Preparation of α-Alkoxy Amides and α-Hydrazino Amides by Base-Promoted Reactions of *N*-Sulfonyloxy Amides

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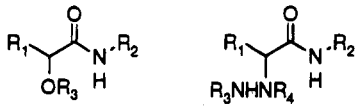
Introduction

N-Sulfonyloxy amides have proven to be interesting and versatile synthetic intermediates. Under ionizing conditions, *N*-triflyloxy amides yield *N*-acyl iminium ions. This entry into *N*-acyl iminium ions is one of the most simple and structurally tolerant yet devised.[1] Alternatively, *N*-mesyloxy amides **1** (and other *N*-sulfonyloxy amides) undergo base-promoted conversion to 2-substituted amides.[2] Two sequentially produced intermediates account for the observed regiochemistry (Scheme 1). Initial base-promoted 1,3-elimination produces an α-lactam **2** which is trapped by good amine nucleophiles to give "rearranged" α-amino amides **3** (path a). When only poor nucleophiles are present, the protic reaction environment results in ring opening of the α-lactam to an ion pair intermediate **4** (path b) which is trapped by even poor nucleophiles at C-2 to produce 2-substituted secondary amides **5**. By this process a variety of relatively weak nucleophiles have been incorporated at C-2 including chloride,[2de] bromide,[2e] hydroxide,[2e] azide,[2b] and hindered amines.[2b]

Considering the success and efficiency of this approach to the synthesis of 2-substituted secondary amides, we sought to extend the method to include alcohol and hydrazine nucleophiles since the resulting 2-alkoxy secondary amides **6** and 2-hydrazino secondary amides **7**, respectively, are not readily accessible. On the other hand these compounds are of interest as potential depsipeptide analogs[3] and as unnatural amino acid derivatives[4a] and azapeptide homologs,[4b,c] respectively, after elaboration.

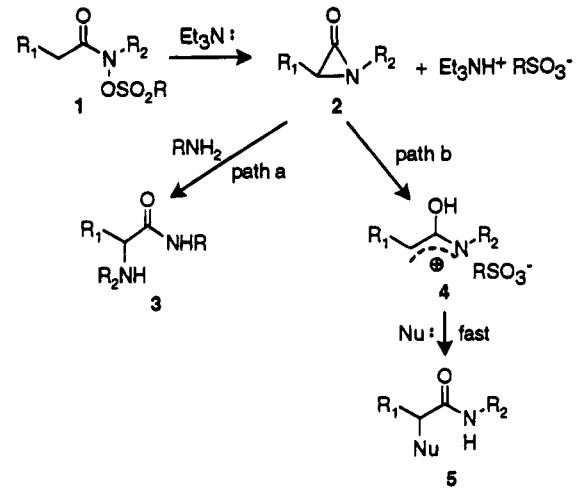


6 **7**

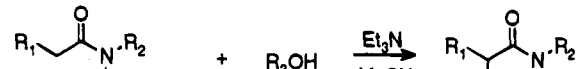
Results

A series of *N*-mesyloxy amides **1a–f** was prepared from the corresponding hydroxamic acids by literature methods.[2b,e] These materials all contained an aromatic group as R_1 to facilitate closure to the α-lactam.[2d] A solution of triethylamine (1 equiv) in acetonitrile was added slowly (10–12 h) to a mixture of the mesylate and an alcohol **8a–e** (>10 equiv) in acetonitrile. Upon workup, the α-alkoxy amide **6** was obtained in good yields

Scheme 1



(eq 1). Neither the nature of the of R_2 group on nitrogen, nor the structure of the alcohol appears to influence the reaction significantly as shown by the yields in Table 1.

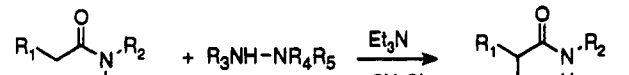


1a, R_1=Ph, R_2=Me
1b, R_1=Ph, R_2=t-Bu
1c, R_1=Ph, R_2=Bn
1d, R_1=Ph, R_2=CH_2CH_2Ph
1e, R_1=3-$CF_3C_6H_4$, R_2=Me
1f, R_1= 1-$C_{10}H_7$, R_2=Me

8a, R_3=Me
8b, R_3=i-Pr
8c, R_3=t-Bu
8d, R_3= E-CH_2CH=$CHCH_3$
8e, R_3= $CH_2C{\equiv}CH$

6

By a similar procedure, triethylamine was added slowly (8–12 h) to mixtures of *N*-mesyloxy amides **1a–c** and hydrazines **9a–e** in dichloromethane (eq 2). Workup provided α-hydrazino amides **7** in the yields shown in Table 2. Comparable yields were obtained for monosubstituted hydrazines **9a,b**, 1,1-disubstituted **9c,d**, and 1,2-disubstituted hydrazines **9e**, which again illustrates the structural tolerance of the method.



1a-c

9a, R_3, R_4=H, R_5=Ph
9b, R_3,R_4=H, R_5=2,4-$C_6H_3Cl_2$
9c, R_3=H, R_4,R_5=Bn
9d, R_3=H, R_4=Me, R_5=Ph
9e, R_3,R_5=Ph, R_4=H

7

Discussion

In both preparations, the slow addition of the base (Et_3N) to a mixture of **1** and alcohol or hydrazine nucleophile is essential for success. Because triethylamine can itself act as a nucleophile toward the ion pair **4**[2d] (Scheme 1), its concentration must be kept as low as possible. Slow addition causes the triethylamine to be converted to the non-nucleophilic triethylammonium salt, and the relatively weak alcohol or hydrazine nucleophile can trap the ion pair **4** successfully. Rapid addition of the triethylamine causes ion pair formation in the presence of unreacted triethylamine, which traps **4**

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Table 1. Preparation of α-Alkoxy Amides 6 from *N*-Mesyloxy Amides and Alcohols

entry	*N*-mesyloxy amide	alcohol	product	yield (%)[a]
1	**1a**	**8a**	**6aa**	72
2	**1a**	**8c**	**6ac**	55
3	**1b**	**8a**	**6ba**	83
4	**1b**	**8c**	**6bc**	63
5	**1c**	**8a**	**6ca**	72
6	**1c**	**8b**	**6cb**	63
7	**1c**	**8c**	**6cc**	63
8	**1c**	**8d**	**6cd**	57
9	**1d**	**8e**	**6de**	71
10	**1e**	**8a**	**6ea**	78
11	**1f**	**8a**	**6fa**	71

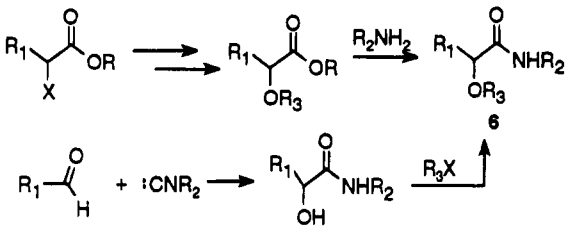
[a] Yields are isolated yields of purified products.

Table 2. Preparation of α-Hydrazino Amides 7 from *N*-Mesyloxy Amides and Hydrazines

entry	*N*-mesyloxy amide	hydrazine	product	yield (%)[a]
1	**1a**	**9a**	**7aa**	65
2	**1b**	**9a**	**7ba**	69
3	**1a**	**9b**	**7ab**	85
4	**1a**	**9c**	**7ac**	64
5	**1c**	**9c**	**7cc**	45
6	**1a**	**9d**	**7ad**	72
7	**1a**	**9e**	**7ae**	68

[a] Yields are isolated yields of purified products.

Scheme 2



preferentially over the weaker alcohol and hydrazine nucleophiles.

This method for the preparation of 2-alkoxy secondary amides is unique in that the oxidation level of nitrogen in the *N*-mesyloxy amide is transferred to the 2-position in the product and the alkoxy group is introduced directly into the product. The method seems to be unaffected by the alcohol structure and is thus adaptable to a large number of alcohols. Alternate preparations of 2-alkoxy secondary amides would necessarily involve condensing 2-alkoxy acids with amines or alkylating 2-hydroxy secondary amides (Scheme 2). The former route is the most viable but still requires several steps and employs a 2-oxidized acid derivative as the starting material. The latter requires formation of a 2-hydroxy secondary amide (which is very problematic[5]) and an alkylation of the hydroxyl group which imposes structural limits on the R_3 groups that can be used. The present method is simple, short, and effective without apparent structural limitations for either the nitrogen substituent R_2 or the alkoxy group R_3. A conjugating group as R_1 is still a requirement.[2d]

The synthesis of 2-hydrazino secondary amides by this method is unique as well, since it is direct and permits substituents to be included at one or both of the hydrazine nitrogens. While direct methods for the preparation of α-hydrazino amides are unknown, these compounds could potentially be prepared by the condensation of α-hydrazino acids with amines. The preparation of α-hydrazino acids and esters has been investigated recently by both substitution[4a,6] and oxidative addition methods;[7] however, these methods do not give N-substituted hydrazine derivatives, and further manipulation to give such derivatives would be difficult. In contrast the present method is direct, effective, and provides an unknown class of substituted amides.

Experimental Section

Melting points are uncorrected. Elemental analyses were performed by M-H-W Laboratories, Phoenix, AZ. TLC was performed on silica gel 60 F254 plates from EM reagents and visualized by UV irradiation and/or iodine. Flash column chromatography was performed using silica gel 60 (230–400mesh). *N*-Mesyloxy-*N*-alkylacetanilides were prepared by the literature methods,[2d] and the products were purified by flash column chromatography (hexanes–ethyl acetate), kugelrohr distillation, or recrystallization (hexanes–dichloromethane). Crotyl alcohol (*cis–trans* mixture), propargyl alcohol, phenylhydrazine, *N,N'*- diphenylhydrazine, (2,4-dichlorophenyl)hydrazine and *N*-phenyl-*N*-methylhydrazine were purchased from Aldrich and used as received. *N,N*-Dibenzylhydrazine[8] was prepared according to a known procedure.

Preparation of 2-Alkoxy-2-aryl-*N*-alkylacetamides. General Procedure. To a solution of the *N*-mesyloxy-2-aryl-*N*-alkylacetamide **1** (2 mmol) in CH_3CN (12 mL) and the corresponding alcohol **8** (12 mL each in case of methanol, 2-propanol, or tert-butyl alcohol, and 10 equiv each in case of crotyl and propargylic alcohols) was added triethylamine (212 mg, 2.1mmol) in 24 mL of CH_3CN over a period of 10–12 h. The mixture was allowed to stir overnight (ca. ~18–20 h). The solvent and excess of alcohol were removed under pressure, and the residue was diluted with ethyl acetate (60 mL), washed with water (4 × 20 mL), 1 N HCl (15 mL), and brine (20 mL), and dried over $MgSO_4$. After rotary evaporation, the product was purified by flash column chromatography, distillation (Kugelrohr), or recrystallization.

2-Methoxy-*N*-methyl-2-phenylethanamide (6aa) was prepared from **1a** (500 mg, 2.05 mmol) and **8a** as a crude oil (295 mg, 83%) which on flash chromatography (hexanes–ethyl acetate, 4:6) gave **6aa** as an oil (265 mg, 72%): ^{1}H NMR δ 2.84 (d, J = 5.08 Hz, 3H), 3.36 (s, 3H), 4.62 (s, 1H), 6.77 (bs, 1H), 7.33–7.43 (m, 5H); ^{13}C NMR δ 25.7, 57.2, 83.8, 126.9, 128.3, 128.4, 129.0, 129.8, 137.0, 171.1; IR ($CHCl_3$) 3310, 3064, 1652, 1602 cm^{-1}. Anal. Calcd for $C_{10}H_{13}NO_2$: C, 67.01; H, 7.31. Found: C, 66.92; H, 7.40.

2-*tert*-Butoxy-*N*-methyl-2-phenylethanamide (6ac) was prepared from **1a** (500 mg, 2.05 mmol) and **8c** as a crude oil (310 mg, 69%) which on flash chromatography (hexanes–ethyl acetate, 6:4) gave **6ac** as an oil (295 mg, 62%): ^{1}H NMR δ 1.23 (s, 9H), 2.81 (d, J = 5.08 Hz, 3H), 4.94 (s, 1H), 5.85 (bs, 1H), 6.81–6.85 (m, 3H), 7.25-7.50 (m, 2H); ^{13}C NMR δ 25.7, 28.1, 74.5,

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126.3, 127.5, 128.1, 140.0, 173.1; IR ($CHCl_3$) 3351, 3091, 1683 cm^{-1}. Anal. Calcd for $C_{13}H_{19}NO_2.H_2O$: C, 65.24; H, 8.00. Found: C, 65.26; H, 8.08.

2-Methoxy-*N*-*tert*-butyl-2-phenylethanamide (6ba) was prepared from **1b** (570 mg, 2.0 mmol) and **8a** as a crude oil (420 mg, 95%) which on flash chromatography (hexanes–ethyl acetate, 1:1) gave **6ba** as a white solid (370 mg, 84%): mp 45–46 °C; ^1H NMR δ 1.36 (s, 9H), 3.34 (s, 3H), 4,48 (s, 1H), 7.35–7.36 (m, 5H); ^{13}C NMR δ 28.7, 50.8, 57.0, 84.1, 127.0, 128.2, 128.4, 137.4, 169.6; IR ($CHCl_3$) 3328, 3064, 1684, 1603 cm^{-1}. Anal. Calcd for $C_{13}H_{19}NO_2 \cdot {}^1/_2H_2O$: C, 67.79; H, 8.31. Found: C, 67.74; H, 8.28.

2-*tert*-Butoxy-*N*-*tert*-butyl-2-phenylethanamide (6bc) was prepared from **1b** (570 mg, 2.0 mmol) and **8c** as a crude oil (460 mg, 87%) which on flash chromatography (hexanes–ethyl acetate, 7:3) gave **6bc** as a white solid (330 mg, 63%): mp 104–105 °C; ^1H NMR δ 1.24 (s, 9H), 1.34 (s, 9H), 4.79 (s, 1H), 6.75 (bs, 1H), 7.25–7.33 (m, 3H),7.45 (d, J = Hz, 2H); ^{13}C NMR δ 28.2, 28.7, 50.6, 75.0, 76.0, 126.4, 127.5, 128.9, 140.1, 171.7; IR ($CHCl_3$) 3398, 3018, 1674 cm^{-1}. Anal. Calcd for $C_{16}H_{25}NO_2$: C, 72.96; H, 9.56. Found: C, 72.90; H, 10.02.

2-Methoxy-*N*-benzyl-2-phenylethanamide (6ca) was prepared from **1c** (650 mg, 2.03 mmol) and **8a** as a crude oil (515 mg, 100%) which on flash chromatography (hexanes–ethyl acetate, 1:1) gave **6ca** as a white solid (375 mg, 72%): mp 63–64 °C; ^1H NMR δ 3.31 (s, 3H), 4.43 (dd, J = 6.03 and 5.78 Hz, 2H), 4.66 (s, 1H), 7.12 (bs, 1H), 7.21–7.43 (m, 10H); ^{13}C NMR δ 42.4, 56.6, 83.2, 126.5, 126.9, 127.2, 127.9, 128.0, 128.1, 136.5, 137.6, 169.9; IR ($CHCl_3$) 3352, 2932, 1660 cm^{-1}. Anal. Calcd for $C_{16}H_{17}NO_2$: C, 75.26; H, 6.71. Found: C, 75.40; H, 6.88.

2-Isopropoxy-*N*-benzyl-2-phenylethanamide (6cb) was prepared from **1c** (650 mg, 2.03 mmol) and **8b** as a crude oil (500 mg, 87%) which on flash chromatography (hexanes–ethyl acetate, 6:4) gave **6cb** as an oil (360 mg, 63%): ^1H NMR δ 1.15 (dd, J = 6.28 and 6.06 Hz, 6H), 3.66 (m, 1H), 4.44 (d, J = 6.03 Hz, 2H), 4.90 (s, 1H), 7.16–7.48 (m, 11H); ^{13}C NMR δ 21.6, 22.8, 42.9, 70.9, 79.5, 126.9, 127.4, 127.6, 128.2, 128.4, 128.7, 138.3, 138.3, 171.4; IR ($CHCl_3$) 3418, 3329, 1669 cm^{-1}. Anal. Calcd for $C_{18}H_{21}NO_2$: C, 76.29; H, 7.47. Found: C, 76.32; H, 7.57.

2-*tert*-Butoxy-*N*-benzyl-2-phenylethanamide (6cc) was prepared from **1c** (650 mg, 2.03 mmol) and **8c** as a crude oil (550 mg, 92%) which on flash chromatography (hexanes–ethyl acetate, 7:3) gave **6cc** as an oil (380 mg, 63%): ^1H NMR δ 1.21 (s, 9H), 4.44 (dd, J = 6.10 and 5.79 Hz, 2H), 5.01 (s, 1H), 7.19–7.53 (m, 11H); ^{13}C NMR δ 27.6, 42.4, 74.1, 75.6, 125.8, 126.8, 127.0, 127.1, 127.7, 128.1, 137.7, 138.4, 171.9; IR ($CHCl_3$) 3415, 3355, 2976, 1672 cm^{-1}. Anal. Calcd for $C_{19}H_{23}NO_2$: C, 76.73; H, 7.79. Found: C, 76.84; H, 7.72.

2-(Crotyloxy)-*N*-benzyl-2-phenylethanamide (6cd) was prepared from **1c** (1.3 g, 4.07 mmol) and **8d** as a crude oil (980 mg, 82%) which on flash chromatography (hexanes–ethyl acetate, 1:1) gave **6cd** (mixture of *cis* and *trans* isomers) as an oil (680 mg, 57%); ^1H NMR δ 1.69 (d, J = 6.0 Hz, 3H), 3.87–4.02 (m, 2H), 4.46 (d, J = 5.96 Hz, 2H), 4.84 (s, 1H), 5.56–5.64 (m, 2H), 7.11 (bs, 1H), 7.22–7.44 (m, 10H); ^{13}C NMR δ 17.7, 42.7, 42.9, 64.4, 69.9, 80.6, 126.4, 127.0, 127.4, 127.6, 127.6, 128.3, 128.3, 128.4, 128.6, 130.8, 137.3, 138.1, 170.8; IR ($CHCl_3$) 3418, 3031, 1672 cm^{-1}. Anal. Calcd for $C_{19}H_{21}NO_2$: C, 77.25; H, 7.16. Found: C, 77.12; H, 7.28.

2-(Propargyloxy)-*N*-(phenylethyl)-2-phenylethanamide (6de) was prepared from **1d** (2.0 g, 6.0 mmol) and **8e** as a crude oil (1.7 gm, 97%) which on kugelrhor distillation (200–220 °C/0.5 mm) gave **6de** as an oil (1.25 gm, 71%): ^1H NMR δ 2.46 (t, J = 2.4 Hz, 1H), 2,82 (t, J = 7.0 Hz, 2H), 3.47–3.61 (m, 2H), 4.06 and 4.05 (2 AB q, J = 15.7 and 15.8 Hz, 2H), 4.98 (s, 1H), 6.78 (bs, 1H), 7.14–7.33 (m, 10H); ^{13}C NMR δ 35.5, 40.1, 56.1, 75.6, 78.4, 80.3, 126.3, 127.3, 128.5, 128.7, 136.1, 138.6, 169.8; IR (neat) 3297, 2117, 1670 cm^{-1}. Anal. Calcd for $C_{19}H_{19}NO_2$: C, 77.78; H, 6.52. Found: C, 77.38; H, 6.68.

2-Methoxy-*N*-methyl-2-(3′-trifluorophenyl)ethanamide (6ea) was prepared from **1a** (630 mg, 2.02 mmol) and **8a** as a crude oil (510 mg, 100%) which on flash chromatography (hexanes–ethyl acetate, 6:4) gave **6ea** as an oil (390 mg, 78%): ^1H NMR δ 2.84 (d, J = 4.9 Hz, 3H), 3.40 (s, 3H), 4.68 (s, 1H), 6.83 (bs, 1H), 7.48–7.68 (m, 4H); ^{13}C NMR δ 26.3, 58.1, 83.6, 123.9, 124.0, 125.7, 125.7, 129.5, 131.1, 138.8, 171.0; IR ($CHCl_3$) 3314, 2942, 1668 cm^{-1}. Anal. Calcd for $C_{11}H_{12}NO_2F_3$: C, 53.44; H, 4.89. Found: C, 53.50; H, 4.78.

2-Methoxy-*N*-methyl-2-(1-napthyl)ethanamide (6fa) was prepared from **1f** (500 mg, 1.70 mmol) and **8a** as a crude solid (390 mg, 100%) which on flash chromatography (hexanes–ethyl acetate, 1:1) gave **6fa** as a white solid (280 mg, 71%); mp 91–93 °C; ^1H NMR δ 2.87 (d, J = 4.8 Hz, 3H), 3.37 (s, 3H), 5.26 (s, 1H), 6.85 (bs, 1H), 7.42–7.57 (m, 4H), 7.82–7.90 (m, 2H), 8.04 (m, 1H); ^{13}C NMR δ 25.7, 57.2, 82.3, 124.0, 124.1, 125.6, 125.7, 126.2, 126.3, 128.4, 128.6, 129.1, 129.2, 131.5, 132.8, 134.0, 171.1; IR ($CHCl_3$) 3430, 2941, 1669 cm^{-1}. Anal. Calcd for $C_{14}H_{15}NO_2$: C, 73.34; H, 6.59. Found: C, 73.54; H, 6.62.

Synthesis of 2-(*N*-Arylhydrazino)-*N*-alkylphenylethanamides: General Procedure. To a solution of the N-mesyloxy-2-aryl-N-alkylacetamide **1** (2 mmol) and the hydrazine (2.2 mmol) in CH_2Cl_2 (25 mL) was added triethylamine (212 mg, 2.1mmol) in 24 mL of CH_2Cl_2 over a period of 8–12 h. The mixture was stirred overnight (ca. ~20 h). The solvent was removed and the residue diluted with ethyl acetate (60mL), washed with water (4 × 20mL), brine (20mL) and dried over $MgSO_4$. After rotary evaporation, the product was purified *immediately* (the crude products decomposed on storage, but the purified products could be stored without any decomposition) by flash column chromatography or recrystallization.

2-(*N*′-Phenylhydrazino)-*N*-methyl-2-phenylethanamide (7aa) was prepared from **1a** (500 mg, 2.05 mmol) and **9a** as a crude oil (475 mg, 91%) which on flash chromatography (hexanes–ethyl acetate, 1:1) gave **7aa** as a light yellow oil (340 mg, 65%): ^1H NMR δ 2.82 (d, J = 4.94 Hz, 3H), 3.44 (bs, 2H, exchangeable with D_2O), 5.40 (s, 1H), 6.85–7.06 (m, 6H), 7.19–7.40 (m, 5H); ^{13}C NMR δ 26.0, 70.4, 115.2, 120.4, 128.2, 128.5, 129.1, 129.2, 134.4, 151.0, 171.5; IR ($CHCl_3$) 3324, 3017, 1656 cm^{-1}. Anal. Calcd for $C_{15}H_{17}N_3O$: C, 70.56; H, 6.71. Found: C, 70.72; H, 6.78.

2-(*N*′-Phenylhydrazino)-*N*-*tert*-butyl-2-phenylethanamide (7ba) was prepared from **1b** (570 mg, 2.0 mmol) and **9a** as a crude solid (580 mg, 98%) which on flash chromatography (hexanes–ethyl acetate, 6:4) gave **7ba** as a light yellow solid (410 mg, 69%): mp 169–170 °C; ^1H NMR δ 1.37 (s, 9H), 3.51 (bs, 2H, exchangeable with D_2O), 5.28 (s, 1H), 6.57 (bs, 1H), 6.88, 6.92 (two d, J = 6.81, 6.67 Hz, 2H), 7.10 (d, J = 8.50 Hz, 3H), 7.26–7.32 (m, 5H); ^{13}C NMR δ 28.7, 51.4, 71.2, 115.3, 120.2, 128.2, 128.6, 129.0, 129.2, 134.7, 151.5, 169.9; IR ($CHCl_3$) 3397, 1681, 1605 cm^{-1}. Anal. Calcd for $C_{18}H_{23}N_3O$: C, 72.69; H, 7.79. Found: C, 72.71; H, 7.60.

2-(*N*′-(2,4-Dichlorophenyl)hydrazino))-*N*-methyl-2-phenylethanamide (7ab) was prepared from **1a** (750 mg, 3.08 mmol) and **9b** as a crude solid (930 mg, 93%) which on crystallization (hexanes–dichloromethane, 8:2) gave **7ab** as a white solid (850 mg, 85%); mp 170–172 °C; ^1H NMR δ 2.89 (d, J = 4.9 Hz, 3H), 3.79 (bs, 2H, exchangeable with D_2O), 5.15 (s, 1H), 6.70 (bs, 1H), 7.07–7.37 (m, 8H); ^{13}C NMR δ 26.1, 71.4, 123.5, 124.9, 128.6, 129.7, 131.0, 133.0, 133.1, 149.6; IR ($CHCl_3$) 3327, 3020, 1667, 1646 cm^{-1}. Anal. Calcd for $C_{15}H_{15}Cl_2N_3O$: C, 55.57; H, 4.66. Found: C, 55.85; H, 4.48.

2-(*N*′,*N*′-Dibenzylhydrazino)-*N*-methyl-2-phenylethanamide (7ac) was prepared from **1a** (1.75 gm, 7.2 mmol) and **9c** as a crude solid (2.3 gm, 89%) which on flash chromatography (hexanes–ethyl acetate, 7:3) gave **7ac** as a white solid (1.64 g, 64%); mp 95–96 °C; ^1H NMR δ 2.26 (d, J = 4.9 Hz, 3H), 3.37 (d, J = 12.8 Hz, 2H), 4.03 (d, J = 12.7 Hz, 2H), 4.49 (s, 1H), 5.99 (bs, 1H), 7.25–7.36 (m, 15H); ^{13}C NMR δ 25.8, 60.8, 66.6, 127.4, 128.2, 128.3, 128.7, 129.7, 137.4, 137.9, 172.1; IR (neat) 3397, 2927, 1674 cm^{-1}. Anal. Calcd for $C_{23}H_{25}N_3O$: C, 76.84; H, 7.01. Found: C, 76.59; H, 6.87.

2-(*N*,*N*-Dibenzylhydrazino)-*N*-benzylphenylethanamide (7cc) was prepared from **1c** (1.0 g, 3.13 mmol) and **9c** as a crude oil (1.1 g, 81%) which on flash chromatography (hexanes–ethyl acetate, 6:4) gave **7cc** as a white solid (610 mg, 45%): mp 92–93 °C, ^1H NMR δ 2.83 (bs, 1H, exchangeable with D_2O), 3.40 (d, J = 12.9 Hz, 2H), 3.99 (d, J = 12.8 Hz, 2H), 4.39 (dd, J = 7.6 and 15.0 Hz, 2H), 3.85 (dd, J = 5.0 and 15.3 Hz, 2H), 4.56 (s, 1H), 6.62 (bs, 1H), 7.00 (bs, 2H), 7.19–7.27 (m, 18H); ^{13}C NMR δ 42.4, 60.6, 66.6, 126.8, 127.2, 127.4, 127.5, 128.1, 128.3, 128.7, 129.7, 137.1, 137.8, 138.6, 171.5; IR ($CHCl_3$) 3375, 3030, 1665 cm^{-1}. Anal. Calcd for $C_{29}H_{29}N_3O \cdot {}^1/_2H_2O$: C, 78.34; H, 6.80. Found: C, 78.26; H, 6.88.

2-(*N*-Phenyl-*N*-methylhydrazino)-*N*-methyl-2-phenylethanamide (7ad) was prepared from **1a** (750 mg, 3.08 mmol) and **9d** as a crude oil (740 mg, 89%) which on flash chromatog-

raphy (hexanes–ethyl acetate, 1:1) gave **7ad** as an oil (600 mg, 72%); ^{1}H NMR δ 2.72 (d, J = 4.9 Hz, 3H), 3.03 (s, 3H), 3.9 (bs, 1H, exchangeable with D_2O), 4.62 (s, 1H), 6.52 (bs, 1H), 6.80–7.47 (m, 10H); ^{13}C NMR δ 26.1, 41.8, 66.7, 114.4, 119.5, 127.9, 128.5, 128.8, 129.2, 137.5, 151.4, 171.9; IR (neat) 3421, 3016, 1669 cm^{-1}. A small impurity (<3%) which chromatographed with **7ad** precluded its elemental analysis.

2-(*N*-Phenyl-*N'*-phenylhydrazino)-*N*-methyl-2-phenylethanamide (7ae) was prepared from **1a** (1.0 gm,4.11 mmol) and **9e** as a crude solid (1.21 gm, 89%) which on recrystallization (hexanes–dichloromethane, 7:3) gave **7ae** as a light yellow solid (920 mg, 68%): mp 127–128 °C; ^{1}H NMR δ 2.66 (d, J = 4.9 Hz, 3H), 5.52 (s, 1H), 6.35 (bs, 1H), 6.55 (d, J = 8.0 Hz, 2H), 6.65 (d, J = 6.9 Hz, 1H), 6.83–7.38 (m, 13H); ^{13}C NMR δ 26.1, 70.2, 112.0, 115.3, 119.0, 120.8, 128.3, 128.4, 128.9, 129.0, 129.2, 129.7, 134.7, 147.6, 150.0, 171.4; IR ($CHCl_3$) 3439, 3331, 3018, 1669, 1602, 1497 cm^{-1}. Anal. Calcd for $C_{21}H_{21}N_3O$: C, 76.10; H, 6.38. Found: C, 75.88; H, 6.35.

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Supporting Information Available: ^{13}C NMR spectra for compound **7ad** (1 page). This material is contained in libraries on microfiche, immediately follows this article in the microfilm version of the journal, and can be ordered from the ACS; see any current masthead for ordering information.

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