**Supporting Information for** 

# Direct Carbon–Carbon Bond Formation via Reductive Soft Enolization: A *syn*-Selective Mannich Addition of α-Iodo Thioesters

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#### I. Experimental

General Considerations: Unless stated to the contrary, where applicable, the following conditions apply: Reactions were carried out using dried solvents (see below) and under a slight static pressure of Ar (pre-purified quality) that had been passed through a column (5 x 20 cm) of Drierite. Glassware was dried in an oven at 120 °C for at least 12 h prior to use and then either cooled in a desiccator cabinet over Drierite or assembled quickly while hot, sealed with rubber septa, and allowed to cool under a stream of Ar. Reactions were stirred magnetically using Tefloncoated magnetic stirring bars. Teflon-coated magnetic stirring bars and syringe needles were dried in an oven at 120 °C for at least 12 h prior to use then cooled in a desiccator cabinet over Drierite. Hamilton microsyringes were dried in an oven at 60 °C for at least 24 h prior to use and cooled in the same manner. Commercially available Norm-Ject disposable syringes were used. Dry benzene, toluene, Et<sub>2</sub>O, CH<sub>2</sub>Cl<sub>2</sub>, THF, MeCN and DME were obtained using an Innovative Technologies solvent purification system. All other dry solvents were of anhydrous quality purchased from Aldrich. Commercial grade solvents were used for routine purposes without further purification. Et<sub>3</sub>N, pyridine, *i*-Pr<sub>2</sub>NEt, 2,6-lutidine, *i*-Pr<sub>2</sub>NH, TMEDA were distilled from CaH<sub>2</sub> under a N<sub>2</sub> atmosphere prior to use. Flash column chromatography was performed on silica gel 60 (230-400 mesh) or, where indicated, high purity silica gel (5-20 mesh). All <sup>1</sup>H chemical shifts are reported in ppm ( $\delta$ ) relative to TMS (0.00); <sup>13</sup>C shifts are reported in ppm ( $\delta$ ) relative to CDCl<sub>3</sub> (77.16). In each instance, the syn-anti ratio was computed from the <sup>1</sup>H NMR spectrum of the crude material. Only the major (svn) isomers are reported below. All aldehvdes. N-Benzylidenebenzenesulfonamide, Mgl<sub>2</sub> and Ph<sub>3</sub>P were commercially available from Aldrich.

The following reaction is representative for the formation of all bromo-thioesters from their respective thiols and  $\alpha$ -bromo-acid bromides, with the exception of the S-t-butyl and the tri-t-butyl-S-phenyl thioester.



**α-Bromo-S-phenyl thioacetate.** Bromoacetyl bromide (4.06 mL, 47.0 mmol) was added to a stirred solution of benzenethiol (4.00 mL, 39.1 mmol) in CH<sub>2</sub>Cl<sub>2</sub> (50 mL). The solution was cooled to 0 °C, and pyridine (6.32 mL, 78.2 mmol) was added to the mixture dropwise over 2 min. Stirring was continued for 15 min, followed by the addition of ca. 4 mg of DMAP. The solution was warmed to room temperature and stirring was continued for 23 h. A saturated solution of aqueous NH<sub>4</sub>Cl was added (20 mL) to the reaction and the biphasic mixture was stirred for 10 min. The mixture was partitioned between EtOAc (100 mL) and H<sub>2</sub>O (20 mL) and the organic phase was isolated and washed with brine (1 x 10 mL), dried over MgSO<sub>4</sub>, and evaporated under reduced pressure to give a yellow solid. Flash chromatography over silica gel, using 5:95 EtOAc-hexanes, gave α-Bromo-S-phenyl thioacetate (6.33 g, 70%) as a pure white solid. <sup>1</sup>H NMR data was identical to previously reported data <sup>1</sup>. <sup>13</sup>C NMR (CDCl<sub>3</sub>, 125 MHz): δ 191.1, 134.7, 130.1, 129.6, 126.9, 33.3; LRMS-ESI *m/z* calcd for C<sub>8</sub>H<sub>7</sub>BrNaOS (M + Na): 252.9, found: 252.9.



 $\alpha$ -Bromo- S-phenyl thiopropionate. Flash chromatography over silica gel, using 10:90 EtOAchexanes, gave  $\alpha$ -Bromo-S-phenyl thiopropionate (4.42 g; 50%) as a pale yellow oil. Spectral data was identical to previously reported data <sup>2</sup>.



**α-Bromo-S-2',6'-dimethylphenyl thiopropionate.** Flash chromatography over silica gel, using 10:90 EtOAc-hexanes, gave α-Bromo-S-2',6'-dimethylphenyl thiopropionate (3.8 g; 63%) as a colorless oil. Spectral data was identical to previously reported data <sup>3</sup>.



**\alpha-Bromo-S-2',4',6'-triisopropylphenyl thiopropionate.** Flash chromatography over silica gel, using 2.5:97.5 EtOAc-hexanes, gave  $\alpha$ -Bromo-S-2',4',6'-triisopropylphenyl thiopropionate (1.89 g; 51%) as a white solid. Spectral data was identical to previously reported data <sup>3</sup>.



**α-Bromo-S-***t***-Butyl thiopropionate.** 2-Methy-2-propanethiol (2.03 mL, 18.0 mmol) was added, dropwise over ca. 2 min, to a suspension of NaH (752 mg, 19.8 mmol [60% dispersion in mineral oil, rinsed with hexane and dried over Ar]) in THF (40 mL) at 0 °C. 2-Bromopropionyl bromide (2.09 mL, 19.8 mmol) was added to the suspension, dropwise over ca. 2 min, and the mixture was warmed to room temperature and stirred for 46 h. A saturated solution of NH<sub>4</sub>Cl (20 mL) was added to the solution and the biphasic mixture was stirred for 10 min. The mixture was partitioned between EtOAc (100 mL) and H<sub>2</sub>O (20 mL) and the organic phase was isolated and washed with brine (1 x 10 mL), dried over MgSO<sub>4</sub>, and concentrated under reduced pressure to give a yellow oil. Flash chromatography over silica gel, using 5:95 EtOAc-hexanes, gave α-Bromo-S-t-Butyl thiopropionate (2.05 g; 52%) as a pale yellow oil. Spectral data was identical to previously reported data <sup>3</sup>.

The following reaction is representative of the formation of all of the  $\alpha$ -iodothioesters from their corresponding  $\alpha$ -bromothioesters.



**α-lodo-S-phenyl thioacetate (11).** Sodium iodide (1.21 g, 17.3 mmol) was added to a stirred solution of α-Bromo-S-phenyl thioacetate (2.00 g, 8.65 mmol) in acetone (15 mL). The solution was stirred for 47 hours. The resulting suspension was partitioned between EtOAc (50 mL) and H<sub>2</sub>O (10 mL) and the organic phase was isolated and washed with a 1M solution of Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> (1 x 10 mL) and brine (1 x 10 mL), dried over MgSO<sub>4</sub>, and concentrated under reduced pressure to give a yellow oil. Flash chromatography over silica gel, using 5:95 EtOAc-hexanes, gave **11** (1.4 g; 58%) as a pale yellow solid. Spectral data was identical to previously reported data <sup>3</sup>.

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 $\alpha$ -lodo-S-phenyl thiopropionate (18). Flash chromatography over silica gel, using 5:95 EtOAchexanes, gave 18 (1.5 g; 63%) as a light brown oil. Spectral data was identical to previously reported data <sup>2</sup>.



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**\alpha-lodo-S-t-butyl thiopropionate (19).** Flash chromatography over silica gel, using 2.5:97.5 EtOAc-hexanes, gave **19** (1.8 g; 67%) as a light brown oil. Spectral data was identical to previously reported data <sup>3</sup>.



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 $\alpha$ -lodo-S-2',6'-dimethylphenyl thiopropionate (20). Flash chromatography over silica gel, using 5:95 EtOAc-hexanes, gave 20 (1.1 g; 62%) as a light brown oil. Spectral data was identical to previously reported data <sup>3</sup>.



α-lodo-S-2',4',6'-triisopropylphenyl thiopropionate (21). Flash chromatography over silica gel, using 2.5:97.5 EtOAc-hexanes, gave 21 (1.6 g; 55%) as a pale yellow solid. Spectral data was identical to previously reported data <sup>3</sup>.

The following reaction is representative of the formation of all aromatic imines from their respective aldehydes, according to a known procedure <sup>4</sup>.



**N-(4-methylbenzylidene)benzenesulfonamide (17).** Benzene sulfonamide (1.60 g, 10.2 mmol) was added to a stirred solution of p-tolualdehyde (1.20 mL, 10.2 mmol) in toluene (50 mL). Montmorillonite K-10 (920 mg) was added to the solution, and the solution was heated to the reflux point (138 °C) for 5 h using a Dean-Stark trap. The reaction mixture was then cooled to room temperature and filtered over a pad of celite. The filtrate was concentrated under reduced pressure and recrystallized from EtOAc and hexanes to give **17** (1.09 g; 41%) as a white solid. The spectral data matched reported values <sup>4</sup>.



**N-(naphthalen-2-ylmethylene)benzenesulfonamide (29).** Recrystallization using EtOAc and Hexanes gave **29** (2.33g, 77%) as a white crystalline solid. <sup>1</sup>H NMR (CDCl<sub>3</sub>, 500 MHz): δ 9.20 (s, 1 H), 8.35 (s, 1 H), 8.06-8.03 (m, 3 H), 7.99-7.95 (m, 1 H), 7.90-7.87 (m, 2 H), 7.66-7.51 (m, 5H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 125 MHz): δ 170.6, 138.4, 136.7, 136.5, 133.7, 132.7, 130.1, 129.7, 129.6, 129.3, 129.3, 128.2, 128.2, 127.4, 124.2; HRMS-ESI *m/z* calcd for  $C_{17}H_{13}NO_2S$  (M + H): 296.0746, found 296.0746.



**N-(4-(trifluoromethyl)benzylidene)benzenesulfonamide (30).** Recrystallization using EtOAc and Hexanes gave **30** (1.74 g, 54.6%) as a fluffy white crystalline solid. <sup>1</sup>H NMR (CDCl<sub>3</sub>, 500 MHz):  $\delta$  9.01 (s, 1 H), 8.00 (m, 4 H), 7.76 (d, *J* = 8.02 HZ, 2H), 7.67 (t, *J* = 7.45 Hz, 1H), 7.58 (t,

J = 7.45 Hz, 2H); <sup>13</sup>**C NMR** (CDCl<sub>3</sub>, 125 MHz):  $\delta$  169, 137.6, 135.9, 135.3, 134.0, 131.5, 129.4, 128.3, 126.2, 126.2; **HRMS-ESI** *m*/*z* calcd for C<sub>14</sub>H<sub>10</sub>F<sub>3</sub>NO<sub>2</sub>S (M + H): 314.0463, found 314.0463.



**N-(4-methoxybenzylidene)benzenesulfonamide (31).** Recrystallization using EtOAc and Hexanes gave **31** (2.05 g, 71.2%) as a fluffy white crystalline solid. The spectral data matched reported value 5.



**N-(4-chlorobenzylidene)benzenesulfonamide (32).** Recrystallization using EtOAc and Hexanes gave **32** (868 mg, 31%) as a fluffy white powder. The data matched reported values <sup>4</sup>.



**N-(4-bromobenzylidene)benzenesulfonamide (33).** Recrystallization using EtOAc and Hexanes gave **33** (47 mg, 14%) as a fluffy white powder. The data matched reported values <sup>7</sup>.



**N-(furan-2-ylmethylene)benzenesulfonamide (34).** Recrystallization using EtOAc and Hexanes gave **34** (1.51 g, 59%) as a light brown crystalline solid. <sup>1</sup>**H NMR** (CDCl<sub>3</sub>, 400 MHz): δ 8.85 (s, 1 H), 8.00 (d, J = 7.33 Hz, 2 H), 7.75-7.74 (m, 1 H), 7.65-7.59 (m, 1 H), 7.56-7.51 (m, 2 H), 7.36 (d, J = 3.66 Hz, 1H) 6.66-6.65 (m, 1 H); <sup>13</sup>**C NMR** (CDCl<sub>3</sub>, 100 MHz): δ 156.0, 150.0, 149.1, 138.2, 133.6, 129.2, 128.1, 125.2, 113.9; **HRMS-ESI** *m*/*z* calcd for C<sub>11</sub>H<sub>9</sub>NO<sub>3</sub>S (M + H): 236.0382, found: 236.0381.



**4-(((phenylsulfonyl)imino)methyl)phenyl acetate (35).** Recrystallization using EtOAc and Hexanes gave **35** (33 mg; 11%) as a white powder. <sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 9.04 (s, 1 H), 8.01-7.96 (m, 4 H), 7.64 (t, J = 7.45 Hz, 1 H), 7.57-7.54 (m, 2 H), 7.25-7.23 (m, 2 H), 2.32 (s, 3 H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 125 MHz): δ 169.4, 168.7, 156.0, 138.2, 133.7, 132.9, 129.9, 129.3, 128.1, 122.7, 21.3; HRMS-ESI *m/z* calcd for C<sub>15</sub>H<sub>13</sub>NO<sub>4</sub>S (M + H): 304.0644, found: 304.0644.

The following reaction is representative for the formation of all  $\beta$ -aminothioesters from their respective imines and thioesters (Tables 1-2).



**α-Methyl,β-aminophenylsulfonyl-2',4',6'-triisopropylphenyl thioester (26).** Imine **15** (50 mg, 0.20 mmol) was added to a stirred solution of **21** (102 mg, 0.24 mmol) in CH<sub>2</sub>Cl<sub>2</sub> (3.2 mL) followed by the addition of Mgl<sub>2</sub> (68 mg, 0.24 mmol). After 20 minutes, the reaction was cooled to -20 °C and Ph<sub>3</sub>P (64 mg, 0.24 mmol) was added. Stirring was continued for 16 h at -20 °C. 6 mL of 20% (w/w) HCl was added and the mixture was stirred for an additional 2 hours. The biphasic mixture was then partitioned between EtOAc (80 mL) and H<sub>2</sub>O (6 mL). The organic layer was isolated, washed with H<sub>2</sub>O (1 x 10 mL), 1M solution Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> (2 x 10 mL) and brine (1 x 10 mL), dried over MgSO<sub>4</sub>, filtered and concentrated under reduced pressure to give a pale yellow oil. Flash chromatography over silica gel, using 20:80 EtOAc-hexanes, gave **26** as a white solid (75.0 mg; 68%) in a 15:1 mixture of diastereomers (*syn:anti*). The spectral data matched reported values <sup>6</sup>.



β-aminophenylsulfonyl-2',4',6'-triisopropylphenyl thioester (16). Flash chromatography over silica gel, using 10:90 EtOAc-hexanes, gave 16 as a white, powdery solid (67 mg; 56%). The spectral data matched reported values <sup>6</sup>.



**α-Methyl,β-aminophenylsulfonyl-S-phenyl thioester (23).** Flash chromatography over silica gel, using 10:90 EtOAc-hexanes, gave **23** (51.0 mg; 88%) as a faint yellow solid in a 1.7:1 mixture of diastereomers (*syn:anti*). <sup>1</sup>**H NMR** (CDCl<sub>3</sub>, 400 MHz):  $\delta$  7.96-6.97 (m, 15 H [containing a d at  $\delta$  7.95, J = 7.6Hz]), 6.01-5.58 (m, 1 H [containing a d at  $\delta$  6.00, J = 8.8 Hz, and a d at  $\delta$  5.59, J = 8.4 Hz]), 4.91 (br s, 1 H), 4.66-4.52 (m, 1 H [containing a d at  $\delta$  4.64, J = 5.6, 8.0 Hz, and a t at  $\delta$  4.55, J = 8.0 Hz]), 3.15-3.05 (m, 1 H), 1.36-1.26 (m, 3 H [containing a d at  $\delta$  1.33, J = 7.2 Hz, and a d at  $\delta$  1.29, J = 7.2 Hz]); <sup>13</sup>**C NMR** (CDCl<sub>3</sub>, 100 MHz):  $\delta$  201.3, 199.6, 140.8, 140.1, 138.5, 137.7, 134.3, 132.3, 132.1, 129.7, 129.5, 129.2, 129.1, 128.6, 128.5, 128.4, 128.3, 127.8, 127.6, 127.2, 127.0, 126.8, 126.7, 126.5, 126.4, 60.6, 60.4, 53.7, 53.3, 16.3, 14.3; **LRMS-ESI** *m/z* calcd for C<sub>22</sub>H<sub>21</sub>NNaO<sub>3</sub>S<sub>2</sub> (M + Na): 434.1, found: 434.1.



**α-Methyl,β-aminophenylsulfonyl-S-***t***-butyl thioester (24).** Flash chromatography over silica gel, using 20:80 EtOAc-hexanes, gave **24** (26.2 mg; 54%) as a white solid in a 2.2:1 mixture of diastereomers (*syn:anti*). <sup>1</sup>**H NMR** (CDCl<sub>3</sub>, 400 MHz): δ 7.65-6.93 (m, 10 H), 6.12-5.56 (m, 1 H [containing a d at δ 6.09, J = 8.4 Hz, and a d at δ 5.59, J = 8.0 Hz]), 4.55-4.42 (m, 1 H [containing a d at δ 4.52, J = 6.0, 8.0 Hz, and a t at δ 4.45, J = 8.0 Hz]), 2.87-2.79 (m, apparent quintet, 1 H), 1.35-1.13 (m, 9 H); <sup>13</sup>**C NMR** (CDCl<sub>3</sub>, 75 MHz): δ 203.3, 202.1, 141.0, 140.3, 138.9, 138.2, 132.4, 132.2, 128.8, 128.7, 128.4, 128.3, 127.7, 127.6, 127.4, 127.3, 127.0, 126.7, 60.9, 60.5, 54.3, 53.7, 48.8, 48.3, 29.6, 16.4, 14.4; LRMS-ESI *m*/*z* calcd for C<sub>20</sub>H<sub>25</sub>NNaO<sub>3</sub>S<sub>2</sub> (M + Na): 414.1, found: 414.1.



α-Methyl,β-aminophenylsulfonyl-S-2',6'-dimethylphenyl thioester (25). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes, gave 25 (33.1 mg; 66%) as a white solid in a 7.6:1 mixture of diastereomers (*syn:anti*). <sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz):  $\delta$  7.59 (d, *J* = 4.8 Hz, 2 H), 7.41-6.92 (m, 11 H), 5.77 (d, *J* = 9.2 Hz, 1 H), 4.48 (t, *J* = 9.2 Hz, 1 H), 3.26-3.16 (m, 1 H), 2.40-1.55 (br m, 6 H), 1.43 (s, *J* = 7.2 Hz, 3 H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 125 MHz):  $\delta$  198.3, 142.8,

140.4, 138.2, 132.4, 130.1, 128.8, 128.5, 128.2, 127.9, 127.5, 127.2, 126.3, 60.6, 54.0, 21.3, 15.9; **LRMS-ESI** *m*/*Z* calcd for C<sub>24</sub>H<sub>25</sub>NNaO<sub>3</sub>S<sub>2</sub> (M + Na): 462.1, found: 462.1.



α-Methyl,β-aminophenylsulfonyl-2',4',6'-triisopropylphenyl thioester (28). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes, gave 28 (62.3 mg; 59%) as a fluffy white solid in a 16:1 mixture of diastereomers (*syn:anti*). <sup>1</sup>H NMR (CDCl<sub>3</sub>, 500 MHz): δ 7.60 (d, J = 7.45 Hz, 2 H), 7.41 (t, J = 7.45 Hz, 1 H), 7.27 (t, J = 7.45 Hz, 2 H), 6.98-6.80 (m, 6 H), 5.65 (d, J = 9.16 Hz, 1 H), 4.40 (t, J = 9.74 Hz, 1 H), 3.27-3.20 (m, 2 H), 2.86-2.80 (m, 1 H), 2.32-2.30 (m, 1 H), 2.24 (s, 3 H), 1.45 (d, J = 6.87 Hz, 3 H), 1.20 (d, J = 6.87 Hz, 6 H), 1.11-1.06 (m, 6 H), 0.83-0.76 (m, 6 H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 125 MHz): δ 199.4, 152.5, 152, 151.1, 140.4, 137.3, 135.4, 132.1, 129.1, 128.9, 128.7, 128.6, 127.3, 127.1, 122, 121.8, 120.8, 60.2, 53.9, 53.8, 34.4, 34.2, 31.7, 31.4, 24.4, 24.0, 23.8, 23.5, 23.0, 21.1, 16.3, 16.2; IR (neat, cm<sup>-1</sup>); 3269, 2959, 2867, 1692, 1447, 1158, 771, 722; LRMS-ESI *m*/*Z* calcd for C<sub>32</sub>H<sub>41</sub>NNaO<sub>3</sub>S<sub>2</sub> (M + Na): 574.2, found: 574.2.



**α-Methyl,β-aminophenylsulfonyl-2',4',6'-triisopropylphenyl** thioester (36). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes, gave **36** (73.7 mg; 73%) as a white crystalline solid in a 15:1 mixture of diastereomers (*syn:anti*). <sup>1</sup>H NMR (CDCl<sub>3</sub>, 500 MHz): δ 7.71 (d, J = 8.02 Hz, 1H), 7.58 (d, J = 6.87 Hz, 4H), 7.44-6.79 (m, 9H), 5.97 (d, J = 9.74, 1H), 4.61 (d, J = 9.74, 1H), 3.45-3.39 (m, 1 H), 3.22-3.17 (m, 1 H), 2.81-2.75 (m, 1 H), 1.91-1.88 (d, J = 6.87 Hz, 3 H), 1.15 (d, J = 6.87 Hz, 6 H), 1.08-1.02 (m, 6 H), 0.47-0.27 (m, 6 H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 125 MHz): δ 199.4, 152.6, 152, 151.1, 140.2, 135.3, 132.9, 132.3, 128.6, 128.5, 128.2, 127.5, 127.3, 127.1, 126.3, 126.2, 124.4, 121.9, 121.8, 120.8, 60.8, 53.8, 34.8, 34.3, 31.8, 31.7, 31.3, 27.0, 25.4, 24.1, 24.0, 23.9, 23.6, 22.8, 22.3, 20.8, 16.4; HRMS-ESI *m/z* calcd for C<sub>35</sub>H<sub>41</sub>NO<sub>3</sub>S<sub>2</sub> (M + NH<sub>4</sub>): 605.2872, found 605.2870.



α-Methyl,β-aminophenylsulfonyl-2',4',6'-triisopropylphenyl thioester (37). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes, gave 37 (63.7 mg; 65%) as a white crystalline solid in a 9:1 mixture of diastereomers (*syn:anti*). <sup>1</sup>H NMR (CDCl<sub>3</sub>, 500 MHz): δ 7.57 (d, J = 6.87 Hz, 2 H), 7.40 (t, J = 7.45 Hz, 1 H), 7.30-6.93 (m, 8 H), 6.26 (d, J = 9.16 Hz, 1 H), 4.55 (t, J = 9.74 Hz, 1 H), 3.29-3.20 (m, 2 H), 2.84-2.82 (m, 1 H), 2.30-2.24 (m, 1 H), 1.48 (d, J = 6.87 Hz, 3 H), 1.20 (d, J = 7.45 Hz, 6 H), 1.11-1.06 (m, 6 H), 0.83-0.72 (m, 6 H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 125 MHz): δ 199.4, 152.5, 152, 151.4, 142.2, 140.1, 132.6, 128.9, 128.1, 127, 125.3, 125, 122.8, 122.1, 120.5, 60.1, 53.6, 34.4, 31.9, 31.5, 24.2, 24.1, 23.9, 23.6, 23.0; HRMS-ESI *m/Z* calcd for C<sub>32</sub>H<sub>38</sub>F<sub>3</sub>NO<sub>3</sub>S<sub>2</sub> (M + NH<sub>4</sub>): 623.2589, found 623.2584.



α-Methyl,β-aminophenylsulfonyl-2',4',6'-triisopropylphenyl thioester (38). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes, gave **38** (62.4 mg; 60%) as a colorless oil in a 17:1 mixture of diastereomers (*syn:anti*). The spectral data matched reported values  $^{6}$ .



α-Methyl,β-aminophenylsulfonyl-2',4',6'-triisopropylphenyl thioester (39). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes, gave **39** (73.8 mg; 70%) as a white crystalline solid in a 12:1 mixture of diastereomers (*syn:anti*). The spectral data matched reported values  $^{6}$ .



α-Methyl,β-aminophenylsulfonyl-2',4',6'-triisopropylphenyl thioester (40). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes, gave 40 (58.1 mg; 62%) as a colorless oil in a 12:1 mixture of diastereomers (*syn:anti*). <sup>1</sup>H NMR (CDCl<sub>3</sub>, 500 MHz): δ 7.59 (d, J = 8.59 Hz, 2 H), 7.45 (t, J = 7.45 Hz, 1 H), 7.30-7.26 (m, 2 H), 7.19 (d, J = 8.59 Hz, 2 H), 7.00 (m, 2 H), 6.83 (d, J = 8.02 Hz, 2H), 5.92 (d, J = 9.16 Hz, 1H), 4.41 (t, J = 9.74 Hz, 1 H), 3.23-3.18 (m, 2 H), 2.85-2.81 (m, 1 H), 2.28-2.26 (m, 1 H), 1.44 (d, J = 6.87 Hz, 3 H), 1.20 (d, J = 6.87 Hz,

6 H), 1.12-1.06 (m, 6 H), 0.90-0.82 (m, 6 H); <sup>13</sup>**C NMR** (CDCl<sub>3</sub>, 125 MHz):  $\delta$  199.4, 152.6, 152.0, 151.4, 140.2, 137.5, 132.6, 131.5, 129.3, 128.9, 127.1, 122.1, 122.0, 121.9, 120.6, 60.0, 53.8, 34.4, 31.9, 31.6, 24.5, 24.1, 23.9, 23.6, 23.1, 16.4; **HRMS-ESI** *m*/*Z* calcd for C<sub>31</sub>H<sub>38</sub>BrNO<sub>3</sub>S<sub>2</sub> (M + NH<sub>4</sub>): 633.1820, found 633.1811.



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α-Methyl,β-aminophenylsulfonyl-2',4',6'-triisopropylphenyl thioester (41). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes, gave 41 (66.0 mg; 58%) as a white foamy solid in a 17:1 mixture of diastereomers (*syn:anti*).. <sup>1</sup>H NMR (CDCl<sub>3</sub>, 500 MHz): δ 7.68 (d, J = 8.02 Hz, 2 H), 7.47-7.43 (t, J = 7.45 Hz, 1 H), 7.35 (m, 2H), 7.12 (m, 1 H), 7.03-7.01 (m, 2 H), 6.03-6.02 (m, 1 H), 5.75 (d, J = 2.86 Hz, 1 H), 5.51 (d, J = 9.74 Hz, 1 H), 4.59 (t, J = 9.74 Hz, 1 H), 3.35-3.26 (m, 2 H), 2.91-2.79 (m, 2 H), 1.46 (d, J = 6.87 Hz, 3 H), 1.23 (d, J = 6.87 Hz, 6 H), 1.14-1.07 (m, 6 H), 1.00-0.97 (m, 6 H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 125 MHz): δ 199.5, 152.6, 152.2, 151.3, 150.6, 142.2, 140.4, 132.5, 128.9, 127.0, 122.1, 120.8, 110.1, 108.4, 53.9, 52.1, 34.4, 31.9, 31.6, 23.9, 16.1; HRMS-ESI *m*/*Z* calcd for C<sub>29</sub>H<sub>37</sub>NO<sub>4</sub>S<sub>2</sub> (M + NH<sub>4</sub>): 545.2508, found: 545.2505.



α-Methyl,β-aminophenylsulfonyl-2',4',6'-triisopropylphenyl thioester (42). Flash chromatography over silica gel, using 20:80 EtOAc-hexanes, gave 42 (51.5 mg; 52%) as a colorless oil in a 11:1 mixture of diastereomers (*syn:anti*). <sup>1</sup>H NMR (CDCl<sub>3</sub>, 500 MHz): δ 7.56 (d, J = 8.02 Hz, 2 H), 7.41 (t, J = 7.45 Hz, 1 H), 7.29-7.26 (m, 2 H), 6.97 (m, 2 H), 6.92 (d, J = 8.59 Hz, 2 H), 6.79 (d, J = 8.59 Hz, 2 H), 5.62 (d, J = 9.16 Hz, 1 H), 4.49 (t, J = 9.16 Hz, 1 H), 3.27-3.18 (m, 2 H), 2.88-2.80 (m, 1 H), 2.50-2.47 (m, 1 H), 2.27 (s, 3 H), 1.46 (d, J = 6.87 Hz, 3 H), 1.20 (d, J = 6.87 Hz, 6 H), 1.11-1.06 (m, 6 H), 0.91-0.82 (m, 6 H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 125 MHz): δ 199.8, 169.0, 152.6, 152.1, 151.3, 150.2, 140.2, 135.8, 132.6, 128.9, 128.5, 127.0, 122.1, 122.0, 121.5, 120.7, 116.0, 60.0, 53.8, 31.9, 31.7, 31.6, 27.0, 25.4, 24.4, 24.1, 23.9, 223.6, 23.1, 22.7, 21.3, 16.3; HRMS-ESI *m*/*Z* calcd for C<sub>32</sub>H<sub>41</sub>NO<sub>5</sub>S<sub>2</sub> (M + NH<sub>4</sub>): 613.2770, found 613.2765.

## II. Spectral Images





















































#### **IV. References**

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