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ASYMMETRIC SYNTHESIS OF HETEROCYCLIC ß-AMINOSULFONES *VIA* NUCLEOPHILIC 1,2-ADDITION OF 2-LITHIO-BENZO[*b*]THIOPHENE TO ALDEHYDE-SAMP-HYDRAZONES

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Abstract – An efficient asymmetric synthesis of α–(1,1-dioxo-2,3-dihydro-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-substituted amines is described. Key steps of the synthesis are the nucleophilic 1,2-addition of 2-lithio-benzo[*b*]thiophene to aldehyde-SAMP-hydrazones, a benzo[*b*]thiophene oxidation using dimethyldioxirane and a highly diastereoselective conjugate reduction with *L*-Selectride®. The heterocyclic ß-aminosulfones are obtained in five steps and good overall yields (23-49%) and very high diastereo-and enantiomeric excesses (*de* ≥ 96%, *ee* = 88-99%).

INTRODUCTION

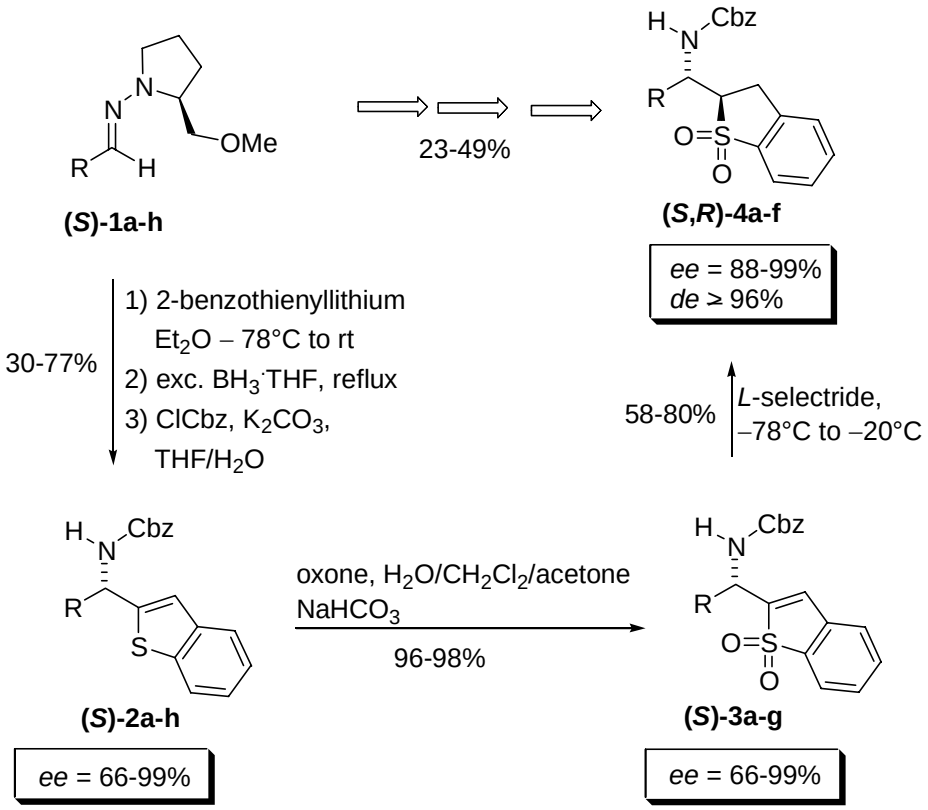
Sulfones are a major class of organosulfur compounds[1] that have been extensively used as versatile intermediates in organic synthesis.[2] The importance of the sulfone moiety has evoked interest in the development of new methodologies to introduce the sulfone functionality into an organic molecule as well as further synthetic transformations of the sulfone intermediates. Cyclic sulfones in particular are an efficient source of conjugated dienes through SO_2 extrusion for intramolecular Diels-Alder reactions.[3] Furthermore, the well-established Ramberg-Bäcklund reaction[4] has demonstrated to be an excellent pathway to gain access to cyclic olefins. On the other hand, a number of biologically significant molecules bear a cyclic sulfone as structural motif.[5] In particular, molecules incorporating the benzo[*b*]thiophene-1,1-dioxide skeleton have shown to be powerful anti-inflammatory agents[6] and have found widespread use due to their antimicrobial activities.[7] Moreover, recent studies have shown that benzene-fused five membered ring sulfones are effective bicyclic acylguanidine Na^+/H^+ antiporter inhibitors[8] as well as non-narcotic analgesic agents.[9] Because of the interesting biological activities associated with the benzo[*b*]thiophene-1,1-dioxide skeleton, it would be of great interest to develop an efficient method to access their functionalized enantioenriched derivatives. In particular, the presence of [1]

This paper is dedicated to Dr. Pierre Potier on the Occasion of his 70th birthday.

an amino group in ß-position to the sulfone moiety would be highly desirable, permitting for instance the incorporation of the molecules into a peptide chain and therefore opening a new entry towards possible pharmacological applications. Intrigued by this idea and regarding our general interest in developing new methodologies for the asymmetric synthesis of ß-aminosulfones,[10] we decided to commence our synthetic efforts towards the first asymmetric synthesis of α–(1,1-dioxo-2,3-dihydro-1H-1λ^6-benzo[*b*]thiophen-2-yl)-substituted amines.

RESULTS AND DISCUSSION

Our synthetic five step strategy employing the SAMP-RAMP-hydrazone methodology[11] to access the target compounds is depicted in Scheme 1.



Scheme 1

The enantiopure aldehyde-SAMP-hydrazones (**1a-h**) were synthesized by direct condensation of the corresponding aldehydes with (*S*)-1-amino-2-methoxymethylpyrrolidine (SAMP). The reactions were performed in Et_2O at room temperature in the presence of magnesium sulfate. After purification the aldehyde hydrazones were obtained in almost quantitative yields. The nucleophilic 1,2-addition of 2-lithio-benzo[*b*]thiophene to the aldehyde-SAMP-hydrazones (**1a-h**) proceeded smoothly using Et_2O as

solvent. High conversions and selectivities were obtained when treating the hydrazones with three equivalents of the heteroaryllithium species at –78°C for 30 minutes after which the reaction mixture was allowed to warm up to room temperature. Complete conversion of the starting material was obtained in approximately 5 hours. Interestingly, at –78°C no reaction took place and attempts to explore different solvents failed. Since the resulting hydrazines are sensitive to oxidation and thus not very stable, the crude products were directly used in the following steps. The N,N-bond cleavage was achieved by refluxing the crude hydrazines with a large excess of $BH_3 \cdot THF$[12] providing the corresponding amines, which were directly protected as benzyl carbamates (**2a-h**) by treatment with benzyl chloroformate. The absolute configuration of the newly formed stereogenic center was assigned as *S* based on our previous studies[13] and in accordance with the relative topicity observed for all 1,2-additions to the CN double bond of aldehyde-SAMP-hydrazones. The yields over three steps as well as enantiomeric excesses are given in table 1.

Table 1

2	R	Yield(%)[a]	*ee*(%)[b]	Confg.
a	Et	76	93	*S*
b	*i*-Pr	77	99	*S*
c	*t*-Bu	60	91	*S*
d	*n*-Bu	62	93	*S*
e	$PhCH_2CH_2$	72	95	*S*
f	Ph	46 (30)	77 (88)[c]	*S*
g	*p*-$MeOC_6H_4$	38	66[c]	*S*
h	Ferrocenyl	45	≥ 95%[d]	*S*

a) Overall yield over three steps.

b) Determined by HPLC with a chiral stationary phase (Daicel OD or Chiralpak AD 2).

c) Determined on the corresponding sulfone (**3**) (HPLC).

d) Determined on the corresponding hydrazine precursor by ^1H and ^{13}C NMR spectroscopy.

As can be seen from Table 1, the procedure is quite general including primary, secondary and tertiary alkyl as well as aromatic groups R within the aldehyde component. However, in the case of the aromatic aldehyde-SAMP-hydrazones (**1f**) and (**1g**) lower yields and enantiomeric excesses were obtained. Further studies showed that the nucleophilic 1,2-addition on these substrates started to take place at about –10°C

instead of the usual –50°C observed with alkylhydrazones. Performing the reaction directly at –10°C did not improve the selectivity.

With the α-(benzothienyl)-substituted amines in hand, we commenced our studies on the oxidation of the benzothiophene ring. Therefore, the carbamates (**2a-g**) were treated with an excess of dimethyldioxirane (DMD). DMD was generated *in situ*[14] in the reaction mixture already containing the carbamate to be oxidized, by reacting acetone with oxone ($2KHSO_5 \cdot KHSO_4 \cdot K_2SO_4$) in the presence of sodium hydrogen carbonate. To our delight, the reaction was extremely clean and high yielding (see Table 2).

Table 2

3	**R**	**Yield(%)**	***ee*(%)**[a]
a	Et	98	93
b	*i*-Pr	98	99
c	*t*-Bu	97	91
d	*n*-Bu	98	93
e	$PhCH_2CH_2$	98	95
f	Ph	96	88[b]
g	*p*-$MeOC_6H_4$	88	66[b]

a) Based on the *ee*-determination of **2**.

b) Determined by HPLC with a chiral stationary phase (Chiralpak AD 2).

In nearly every case the sulfones (**3a-g**) did not require purification *via* flash column chromatography as demonstrated by the elemental analyses performed directly on the crude products (see experimental part). Finally, reduction of the double bond of **3a-f** was more challenging than expected. $NaBH_4$ as reducing agent resulted in a sluggish reaction affording after four days very poor conversion (*ca*. 20%) as shown by NMR spectral analysis. A major improvement was achieved by employing $NaBH_4$ in the presence of a catalytic amount of $NiCl_2$ in MeOH. The reduction took place smoothly and the corresponding heterocyclic ß-aminosulfones (**4a,c-f**) could be isolated in excellent yields (Table 3). Especially with compounds (**3a,d** and **e**) the reduction proceeded with excellent diastereoselectivity (*de* ≥ 96%) affording the corresponding *anti* diastereomers (**4a,d** and **e**) as a mixture of carbamate *E*/*Z*-isomers in a ratio of approximately 2:1. Increasing the steric hindrance of the substituents resulted in a drastic decrease of the diastereoselectivity of the reaction.

Table 3

4	R	Time (h)	Yield (%)	*de*[a] (%)	*ee*[b] (%)	Confg.
a	Et	3	89	≥ 96	93	*S*,*R*
c	*t*-Bu	14	70	15	91	*S*,*R*
d	*n*-Bu	3	79	≥ 96	93	*S*,*R*
e	$PhCH_2CH_2$	3	87	≥ 96	95	*S*,*R*
f	Ph	3	60	90	88	*S*,*R*

a) Determined by ^1H and ^{13}C NMR spectroscopy.

b) Based on the *ee*-values of **2**-or **3**.

The effect was particularly marked with the *tert*-butyl group. When **3c** was treated with $NaBH_4$ in the presence of $NiCl_2$, a longer reaction time was necessary and the reaction gave three products as shown by NMR spectral analysis of the crude mixture. Purification by flash column chromatography provided two fractions: the former was the desired diastereomer (**4c**) as a mixture of carbamate *E*/*Z*-isomers, the latter

Table 4

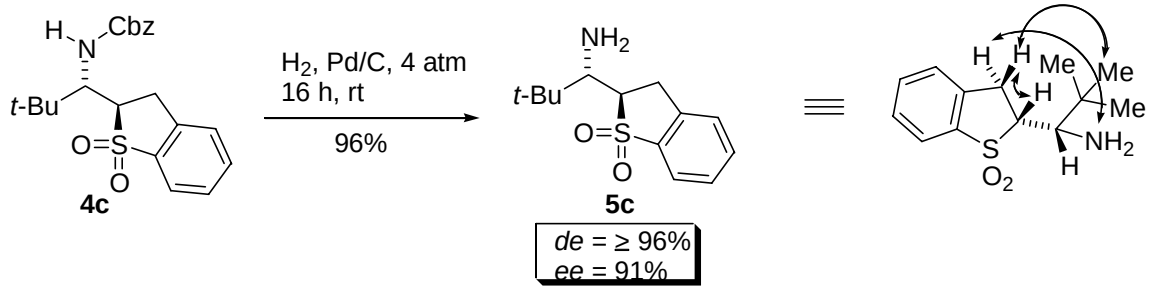
4	R	Time (h)	Yield (%)	*de*[a] (%)	*ee*[b] (%)	Confg.
a	Et	5	66	≥ 96	93	*S*,*R*
b	*i*-Pr	10	58	≥ 96	99	*S*,*R*
c	*t*-Bu	10	60	≥ 96	91	*S*,*R*
d	*n*-Bu	5	70	≥ 96	93	*S*,*R*
e	$PhCH_2CH_2$	5	70	≥ 96	95	*S*,*R*
f	Ph	5	80	≥ 96	88	*S*,*R*

a) Determined by ^1H and ^{13}C NMR spectroscopy.

b) Based on the *ee*-values of **2** or **3**.

the *syn* diastereomer as a single product (no second carbamate *E*/*Z*-isomer could be detected).The diastereomers were produced in a disappointing ratio of approximately 1.3:1. To overcome the problem, a screening of different hydride reagents and solvents was commenced. Best results were achieved when the reductions were performed with L-selectride® in THF at low temperature. The desired products (**4a-f**)

were obtained in good yields and outstanding stereocontrol (*de* ≥ 96%) (Table 4). Finally, the absolute configuration of the newly formed stereogenic centre after the double bond reduction was assigned as *R* by a NOE experiment performed on the deprotected ß-aminosulfone (**5c**). Selected NOE interactions are depicted in Scheme 2.



Scheme 2

CONCLUSION

In summary, we have developed a very efficient asymmetric synthesis of α–(1,1-dioxo-2,3-dihydro-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-substituted amines using as key step a nucleophilic 1,2-addition of 2-lithio-benzo[*b*]thiophene to aldehyde-SAMP-hydrazones. The title compounds were obtained in good overall yields and excellent diastereo- and enantiomeric excesses. The pharmacological properties of these interesting heterocyclic ß-aminosulfones are currently under evaluation.

EXPERIMENTAL

General procedure (GP1) for the synthesis of (1*S*)-(1-benzo[*b*]thiophen-2-yl-substituted)-carbamic acid benzyl esters (**2a-h**):

To a solution of 2-benzothienyllithium (6.4 mmol) in Et_2O (20 mL) cooled to –78°C was added dropwise the aldehyde hydrazone (**1a-h)** (2 mmol) in dry Et_2O (2 mL). After 30 min the cooling bath was removed, the reaction mixture allowed to warm to rt and stirred for additional 2-9 h. The mixture was quenched with saturated aqueous NH_4Cl and extracted three times with Et_2O. The organic layer was then washed twice with brine, dried over $MgSO_4$ and evaporated *in vacuo*. The crude hydrazine was dissolved in dry THF (10 mL pro mmol of hydrazine) and heated up to reflux with 10 or 20 equivalents of BH_3·THF (1.0 M in THF) for 9-36 h. The reaction was cooled to rt, acidified with aqueous HCl (1N) and stirred for 1 h. The THF was evaporated under reduced pressure and the aqueous solution was made basic with a saturated solution of K_2CO_3 and extracted with methylene chloride. The organic layers were concentrated in *vacuo* and the residue was dissolved in a mixture of H_2O and THF (1:1). 2 Equivalents of potassium

carbonate were added, followed by 1.8 equivalents of benzyl chloroformate and the heterogeneous solution was stirred at rt overnight. Et_2O (10 mL) was added to the mixture, the layers were separated and the aqueous layer was washed with two further portions (10 mL) of Et_2O. The combined organic layers were dried ($MgSO_4$) and evaporated. The crude product was purified by column chromatography.

General procedure (GP2) for the synthesis of (*S*)-[1-(1,1-Dioxo-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-substituted]-carbamic acid benzyl esters (**3a-g**):
To a 2 neck flask, equipped with an efficient stirrer and a condenser, charged with H_2O (20 mL pro mmol), acetone (16 mL pro mmol) and $NaHCO_3$ (1.2 g pro mmol) was added a solution of the protected benzothiophene amine (**2a-g**) in CH_2Cl_2 (18 mL pro mmol). To the resulting heterogeneous mixture oxone was carefully added over 5 min (2g pro mmol). The reaction mixture was stirred at rt for 2-7 h before water was added to dissolve most of the inorganic salts. The decanted aqueous layer, and all remaning solids were extracted with CH_2Cl_2, the combined organic phases washed with water and dried over $MgSO_4$. The solvent was removed *in vacuo* and the crude product purified by column chromatography or directly used in the next step without any purification.

General procedure (GP3) for the reduction of **3a,c-f** with sodium borohydride/$NiCl_2$ (cat.):

The ß-aminosulfone (**3a,c-f**) was dissolved in MeOH (10 mL pro mmol) in the presence of a catalytic amount of $NiCl_2$ (20 mol%) and the resulting solution was cooled to –20°C. 4 Equivalents of $NaBH_4$ were carefully added to the mixture under vigorous stirring. After 2-7 h the solvent was removed under reduced pressure and the residue was dissolved in a solution of CH_2Cl_2 and water (10 mL, ratio 1:1,). The layers were separated and the aqueous phase extracted three times with CH_2Cl_2 (5 mL). The combined organic extracts were washed with brine and dried over $MgSO_4$. The solvent was removed *in vacuo* and the crude product purified by flash chromatography.

General procedure (GP 4) for the reduction of **3a-f** with L-Selectride®:
To a solution of the ß-aminosulfone (**3a-f**) in THF (10 mL pro mmol) were added dropwise 2 equivalents of L-selectride at –78°C. The solution was slowly allowed to warm to –20°C and after 2-9 h was quenched by addition of AcOH. The solvent was removed under reduced pressure and the residue was diluted with CH_2Cl_2. The organic layer was washed with brine and dried over $MgSO_4$. The solvent was removed *in vacuo* and the crude product purified on silica gel chromatography.

(1*S*)-(1-Benzo[*b*]thiophen-2-ylpropyl)carbamic acid benzyl ester (**2a**): To a solution of 2-lithio-benzo[*b*]thiophene (6.4 mmol) in 20 mL of Et_2O was added hydrazone (**1a**) (340 mg, 2.0 mmol) in 4 mL

of Et_2O according to GP1. Purification by column chromatography (Et_2O:pentane 1:3) afforded 495 mg, (76%) of **2a** as a colorless solid; mp = 86-87°C (Et_2O:pentane 1:10). *ee* = 93% determined by HPLC over chiral stationary phase (Daicel OD). $[\alpha]_D^{22} = -46.80$ (c = 0.25 $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ = 0.89 (t, 3H, *J* = 7.4 Hz, C*H*$_3$), 1.82-1.87 (m, 2H, CH_3CH_2), 4.92-5.08 (m, 4H, C*H*NH, N*H,* CH_2O), 7.08-7.25 (m, 8H, arom C*H*), 7.58-7.66 (m, 1H, arom C*H*), 7.67-7.69 (m, 1H, arom C*H*) ppm. ^{13}C NMR (75 MHz, $CDCl_3$) δ = 10.83 (*C*H$_3$), 30.01 (CH_3CH_2), 53.43 (*C*HN), 67.26 (*C*H$_2$O), 121.29, 122.65, 123.74, 124.44, 124.61, 128.47, 128.82 (arom *C*H), 136.60, 139.39, 139.86, 147.20 (arom *C*), 156.04 (*C*=O) ppm; IR (KBr) $\tilde{\upsilon}$ = 3289 (s), 1715 (m), 1690 (vs), 1541 (s), 1271 (s), 1235 (s), 1040 (m), 974 (m), 746 (s), 696 (m) cm^{-1}; MS (EI, 70 eV): *m/z* (%) = 326 (7) [$M^{+\bullet}$+1], 325 [$M^{+\bullet}$], 252 (11), 235 (8), 234 (53), 191 (5), 190 (37), 147 (6), 135 (13), 92 (7), 91 (100), 65 (5), 56 (10). *Anal.* Calcd for $C_{19}H_{19}NO_2S$: C, 70.12; H, 5.88; N, 4.30. Found: C, 70.00, H, 5.71; N, 4.22.

(1*S*)-(1-Benzo[*b*]thiophen-2-yl-2-methylpropyl)carbamic acid benzyl ester (**2b**) To a solution of 2-lithio-benzo[*b*]thiophene (6.4 mmol) in 20 mL of Et_2O was added hydrazone (**1b**) (370 mg, 2.0 mmol) in 4 mL of Et_2O according to GP1. Purification by column chromatography (Et_2O:pentane 1:3) afforded 520 mg of **2b** (77%) as a colorless solid; mp = 77-78°C (Et_2O:pentane 1:10). *ee* = 99% determined by HPLC over chiral stationary phase (Daicel OD). $[\alpha]_D^{22} = -43.7$ (c = 1.4, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ = 0.98 (t, 6H, *J* = 6.5 Hz, C*H*$_3$CH), 2.05-2.16 (m, 1H, CH_3CH), 4.86-4.91 (m, 1H, C*H*N), 5.05-5.16 (m, 3H, N*H*, CH_2O), 7.14 (s, 1H, arom C*H*), 7.24-7.34 (m, 7H, arom C*H*), 7.68 (d, 1H, *J* = 7.4 Hz, arom C*H*), 7.76 (d, 1H, *J* = 7.4 Hz, arom C*H*) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 18.17, 19.75 (*C*H$_3$), 34.00 (CH_3CH), 57.56 (*C*HN), 67.03 (*C*H$_2$O), 121.26, 122.28, 123.38, 124.05, 124.29, 128.17, 128.53 (arom *C*H), 136.29, 139.11, 139.54, 146.43 (arom *C*), 155.94 (*C*=O) ppm; IR (KBr) $\tilde{\upsilon}$ = 3429 (m), 3327 (s), 1685 (vs), 1537 (s), 1271 (s), 1243 (m) cm^{-1}; MS (EI, 70 eV,) *m/z* (%) = 339 (6) [$M^{+\bullet}$], 296 (16), 252 (25), 248 (5), 231 (32), 190 (8), 189 (22), 188 (82), 162 (5), 161 (12), 160 (17), 149 (10), 147 (12), 135 (7), 134 (6), 133 (18), 111 (8), 109 (7), 105 (5), 99 (6), 97 (10), 95 (8), 92 (9), 91 (100), 89 (24), 85 (11), 83 (10), 82 (5), 81 (7), 79 (27), 77 (17), 71 (14), 70 (5), 69 (15), 65 (7), 63 (5), 60 (5), 57 (28), 56 (6), 55 (12), 51 (10), 45 (8). *Anal.* Calcd for $C_{20}H_{21}NO_2S$: C, 70.77; H, 6.24; N, 4.13. Found: C, 70.90, H, 6.38; N, 3.98.

(1*S*)-(1-Benzo[*b*]thiophen-2-yl-2,2-dimethylpropyl)carbamic acid benzyl ester (**2c**): To a solution of 2-lithio-benzo[*b*]thiophene (6.4 mmol) in 20 mL of Et_2O was added hydrazone (**1c**) (396 mg, 2.0 mmol) in 4 mL of Et_2O according to GP1. Purification by column chromatography (Et_2O:pentane 1:3) afforded 425 mg of **2c** (60%) as a colorless solid; mp = 73-74°C (Et_2O:pentane 1:10). *ee* = 91% determined by

HPLC over chiral stationary phase (Daicel OD). $[\alpha]_D^{22} = -12.2$ (c = 1.2, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ = 1.04 (s, 9H, $(CH_3)_3C$), 4.90 (d, 1H, *J* = 9.3 Hz, C*H*NH), 5.03 (d, 1H, J_{AB} = 12.1 Hz CH*H*O), 5.10 (d, 1H, J_{AB} = 12.1 Hz C*H*HO), 5.26 (d, 1H, *J* = 9.3 Hz, N*H*), 7.15 (s, 1H, arom C*H*), 7.23-7.35 (m, 7H, arom C*H*), 7.68-7.71 (m, 1H, arom C*H*), 7.74-7.79 (m, 1H, arom C*H*) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 26.78 (CH_3), 35.10 (CH_3C), 60.93 (*C*HN), 67.06 (CH_2O), 122.08, 122.87, 123.34, 124.07, 124.25, 128.25, 128.54 (arom *C*H), 136.26, 139.10, 139.24, 144.41 (arom *C*), 155.93 (*C*=O) ppm; IR (solution in $CDCl_3$) ῡ = 3277 (m), 2957 (m), 1706 (vs), 1402 (m), 1342 (s), 1053 (m), 741 (m), 696 (m) cm^{-1}; MS (EI, 70 eV,) *m/z* (%) = 353 (3) [$M^{+\bullet}$], 297 (5), 296 (28), 252 (27), 160 (5), 129 (10), 92 (7), 91 (100), 57 (7); *Anal.* Calcd for $C_{21}H_{23}NO_2S$: C, 71.36; H, 6.56; N, 3.96. Found: C, 70.96, H, 6.44; N, 4.07.

(1*S*)-(1-Benzo[*b*]thiophen-2-ylpentyl)carbamic acid benzyl ester (**2d**): To a solution of 2-lithio-benzo[*b*]thiophene (6.4 mmol) in 20 mL of Et_2O was added hydrazone (**1d**) (396 mg, 2.0 mmol) in 4 mL of Et_2O according to GP1. Purification by column chromatography (Et_2O:pentane 1:3) afforded 440 mg of **2d** (62%) as a colorless solid; mp 89-90°C (Et_2O:pentane 1:10). *ee* = 93% determined by HPLC over chiral stationary phase (Daicel OD). $[\alpha]_D^{22} = -52.0$ (c = 1.0, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 0.76 (t, 3H, *J* = 6.8 Hz, CH_3CH_2), 1.22-1.30 (m, 4H, $CH_3CH_2CH_2$), 1.67-1.74 (m, 2H, CH_2CH), 4.93-5.08 (m, 3H, C*H*N, CH_2O), 5.20 (d, 1H, *J* = 8.2 Hz, N*H*), 7.03 (s, 1H, arom C*H*), 7.12-7.20 (m, 7H, arom C*H*), 7.54 (d, 1H, J = 7.7 Hz, arom C*H*), 7.62 (d, 1H, *J* = 9.0 Hz, arom C*H*) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 14.25 (CH_3), 22.65 (CH_3CH_2), 28.44 ($CH_3CH_2CH_2$), 36.64 (CH_2CH), 51.99 (*C*HN), 67.20 (CH_2O), 121.18, 122.65, 123.75, 124.40, 124.59, 128.42, 128.80 (arom *C*H), 136.69, 139.40, 139.89, 147.68 (arom *C*), 156.06 (*C*=O) ppm; IR (KBr) ῡ = 3310 (s), 2953 (m), 2925 (m), 2855 (m), 1684 (vs), 1537 (s), 1456 (m), 1294 (m), 1256 (s), 1046 (m), 749 (s), 725 (m), 696 (m), 663 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 353 (16) [$M^{+\bullet}$], 263 (6), 262 (41), 252 (11), 245 (10), 218 (30), 189 (6), 188 (46), 160 (7), 147 (12), 135 (9), 108 (6), 92 (8), 91 (100), 89 (7), 84 (5), 79 (5), 77 (5), 65 (6). *Anal.* Calcd for $C_{21}H_{23}N_2O_2S$: C, 71.36; H, 6.56; N, 3.96. Found: C, 71.02, H, 6.26; N, 3.80.

(1*S*)-(1-Benzo[*b*]thiophen-2-yl-3-phenylpropyl)carbamic acid benzyl ester (**2e**): To a solution of 2-lithio-benzo[*b*]thiophene (6.4 mmol) in 20 mL of Et_2O was added hydrazone (**1e**) (492 mg, 2.0 mmol) in 4 mL of Et_2O according to GP1. Purification by column chromatography (Et_2O:pentane 2:5) afforded 580 mg of **2e** (72%) as a colorless solid; mp = 113-114°C (Et_2O:pentane 1:10). *ee* = 95% determined by HPLC over chiral stationary phase (Daicel OD). $[\alpha]_D^{22} = -29.0$ (c = 0.9, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ = 2.09-2.17 (m, 2H, CH_2CH_2), 2.54-2.67 (m, 2H, $PhCH_2$), 4.97-5.08 (m, 4H, N*H*, C*H*NH, CH_2O), 6.99-7.26 (m, 13H, arom C*H*), 7.60 (d, 1H, *J* = 7.2 Hz, arom C*H*), 7.69 (d, 1H, *J* = 7.2 Hz, arom

C*H*) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 32.39 (Ph*C*H_2), 38.40 (CH_2*C*H_2), 51.51 (*C*HN), 67.10 (*C*H_2O), 121.33, 122.48, 123.60, 124.35, 124.48, 126.23, 128.26, 128.47, 128.60 (arom *C*H), 136.34, 139.20, 139.60, 140.93, 146.71 (arom *C*), 155.69 (*C*=O) ppm; IR ($CHCl_3$) ῡ = 3313 (s), 1686 (vs), 1533 (s), 1454 (m), 1260 (s), 744 (s), 698 (m); MS (EI, 70 eV) *m/z* (%) = 401 (5) [$M^{+\bullet}$], 309 (30), 265 (16), 251 (10), 250 (5), 248 (25), 187 (6), 159 (6), 134 (7), 92 (7), 90 (100), 65 (6). *Anal.* Calcd for $C_{25}H_{23}NO_2S$: C, 74.78; H, 5.77; N, 3.49. Found: C, 75.05, H, 6.10; N, 3.29.

(1*S*)-(1-Benzo[*b*]thiophen-2-ylphenylmethyl)carbamic acid benzyl ester (**2f**): To a solution of 2-lithio-benzo[*b*]thiophene (6.4 mmol) in 20 mL of Et_2O was added hydrazone (**1f**) (436 mg, 2.0 mmol) in 4 mL of Et_2O according to GP1. Purification by column chromatography (Et_2O:pentane 1:2) afforded 345 mg of **2f** (46%) as a colorless solid; mp = 101-103°C (Et_2O:pentane 1:8). *ee* = 77% (88% after single recrystallization) determined on the corresponding sulfone **3f** by HPLC over chiral stationary phase (Chiralpak AD 2). $[\alpha]_D^{22}$ = –7.27 (c = 1.1, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ = 5.13 (s, 2H, CH_2O), 5.58-5.61 (br, 1H, N*H*), 6.23-6.26 (br 1H, C*H*N), 7.03 (s, 1H, arom C*H*), 7.21-7.37 (m, 12H, arom C*H*), 7.61-7.67 (m, 1H, arom C*H*), 7.72-7.75 (m, 1H, arom C*H*) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 55.64 (*C*HN), 67.22 (*C*H_2O), 122.25, 122.30, 123.59, 124.34, 124.40, 127.08, 128.17, 128.53, 128.82 (arom *C*H), 136.13, 139.39 139.74, 140.57, 146.42 (arom *C*), 155.38 (*C*=O) ppm; IR ($CHCl_3$) ῡ = 3318 (s), 1688 (vs), 1527 (s), 1240 (s), 1041 (m), 744 (m), 700 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 374 (6) [$M^{+\bullet}$+1], 373 (24) [$M^{+\bullet}$], 283 (17), 282 (100), 239 (11), 238 (61), 223 (9), 221 (10), 160 (6), 135 (11), 104 (42), 91 (43), 77 (8), 65 (6). *Anal.* Calcd for $C_{23}H_{19}NO_2S$: C, 73.97; H, 5.13; N, 3.75. Found: C, 73.72, H, 5.27; N, 3.71.

(1*S*)-[1-Benzo[*b*]thiophen-2-yl-(4-methoxyphenyl)methyl]carbamic acid benzyl ester (**2g**): To a solution of 2-lithio-benzo[*b*]thiophene (6.4 mmol) in 20 mL of Et_2O was added hydrazone (**1g**) (496 mg, 2.0 mmol) in 4 mL of Et_2O according to GP1. Purification by column chromatography (Et_2O:pentane 1:2) afforded 375 mg of **2g** (38%) as a colorless solid; mp = 142-143°C (Et_2O:pentane 1:5). *ee* = 66% determined on the corresponding sulfone (**3g**) by HPLC over chiral stationary phase (Chiralpak AD 2): $[\alpha]_D^{22}$ = +5.5 (c = 1.1, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ = 3.77 (s, 3H, OCH_3), 5.13 (d, 2H, *J* = 1.0 Hz, CH_2O), 5.58-5.62 (br, 1H, N*H*), 6.17-6.20 (br 1H, C*H*N), 6.83-6.88 (m, 2H, arom C*H*), 7.02 (s, 1H, arom C*H*), 7.21-7.32 (m, 9H, arom C*H*), 7.61-7.64 (m, 1H, arom C*H*), 7.70-7.73 (m, 1H, arom C*H*). ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 55.22 (*C*HN), 55.37 (OCH_3), 67.25 (*C*H_2O), 114.22, 122.11, 122.40, 123.63, 124.36, 124.45, 128.28, 128.45, 128.61 (arom *C*H), 132.90, 136.27, 139.54 139.84, 147.02 (arom *C*), 155.48 (*C*=O), 159.48 (arom *C*) ppm; IR ($CHCl_3$) ῡ = 3317 (s), 1689 (vs), 1514 (s), 1457 (s), 1294 (m), 1245 (vs), 1044 (m), 1028 (m), 833 (m), 741 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 404 (8) [$M^{+\bullet}$+1],

403 (21) [$M^{+\bullet}$], 313 (19), 312 (100), 269 (11), 268 (68), 253 (13), 160 (18), 135 (7), 134 (39), 109 (6), 91 (47), 65 (5). *Anal.* Calcd for $C_{24}H_{21}NO_3S$: C, 71.44; H, 5.25; N, 3.47. Found: C, 71.76, H, 5.16; N, 3.51.

(1*S*)-(1-Benzo[*b*]thiophen-2-ylferrocenylmethyl)carbamic acid benzyl ester (**2h**): To a solution of 2-lithio-benzo[*b*]thiophene (3.2 mmol) in 10 mL of Et_2O was added hydrazone (**1h**) (326 mg, 1.0 mmol) in 2 mL of Et_2O according to GP1. Purification by column chromatography (Et_2O:pentane 1:3) afforded 220 mg of **2h** (46%) as an orange solid; mp = 128-129°C (Et_2O:pentane 1:8). *ee* ≥ 95% determined on the corresponding hydrazine by ^1H and ^{13}C NMR spectroscopy. $[\alpha]_D^{22} = -9.1$ (c = 1.1, $CHCl_3$). ^1H NMR (300 MHz, $CDCl_3$) δ = 4.07-4.15 (m, 9H, C*H* Fc), 5.03 (d, 1H, J_{AB} = 12.2 Hz, CH*H*O), 5.12 (d, 1H, J_{AB} = 12.2 Hz, CH*H*O), 5.51-5.53 (br, 1H, N*H*), 5-89-5.91 (br 1H, C*H*N), 7.05-7.28 (m, 8H, arom C*H*), 7.56-7.59 (m, 1H, arom C*H*), 7.66-7.69 (m, 1H, arom C*H*) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 50.91 (*C*HN), 66.78 (*C*H, Fc), 67.25 (*C*H_2O), 67.44, 68.23, 69.11 (*C*H, Fc), 89.68 (*C*, Fc), 121.75, 122.42, 123.65, 124.28, 124.36, 128.34, 128.66 (arom *C*H), 136.38, 139.39 139.49, 146.87 (arom *C*), 155.39 (*C*=O) ppm; IR ($CHCl_3$) $\tilde{\upsilon}$ = 3428 (s), 1696 (vs), 1509 (vs), 1307 (m), 1284 (m), 1233 (s) 1044 (m), 1024 (m), 823 (m), 751 (s), 700 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 483 (10) [$M^{+\bullet}$+2], 482 (33) [$M^{+\bullet}$+1], 481 (100) [$M^{+\bullet}$], 479 (7), 346 (20), 280 (10), 267 (7), 226 (8), 212 (13), 210 (6), 209 (8), 121 (7), 91 (13). *Anal.* Calcd for $C_{27}H_{23}NO_2FeS$: C, 67.35; H, 4.81; N, 2.91. Found: C, 67.44, H, 5.18; N, 2.73.

(*S*)-[1-(1,1-Dioxo-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)propyl]carbamic acid benzyl ester (**3a**): To a well stirred solution of carbamate (**2a**) (325 mg, 1.0 mmol) in 54 mL of a H_2O/CH_2Cl_2/acetone (1:0.9:0.8) mixture, were added 1.2 g of $NaHCO_3$ followed by 2 g of oxone according to GP2. After work-up, removal of the solvent in vacuo afforded 350 mg of **3a** (98%) as a colorless solid; mp = 68-69°C (Et_2O:pentane 1:5). *ee* = 93%. $[\alpha]_D^{22} = -72.8$ (c = 1.7, $CHCl_3$). ^1H NMR (300 MHz, $CDCl_3$) δ = 1.00 (t, 3H, *J* = 7.4 Hz, CH_3), 1.85-1.94 (m, 1H, CH_3C*H*H), 2.02-213 (m, 1H, CH_3CH*H*), 4.72-4.78 (m, 1H, C*H*NH,), 5.07 (d, 1H, J_{AB} = 12.4 Hz, CH*H*O), 5.13 (d, 1H, J_{AB} = 12.4 Hz, C*H*HO), 5.62 (d, *J* =8.5 Hz, N*H*), 6.96 (s, 1H, C*H*CSO_2), 7.23-7.34 (m, 6H, arom C*H*), 7.38-7.49 (m, 2H, arom C*H*), 7.60 (d, *J* = 7.4 Hz, 1H, arom C*H*) ppm.; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 10.38 (*C*H_3), 26.22 (CH_3*C*H_2), 50.87 (*C*HN), 66.85 (*C*H_2O), 120.91, 124.84, 127.69 127.78, 127.89, 128.26, 129.80 (arom *C*H, *C*HCSO_2), 130.26 (*C*SO_2), 133.41 (arom CH), 136.02, 137.03, 143.32 (arom *C*), 155.50 (*C*=O) ppm. IR (KBr) $\tilde{\upsilon}$ = 3348 (m), 2970 (m), 1710 (vs), 1524 (vs), 1456 (s), 1299 (vs), 1235 (s), 1149 (vs), 1125 (m), 756 (vs), 700 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 357 [$M^{+\bullet}$], 284 (9), 222 (7), 192 (5), 181 (5), 148 (7), 137 (5), 108 (5), 92 (7), 91 (100), 65 (6). *Anal.* Calcd for $C_{19}H_{19}NO_4S$: C, 63.85; H, 5.36; N, 3.92. Found: C, 63.50, H, 5.61; N, 3.67.

(*S*)-[1-(1,1-Dioxo-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-2-methylpropyl]carbamic acid benzyl ester (**3b**): to a well stirred solution of carbamate (**2b**) (340 mg, 1.0 mmol) in 54 mL of a H_2O/CH_2Cl_2/acetone (1:0.9:0.8) mixture, were added 1.2 g of $NaHCO_3$ followed by 2 g of oxone according to GP2. After work-up, removal of the solvent in vacuo afforded 365 mg of **3b** (98%) as a colorless foam; *ee* = 99%. $[\alpha]_D^{22} = -74.3$ (c = 1.6, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 0.99 (d, 3H, *J* = 6.6 Hz, C*H*$_3$CH), 1.02 (d, 3H, *J* = 6.3 Hz, C*H*$_3$CH), 2.35-2.43 (m, 1H, CH$_3$C*H*), 4.66 (t, 1H, *J* = 8.9 Hz, C*H*NH,), 5.07 (d, 1H, J_{AB} = 12.3 Hz, CH*H*O), 5.15 (d, 1H, J_{AB} = 12.2Hz, C*H*HO), 5.69 (d, *J* = 8.9 Hz, N*H*), 6.96 (s, 1H, C*H*CSO$_2$), 7.21-7.31 (m, 6H, arom C*H*), 7.41 (dt, *J* = 7.4, 28.3 Hz, 2H, arom C*H*), 7.58 (d, 1H, *J* = 7.2 Hz, arom C*H*) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 18.02, 19.88 (*C*H$_3$), 30.48 (CH$_3$*C*H), 55.62 (*C*HN), 66.83 (*C*H$_2$O), 120.86, 124.78, 127.71 127.85, 128.05, 128.24, 129.75 (arom *C*H, *C*HCSO$_2$), 130.25 (*C*SO$_2$), 133.41 (arom *C*H), 136.05, 136.98, 143.18 (arom *C*), 155.74 (*C*=O) ppm. IR (KBr) ῡ = 3351 (s), 3063 (m), 3030 (m), 2966 (s), 2934 (m), 1711 (vs), 1523 (vs), 1458 (s), 1300 (vs), 1237 (vs), 1149 (vs), 1125 (m), 1099 (m), 1021 (m), 756 (vs), 700 (m), 545 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 371 (1) [M$^{+\bullet}$], 328 (15), 284 (22), 238 (6), 194 (7), 92 (7), 91 (100), 65 (6). *Anal.* Calcd for $C_{20}H_{21}NO_4S$: C, 64.67; H, 5.70; N, 3.77. Found: C, 64.58, H, 6.09; N, 3.51.

(*S*)-[1-(1,1-Dioxo-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-2,2-dimethylpropyl]carbamic acid benzyl ester (**3c**): To a well stirred solution of carbamate (**2c**) (353 mg, 1.0 mmol) in 54 mL of a H_2O/CH_2Cl_2/acetone (1:0.9:0.8) mixture, were added 1.2 g of $NaHCO_3$ followed by 2 g of oxone according to GP2. After work-up, removal of the solvent in vacuo afforded 375 mg of **3c** (97%) as a colorless solid; mp = 75°C (Et_2O:pentane 1:5). *ee* = 91%. $[\alpha]_D^{22} = -54.3$ (c = 1.3 $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 1.10 (s, 9H, (C*H*$_3$)$_3$C), 4.72 (d, 1H, *J* = 9.9 Hz, C*H*NH,), 5.04 (d, 1H, J_{AB} = 12.1 Hz, CH*H*O), 5.13 (d, 1H, J_{AB} = 12.1 Hz, C*H*HO), 5.64 (d, 1H, *J* = 9.6 Hz, N*H*), 7.03 (s, 1H, C*H*CSO$_2$), 7.25-7.33 (m, 6H, arom. C*H*), 7.39-7.49 (m, 2H, arom C*H*), 7.61 (d, 1H, *J* = 7.5 Hz, arom C*H*) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 26.84 (*C*H$_3$), 35.31 (CH$_3$*C*), 59.23 (*C*HN), 66.97 (*C*H$_2$O), 120.98, 124.78, 127.79 127.85, 128.24, 129.96 (arom *C*H, C*H*CSO$_2$), 130.15 (*C*SO$_2$), 133.37 (arom CH), 136.00, 136.64, 142.98 (arom *C*), 155.67 (*C*=O) ppm. IR (KBr) ῡ = 3350 (s), 2964 (s), 1702 (vs), 1527 (vs), 1455 (s), 1300 (vs), 1235 (vs), 1149 (vs), 1126 (s), 1067 (m), 1009 (m), 756 (s), 548 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 385 (1) [M$^{+\bullet}$], 284 (6), 268 (10), 239 (11), 238 (88), 195 (6), 194 (56), 137 (5), 92 (5), 91 (100), 65 (7), 57 (12). *Anal.* Calcd for $C_{21}H_{23}NO_4S$: C, 65.43; H, 6.01; N, 3.63. Found: C, 65.42, H, 6.24; N, 3.55.

(*S*)-[1-(1,1-Dioxo-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)pentyl]carbamic acid benzyl ester (**3d**): To a well stirred solution of carbamate (**2d**) (353 mg, 1.0 mmol) in 54 mL of a H_2O/CH_2Cl_2/acetone (1:0.9:0.8)

mixture, were added 1.2 g of $NaHCO_3$ followed by 2 g of oxone according to GP2. After work-up, removal of the solvent in vacuo afforded 377 mg of **3d** (98%) as a colorless foam. *ee* = 93%. $[\alpha]_D^{22} = -52.7$ (c = 1.4, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 0.90 (t, 3H, *J* = 7.2 Hz, C*H*$_3$), 1.34-1.47 (m, 4H, $CH_3CH_2CH_2$), 1.85-1.96 (m, 1H, C*H*HCHN), 2.01-2.09 (m, 1H, CH*H*CHN), 4.79-4.85 (m, 1H, C*H*NH,), 5.07 (d, 1H, J_{AB} = 12.1 Hz, CH*H*O), 5.14 (d, 1H, J_{AB} = 12.1 Hz, C*H*HO), 5.45 (d, 1H, *J* =8.5 Hz, N*H*), 6.97 (s, 1H, C*H*CSO_2), 7.26-7.33 (m, 6H, arom. C*H*), 7.42-7.52 (m, 2H, arom C*H*), 7.64 (d, 1H, *J* = 7.4 Hz, arom C*H*) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 14.08 (CH_3), 22.34 (CH_3CH_2), 28.20 ($CH_3CH_2CH_2$), 32.82 (CH_2CHN), 49.90 (*C*HN), 67.13 (CH_2O), 121.22, 125.05, 127.85 128.06, 128.14, 128.50, 130.07 (arom *C*H, *C*HCSO_2), 130.56 (CSO_2), 133.63 (arom CH), 136.24, 137.38, 143.73 (arom *C*), 155.63 (*C*=O) ppm. IR (KBr) ῡ = 3418 (vs), 2956 (s), 2930 (s), 2856 (s), 1705 (s), 1527 (s), 1456 (m), 1384 (m), 1301 (s), 1258 (s), 1149 (s), 1123 (s), 1037 (m), 755 (s), 699 (m) cm^{-1}; MS (CI, 100 eV, methane) *m/z* (%) = 386 (6) [$M^{+\bullet}$+1], 342 (6), 238 (5), 237 (35), 236 (6), 235 (35), 217 (6), 119 (6), 108 (7), 107 (14), 93 (6), 92 (10), 91 (100), 79 (23). *Anal.* Calcd for $C_{21}H_{23}NO_4S$: C, 65.43; H, 6.01; N, 3.63. Found: C, 65.37, H, 6.10; N, 3.60.

(*S*)-[1-(1,1-Dioxo-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-2-phenylpropyl]carbamic acid benzyl ester (**3e**): To a well stirred solution of carbamate (**2e**) (401 mg, 1.0 mmol) in 54 mL of a H_2O/CH_2Cl_2/acetone (1:0.9:0.8) mixture, were added 1.2 g of $NaHCO_3$ followed by 2 g of oxone according to GP2. After work-up, removal of the solvent in vacuo afforded 425 mg of **3e** (98%) as a colorless solid; mp = 43-44°C (Et_2O:pentane 1:5). *ee* = 95%. $[\alpha]_D^{22} = -50.2$ (c = 1.2, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ = 2.19 (m, 2H, C*H*$_2$CH), 2.73 (t, 2H, *J* = 7.4 Hz, PhC*H*$_2$), 4.82-4.85 (m, 1H, C*H*NH,), 5.05 (d, 1H, J_{AB} = 12.3 Hz, CH*H*O), 5.13 (d, 1H, J_{AB} = 12.3 Hz, C*H*HO), 5.66 (d, *J* = 8.4 Hz, N*H*), 6.93 (s, 1H, C*H*CSO_2), 7.17-7.48 (m, 13H, arom C*H*), 7.60 (d, 1H, *J* = 7.4 Hz, arom C*H*) ppm.; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 31.03 (PhCH_2), 34.62 (CH_2CHN), 49.74 (*C*HN), 67.15 (CH_2O), 121.28, 125.25, 126.30 128.15, 128.26, 128.47, 128.59, 128.65, 130.25 (arom *C*H, *C*HCSO_2), 130.56 (CSO_2), 133.79 (arom CH), 136.32, 137.37, 140.58, 143.26 (arom *C*), 155.79 (*C*=O) ppm. IR (KBr) ῡ = 3335 (m), 3062 (m), 3027 (s), 2951 (m), 1711 (vs), 1522 (vs), 1454 (s), 1300 (vs), 1240 (vs), 1149 (vs), 1047 (s), 756 (vs), 701 (s) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 386 (6) [$M^{+\bullet}$+1], 342 (6), 238 (5), 237 (35), 236 (6), 235 (35), 217 (6), 119 (6), 108 (7), 107 (14), 93 (6), 92 (10), 91 (100), 79 (23). *Anal.* Calcd for $C_{25}H_{23}NO_4S$: C, 69.26; H, 5.35; N, 3.23. Found: C, 69.29, H, 5.53; N, 3.09.

(*S*)-[1-(1,1-Dioxo-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)phenylmethyl]carbamic acid benzyl ester (**3f**): To a well stirred solution of carbamate (**2f**) (375 mg, 1.0 mmol) in 54 mL of a H_2O/CH_2Cl_2/acetone (1:0.9:0.8)

mixture, were added 1.2 g of $NaHCO_3$ followed by 2 g of oxone according to GP2. After work-up, purification by column flash chromatography (Et_2O:pentane = 3:1) afforded 390 mg of **3f** (96%) as a colorless solid; mp = 63-65°C (Et_2O:pentane 1:5). *ee* = 88%. $[\alpha]_D^{22} = -22.0$ (c = 1.5, $CHCl_3$). ^1H NMR (300 MHz, $CDCl_3$) δ = 5.09 (s, 1H, C*H*$_2$O), 5.99-6.03 (br, 2H, C*H*N, N*H*), 6.64 (s, 1H, C*H*CSO_2), 7.10-7.49 (m, 13H, arom C*H*), 7.60-7.63 (m, 1H, arom C*H*) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 51.17 (*C*HN), 66.23 (*C*H_2O), 120.36, 124.20, 126.18 127.10, 127.44, 127.61, 128.00 (arom *C*H, *C*HCSO_2), 129.03 (*C*SO_2), 129.26 132.65 (arom *C*H), 135.03, 136.33, 136.45, 142.86 (arom *C*), 154.34 (*C*=O) ppm. IR (KBr) ῡ = 3430 (vs), 1718 (vs), 1523 (s), 1455 (m), 1303 (vs), 1243 (s), 1149 (vs), 1127 (m), 757 (m), 702 (s), 545 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 405 (1) [$M^{+\bullet}$], 271 (12), 270 (67), 256 (14), 250 (11), 240 (12), 233 (6), 210 (6), 208 (5), 207 (6), 206 (8), 205 (6), 204 (13), 196 (5), 191 (6), 189 (7), 180 (5), 179 (11), 178 (11), 165 (9), 137 (10), 108 (7), 106 (6), 104 (7), 92 (9), 91 (100), 89 (5), 79 (8), 77 (13), 65 (9), 51 (6). *Anal.* Calcd for $C_{23}H_{19}NO_4S$: C, 68.13; H, 4.72; N, 3.45. Found: C, 68.26, H, 4.92; N, 3.38.

(*S*)-[1-(1,1-Dioxo-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-(4-methoxyphenyl)methyl]carbamic acid benzyl ester (**3g**): To a well stirred solution of carbamate (**2g**) (405 mg, 1.0 mmol) in 54 mL of a H_2O/CH_2Cl_2/acetone (1:0.9:0.8) mixture, were added 1.2 g of $NaHCO_3$ followed by 2 g of oxone according to GP2. After work-up, purification by column flash chromatography (Et_2O:pentane = 3:1) afforded 385 mg of **3g** (88%) as a colorless solid; mp = 60-62°C (Et_2O:pentane 1:5). *ee* = 66%. $[\alpha]_D^{22} = -2.5$ (c = 1.0 $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$) δ = 3.79 (s, 3H, OC*H*$_3$), 5.11 (s, 2H, C*H*$_2$O), 5.80-5.84 (br, 1H, N*H*), 5.96-6.00 (br, 1H, C*H*N), 6.67 (s, 1H, C*H*CSO_2), 6.88-6.92 (m, 2H, arom C*H*), 7.18-7.36 (m, 13H, arom C*H*), 7.44 (ddt, 2H, *J* = 1.1, 7.4, 21.4, arom CH), 7.61-7.63 (m, 1H, arom C*H*) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 51.73 (*C*HN), 55.19 (O*C*H_3), 67.10 (*C*H_2O), 114.20, 121.17, 124.96 127.90, 128.25, 128.32, 128.55 (arom *C*H, *C*HCSO_2), 129.29, 129.94 (*C*SO_2, arom *C*), 129.99 133.41 (arom *C*H), 135.91, 137.27, 144.09 (arom *C*), 155.06 (*C*=O), 159.48 (arom *C*) ppm. IR (KBr) ῡ = 3349 (m), 1717 (vs), 1512 (vs), 1457 (m), 1303 (vs), 1248 (vs), 1148 (vs), 1125 (m), 835 (m), 757 (s), 700 (m), 546 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 344 (10), 327 (14), 301 (11), 236 (6), 137 (6), 135 (5), 109 (8), 108 (9), 107 (6), 91 (37), 79 (8), 77 (8). *Anal.* Calcd for $C_{24}H_{21}NO_5S$: C, 66.19; H, 4.86; N, 3.22. Found: C, 66.15, H, 5.18; N, 3.05.

(1*S*,2*R*)-[1-(1,1-Dioxo-2,3-dihydro-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)propyl]carbamic acid benzyl ester (**4a**) was prepared according to GP3 or GP4. Purification *via* column flash chromatography (AcOEt:pentane = 1:2) afforded a colorless solid; mp = 101-103°C (Et_2O:pentane 1:3). GP3 starting from 140 mg (0.39 mmol) of **3a** yielded 125 mg (89%) of **4a**; *ee* = 93%, *de* ≥ 96% (determined by ^1H and ^{13}C

NMR spectroscopy). GP4 starting from 140 mg (0.39 mmol) of **3a** yielded 93 mg (66%) of **4a**. *ee* = 93%, *de* ≥ 96% (determined by ^{1}H and ^{13}C NMR spectroscopy). $[\alpha]_D^{22}$ = –9.4 (c = 1.0, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$), (signals of carbamate *E*/*Z* isomers are reported) δ = 0.98 (t, < 3H, *J* = 7.2 Hz, C*H*$_3$), 1.06 (t, < 3H, *J* = 7.2 Hz, C*H*$_3$), 1.80-2.04 (m, 2H, CH_3CH_2), 3.24-3.37 (m, 2H, CH_2CHSO_2), 3.64 (q, < 1H, *J* = 8.2 Hz, $CHSO_2$), 3.77 (dt, < 1H, *J* = 4.2, 8.5 Hz, $CHSO_2$), 4.07-4.18 (m, 1H, C*H*N), 5.01-5.13 (m, 2H, N*H*, CH_2OC=O), 5.23 (d, 1H, *J* = 9.2 Hz, N*H*), 5.79 (d, 1H, *J* = 10.1 Hz, N*H*) 7.25-7.38 (m, 6H, arom C*H*), 7.39-7.46 (m, 1H, arom C*H*), 7.51-7.58 (m, 1H, arom C*H*), 7.65-7.71 (m, 1H, arom C*H*) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 10.39, 11.13 (CH_3), 25.38, 26.80 (CH_3CH_2), 29.82, 30.71 (CH_2CHSO_2), 52.65, 53.08 (*C*HN), 63.57, 65.01 ($CHSO_2$), 66.95, 67.08 (CH_2OC=O), 121.91, 121.63, 127.03 127.20, 127.92 128.16, 128.33, 128.54, 128.64, 128.77, 128.85, 133.60, 133.65 (arom *C*H), 136.34, 136.41, 139.00, 139.44 (arom *C*), 156.21, 156.82 (*C*=O) ppm. IR (KBr) $\tilde{\upsilon}$ = 3346 (s), 2966 (m), 1686 (vs), 1527 (vs), 1457 (m), 1290 (vs), 1243 (s), 1151 (s), 1125 (m), 1098 (m), 757 (m), 543 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 359 (7) [$M^{+\bullet}$], 108 (42), 92 (5), 91 (100), 58 (5). *Anal.* Calcd for $C_{19}H_{21}NO_4S$: C, 63.49; H, 5.89; N, 3.90. Found: C, 63.79, H, 5.51; N, 3.88.

(1*S*,2*R*)-[1-(1,1-Dioxo-2,3-dihydro-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-2-methylpropyl]carbamic acid benzyl ester (**4b**): To a well stirred solution of the ß-aminosulfone (**3b**) (185 mg, 0.5 mmol) in 5 mL of THF at – 78°C, was added dropwise 1.0 mL of L-selectride® (1M solution in THF) according to GP4. After work-up, purification by flash chromatography (Et_2O:pentane = 1:2) afforded 108 mg of **4b** (58%) as a colorless foam. *ee* = 99%, *de* ≥ 96% (determined by ^{1}H and ^{13}C NMR spectroscopy). $[\alpha]_D^{22}$ = – 39.9 (c = 1.0, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$), (signals of carbamate *E*/*Z* isomers are reported) δ = 0.96 (d, < 6H, *J* = 6.6 Hz, C*H*$_3$), 1.01 (d, < 6H, *J* = 6.6 Hz, C*H*$_3$), 2.22-2.46 (m, 1H, CH_3CH), 3.24-3.30 (m, 2H, CH_2CHSO_2), 3.59 (q, < 1H, *J* = 8.9 Hz, $CHSO_2$), 3.71-4.00 (m, < 2H, C*H*N, $CHSO_2$), 4.33 (dt, < 1H, *J* = 2.7, 10.2 Hz, C*H*N), 5.00-5.13 (m, 2H, CH_2O), 5.18 (br, 1H, N*H*), 5.85 (d, 1H, *J* = 10.2 Hz, N*H*), 7.22-7.41 (m, 7H, arom C*H*), 7.47-7.54 (m, 1H, arom C*H*), 7.63 (t, 1H, *J* = 7.9 Hz, arom C*H*) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 15.29, 19.89, 20.25, 20.57 (CH_3), 29.91 (CH_3CH), 30.16, 30.97 (CH_2CHSO_2), 31.58 (CH_3CH), 55.18, 57.27 (*C*HN), 61.39, 63.03 ($CHSO_2$), 66.95, 67.17 (CH_2O), 121.43, 121.66, 127.04, 127.88, 128.13, 128.21, 128.35, 128.54, 128.66, 133.46, 133.64 (arom *C*H), 136.18, 136.42, 136.50, 139.02, 139.64 (arom *C*), 156.54, 157.02 (*C*=O) ppm. IR (KBr) $\tilde{\upsilon}$ = 3350 (m), 3023 (m), 2965 (m), 1711 (vs), 1523 (s), 1457 (m), 1296 (s), 1242 (s), 1151 (s), 1121 (m), 757 (vs), 574 (m), 533 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 373 (15) [$M^{+\bullet}$], 330 (10), 287 (5), 286 (47), 266 (7), 108 (10), 92 (12), 91 (100), 65 (7). *Anal.* Calcd for $C_{20}H_{23}NO_4S$: C, 64.32; H, 6.21; N, 3.75. Found: C, 64.34, H, 6.11; N, 3.48.

(1*S*,2*R*)-[1-(1,1-Dioxo-2,3-dihydro-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-2,2-dimethylpropyl]carbamic acid benzyl ester (**4c**) Prepared according to GP3 or GP4. Purification *via* flash column chromatography (Et_2O:pentane = 2:1) afforded a colorless solid; mp = 56-57°C (Et_2O:pentane = 1:5). GP3 starting from 200 mg of ß-aminosulfone (**3c)** yielded 81 mg (40%) of **4c**. *ee* = 91%, *de* ≥ 96% (determined by ^{1}H and ^{13}C NMR spectroscopy). GP4 starting from 200 mg of ß-aminosulfone (**3c**) yielded 121 mg (60%) of **4c**. *ee* = 91%, *de* ≥ 96% (determined by ^{1}H and ^{13}C NMR spectroscopy). $[\alpha]_D^{22} = -8.9$ (c = 1.3, $CHCl_3$). mp = 56-57°C (Et_2O:pentane = 1:5). ^{1}H NMR (300 MHz, $CDCl_3$), (signals of carbamate *E*/*Z* isomers are reported) δ = 0.98, 1.03 (s, 9H, (CH_3)$_3$C), 3.08 (d, < 2H, *J* = 7.2 Hz, CH_2CHSO_2), 3.27 (ddd, < 2H, *J* = 7.9, 16.3, 37.1 Hz, CH_2CHSO_2)*, 3.48-3.58 (m, < 1H, $CHSO_2$) 3.61-3.67 (m, < 1H, $CHSO_2$), 4.37 (d, < 1H, *J* = 10.1 Hz, CHN), 4.42 (dd, < 1H, *J* = 3.2, 10.9 Hz, CHN), 4.94-5.13 (m, < 3H, CH_2O, NH), 6.49 (d, < 1H, *J* = 11.1 Hz, NH), 7.05 (d, < 1H, *J* = 7.1 Hz, arom CH), 7.24-7.55 (m, 9H, arom CH), 7.66 (d, < 1H, *J* = 7.4 Hz, arom CH) ppm. ^{13}C NMR (75 MHz, $CDCl_3$) δ = 26.60 (CH_3)$_3$C, 28.82, 29.54 (CH_2CHSO_2), 35.72 (CH_3C), 55.79, 55.95 (CHN), 61.56 ($CHSO_2$), 66.87, 67.10 (CH_2O), 121.13, 121.64, 126.84, 127.19, 127.86, 128.06 128.30, 128.43 128.59, 133.27 (arom CH), 136.25, 136.40, 136.78, 137.98, 138.56 (arom *C*), 155.89, 156.97 (C=O) ppm. IR (KBr) ῡ = 3347 (s), 3046 (m), 3026 (s), 2963 (vs), 2876 (m), 1706 (vs), 1534 (vs), 1472 (m), 1454 (m), 1298 (s), 1241 (s), 1152 (vs), 1122 (s), 1059 (s), 1012 (m), 756 (vs), 700 (s), 586 (s) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 387 (12) [$M^{+\bullet}$], 330 (27), 313 (8), 288 (5), 287 (11), 286 (67), 196 (10), 130 (5), 130 (5), 92 (13), 91 (100), 65 (8). *Anal.* Calcd for $C_{21}H_{25}NO_4S$: C, 65.09; H, 6.50; N, 3.61. Found: C, 64.80, H, 6.38; N, 3.50.

(1*S*,2*S*)-[1-(1,1-Dioxo-2,3-dihydro-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-2,2-dimethylpropyl]carbamic acid benzyl ester (4c): GP3 60 mg (30%). mp = 59-60°C (Et_2O:pentane = 1:5). *ee* = 91%, *de* ≥ 96% (determined by ^{1}H and ^{13}C NMR spectroscopy). $[\alpha]_D^{22} = -12.3$ (c = 1.0, $CHCl_3$). ^{1}H-NMR (400 MHz, $CDCl_3$): δ = 1.16 (s, 9H, (CH_3)$_3$C), 3.35 (d, 2H, *J* = 8.9 Hz, CH_2CHSO_2), 3.93 (dt, 1H, *J* = 2.7, 8.9 Hz, $CHSO_2$) 4.10 (dd, 1H, *J* = 2.7, 10.7 Hz, CHN), 5.05 (d, 1H, J_{AB} = 12.3 Hz, CHHO), 5.15 (d, 1H, J_{AB} = 12.3 Hz, CHHO), 6.25 (d, 1H, *J* = 10.7 Hz, NH), 7.27-7.34 (m, 9H, arom CH), 7.44 (t, 1H, *J* = 7.4 Hz, arom CH), 7.56 (dt, 1H, *J* = 1.1, 7.4 Hz, arom CH) 7.68 (d, 1H, *J* = 8.0 Hz, arom CH) ppm. ^{13}C-NMR (75 MHz, $CDCl_3$): δ = 27.24 (CH_3), 31.64 (CH_2CHSO_2), 35.89 (CH_3C), 60.39 (CHN), 60.50 ($CHSO_2$), 66.90 (CH_2O), 121.35, 126.70, 127.68, 127.87, 128.27, 128.62, 133.29 (arom CH), 136.07, 136.13, 139.01 (arom *C*), 156.97 (C=O) ppm. IR (KBr): ῡ = 3421 (vs), 2963 (vs), 1722 (vs), 1513 (vs), 14724 (s), 1456 (m), 1337 (m), 1336 (m), 1301 (m), 1253 (vs), 1149 (vs), 1120 (vs), 1061 (vs), 1019 (s), 803 (s), 753 (vs), 699 (s), 541 (s). MS (EI, 70 eV): *m/z* (%) = 387 (2) [$M^{+\bullet}$], 330 (12), 313 (6), 287 (5), 286 (33), 222 (5),

196 (5), 92 (8), 91 (100), 57 (6). *Anal.* Calcd for $C_{21}H_{25}NO_4S$: C, 65.09; H, 6.50; N, 3.61. Found: C, 64.98, H, 6.41; N, 3.48.

(1*S*,2*R*)-[1-(1,1-Dioxo-2,3-dihydro-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)pentyl]carbamic acid benzyl ester (**4d**): Prepared according to GP3 or GP4. Purification *via* column flash chromatography (Et_2O:pentane = 1:2) afforded a colorless solid; mp = 82-84°C (Et_2O:pentane = 1:5). GP3 starting from 190 mg (0.49 mmol) of ß-aminosulfone (**3d**) yielded 150 mg (79%) of **4d**. *ee* = 93%, *de* ≥ 96% (determined by ^{1}H and ^{13}C NMR spectroscopy). GP4 starting from 190 mg (0.49 mmol) of ß-aminosulfone (**3d**) yielded 134 mg (70%) of **4d**. *ee* = 93%, *de* ≥ 96% (determined by ^{1}H and ^{13}C NMR spectroscopy). $[\alpha]_D^{22} = -14.2$ (c = 1.7, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$), (signals of the major carbamate *E*/*Z* isomer are reported) δ = 0.86 (t, 3H, *J* = 6.7 Hz, C*H*$_3$), 1.21-1.43 (m, 4H, CH_3CH_2, $CH_3CH_2CH_2$), 1.55-1.72 (m, 1H, C*H*HCHNH), 1.79-1.92 (m, 1H, CH*H*CHNH), 3.17-3.38 (m, 2H, CH_2CHSO_2), 3.62 (q, 1H, *J* = 8.2 Hz, C*H*SO_2), 4.09-4.20 (m, 1H, C*H*N), 5.12 (s, 2H, CH_2O), 5.24 (d, 1H, *J* = 9.4 Hz, N*H*), 7.25-7.43 (m, 7H, arom C*H*), 7.49-7.55 (m, 1H, arom C*H*), 7.65-7.69 (m, 1H, arom C*H*) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 13.93 (CH_3), 22.12 (CH_3CH_2), 27.91 ($CH_3CH_2CH_2$), 30.61 (CH_2CHSO_2), 32.00 (CH_2CHN), 51.45 (*C*HN), 65.23 (*C*HSO_2), 66.95 (CH_2O), 121.52, 126.97, 128.05 128.25, 128.57 128.69, 133.52 (arom *C*H), 136.14, 136.34, 139.40 (arom *C*), 156.10 (*C*=O) ppm. IR (KBr) $\tilde{\upsilon}$ = 3402 (s), 2958 (m), 2928 (m), 1717 (vs), 1527 (vs), 1452 (m), 1298 (vs), 1238 (s), 1152 (s), 1114 (m), 1014 (m), 756 (s), 699 (m), 586 (s), 552 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 387 (8) [$M^{+\bullet}$], 286 (7), 176 (7), 130 (5), 108 (33), 91 (100), 65 (5). *Anal.* Calcd for $C_{21}H_{25}NO_4S$: C, 65.09; H, 6.50; N, 3.61. Found: C, 64.79, H, 6.15; N, 3.48.

(1*S*,2*R*)-[1-(1,1-Dioxo-2,3-dihydro-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-3-phenylpropyl]carbamic acid benzyl ester (**4e**): Prepared according to GP3 or GP4. Purification *via* column flash chromatography (Et_2O:pentane = 1:2) afforded a colorless solid; mp = 123-125°C (Et_2O:pentane = 1:5). GP3 starting from 250 mg (0.58 mmol) of ß-aminosulfone (**3e**) yielded 220 mg (87%) of **4e**. *ee* = 95%, *de* ≥ 96% (determined by ^{1}H and ^{13}C NMR spectroscopy). GP4 starting from 250 mg (0.58 mmol) of ß-aminosulfone (**3e**) yielded 175 mg (70%) of **4e**. *ee* = 95%, *de* ≥ 96% (determined by ^{1}H and ^{13}C NMR spectroscopy). $[\alpha]_D^{22} = -8.0$ (c = 1.0, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$), (signals of carbamate *E*/*Z* isomers are reported) δ = 2.04-2.51 (m, 2H, CH_2CHNH), 2.66-2.89 (m, 2H, PhCH_2), 3.13-3.32 (m, 2H, CH_2CHSO_2), 3.72-3.80 (m, 1H, C*H*SO_2) 4.18-4.35 (m, 1H, C*H*N), 5.06-5.18 (m, 2H, CH_2O), 5.36 (d, < 1H, *J* = 9.1 Hz, N*H*), 5.90 (d, < 1H, *J* = 9.9 Hz, N*H*), 7.16-7.72 (m, 14H, arom C*H*) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 29.76, 30.59 (PhCH_2), 32.24, 32.71 (CH_2CHSO_2), 33.50, 35.27 (CH_2CHNH), 50.56, 51.45 (*C*HN), 64.00, 64.98 (*C*HSO_2), 67.05, 67.15 (CH_2O), 121.49, 121.64, 126.20, 126.26, 127.04,

127.24, 127.99, 128.23, 128.40, 128.52, 128.55, 128.60, 128.64, 128.68, 128.84, 128.89, 133.66, 133.71 (arom *C*H), 136.16, 136.34, 136.37, 138.91, 139.39, 140.76 (arom *C*), 156.06, 156.71 (*C*=O) ppm. IR (KBr) $\tilde{\upsilon}$ = 3347 (m), 3030 (m), 1714 (vs), 1526 (vs), 1453 (s), 1296 (vs), 1244 (vs), 1151 (vs), 1123 (s), 1054 (m), 911 (s), 734 (vs), 700 (s), 590 (m), 543 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 435 (3) [$M^{+\bullet}$], 344 (15), 327 (10), 284 (10), 283 (47), 218 (6), 196 (40), 137 (12), 130 (6), 129 (15), 117 (8), 116 (5), 115 (11), 108 (10), 107 (5), 105 (7), 104 (8), 92 (8), 91 (100), 79 (12), 77 (13). *Anal.* Calcd for $C_{25}H_{25}NO_4S$: C, 68.94; H, 5.79; N, 3.22. Found: C, 69.09, H, 5.74; N, 3.16.

(1*S*,2*R*)-[1-(1,1-Dioxo-2,3-dihydro-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)phenylmethyl]carbamic acid benzyl ester (**4f**): Prepared according to GP3 or GP4. Purification *via* column flash chromatography (Et_2O:pentane = 1:2) afforded a colorless solid; mp = 55-57°C (Et_2O:pentane = 1:5). GP3 starting from 260 mg (0.64 mmol) of **3f** yielded 155 mg (60%) of **4f**. *ee* = 88%, *de* ≥ 90% (determined by ^{1}H and ^{13}C NMR spectroscopy). GP4 starting from 260 mg (0.64 mmol) of **3f** yielded 210 mg (80%) of **4f**. *ee* = 88%, *de* ≥ 96% (determined by ^{1}H and ^{13}C NMR spectroscopy). $[\alpha]_D^{22} = -16.1$ (c = 2.0, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$), (signals of carbamate *E*/*Z* isomers are reported) δ = 2.99-3.08 (m, < 2H, C*H*$_2$CHSO$_2$), 3.23-3.40 (m, 2H, C*H*$_2$CHSO$_2$), 3.13-3.32 (m, < 2H, C*H*$_2$CHSO$_2$), 3.95 (q, 1H, J = 7.9 Hz, C*H*SO$_2$) 5.02-5.08 (m, 2H, C*H*$_2$O), 5.26-5.35 (m, 1H, C*H*N), 5.78 (d, < 1H, *J* = 8.9 Hz, N*H*), 6.33 (d, < 1H, *J* = 8.9 Hz, N*H*), 7.16-7.64 (m, 14H, arom C*H*) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 30.70, 31.00 (*C*H$_2$CHSO$_2$), 54.75, 54.96 (*C*HN), 64.93, 65.45 (*C*HSO$_2$), 67.09, 67.25 (*C*H$_2$O), 121.54, 127.03, 127.09, 127.66, 127.86, 128.00, 128.11, 128.22, 128.36, 128.44, 128.55, 128.62, 128.78, 128.84, 129.00, 133.33, 133.48 (arom *C*H), 135.61, 135.87, 136.29, 136.36, 138.13, 138.75, 139.52, 139.68 (arom *C*), 155.75 (*C*=O) ppm. IR (KBr) $\tilde{\upsilon}$ = 3347 (m), 1717 (vs), 1522 (s), 1454 (m), 1303 (vs), 1243 (s), 1149 (vs), 1126 (m), 757 (s), 701 (s), 545 (m) cm^{-1}; MS (EI, 70 eV) *m/z* (%) = 407 (1) [$M^{+\bullet}$], 271 (9), 270 (54), 256 (12), 250 (10), 240 (16), 210 (5), 208 (6), 207 (5), 206 (7), 205 (5), 204 (8), 196 (9), 180 (5), 179 (16), 178 (8), 165 (7), 137 (9), 108 (10), 107 (8), 104 (5), 92 (7), 91 (100), 79 (6), 77 (8), 65 (6). *Anal.* Calcd for $C_{23}H_{21}NO_4S$: C, 67.79; H, 5.19; N, 3.44. Found: C, 67.32, H, 4.97; N, 3.42.

(1*S*,2*R*)-1-(1,1-Dioxo-2,3-dihydro-1*H*-1λ^6-benzo[*b*]thiophen-2-yl)-2,2-dimethylpropanamine (**5c**): ß-Aminosulfone (**4c**) (190 mg, 0.49 mmol) was dissolved in dry EtOH (30 mL) and the mixture was hydrogenated using 10% Pd/C (60 mg) as catalyst at 4 atm. After 16 h, the solution was neutralized with solid Na_2CO_3 and the catalyst was filtered off. The solvent was evaporated in vacuo to give 120 mg of **5c** (96%) as a colorless solid. mp = 56-57°C (Et_2O:pentane = 1:1). *ee* = 91%, *de* ≥ 96% (determined by ^{1}H and ^{13}C NMR spectroscopy). $[\alpha]_D^{22} = -29.6$ (c = 1.4, $CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ = 1.03 (s, 9H,

C*H*$_3$), 1.39-1.43 (br, 2H, N*H*$_2$), 3.21 (dd, 1H, *J* = 8.2, 16.2 Hz, CH*H*CHSO$_2$), 3.50 (d, 1H, *J* = 0.9 Hz, C*H*NH), 3.71 (t, 1H, *J* = 8.2 Hz C*H*SO$_2$), 3.79 (dd, 1H, *J* = 8.2, 16.2 Hz, C*H*HCHSO$_2$), 7.32-7.47 (m, 2H, arom C*H*), 7.56 (dt, 1H, *J* = 1.2, 7.4 Hz, arom C*H*), 7.73 (d, 1H, *J* = 7.4 Hz, arom C*H*) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 26.64 (*C*H$_2$), 27.08 (*C*H$_3$), 34.97 (CH$_3$*C*), 55.49 (*C*HN), 62.41 (*C*HSO$_2$), 121.53, 127.38, 128.54, 133.46 (arom *C*H), 137.58, 137.98 (arom *C*) ppm. IR (KBr) $\tilde{\upsilon}$ = 3390 (m), 2959 (s), 2870 (m), 1601 (m), 1472 (m), 1454 (m), 1294 (vs), 1151 (vs), 1121 (s), 756 (vs), 587 (s), 550 (s) cm^{-1}; MS (CI, 100 eV, isobutane): *m/z* (%) = 255 (16) [M$^{+\bullet}$+2], 254 (100) [M$^{+\bullet}$+1], 237 (5), 197 (6), 196 (16). *Anal.* Calcd for $C_{13}H_{19}NO_2S$: C, 61.63; H, 7.56; N, 5.53. Found: C, 61.64, H, 7.62; N, 5.35.

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