Synthesis of 7-Methyl-4,6,6a,7,10,10a-hexahydroindolo[4,3-*fg*]quinazoline Derivatives

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The synthesis of a series of compounds indolo[4,3-*fg*]quinazoline related to ergoline (indolo[4,3-*fg*]quinoline) is reported. The key step of the synthetic sequence is the ring cleavage of the ketone **IV**. The stereochemistry of the chiral centers is established by the chirality of dihydrolysergic acid **I**.

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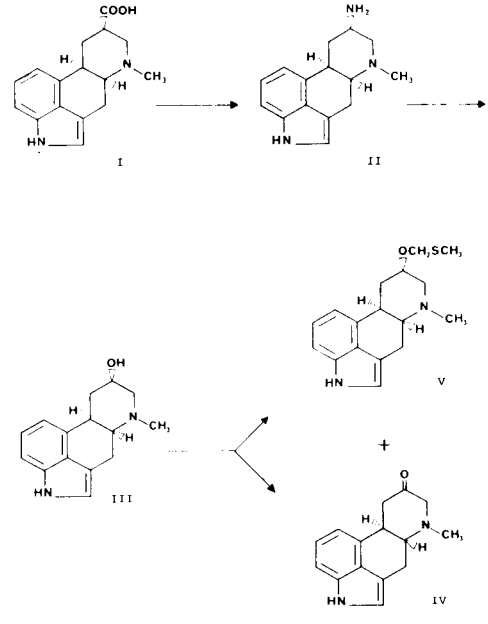
Ergoline compounds have always aroused much interest in medicine because of their remarkable properties [1a-b]. In fact ergoline derivatives are used as oxytocics like ergotamine [2], for the control of prolactin release and treatment of Parkinson disease such as cabergoline [3a-b] and bromocriptine [4] and as central vasodilator such as nicergoline [5]. During recent years increasing efforts have been concentrated on the synthesis of new derivatives [6] and partial structures [7a-e] with the aim of obtaining new compounds that are more active and more selective and therefore suitable candidates for human therapy. As a continuation of our interest in the synthesis and pharmacological properties of ergoline derivatives and as a part of our program of seeking new ergoline congeners, the synthesis of hexahydroindolo[4,3-*fg*]quinazoline derivatives has been undertaken, following the reasonable assumption that, as shown in previous works [8a-d], a whole ergoline skeleton is not fundamental for displaying biological properties generally associated with this ring system (octahydroindolo[4,3-*fg*]quinoline).

Our approach to these congeners of the ergoline structure is based on the expectation that these molecules, which have certain structural features in common with the ergolines and moreover encompass the quinazoline unit that is known to be biologically versatile [9a-b], could display biological activity.

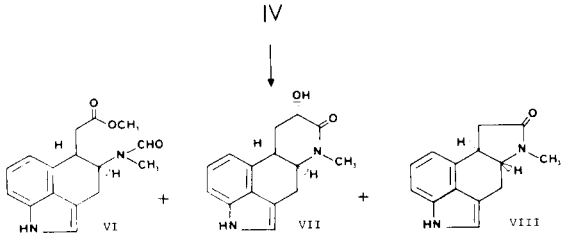
The synthetic route was chosen so as to overcome stereochemical ambiguities of the resulting compounds on account of the crucial role of the stereochemistry in determining the biological effects in the ergoline field [10a-b]. With this assumption, a semisynthetic scheme was planned starting from 6-methyl-8-oxoergoline **IV**, available from dihydrolysergic acid **I**. Compound **IV** [11] was prepared by oxidation of 6-methyl-8β-hydroxyergoline **III** [12], which can be obtained by diazotation of 6-methyl-8β-aminoergoline **II** arousing from a Curtius degradation of dihydrolysergic acid hydrazide [13]. By this route the chiral centers of the target compounds are already established at the first step of the synthesis and are not involved in the following as shown in Scheme 1.

Scheme 1



The oxidation of the alcohol **III** was accomplished by a modified Parikh and Doering method [14], affording the ketone **IV** in good yield besides the methylthiomethyl ether **V**. The following step was the cleavage of the piperidone ring of compound **IV**. Exploiting a reaction of β-aminoketones [14a-b], the cleavage was accomplished by bubbling a stream of oxygen in a methanolic solution of **IV** containing one equivalent of sodium methoxide. The amido ester (4α,5β)-1,3,4,5-tetrahydro-4-*N*-formylmethylamino-5-methoxycarbonylmethylbenz[*cd*]indole **VI** was formed, as the major compound, accompanied by the hydroxy lactam 6-methyl-7-oxo-8α-hydroxyergoline **VII** and the lactam 7-methyl-8-oxo-6,6a,7,8,9,9a-hexahydro-4*H*-indolo[4,3-*ef*]indole deriving from deformylation of compound **VI** and subsequent ring closure as depicted in Scheme 2.

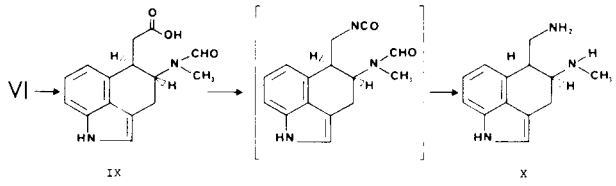
Scheme 2



The structures and the stereochemical assignments of these compounds were established on the basis of spectral data. The stereochemistry of compound **VII** was moreover supported by comparison of the LAH reduction product with an authentic sample of 6-methyl-8α-hydroxyergoline.

The amino function required for the construction of the prefixed ring system was obtained by a Curtius reaction carried out on the acid (4α,5β)-1,3,4,5-tetrahydro-4-*N*-formylmethylamino-5-carboxymethylbenz[*cd*]indole **IX**, prepared by a controlled alkaline saponification of compound **VI**. By treatment of compound **IX** with diphenylphosphoryl azide [15], the corresponding isocyanate was obtained, which, without isolation, was hydrolysed in aqueous hydrochloric acid to the diamine (4α,5β)-1,3,4,5-tetrahydro-4-methylamino-5-aminomethylbenz[*cd*]indole **X**, key intermediate for the synthesis of hexahydroindolo-[4,3-*fg*]quinazoline derivatives as illustrated in the following Scheme 3.

Scheme 3

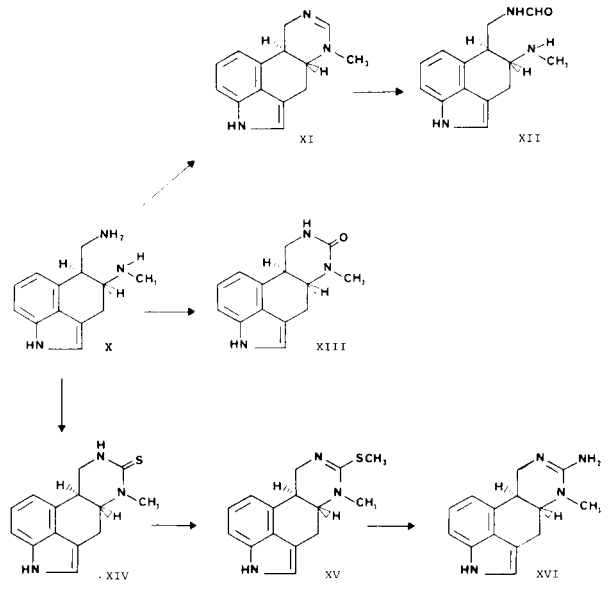


The preparation of the proposed hexahydroindolo[4,3-*fg*]quinazoline derivatives was achieved by reaction of compound **X** with the suitable reagents as depicted in the following Scheme 4.

By reaction of compound **X** with triethyl orthoformate, 7-methyl-4,6,6a,7,10,10a-hexahydroindolo[4,3-*fg*]quinazoline **XI** was formed in almost quantitative yield [16a-b]. Compound **XI** was easily hydrolysed in acid aqueous solution affording (4α,5β)-1,3,4,5-tetrahydro-4-methylamino-5-formylaminomethylbenz[*cd*]indole **XII**. The other regioisomer in regard to the position of the formyl group [17a-b] was not detected. The position of the formyl group has been established on the basis of the chemical shift of the *N*-methyl which for compound **XII** is 2.35 ppm instead of 2.85 ppm in the case of the other regioisomer.

The preparation of 7-methyl-8-oxo-4,6,6a,7,8,9,10,10a-

Scheme 4



octahydroindolo[4,3-*fg*]quinazoline **XIII** was accomplished through the cyclization of compound **X** with 1,1'-carbonyldiimidazole in dimethylformamide [18]. The thione 7-methyl-8-thioxo-4,6,6a,7,8,9,10,10a-octahydroindolo[4,3-*fg*]quinazoline **XIV** in turn, was prepared condensing compound **X** with 1,1'-thiocarbonyldiimidazole in dimethylformamide at 60° [19a-b]. The reaction takes place under milder conditions than those required for a similar reaction using carbon disulphide [20]. The treatment of compound **XIV** with methyl iodide in refluxing tetrahydrofuran, afforded 7-methyl-8-methylthio-4,6,6a,7,10,10a-hexahydroindolo[4,3-*fg*]quinazoline.

As illustrated in Scheme 4, the synthesis of 7-methyl-8-amino-4,6,6a,7,10,10a-hexahydroindolo[4,3-*fg*]quinazoline **XVI** was readily achieved by heating a methanolic solution of the hydroiodide of compound **XIV** in the presence of gaseous ammonia [21]. The compounds of this series were tested for pharmacological activity. The pharmacological results will be published elsewhere.

EXPERIMENTAL

Melting points were determined on a Büchi melting point apparatus and are uncorrected. The ir spectra were recorded on a Perkin Elmer 125 spectrophotometer. The ^{1}H-nmr spectra were recorded on a Varian XL-200 (chemical shifts are given in ppm (δ) downfield from tetramethylsilane). The EI mass spectra were recorded at 70 eV on a Varian MAT 3111A Mass spectrometer. All compounds had ir, nmr and mass spectra that were fully consistent with their structures. The elemental analysis were within ±0.4% their theoretical values.

6-Methyl-8-oxoergoline (**IV**) and 6-Methyl-8β-methylthiomethyloxyergoline (**V**).

To a stirred solution of 6-methyl-8β-hydroxyergoline (**III**) (14.5 g, 0.06 mole) in a mixture of dimethyl sulphoxide (50 ml) and triethylamine (50 ml) was added portionwise the complex sulphuric anhydride/triethylamine (21.7 g, 0.12 mole) at room temperature. After 10 minutes, a solution of glacial acetic acid (80 ml) in water (500 ml) was added to the reaction mixture and the stirring was continued for 30 minutes. The resulting solution was basified with concentrated ammonium hydroxide until *p*H 10. After extraction with ethyl acetate, the organic phase was washed with brine and dried (magnesium sulfate). The solvent was removed *in vacuo* affording the crude ketone **IV**, which was crystallized from a small volume of acetone giving 10.5 g (73%) of pure compound, mp 210-212°; ir (potassium bromide): ν 3300 (N-H), 1710 (C=O) cm^{-1}; ^{1}H-nmr (pentadeuterio pyridine) δ: 2.34 (s, 3H, N-CH_3), 2.54 (dd, J = 16.0, 16.0 Hz, 1H, H-9ax), 2.59 (m, 1H, H-5), 2.78 (ddd, J = 1.5, 11.0, 14.0 Hz, 1H, H-4ax), 3.00 (d, J = 15.0 Hz, 1H, H-7ax), 3.38 (d, J = 15.0 Hz, 1H, H-7e), 3.3-4.7 (m, 3H, H-4e, H-9e, H-10), 6.8-7.4 (m, 4H, aromatic H's); ms: m/z 240 (79, $M^{+\cdot}$), 212 (42), 211 (35), 197 (22), 181 (53), 168 (45), 167 (75), 154 (100), 144 (27), 127 (54), 115 (33).

Anal. Calcd. for $C_{15}H_{16}N_2O$: C, 74.97; H, 6.71; N, 11.66. Found: C, 74.85; H, 6.65; N, 11.59.

The acetone mother liquor of compound **IV** was chromatographed on silica gel eluting with hexane/ethyl acetate 4/1. The fractions containing the less polar compound were combined, yielding after removal of the solvent and crystallization from diethyl ether 0.8 g of compound **V**, mp 154-157°; ir (potassium bromide): ν 2700-3600 (N-H, C-H) cm^{-1}; ^{1}H-nmr (deuteriochloroform): δ 1.40 (ddd, J = 12.0, 12.0, 12.0 Hz, 1H, H-9ax), 2.21 (s, 3H, S-CH_3), 2.54 (s, 3H, N-CH_3), 4.10 (m, 1H, H-8ax), 4.78 (s, 2H, OCH_2-S), 6.7-7.2 (m, 4H, aromatic H's), 8.50 (bs, 1H, NH-1); ms: m/z 302 (28, $M^{+\cdot}$), 240 (49), 225 (51), 223 (56), 211 (35), 195 (39), 167 (61), 154 (100), 127 (30), 47 (46).

Anal. Calcd. for $C_{17}H_{22}N_2OS$: C, 67.51; H, 7.33; N, 9.26. Found: C, 67.68; H, 7.40; N, 9.21.

[4α,5β]-1,3,4,5-Tetrahydro-4-*N*-formylmethylamino-5-methoxycarbonylmethylbenz[*cd*]indole **VI**, 6-Methyl-7-oxo-8α-hydroxyergoline **VII** and 7-Methyl-8-oxo-6,6a,7,8,9,9a-hexahydro-4*H*-indolo[4,3-*ef*]indole **VIII**.

Into a solution of 4-methyl-8-oxoergoline **IV** (16.8 g, 0.07 mole) and sodium methoxide (3.85 g, 0.07 mole) in methanol (300 ml) was bubbled a stream of oxygen until disappearance of the starting material. The solvent was removed and the residue was partitioned between ethyl acetate and brine. The organic layer was separated, dried (magnesium sulphate) and the solvent was removed *in vacuo*. The reaction mixture was chromatographed on silica gel eluting with a gradient of ethyl acetate (10-30%) affording 1.2 g of compound **VII**, mp 273-275°; ir (potassium bromide); ν 2700-3600 (N-H, O-H, C-H), 1630 (C=O) cm^{-1}; ^{1}H-nmr (deuteriochloroform): δ 1.90 (ddd, J = 4.5, 12.0, 13.5 Hz, 1H, H-9ax), 2.50 (m, 1H, H-9e), 2.68 (ddd, J = 1.5, 12.0, 15.0 Hz, 1H, H-4a), 2.98 (s, 3H, N-CH_3), 3.2-3.5 (m, 3H, H-4e, H-5, H-10), 4.10 (m, 1H, H-8e), 5.54 (d, J = 5.0 Hz, 1H, OH-8), 6.8-7.2 (m, 4H, aromatic H's), 10.64 (bs, 1H, NH-1); ms: m/z 256 (90, $M^{+\cdot}$), 239 (7), 211 (4), 168 (72), 167 (50), 154 (100), 144 (7), 127 (35), 115 (25).

Anal. Calcd. for $C_{15}H_{16}N_2O_2$: C, 70.29; H, 6.29; N, 10.93. Found: C, 70.15; H, 6.18; N, 10.81.

Continuing the elution 0.8 g of compound **VIII** was obtained, mp 270-273°; ir (potassium bromide); ν 3000-3600 (C-H, N-H), 1685 (C=O) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 2.9 (s, 3H, N-CH_3), 6.7-7.3 (m, 4H, aromatic H's), 10.08 (bs, 1H, NH-1); ms: m/z 226 (100, $M^{+\cdot}$), 211 (10), 197 (65), 183 (25), 168 (57), 167 (70), 154 (98), 144 (23), 127 (58), 115 (38).

Anal. Calcd. for $C_{14}H_{14}N_2O$: C, 74.31; H, 6.24; N, 12.39. Found: C, 74.20; H, 6.28; N, 12.26.

Increasing the percentage of ethyl acetate, 14.3 g (70%) of pure compound **VI** was obtained after crystallization from acetone, mp 291-293°; ir (potassium bromide): ν 3100-3600 (N-H, C-H); 1725-1740 (C=O ester), 1645-1660 (C=O amide) cm^{-1}; ^{1}H-nmr (deuteriochloroform): δ 2.80 (m, 2H, CH_2COO), 2.90 (s, 3H, N-CH_3), 3.70 (s, 3H, O-CH_3), 6.8-7.2 (m, 4H, aromatic H's), 8.20 (bs, 1H, NH-1), 8.23 (s, 1H, N-CHO); ms: m/z 286 (16, $M^{+\cdot}$), 255 (1), 227 (39), 213 (3), 183 (4), 167 (27), 154 (100), 144 (3), 127 (14), 115 (7).

Anal. Calcd. for $C_{16}H_{18}N_2O_3$: C, 67.12; H, 6.34; N, 9.78. Found: C, 67.08; H, 6.39; N, 9.70.

[4α,5β]-1,3,4,5-Tetrahydro-4*N*-formylmethylamino-5-carboxymethylbenz[*cd*]indole **IX**.

To a solution of [4α,5β]-1,3,4,5-tetrahydro-4*N*-formylmethylamino-5-methoxycarbonylmethylbenz[*cd*]indole **VI** (15 g, 0.05 mole) in methanol (250 ml) was added dropwise a solution of 1*M* sodium hydroxide (60 ml, 0.06 mole). The resulting solution was stirred for 2 hours at room temperature. After concentration, the mixture was diluted with brine and acidified at *p*H 3 with an aqueous solution of 1*M* methanesulphonic acid, then extracted several times with dichloromethane. The combined organic extracts were washed with brine, dried (magnesium sulphate), charcoalized and finally the solvent was removed *in vacuo*. The crude product was crystallized from acetone affording 12.3 g (88%) of **IX**, mp 218-220°; ir (potassium bromide): ν 2500-3300 (O-H, C-H, N-H); 1715-1725 (C=O); 1650 (C=O amide) cm^{-1}; ^{1}H-nmr (deuteriochloroform): δ 2.65 (m, 2H, CH_2-COO), 2.85 (s, 3H, N-CH_3), 6.8-7.2 (m, 4H, aromatic H's), 8.10 (bs, 1H, NH-1), 8.25 (s, 1H, N-CHO), 11.2 (bs, 1H, COOH); ms: m/z 272 (0.3, $M^{+\cdot}$), 226 (3), 213 (10), 183 (2), 167 (10), 154 (100), 127 (12), 115 (7).

Anal. Calcd. for $C_{15}H_{16}N_2O_3$: C, 66.16; H, 5.92; N, 10.29. Found: C, 66.07; H, 5.80; N, 10.21.

[4α,5β]-1,3,4,5-Tetrahydro-4-methylamino-5-aminomethylbenz-[*cd*]indole **X**.

To a stirred solution of [4α,5β]-1,3,4,5-tetrahydro-4*N*-formylmethylamino-5-carboxymethylbenz[*cd*]indole **IX** (16.3 g, 0.06 mole) in anhydrous tetrahydrofuran (50 ml) were added dropwise triethylamine (8.5 g, 0.06 mole) and after 10 minutes diphenylphosphoryl azide (17.5 g, 0.06 mole) at 0°. After 30 minutes, the resulting solution was added dropwise to a refluxing solution of 1*N* hydrochloric acid (300 ml). The reflux was continued for 30 minutes, then after cooling the solution was extracted with dichloromethane. The aqueous phase was basified with concentrated ammonium hydroxide and further extracted several times with dichloromethane. After drying (magnesium sulphate), the solvent was removed *in vacuo*. The resulting white foam was crystallized from diethyl ether yielding 10.3 g (80%) of **X**, mp 73-75°; ir (potassium bromide); ν 2000-3700 (N-H, N-H_2, C-H), 1550-1650 (N-H) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 2.27 (s, 3H, N-CH_3), 2.74 (m, 2H, CH_2-NH_2), 2.8-2.9 (m, 3H, CH_2-3, H-5), 3.16 (m, 1H, H-4), 6.7-7.1 (m, 4H, aromatic H's), 10.48 (bs, 1H, NH-1); ms: FD 215 (M).

Anal. Calcd. for $C_{13}H_{17}N_3$: C, 72.52; H, 7.96; N, 19.52. Found:

C, 72.38; H, 7.88; N, 19.37.

7-Methyl-4,6,6a,7,10,10a-hexahydroindolo[4,3-*fg*]quinazoline **XI**.

A suspension of (4α,5β)-1,3,4,5-tetrahydro-4-methylamino-5-aminomethylbenz[*cd*]indole **X** (5 g, 0.03 mole) in triethyl orthoformate (50 ml) was heated at reflux for 3 hours. The resulting solution was evaporated *in vacuo* and the residue dissolved in ethanol was charcoalized. Filtration and concentration afforded 4.2 g (80%) of **XI** as shiny crystals, mp 220-222°; ir (potassium bromide): ν 2500-2600 (C-H; N-H), 1640 (N=C-N) cm^{-1}; ^{1}H-nmr (deuteriochloroform): δ 2.70 (m, 1H, H-10ax), 3.00 (s, 3H, N-CH_3), 6.8-7.2 (m, 6H, NH-4, H-8, aromatic H's); ms: m/z 225 (28, $M^{+\cdot}$), 210 (4), 183 (3), 167 (14), 155 (83), 154 (100), 127 (29), 115 (6).

Anal. Calcd. for $C_{14}H_{15}N_3$: C, 74.63; H, 6.71; N, 18.65. Found: C, 74.52; H, 6.59; N, 18.58.

7-Methyl-8-oxo-4,6,6a,7,8,9,10,10a-octahydroindolo[4,3-*fg*]quinazoline **XIII**.

To a stirred solution of (4α,5β)-1,3,4,5-tetrahydro-4-methylamino-5-aminomethylbenz[*cd*]indole **X** (3 g, 0.014 mole) in dimethylformamide (50 ml) was added dropwise a solution of 1,1'-carbonyldiimidazole (2.26 g, 0.014 mole) in dimethylformamide (30 ml) over a period of 30 minutes. After heating at 50° for 1 hour, the solution was diluted with ethyl acetate, washed with a solution of 1*N* methanesulphonic acid then with brine. After drying (magnesium sulphate) and concentration 2.7 g (80%) of **XIII** were obtained, mp 267-269°; ir (potassium bromide): ν 2700-3600 (N-H, C-H); 1650 (C=O) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 2.67 (ddd, J = 1.5, 12.0, 15.0 Hz, 1H, H-6ax), 3.20 (s, 3H, N-CH_3), 3.25 (m, 2H, H-13ax, H-10'), 3.4-3.5 (m, 2H, H-6', H-6e), 3.87 (dd, J = 5.0, 7.0 Hz, 1H, H-10e), 6.52 (d, J = 5.0 Hz, 1H, NH-CO), 6.7-7.2 (m, 4H, aromatic H's), 10.66 (bs, 1H, NH-4); ms: m/z 241 (35, $M^{+\cdot}$), 226 (8), 197 (7), 184 (5), 183 (10), 167 (11), 155 (39), 154 (100), 127 (16), 115 (8).

Anal. Calcd. for $C_{14}H_{15}N_3O$: C, 69.69; H, 6.27; N, 17.42. Found: C, 69.56; H, 6.25; N, 17.30.

7-Methyl-8-thioxo-4,6,6a,7,8,9,10,10a-octahydroindolo[4,3-*fg*]-quinazoline **XIV**.

To a stirred solution of (4α,5β)-1,3,4,5-tetrahydro-4-methylamino-5-aminomethylbenz[*cd*]indole **X** (4 g, 0.018 mole) in dimethylformamide (60 ml) at 50° was added dropwise a solution of 1,1'-thiocarbonyldiimidazole in dimethylformamide (40 ml). The heating was continued for 2 hours. After this time, the resulting yellow solution was poured into a solution of 1*M* methanesulphonic acid, and extracted with dichloromethane. The combined extracts were washed with a solution of 1*M* sodium carbonate, then dried (magnesium sulphate). The solvent was evaporated off and the crude product was crystallized from methanol affording 3.9 g (81%) of **XIV** as brown crystals, mp 258-260°; ir (potassium bromide): ν 2700-3600 (N-H, C-H); 1510-1550 (C=S thiourea) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 3.38 (s, 3H, N-CH_3), 3.90 (m, 1H, H-10e), 6.7-7.3 (m, 4H, aromatic H's), 8.37 (d, J = 5.0 Hz, 1H, NHC=S), 10.80 (bs, 1H, NH-4); ms: m/z 257 (38, $M^{+\cdot}$), 242 (15), 197 (5), 183 (9), 168 (15), 167 (44), 155 (27), 154 (100), 127 (23), 115 (8).

Anal. Calcd. for $C_{14}H_{15}N_3S$: C, 65.34; H, 5.87; N, 16.33. Found: C, 65.28; H, 5.85; N, 16.19.

7-Methyl-8-methylthio-4,6,6a,7,10,10a-hexahydroindolo-[4,3-*fg*]quinazoline Hydroiodide **XV**.

To a suspension of 7-methyl-8-thioxo-4,6,6a,7,8,9,10,10a-octahydroindolo[4,3-*fg*]quinazoline **XIV** (6 g, 0.023 mole) in tetrahydrofuran (200 ml) was added dropwise methyl iodide (14.82 g, 0.1 mole). The mixture was stirred at reflux of 2 hours. The resulting solution was charcoalized and filtered. Concentration *in vacuo* yielded 7.6 g (83%) of **XV** as tan crystals, mp 285-287°; ir (potassium bromide): ν 2500-3600 (N-H, C-H), 1595 (N-C(=S)-N-) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 2.75 (s, 3H, S-CH_3), 3.40 (s, 3H, $=N^+$-CH_3), 6.8-7.3 (m, 4H, aromatic H's), 9.43 (m, 1H, N^+H-9), 10.90 (bs, 1H, NH-4); ms: m/z 271 (6, $M^{+\cdot}$), 257 (17), 224 (2), 197 (3), 183 (5), 167 (32), 155 (42), 154 (83), 142 (100), 127 (76).

Anal. Calcd. for $C_{15}H_{17}N_3S$·HI: C, 45.11; H, 4.51; N, 10.52. Found: C, 45.22; H, 4.49; N, 10.21.

7-Methyl-8-amino-4,6,6a,7,10,10a-hexahydroindolo[4,3-*fg*]quinazoline **XVI**.

A suspension of 7-methyl-8-methylthio-4,6,6a,7,10,10a-hexahydroindolo[4,3-*fg*]quinazoline (4 g, 0.01 mole) in methanol (200 ml) was saturated with gaseous ammonia at −10°, then was heated in a stainless vessel at 50° for 1 hour. The resulting solution was evaporated and the residue was taken up in a solution of 0.1*M* sodium hydroxide (50 ml). The aqueous solution was extracted several times with dichloromethane. The organic phase was dried (magnesium sulphate) and evaporated to dryness. The crude product was crystallized from ethanol, giving 2.1 g (87%) of **XVI**, as shiny crystals, mp 228-231°; ir (potassium bromide): ν 2400-3600 (N-H, C-H), 1650 (N=C(=N)-N) cm^{-1}; ^{1}H-nmr (DMSO-d_6): δ 2.70 (ddd, J = 2.0, 12.0, 12.0 Hz, 1H, H-6ax), 3.04 (s, 3H, N-CH_3), 4.02 (dd, J = 1.0, 8.5 Hz, 1H, H-10e), 6.7-7.2 (m, 4H, aromatic H's), 10.5 (bs, 1H, NH-4); ms: m/z 241 (71, $MH^{+\cdot}$), 240 (100, $M^{+\cdot}$).

Anal. Calcd. for $C_{14}H_{16}N_4$: C, 69.97; H, 6.71; N, 23.32. Found: C, 69.85; H, 6.78; N, 23.20.

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