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STUDIES ON THE SYNTHESES OF HETEROCYCLIC COMPOUNDS—DXLVII[1]

SYNTHESIS OF A YOHIMBANE DERIVATIVE BY THERMOLYSIS[2]

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Abstract—Thermolysis of 3,4-dihydro-1-(5-methoxybenzocyclobutenyl)-β-carboline hydrochloride (**16**) in bromobenzene gave the decadehydroyohimbane (**19**), which on reduction with sodium borohydride afforded the hexadehydroyohimbane (**20**) which had already been converted into (±)-yohimbone (**21**) and (±)-alloyohimbone (**22**).

Tetralin synthesis by thermolysis of the benzocyclobutenes[3] in the presence of the dienophiles in light of the Woodward–Hoffmann rule[4] has been named the Oppolzer reaction[5] and applied to the total synthesis of chelidonine (**1**).[5]

We have recently investigated an extension of this reaction to the synthesis of a heterocyclic compound by use of the imine system as the dienophile and achieved the syntheses of the dibenzo[a,g]quinolizines (**4**) from the 1- and 2-(1-benzocyclobutenyl)-3,4-dihydroisoquinolines (**2** and **3**).[6,7] We have also examined an application of the Oppolzer reaction to the 3,4-dihydro-β-carboline and now wish to report the synthesis of the yohimbane ring system in good yield as a simple but interesting extension.

The benzocyclobutene-1-carboxylic acid (**13**), as a key intermediate, was synthesised in the usual way;[6] thus, a Knoevenagel reaction of *p*-anisaldehyde (**5**) with cyanoacetic acid in the presence of pyridine and ammonium acetate in boiling benzene using a Dean–Stark apparatus gave α-cyano-4-methoxycinnamic acid (**6**), which on reduction with sodium borohydride in the presence of saturated sodium bicarbonate solution[8] afforded the dihydrocinnamic acid (**7**). Decarboxylation was achieved in N,N-dimethylacetamide at 150°, and the resulting nitrile (**8**)[9] was treated with bromine in the presence of sodium acetate in acetic acid to give 3-bromo-4-methoxyphenylpropionitrile (**9**). The position of the Br atom was determined by conversion of **9** into the known carboxylic acid (**10**)[10] by hydrolysis with ethanolic potassium hydroxide. Treatment of the bromo-nitrile (**9**) with sodium amide, prepared freshly,[11] in liquid ammonia gave the benzocyclobutene (**12**) [ν_{max} ($CHCl_3$) 2246 cm^{-1}, *m/e* 159 (M^+)][12] by *cine*-substitution, which indicated this reaction proceeds through a benzyne intermediate

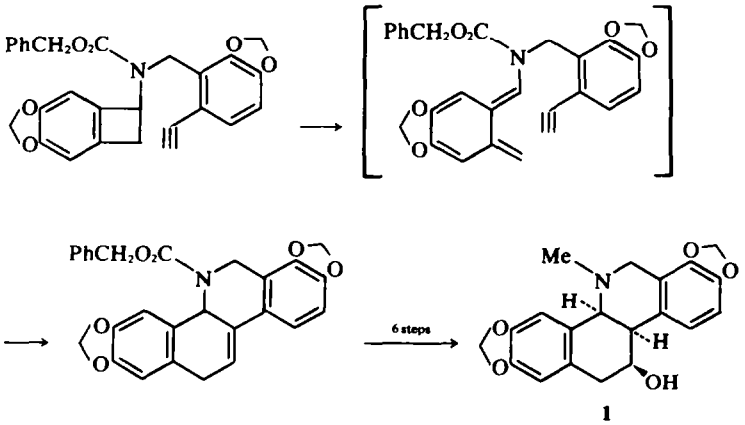

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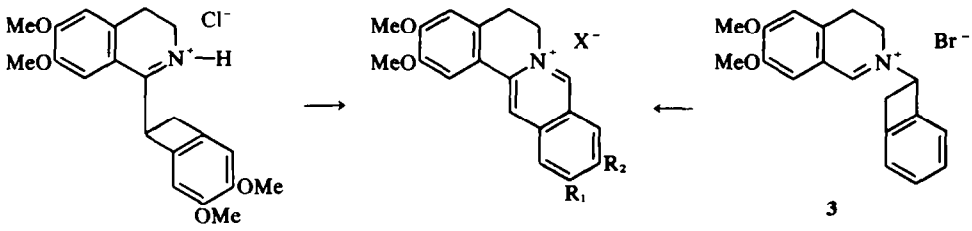
CHART 1



2 4a: $R_1 = R_2 = OMe$, X = Cl
4b: $R_1 = R_2 = H$, X = Br 3

CHART 2

(11). Hydrolysis of the nitrile (12) with ethanolic potassium hydroxide by Cava's method[13] yielded the corresponding carboxylic acid (13) [ν_{max} ($CHCl_3$) 1710; *m/e* 178 (M^+), and 134 ($M^+ - CO_2$)], the structure of which was proven by NMR spectroscopy which showed the methine proton at δ 4·24 as a triplet ($J = 4·5$ Hz) and methylene protons at 3·38 as a doublet, in addition to the O-Me, three aromatic and carboxylic protons.

Condensation of the carboxylic acid (13) with tryptamine (14) in dichloromethane in the presence of dicyclohexylcarbodiimide[14] gave the corresponding amide (15), which was converted by a Bischler-Napieralski reaction with phosphoryl chloride in boiling benzene to the 3,4-dihydro-1-(5-methoxybenzocyclobutenyl) -β - carboline, characterized as the hydrochloride (16). This structure was proven by mass [*m/e* 302 ($M^+ -$ HCl)], IR[ν_{max} ($CHCl_3$) 1625 cm^{-1} ($\overset{\diagdown}{\underset{\diagup}{C{=}\overset{+}{N}}}$)], UV[λ_{max} (MeOH) 356, 290sh, 283, 250sh and 246 nm] and NMR spectra [δ ($CDCl_3$ + DMSO-d_6) 4·00 ppm (1H, t, $J = 7$ Hz, $-\overset{\diagup}{\underset{\diagdown}{CH}}$)].

Thermolysis of the 3,4-dihydro-β-carboline hydrochloride (16) was carried out at 155° for 0·5 h in a distilled bromobenzene in a current of nitrogen to afford, in 70% yield, the expected decadehydroyohimbane (19), which could be formed by the electrocyclic reaction of 16 followed by dehydrogenation of the intermediate (18) formed by cyclization of the *o*-quinodimethane (17). It is well known that dehydrogenation of the quinolizine ring system, present in 18, gives aromatized compounds.[6,7] The structural assignment was achieved by UV [λ_{max} (MeOH) 350, 313, and 255 nm] and NMR[15] [δ (CF_3CO_2H) 7·96 (1H, s, 14-H) and 8·96 (1H, s, 21-H)] spectral considerations. Moreover, it was further proven by direct comparison with an authen-

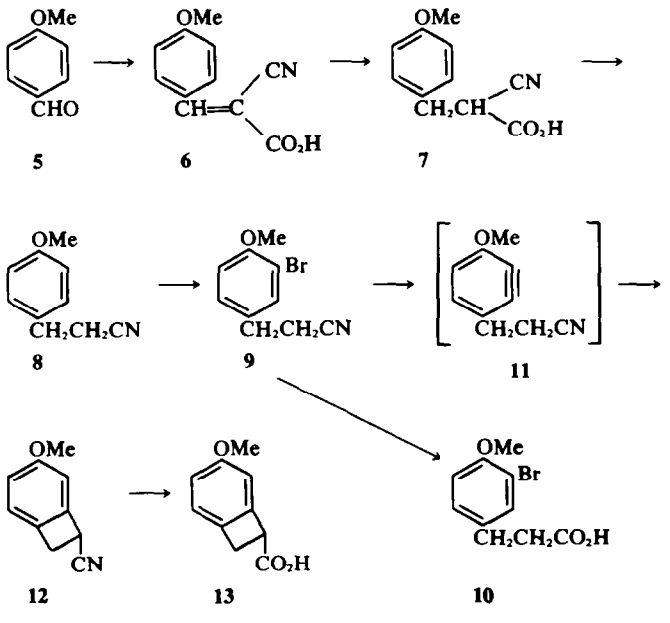


CHART 3

tic sample prepared by the Vilsmeier reaction of 3,4-dihydro-1-(3-methoxybenzyl)-β-carboline (**26**) hydrochloride. The reduction of **19** with sodium borohydride in methanol gave 15,16,17,-18, 19, 20-hexadehydro-17-methoxyyohimbane (**20**),[16] which was also prepared from the 1,2,3,4-tetrahydro-β-carboline (**27**) by the Mannich reaction. Hexadehydroyohimbane (**20**) showed the Bohlmann bands at 2805–2760 cm^{-1} in the IR, and the UV [λ_{max} (MeOH) 290sh and 282 nm] and mass spectra [*m/e* 304 (M^+), 169, 144, and 134] revealed the presence of the 15,16,17,18,19,20-hexadehydroyohimbane system,[15] which was also supported by NMR, showing the presence of the "berberine bridge" at δ 4·00 as a doublet (1H, d, $J = 15·0$ Hz; the higher field of this type quartet was obscured by other resonances).

Authentic yohimbanes (**19** and **20**) were synthesized by classic methods.[17] *m*-Methoxybenzyl cyanide (**23**)[18] was treated with alcoholic potassium hydroxide to give the corresponding phenylacetic acid (**24**), which was fused with tryptamine (**14**) at 180–185° for 0·5 h to afford the amide (**25**). The Bischler–Napieralski reaction of this amide with phosphoryl chloride in benzene furnished the 3,4-dihydro-β-carboline (**26**) hydrochloride, which was

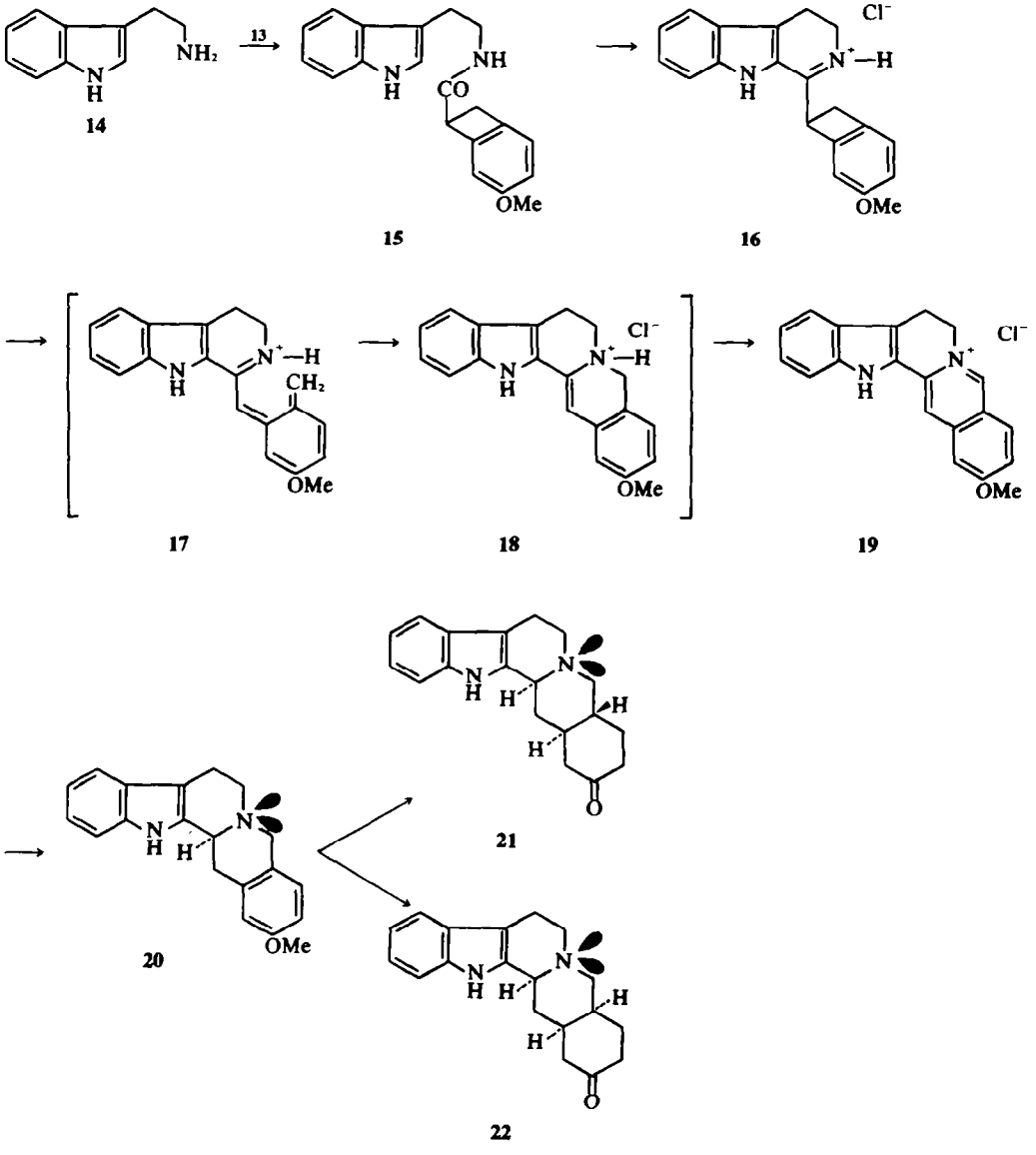


CHART 4

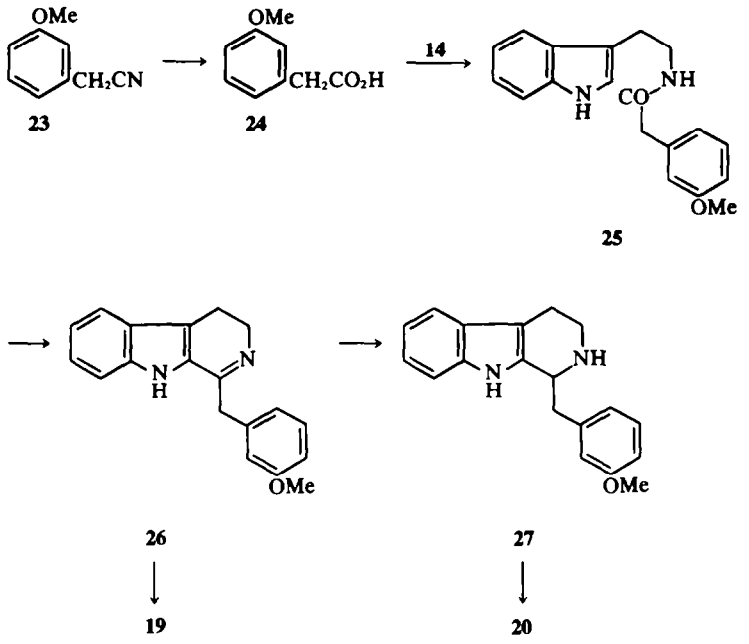


CHART 5

subjected to a Vilsmeier reaction at 60° for 2 h using phosphoryl chloride and N,N-dimethylformamide[19] to yield the decadehydroyohimbane (**19**) in poor yield. This compound was identical with the product (**19**) obtained by thermolysis of **16** by spectroscopic and m.p. comparisons. The reduction of crude 3,4-dihydro-β-carboline (**26**) hydrochloride with sodium borohydride gave the 1,2,3,4-tetrahydro-β-carboline (**27**), easily characterized as the hydrochloride.[16] The Mannich reaction of this hydrochloride with 37% formalin in the presence of concentrated hydrochloric acid in methanol gave, in poor yield, the hexadehydroyohimbane (**20**), which was identical with the above sample by m.p. comparison.

The hexadehydroyohimbane (**20**) had been converted into *trans*-yohimbone (**21**)[16] and (±)-alloyohimbone (**22**)[20] by the Birch reduction. Therefore, the formation of **20** by thermolysis of the benzocyclobutene derivative (**16**) indicated that the synthesis of two types of yohimbane has been accomplished.

EXPERIMENTAL

M.ps are uncorrected and were determined on a Yanagimoto microapparatus (MP-S2). IR spectra were measured with a Hitachi EPI-3 and UV spectra with a Hitachi 124 spectrophotometer. NMR spectra were measured on a Hitachi H-60 using TMS as an internal standard, and mass spectra were taken with a Hitachi RMU-7.

α-Cyano-4-methoxycinnamic acid (**6**). A mixture of **5** (136·1 g), cyanoacetic acid (85 g), ammonium acetate (15 g), pyridine (140 ml) and benzene (780 ml) was heated under reflux using a Dean–Stark apparatus. After a calculated amount of water had separated, the mixture was cooled and the yellow crystals which separated were collected to give **6** (232·4 g; 82·3%) as the pyridinium salt; (Nujol) 2220 (CN), 1670 cm^{-1} (C=O). After acidification of the above salt with 10% HCl, pale yellow crystals were collected and recrystallised from MeOH to give **6** as pale yellow needles; m.p. 235° (lit.,[21] m.p. 226°); IR (Nujol) 2220 (CN), 1670 cm^{-1} (C=O); NMR (CF_3CO_2H) δ 4·03 (3H, s, OMe), 7·10 (2H, d, J = 9 Hz, 3-H and 5-H), 8·05 (2H, d, 2-H and 6-H), 8·44 (1H, s, Ar—CH=C—), and 9·94 (1H, s, —CO_2H). (Calc. for $C_{11}H_9NO_3$: C, 65·02; H, 4·46; N, 6·89. Found: C, 64·89; H, 4·33; N, 6·71%).

α-Cyano-β-(4-methoxyphenyl)propionic acid (**7**). To a soln of **6** (26 g) in MeOH (300 ml) and $NaHCO_3$ aq (100 ml) was added $NaBH_4$ (15 g) in small portions with stirring at 18° over 1 h. After addition, the stirring was continued for 0·5 h at room temp and the solvent was removed by distillation. The residue was diluted with water and washed with ether. The aqueous layer was acidified with 10% HCl and extracted with ether, and the extract was washed with water, dried (Na_2SO_4), and evaporated to give **7** (21·3 g; 81%) as colorless prisms after recrystallisation from benzene: m.p. 82°; IR ($CHCl_3$) 2255 (CN), 1735 cm^{-1} (C=O); NMR ($CDCl_3$) δ3·25 (2H, d, J = 6 Hz, $ArC\underline{H}_2$—), 3·73 (1H, t, J = 8 Hz, —C^{CN}_H_{CO_2H}), 3·78 (3H, s, OMe), 6·85 (2H, d, J = 8 Hz, 3-H and 5-H), 7·20 (2H, d, 2-H and 6-H). (Calc. for $C_{11}H_{11}NO_3$: C, 64·38; H, 5·40; N, 6·83. Found: C, 63·91; H, 5·38; N, 6·83%).

p-Methoxyphenylpropionitrile (**8**). A soln of **7** (270 g) in N,N-dimethylacetamide (600 ml) was heated at 150° for 3·5 h, and the mixture was then poured into water. The

oil which separated was extracted with ether and the extract was washed with water, dried (Na_2SO_4), and evaporated to leave a residue, which was distilled *in vacuo* to give 186·6 g (88%) of **8** as a colorless oil; b.p. 125–132°/0·8 mm Hg (lit.,[9] b.p. 127°/0·8 mm Hg); IR ($CHCl_3$) 2246 cm^{-1} (CN); UV λ_{max} (MeOH) 277 and 282 nm; NMR ($CDCl_3$) δ2·35–3·00 (4H, m, $-C\underline{H}_2-C\underline{H}_2-$), 3·73 (3H, s, OMe), 6·77 (2H, d, $J = 8$ Hz, 3-H and 5-H), 7·10 (2H, d, $J = 8$ Hz, 2-H and 6-H). (Calc. for $C_{10}H_{11}NO$: C, 74·51; H, 6·88; N, 8·69. Found: C, 75·08; H, 7·00; N, 8·75%).

3-Bromo-4-methoxyphenylpropionitrile (**9**). To a mixture of **8** (152 g), NaOAc (154 g), and AcOH (950 ml) was added dropwise 150·3 g of Br_2 with stirring at room temp over 7 h. Stirring was continued for 0·5 h and then the mixture was poured into water. The oil which separated was extracted with ether and the extract was washed with Na_2CO_3 aq, 10% NaOH and water, dried (Na_2SO_4), and distilled to give 199·4 g (88%) of **9** as a colorless oil: b.p. 168–174°/4 mm Hg; IR ($CHCl_3$) 2255 cm^{-1} (CN); UV λ_{max} (MeOH) 287, 282 nm; *m/e* 239 (M^+), 241 (isotope peak), 199 ($M^+ - CH_2CN$), 201 (isotope peak); NMR ($CDCl_3$) δ2·72 (2H, t, $J = 10·5$ Hz, $-CH_2CN$), 2·78 (2H, t, $J = 10·5$ Hz, $ArCH_2$), 3·75 (3H, s, OMe), 6·78 (1H, d, $J = 9$ Hz, 5-H), 7·12 (1H, dd, $J = 9$ and 3 Hz, 6-H), 7·38 (1H, d, $J = 3$ Hz, 2-H). (Calc. for $C_{10}H_{10}BrNO$: N, 5·84. Found: N, 5·92%).

3-Bromo-4-methoxyphenylpropionic acid (**10**). A mixture of **9** (2·3 g), KOH (2·8 g), and EtOH (50 ml) was refluxed for 30 h, EtOH was distilled off *in vacuo*, and the residue was poured into water, the resulting solution was acidified with 10% HCl and extracted with $CHCl_3$. The extract was washed with water, dried (Na_2SO_4) and evaporated *in vacuo* to give **10** (1·7 g; 65·5%) as colorless plates from benzene–n-hexane: m.p. 99° (lit.,[10] m.p. 96–97°); IR ($CHCl_3$) 1710 cm^{-1} (C—O); NMR ($CDCl_3$) δ2·72 (2H, t, $J = 10·5$ Hz, $-C\underline{H}_2-CO_2H$), 2·78 (2H, t, $J = 10·5$ Hz, $Ar-C\underline{H}_2-$), 3·85 (3H, s, OMe), 6·78 (1H, d, $J = 9$ Hz, 5-H), 7·12 (1H, dd, $J = 9$ and 3 Hz, 6-H), 7·38 (1H, d, $J = 3$ Hz, 2-H). (Calc. for $C_{10}H_{11}BrO_3$: C, 46·35; H, 4·30; Br, 30·84. Found: C, 46·75; H, 4·35; Br, 30·59%).

1-Cyano-5-methoxybenzocyclobutene (**12**). To a soln of $NaNH_2$ (prepared from 1 l of liquid NH_3 and 25 g of Na by using $FeCl_3 \cdot 6H_2O$ as a catalyst) **9** (15 g) was added in portions and the mixture was stirred for 3·5 h. After evaporation of excess NH_3, 20 g of solid NH_4Cl and 200 ml of water were added to the remaining residue in portions. The mixture was shaken with $CHCl_3$ and the organic layer was separated, washed with 5% HCl and water, dried (Na_2SO_4) and distilled to give 7·7 g (79%) of **12** as a colorless oil: b.p. 105–109°/0·75 mm Hg (lit.,[12] b.p. 101–105°/0·6 mm Hg; 93°/0·1 mm Hg); IR ($CHCl_3$) 2246 cm^{-1} (CN); UV λ_{max} (MeOH) 290, 283 nm; *m/e* 159 (M^+), 141; NMR ($CDCl_3$) δ3·46 (2H, distorted q, $J = 5$ Hz, $-CH_2-$), 3·72 (3H, s, OMe), 4·09 (1H, t, $J = 5$ Hz, $-CH<$), 6·73 (1H, d, $J = 2$ Hz, 6-H), 6·88 (1H, dd, $J = 5$ and 2 Hz, 4-H), 7·03 (1H, d, $J = 5$ Hz, 3-H).

5-Methoxybenzocyclobutene-1-carboxylic acid (**13**). A soln of **12** (7·7 g) in 37·2 ml sat ethanolic KOH was set aside at room temp for 20 h and then diluted with 8 ml water. The mixture was refluxed for 3 h and then poured into 50 ml water, and washed with ether. The aqueous layer was acidified with 6N HCl and extracted with ether. The extract was washed with water, dried (Na_2SO_4), and evaporated to give 7·5 g (87·2%) of **13** as colorless prisms from benzene–n-hexane: m.p. 99·5°; IR ($CHCl_3$) 1710 cm^{-1} (C=O); *m/e* 178 (M^+), 134 ($M^+ - CO_2$); NMR ($CDCl_3$) δ3·38 (2H, d, $J = 4·5$ Hz, $-CH_2-$), 3·75 (3H, s, OMe), 4·24 (1H, t, $J = 4·5$ Hz, $>CH-$), 6·80–7·05 (3H, m, ArH), 9·00 (1H, broad, $-CO_2H$). Calc. for $C_{10}H_{10}O_3$: C, 67·40; H, 5·66. Found: C, 67·67; H, 5·80%).

N-(3-Indolylethyl)-5-methoxybenzocyclobutene-1-carboxamide (**15**). To a suspension of **14** (1·76 g) and **13** (1·78 g) in 6·0 ml of CH_2Cl_2 was added 2·32 g of dicyclohexylcarbodiimide at room temp with stirring and the mixture was stirred for 2 h. After removal of an insoluble material, the filtrate was diluted with 10 ml of CH_2Cl_2. The organic layer was washed with 2% HCl, 5% $NaHCO_3$, and water, and dried (Na_2SO_4). Evaporation of the solvent gave 2·08 *g* (65%) of **15** as colorless needles from benzene–n-hexane: m.p. 150°; IR ($CHCl_3$) 3485 (indole NH), 3430 (—NH—), 1655 cm^{-1} (C=O); *m/e* 320 (M^+), 144; NMR ($CDCl_3$) δ2·93 (2H, t, $J = 6$ Hz, $ArC\underline{H}_2CH_2-$), 2·98 (1H, dd, $J = 16$ and 3 Hz, $-CH_2-CH<$, the lower field of this was obscured by other resonances), 3·43 (2H, t, $J =$ Hz, $-NH-C\underline{H}_2-$), 3·62 (3H, s, OMe), 4·15 (1H, dd, $J = 3$ and 6 Hz, $>C\underline{H}-CH_2-$), 8·50 (1H, broad, indole NH). (Calc. for $C_{20}H_{20}N_2O$: C, 74·97; H, 6·29; N, 8·74. Found: C, 74·91; H, 6·24; N, 8·64%).

3,4-Dihydro-1-(5-methoxybenzocyclobutenyl)-β-carboline hydrochloride (**16**). A mixture of **15** (2·35 g), $POCl_3$ (2 g), and 50 ml of dry benzene was refluxed for 2 h, and excess reagent and solvent were distilled off at reduced pressure. After addition of n-hexane to the above residue, the solid separated was recrystallised from EtOH–n-hexane to give **16** (1·48 g; 59·5%) as yellow prisms: m.p. 215°; IR ($CHCl_3$) 1625 cm^{-1} ($C=N^+$); UV λ_{max} (MeOH) 356, 290sh 283, 250sh 246 nm; *m/e* 302 ($M^+ - HCl$), 169; NMR ($CDCl_3 - DMSO-_6$) δ3·73 (3H, s, OMe), 4·00 (1H, t, $J = 7$ Hz, $>CH-$). (Calc. for $C_{20}H_{18}N_2O \cdot HCl \cdot 1/2H_2O$: C, 69·06; H, 5·80; N, 8·05. Found: C, 69·51; H, 6·12; N, 7·74%).

3, 4, 14, 15, 16, 17, 18, 19, 20, 21-Decadehydro-17-methoxyyohimbane (**19**)

(a) A suspension of **16** (430 mg) in 20 ml distilled bromobenzene was heated at 155° for 0·5 h in a current of N_2. After an excess of hexane had been added to the mixture, the yellow powder which separated was recrystallised from MeOH to give 300 mg (70%) of **19** as hygroscopic yellow needles: m.p. 248° (dec); IR ($CHCl_3$) 1605 cm^{-1}; UV λ_{max} (MeOH) 350, 312, 255 nm; *m/e* 301 ($M^+ - Cl$), 286, 256, 150; NMR (CF_3CO_2H) δ3·35 (2H, t, $J = 6$ Hz, $-CH_2-$), 4·11 (3H, s, OMe), 4·81 (2H, t, $J = 6$ Hz, $-CH_2-\overset{+}{N}<$), 7·0–7·55 (7H, m, ArH), 7·96 (1H, s, 14-H), 8·10 (1H, broad, indole NH), 8·96 (1H, s, 21-H). (Calc. for $C_{20}H_{17}ClN_2O \cdot 1/2H_2O$: C, 69·46; H, 5·25; N, 8·10. Found: C, 69·59; H, 5·00; N, 8·01%).

(b) To a soln of N,N-dimethylformamide (2·41 ml) and $POCl_3$ (3·53 ml) **26** hydrochloride (1 g) was added in small portions at 0° with stirring. The mixture was heated at

60° for 2 h and then poured into ice. After standing at 0° for 15 h, the solid which separated was collected by filtration, washed with water, and dried in a vacuum desicator to give 10 mg of **19** after recrystallization from MeOH: m.p. 246°, which was identical with the sample prepared by method (a).

15, 16, 17, 18, 19, 20-*Hexadehydro*-17-*methoxyyohimbane* (**20**)

(a) To a soln of **19** (200 mg) in 30 ml of MeOH was added in portions 800 mg of $NaBH_4$ with stirring at below 5° over 20 min, and then the mixture was stirred for 0·5 h at room temp. After the solvent was evaporated, the residue was decomposed with water and extracted with $CHCl_3$. The extract was washed with water, dried (Na_2SO_4), and evaporated to give 0·1 g (55·5%) of **20** as hygroscopic colorless plates after recrystallisation from benzene–n-hexane: m.p. 169° (sinters at 150°) (lit.,[16] m.p. 168–169°); IR ($CHCl_3$) 3480 (NH), 2805–2760 cm^{-1} (Bohlmann Bands); UV λ_{max} (MeOH) 290sh, 282 nm; *m/e* 304 (M^+), 169, 144, 134; NMR ($CDCl_3$) δ3·72 (3H, s, OMe), 4·00 (1H, d, $J = 15$ Hz, 21-H, the higher field of this type quartet was obscured by other resonances). (Calc. for $C_{20}H_{20}N_2O \cdot 1/3H_2O$: C, 77·39; H, 6·71; N, 9·02. Found: C, 77·73; H, 6·53; N, 9·13%).

(b) A mixture of **27** hydrochloride (64 mg), 20 ml of 37% formalin, 4 drops of conc HCl and 20 ml of MeOH was refluxed for 2 h and then the solvent was distilled. The residue was made alkaline with 10% NaOH and extracted with $CHCl_3$. The extract was washed with water, dried (Na_2SO_4), and evaporated to leave a residue which was subjected to chromatography on 20 g of silica gel eluted by $CHCl_3$–MeOH (v/v 99 : 1) to give 5 mg of **20** after recrystallisation from benzene–n-hexane; m.p. 169° (sinters at 150°), identical with the sample prepared by method (a).

m-*Methoxyphenylacetic acid* (**24**). A mixture of **23** (7 g), KOH (12 g), and EtOH (100 ml) was refluxed for 36 h and then the solvent distilled *in vacuo*. The residue was dissolved in water and washed with benzene. The aqueous layer was acidified with 10% HCl and extracted with ether. The extract was washed with water, dried (Na_2SO_4), and evaporated to furnish 7·7 g of **24** as colorless prisms from benzene–n-hexane; m.p. 67° (lit.,[22] m.p. 67°); IR ($CHCl_3$) 1710 cm^{-1} (C=O); NMR ($CDCl_3$) δ3·61 (2H, s, $ArCH_2$), 3·78 (3H, s, OMe), 6·70–7·10 (4H, m, ArH).

N-(3-*Indolylethyl*)-3-*methoxyphenylacetamide* (**25**). A mixture of **14** (7·2 g) and **24** (6·65 g) was heated at 180–185° for 0·5 h to give **25** (8·0 g; 66·5%) as colorless needles after recrystallisation from ether: m.p. 86°; IR ($CHCl_3$) 3480 (indole NH), 3425 (NH), 1655 cm^{-1} (C=O); NMR ($CDCl_3$) δ2·89 (2H, t, $J = 6$ Hz, $ArCH_2CH_2$), 3·49 (2H, t, $J = 6$ Hz, $ArCH_2CH_2$), 3·49 (2H, s, $ArCH_2$-CO), 3·73 (3H, s, OMe). (Calc. for $C_{19}H_{20}N_2O_2$: C, 74·00: H, 6·54; N, 9·09. Found: C, 73·73; H, 6·62; H, 9·16%).

1,2,3,4-*Tetrahydro*-1-(3-*methoxybenzyl*)-β-*carboline* (**27**). A soln of **25** (2 g) and $POCl_3$ (2 ml) in 50 ml of dry benzene was refluxed for 4 h and the resulting mixture was poured into an excess of n-hexane. The separated material was collected by filtration to give the crude **26**, which was very hygroscopic and was used without purification.

To a soln of the above carboline in 30 ml of MeOH was added in portions 3 g of $NaBH_4$ with stirring at 5°. After stirring for 0·5 h at room temp, the solvent was evaporated *in vacuo*. The residue was decomposed with water and acidified with 10% HCl. After extraction with $CHCl_3$, the extract was washed with water, dried (Na_2SO_4), and evaporated to give 200 mg of **27** hydrochloride as colorless crystals after recrystallisation from MeOH: m.p. 270° (dec) (lit.,[16] m.p. 270°); *m/e* 292 ($M^+ - HCl$), 291, 172, 121. (Calc. for $C_{19}H_{20}N_2O \cdot HCl$: C, 69·34; H, 6·44; N, 8·52. Found: C, 69·19; H, 6·69; N, 8·61%).

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