heated at reflux for 12 h. The yellow solution was concentrated to a small volume. Trituration with ether afforded 5.35 g (57%) of **5b**: mp 132–133 °C (yellow prisms from EtOH–hexane); ir (Nujol) 3300 (NH), 1685 cm^{-1} (C=O); uv λ_{max} (95% EtOH) 228 nm (log ϵ 5.25), 252 sh (4.97), 288 sh (4.51); NMR ($CDCl_3$) δ 8.00–7.82 (m, 1, H ortho to C=O), 7.35–7.15 (m, 1, H para to C=O), 7.10–6.85 (m, 1, H para to N), 6.75–6.60 (m, 1, H ortho to N), 6.45 (broad s, 1, NH, D_2O exchangeable), 3.30 (s, 3, NCH_3), 2.07 (s, 3, CCH_3); mass spectrum (70 eV) *m/e* 189 (molecular ion).

Anal. Calcd for $C_{10}H_{11}N_3O$: C, 63.47; H, 5.86; N, 22.21. Found: C, 63.60; H, 5.92; N, 21.93.

Preparation of 2-Ethyl-3,4-dihydro-4-methyl-5*H*-1,3,4-benzotriazepin-5-one (5c). An 8.26-g (50.0 mmol) quantity of **2**[12] and 8.81 g (50.0 mmol) of triethyl orthopropionate (Aldrich) in 50 ml of EtOH were heated at reflux for 12 h. The light yellow solution was concentrated to a thick oil and crystallized from EtOH–hexane to afford 5.92 g (58%) of **5c** (yellow prisms): mp 103–104.5 °C; ir (Nujol) 3250 (NH), 1665 cm^{-1} (C=O); uv λ_{max} (95% EtOH) 229 nm (log ϵ 5.24), 251 sh (4.98), 285 sh (4.41); NMR ($CDCl_3$) δ 8.00–7.83 (m, 1, H ortho to C=O), 7.40–7.16 (m, 1, H para to C=O), 7.16–6.77 (m, 3, remaining aromatic plus NH), 3.37 (s, 3, NCH_3), 2.38 (q, J = 5 Hz, 2, CH_2), 1.17 (t, J = 5 Hz, 3, CH_2CH_3); mass spectrum (70 eV) *m/e* 203 (molecular ion).

Anal. Calcd for $C_{11}H_{13}N_3O$: C, 65.00; H, 6.45; N, 20.68. Found: C, 65.30; H, 6.49; N, 20.56.

Preparation of 3,4-Dihydro-4-methyl-2-phenyl-5*H*-1,3,4-benzotriazepin-5-one (5d). An 8.26-g (50.0 mmol) quantity of **2**[12] and 11.2 g (50.0 mmol) of triethyl orthobenzoate (ICN Pharmaceuticals, Inc.) in 40 ml of EtOH were heated at reflux for 12 h. The dark yellow solution was concentrated and the resulting solid was recrystallized from EtOH–ether to afford 7.90 g (63%) of **5d** (yellow prisms): mp 162–163.5 °C; ir (Nujol) 3260 (NH), 1610 cm^{-1} (C=O); uv λ_{max} (95% EtOH) 229 nm (log ϵ 5.34), 250 sh (4.25), 297 sh (4.81); NMR ($CDCl_3$) δ 8.03–7.85 (m, 1, H ortho to C=O), 7.85–7.65 (m, 2, aromatic), 7.55–7.26 (m, 4, aromatic), 7.15–6.82 (m, 2, aromatic), 6.79 (s, 1, NH, D_2O exchangeable), 3.43 (s, 3, CH_3); mass spectrum (70 eV) *m/e* 251 (molecular ion).

Anal. Calcd for $C_{15}H_{13}N_3O$: C, 71.69; H, 5.21; N, 16.72. Found: C, 71.60; H, 5.23; N, 16.65.

Registry No.—**1**, 118-48-9; **2**, 59169-69-6; **3**, 59169-47-0; **5a**, 59169-76-5; **5b**, 59169-80-1; **5c**, 59187-60-9; **5d**, 59169-87-8; methyhydrazine, 60-34-4; triethyl orthoformate, 122-51-0; triethyl orthoacetate, 78-39-7; triethyl orthopropionate, 115-80-8; triethyl orthobenzoate, 1663-61-2.

References and Notes

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(10) The isatoic anhydride (mp 243–247 °C dec, colorless prisms) used in this reaction was prepared as described by N. P. Peet and S. Sunder, *J. Org. Chem.*, **39**, 1931 (1974), from methyl anthranilate.
(11) We are indebted to Dr. R. L. Jacobs of Sherwin-Williams Chemicals for suggesting these reaction conditions in a private communication.
(12) The mixture of hydrazides **2** and **3** (85:15, respectively) was used in this reaction. Yield is based on the total weight of the starting mixture.
(13) R. M. Silverstein and G. C. Bassler, "Spectrometric Identification of Organic Compounds", 2d ed, Wiley, New York, N.Y., 1967, p 162.
(14) Melting points are uncorrected. Ir spectra were recorded with a Perkin-Elmer 727B instrument; NMR spectra with Varian T-60 and Perkin-Elmer R32 (90 MHz) spectrometers; uv spectra with a Cary 15 spectrophotometer; mass spectra with a Hitachi RMU-6D mass spectrometer. Combustion analyses were performed by Dow Analytical Laboratories.
(15) The position of the NCH_3 group assigned to **3** was identical with that found for an authentic sample of **3**, whose synthesis will be described in a future report.[3c] The 85:15 mixture of hydrazides **2** and **3** was also substantiated by VPC analysis (5 ft × 0.125 in. 5% SE-30, 225 °C, 30 ml/min of He) where **2** eluted at 1.7 min and **3** at 2.3 min. Coinjection of this mixture with authentic **3** enhanced the peak at 2.3 min.
(16) Another paper by R. W. Leiby and N. D. Heindel, describing compounds **5a, b,** and **d**, appears in this issue.

Preparation and Utility of 1-Acetyl-1-methylhydrazine

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An efficient, simple synthesis of 1-acetyl-1-methylhydrazine (**1**) from acetyl chloride and methylhydrazine is reported. The utility of this protected methylhydrazine unit is demonstrated by the preparation of 1-methyl-4-phenylsemicarbazide (**5**) and 2-(*o*-nitrobenzoyl)-1-methylhydrazine (**14**). 2-(*o*-Aminobenzoyl)-1-acetyl-1-methylhydrazine (**9**), which was prepared either from **1** and isatoic anhydride (**10**) or from **1** and *o*-nitrobenzoyl chloride (**7**) followed by reduction, was cyclized to 2-methyl-3-(methylamino)-4(3*H*)-quinazolinone (**11**) with 10% sulfuric acid. The mechanism of this transformation, which demonstrates the utility of **1** in heterocyclic synthesis, is discussed.

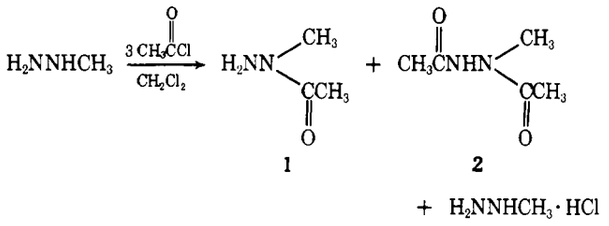
1-Acetyl-1-methylhydrazine has been prepared from the monoacetylhydrazone of 2,3-butanedione by methylation of the potassium salt with methyl iodide and subsequent hydrolysis.[1] (An earlier report,[2] describing 1-acetyl-1-methylhydrazine as a solid, mp 98 °C, as the product from this same synthetic procedure is in error.) This three-step synthesis is cumbersome and the overall yield is poor.

A more recent procedure[3] describes the preparation of 1-acetyl-1-methylhydrazine from methylhydrazine and acetic anhydride in acetic acid (99% purity in 46% yield) or pyridine (96% purity in 76% yield). These procedures suffer the disadvantages of requiring specialized equipment, specific temperature monitoring, a long reaction time, a neutralization step which produces troublesome sodium acetate trihydrate, and extractions with a toxic solvent (pyridine). Distillation of the crude product is also troubled by the presence of pyridine, water, methylhydrazine, and a significant amount of unidentified white solid. These drawbacks are obviated by the following procedure, which is exceedingly simple.

A methylene chloride solution of acetyl chloride was added to a rapidly stirring solution of 3 equiv of methylhydrazine in methylene chloride. The methylhydrazine hydrochloride was

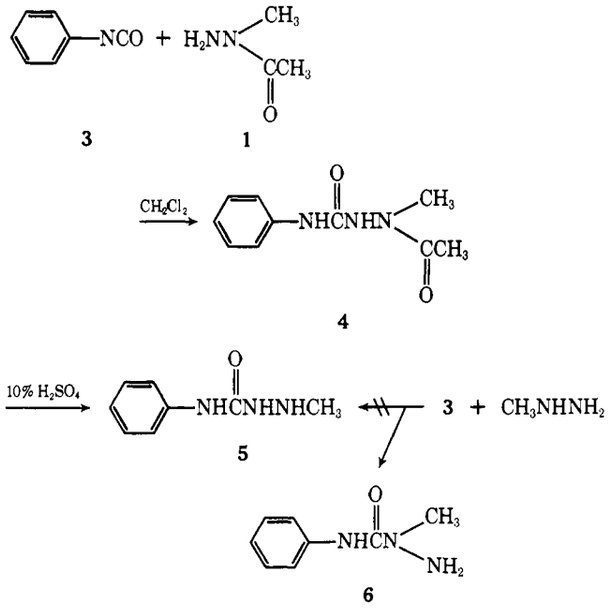
removed by filtration and the concentrated filtrate distilled under reduced pressure to yield 60–65% of pure 1-acetyl-1-methylhydrazine (1). A second fraction could be obtained which yielded 25–29% of (crude) 1,2-diacetylmethylhydrazine (2). See Scheme I.

Scheme I



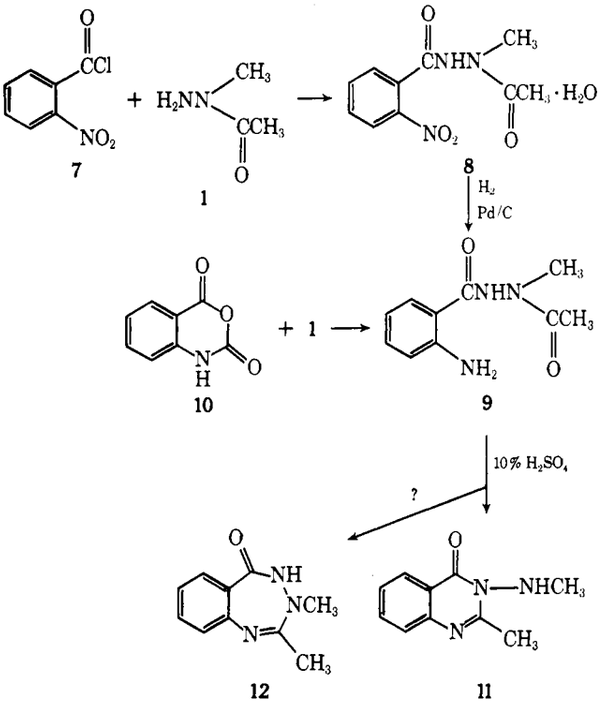
The methyl-bearing nitrogen of methylhydrazine has been shown to selectively attack reactive functional groups such as carboxylic acid anhydrides[3,4] and chlorides,[5] isocyanates,[5,6] and isothiocyanates.[6] By acylating the methyl-bearing nitrogen of methylhydrazine, a derivative is produced which can react only by nucleophilic attack of the primary amino nitrogen. Thus, we were able to produce 1-acetyl-1-methyl-4-phenylsemicarbazide (4) in 86% yield from the reaction of 1 with phenyl isocyanate (3). The acetyl group was cleanly removed by hydrolysis with 10% sulfuric acid to yield 1-methyl-4-phenylsemicarbazide (5), isomeric with 2-methyl-4-phenylsemicarbazide (6), which is the sole product obtained from the reaction of methylhydrazine with 3.[7,8] See Scheme II.

Scheme II



In exploring the utility of 1-acetyl-1-methylhydrazine (1) in heterocyclic syntheses, we treated *o*-nitrobenzoyl chloride (7) with 1, as shown in Scheme III. Catalytic reduction of the resulting 2-(*o*-nitrobenzoyl)-1-acetyl-1-methylhydrazine monohydrate (8) produced the corresponding aniline 9, which could also be prepared from isatoic anhydride (10) and 1. Treatment of 9 with 10% sulfuric acid led to a new compound, from net dehydration. At this point we suspected that the new material was 2-methyl-3-(methylamino)-4(3*H*)-quinazolinone

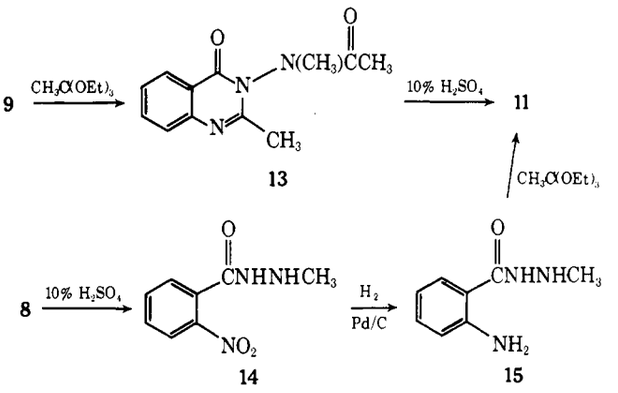
Scheme III



(11), but we could not rule out the possibility of the interesting benzotriazepinone 12.

To establish the structure of this new product we synthesized authentic 11 by the routes shown in Scheme IV. Com-

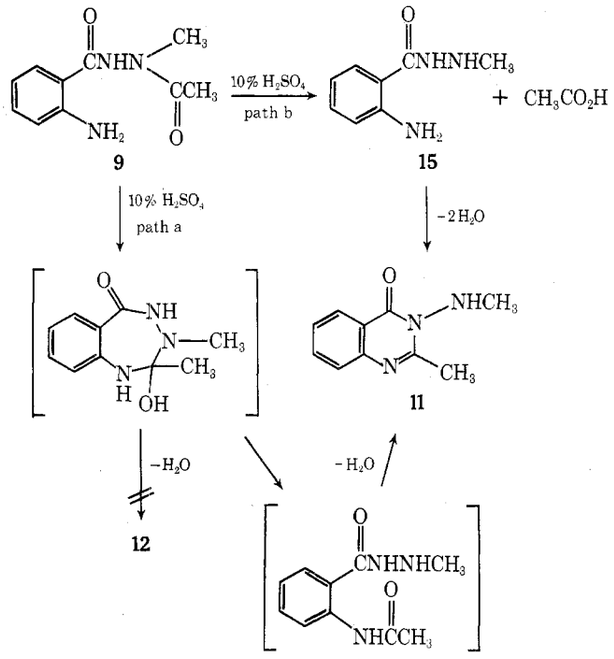
Scheme IV



pound 9 was cyclized with triethyl orthoacetate to yield *N*-methyl-*N*-[2-methyl-4-oxo-3(4*H*)-quinazolinyl]acetamide (13). Subsequent hydrolysis with 10% sulfuric acid produced 11. Alternatively, 8 was hydrolyzed with 10% sulfuric acid to 2-(*o*-nitrobenzoyl)-1-methylhydrazine (14), which was catalytically reduced to 2-(*o*-aminobenzyl)-1-methylhydrazine (15).[10] Hydrazide 15 was then cyclized to 11 with triethyl orthoacetate. Quinazolinone 11, made by the routes shown in Scheme IV, was identical with the product obtained from the treatment of 9 with sulfuric acid (Scheme III).

Two possible mechanisms for the conversion of diacylhydrazine 9 to quinazolinone 11 are depicted in Scheme V. Path a involves the initial transfer of the acetyl moiety to the aromatic amino group via a hydroxybenzotriazepinone to afford 2-[*o*-(acetylamino)benzoyl]-1-methylhydrazine, which should readily cyclodehydrate under acidic conditions to give 11.

Scheme V



Alternatively, we considered path b, in which hydrolysis produces hydrazide **15** and acetic acid, which then might condense to form **11**. However, when we treated hydrazide **15** with 1 equiv of acetic acid and 10% sulfuric acid, we isolated only unchanged **15**. We, therefore, favor the mechanism depicted in path a.

The use of 1-acetyl-1-methylhydrazine (**1**) in the preparation of 2-alkyl-1-methylhydrazines is documented.[3,12] A future report from our laboratory will include additional utility of **1** in heterocyclic synthesis.

Experimental Section[13]

Reaction of Acetyl Chloride with Methylhydrazine.[14] To an efficiently stirred solution of 138 g (3.00 mol) of methylhydrazine (Aldrich) in 800 ml of CH_2Cl_2 was added a 78.5-g (1.00 mol) quantity of acetyl chloride (Mallinckrodt) in 250 ml of CH_2Cl_2 over a 30-min period with ice-bath cooling.[15] After 30 min of stirring at room temperature the white solid was removed by filtration and washed with CH_2Cl_2.[16] Evaporation of the filtrate left 80–85 g of clear oil, which was distilled in two major fractions.[17] After a 1–2-g forerun, the first fraction yielded 53–57 g (60–65%) of 1-acetyl-1-methylhydrazine (**1**): bp 75–79 °C (0.60 mm) [lit.[3] bp 103 °C (8 mm)]; n^{25}D 1.4677; ir (neat) 3330 and 3230 (NH), 1640 cm^{-1} (broad, C=O); NMR ($CDCl_3$) δ 4.25 (s, 2, NH_2, D_2O exchangeable), 3.20 and 3.14 (2 singlets, 3, NCH_3), 2.17 and 2.07 (2 singlets, 3, $COCH_3$);[18] mass spectrum (70 eV) *m/e* 88 (molecular ion); VPC analysis (8 ft × 0.125 in., 5% SE-30, 125 °C, 30 ml/min of He) showed a single peak at 1.6 min.

Anal. Calcd for $C_3H_8N_2O$: C, 40.89; H, 9.15; N, 31.80. Found: C, 40.70; H, 8.94; N, 31.64.

Complete distillation of the first fraction was signaled by a head-temperature drop, and an intermediary fraction of viscous, yellow oil (3–4 g) was collected. The second fraction was collected as a clear or yellow liquid which codistilled with a small amount of white solid, and yielded 16–19 g (25–29%) of crude 1,2-diacetylmethylhydrazine (**2**). The distillate was purified by elution through a short column of alumina (Fisher A-540) with CH_2Cl_2. The eluent was concentrated and redistilled to afford 12–16 g (18–25%) of pure **2**:[20] bp 164 °C (1.10 mm); n^{25}D 1.4666; ir (neat) 3250 (broad NH), 167 cm^{-1} (broad C=O); NMR ($CDCl_3$) δ 9.37 (s, 1, NH, D_2O exchangeable), 3.07 (s, 3, NCH_3), 2.03 (s, 6, both CH_3CO groups); mass spectrum (70 eV) *m/e* 131 (molecular ion). VPC analysis (8 ft × 0.125 in., 5% SE-30, 225 °C, 30 ml/min of He) showed a single peak at 1.6 min.

Anal. Calcd for $C_5H_{10}N_2O_2$: C, 46.14; H, 7.75; N, 21.53. Found: C, 45.90; H, 7.58; N, 21.35.

1-Acetyl-1-methyl-4-phenylsemicarbazide (4). To a solution of 11.9 g (0.100 mol) of phenyl isocyanate (Aldrich) in 50 ml of CH_2Cl_2 was added a solution of 8.81 g (0.100 mol) of **1** in 25 ml of CH_2Cl_2 with ice-bath cooling. The resulting white solid was collected and washed with ether to yield 17.9 g (86%) of **4** (mp 156–158 °C): mp 163–164 °C (EtOH); ir (Nujol) 3300, 3200, 3150 and 3100 (NH), 1660 cm^{-1} (broad C=O); NMR (Me_2SO-d_6) δ 8.95 (broad s, 1, NH, D_2O exchangeable), 8.60 (broad s, 1, NH, D_2O exchangeable), 7.58–6.71 (m, 5, aromatic), 3.00 (s, 3, NCH_3), 1.97 (s, 3, $COCH_3$).

Anal. Calcd for $C_{10}H_{13}N_3O_2$: C, 57.96; H, 6.32; N. 20.28. Found: C, 58.00; H, 6.16; N, 20.17.

1-Methyl-4-phenylsemicarbazide (5). A 4.00-g (19.3 mmol) quantity of **4** was mixed with 50 ml of 10% H_2SO_4 and warmed gently (5 min) until solution resulted. After 10 min at room temperature, the solution was diluted with water and extracted with CH_2Cl_2. The CH_2Cl_2 extract was dried (Na_2SO_4) and concentrated to yield 0.82 g (21%) of recovered **4**. The aqueous phase was basified with NaOH, extracted with CH_2Cl_2, and the extracts were dried (Na_2SO_4) and concentrated to yield 1.98 g (62%) of **5**: mp 107–108 °C (EtOH) (lit.[7c] mp 102–104 °C); ir (Nujol) 3350 (s), 3280 (s), and 3250 (NH), 1675, 1640 cm^{-1}; NMR ($CDCl_3$) δ 8.10 (broad s, 1, NH), 7.50–6.75 (m, 5, aromatic), 6.60 (broad s, 1, NH), 3.60 (broad s, 1, NH), 2.60 (s, 3, CH_3).

Anal. Calcd for $C_8H_{11}N_3O$: C, 58.16; H, 6.71; N, 25.44. Found: C, 57.90; H, 6.70; N, 25.22.

2-(*o*-Nitrobenzoyl)-1-acetyl-1-methylhydrazine Monohydrate (8). To a solution of 21.0 g (0.113 mol) of *o*-nitrobenzoyl chloride (Aldrich) in 100 ml of CH_2Cl_2 was added 19.9 g (0.226 mol) of **1** in 25 ml of CH_2Cl_2 with ice-bath cooling. After 1 h, 100 ml of water was added and a heavy precipitate formed. The precipitate was collected and air dried to yield 18.5 g (64%) of **8**: mp 106–108 °C (EtOH); ir (Nujol) 3440–3170 (NH and H_2O), 1670, 1640 cm^{-1}; NMR (Me_2SO-d_6) δ 11.00 (s, 1, NH), 8.20–8.00 (m, 1, H ortho to C=O), 8.00–7.60 (m, 3, remaining aromatic), 3.50 (s, 2, H_2O), 3.08 (s, 3, NCH_3), 2.02 (s, 3, $COCH_3$).

Anal. Calcd for $C_{10}H_{13}N_3O_5$: C, 47.06; H, 5.13; N, 16.47. Found: C, 47.00; H, 5.10; N, 16.53.

2-(*o*-Aminobenzoyl)-1-acetyl-1-methylhydrazine (9). A. From 8. A 4.00-g (15.7 mmol) quantity of **8** in 40 ml of EtOH was hydrogenated in a Parr apparatus at 50 psi of hydrogen in the presence of 10% Pd/C (400 mg) for 2 h. Uptake of hydrogen (3.5 lb) was essentially complete after 10 min. The catalyst was removed by filtration and the filtrate was concentrated to a small volume. The white prisms which formed were collected and washed with ether to yield 2.60 g (80%) of **9**: mp 147–148.5 °C; ir (Nujol) 3480 (s), 3360 (s), and 3280 (NH), 1660 cm^{-1} (both C=O groups); NMR ($CDCl_3$ + Me_2SO-d_6) δ 10.37 (s, 1, NH, D_2O exchangeable), 7.48–7.34 (m, 1, H ortho to C=O), 7.27–6.97 (m, 1, H para to C=O), 6.78–6.38 (m, 2, remaining aromatic), 5.88 (broad s, 2, NH_2, D_2O exchangeable), 3.30 and 3.14 (2 singlets in 1:10 ratio, respectively, NCH_3), 2.15 and 2.03 (2 singlets in 1:10 ratio, respectively, $COCH_3$).

Anal. Calcd for $C_{10}H_{13}N_3O_2$: C, 57.96; H, 6.32; N, 20.28. Found: C, 58.00; H, 6.39; N, 20.28.

B. From Isatoic Anhydride (10). An 11.8-g (72.3 mmol) quantity of isatoic anhydride[21] and 6.37 g (72.3 mmol) of **1** were mixed together and heated on a steam bath until CO_2 evolution ceased. The viscous oil was dissolved in a minimal volume of EtOH, a seed crystal was added, and the solution was cooled overnight in a freezer. The next morning, the white solid was collected to yield 4.48 g (30%) of **9**, mp 148.5–149.5 °C, whose ir (Nujol) was identical with that of the material prepared in part A.

***N*-Methyl-*N*-[2-methyl-4-oxo-3(4*H*)-quinazolinyl]acetamide (13).** A 4.20-g (20.0 mmol) quantity of **9** in 20 ml of triethyl orthoacetate (Aldrich) was heated at reflux for 12 h. The solution was concentrated to dryness, the resulting solid was slurried with hot EtOH and cooled, and the product was collected to yield 3.00 g (64%) of **13**: mp 148–149 °C; ir (Nujol) 1690, 1670 cm^{-1}; NMR ($CDCl_3$) δ 8.37–8.14 (m, 1, H ortho to C=O), 8.00–7.34 (m, 3, remaining aromatic), 3.50 and 3.34 (2 singlets in a 1:3 ratio, respectively, NCH_3), 2.59 and 2.48 (2 singlets in a 3:1 ratio, respectively, CCH_3), 2.36 and 1.92 (2 singlets in a 1:3 ratio, respectively, $COCH_3$).

Anal. Calcd for $C_{12}H_{13}N_3O_2$: C, 62.32; H, 5.67; N, 18.17. Found: C, 62.33; H, 5.74; N, 18.19.

2-(*o*-Nitrobenzoyl)-1-methylhydrazine (14). A 10.0-g (39.2 mmol) quantity of **8** was slurried with 50 ml of 10% H_2SO_4, warmed on a hot plate until solution resulted, and then warmed at 80 °C for an additional 25 min. The solution was cooled, neutralized, and made slightly basic with NaOH. The resulting precipitate was collected and air dried to yield 6.20 g (81%) of **14**: mp 130–131 °C (EtOH); ir (Nujol) 3275 (NH), 1640 cm^{-1} (C=O); NMR ($CDCl_3$) δ 8.17–7.90 (m, 1, aromatic), 7.70–7.32 (m, 3, aromatic), 4.47 (broad s, 2, both NH groups, D_2O exchangeable), 2.64 and 2.47 (2 singlets in a 3:1 ratio, respectively, NCH_3).

Anal. Calcd for $C_8H_9N_3O_3$: C, 49.23; H, 4.65; N, 21.53. Found: C, 49.10; H, 4.60; N, 21.66.

2-(*o*-Aminobenzoyl)-1-methylhydrazine (15). A 4.00-g (20.5 mmol) quantity of **14** in 40 ml of EtOH was hydrogenated in a Parr apparatus at 50 psi of hydrogen in the presence of 10% Pd/C (400 mg) for 90 min. Uptake of hydrogen (4 lb) was essentially complete after 10 min. The catalyst was removed by filtration and the filtrate was concentrated and triturated with ether. The resulting solid was collected to yield 3.00 g (89%) of **15** (mp 85–87 °C): mp 90–91 °C (hexane); ir (Nujol) 3430 and 3300 (NH), 1620 cm^{-1} (C=O); NMR ($CDCl_3$) δ 7.34–6.90 (m, 2, aromatic), 6.66–6.32 (m, 2, aromatic), 5.50 (broad s, 4, both NH groups and NH_2), 2.63 (s, 3, CH_3).

Anal. Calcd for $C_8H_{11}N_3O$: C, 58.16; H, 6.71; N, 25.44. Found: C, 57.90; H, 6.56; N, 25.23.

2-Methyl-3-(methylamino)-4(3*H*)-quinazolinone (11). A. From 9. A 1.00-g (4.83 mmol) quantity of **9** was mixed with 20 ml of 10% H_2SO_4, warmed on a hot plate until solution resulted, and then warmed at 80 °C for an additional 30 min. The solution was cooled, basified with NaOH, and extracted with CH_2Cl_2. The extract was dried (Na_2SO_4) and concentrated to yield 710 mg (78%) of **11**: mp 110–111 °C (EtOH); ir (Nujol) 3300 (NH) and 1660 cm^{-1}; (C=O); NMR ($CDCl_3$) δ 8.31–8.10 (m, 1, H ortho to C=O), 7.81–7.24 (m, 3, remaining aromatic), 5.78 (q, J = 6 Hz, 1, NH), 2.81 (d, J = 6 Hz, 3, NCH_3), 2.71 (s, 3, CCH_3). When the NMR sample was shaken with D_2O, the NH signal at δ 5.78 disappeared and the NCH_3 doublet at δ 2.81 collapsed to a singlet at δ 2.81; mass spectrum (70 eV) m/e 189 (molecular ion).

Anal. Calcd for $C_{10}H_{11}N_3O$: C, 63.47; H, 5.86; N, 22.21. Found: C, 63.60; H, 5.85; N, 22.07.

B. From 13. A 1.00-g (4.32 mmol) quantity of **13** was mixed with 10 ml of 10% H_2SO_4 and heated at 80–90 °C for 1 h. The solution was cooled, basified with NaOH, and extracted with CH_2Cl_2. The extracts were dried (Na_2SO_4) and concentrated to afford 480 mg (59%) of crude **11**, mp 97–99 °C, whose ir (Nujol) was identical with that of the material prepared in part A.

C. From 15. A 1.00-g (4.83 mmol) quantity of **15** in 20 ml of triethyl orthoacetate was heated at reflux for 12 h. The solution was concentrated and the resulting solid was crystallized (EtOH) to afford 450 mg (49%) of pure **11**, mp 110–111 °C, whose ir (Nujol) was identical with that of the material prepared in part A.

Registry No.—**1**, 3530-13-0; **2**, 38604-72-7; **3**, 931-54-4; **4**, 5790-59-0; **5**, 40028-55-5; **7**, 610-14-0; **8**, 59169-42-5; **9**, 59169-43-6; **10**, 118-48-9; **11**, 59169-44-7; **13**, 59169-45-8; **14**, 59169-46-9; **15**, 59169-47-0; methylhydrazine, 60-34-4; acetyl chloride, 75-36-5; methylhydrazine HCl, 7339-53-9; triethyl orthoacetate, 78-39-7.

References and Notes

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(7) (a) M. Wilcox, *J. Med. Chem.*, **11**, 171 (1968); (b) French Patent 1 521 959 (1968); *Chem. Abstr.*, **71**, 3166k (1969); (c) G. Zinner and K. Dorschner, *Arch. Pharm. (Weinheim, Ger.)*, **306**, 35 (1973).
(8) 1-Methyl-4-phenylsemicarbazide (hydrochloride) has been prepared using less direct methods than the one described in Scheme II. 2-Phenyl-3-methyl-5-(phenyl)amino-1,3,4-oxadiazolium chloride, which was prepared from 1-benzoyl-1-methylhydrazine and phenyl isocyanide dichloride, was decomposed in methanol solution to yield **5** HCl.[9a] In addition, 1-methyl-3,3-pentamethylenediaziridine, prepared either from cyclohexanone, ammonia, and methylhydroxylamine-*O*-sulfonic acid or cyclohexanone, methylamine, and hydroxylamine-*O*-sulfonic acid,[9b] was reacted with phenyl isocyanate and subsequently hydrolyzed to **5**.[7c] In both of these syntheses, as in ours, the methylhydrazine derivative employed to introduce the methylhydrazine unit was one in which the *N*-methyl nitrogen was protected.
(9) (a) W. D. Ollis and C. Ramsden, *Chem. Commun.*, 1223 (1971); (b) E. Schmitz, R. Ohme, and R. D. Schmidt, *Chem. Ber.*, **95**, 2714 (1962).
(10) A mixture of hydrazide **15** and 1-(*o*-aminobenzoyl)-1-methylhydrazine were produced in a 15:85 ratio, respectively, by the reaction of isatoic anhydride with methylhydrazine in DMF. The authentic sample of **15** produced as shown in Scheme IV was used to identify its presence in the mixture.[11]
(11) S. Sunder, N. P. Peet, and D. L. Trepanier, *J. Org. Chem.*, preceding paper in this issue.
(12) F. E. Condon, *J. Org. Chem.*, **37**, 3615 (1972).
(13) Melting points are uncorrected. Ir spectra were recorded with a Perkin-Elmer 727B instrument; NMR spectra with a Varian T-60 spectrometer; and mass spectra with a Hitachi RMU-6D mass spectrometer. Combustion analyses were performed by Dow Analytical Laboratories.
(14) The procedure described is based on several reactions.
(15) The atmosphere in the reaction vessel is foggy during the addition. Vigorous stirring during the addition appears to increase the ratio of monoacylated to diacylated product. Midway through the addition a white precipitate is observed.
(16) The dried, white, crystalline solid is methylhydrazine hydrochloride, (mp 78–79.5 °C), weighing 80–82 g, and is analytically pure. Anal. Calcd for CH_7ClN_2: C, 14.55; H, 8.54; N, 33.93. Found: C, 14.50; H, 8.49; N, 34.28.
(17) The separation is easily effected with a 1 × 10 cm vacuum-jacketed Vigreux column (ca. three theoretical plates).
(18) The NMR spectrum of **1** indicated the presence of two conformers, with the inside, slightly more intense, set of singlets belonging to the methyl groups of one rotamer and the outside set to the methyl groups of the other. An NMR study on the conformer proportions of 1-acetyl-1-methylhydrazine in polar and nonpolar solvents is reported.[19] The NMR spectrum also indicated the absence of significant amounts of 1-acetyl-2-methylhydrazine, whose NMR spectrum ($CDCl_3$) is recorded.[3]
(19) P. Bouchet, J. Elquero, R. Jacquier, and J. M. Pereillo, *Bull. Soc. Chim. Fr.*, 2264 (1972).
(20) 1,2-Diacetylmethylhydrazine (bp 280 °C) has been prepared by reacting methylhydrazine with excess acetic anhydride: A. Michaelis and E. Hadanck, *Ber.*, **41**, 3285 (1908).
(21) The isatoic anhydride (mp 243–247 °C dec, colorless prisms) used in this reaction was prepared as described by N. P. Peet and S. Sunder, *J. Org. Chem.*, **39**, 1931 (1974), from methyl anthranilate.

Synthesis of 3,4-Dihydro- and 1,4-Dihydro-5*H*-1,3,4-benzotriazepin-5-ones

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2-Aminobenzoic acid 1-methylhydrazides (**1**) react with ortho esters to yield 3,4-dihydro-(**2a–o**) and 1,4-dihydro-5*H*-1,3,4-benzotriazepin-5-ones (**3a–h**). Proton magnetic resonance studies were employed to define the predominant tautomer in the tautomeric members of the benzotriazepine class.

The synthetic interest in benzodiazepines arising from their well-established role as potential psychotherapeutics has prompted investigations into their nitrogen homologues, the benzotriazepines. Several studies have reported the preparation of members of the 1,3,4-benzotriazepine family[1–6] but the synthetic methods were not unambiguous and could easily have generated isomeric five- or six-membered heterocyclics. In fact, several of these earlier syntheses were recently called into question and the alternate structures established.[7]

The availability of authentic 2-aminobenzoic acid 1-methylhydrazides[8] ensures that cyclization with a one carbon insertion unit will involve the ortho amino and the β nitrogen