4-(2-Di-*n*-Propylaminoethyl)-7-methoxyindole

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Preparation of the title compound has been achieved by a modification of the Reissert indole synthesis, starting with 2-nitro-3-methyl-4-cyanoanisole (**3**), and homologation of the CN group of the resulting 4-cyano-7-methoxyindole. The starting material **3** was prepared by bromination of 2-nitro-3-methylphenol, and the structure of the bromination product was verified chemically.

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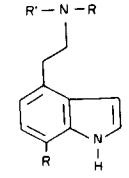
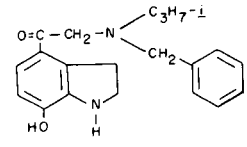
The recent literature (2-5) reveals an increased interest in 4-C-substituted indoles, because of their synthetic utility as ergot alkaloid precursors and their structural relationship to compounds of the ergoline type, which have demonstrated potent biological effects (6). A prior communication (5) described preparation of 4-(2-aminoethyl) indoles **1a** by Arndt-Eistert homologation of indole-4-carboxylic acid. The target structure in the present study was the indole system **1b** (R = R′ = *n*-C_3H_7), bearing as an added substituent a 7-methoxy group.

The literature did not reveal that indole derivatives bearing these types of subsituents at 4 and 7 have been prepared, and indeed, no 4,7-substituted indoles were found



1a R = H
1b R = OCH_3



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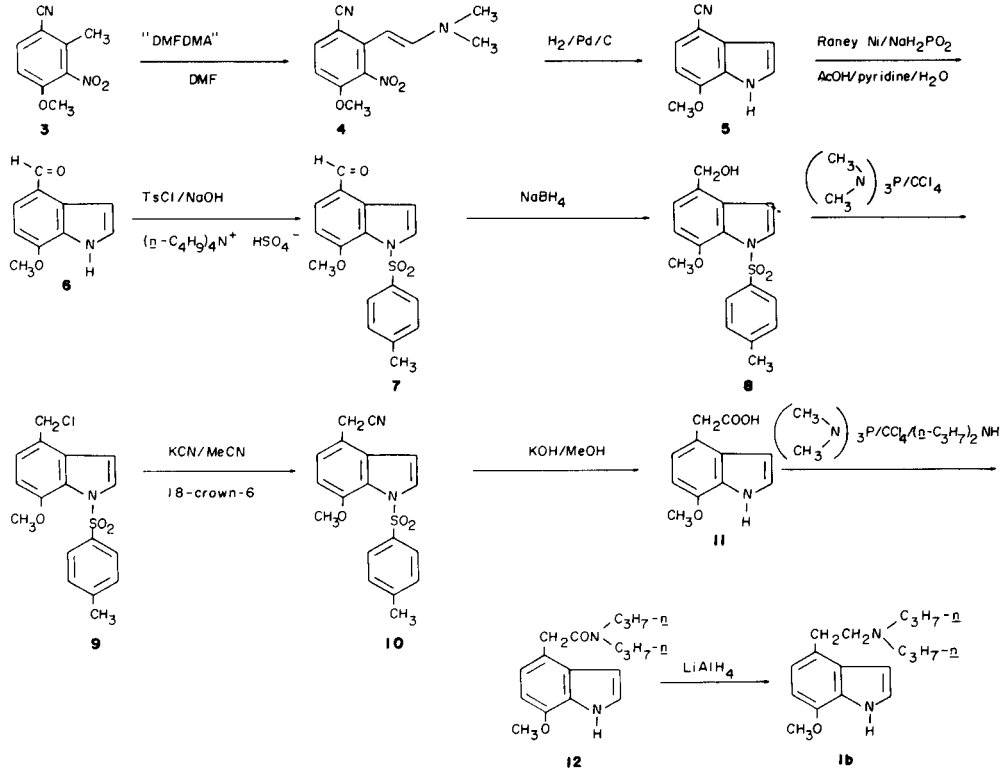
which might easily be converted into **1b**. Troxler, *et al.*, (7) prepared the indoline **2**, but all attempts to aromatize the heterocyclic ring failed. The Troxler, *et al.*, (7) synthetic sequence leading to **2** involved an electrophilic attack on

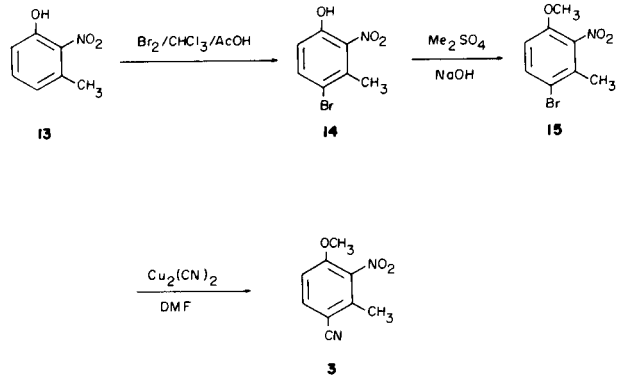
Scheme I

Preparation of
4-(2-Di-n-Propylaminoethyl)-7-methoxyindole



Scheme II

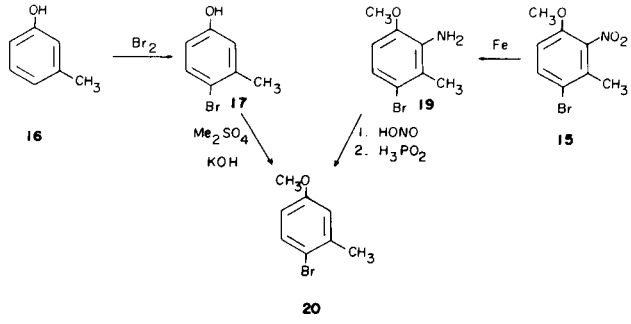
Preparation of 2-Nitro-3-methyl-4-cyanoanisole



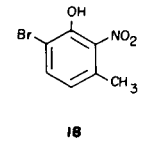
position 4 of a 7-oxygenated indoline. Such a reaction would not be expected to be applicable to a 7-oxygenated indole system, because of the sensitivity of position 3 of the indole ring to electrophilic attack.

In the present work, a strategy was devised in which the indole nucleous was prepared with appropriate 4- and 7-substituents on the ring system. This involved reductive cyclization of the *o*-nitroenamine **4** (Scheme I) by the Batcho-Leimgruber modification (8) of the Reissert indole synthesis. Masking of the indole ring nitrogen in **7** rendered the ring system stable toward the reagents and conditions required for homologation of the 4-formyl group. Later steps in the homologation (Scheme I: **9** → **10** → **11**) followed a scheme of Ponticello and Baldwin (2).

A critical factor in the success of the sequence shown in Scheme I was the availability of sizeable amounts of 2-nitro-3-methyl-4-cyanoanisole **3**, which was prepared as shown in Scheme II. Other groups have reported predominant (9) or exclusive (10, 11) bromination of *m*-cresol **16** in the 6-position (**17**). It seemed likely that bromination of the 2-nitro congener **13** (Scheme II) would take a similar course to form the desired bromo compound **14**.



Neither compound **14** (Scheme II) nor the alternate possible bromination product **18** was found in the literature.



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Accordingly, the structure of the bromination product of **13** was established by reduction of the nitro group of its methyl ether **15**, and replacement of the NH_2 with H by diazotization and reduction of the diazonium salt. The resulting product was identical (as evidenced by infrared, nuclear magnetic resonance, and thin layer chromatographic data comparison) with an authentic sample (11) of 3-methyl-4-bromoanisole **20**.

EXPERIMENTAL

Melting points are uncorrected and were determined in open glass capillaries using a Thomas Hoover Uni-Melt apparatus. Infrared spectra were recorded with a Beckman IR 4240 instrument, and nuclear magnetic resonance spectra were recorded with a Varian Associates EM-360A spectrometer with internal tetramethylsilane reference. Elemental analyses were performed by Galbraith Laboratories, Knoxville, Tennessee.

2-Nitro-3-methyl-4-bromophenol (**14**).

Bromine (113.6 g, 0.71 mole) in 85 ml of acetic acid was added dropwise with stirring to an ice-cold solution of 114.7 g (0.75 mole) of 2-nitro-*m*-cresol **13** (Aldrich Chemical Co) in 110 ml of chloroform and 380 ml of acetic acid. After the addition was complete, the reaction mixture was stirred in the cold for 2 hours, then it was poured over 1.5 l of ice. The organic phase was separated, and the water layer was extracted with three 100 ml portions of chloroform. The pooled organic phases were washed with water and with saturated sodium chloride solution, dried (sodium sulfate), filtered and the filtrate was evaporated to give 160.5 g of yellow semi-solid. This material was used in the next step without purification.

An analytical sample was recrystallized twice from cyclohexane, mp 79-81°; nmr (deuteriochloroform): δ 2.61 (s, 3H, C*H*$_3$), 6.90 (d, 1H, ArH), 7.64 (d, 1H, Ar*H*), 9.24 (br s, 1H, O*H*).

Anal. Calcd. for $C_7H_6BrNO_3$: C, 36.23; H, 2.60; Br, 34.44; N, 6.04. Found: C, 36.22; H, 2.58; Br, 34.25; N, 5.99.

2-Nitro-3-methyl-4-bromoanisole (**15**).

The crude product **14** was mixed with 126 g (1 mole) of dimethyl sulfate in a round bottom flask and a solution of 40 g (1 mole) of sodium hydroxide in 100 ml of water was added in small portions, with shaking and warming on a steam bath. After further additions of the sodium hydroxide produced no red color of the phenolate anion, the reaction mixture was diluted with 500 ml of cold water and the solid product was collected on a filter, washed with water, and recrystallized twice from methanol to give 81.2 g (44% from **13**) of white material, mp 98-100°; nmr (deuteriochloroform) δ 2.33 (s, 3H, C*H*$_3$), 3.83 (s, 3H, OC*H*$_3$), 6.73 (d, 1H, Ar*H*), 7.51 (d, 1H, Ar*H*).

Anal. Calcd. for $C_8H_8BrNO_3$: C, 39.05; H, 3.27; Br, 32.47; N, 5.69. Found: C, 39.09; H, 3.31; Br, 32.50; N, 5.59.

2-Nitro-3-methyl-4-cyanoanisole (**3**).

A mixture of 30.0 g (0.122 mole) of **15**, 16.3 g (0.183 mole) of cuprous cyanide, 10 g (0.2 mole) of sodium cyanide, and 135 ml of dimethylformamide was heated under reflux for 3.25 hours. The light brown solution was poured into a solution of 51.3 g (0.130 mole) of ferric chloride hexahydrate and 18 ml of concentrated hydrochloric acid in 1 ℓ of water. The solid which separated was collected on a filter and washed several times with water, then with 90% methanol. The air-dried product was chromatographed on silica gel and eluted with methylene chloride. The light

yellow eluate was evaporated to give 19.3 g (82%) of off- white solid which was used in the next step without purification.

An analytical sample was recrystallized from methanol, mp 138-140°; nmr (deuteriochloroform): δ 2.46 (s, 3H, C*H*$_3$), 3.97 (s, 3H, OC*H*$_3$), 7.03 (d, 1H, Ar*H*), 7.71 (d, 1H, Ar*H*).

Anal. Calcd. for $C_9H_8N_2O_3$: C, 56.25; H, 4.19; N, 14.57. Found: C, 55.95; H, 4.27; N, 14.63.

N,N-Dimethyl-2-(2-nitro-3-methoxy-6-cyanophenyl)ethenamine (**4**).

A solution of 28.8 g (0.15 mole) of **3** and 35.7 g (0.30 mole) of *N,N*-dimethylformamide dimethylacetal in 35 ml of dimethylformamide was heated under reflux for 15 hours, then the reflux condenser was replaced by a distillation apparatus, and methanol was permitted to distil from the reaction mixture. After 3.5 hours, 13 ml of distillate had been collected, and no more material distilled. Volatiles were removed from a hot water bath at 0.5 mm. The dark red oily residue (42 g) was diluted with 45 ml of hot methanol and solid formed at once. After cooling for 1 hour, the material was collected on a filter and washed successively with cold methanol, cyclohexane, and petroleum ether (bp 37-54°), and was recrystallized from methanol to give 29.0 g (78%) of bright orange crystals, mp 124-126°; nmr (deuteriochloroform): δ 2.90 (s, 6H, NC*H*$_3$), 3.90 (s, 3H, OC*H*$_3$), 4.86 (d, 1H, C=C*H*), 6.61 (d, 1H, Ar*H*), 7.28 (d, 1H, C=C*H*), 7.54 (d, 1H, Ar*H*).

Anal. Calcd. for $C_{12}H_{13}N_3O_3$: C, 58.29; H, 5.30; N, 16.99. Found: C, 58.21; H, 5.56; N, 16.96.

4-Cyano-7-methoxyindole (**5**).

Compound **4** (28.0 g, 0.113 mole) in 300 ml of ethyl acetate was hydrogenated over 1.8 g of 5% palladium on charcoal at an initial pressure of 57 psig. The calculated amount of hydrogen was absorbed in 2.5 hours. The reduction mixture was filtered, and the filtrate was evaporated under reduced pressure. The greenish solid residue was dissolved in ethyl acetate, and this solution was extracted with 1*N* hydrochloric acid, washed with 5% sodium bicarbonate solution, dried (sodium sufate), and evaporated under reduced pressure to afford a solid which was recrystallized from 60% methanol/40% water to yield 16.1 g (83%) of long light yellow needles, mp 140-142°; nmr (acetone-d_6): δ 4.01 (s, 3H, OC*H*$_3$), 6.33-7.45 (m, 4H, Ar*H*).

Anal. Calcd. for $C_{10}H_8N_2O$: C, 69.75; H, 4.68; N, 16.27. Found: C, 69.92; H, 4.98; N, 16.23.

4-Formyl-7-methoxyindole (**6**).

A method of Backeberg and Staskun (12) was used. A freshly prepared Raney nickel slurry (13) (from 15 g of Raney nickel alloy) in 45 ml of methanol was added in one portion to a stirred mixture of 8.7 g (0.0505 mole) of **5**, 73 ml of acetic acid, and 146 ml of pyridine, then 20 g (0.19 mole) of sodium hypophosphite monohydrate in 73 ml of water was added in one portion. The reaction mixture was stirred at 30-40° for 75 minutes, then it was filtered and the filtrate was poured into 800 ml of ice-cold 2*N* hydrochloric acid. After 10 minutes, the crystals which separated were collected on a filter, washed successively with 1% hydrochloric acid, 5% sodium bicarbonate solution, and distilled water. The filtrate was extracted several times with ethyl acetate, and the pooled extracts were washed with water, 5% sodium bicarbonate solution, and saturated sodium chloride solution. The organic layer was dried (sodium sulfate), filtered, ad concentrated under reduced pressure to give a brownish solid which was triturated with a 1:1 mixture of ether and cyclohexane to give a second crop of product. The combined crops of material were recrystallized from ethanol to afford 7.7 g (87%) of product, mp 165-167°; ir (potassium bromide): 1610 cm^{-1} (C=O); nmr (deuteriochloroform): δ 4.03 (s, 3H, OC*H*$_3$), 6.86 (d, 1H, Ar*H*), 7.10 (d, 1H, Ar*H*), 7.46 (d, 1H, Ar*H*), 7.63 (d, 1H, Ar*H*), 10.03 (s, 1H, C*H*O).

Anal. Calcd. for $C_{10}H_9NO_2$: C, 68.56; H, 5.18; N, 7.99. Found: C, 68.66; H, 5.25; N, 8.00.

N-(*p*-Toluenesulfonyl)-4-formyl-7-methoxyindole (**7**).

A phase transfer catalysis method of Illi (14) was used. To a stirred mixture of 10 g (0.25 mole) of powdered sodium hydroxide, 0.7 g of tetra-*n*-butylammonium bisulfate, and 130 ml of methylene chloride was added 13.8 g (0.0788 mole) of **6**, followed at once by a solution of 19.1 g (0.0985 mole) of *p*-toluenesulfonyl chloride in 70 ml of methylene chloride, and an additional 50 ml portion of methylene chloride. During additions, the internal temperature was maintained at 5-10°. The reaction mixture was stirred at this temperature for 30 minutes, then it was filtered, and the filter cake was washed with two 25 ml portions of methylene chloride, which were added to the original filtrate. The pooled organic phases were concentrated under reduced pressure to yield 28.6 g of crude product. This was taken up in 130 ml of hot ethyl acetate, and this solution was diluted with 100 ml of cyclohexane and 50 ml of petroleum ether (bp 37-56°). On standing, 21.6 g (83%) of crystalline product separated, mp 156-158°; nmr (deuteriochloroform): δ 2.39 (s, 3H, C*H*$_3$), 3.77 (s, 3H, OC*H*$_3$), 6.69-8.02 (m, 8H, Ar*H*).

Anal. Calcd. for $C_{17}H_{15}NO_4S$: C, 61.99; H, 4.59; N, 4.25. Found: C, 61.97; H, 4.50; N, 4.20.

N-(*p*-Toluenesulfonyl)-4-hydroxymethyl-7-methoxyindole (**8**).

A solution of 0.4 g (0.01 mole) of sodium hydroxide and 4.57 g (0.120 mole) of sodium borohydride in 30 ml of water was added dropwise over 10 minutes to a stirred suspension of 21.5 g (0.065 mole) of **7** in 270 ml of methanol, maintaining the internal temperature between 5-10°. After addition was complete, the reaction mixture was stirred at the same temperature for 20 minutes, and then at room temperature for 40 minutes. Acetic acid (5 ml) was then added, and most of the methanol was distilled. The semi-solid residue was treated with 500 ml of ice water, stirred for 5 minutes, and the solid which separated was collected on a filter. It was washed with water and air-dried to give 19.4 g (90%) of product, mp 97-101°; nmr (deuteriochloroform): δ 2.35 (s, 3H, C*H*$_3$), 3.64 (s, 3H, OC*H*$_3$), 4.77 (s, 2H, C*H*$_2$OH), 6.53-7.80 (m, 8H, Ar*H*).

Anal. Calcd. for $C_{17}H_{17}NO_4S$ (Karl Fischer determination 2.64% H_2O): C, 59.98; H, 5.32; N, 4.11. Found: C, 60.27; H, 5.43; N, 4.03.

1-(*p*-Toluenesulfonyl)-4-chloromethyl-7-methoxyindole (**9**).

A procedure of Downie, *et al.*, (15) was used. A solution of 11.9 g (0.073 mole) of hexamethylphosphoroustriamide in 50 ml of anhydrous tetrahydrofuran was added dropwise over 8 minutes to a cold (-40°), stirred solution of 21 g (0.063 mole) of **8** and 38.8 g (0.252 mole) of carbon tetrachloride in 160 ml of tetrahydrofuran. The resulting mass was kept at -40° for an additional 10 minutes and then it was allowed to come to room temperature. The solid mass dissolved, and the reaction mixture was stirred again for 70 minutes. Cold water (1 *l*) was added and the resulting mixture was extracted with three 150 ml portions of chloroform. The pooled extracts were washed with 1% hydrochloric acid, 1% sodium bicarbonate solution, saturated sodium chloride solution, then they were dried over sodium sulfate. The extract was concentrated under reduced pressure to give a yellow semi-solid which was triturated with 60 ml of anhydrous ether to afford 18.1 g (82%) of yellow crystalline material, mp 134-136°. An analytical sample was recrystallized from benzene-cyclohexane, mp 136-138°; nmr (deuteriochloroform): δ 2.37 (s, 3H, C*H*$_3$), 3.66 (s, 3H, OC*H*$_3$), 4.77 (s, 2H, C*H*$_2$Cl), 6.54-7.91 (m, 8H, Ar*H*).

Anal. Calcd. for $C_{17}H_{16}ClNO_3S$: C, 58.36; H, 4.61; Cl, 10.13; N, 4.00. Found: C, 58.72; H, 4.95; Cl, 9.85; N, 3.94.

1-(*p*-Toluenesulfonyl)-4-methoxy-4-indoleacetonitrile (**10**).

A mixture of 3.1 g (0.0088 mole) of **9**, 1.3 g (0.020 mole) of potassium cyanide, 0.238 g (0.0009 mole) of 18-crown-6, and 25 ml of acetonitrile was stirred and heated under reflux for 6 hours, then it was stirred at room temperature overnight. The reaction mixture was filtered through an alumina filter cake and the filtrate was concentrated under reduced pressure. The yellow solid residue was chromatographed on silica gel and eluted with benzene, to afford 2.45 g (81%) of pure product, mp 134-136°. An analytical sample was recrystallized from ethanol, mp 134-136°; nmr (deuteriochloroform): δ 2.38 (s, 3H, C*H*$_3$), 3.67 (s, 3H, OC*H*$_3$), 3.82 (s, 2H, C*H*$_2$CN), 6.65-7.90 (m, 8H, Ar*H*).

Anal. Calcd. for $C_{18}H_{16}N_2O_3S$: C, 63.51; H, 4.73; N, 8.22. Found: C,

63.58; H, 4.79; N, 8.20.

7-Methoxyindole-4-acetic Acid (**11**).

A mixture of 3.8 g (0.0111 mole) of **10**, 12.0 g (0.157 mole) of potassium hydroxide, 10 ml of water, and 40 ml of methanol was heated under reflux for 24 hours. The methanol was distilled, and the residue was diluted with 50 ml of water and extracted with two 50 ml portions of ether. The aqueous layer was decolorized with charcoal, filtered, cooled, and treated with excess 3*N* hydrochloric acid. The turbid mixture was extracted with four 25 ml portions of ether. The pooled extracts were washed with saturated sodium chloride solution, dried over sodium sulfate, and concentrated under reduced pressure to give a brown oil which slowly crystallized. This was recrystallized from benzene-petroleum ether (bp 37-54°) to yield 2.05 g (90%) of product, mp 125-127°; nmr (deuteriochloroform): δ 3.83 (s, 2H, CH_2COOH), 3.92 (s, 3H, OCH_3), 6.50-7.22 (m, 4H, Ar*H*), 8.48 (br s, 1H), 9.14 (br s, 1H).

Anal. Calcd. for $C_{11}H_{11}NO_3$: C, 64.38; H, 5.40; N, 6.82. Found: C, 64.63; H, 5.63; N, 6.67.

7-Methoxyindole-4-(*N,N*-di-*n*-propylacetamide) (**12**).

A solution of 2.05 g (0.01 mole) of **11**, 3.03 g (0.030 mole) of di-*n*-propylamine, and hexamethylphosphoroustriamide (2.88 g of 85% purity, 0.03 mole) in 55 ml of tetrahydrofuran was stirred and cooled to -20°, then 3.08 g (0.020 mole) of carbon tetrachloride in 10 ml of tetrahydrofuran was added over 3 minutes. The resulting suspension was stirred for 10 minutes, then the reaction mixture was allowed to warm to room temperature, and it was stirred for 40 minutes more. The reaction mixture was then poured into 500 ml of 1% hydrochloric acid, and this mixture was extracted with four 50 ml portions of ether. Evaporation of the pooled extracts gave a semi-solid which was chromatographed on silica gel and eluted with chloroform to afford 2.32 g (80%) of product, mp 86-89°. An analytical sample was recrystallized from cyclohexane, mp 88-90°; nmr (deuteriochloroform): δ 0.69-0.94 (m, 6H, aliphatic *H*), 1.25-1.69 (m, 4H, aliphatic *H*), 3.07-3.38 (m, 4H, aliphatic *H*), 3.91 (s, 5H, CH_2CO and OCH_3), 6.51-7.35 (m, 4H, Ar*H*).

Anal. Calcd. for $C_{17}H_{24}N_2O_2$: C, 70.80; H, 8.38; N, 9.71. Found: C, 70.83; H, 8.30; N, 9.75.

4-(2-Di-*n*-Propylaminoethyl)-7-methoxyindole Bifumarate (**1b**).

A solution of 2.3 g (0.008 mole) of **12** in 10 ml of anhydrous tetrahydrofuran was added in one portion to a stirred suspension of 3.07 g (0.080 mole) of lithium aluminum hydride in 90 ml of anhydrous tetrahydrofuran, and the resulting mixture was stirred under nitrogen under reflux for 12 hours. Excess lithium aluminum hydride was destroyed with 15 ml of saturated sodium sulfate solution. The resulting mixture was filtered, and the filter cake was washed with three 50 ml portions of ether, which were added to the filtrate. The filter cake was then dissolved in 3*N* potassium hydroxide, and this solution was extracted with two 50 ml portions of ether. The pooled filtrate and ethereal extracts were dried over sodium sulfate and evaporated under reduced pressure. The brown, oily residue was taken up in 15 ml of ether, and this solution was added to a solution of 1.16 g of fumaric acid in 15 ml of ethanol. The resulting solution was diluted with 20 ml of ether, and was permitted to stand for several hours. The solid which separated was collected on a filter, washed with ether, and dried under reduced pressure to afford 2.37 g (75%) of product, mp 169-171° dec; nmr (deuteriochloroform): (free base) δ 0.72-1.13 (t, 6H, aliphatic *H*), 1.20-2.23 (m, 4H, aliphatic *H*), 2.34-2.75 (m, 4H, aliphatic *H*), 2.93 (br s, 4H, aliphatic *H*), 3.93 (s, 3H, OCH_3), 6.45-7.18 (m, 4H, Ar*H*).

Anal. Calcd. for $C_{21}H_{30}N_2O_5$ (bifumarate salt): C, 64.59; H, 7.74; N, 7.17. Found: C, 64.77; H, 7.80; N, 7.17.

2-Methyl-3-bromo-6-methoxyaniline Hydrochloride (**19**).

A reduction procedure of Hazlet and Dornfeld (16) was used. Iron filings (40 mesh: 5 g, 0.09 g atom) were activated by treatment with 1 ml of concentrated hydrochloric acid with manual stirring. After thorough drying in a vacuum desiccator at 60°, the iron was added to a refluxing solution of 0.5 g (0.0002 mole) of **15** in 25 ml of benzene. The resulting mixture was heated and stirred under reflux for 30 minutes, then 3 ml of water was added in increments over 10 hours. The warm mixture was filtered, and the filter cake was washed with three 35 ml portions of hot benzene. The combined filtrate and washings were dried over sodium sulfate, then filtered. Addition of ethereal hydrogen chloride to the filtrate resulted in separation of 0.47 g (93%) of product, mp 225-230°.

Anal. Calcd. for $C_8H_{11}BrClNO$: C, 38.05; H, 4.39; N, 5.55. Found: C, 38.27; H, 4.44; N, 5.32.

3-Methyl-4-bromoanisole (**20**). Method A.

To a mixture of 0.55 g (0.0022 mole) of **19** in 0.9 ml of concentrated hydrochloric acid and 3.5 ml of water, cooled to 0-5°, was added a cold solution of 0.2 g (0.003 mole) of sodium nitrite in 15 ml of water. After stirring in the cold for 15 minutes, 5 g (0.0375 mole) of cold 50% hypophosphorous acid was added. Stirring was continued in the cold for 15 minutes more, and the reaction mixture was allowed to come to room temperature and stand for 6 hours. It was then treated with excess sodium hydroxide and was extracted with three 25 ml portions of ether. The pooled extracts were washed with water, dried over sodium sulfate, the solvent was evaporated, and the residue was sublimed at 0.5 mm to give 0.27 g (61%) of product. Lit (11) bp 112° (14 mm); nmr (deuteriochloroform): δ 2.32 (s, 3H, $ArCH_3$), 3.72 (s, 3H, OCH_3), 6.40-6.80 (m, 2H, Ar*H*), 7.4 (d, 1H, Ar*H*); ir (film): 2840, 1285, 605, 860, 845, 800 cm^{-1}. Thin layer chromatography (silica gel G, 1:5 benzene-petroleum ether) R_f 0.709.

6-Bromo-*m*-cresol (**17**).

To a chilled (5°) solution of 5.4 g (0.05 mole) of *m*-cresol in 27 g of acetic acid was added dropwise and with stirring 8 g (0.05 mole) of bromine in 8 g of acetic acid. The reaction mixture was maintained at 5° for 2 hours, then it was poured into 100 ml of ice water. The resulting mixture was extracted with three 75 ml portions of methylene chloride, and the pooled extracts were dried over sodium sulfate. Removal of the solvent under reduced pressure and distillation of residue, bp 123-142° (20 mm) gave 8.12 g of material which partially solidified. Recrystallization of this from petroleum ether (bp 37-54°) provided 6.62 g (71%) of hygroscopic needles, mp 54-55°. Lit (11) mp 54°.

3-Methyl-4-bromoanisole (**20**). Method B.

Dimethyl sulfate (3.4 g, 0.027 mole) was slowly added to a cooled flask containing 2.85 g (0.0153 mole) of **17**. The resulting white paste was stirred in an ice bath and 1.2 g (0.03 mole) of sodium hydroxide in 2.5 ml of water was added. The resulting mixture was heated at 100° for 15 minutes. The cooled reaction mixture was extracted with three 25 ml portions of ether, and the pooled extracts were dried over sodium sulfate. Removal of the ether gave 3.05 g (99%) of a colorless oil whose ir and nmr spectra were superimposable upon corresponding spectra of the product of Method A. The products of Methods A and B gave the same R_f value on thin layer chromatographic analysis (silica gel G, 1:5 benzene-petroleum ether), and a mixture of the two products gave a single spot with the same R_f value.

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