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Bing Li [a] & Michael B. Smith [a]
[a] Rm. 151, 215 Glenbrook Rd., Department of Chemistry , University of Connecticut , Storrs, Connecticut, 06269-3060
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# PREPARATION AND EPOXIDATION OF CONJUGATED LACTAMS: INFLUENCE OF RING SIZE ON EPOXIDATION

**Bing Li[1] and Michael B. Smith***

*Rm. 151, 215 Glenbrook Rd., Department of Chemistry*
*University of Connecticut, Storrs, Connecticut 06269-3060*



***Abstract***: α,β-Epoxy-lactams can be prepared from conjugated lactams by treatment with *m*-chloroperoxybenzoic acid. Good yields are obtained, however, only with 2-pyrrolidinone derivatives. The yield of epoxy-lactam diminishes dramatically as the size of the lactam ring increases.

Epoxide derivatives are important synthetic intermediates in a variety of applications. Conjugated ketones, conjugated aldehydes, and conjugated esters have all been converted to the α,β-epoxy derivative by reaction with peroxyacids or, more commonly, by reaction with basic hydrogen peroxide. Conjugated amides have also been converted to the α,β-epoxy-amide. Although α,β-conjugated lactams are known, there have been no reports of the preparation of α,β-epoxy-lactams. This report describes the synthesis of these compounds from lactam precursors. Good yields of α,β-epoxy-2-pyrrolidinone derivatives can be obtained by this approach, but the related epoxy-piperidone and epoxy-hexahydroazepin-2-one derivatives are generated in very poor yields.

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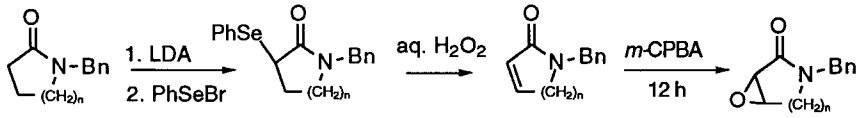
* Author to whom correspondence should be addressed

**Table. Preparation of α,β-unsaturated and epoxy-lactams.**




**1** n = 1 **4** n = 1 **7** n = 1 **10** n = 1
**2** n = 2 **5** n = 2 **8** n = 2 **11** n = 2
**3** n = 3 **6** n = 3 **9** n = 3 **12** n = 3

| n | %(*4,5,6*)[a] | %(*7,8,9*)[a] | %(*10,11,12*)[a] |
|---|---|---|---|
| 1 | 80 | 83 | 91 |
| 2 | 82 | 80 | 25[b] |
| 3 | 78 | 79 | 5[c] |

[a] Isolated yields [b] 30% yield (GC yield) after reaction for 24 hours
[c] 7% yield (GC yield) after reaction for 24 hours

Conversion of the lactam precursor to the requisite conjugate lactam involved standard methodology.[2] To prepare the requisite N-benzyl lactams,[3] we used Takahata's phase transfer methodology,[4] and also the sonication conditions we previously found[5] gave better yields. Treatment of N-benzyl lactams (*1,2,3*)[3] with lithium diisopropylamide, followed by benzene selenium bromide led to formation of the 3-phenylselenyl derivative (*4,5,6*) in good yield.[2,6] Oxidation of the selenide with aqueous hydrogen peroxide generated the selenoxide[2] which spontaneously eliminated PhSeOH under the reaction conditions[2,6] to give the conjugated lactam (*7,8 9*) in good yield.

The next step in our sequence was epoxidation of the conjugated lactam. There are several methods used to induce epoxidation of conjugated systems. Perhaps the most common method uses hydrogen peroxide in basic aqueous media, where the key reactant is the hydroperoxide anion.[7] A solution of enone in methanol treated with sodium hydroxide and 30% hydrogen peroxide is a typical procedure. Attempts

to epoxidize N-benzyl-3-pyrrolin-2-one (*7*) failed to give epoxide, and only starting material was detected.

It is also well known that peroxycarboxylic acids convert alkenes to epoxides. Rapoport used *m*-chloroperoxybenzoic acid, for example, to convert 1-methyl-3-methylene-2-piperidone to 3-epoxymethylene-1-methyl-2-piperidone in 88% yield.[8] We therefore treated N-benzyl-3-pyrrolin-2-one (*7*) with *m*-chloroperoxybenzoic acid in refluxing chloroform, and obtained epoxy lactam ***10*** in 74% yield. When the reaction was done at ambient temperature for 21 hours, however, less than 5% of epoxide was obtained. Encouraged by this result, we examined the same reaction with the tetrahydropyridone derivative (*8*) but observed ***11*** in only 25% yield as a mixture that proved intractable to isolation of pure material. The results were poorer with the hydroazepin-2-one derivative (*9*), which gave only 5% of ***12*** in an intractable mixture. Even when the reaction was refluxed for 24 hours, there were negligible increases in the yield of the epoxy lactam. In these latter cases, we used GC/MS techniques to identify formation of the targeted epoxy lactams.

Formation of the conjugated lactams from their unconjugated precursor is straightforward for five-membered, six-membered, and seven-membered ring lactams. It is clear, however, that epoxidation of conjugated lactams is synthetically useful only for the 3-pyrrolin-2-one derivative and that increasing the size of the ring diminishes the yield of epoxy-lactam and leads to a number of decomposition products. Epoxy lactams are potentially useful synthetic intermediates, but at this time only five-membered ring derivatives can be obtained using this methodology.

## Experimental

All glassware was flame dried prior to use. Most reactions were conducted under an atmosphere of dry argon. Reaction progress was checked by TLC or GC/MS. Melting points were measured on a Thomas-Hoover-capillary melting point

apparatus. All melting point and boiling points were uncorrected. Infrared spectra were taken on a Perkin-Elmer Spectrophotometer Model 283 and recorded in reciprocal centimeters. All $^{1}H$ and $^{13}C$ NMR spectra were recorded with an IBM WP-270 Spectrometer at 270 MHz or at 67.92 MHz as solution in $CDCl_3$ and reported in ppm downfield from tetramethylsilane, which is used as an internal reference. High resolution mass spectra were measured on an AEI MS-902 mass spectrometer and are accurate to ±5 ppm. All chemicals were purchased from Janssen or Aldrich. The THF was distilled from sodium metal prior to use. General drying of product solutions was accomplished over anhydrous magnesium sulfate. Thin layer chromatography was performed with E. Merck AG Darmstadt silica 60F-254 sheets. Column chromatography was performed on silica gel 60 (70-230 mesh).



**General Procedure For the Preparation of N-Benzyl Lactams**

A suspension of pulverized KOH (1.1 eq.) and tetrabutylammonium bromide (TBAB, 0.20 eq.) in 100 mL of dry THF was added to a 500 mL three-neck round-bottom flask, fitted with a mechanical stirrer. The solution of benzyl bromide (1.1 eq.) and the appropriate lactam (1.1 eq.) in 100 mL of dry THF was added over one h. via a dropping funnel, at room temperature. During the addition and subsequent reaction the flask was immersed in an ultrasonic bath (Bransonic 220). After addition, the reaction mixture was stirred for one hour in the ultrasonic bath at room temperature. The precipitate was filtered and the filtrate was concentrated *in vacuo* to leave an oil. Upon addition of diethyl ether to the oil, the phase transfer catalyst crystallized out of solution and was filtered off. The organic layer was dried with magnesium sulfate, the solution was filtered, and it was concentrated *in vacuo*. The product was isolated by column chromatography.

**1-Benzyl-2-pyrrolidinone, *1***

Addition of benzyl bromide (18 mL, 151 mmol) and 2-pyrrolidinone (12.75 g, 150 mmol) to KOH (8.30 g, 149 mmol) and TBAB (7.09 g, 22 mmol) in 100 mL

THF, and reaction for one h. led to 15.0 g of *1* (86.0 mmol, 57%): $^1$H NMR ($CDCl_3$): δ 7.27-7.19 (m, 5H), 4.40 (s, 2H), 3.17 (t, 2H), 2.33 (t, 2H), and 1.94 (m, 2H) ppm; $^{13}$C NMR ($CDCl_3$): δ 174.5 (s), 136.7 (s), 128.4 (d), 128.3 (d), 128.1 (d), 127.8 (d), 127.5 (d), 46.4 (t), 46.3 (t), 30.8 (t), and 17.6 (t) ppm; Infrared (neat): 3030 (m), 2915 (br), 1687 (s), 1429 (m), 1286 (s), and 702 (m) cm$^{-1}$; Mass Spectrum (m/z, Rel. intensity): P$^+$ 175 (67), 146 (44), 118 (19), 104 (38), 91 (100), 65 (35), and 51 (15). HRMS. Calcd. for $C_{11}H_{13}NO$, 175.0997; Observed 175.0993 (± 0.9 mmu).

**1-Benzyl-2-piperidone, *2***

Addition of benzyl bromide (18 mL, 151 mmol) and 2-piperidone (14.85 g, 150 mmol) to KOH (8.30 g, 149 mmol) and TBAB (7.09 g, 22 mmol), and reaction for 1 h. led to 15.48 g of *2* (81.9 mmol, 55%):[3,9] $^1$H NMR ($CDCl_3$): δ 7.23 (m, 5H), 4.55 (s, 2H), 3.1 (t, 2H), 2.38 (t, 2H), and 1.68 (m, 4H) ppm; $^{13}$C NMR ($CDCl_3$): δ 170.5 (s), 137.4 (s), 128.4 (d), 128.3 (d), 128.0 (d), 127.2 (d), 50.0 (t), 47.1 (t), 32.4 (t), 23.1 (t), and 21.3 (t) ppm; Infrared (neat): 3030 (m), 2943 (s), 1641 (s), 1449 (m), 1258 (m), 1071 (m), and 714 (m) cm$^{-1}$; Mass Spectrum (m/z, Rel. intensity): P$^+$ 189 (76), 160 (8.8), 132 (8.8), 106 (31), 91 (100), 85 (27), and 55 (34). HRMS. Calcd. for $C_{12}H_{15}NO$, 189.1154; Observed 189.1158 (± 0.9 mmu).

**1-Benzyl-(1H)-hexahydroazepin-2-one, *3***

Addition of benzyl bromide (18 mL, 151 mmol) and (1H)-hexahydroazepin-2-one (16.95 g, 150 mmol) to KOH (8.30 g, 149 mmol) and TBAB (7.09 g, 22 mmol), and reaction for 1 h. led to 15.74 g of *3* (77.6 mmol, 52%): $^1$H NMR ($CDCl_3$): δ 7.2 (m, 5H), 4.55 (s, 2H), 3.2 (t, 2H), 2.5 (t, 2H), 1.6 (m, 4H), and 1.4 (m, 2H) ppm; $^{13}$C NMR ($CDCl_3$): δ 175.7 (s), 137.9 (s), 128.6 (d), 128.0 (d), 127.4 (d), 127.1 (d), 126.6 (d), 50.9 (t), 48.8 (t), 37.0 (t), 30.5 (t), and 28.5 (t) ppm; Infrared (neat): 3029 (w), 2928 (m), 1632 (s), 1485 (m), 1198 (m), 970 (m), and 726 (m) cm$^{-1}$; Mass Spectrum (m/z, Rel. intensity): P$^+$ 203 (49), 188 (4), 160 (12), 146 (8), 106

(33), 91 (100), 65 (22), and 55 (24). HRMS. Calcd. for $C_{13}H_{17}NO$, 203.1310; Observed 203.1297 (± 1.0 mmu).

**General Procedure For the Preparation of 3-Phenylseleno-N-Benzyl Lactams**

Butyllithium (1.6 M solution in hexane) was added to a solution of diisopropylamine (1.05 eq.) in dry THF at -78 °C. The mixture was stirred at -78 °C for 10 min., and a solution of N-benzyl lactam in dry THF was added. The mixture was stirred at -78°C for 10 min., at -20 °C for 5 min., and then at -78 °C for 15 min. A solution of PhSeBr in THF was added, the mixture was stirred for 10 min. at -78°C, and then 10% aqueous $NH_4Cl$ was added. After ethyl acetate was added, the organic layer was separated, washed with water and then with saturated aqueous NaCl. Drying, followed by concentration *in vacuo*, gave a residue that was chromatographed (silica gel, 4:1 ethyl acetate: hexane) to afford the 3-phenylseleno derivative.

**1-Benzyl-3-phenylseleno-2-pyrrolidinone, *4***

Butyllithium (24.4 mL, 24.4 mmol) was added to a solution of diisopropylamine (3.5 mL, 25.0 mmol, 1.05 eq.) in 30 mL of THF at -78 °C. The mixture was stirred at -78 °C for 10 min., and then a solution of 1-benzyl-2-pyrrolidinone (***1***, 3.675 g 21.8 mmol) in 40 mL of THF was added. A solution of PhSeBr (6.18 g , 26.2 mmol) in 30 mL THF was added, the mixture was stirred at -78 °C for 10 min., and then 10 % aqueous $NH_4Cl$ was added.[10] Workup and chromatography gave 5.79 g of 3-phenylseleno-2-pyrrolidinone, ***4*** (17.6 mmol, 80%): $^1H$ NMR ($CDCl_3$): δ 7.63-7.11 (m, 10H), 4.34 (s, 2H), 3.91 (m, 1H), 3.00 (m, 1H), 2.88 (m, 1H), 2.41 (m, 1H) and 2.06 (m, 1H) ppm; $^{13}C$ NMR ($CDCl_3$): δ 172.8 (s), 135.9 (s), 135.5 (s), 129.1 (d), 128.9 (d), 128.5 (d), 128.3 (d), 128.1 (d), 128.0 (d), 127.7 (d), 127.6 (d), 127.5 (d), 127.3 (d), 46.9 (t), 44.9 (t), 40.9 (d), and 26.7 (t) ppm; Infrared (neat): 3027-2998 (br), 1683 (s), 1418 (m), 1022 (m), 1281 (s), and 758 (s) $cm^{-1}$; Mass Spectrum: (m/z, Rel. intensity: $P^+$ 331 (22), 250 (3), 174 (82), 118 (4), 91

(100), and 65 (16). HRMS. Calcd. for $C_{17}H_{17}NOSe$, 331.0475; Observed 331.0470 (± 1.7 mmu).

**1-Benzyl-3-phenylseleno-2-piperidone, *5***

Butyllithium (24.4 mL, 24.4 mmol) was added to a solution of diisopropylamine (3.5 mL, 25.0 mmol, 1.05 eq.) in 30 mL of THF at -78 °C. The mixture was stirred at -78 °C for 10 min., and a solution of 1-benzyl-2-piperidone (***2***, 4.12 g, 21.8 mmol) in 40 mL dried THF was added. A solution of PhSeBr (6.18 g , 26.2 mmol) in 30 mL THF was added, the mixture was stirred at -78 °C for 10 min., and then 10% aqueous $NH_4Cl$ was added.[10] Workup and chromatography gave 5.92 g of 1-benzyl-3-phenylseleno-2-piperidone, ***5*** (17.2 mmol, 79%): $^1H$ NMR ($CDCl_3$): δ 7.7 (m, 2H), 7.3 (m, 8H), 4.7 (d, 1H), 4.5 (d, 1H), 4.1 (t, 1H), 3.2 (t, 2H), and 2.0 (m, 3H) ppm; $^{13}C$ NMR ($CDCl_3$): δ 169.1 (s), 137.0 (s), 135.2 (s), 129.2 (d), 129.1 (d), 128.6 (d), 128.5 (d), 128.4 (d), 128.3 (d), 128.1 (d), 128.05 (d), 128.00 (d), 127.39 (d), 50.5 (t), 47.1 (t), 43.0 (d), 29.0 (t), and 21.0 (t) ppm; Infrared (neat): 3011 (w), 2990 (s), 1651.3 (s), 1493 (m), 1201 (m), 750 (m), and 700 (m) $cm^{-1}$; Mass Spectrum (m/z, Rel. intensity): $P^+$ 345 (9), 264 (67), 188 (100), 157 (7), 91 (67), and 65 (13). HRMS. Calcd. for $C_{18}H_{19}NOSe$, 345.0632; Observed 345.0628 (± 1.7 mmu).

**1-Benzyl-3-phenylseleno-(1H)-hexahydroazepin-2-one, *6***

Butyllithium (24.4 mL, 24.4 mmol) was added to a solution of diisopropylamine (3.5 mL, 25.0 mmol, 1.05 eq.) in 30 mL of THF at -78 °C. The mixture was stirred at -78 °C for 10 min., and a solution of 1-benzyl-(1H)-hexahydroazepin-2-one (***3***, 4.43 g , 21.8 mmol) in 40 mL of THF was added. A solution of PhSeBr (6.18 g , 26.2 mmol) in 30 mL of THF was added, the mixture stirred at -78 °C for 10 min., and then 10% aqueous $NH_4Cl$ was added. Workup and chromatography gave 6.14 g of 1-benzyl-3-phenylseleno-(1H)-hexahydroazepin-2-one, ***6*** (17.2 mmol, 79 %): $^1H$ NMR ($CDCl_3$): δ 7.6 (m, 2H), 7.2 (m, 8H), 4.6 (d, 1H), 4.5 (d, 1H), 4.3 (t, 1H),

3.4 (m, 2H), 2.0 (m, 2H), and 1.4 (m, 4H) ppm; $^{13}C$ NMR ($CDCl_3$): δ 173.4 (s), 137.4 (s), 134.0 (s), 129.9 (d), 129.0 (d), 128.9 (d), 128.6 (d), 128.5 (d), 128.1 (d), 127.9 (d), 127.7 (d), 127.4 (d), 127.3 (d), 51.9 (t), 49.5 (t), 49.3 (d), 31.2 (t), 28.6 (t), and 27.8 (t) ppm; Infrared (neat): 3060 (w), 2930 (m), 1633 (s), 1480 (m), 1432 (m), 1076 (w), and 733 (m) $cm^{-1}$; Mass Spectrum (m/z, Rel. intensity): $P^+$ 359 (9), 278 (3), 202 (100), 157 (77), 91 (78), and 55 (13). HRMS. Calcd. for $C_{19}H_{21}NOSe$, 359.0788 Observed 359.0778 (± 1.8 mmu).

**General Procedure For The Preparation of Conjugated Lactams**

A solution of phenylseleno lactam in ethyl acetate was treated with a solution of 30% hydrogen peroxide at 0°C, and the mixture was stirred at 15-20 °C for 30 min. At this time, the ethyl acetate layer was separated, washed with water, saturated aqueous $NaHCO_3$, and then saturated aqueous NaCl. Drying, followed by concentration *in vacuo* gave a residue which was purified by column chromatography (silica gel, 3:2 ethyl acetate: hexane).

**1-Benzyl-3-pyrrolin-2-one, *7***

A solution of 1-benzyl-3-phenylseleno-2-pyrrolidinone (***4***, 5.5 g, 16.6 mmol) in 60 mL of ethyl acetate was treated with 15 mL 30% hydrogen peroxide solution at 0°C. The mixture was stirred at 15-20 °C for 30 min. Workup and chromatography gave 2.37 g 1-benzyl-3-pyrrolin-2-one, ***7*** (13.7 mmol, 83%): $^1H$ NMR ($CDCl_3$): δ 7.3-7.2 (m, 5H), 7.0 (t, 1H), 6.2 (t, 1H), 4.6 (s, 2H), and 3.9 (s, 2H) ppm; $^{13}C$ NMR ($CDCl_3$): δ 171.6 (s), 143.8 (d), 137.3 (s), 128.7 (d), 128.0 (d), 127.9 (d), 127.8 (d), 127.59 (d), 53.3 (t), and 46.0 (t) ppm; Infrared (neat): 3182 (m), 2989 (m), 1641 (s), 1452 (m), 1334 (m), 1076 (m), 945 (m), and 700 (m) $cm^{-1}$; Mass Spectrum (m/z, Rel. intensity): $P^+$ 173 (67), 144 (6.6), 91 (100), 68 (31), and 39 (27). HRMS. Calcd. for $C_{11}H_{11}NO$, 173.0841; Observed 173.0839 (± 0.9 mmu).

**1-Benzyl-5,6-dihydropyridin-2-one, *8***

A solution of 1-benzyl-3-phenylseleno-2-piperidone (***5***, 5.8 g, 16.8 mmol) in 60

mL of ethyl acetate was treated with 15 mL 30% hydrogen peroxide solution at 0°C, and the mixture was stirred at 15-20 °C for 30 min. Workup and chromatography gave 2.52 g of 1-benzyl-5,6-dihydropyridin-2-one, ***8*** (13.5 mmol, 80%):[3] $^1$H NMR ($CDCl_3$): δ 7.3 (m, 5H), 6.5 (m, 1H), 6.0 (m, 1H), 4.6 (s, 2H), 3.3 (t, 2H), and 2.3 (m, 2H) ppm;[3] $^{13}$C NMR ($CDCl_3$): δ 164.6 (s), 139.6 (d), 137.3 (s), 128.6 (d), 128.1 (d), 128.0 (d), 127.5 (d), 127.4 (d), 125.2 (d), 49.7 (t), 44.6 (t), and 24.1 (t) ppm; Infrared (neat): 3005 (m), 2979 (s), 1671 (s), 1600 (m), 1501 (m), 1204 (m), 823 (m), and 710 (m); Mass Spectrum (m/z, Rel. intensity):[3] 187 (92), 158 (3), 143 (3), 120 (10), 106 (10), 91 (100), 65 (31), and 51 (17).

**1-Benzyl-1,5,6,7-tetrahydroazepin-2-one, *9***

A solution of 1-benzyl-phenylseleno-(1H)-hexahydroazepin-2-one (***6***, 6.0 g, 16.7 mmol) in 60 mL ethyl acetate was treated with 15 mL 30% hydrogen peroxide solution at 0°C, and the mixture was stirred at 15-20 °C for 30 min. Workup and chromatography gave 2.65 g 1-benzyl-1,5,6,7-tetrahydroazepin-2-one, ***9*** (13.2 mmol, 79%): $^1$H NMR ($CDCl_3$): δ 7.2 (m, 5H), 6.1 (m, 1H), 6.0 (m, 1H), 4.7 (s, 2H), 3.3 (m, 2H), 2.3 (t, 2H), and 1.7 (m, 2H) ppm; $^{13}$C NMR ($CDCl_3$): δ 168.3 (s), 139.9 (d), 139.3 (s), 129.1 (d), 128.9 (d), 128.5 (d), 128.2 (d), 127.8 (d), 126.5 (d), 51.1 (t), 46.7 (t), 29.3 (t), and 27.3 (t) ppm; Infrared (neat): 3031 (w), 2994 (m), 1649 (s), 1481 (s), 1361 (m), 1248 (m), 915 (m), and 733 (m) $cm^{-1}$; Mass Spectrum (m/z, Rel. intensity): $P^+$ 201 (71), 172 (13), 160 (3), 144 (3), 106 (18), 91 (100), and 65 (22). HRMS. Calcd. for $C_{13}H_{15}NO$, 201.1154; Observed 201.1154 (± 1.0 mmu).

**General Procedure For Preparing 1-Benzyl-3,4-epoxy-2-pyrrolidinone**

A stirred solution of conjugated lactam in chloroform was treated with 1.2 eq. of *m*-chloroperoxybenzoic acid, at room temperature. The mixture was heated to reflux under nitrogen and then diluted with diethyl ether. Washing with saturated $Na_2SO_3$ to remove remaining *m*-chloroperoxybenzoic acid was followed by drying, and

concentration *in vacuo* to give a residue. Purification by column chromatography (silica gel, 3:2 ethyl acetate: hexane) gave the epoxy-lactam.

**1-Benzyl-3,4-epoxy-2-pyrrolidinone, *10***

A stirred solution of 1-benzyl-3-pyrrolin-2-one (***7***, 2.37 g, 13.7 mmol) in chloroform was treated with 1.2 eq. of *m*-chloroperoxybenzoic acid at room temperature. The mixture was then refluxed for 12 h. Workup and chromatography gave 1.9 g 1-benzyl-3,4-epoxy-2-pyrrolidinone, ***10*** (10.1 mmol, 74%): $^1$H NMR ($CDCl_3$): δ 7.39-7.26 (m, 5H), 4.6 (s, 2H), 2.68 (s, 2H), and 2.16 (s, 2H) ppm; $^{13}$C NMR ($CDCl_3$): δ 177.4 (s), 135.5 (s), 128.9 (d), 128.8 (d), 128.6 (d), 128.1 (d), 127.92 (d), 67.1 (d), 37.7 (d), 42.4 (t), and 28.2 (t) ppm; Infrared (neat): 3064 (m), 2928 (m), 1694 (s), 1435 (s), 1169 (m), and 702 (m) cm$^{-1}$; Mass Spectrum (m/z, Rel. intensity): P$^+$ 189 (100), 160 (48), 146 (6.7), 132 (42), 104 (58), 91 (33), 65 (22), and 55 (22). HRMS. Calcd. for $C_{11}H_{11}NO_2$, 189.0790; Observed 189.0791 (± 0.9 mmu).

**1-Benzyl-3,4-epoxy-2-Piperidone, *11***

A stirred solution of 1-benzyl-5,6-dihydropyridin-2-one (***8***, 2.52 g, 13.7 mmol) in chloroform was treated with 1.2 eq. of *m*-chloroperoxybenzoic acid at room temperature. The mixture was then refluxed under the nitrogen for 12 h. Analysis of the reaction mixture by GC/MS showed 25% of the starting material was converted to ***11***. Mass spectral analysis with this small amount of material provided the HRMS, but insufficient material was obtained for NMR analysis. HRMS. Calcd. for $C_{12}H_{13}NO_2$, 203.0946; Observed 203.0940 (± 1.0 mmu).

**1-Benzyl-3,4-epoxy-(1H)-hexahydroazepin-2-one, *12***

To a stirred solution of 1-benzyl-1,5,6,7-tetrahydroazepin-2-one (***9***, 2.65 g, 13.2 mmol) in chloroform was treated with 1.2 eq. of *m*-chloroperoxybenzoic acid at room temperature. The mixture was then refluxed under the nitrogen for 12 h. Analysis of

the reaction mixture by GC/MS showed 5% of the starting material was converted to what appeared to be ***12***. This identification is tentative since we were unable to obtain sufficient material for NMR or conclusive HRMS data.

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