Quinolizidines. XXX. A ready access to the dibenzo[a,f]quinolizidine ring system from 1,2,3,4-tetrahydroquinoline

Quinolizidines. XXX.[1] A Ready Access to the Dibenzo[*a*,*f*]quinolizidine Ring System from 1,2,3,4-Tetrahydroquinoline

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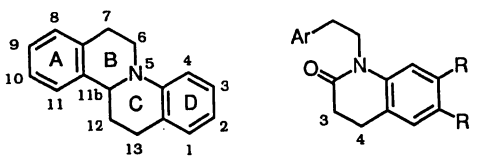
An alternative synthesis of 9,10-dimethoxydibenzo[*a*,*f*]quinolizidine (16) has been accomplished through a route including mercuric acetate–edetic acid oxidation of a benzene-fused piperidine. The route started with an initial condensation of 1,2,3,4-tetrahydroquinoline (5) with 3,4-dimethoxyphenacyl bromide (6) and proceeded through the amino ketone (7), amino alcohol (8), lactam alcohol (9), *N*-substituted dihydrocarbostyril (10), and quaternary iminium salt (11 or 15).

Keywords dibenzoquinolizidine synthesis; mercuric acetate–edetic acid oxidation tetrahydroquinoline; phenacylation; sodium borohydride reduction; catalytic hydrogenolysis; Bischler–Napieralski cyclization; catalytic reduction; disproportionation; ^{1}H-NMR

The dibenzo[*a*,*f*]quinolizidine ring system (**1**) is one of the seven theoretically possible dibenzoquinolizidines in which two benzene rings are fused to various sides of a quinolizidine ring.[2] It has been synthesized in the form of the 2,3,9,10-tetramethoxy derivative,[3] the 9,10-methylenedioxy derivative,[4] or the 9,10-dimethoxy derivative (**16**)[5] *via* a route proceeding through Bischler–Napieralski cyclization of an *N*-arylethylated 3,4-dihydrocarbostyril (type **2**) or carbostyril (type **3**) intermediate. In the case of **16**, an alternative route following a low-yield intramolecular benzyne reaction of 1-(*m*-chlorophenethyl)-1,2,3,4-tetrahydro-6,7-dimethoxyisoquinoline has also been reported.[6] In addition, the parent skeleton (**1**) itself and its ring D-substituted derivatives have been prepared through a route including condensation of 2-aryl-3,4-dihydroisoquinolinium bromides with acetaldehyde.[7]

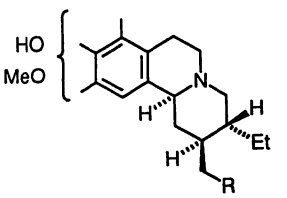
The first of the above synthetic strategies to utilize the Bischler–Napieralski reaction, a useful vehicle for constructing a 3,4-dihydroisoquinoline skeleton from an amide or a lactam,[8] would be most reasonable in view of the structural features of **1**, in which 1,2,3,4-tetrahydroisoquinoline is fused to 1,2,3,4-tetrahydroquinoline (**5**), and its value may be enhanced by a device for efficient preparation of the dihydrocarbostyril intermediate (type **2**), a benzene-fused 2-piperidone. In the present study, therefore, we sought to synthesize such a dihydrocarbostyril from **5** by application of the mercuric acetate–edetic acid oxidation method. This method had been developed for generation of the lactam carbonyl function in a piperidine ring[9-11] and had been utilized by us[11i,12] for chiral syntheses of benzo[*a*]quinolizidine-type *Alangium* alkaloids (type **4**).



1

2: R = MeO or H

3: 3,4-didehydro



4: R = CH_2OH, CO_2H, or a heterocyclic ring

We next investigated the Bischler–Napieralski reaction of **10** to reach the title ring system (**1**), because Tourwé and Van Binst[5] had followed a similar route only with the 3,4-didehydro derivative (type **3**) of **10**. On treatment with $POCl_3$ in boiling toluene for 3 h, **10** produced a cyclized product presumed to be the quaternary iminium chloride **11**. The crude chloride **11** was then hydrogenated in 50% aqueous EtOH over Adams catalyst for 2 h, giving the desired tetracyclic base **16**[5,6] in 75% overall yield (from **10**). On the other hand, treatment of crude **11** with KI in H_2O and repeated recrystallizations of the resulting iodide **12** from MeOH produced the 12,13-didehydro derivative **15** and the C(11b)–N(5) saturated derivative **16** in 38% and 18% yields, respectively. The formation of **15** and **16** is probably due to disproportionation of **11** or **12** during the cyclization or recrystallization process. Reduction of **15** with $NaBH_4$ in 80% aqueous EtOH or with hydrogen over Adams catalyst in 50% aqueous EtOH afforded **16** in 71% or 45% yield, respectively. The structure (**15**) with a fully aromatized quinoline moiety was assignable to the dehydrogenated product on the basis of its proton nuclear magnetic resonance (^{1}H-NMR) spectrum in Me_2SO-d_6. It exhibited two two-proton triplets at δ 3.34 [C(7)-H's] and 5.10 [C(6)-H's] among other signals, including those assigned from nuclear Overhauser effect (NOE) data,

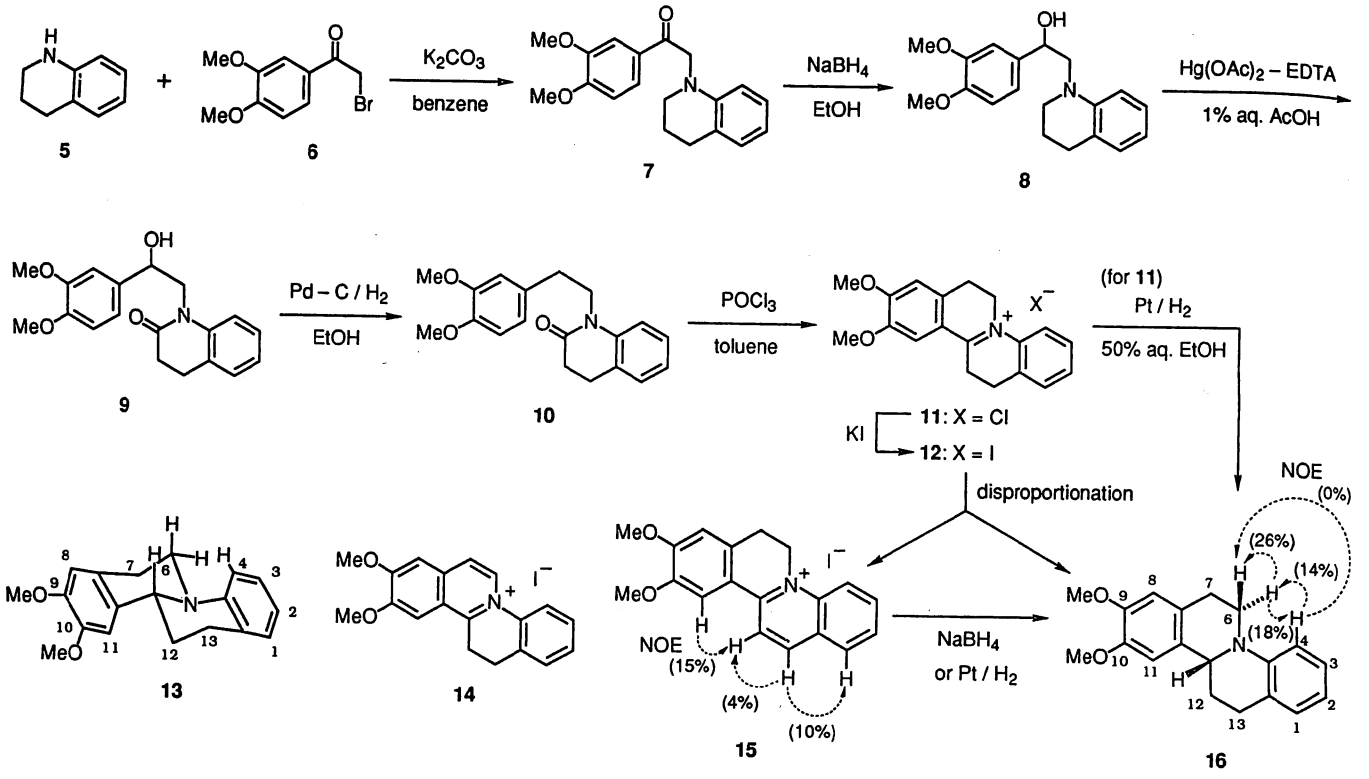


Chart 1

as shown in formula **15** (Chart 1). A large difference of 1.76 ppm in chemical shift between the above two methylene signals clearly eliminates the possibility of the alternative structure (**14**) (with a fully aromatized isoquinoline moiety) in which none of the two methylenes are directly connected to the positively charged heterocyclic nitrogen. The observed dehydrogenation of **11** or **12** in the quinoline moiety is in general agreement with that reported[4] for the 9,10-methylenedioxy analogue.

As regards the problem of the conformation of the tetracyclic base **16**, Van Binst and Tourwé[13] have determined the preferential *trans*-quinolizidine conformation (**13**) by measurement of the ^{13}C–H coupling constant for the angular C–H bond. In the present study, their conclusion was supported by the measurement of the ^1H-NMR spectrum of **16** in $CDCl_3$. It may be seen from formula **16** (Chart 1) that the NOE observed for the C(6)-H (equatorial) signal on irradiation of the C(4)-H signal or *vice versa* revealed the proximity of the two protons in question. Inspection of molecular models indicates that such proximity is permissible only in the *trans*-quinolizidine conformer **13** and not in either of the two possible *cis*-quinolizidine conformers.

In conclusion, the above results represent an extension of the mercuric acetate–edetic acid oxidation method to a benzene-fused piperidine system and have revealed that the tetracycle **16** is accessible from 1,2,3,4-tetrahydroquinoline (**5**) in six steps in 33% overall yield. Further extension of this oxidation route to the synthesis of another dibenzoquinolizidine system is in progress in our laboratory.

Experimental

General Notes All melting points were determined by using a Yamato MP-1 capillary melting point apparatus and are corrected. Thin-layer chromatography (TLC) was developed on Merck silica gel 60 F_{254} plates (0.25-mm thickness), and spots were detected by means of ultraviolet (UV) absorbance measurement (at 254 nm) and/or by spraying with the standard I_2–KI reagent. Flash chromatography[14] was carried out by using Merck silica gel 60 (No. 9385). Spectra reported herein were recorded on a Hitachi model 320 UV spectrophotometer, a JASCO A-202 infrared (IR) spectrophotometer, a Hitachi M-80 mass spectrometer, or either a JEOL JNM-FX-100 (^1H 100 MHz) or a JEOL JNM-GSX-500 (^1H 500 MHz) nuclear magnetic resonance (NMR) spectrometer, and chemical shifts are reported in ppm downfield from internal Me_4Si. Elemental analyses were performed by Mr. Y. Itatani and his associates at Kanazawa University. The following abbreviations are used: br = broad, d = doublet, dd = doublet-of-doublets, ddd = doublet-of-dd's, dddd = doublet-of-ddd's, H_{ax} = axial H, H_{eq} = equatorial H, m = multiplet, s = singlet, sh = shoulder, t = triplet.

1-(3,4-Dimethoxyphenyl)-2-(1,2,3,4-tetrahydro-1-quinolinyl)ethanone (7) A stirred mixture of 1,2,3,4-tetrahydroquinoline (**5**)[15] (2.02 g, 15.2 mmol), anhydrous K_2CO_3 (4.15 g, 30 mmol), 3,4-dimethoxyphenacyl bromide (**6**)[16] (3.89 g, 15 mmol), and dry benzene (40 ml) was heated under reflux in an atmosphere of N_2 for 24 h. After cooling, the reaction mixture was concentrated *in vacuo*, and the residue was partitioned by extraction with a mixture of H_2O and $CHCl_3$. The $CHCl_3$ extracts were washed with saturated aqueous NaCl, dried over anhydrous K_2CO_3, and concentrated *in vacuo* to leave a brown solid (4.62 g), mp 123—134.5 °C. Recrystallization of the solid from MeOH gave a first crop (3.66 g) of **7** as brownish prisms, mp 136.5—138 °C. Concentration of the mother liquor of this recrystallization yielded a second crop (256 mg) of **7**, mp 133—136.5 °C, and concentration of the mother liquor from the second crystallization and purification of the residue by means of flash chromatography[14] [hexane–AcOEt (3 : 1, v/v)] afforded a third crop (76 mg) of **7**. The total yield of **7** was 3.99 g (85% from **6**). For analysis, the crude **7** was recrystallized from MeOH to furnish faintly yellowish prisms, mp 137—138 °C; MS *m/z*: 311 (M^+); UV $\lambda_{max}^{99\%\,aq.EtOH}$ 229 nm (ε 21400), 264 (18800), 303 (12100); IR ν_{max}^{Nujol} 1678 cm^{-1} (ArCO); ^1H-NMR ($CDCl_3$) δ[17]: 1.85—2.15 [2H, m, C(3)-H's], 2.83 [2H, t, J = 6 Hz, C(4)-H's], 3.39 [2H, t, J = 6 Hz, C(2)-H's], 3.90 and 3.96 (6H, s each, two MeO's), 4.66 [2H, s, N(1)-CH_2CO], 6.2—6.65 and 6.8—7.0 [4H, m, C(5)-H, C(6)-H, C(7)-H, and C(8)-H], 6.91 [1H, d, J = 8.5 Hz, C(5')-H], 7.54 [1H, d, J = 2 Hz, C(2')-H], 7.66 [1H, dd, J = 8.5 and 2 Hz, C(6')-H]. *Anal.* Calcd for $C_{19}H_{21}NO_3$: C, 73.29; H, 6.80; N, 4.50. Found: C, 73.30; H, 6.88; N, 4.65.

α-(3,4-Dimethoxyphenyl)-3,4-dihydro-1(2*H*)-quinolineethanol (8) A stirred suspension of **7** (3.98 g, 12.8 mmol) in EtOH (80 ml) was heated at

80 °C to minimize the amount of **7** that remained insoluble. The resulting suspension was kept stirring under ice-cooling, and $NaBH_4$ (492 mg, 13 mmol) was added portionwise. After the mixture had been stirred at room temperature for 24 h, acetone (5 ml) was added and the reaction mixture was concentrated *in vacuo*. The residue was partitioned by extraction with a mixture of H_2O and $CHCl_3$. The $CHCl_3$ extracts were washed with saturated aqueous NaCl, dried over anhydrous K_2CO_3, and concentrated *in vacuo* to leave a brown, viscous oil (3.93 g). The oil crystallized from EtOH–H_2O (2:1, v/v) (60 °C) to give a first crop (3.29 g, 82%) of **8** as slightly brownish prisms, mp 94—94.5 °C. Concentration of the mother liquor from this crystallization and recrystallization of the residue in a similar manner yielded a second crop (160 mg, 4%) of **8**. Concentration of the mother liquor of the last recrystallization and purification of the residue by means of flash chromatography[14] ($CHCl_3$) furnished a third crop (241 mg, 6%) of **8**. The total yield of **8** was 3.69 g (92%). Recrystallizations of the crude **8** from EtOH–H_2O (2:1, v/v) produced an analytical sample as colorless prisms, mp 96.5—97 °C; MS *m/z*: 313 (M^+); UV $\lambda_{max}^{99\%\,aq.\,EtOH}$ 230 nm (sh) (ε 11400), 266 (14700), 308 (2780); IR $\nu_{max}^{CHCl_3}$ cm^{-1}: 3620, 3540 (OH); ^{1}H-NMR ($CDCl_3$) δ[17]: 1.75—2.05 [2H, m, C(3)-H's], 2.44 (1H, br s, *OH*), 2.77 [2H, t, *J*=6.5 Hz, C(4)-H's], 3.1—3.35 [2H, m, C(2)-H's], 3.2—3.6 [2H, m, N(1)-C<u>H</u>$_2$CH(OH)], 3.89 and 3.91 (6H, s each, two MeO's), 4.8—5.05 [1H, m, N(1)-CH$_2$C<u>H</u>(OH)], 6.5—7.15 (7H, m, aromatic protons). *Anal.* Calcd for $C_{19}H_{23}NO_3$: C, 72.82; H, 7.40; N, 4.47. Found: C, 72.64; H, 7.58; N, 4.24.

1-[2-(3,4-Dimethoxyphenyl)-2-hydroxyethyl]-3,4-dihydro-2(1*H*)-quinolinone (9) A stirred mixture of **8** (627 mg, 2 mmol), (ethylenedinitrilo)-tetraacetic acid disodium salt dihydrate (1.86 g, 5 mmol), and $Hg(OAc)_2$ (1.59 g, 5 mmol) in 1% aqueous AcOH (15 ml) was heated for 1.5 h in an oil bath kept at 110—120 °C. After cooling, the reaction mixture was extracted with three 15-ml portions of $CHCl_3$. The $CHCl_3$ extracts were combined, washed successively with 10% aqueous HCl (2 × 15 ml), H_2O (2 × 15 ml), 5% aqueous NaOH (2 × 15 ml), and saturated aqueous NaCl (2 × 15 ml), dried over anhydrous Na_2SO_4, and concentrated *in vacuo* to leave a brown oil. The residue was dissolved in $CHCl_3$ (4 ml), and the *CH*Cl_3 solution was passed through a column packed with alumina (6 g), which was then eluted with $CHCl_3$ (66 ml). The eluate was concentrated *in vacuo*, and the residual light brown foam (584 mg) was dissolved in EtOH (10 ml). The resulting ethanolic solution was stirred, after addition of 50% aqueous NaOH (1.5 ml), at room temperature for 24 h. The reaction mixture was neutralized by addition of 10% aqueous HCl and then concentrated *in vacuo*. The resulting residue was partitioned by extraction with a mixture of H_2O and $CHCl_3$. The $CHCl_3$ extracts were washed successively with 10% aqueous HCl, H_2O, 5% aqueous NaOH, and H_2O, dried over anhydrous Na_2SO_4, and concentrated *in vacuo* to leave an orange oil. Purification of the oil by means of flash chromatography[14] [hexane–AcOEt (1:2, v/v)] gave **9** (457 mg, 70%) as a brownish solid. Recrystallization of the solid from hexane–AcOEt (1:1, v/v) yielded an analytical sample of **9** as faintly brownish prisms, mp 105.5—106 °C; MS *m/z*: 327 (M^+); UV $\lambda_{max}^{99\%\,aq.\,EtOH}$ 233 nm (ε 13200), 254 (10700); IR $\nu_{max}^{CHCl_3}$ cm^{-1}: 3420 (OH), 1650 (lactam CO); ^{1}H-NMR ($CDCl_3$) δ[17]: 2.55—3.0 [4H, m, C(3)-H's and C(4)-H's], 3.70 (1H, d, *J*=4 Hz, OH), 3.88 and 3.90 (6H, s each, two MeO's), 3.97 (dd, *J*=14.5 and 3 Hz) and 4.38 (dd, *J*=14.5 and 8.5 Hz) [1H each, N(1)-C<u>H</u>$_2$CH(OH)], 4.95—5.15 [1H, m, N(1)-CH$_2$C<u>H</u>(OH)], 6.75—7.35 (7H, m, aromatic protons). *Anal.*Calcd for $C_{19}H_{21}NO_4$: C, 69.71; H, 6.47; N, 4.28. Found: C, 69.67; H, 6.56; N, 4.09.

***1*-(3,4-Dimethoxyphenethyl)-3,4-dihydro-2(1*H*)-quinolinone (10)** A solution of **9** (917 mg, 2.8 mmol) in EtOH (50 ml) containing 70% aqueous $HClO_4$ (0.56 ml) was hydrogenated over 10% Pd–C catalyst (840 mg) at 2—5 atm and 45 °C for 10 h. The catalyst was removed by filtration and washed with EtOH. The filtrate and washings were combined and concentrated *in vacuo* to leave a brown oil, which was partitioned between H_2O and $CHCl_3$. The $CHCl_3$ layer was separated from the aqueous layer, washed successively with 10% aqueous HCl, H_2O, saturated aqueous $NaHCO_3$, and H_2O, dried over anhydrous Na_2SO_4, and concentrated *in vacuo* to leave an orange oil. Purification of the oil by means of flash chromatography[14] [hexane–AcOEt (1:1, v/v)] afforded **10** (704 mg, 81%) as a faintly yellowish solid, mp 63—64 °C. Recrystallization of the solid from hexane–AcOEt (15:1, v/v) yielded an analytical sample as colorless needles, mp 64.5—65.5 °C; MS *m/z*: 311 (M^+); UV $\lambda_{max}^{99\%\,aq.\,EtOH}$ 233 nm (ε 13000), 254 (11000); IR $\nu_{max}^{CHCl_3}$ 1660 cm^{-1} (lactam CO); ^{1}H-NMR ($CDCl_3$) δ[17]: 2.5—3.2 [6H, m, N(1)-CH$_2$C<u>H</u>$_2$Ar, C(3)-H's, and C(4)-H's], 3.86 (6H, s, two MeO's), 4.05—4.25 [2H, m, N(1)-C<u>H</u>$_2$CH$_2$Ar], 6.7—7.3 (7H, m, aromatic protons). *Anal.* Calcd for $C_{19}H_{21}NO_3$: C, 73.29; H, 6.80; N, 4.50. Found: C, 73.02; H, 6.68; N, 4.39.

7,11b,12,13-Tetrahydro-9,10-dimethoxy-6*H*-dibenzo[*a*,*f*]quinolizine (16) i) From **10** *via* **11**: A stirred solution of **10** (226 mg, 0.73 mmol) and $POCl_3$ (1.12 g, 7.3 mmol) in dry toluene (5 ml) was heated under reflux for 3 h. The reaction mixture was concentrated *in vacuo* to leave an orange solid (presumed to be crude **11**), which was dissolved in 50% (v/v) aqueous EtOH (30 ml). The resulting solution was hydrogenated over Adams catalyst (50 mg) at 1 atm and room temperature for 2 h. The catalyst was removed by filtration, and the filtrate was concentrated *in vacuo*. The residual oil was partitioned by extraction with a mixture of aqueous K_2CO_3 and $CHCl_3$, and the $CHCl_3$ extracts were dried over anhydrous K_2CO_3 and concentrated *in vacuo* to leave a brown oil. Purification of the oil by means of flash chromatography[14] (CH_2Cl_2) yielded **16** (160 mg, 75%) as a yellowish brown solid, mp 95—96 °C. Recrystallization of the solid from hexane furnished an analytical sample of **16** as slightly pinkish needles, mp 98—99 °C [lit. mp 113 °C (from EtOH)[5]; 141—142 °C (from hexane)[6]]; MS *m/z*: 295 (M^+); UV λ_{max}^{MeOH} 232 nm (sh) (ε 12300), 252 (sh) (10100), 281 (7480); ^{1}H-NMR ($CDCl_3$) δ: 2.08 [1H, dddd, *J*=13, 10, 9.5, and 5.5 Hz, C(12)-H$_{ax}$], 2.41 [1H, dddd, *J*=13, 6, 5.5, and 3 Hz, C(12)-H$_{eq}$], 2.70 [1H, ddd, *J*=15.5, 4, and 3.5 Hz, C(7)-H$_{eq}$], 2.81 [1H, ddd, *J*=16, 5.5, and 5.5 Hz, C(13)-H$_{eq}$], 2.93 [1H, ddd, *J*=16, 10, and 6 Hz, C(13)-H$_{ax}$], 3.00 [1H, ddd, *J*=15.5, 10.5, and 4.5 Hz, C(7)-H$_{ax}$], 3.22 [1H, ddd, *J*=12.5, 10.5, and 3.5 Hz, C(6)-H$_{ax}$], 3.86 and 3.88 (3H each, s, two MeO's), 3.98 [1H, ddd, *J*=12.5, 4.5, and 4 Hz, C(6)-H$_{eq}$], 4.39 [1H, dd, *J*=9.5 and 3 Hz, C(11b)-H], 6.61 [1H, s, C(8)- or C(11)-H], 6.68 [1H, dd, *J*=7.5 Hz each, C(2)-H], 6.75 [1H, s, C(11)- or C(8)-H], 6.87 [1H, d, *J*=7.5 Hz, C(4)-H], 7.00 [1H, d, *J*=7.5 Hz, C(1)-H], 7.10 [1H, dd, *J*=7.5 Hz each, C(3)-H].[18] *Anal.* Calcd for $C_{19}H_{21}NO_2$: C, 77.26; H, 7.17; N, 4.74. Found: C, 77.27; H, 7.17; N, 4.81. The ^{1}H-NMR spectral data for the aliphatic protons are in agreement with those reported selectively in the literature.[7b]

ii) By $NaBH_4$ Reduction of **15**: A solution of **15**·H_2O (150 mg, 0.34 mmol) in 80% (v/v) aqueous EtOH (15 ml) was stirred under ice-cooling, and $NaBH_4$ (26 mg, 0.69 mmol) was added portionwise. After the solution had been stirred at room temperature for 1 h, acetone (0.5 ml) was added. Concentration of the resulting mixture under vacuum left a yellow oil, which was partitioned by extraction with a mixture of 5% aqueous K_2CO_3 and CH_2Cl_2. The CH_2Cl_2 extracts were washed with saturated aqueous NaCl, dried over anhydrous K_2CO_3, and concentrated *in vacuo*. The residue was purified by flash chromatography[14] [CH_2Cl_2–hexane (3:1, v/v)] to yield **16** (72 mg, 71%) as an orange solid. Recrystallization of the solid from hexane gave a pure sample as slightly pinkish needles, mp 98—99 °C, shown to be identical (by comparison of the IR spectrum and TLC mobility) with the one prepared by method (i).

iii) By Catalytic Hydrogenation of **15**: A solution of **15**·H_2O (336 mg, 0.77 mmol) in 50% (v/v) aqueous EtOH (40 ml) was hydrogenated over Adams catalyst (53 mg) at 1 atm and room temperature for 18 h. Work-up of the reaction mixture in a manner similar to that described above under method (i) afforded **16** (102 mg, 45%) as a brown oil. The IR spectrum and TLC behavior of this oil were identical with those of authentic **16**.

Formation of 6,7-Dihydro-9,10-dimethoxydibenzo[*a*,*f*]quinolizinium Iodide (15) and 16 from 10 *via* 12 A solution of **10** (311 mg, 1 mmol) and $POCl_3$ (1.53 g, 10 mmol) in dry toluene (6 ml) was heated under reflux for 4.5 h. The reaction mixture was concentrated *in vacuo* to leave a yellow solid (presumed to be crude **11**), which was washed with hexane and then dissolved in hot H_2O (15 ml). On addition of KI (1.00 g, 6 mmol), the hot aqueous solution deposited a yellowish brown precipitate, which was collected by filtration after the mixture had been cooled in an ice bath. Recrystallization of the precipitate from MeOH yielded **15**·H_2O (168 mg, 38%). Further recrystallizations from MeOH and drying over P_2O_5 at 2 mmHg and 50 °C for 10 h gave an analytical sample of **15**·H_2O as yellow needles, mp 242—243 °C (dec.); UV $\lambda_{max}^{99\%\,aq.\,EtOH}$ 249.5 nm (ε 15300), 293 (19800), 345.5 (8210), 412 (18400); ^{1}H-NMR (Me_2SO-d_6) δ: 3.34 [2H, t, *J*=7 Hz, C(7)-H's], 3.95 and 3.96 (3H each, s, two MeO's), 5.10 [2H, t, *J*=7 Hz, C(6)-H's], 7.27 [1H, s, C(8)-H], 7.83 [1H, s, C(11)-H], 7.95 [1H, dd, *J*=8 and 7.5 Hz, C(2)-H], 8.20 [1H, ddd, *J*=9, 7.5, and 1.5 Hz, C(3)-H], 8.39 [1H, dd, *J*=8 and 1.5 Hz, C(1)-H], 8.65 [1H, d, *J*=9 Hz, C(4)-H], 8.78 [1H, d, *J*=9 Hz, C(12)-H],[19] 9.14 [1H, d, *J*=9 Hz, C(13)-H].[19-21] *Anal.* Calcd for $C_{19}H_{18}INO_2 \cdot H_2O$: C, 52.19; H, 4.61; N, 3.20. Found: C, 52.19; H, 4.73; N, 3.13.

On the other hand, the mother liquor from the above first recrystallization was concentrated *in vacuo*, and the residue was purified by flash chromatography[14] ($CHCl_3$) to give **16** (53 mg, 18%) as a reddish brown

oil. The IR spectrum and TLC mobility of the oil were identical with those of authentic **16**.

References and Notes

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17) For convenience, each skeletal atom in the quinoline moiety is indicated by a usual number and each aromatic carbon in the phenacyl moiety by a primed number.
18) See formula **16** for NOE's observed for selected protons.
19) In our opinion, the signal assignments reported by Brown *et al.*[4] for C(12)-H and C(13)-H of the 9, 10-methylenedioxy analogue of **15** should be reversed.
20) See formula **15** for NOE's observed for selected protons.
21) See ref. 5 for spectral data for the corresponding chloride salt.