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Total Synthesis of (−)- and (+)-Tedanalactam

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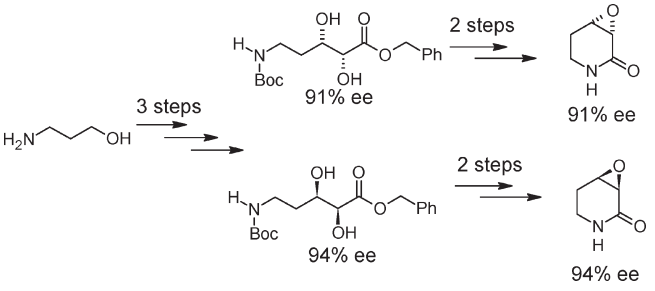

The first stereoselective route providing access to both enantiomers of tedanalactam, a naturally occurring piperidone, has been developed. The stereogenic centers were generated by the use of Sharpless asymmetric dihydroxylation. Tandem oxidation−Wittig reaction and one-pot deprotection, lactamization, and oxirane ring formation are the other key elements.

The piperidine motif is widely encountered in naturally occurring alkaloids, displaying a wide range of biological activities.[1] Piperidones are key synthetic intermediates[2] for the synthesis of the piperidine ring due to the presence of the keto function, which allows the introduction of other groups. Piperidones are also known for their therapeutic usage and a few are isolated as natural products.

Tedanalactam, a *cis*-3,4-epoxy-2-piperidone **1**, was first isolated from sponge *Tedania ignis* in 1994 by Cronan and Cardellina.[3] Recently in 2007, Lago and Kato[4] found it in leaves of *Piper crassinervium* (piperaceae). It displays promising fungicidal activity. The core structure containing an epoxy-δ-lactam derivative (Figure 1) is also found in piplaroxide **2**, an ant-repellant alkaloid[5a] isolated from *Piper tuberculatum*, 3,4-epoxy-8,9-dihydropiplartine **3** isolated from leaves[5b] and twigs of *Piper verrucosum*, and 3,4-epoxy-5-pipermethystine **4** from roots[5c] of the kava shrub (*Piper methysticum*). The kava shrub is a source of traditional beverage for many South Pacific Island people.

So far there are no reports on the synthesis of these epoxy piperidones, nor is their absolute stereochemistry described. Our ongoing interest in the synthesis of small molecules,[6] and potential anticancer activity of epoxy piperidines[7] prompted us to devise the synthesis of tedanalactam. Herein, we report the first total synthesis of (−)- and (+)-tedanalactam employing Sharpless dihydroxylation as the source of chirality.

Retrosynthetic analyses (Scheme 1) of tedanalactam **1** lead to 3-tosyloxy-4-hydroxy-2-piperidone **5** as a suitable precursor, which can be assembled from δ-amino ester **6**. The required monotosyl ester **6** could be prepared from the corresponding dihydroxy ester **7** to be obtained by Sharpless asymmetric dihydroxylation of the unsaturated ester **8**.

With the above objective in mind, 3-amino-1-propanol **9** was subjected to N-protection by using Boc anhydride and subsequently transformed into olefin **8** by tandem oxidation−Wittig reaction,[6e,8] using PCC/NaOAc and phosphorane. Exclusively *E*-olefin was formed during this step (Scheme 2).

Following Scheme 3, cis dihydroxylation of α,β-unsaturated ester **8** in the presence of OsO_4 and NMO as co-oxidant gave a *rac*-diol **7**. Enantioselective Sharpless dihydroxylation with the AD-mix α catalyst ($NH_2SO_2CH_3$, *t*-BuOH:H_2O (1/1), 0 °C) afforded diol **7a** in 77% yield and 91% ee as determined by the HPLC analyses, whereas reverse selectivity was obtained when the AD-mix β catalyst was used. Thus, diol **7b** was prepared by employing the AD-mix β as catalyst with 94% ee and 71% yield. The absolute stereochemistry of diols was assumed from the predictable facial selectivity rule (mnemonic rule) suggested by Sharpless et al.[9]

To test the viability of the proposed route, *rac*-2,3-dihydroxy ester **7** was used for our initial studies. Regioselective monotosylation[10] at the 2-position of *rac*-2,3-dihydroxy ester **7** worked well to give the monotosylated ester **6** (Scheme 4). Conversion of *rac*-**6** to *rac*-**1** required N-deprotection, followed by the corresponding cyclization to the

(1) (a) Pei, Z.; Li, X.; von Geldern, T. W.; Longenecker, K.; Pireh, D.; Stewart, K. D.; Backes, B. J.; Lai, C.; Lubben, T. H.; Ballaron, S. J.; Beno, B. W. A.; Kempf-Grote, A. J.; Sham, H. L.; Trevillyan, J. M. *J. Med. Chem.* **2007**, *50*, 1983. (b) Elworthy, T. R.; Brill, E. R.; Caires, C. C.; Kim, W.; Lach, L. K.; Tracy, J. L.; Chiou, S.-S. *Biorg. Med. Chem. Lett.* **2005**, *15*, 2523. (c) Yu, Y. K.; Nagimoxa, A. D.; Praliev, K. D.; Shin, S. N.; De kempe, N. *Pharm. Chem. J.* **2002**, *36*, 382. (d) Watson, P. S.; Jiang, B.; Scott, B. *Org. Lett.* **2000**, *23*, 3679.

(2) (a) Godineau, E.; Schenk, K.; Landais, Y. *J. Org. Chem.* 2008, *73*, 6983 and references cited therein. (b) Buffat, M. G. P. *Tetrahedron* **2004**, *60*, 1701. (c) Weintraub, P. M.; Sabol, J. S.; Kane, J. M.; Borcherding, D. R. *Tetrahedron* **2003**, *59*, 2953. (d) Mitchinson, A.; Nadin, A. *J. Chem. Soc., Perkin Trans. 1* **2000**, 2862. (e) Laschat, S.; Dickner, T. *Synthesis* **2000**, 1781.

(3) Cronan, J. M., Jr.; Cardellina, J. H. II *Nat. Prod. Lett.* **1994**, *5*, 85.

(4) Lago, J. H.; Kato, M. J. *Nat. Prod. Res.* **2007**, *21*, 910.

(5) (a) Capron, M. A.; Weimer, D. F. *J. Nat. Prod.* **1996**, *59*, 794. (b) Seeram, N. P.; Lewis, P. A.; Jacobs, H. *J. Nat. Prod.* **1996**, *59*, 436. (c) Dragull, K.; Yoshida, W. Y.; Tang, C. *Phytochemistry* **2003**, *64*, 555.

(6) (a) Majik, M. S.; Parameswaran, P. S.; Tilve, S. G. *J. Org. Chem.* **2009**, *74*, 3591. (b) Patre, R.; Gawas, S.; Sen, S.; Parameswaran, P. S.; Tilve, S. G. *Tetrahedron Lett.* **2007**, *48*, 3517. (c) Parvatkar, P.; Parameswaran, P. S.; Tilve, S. G. *Tetrahedron Lett.* **2007**, *48*, 7870. (d) Majik, M. S.; Shet, J. B.; Tilve, S. G.; Parameswaran, P. S. *Synthesis* **2007**, 663. (e) Shet, J.; Desai, V.; Tilve, S. G. *Synthesis* **2004**, 1859.

(7) Miyashita, K.; Park, M.; Adachi, S.; Seki, S.; Obika, S.; Imanishi, T. *Bioorg. Med. Chem. Lett.* **2002**, *12*, 1075.

(8) Taylor, R. J. K.; Reid, M.; Foot, J.; Raw, S. A. *Acc. Chem. Res.* **2005**, *38*, 851.

(9) (a) Becker, H.; Sharpless, K. B. *Angew. Chem., Int. Ed. Engl.* **1996**, *35*, 448. (b) Kolb, H. C.; VanNieuwenhze, M. S.; Sharpless, K. B. *Chem. Rev.* **1994**, *94*, 2483.

(10) Fleming, P. R.; Sharpless, K. B *J. Org. Chem.* **1991**, *56*, 2869.

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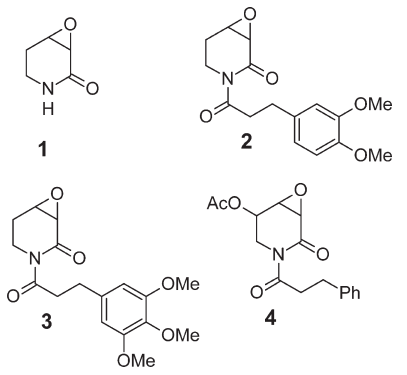
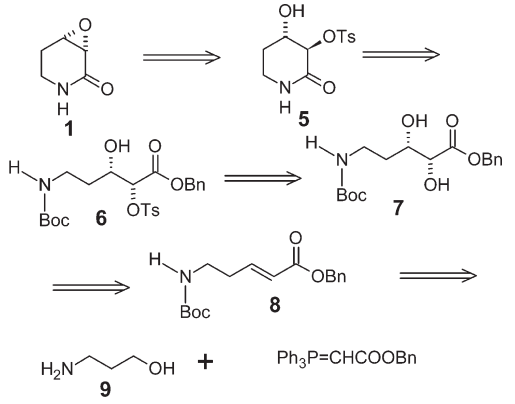
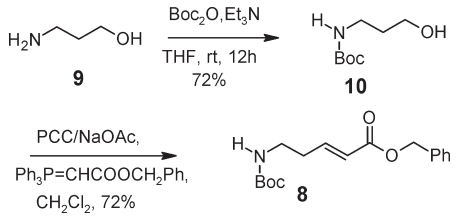


FIGURE 1. Examples of epoxy-2-piperidone.

SCHEME 1. Retrosynthesis of Tedanalactam 1



SCHEME 2. Synthesis of Olefin 8

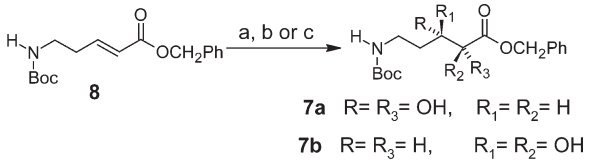


lactam ring and epoxidation without formation of the pyrrolidine ring[11] by nucleophilic displacement of the tosyl group. This was achieved via one-pot strategy employing the acid-mediated Boc deprotection (TFA, CH_2Cl_2, 0 °C) and lactamization−epoxidation sequence promoted by basic medium (aq NH_3). The basic features involved in this step are the occurrence of three reactions in one pot in tandem fashion to furnish tedanalactam **1** in 74% yield. The overall yield of **1** from **9** is 21%.

Having secured the route in terms of relative stereochemistry, we focused our effort on completing an enantioselective synthesis of tedanalactam. To this end, the diol **7a** prepared with AD-mix α and the diol **7b** prepared with AD-mix β was subjected to selective monotosylation at the 2-position by using TsCl, Et_3N at 0 °C for 72 h to provide the corresponding monotosylates **6a** and **6b** in good yield (Scheme 4). To complete the total asymmetric synthesis, final steps of deprotection, cyclization, and epoxidation were

(11) The steric crowding is inhibiting the nucleophilic displacement of the tosyl group to form the pyrrolidine ring.

SCHEME 3. Synthesis of Diol 7



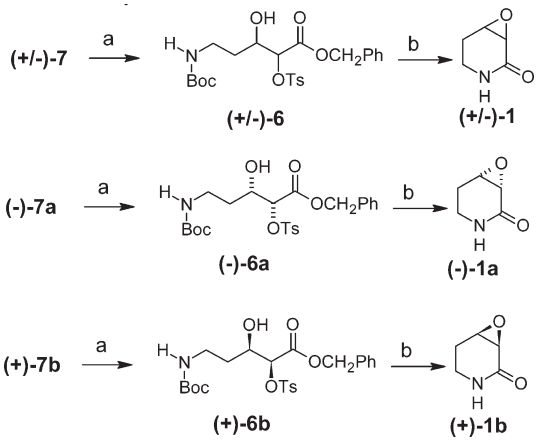
7a R= R_3= OH, R_1= R_2= H

7b R= R_3= H, R_1= R_2= OH

Reaction condition	Yield%	ratio[a] **7a:7b**
a) OsO_4/ NMO/ no catalyst	83	1:1
b) AD-mix α: $(DHQ)_2$-PHAL	77	95.5:4.5
c) AD-mix β: $(DHQD)_2$-PHAL	71	3:97

[a]Determined by chiral HPLC, using a Chiralpak AD column.

SCHEME 4. Synthesis of Tedanalactam 1



Reagents and conditions: (a) TsCl, Et_3N, CH_2Cl_2, 0 °C, 72 h (65−66%); (b) (1) TFA, CH_2Cl_2, 0 °C to rt, 2 h; (2) aq NH_3 (72−77%).

achieved successfully by treatment of **6a** and **6b** with TFA followed by aq NH_3 to give (−)-tedanalactam **1a** having $[\alpha]^{30}_D$ −7.60 (*c* 0.130, MeOH) [lit[3] $[\alpha]^{30}_D$ −8.90 (*c* 0.3, MeOH)] in 91% ee and (+)-tedanalactam **1b** in 94% ee (determined by HPLC analyses). The sign of specific rotation of (−)-tedanalactam is consistent with that of the natural tedanalactam, which reveals the presence of (3*S*,4*S*) configuration at the epoxy ring of the natural product.

In conclusion, the first total synthesis of (−)-tedanalactam with 91% ee and (+)-tedanalactam with 94% ee has been completed in a simple way from 3-amino-1-propanol in five steps. Sharpless asymmetric dihydroxylation was employed as the source of chirality. The tandem processes used in our synthetic endeavors such as oxidation−Wittig reaction, deprotection−lactamization−epoxidation are the highlights of this synthesis. Moreover, our successful asymmetric total synthesis of both enantiomers of **1** also suggests the **1a** (3*S*,4*S*) configuration of the natural isomer.

Experimental Section

General Remarks. Column chromatography was performed by using Merck silica gel 60/120 mesh size. ^1H (300 MHz) and ^{13}C (75 MHz) NMR spectra were recorded on a Bruker 300

instrument. Chemical shifts are expressed in δ relative to tetramethylsilane (TMS), the coupling constant J are given in Hz. Chiral HPLC analyses was executed by using a Jasco HPLC model MX-2080-31 instrument.

***tert*-Butyl (3-Hydroxypropyl)carbamate (10).** The Boc_2O (5.83 g, 0.026 mol) was added dropwise to a stirred solution of 3-amino-1-propanol **9** (1.744 g, 0.023 mol) in dry THF (40 mL) at 0 °C. Then Et_3N (5.882 g, 0.058 mol) was added dropwise to the mixture. The reaction mixture was then stirred at rt for 12 h. THF was removed under vacuum, then water (30 mL) was added and extracted in CH_2Cl_2 (3 × 30 mL). The organic layer was washed with 5% aq HCl (2 × 20 mL), 5% aq $NaHCO_3$ (2 × 20 mL), sat. NaCl (20 mL), and then water (30 mL), dried over anhyd Na_2SO_4, and concentrated in vacuum. Purification of the oily crude product by column chromatography on silica gel (hexanes:EtOAc = 4:6) afforded *tert*-butyl (3-hydroxypropyl)-carbamate (**10**) (2.929 g, 72%) as a thick colorless liquid. IR (neat) 3612−3115, 1703 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$) δ 1.46 (s, 9H), 1.66−1.70 (m, 2H), 2.97 (br s, 1H), 3.30 (q, J = 6.0 Hz, 2H), 3.68 (t, J = 6.0 Hz, 2H), 4.79 (br s, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 28.3, 34.4, 37.0, 59.7, 79.6, 157.1. HRMS m/z $[M + Na]^+$ calcd for $C_8H_{17}NO_3Na$ 198.1106, found 198.1104.

Benzyl (2*E*)-5-[(*tert*-Butoxycarbonyl)amino]pent-2-enoate (8). To a magnetically stirred suspension of PCC (3.068 g, 14.2 mmol) and NaOAc (1.167 g, 14.2 mmol) in anhyd CH_2Cl_2 (40 mL) was added *tert*-butyl (3-hydroxypropyl)carbamate (**10**) (1.556 g, 8.89 mmol) in anhyd CH_2Cl_2 (5 mL), followed by the addition of (benzyloxycarbonylmethylene) triphenylphosphorane (4.014 g, 9.78 mmol) in one portion. The mixture was stirred at rt for 7 h. Et_2O (50 mL) was added and the supernatant solution was decanted from the black granular solid. The combined organic solutions were filtered through a short bed of Celite and the filtrate obtained was evaporated to give a residue that was purified by column chromatography on silica gel (hexanes:EtOAc = 7:3) to give pure benzyl (2*E*)-5-[(*tert*-butoxycarbonyl)amino]pent-2-enoate (**8**) (1.955, 72%) as a colorless viscous liquid. IR (neat) 3373, 1712, 1693 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$) δ 1.45 (s, 9H), 2.42 (q, J = 6.6 Hz, 2H), 3.28 (q, J = 6.0 Hz, 2H), 4.62 (br s, 1H), 5.20 (s, 2H), 5.95 (d, J = 15.6 Hz, 1H), 6.96 (ddd, J = 6.9, 7.2, 15.6 Hz, 1H), 7.35−7.38 (m, 5H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 28.3, 32.9, 39.0, 66.2, 79.6, 123.0, 128.3, 128.5, 128.6, 136.0, 146.1, 155.8, 166.0. HRMS m/z $[M + Na]^+$ calcd for $C_{17}H_{23}NO_4Na$ 328.1525, found 328.1518.

Benzyl 5-[(*tert*-Butoxycarbonyl)amino]-2,3-dihydroxypentanoate (7). To a stirred solution of **8** (0.736 g, 2.41 mmol) in acetone−water 8:1 (v/v) (18 mL) was added NMO (0.566 g, 4.83 mmol) and aq 1% OsO_4 (2 mL). The mixture was stirred at rt for 8 h. Na_2SO_3 (3.2 g) in 5 mL of water was added and the mixture was further stirred for 1 h, then concentrated on a vacuum pump to remove acetone. EtOAc (30 mL) was added and the aq layer was extracted with EtOAc (3 × 20 mL). The combined organic layer was dried over anhyd Na_2SO_4, concentrated, and purified by column chromatography on silica gel (hexanes:EtOAc = 6:4) to give the diol **7** (0.679 g, 83%) as a white semisolid. IR (KBr) 3602−3041, 1749, 1680 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$) δ 1.43 (s, 9H), 1.64−1.69 and 1.81−1.91 (2m, 2H), 2.84 (br s, 2H), 3.15−3.20 and 3.38−3.48 (2m, 2H), 4.0−4.03 (m, 1H), 4.13 (d, J = 2.4 Hz, 1H), 5.26 (br s, 3H), 7.37 (s, 5H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 28.3, 34.1, 37.2, 67.6, 69.7, 73.8, 79.8, 128.3, 128.5, 128.6, 135.1, 157.0, 173.1. HRMS m/z $[M + Na]^+$ calcd for $C_{17}H_{25}NO_6Na$ 362.1580, found 362.1579.

General Procedure for Dihydroxylation of Alkene 8 with a Chiral Catalyst. A mixture of $K_3Fe(CN)_6$ (2.731 g, 8.36 mmol), K_2CO_3 (1.142 g, 8.36 mmol), and either $(DHQ)_2PHAL$ (0.108 g, 0.139 mmol, AD-mix α) or $(DHQD)_2PHAL$ (5 mol %, AD-mix β) were stirred in *t*-BuOH (10 mL) and H_2O (10 mL), after which OsO_4 (0.7 mL, 1% aq OsO_4 soln.) was added with further stirring for 30 min at rt. $CH_3SO_2NH_2$ (0.264 g, 2.78 mmol) was added and the mixture was cooled to 0 °C. Olefin **8** (0.850 g, 2.78 mmol) was added and the heterogeneous slurry was stirred vigorously for 15 h at 0 °C and then 8 h at rt. Na_2SO_3 (3.2 g) was added and the mixture was further stirred for 1 h. EtOAc (30 mL) was added and the aq layer was extracted with EtOAc (3 × 20 mL). The combined organic layer was washed with 5% KOH (2 × 20 mL), dried over anhyd Na_2SO_4, concentrated, and purified by column chromatography on silica gel (hexanes:EtOAc = 6:4) to give the corresponding diol **7a** or **7b**. IR and ^1H and ^{13}C NMR data for **7a** and **7b** were identical with those of *rac*-diol **7** described above.

Benzyl (2*R*,3*S*)-5-[(*tert*-Butoxycarbonyl)amino]-2,3-dihydroxypentanoate (7a). Product **7a** was obtained as a white semisolid (0.730 g, 77% yield), using AD-mix α; $[\alpha]^{31}_D$ −3.93 (*c* 0.891, $CHCl_3$); HPLC of diol **7a**: 91% ee (R_t = 16.0 min for the major enantiomer, R_t = 12.5 min for the minor one; column: Chiralpak AD, UV detector, 254 nm, 20% 2-propanol in *n*-hexane; flow rate: 0.7 mL/min).

Benzyl (2*S*,3*R*)-5-[(*tert*-Butoxycarbonyl)amino]-2,3-dihydroxypentanoate (7b). Product **7b** (0.388 g, 71%) as a white semisolid was obtained from olefin **8** (0.492 g) by using AD-mix β; $[\alpha]^{31}_D$ +4.16 (*c* 0.721, $CHCl_3$); HPLC of diol **7b**: 94% ee (R_t = 11.8 min for the major enantiomer, R_t = 17.2 min for the minor one; column: Chiralpak AD, UV detector, 254 nm, 20% 2-propanol in *n*-hexane; flow rate: 0.7 mL/min).

General Procedure for Monotosylation of Diol 7 (7a and 7b). To a one-necked round-bottomed flask were added the 2,3-dihydroxy ester **7** (0.600 g, 1.77 mmol), CH_2Cl_2 (15 mL, 0.2 M solution in 2, 3-dihydroxy ester **7**), and Et_3N (0.268 g, 2.85 mmol). The flask was placed in an ice−water bath and the reaction mixture was allowed to equilibrate for 20 min and then *p*-toluenesulfonyl chloride (0.371 g, 1.94 mmol) was added in one portion. The flask was fitted with septum and placed in a refrigerator (5 °C) for 72 h. The mixture was then concentrated to afford a paste that was dissolved in $CHCl_3$ (40 mL). The organic phase was washed with 1 N HCl (3 × 15 mL), sat. $NaHCO_3$ (1 × 20 mL), and brine (2 × 15 mL), dried over anhyd Na_2SO_4, and concentrated to afford the crude mixture, which was purified by column chromatography on silica gel (hexanes: EtOAc = 6:4) to give the *rac*-monotosylate **6** as a white solid (0.575 g, 66%), mp 88−89 °C. IR (KBr) 3621−3140, 1764, 1685 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$) δ 1.42 (s, 9H), 1.64 (m, 2H), 2.44 (s, 3H), 3.16 (m, 1H), 3.42 (m, 2H), 4.13−4.17 (m, 1H), 4.75 (br s, 1H), 4.95 (d, J = 3.3 Hz, 1H), 5.13 (s, 2H), 7.26−7.36 (m, 7H), 7.80 (d, J = 8.4 Hz, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 21.7, 28.3, 33.5, 36.7, 67.5, 68.7, 79.8, 79.9, 128.2, 128.3, 128.4, 128.5, 128.7, 132.9, 134.8, 145.1, 157.1, 167.0. HRMS m/z $[M + Na]^+$ calcd for $C_{24}H_{31}NO_8SNa$ 516.1668, found 516.1658.

Benzyl (2*R*,3*S*)-5-[(*tert*-Butoxycarbonyl)amino]-2-tosyl-3-hydroxypentanoate, 6a. Product **6a** (0.609 g, 65%) was obtained from **7a** (0.645 g) as a white solid: mp 89−90 °C; $[\alpha]^{31}_D$ −13.33 (*c* 0.150, $CHCl_3$); HPLC of monotosylate **6a**: 91% ee (R_t = 28.1 min for the major enantiomer, R_t = 26.1 min for the minor one; column: Chiralpak AD, UV detector, 254 nm, 10% 2-propanol in *n*-hexane; flow rate: 1.0 mL/min).

Benzyl (2*S*,3*R*)-5-[(*tert*-Butoxycarbonyl)amino]-2-tosyl-3-hydroxypentanoate, 6b. Product **6b** (0.437 g, 65%) was obtained from **7b** (0.460 g) as a white solid: mp 88−89 °C; $[\alpha]^{31}_D$ +13.42 (*c* 0.149, $CHCl_3$); HPLC of monotosylate **6b**: 94% ee (R_t = 27.5 min for the major enantiomer, R_t = 30.1 min for the minor one; column: Chiralpak AD, UV detector, 254 nm, 10% 2-propanol in n-hexane; flow rate: 1.0 mL/min). IR and ^1H and ^{13}C NMR data for **6a** and **6b** were identical with those of *rac*- **6** described above.

General Procedure for the Preparation of Tedanalactam (1). To a stirred solution of monotosylate **6** (0.501 g, 1.02 mmol) in CH_2Cl_2 (12 mL) was added TFA (3 mL) at 0 °C. The mixture

was stirred at rt for 2 h and then concentrated under vacuum. Aq NH_3 (6 mL) was added to the resulting residue in CH_2Cl_2 (10 mL) at 0 °C and the solution was stirred for 2 h at rt. The mixture was diluted with EtOAc (20 mL), washed with aq NH_4Cl (2×15 mL), and brine (1×15 mL), dried over anhyd Na_2SO_4, concentrated, and purified by column chromatography on silica gel (MeOH:$CHCl_3$ = 1:19) to give the tedanalactam **1** (0.084 g, 74%) as a pale yellow oil. IR (neat) 3268, 1680 cm^{-1}. ^1H NMR (300 MHz, $CDCl_3$) δ 2.05 (ddd, J = 6.0, 6.6, 12.3 Hz, 1H), 2.34−2.90 (m, 1H), 3.06 (ddd, J = 6.0, 6.6, 12.3 Hz, 1H), 3.34 (dd, J = 4.2, 12.3 Hz, 1H), 3.42 (m, 1H), 3.63 (br s, 1H), 6.18 (br s, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 23.5, 35.2, 50.6, 53.1, 169.1. HRMS: m/z $[M + Na]^+$ calcd for $C_5H_7NO_2Na$ 136.0351, found 136.0374.

(3*S*,4*S*)-Epoxy-2-piperidone [(−)-Tedanalactam] (1a). Product **1a** (0.092 g, 77% yield) was obtained from **6a** (0.521 g) as a yellow oil: $[\alpha]^{30}_D$ −7.60 (*c* 0.130, MeOH); HPLC of tedanalactam **1a**: 91% ee (R_t = 14.5 min for the major enantiomer, R_t = 12.7 min for the minor one; column: Chiralpak AD, UV detector, 206 nm, 10% 2-propanol in *n*-hexane; flow rate: 1.0 mL/min).

(3*R*,4*R*)-Epoxy-2-piperidone [(+)-Tedanalactam] (1b). Product **1b** (0.031 g, 72% yield) was obtained from **6b** (0.189 g) as a yellow oil: $[\alpha]^{30}_D$ +8.47 (*c* 0.118, MeOH); HPLC of tedanalactam **1b**: 94% ee (R_t = 10.9 min for the major enantiomer, R_t = 12.6 min for the minor one; column: Chiralpak AD, UV detector, 206 nm, 10% 2-propanol in *n*-hexane; flow rate: 1.0 mL/min). IR and ^1H and ^{13}C NMR data for **1a** and **1b** were identical with those of *rac*-**1** described above.

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Supporting Information Available: Copies of ^1H NMR, ^{13}C NMR, and DEPT spectra of all the compounds and the HPLC chromatograph of **7**, **6**, and **1**. This material is available free of charge via the Internet at http://pubs.acs.org.