Supporting Information

The Total Synthesis of Pantocin B

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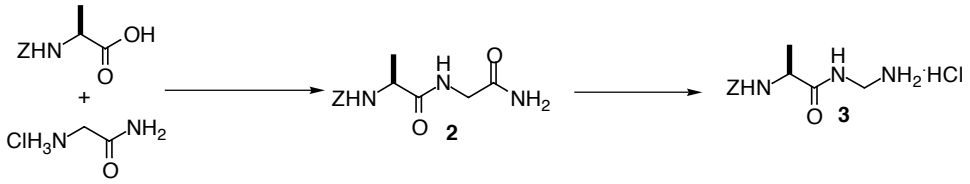
The Synthesis



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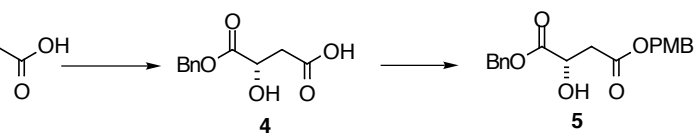
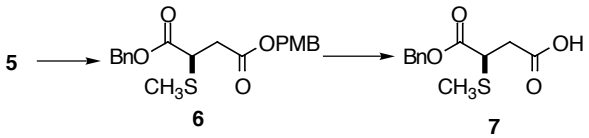
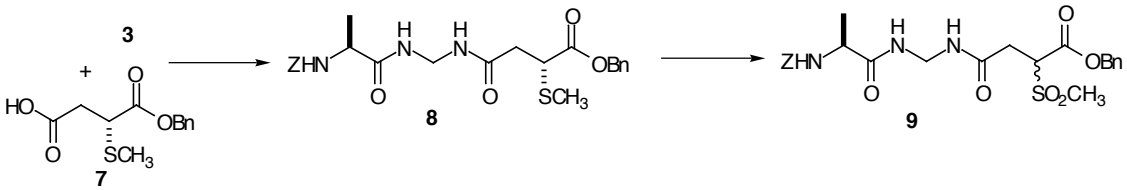


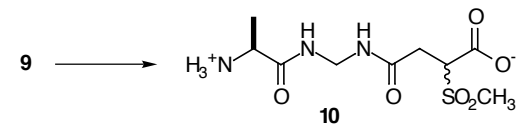
4 **5**



6 **7**



8 **9**



10

General Information: ^{1}H NMR spectra were recorded at 400 or 500 MHz on a Varian Inova 400 or a Varian Unity 500, respectively. All proton spectra were referenced to residual solvent: 3.30 ppm for CD_3OD, 2.50 ppm for DMSO-d_6, 7.27 ppm for $CDCl_3$ and 4.80 ppm for D_2O. ^{13}C NMR spectra were recorded at 100 MHz on a Varian VXR-400s spectrometer. Carbon spectra were referenced to residual solvent for DMSO-d_6 (39.51 ppm) and $CDCl_3$ (77.23 ppm). ^{13}C spectra obtained in D_2O were externally referenced to acetonitrile (1.39 ppm) in D_2O. Coupling constants are given in hertz. The phrase "partial data" refers to spectral data of certain compounds that could not be assigned unambiguously because of overlap with other signals. All melting points were measured on a Fisher-Johns Melting Point Apparatus. Melting points are reported in degrees centigrade (^{o}C) and are uncorrected. Optical rotations were measured on a Perkin-Elmer 241 Polarimeter and sample concentrations are given in grams per 100 mL of solvent. IR spectra were recorded on a Nicolet Impact 410 Infrared Spectrometer. Mass spectra were recorded at the University of Illinois Mass Spectrometry Laboratory using a VG ZAB-SE for fast atom bombardment spectra (FAB) and a VG 70SE for instrument for chemical ionization (CI) and electron impact (EI) spectra. Elemental analysis were performed by Robertson Microanalytic Labs, Inc.. All reagents and solvents were purchased from commercial suppliers and were used without further purification unless noted. All reagents and solvents were purchased from Aldrich except triflic anhydride (Strem Chemicals), 68% m-chloroperbenzoic acid and N-CBZ-d-alanine (Sigma). Triethylamine was distilled from potassium hydroxide and was stored over potassium hydroxide. The bis(trifluoroacetoxy) iodobenzene was recrystallized from cold trifluoroacetic acid as needed (clean material is white in color). All yields were calculated when material was homogenous by both TLC and NMR and dried to a constant weight. Yields were unoptimized. Flash chromatography was conducted on Si gel (40 μm). All reactions were monitored by TLC using EM Science Si gel 60 F_{254} glass-backed plates and were visualized using ultraviolet light, phosphomolybdic acid stain (1% (w/v) phosphomolybdic acid hydrate in abs. EtOH), ninhydrin stain (.2% ninhydrin in MeOH) or ceric stain (5g phosphomolybdic acid hydrate, 2g of $Ce(SO_4)$, 16 mL H_2SO_4, 200 mL of H_2O).

General Procedure to Synthesize Glycinamide Derivatives (2): In a flame-dried flask under an atmosphere of argon, a N-CBZ protected amino acid (1 equiv.) was dissolved in anhydrous tetrahydrofuran. To the resultant solution 1, 1' carbonyldiimidazole (1.1 equiv.) was added with stirring. After stirring 1-2 hours at room temperature, 1 equivalent of glycinamide hydrochloride and 1 equivalent of triethylamine were added to the reaction mixture. The reaction was allowed to proceed at room temperature until judged complete by TLC, typically 1-2 days. The tetrahydrofuran was then removed on a rotary evaporator. To the resultant residue a 4% sodium bicarbonate in water solution was added and the reaction was allowed to stir until a white precipitate was observed. The precipitate was collected by vacuum filtration and dried in vacuo.

CBZ-L-Alanylglycinamide (2): 4.4616 g (20 mmol) of CBZ-L-alanine, 2.2174 g (20 mmol) of glycinamide hydrochloride, 3.3215 g (20.2 mmol) of 1,1' carbonyldiimidazole, 2.6 mL (20.2 mmol) of triethylamine, 20 mL of tetrahydrofuran; yield 4.0724 g (73%) of a white solid. $[\alpha]_D^{25}$= -6.3° (c = 0.80, MeOH); mp = 95-97 °C; ^{1}H NMR (400 MHz, dmso-d_6) 1.20 (d, 3H, J = 7.6 Hz), 3.61 (t, 2H, J = 5.0 Hz), 4.03 (quintet, 1H, J = 7.6 Hz), 5.02 (ab quart, 2H, J = 6.0, 12.4 Hz), 7.10 (s, 1H), 7.18 (s, 1H), 7.35 (m, 6H), 7.56 (d, 1H, J = 6.8 Hz), 8.10 (t, 1H, J = 6.0 Hz); ^{13}C NMR (100 MHz, dmso-d_6) 17.84, 41.93, 65.46, 127.77, 128.34, 136.90, 155.87, 170.83, 172.60; IR (nujol mull) 3467, 3283, 1659, 1538, 1253 cm^{-1}; MSFAB$^+$ (relative intensity) 280(100), 236(12); HRMS ($C_{13}H_{18}N_3O_4$) calcd: 280.129731 found: 280.129600.

General Procedure to Synthesize Geminal Amino Amide Hydrochlorides (3): Following Loudon's procedure, 1 equivalent of bis(trifluoroacetoxy) iodobenzene (PIFA) was dissolved in acetonitrile. To this solution an equal volume of purified (Barnstead, Easy Pure Rf water filtration system) deionized water was added. Finally **1** (1 equiv.) was added and the reaction was allowed to stir at room temperature for approximately 12 hours. The reaction was diluted with 1 N HCl (20 equiv.) and washed twice with ether. The aqueous layer was concentrated on the rotary evaporator. The residue was recrystallized from MeOH: Et_2O. The resultant white solid was collected by vacuum filtration and dried in vacuo.

[1-S-(Aminomethyl-carbamoyl)-ethyl] carbamic acid benzyl ester (3): 1.6372 g (5.7 mmol) of **2**, 2.4844 g (5.7 mmol) of PIFA, 15 mL of acetonitrile, 15 mL of H_2O; yield 0.7705 g (48%) of a white solid. $[\alpha]_D^{25}$=-11.3° (c = 0.63, MeOH); mp = 168-171 °C; ^{1}H NMR (500 MHz, dmso-d_6) 1.23 (d, 3H, J = 7.5 Hz), 4.09 (quintet, 1H, J = 7.5 Hz), 4.17 (br s, 1H), 4.22 (br s, 1H), 5.00 (ab quart, 2H, J = 12.5, 19.5 Hz), 7.34 (m, 5H), 7.62 (d, 1H, J = 7.5 Hz), 8.22 (br s, 3H), 8.91 (t, 1H, J = 6.5 Hz); ^{13}C NMR(100 MHz, dmso-d_6) 17.80, 44.70, 49.92, 65.53, 127.86, 128.39, 136.88, 155.73, 174.14; IR (nujol mull) 3340, 1684, 1538, 1240 cm^{-1}; MSFAB$^+$ (relative intensity) 252(85), 223(100), 206(50); HRMS ($C_{12}H_{18}N_3O_3$) calcd: 252.134817 found: 252.134700.

General Procedure to Synthesize 2-Hydroxy-succinic acid-1-benzyl ester (4): Following Miller's procedure, 2.4 equivalents of trifluoroacetic anhydride were placed in a dried flask under an argon atmosphere and the flask was placed in an ice bath. To the chilled anhydride, malic acid (1 equiv.) was added and the resultant suspension was stirred at 0 °C until all the malic acid was dissolved. The clear solution was then concentrated on the rotary evaporator not exceeding a water bath temperature of 30 °C. To the resultant solid residue benzyl alcohol was added, eventually giving rise to a clear solution. The reaction was stirred overnight at room temperature. The reaction was then diluted with EtOAc and extracted with

4% aqueous sodium bicarbonate solution. The combined aqueous extracts were washed with EtOAc and then were acidified to pH = 2 with concentrated HCl. The acidified solution was then extracted with EtOAc and the combined organic extracts were dried over $MgSO_4$. The organics were then concentrated in vacuo to give a clear oil.

2-S-Hydroxysuccinic Acid 1-Benzylester (4): 10.12 g (75 mmol) of L-malic acid, 25 mL (180 mmol) of trifluoroacetic anhydride, 25 mL of benzyl alcohol; yield 13.45 g (80%) of a clear oil. $[\alpha]_D^{25} = -15.9^o$ (c = 0.59, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$) 2.85 (dd, 1H, J = 6.0, 17.0 Hz), 2.93 (dd, 1 H, J = 4.3, 17.0 Hz), 4.55 (dd, 1H, J = 4.3, 6.0 Hz), 5.24 (s, 2H), 7.37 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$) 38.53, 67.25, 68.15, 128.67, 128.91, 128.92, 134.99, 173.23, 175.86; IR (neat) br 3480-2660, 1729, 1411, 1202, 1107 cm^{-1}; $MSCI^+$ (relative intensity) 225(1), 181(4.4), 91(100); HRMS ($C_{11}H_{12}O_5$) calcd: 224.068474 found: 224.068186.

General Procedure to Synthesize 2-Hydroxy-succinic acid-1-benzyl ester-4(4-methoxybenzyl)ester (5): In a dried flask under an atmosphere of argon **4** (1 equiv.) was dissolved in anhydrous dimethylformamide. To the resultant solution potassium bicarbonate (K_2CO_3, 2 equiv.) was added with vigorous stirring. 4-methoxybenzyl chloride was added to the stirred suspension and the reaction was stirred at room temperature for 4 days. The reaction was then diluted with EtOAc and the organics were washed three times with dI H_2O. The organics were dried over $MgSO_4$. The organics were then concentrated on the rotary evaporator giving a viscous oil. Flash chromatography on Si gel with 70:30 hexanes:EtOAc provided the desired diester **5** as a clear oil.

2-S-Hydroxysuccinic acid-1-benzyl ester-4-(4-methoxybenzyl) ester (5): 13.63 g (61 mmol) of **4**, 10.0 mL (67 mmol) of 4-methoxybenzyl chloride, 16.99 g (122 mmol) of K_2CO_3, 100 mL of dimethylformamide; yield 15.11 g (74%) of a clear oil. $[\alpha]_D^{25}$=-19.0 (c = 0.82, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$) 2.83 (dd, 1h, J = 6.0, 16.2 Hz), 2.89 (dd, 1H, J = 4.5, 16.2 Hz), 3.21 (m, 1H), 3.81 (s, 3H), 4.54 (ab quart, 1H, J = 4.5, 6.0 Hz), 5.05 (s, 2H), 5.19 (s, 2H), 6.88 (d, 2H, J = 9.0 Hz), 7.26 (d, 2H, J = 9.0 Hz), 7.33 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$) 38.89, 55.49, 66.86, 67.51, 67.93, 114.15, 127.69, 128.62, 128.81, 128.85, 130.45, 159.93, 170.50, 173.39; IR (neat) 3500, 2960, 1748, 1614, 1519, 1215 cm^{-1}; $MSEI^+$ 344(8.8), 253(2), 137(100), 121(80), 91(45), 77(20); HRMS ($C_{19}H_{20}O_6$) calcd: 344.125989, found: 344.126839.

General Procedure to Synthesize 2-Methanesulfanyl-succinic acid 1-benzyl ester -4-(4-methoxybenzyl) ester (6): In a flame-dried schlenck flask under argon atmosphere **5** (1 equiv.) was dissolved in anhydrous dichloromethane. The resultant solution was chilled to -78 ^{o}C in a dry ice/acetone bath. To the chilled solution 2, 6 lutidine (1.3 equiv.) was added with stirring. Finally triflic anhydride

(1.2equiv.) was added dropwise to the reaction. After complete addition the reaction was allowed to stir for 4 hours at -78 °C. In a second flame dried flask 15-crown-5 (4 equiv.) was dissolved in anhydrous DMF. Sodium thiomethoxide (4 equiv.) was added to the solution of crown ether and was stirred vigorously. The resultant suspension was added in small portions over 1 hour *via* an addition funnel to the stirred triflate solution under positive argon flow. (*Note: The reaction must be stirred vigorously to ensure adequate mixing*.) When the suspension was completely added to the triflate solution the reaction was allowed to warm slowly to room temperature. The reaction was monitored by nmrs of quenched (1N HCl) aliquots; the reaction was judged complete when no chlorosuccinate derivative was seen in the nmr. The reaction was then diluted with ether and washed with dI H_2O and 1 N HCl. The organics were then dried over $MgSO_4$. The dried solution was concentrated on a rotary evaporator yielding a crude oil. The ether was chased with hexanes on the rotary evaporator to yield a white solid which was recrystallized from ether: hexanes to yield **6**. The solid was collected by vacuum filtration and dried in vacuo.□

2-R-Methanesulfanyl-succinic acid-1-benzyl ester-4-(4-methoxybenzyl) ester (6): 4.57 g (13 mmol) of **5**, 2.6 mL (15.6 mmol) of triflic anhydride, 2.0 mL (17 mmol) of 2,6 lutidine, 30 mL of dichloromethane, 3.67 g (52 mmol) of sodium thiomethoxide, 10 mL (52 mmol) of 15-crown-5, 45 mL of dimethylformamide; yield 3.88 g (78%) of a white solid. $[\alpha]_D^{25}$=25.4° (c = 0.73, $CHCl_3$); mp = 56-58 °C;
^{1}H NMR (500 MHz, $CDCl_3$) 2.12 (s, 3H), 2.72 (dd, 1H, J = 6.0, 17.0 Hz),
3.06 (dd, 1H, J = 10.0, 17.0 Hz), 3.67 (dd, 1H, J = 6.0, 10.0 Hz), 3.80 (s, 3H),
5.04 (ab quart, 2H, J = 3.6, 12.0 Hz), 5.17 (ab quart, 2H, J = 12.0, 27.0 Hz),
6.87 (d, 2H, J = 9.0 Hz), 7.25 (d, 2H, J = 9.0 Hz), 7.36 (m, 5H);
^{13}C NMR (100 MHz, $CDCl_3$) 14.15, 36.21, 42.45, 55.49, 66.85, 67.22, 114.15, 127.78, 128.31, 128.49, 128.74, 130.37, 135.81, 159.91, 170.64, 171.22; IR (nujol mull) 1722, 1614, 1513, 1240, 1151 cm^{-1}; MSEI$^+$ 374(1.3), 137(1.3), 121(100), 91(25); HRMS ($C_{20}H_{22}O_5S$) calcd: 374.118796 found: 374.118737.

General Procedure to Synthesize 2-Methanesulfanyl-succinic acid 1-benzyl ester (7): In an icebath, a 10% trifluoroacetic acid in dichloromethane solution was chilled. **6** (.1g/ml) was dissolved in the chilled acid solution and was stirred for 3-4 hours while letting the reaction warm slowly to room temperature. The reaction was concentrated on a rotary evaporator and the residue was dissolved in ether. The ether solution was extracted with an aqueous 4% sodium bicarbonate solution. The combined aqueous extracts were acidified to pH = 1 with concentrated HCl. The acidified aqueous solution was extracted with EtOAc. The EtOAc extracts were dried over $MgSO_4$. The solution was concentrated on a rotary evaporator and the resultant clear oil was dried in vacuo.

2-R-Methanesulfanyl-succinic acid 1-benzyl ester (7): 4.0059 g (10.7 mmol) of **6**, 40 mL of 10% trifluoroacetic acid in dichloromethane; yield 2.6853 g (98%) of a clear oil. $[\alpha]_D^{25}$=27.9° (c = 0.41, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) 2.14 (s, 3H), 2.76 (dd, 1H, J = 5.4, 17.2 Hz), 3.12 (dd, 1H, J = 10, 17.2 Hz), 3.67 (dd, 1H, J = 5.4, 10 Hz), 5.23 (ab quart, 2H, J = 4.8, 12.4 Hz), 7.36 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$) 14.15, 35.87, 42.04, 67.36, 128.291, 128.55, 128.77, 135.70, 171.14, 176.87; IR (neat) br 3400-2400, 1722, 1443, 1150, 760, 701 cm^{-1}; $MSEI^+$ 254 (1.7), 236(4.7), 208(3.5), 162(6.1), 91(100); HRMS ($C_{12}H_{14}O_4S$) calcd: 254.061281 found: 254.061528.

General Procedure to Synthesize Coupling Product (8): In a dried flask under argon **3** (1 equiv.) was suspended in anhydrous dichloromethane. To the suspension N-ethylmorpholine (1.5 equiv.) was added and the reaction was stirred for 10 minutes at room temperature. The reaction was then chilled in an ice bath. To the chilled suspension, a solution of **7** (1 equiv.) in anhydrous dichloromethane was added. N-hydroxybenzotriazole hydrate (HOBT, 1.3 equiv.) was added to the chilled reaction mixture with stirring. Finally N-ethyl-N'-[(3-dimethylamino)propyl] carbodiimide (EDAC, 1.2 equiv.) was added. The reaction was maintained at 0 °C for 1 hour before the reaction was allowed to warm to room temperature. Upon completion the dichloromethane was removed on a rotary evaporator. To the resultant residue 1 N HCl was added and the white precipitate was collected by vacuum filtration and dried in vacuo.

N-[(2-S-Benzyloxycarbonylamino-propionylamino) methyl]-2-R-methanesulfanyl succinamic acid benzyl ester (8a): 0.2839 g (1.0 mmol) of **3a**, 15 mL of dichloromethane, 0.2561 g (1.0 mmol) of **7a**, 5 mL of dichloromethane, 0.2369 g (1.2 mmol) of EDAC, 0.2061 g (1.3 mmol) of HOBT, 0.20 mL (1.5 mmol) of N-ethylmorpholine; yield 0.3525 g (73%) of a white solid. $[\alpha]_D^{25}$= 12.9° (c = 0.89, DMF); mp = 130-131 °C; ^1H NMR (400 MHz, dmso-d_6, partial data) 1.17 (d, 3H, J = 7.2 Hz), 2.05 (s, 3H), 2.74 (dd, 1H, J = 9.6, 6.8 Hz), 3.61 (m, 1H), 4.02 (quintet, 1H, J = 7.2 Hz), 4.38 (m, 2H), 5.02 (ab quart, 2H, J = 12.6, 7.2 Hz), 5.14 (quart, 2H, J = 12.8 Hz), 7.35 (m, 10H), 8.44 (m, 1H), 8.58 (t, 1H, J = 5.8 Hz); ^{13}C NMR (100 MHz, dmso-d_6) 13.87, 18.65, 36.69, 42.68, 43.75, 50.29, 65.81, 66.36, 128.22, 128.47, 128.80, 128.88, 136.51, 137.48, 156.03, 171.39, 173.48; IR (nujol mull) 3295, 3061, 1735, 1691, 1650, 1520 cm^{-1}; $MSFAB^+$ (relative intensity) 488(100), 254(55), 223(25); HRMS ($C_{24}H_{30}N_3O_6S$) calcd: 488.185533 found: 488.185500.

Scheme A: General Procedure to Synthesize Sulfone (9): In a dried flask under argon, 1 equivalent of **8** was suspended in anhydrous dichloromethane. The suspension was chilled in ice bath to approximately 0 °C. In a second dried flask under argon 2.2 equivalents of m-chloroperbenzoic acid (mCPBA) were dissolved in anhydrous dichloromethane. The solution of mCPBA was added in portions to the suspension of **8**. The reaction was stirred for 3-4 hours at 0 °C. When the oxidation

was complete 2-4 mLs of a saturated sodium thiosulfate solution was added to the reaction. The reaction was then stirred vigorously for 10-20 minutes at which time the reaction was partitioned between dI H_2O and chloroform. The organics were washed three times with saturated aqueous sodium bicarbonate solution and one time with brine. The organics were then dried over $MgSO_4$. The organics were concentrated on the rotary evaporator. The resultant solid was dried in vacuo to yield the sulfone **9** cleanly.

N-[(2-S-Benzyloxycarbonylamino-propionylamino)-methyl] 2-Methanesulfonyl succinamic acid benzyl ester (9): 0.4873 g (1.0 mmol) of **8**, 20 mL of dichloromethane, 0.6731 g (2.2 mmol) of mCPBA, 20 mL of dichloromethane; yield 0.3999 g (77%) of a white solid. Mp = 148-150 ^oC; ^1H NMR (400 MHz, dmso-d_6) 1.17 (d, 3H, J = 7.6 Hz), 2.84 (dd, 1H, J = 4.0, 12.8 Hz), 2.93 (dd, 1H, J = 10.4, 5.2 Hz), 3.13 (s, 3H), 4.02 (quintet, 1H, J = 7.6 Hz), 4.39 (t, 2H, J = 6.0 Hz), 4.65 (dd, 1H, J = 4.0, 10.4 Hz), 5.00 (ab quart, 2H, J = 12.6, 8.8 Hz), 5.19 (dd, 1H, J = 12.4, 3.6 Hz), 5.24 (dd, 1H, J = 12.6, 2.0 Hz), 7.36 (m, 10H), 8.46 (t, 1H, J = 5.6 Hz), 8.70 (t, 1H, J = 6.0 Hz); ^{13}C NMR (100 MHz, dmso-d_6) 18.17, 30.58, 43.49, 49.83, 64.19, 65.34, 67.14, 127.74, 127.95, 128.21, 128.42, 135.19, 136.99, 155.57, 165.27, 168.38, 168.41, 173.00; IR(nujol mull) 3295, 1741, 1691, 1640, 1545 cm^{-1}; $MSFAB^+$ (relative intensity) 520(73), 286(30), 223(32); HRMS ($C_{24}H_{30}N_3O_8S$) calcd: 520.175362 found: 520.176100.

Scheme A: General Procedure to Synthesize Zwitterion (10): A 5% formic acid in MeOH solution was degassed with argon. Under a positive argon flow, the Pd-black catalyst (1:1 by weight) was slowly added to the vigorously stirring degassed solution. **9** was dissolved in a minimal amount of formic acid and was added to the suspension of catalyst. After 15-25 minutes the catalyst was filtered off through celite and washed with more of the formic acid solution and with dI H_2O. The filtrate was concentrated on the rotary evaporator and the residue was crystallized from ethanol: ether. (In some cases a recrystallization from H_2O: EtOH was required to obtain a clean compound.) The resultant solid was collected by vacuum filtration and was dried in vacuo with heating over P_2O_5 to yield **10.**

N-[(2-S-Amino-propionylamino) methyl] 2-methanesulfonyl succinamic acid (10): 378.2 mg (0.73 mmol) of **9**, 350 mg of Pd-black, 40 mL of 5% formic acid in MeOH; yield 130.4 mg (61% from **9**, 47% from **8**) of a white solid. Mp = 185-186 ^oC; ^1H NMR (400 MHz, D_2O) 1.52 (d, 3H, J = 7.0 Hz), 2.94 (m, 2H), 3.22 (s, 3H), 4.05 (q, 1H, J = 7.0 Hz), 4.32 (t, 1H, J = 7.4 Hz), 4.65 (ab quart and s, 2H, J = 14.0, 13.6 Hz); ^{13}C NMR (100 MHz, D_2O) 16.84, 32.56, 39.89, 44.89, 49.52, 68.10, 170.08, 171.40, 171.46, 172.57, 172.61; IR (nujol mull) br 3420-2500, 1691, 1665, 1614, 1538 cm^{-1}; $MSFAB^+$ (relative intensity) 296(5); HRMS ($C_9H_{18}N_3O_6S$) calcd: 296.091632 found: 296.091600; Anal. calcd. for $C_9H_{17}N_3O_6S$: C 36.61 H 5.80 N 14.23; found: C 36.45 H 5.85 N 14.13.

Scheme B: General Procedure to Synthesize Zwitterion (10): In a dried flask under argon, 1 equivalent of **8** was suspended in anhydrous dichloromethane. The suspension was chilled in ice bath to approximately 0 ^{o}C. In a second dried flask under argon 2.2 equivalents of m-chloroperbenzoic acid (mCPBA) were dissolved in anhydrous dichloromethane. The mCPBA solution was added in portions to the suspension of **8**. The reaction was stirred for 3-4 hours at 0 ^{o}C. When the oxidation was complete 2-4 mLs of a saturated sodium thiosulfate solution was added to the reaction. The reaction was then stirred vigorously for 10-20 minutes at which time the reaction was partitioned between dI H_2O and chloroform. The organics were washed three times with saturated aqueous sodium bicarbonate solution and one time with brine. The organics were then dried over $MgSO_4$. After filtration the organics were concentrated in vacuo and the resultant crude sulfone **9** was used directly in the hydrogenation reaction. A 5% formic acid in MeOH solution was degassed with argon. Under a positive argon flow, the Pd-black catalyst (1:1 by weight) was slowly added to the vigorously stirring degassed solution. **9** was dissolved in a minimal amount of formic acid and was added to the suspension of catalyst. After 15-25 minutes the catalyst was filtered off through celite and washed with more of the formic acid solution and with dI H_2O. The filtrate was concentrated on the rotary evaporator and the residue was crystallized from ethanol: ether. (In some cases a recrystallization from H_2O: EtOH was needed.) The resultant solid was collected by vacuum filtration and was dried in vacuo with heating over P_2O_5 to yield **10.**