature. A solution of optically pure tert-butane sulfinylimine 2 (1 M in THF, 1 mL, 1 mmol) was added to the reaction mixture in 5 min. This one was stirred at room temperature until the reaction had reached completion and was quenched with a 2:1 mixture of a saturated aqueous NH₄Cl solution and NH₃ (28% water, 10 mL). The layers were separated and the aqueous one was extracted with Et₂O (3×10 mL). The combined organic phases were washed with water (20 mL) then with a saturated aqueous NaCl solution (20 mL). The organic phase was dried over anhydrous MgSO₄, filtrated and concentrated under vacuo to afford the corresponding crude tert-butane sulfinylamine 3.

(-)-(R)-2-methyl-N-((R)-1-phenyl-4-(trimethylsilyl)but-3-ynyl)propane-2-sulfinamide (3a):

The product (R,Rs)-3a was obtained according general procedure A (entry 1, table 2) from tert-butane sulfinylimine 2a at T = −78 °C as a single diastereoisomer, the other isomer was not detected by ¹H NMR. The crude material was purified by flash chromatography on silica gel (Pentane/Et₂O, 6/4) to afford pure (R,Rs)-3a (251 mg, 79%) as a white solid.

Analytical data: mp 86.9-87.5 °C. [α]D²⁰ = −28.6 (c 0.84, CHCl₃). ¹H NMR (400 MHz, CDCl₃) δ 7.39-7.26 (m, 5H), 4.54 (dd, J = 5.8, 10.4 Hz, 1H), 3.76 (d, J = 4.1 Hz, 1H), 2.75 (d, J = 6.0 Hz, 2H), 1.24 (s, 9H), 0.09 (s, 9H). ¹³C NMR (100 MHz, CDCl₃) δ 141.1, 128.5, 128.1, 127.1, 102.7, 88.2, 57.4, 56.2, 28.8, 22.7, 0.0. IR 3230, 2967, 2181, 1251, 1054, 843, 748. HRMS-ESI calcld [C₁₇H₂₇NOSSi + H⁺] 322.1655 found 322.1652.
(+)-(R)-2-methyl-N-((S)-1-(trimethylsilyl)hept-1-yn-4-yl)propane-2-sulfinamide (3b) :

The product (S,Rs)-3b was obtained according general procedure A (entry 4, table 2) from tert-butane sulfinylimine 2b as a single diastereoisomer, the other isomer was not detected by ¹H NMR. The crude material was purified by flash chromatography on silica gel (Pentane/Et₂O, 7/3) to afford pure (S,Rs)-3b (278 mg, 97%) as a pale yellow solid.

**Analytical data**: mp 37.9-38.5 °C. [α]₀^2⁰ = +40.1 (c 1.03, CHCl₃). ¹H NMR (400 MHz, CDCl₃) δ 3.36 (m, 1H), 3.29 (d, J = 6.7 Hz, 1H), 2.47 (ddt, J = 5.2, 13.6, 16.9 Hz, 1H), 1.65 (dt, J = 7.7, 14.7 Hz, 2H), 1.21 (s, 9H), 0.93 (t, J = 7.3 Hz, 3H). ¹³C NMR (100 MHz, CDCl₃) δ 103.2, 87.2, 55.9, 54.8, 38.1, 37.6, 22.6, 19.1, 13.9, −0.8. HRMS-ESI calcd [C₁₄H₂₉NOSSi + H⁺] 288.1812 found 288.1810.

(+)-(6R,3R)-2-methyl-N-(2-methyl-6-(trimethylsilyl)hex-5-yn-3-yl)propane-2-sulfinamide (3c) :

The product (R,Rs)-3c was obtained according general procedure A (entry 5, table 2) from tert-butane sulfinylimine 2c with 96/4 (R,Rs)/(S,Rs) diastereoselectivity. The crude material was purified by flash chromatography on silica gel (Pentane/Et₂O, 6/4) to afford pure 3d (200 mg, 70%) as a white solid.

**Analytical data**: mp 59.3-59.6 °C. [α]₀^2⁰ = +41.7 (c 0.92, CHCl₃). ¹H NMR (400 MHz, CDCl₃) δ 3.36 (d, J = 6.9 Hz, 1H), 3.18 (dt, J = 6.0, 2.4 Hz, 1H), 2.42 (dd, J = 2.4, 5.7 Hz, 2H), 1.22 (s, 9H), 0.97 (d, J = 6.8 Hz, 6H), 0.12 (s, 9H). ¹³C NMR (100 MHz, CDCl₃) δ 103.9, 87.2, 60.6, 56.2, 32.2, 24.7, 22.8, 18.7, 0.1. IR 3163, 2956, 2175, 1466, 1247, 1010, 837. HRMS-ESI calcd [C₁₄H₂₉NOSSi + H⁺] 288.1812 found 288.1809.
(-)-(6R,4S)-N-(1-cyclohexyl-4-(trimethylsilyl)but-3-ynyl)-2-methylpropane-2-sulfinamide (3d):

The product (R,Rs)-3d was obtained according general procedure A (entry 6, table 2) from tert-butane sulfinylimine 2d as a single diastereoisomer, the other isomer was not detected by $^1$H NMR. The crude material was purified by flash chromatography on silica gel (Pentane/Et$_2$O, 7/3) to afford pure (R,Rs)-3d (280 mg, 86%) as a white solid.

**Analytical data**: mp 100.2-100.8 °C. [α]$_D^{20}$ = −26.6 (c 1.17, CHCl$_3$). $^1$H NMR (400 MHz, CDCl$_3$) δ 3.33 (d, J = 7.2 Hz, 1H), 3.08 (dt, J = 6.4, 5.9 Hz, 1H), 2.34 (dd, J = 5.6, 1.7 Hz, 2H), 1.80-1.53 (m, 7H), 1.14 (s, 9H), 0.05 (s, 9H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 103.8, 87.0, 59.8, 56.0, 53.4, 41.8, 29.1, 26.1, 24.7, 22.6, 0.0. IR 3129, 2176, 1450, 1249, 1008, 838. HRMS-ESI calcd [C$_{17}$H$_{33}$NOSSi + H$^+$] 328.2125 found 328.2120.

(+)-(6R,E)-1-phenyl-6-(trimethylsilyl)hex-1-en-5-yn-3-yl)propane-2-sulfinamide (3e):

The product (R,Rs)-3e was obtained according general procedure A (entry 7, table 2) from tert-butane sulfinylimine 2e as a single diastereoisomer, the other isomer was not detected by $^1$H NMR. The crude material was purified by flash chromatography on silica gel (Pentane/Et$_2$O, 6/4) to afford pure (R,Rs)-3e (340 mg, 98%) as a white solid.

**Analytical data**: mp 69.0-69.6 °C. [α]$_D^{20}$ = +13.6 (c 1.85, CHCl$_3$). $^1$H NMR (400 MHz, CDCl$_3$) δ 7.40-7.22 (m, 5H), 6.67 (d, J = 15.9 Hz, 1H), 6.30 (dd, J = 7.2, 15.9 Hz, 1H), 4.13 (ddt, J = 6.6, 6.3, 6 Hz, 1H), 3.56 (d, J = 6.0 Hz, 1H), 2.64 (dd, J = 5.7, 16.8 Hz, 2H), 1.25 (s, 9H), 0.14 (s, 9H). $^{13}$C NMR (100 MHz, CDCl$_3$) δ 136.2, 132.3, 129.2, 128.4, 127.8, 126.6, 102.5, 87.8, 56.4, 56.0, 27.5, 22.5, 0.0. IR 3212, 2957, 2173, 1246, 1058, 838, 750. HRMS-ESI calcd [C$_{19}$H$_{29}$NOSSi + H$^+$] 348.1812 found 348.1808.
(+)-(S)-N-((R)-1-(tert-butyldimethylsilyloxy)-5-(trimethylsilyl)pent-4-yn-2-yl)-2-methylpropane-2-sulfinamide (3f):

The product (R,Ss)-3f was obtained according general procedure A (entry 6, table 2) from tert-butane sulfinylimine 2f as a single diastereoisomer, the other isomer was not detected by $^1$H NMR. The crude material was purified by flash chromatography on silica gel (Pentane/Et$_2$O, 7/3) to afford pure (S,Rs)-3f (314 mg, 81%) as a yellow oil.

**Analytical data**: $[\alpha]_D^{20} = +34.7$ (c 2.7, CHCl$_3$). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 3.79 (d, J = 5.2 Hz, 2H), 3.47 (td, J = 5.3, 7.0 Hz, 1H), 2.50 (ddd, J = 6.1, 16.9 Hz, 2H), 1.22 (s, 9H), 0.90 (s, 9H), 0.14 (s, 9H), 0.08 (d, J = 2.2 Hz, 6H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 103.1, 87.2, 64.9, 56.0, 26.0, 23.8, 22.7, 18.4, 0.1, −5.3. IR 3193, 2955, 2177, 1471, 1062. HRMS-ESI calcd [C$_{18}$H$_{39}$NO$_2$S$\text{Si}_2$ + H$^+$] 390.2313 found 390.2313.

(+)-(R)-N-((2S,3R)-2-(tert-butyldimethylsilyloxy)-6-(trimethylsilyl)hex-5-yn-3-yl)-2-methylpropane-2-sulfinamide (3g):

The product (S,R,Rs)-3g was obtained according general procedure A (entry 10, table 2) from tert-butane sulfinylimine 2g as a single diastereoisomer, the other isomer was not detected by $^1$H NMR. The crude material was purified by flash chromatography on silica gel (Pentane/Et$_2$O, 7/3) to afford pure (S,R,Rs)-3g (280 mg, 70%) as a white solid.

**Analytical data**: mp 87.5-88.0 °C. $[\alpha]_D^{20} = +5.7$ (c 1.07, CHCl$_3$). $^1$H NMR (400 MHz, CDCl$_3$) $\delta$ 4.17 (dt, J = 5.1, 10.1 Hz, 1H), 3.74 (d, J = 7.2 Hz, 1H), 3.34 (ddt, J = 3.9, 7.2, 13.1 Hz, 1H), 2.59-2.34 (2×dd, J = 6.6, 17.1, 23.0 Hz, 2H), 1.24 (s, 9H), 1.7 (d, J = 6.3 Hz, 3H), 0.90 (s, 9H), 0.13 (s, 9H), 0.09 (s, 3H). $^{13}$C NMR (100 MHz, CDCl$_3$) $\delta$ 104.2, 86.7, 70.5, 60.6, 56.3, 26.0, 22.8, 21.7, 19.6, 18.1, 0.1, −4.2. IR 3191, 2956, 2176, 1248, 1040, 834. HRMS-ESI calcd [C$_{19}$H$_{41}$NO$_2$SSi$_2$ + H$^+$] 404.2469 found 404.2469.
(S)-N-((2S)-2-(tert-butyldimethylsilyloxy)-6-(trimethylsilyl)hex-5-yn-3-yl)-2-methylpropane-2-sulfinamide (3h):

The product 3h was obtained according general procedure A (entry 11, table 2) from tert-butane sulfinylimine 2h as a mixture of two diastereoisomeres in (S,R,Ss)-syn/(S,S,Ss)-anti = 58:42 ratio. The crude material was purified by flash chromatography on silica gel (Pentane/Et₂O, 7/3) to afford pure 3h (368 mg, dr = 58:42, 90%) as a colorless oil.

Analytical data: ¹H NMR (400 MHz, CDCl₃) δ 4.11 (dd, J = 2.7, 6.3 Hz, 1H, anti), 3.93 (d, J = 6.7 Hz, 1H, anti), 3.83 (dd, J = 6.2, 7.1 Hz, 1H, syn), 3.75 (d, J = 9.0 Hz, syn), 3.25-3.11 (m, 2H), 2.72 (ddd, J = 4.6, 16.8, 22.5 Hz, 2H, syn), 2.43 (ddd, J = 6.7, 17.0, 23.0 Hz, 2H, anti), 1.27-1.17 (m, 24H), 0.89 (s, 18H), 0.14-0.07 (m, 30H). ¹³C NMR (100 MHz, CDCl₃) δ 103.9 (syn), 103.0 (anti), 88.5, 69.3 (syn), 68.6 (anti), 60.7 (anti), 60.6 (syn), 56.3 (syn), 56.0 (anti), 25.9 (syn), 25.5 (anti), 24.2 (anti), 22.9 (syn), 21.0 (syn), 20.7 (anti), 18.1 (syn), 0.1 (syn), −4.0 (syn), −4.8 (anti). HRMS-ESI calcd [C₁₉H₄₁NO₂SSi₂ + H⁺] 404.2469 found 404.2469.
III. $^1$H and $^{13}$C NMR Spectra for 3a-h

(-)-(R)-2-methyl-N-((R)-1-phenyl-4-(trimethylsilyl)but-3-ynyl)propane-2-sulfinamide (3a):
(+)-(R)-2-methyl-N-((S)-1-(trimethylsilyl)hept-1-yn-4-yl)propane-2-sulfinamide (3b):
(+)-(6R,3R)-2-methyl-N-(2-methyl-6-(trimethylsilyl)hex-5-yn-3-yl)tert-butanesulfynylamine (3c):
(-)-(6R,4S)-N-(1-cyclohexyl-4-(trimethylsilyl)but-3-ynyl)\textit{tert}-butanesulfinylamine (3d) :
(+)-(6R,E)-1-phenyl-6-(trimethylsilyl)hex-1-en-5-yn-3-yl)tert-butanesulfinylamine (3e):
(+)-(S)-N-((R)-1-(tert-butyldimethylsilyloxy)-5-(trimethylsilyl)pent-4-yn-2-yl)-2-methylpropane-2-sulfinamide (3f)
(+)-(R)-N-((2S,3R)-2-(tert-butyldimethylsilyloxy)-6-(trimethylsilyl)hex-5-yn-3-yl)-tert-butanesulfinylamine (3g):
(5)-N-((2S)-2-(tert-butyldimethylsilyloxy)-6-(trimethylsilyl)hex-5-yn-3-yl)tert-butanesulfinylamine (3h) :