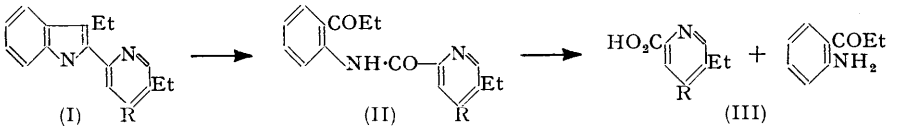
153. *The Constitution of Yohimbine and Related Alkaloids. Part IX.* Synthesis of 2-(4 : 5-Diethyl-2-pyridyl)-3-ethylindole (Alstyrine or Coryline) and Two Related Compounds.*

By T. B. Lee and G. A. Swan.

2-(4 : 5-Diethyl-2-pyridyl)-3-ethylindole (I; R = Et) and 4 : 5-diethylpyridine-2-carboxylic acid (III; R = Et) have been synthesised and shown to be identical with the products of natural origin, *i.e.*, degradation products of the *Alstonia* alkaloids and of corynantheine. 3-Ethyl-2-(5-ethyl-2-pyridyl)-5-methoxyindole (IV; R = H) and 2-(4 : 5-diethyl-2-pyridyl)-3-ethyl-5-methoxyindole (IV; R = Et) have also been synthesised; but it was not possible to confirm the identity of the former with a product (supposedly of this structure) previously obtained by the degradation of aricine.

The alkaloid corynantheine, on dehydrogenation with selenium, gives two oxygen-free products, coryline and de-ethylcoryline (I; R = H). The structure of the latter has been confirmed by synthesis.[1] Karrer and Enslin [2] showed that ozonolysis of coryline yielded an amide (II; R = Et), which on hydrolysis gave *o*-aminopropiophenone and a diethylpyridinecarboxylic acid, formulated as (III; R = Et) because it gave 3 : 4-diethylpyridine on decarboxylation. They therefore formulated coryline as (I; R = Et) and later [3] proved the identity of coryline and alstyrine, the latter being obtained by



dehydrogenation of certain *Alstonia* alkaloids.[4] More recently, alstyrine has also been obtained by the selenium dehydrogenation of the alkaloids serpentine,[5] sepentinine,[6] akuammigine,[7] δ-yohimbine,[8] mayumbine,[9] and normelinonine-A.[10]

We therefore undertook the synthesis of 4 : 5-diethylpyridine-2-carboxylic acid (III;

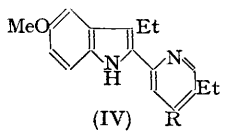
* Part VIII, *J.*, 1954, 2962.

[1] Anderson, Clemo, and Swan, *J.*, 1954, 2962.
[2] Karrer and Enslin, *Helv. Chim. Acta*, 1949, **32**, 1390.
[3] *Idem, ibid.*, 1950, **33**, 100.
[4] Sharp, *J.*, 1938, 1353.
[5] Schlittler and Schwarz, *Helv. Chim. Acta*, 1950, **33**, 1463.
[6] Schlittler, Huber, Bader, and Zahnd, *ibid.*, 1954, **37**, 1912.
[7] Robinson and Thomas, *J.*, 1954, 3479.
[8] Goutarel and Le Hir, *Bull. Soc. chim. France*, 1951, 909.
[9] Janot, Goutarel, and Massoneau, *Compt. rend.*, 1952, **234**, 850.
[10] Schlittler and Hohl, *Helv. Chim. Acta*, 1952, **35**, 29.

R = Et) and 2-(4 : 5-diethyl-2-pyridyl)-3-ethylindole (I; R = Et). 5-Ethyl-2-methylpyridine was converted into the *N*-oxide, which was nitrated to give 5-ethyl-2-methyl-4-nitropyridine *N*-oxide. The action of phosphorus tribromide on the latter yielded 4-bromo-5-ethyl-2-methylpyridine, which, when heated in an autoclave with cuprous cyanide and aqueous potassium cyanide and then esterified, yielded ethyl 5-ethyl-2-methylpyridine-4-carboxylate. Claisen condensation of this ester with ethyl acetate and subsequent hydrolysis gave 4-acetyl-5-ethyl-2-methylpyridine, which on reduction under Clemmensen conditions yielded 4 : 5-diethyl-2-methylpyridine (recently prepared by a different method by Kao and Robinson [11]). The latter product with benzaldehyde gave 4 : 5-diethyl-2-styrylpyridine, mild oxidation of which resulted in 4 : 5-diethylpyridine-2-carboxylic acid (III; R = Et), identical with that of natural origin, mentioned above. Decarboxylation of the synthetic acid gave 3 : 4-diethylpyridine, the picrate of which was identical with an authentic sample. The amide of this acid was dehydrated by phosphorus oxychloride to 2-cyano-4 : 5-diethylpyridine. Treatment of the latter with *n*-propylmagnesium bromide led to 2-butyryl-4 : 5-diethylpyridine, the phenylhydrazone of which underwent the Fischer indole reaction to give 2-(4 : 5-diethyl-2-pyridyl)-3-ethylindole (I; R = Et). The identity of the latter with alstyrine of natural origin was shown by mixed m. p. determinations as well as by ultraviolet and infrared absorption spectra.

After the above synthesis has been completed, we were informed by Sir Robert Robinson, O.M., F.R.S., that he and Mr. Robbins had carried out a rather similar synthesis of alstyrine.

By degration of aricine, Goutarel, Janot, Le Hir, Corrodi, and Prelog [12] obtained a base which they formulated as 3-ethyl-2-(5-ethyl-2-pyridyl)-5-methoxyindole (IV; R = H), because treatment with hydrogen peroxide followed by hydrolysis gave 2-amino-5-methoxypropiophenone and a mixture of 4 : 5-diethyl- and 5-ethyl-pyridine-2-carboxylic acid (the latter acid being present in greater amount than the former). We have synthesised a compound of the above structure (IV; R = H), as well as 2-(4 : 5-diethyl-2-pyridyl)-3-ethyl-5-methoxyindole (IV; R = Et); and although both these compounds have ultraviolet absorption spectra closely resembling the product of Goutarel *et al.*,[12] the melting points of the bases and picrates are not in close agreement. A mixture of our two synthetic bases resulted in a deep depression of melting point, which rules out the possibility that the product of Goutarel *et al.*[12] might be a mixture of the two. Unfortunately we have been unable to obtain a sample of the product of natural origin for comparison.



(IV)

	M. p. of base	M. p. of picrate
Product from aricine	128°	233°
(IV; R = H)	111—112	201—203
(IV; R = Et)	118	225

[*Added, February 3rd*, 1956.—Professor Janot kindly supplied us with a sample of the base obtained by degradation of aricine. This had m. p. 128°, as stated. We recrystallised our synthetic base (IV; R = H), seeding the solution with Professor Janot's specimen; but the product still had m. p. 111—112°.]

2-Butyryl-5-ethylpyridine, previously prepared by Anderson, Clemo, and Swan,[1] is better obtained by the action of *n*-propylmagnesium iodide on 2-cyano-5-ethylpyridine.

Experimental

Ultraviolet absorption measurements were made with solutions in EtOH and a Hilger "Uvispec" spectrophotometer.

5-Ethyl-2-methylpyridine N-*Oxide* (with R. M. Anderson).—To a solution of 5-ethyl-2-methylpyridine (56 g.) in acetic acid (250 ml.) was added 30% hydrogen peroxide (54 ml.). The mixture was kept at 70° for 5 hr., then further hydrogen peroxide (40 ml.) was added and the mixture was kept at 70—80° for 15 hr. The solution was concentrated to 100 ml. under reduced pressure, diluted with water (100 ml.), and evaporated almost to dryness under reduced pressure. The residue was basified with saturated sodium carbonate solution and extracted with chloroform. Distillation of the dried (Na_2SO_4) extract gave the N-*oxide* (52 g.),

[11] Kao and Robinson, *J.*, 1955, 2865.
[12] Goutarel, Janot, Le Hir, Corrodi, and Prelog, *Helv. Chim. Acta*, 1954, **37**, 1805.

b. p. 124—128°/2 mm. (Found: C, 69·8; H, 8·0. $C_8H_{11}ON$ requires C, 70·1; H, 8·0%). The *picrate* separated from ethanol as pale yellow needles, m. p. 107—108° (Found: C, 46·1; H, 3·8. $C_8H_{11}ON,C_6H_3O_7N_3$ requires C, 45·9; H, 3·8%).

5-Ethyl-2-methyl-4-nitropyridine N-Oxide (with R. M. ANDERSON).—A solution of the above oxide (52 g.) in concentrated sulphuric acid (98 ml.) was added dropwise to a stirred mixture of concentrated sulphuric acid (156 ml.) and concentrated nitric acid (175 ml.; *d* 1·42) at room temperature. The mixture was heated at 90—100° for 3 hr., cooled, and added dropwise to stirred concentrated aqueous ammonia and ice. The *nitro-compound* (48 g.) was collected, washed with a little ice-cold water, and recrystallised from acetone in pale yellow needles, m. p. 80° (Found: C, 52·8; H, 5·7. $C_8H_{10}O_3N_2$ requires C, 52·75; H, 5·5%).

4-Bromo-5-ethyl-2-methylpyridine (with R. M. ANDERSON).—Phosphorus tribromide (50 ml.) was added dropwise, with stirring, to a solution of the above nitro-compound (10 g.) in anhydrous benzene (50 ml.), and the mixture was heated under reflux in an oil-bath (125—140°), with stirring, for 7 hr. The cooled mixture was poured with stirring on ice, basified with 10% sodium hydroxide solution, and extracted with chloroform. Distillation of the dried (Na_2SO_4) extract gave the *bromopyridine* (6·6 g.), b. p. 105—110°/20 mm. (Found: C, 47·8; H, 4·8. $C_8H_{10}NBr$ requires C, 48·0; H, 5·0%). The *picrate* separated from ethanol in needles, m. p. 141—142° (decomp.) (Found: C, 39·5; H, 3·2. $C_8H_{10}NBr,C_6H_3O_7N_3$ requires C, 39·2; H, 3·0%). The *methiodide* crystallised from acetone–ether in prisms, m. p. 167—169° (Found: C, 31·8; H, 4·2. $C_8H_{10}NBr,CH_3I$ requires C, 31·6; H, 3·8%).

Ethyl 5-Ethyl-2-methylpyridine-4-carboxylate (with R. M. ANDERSON).—A solution of the bromo-compound (28 g.) in ethanol (120 ml.) was added to cuprous cyanide (20 g.), dissolved in water (180 ml.) containing potassium cyanide (46 g.), and the mixture was heated in an autoclave at 180—200° for 40 hr. The solution was adjusted to pH 4 with concentrated hydrochloric acid, and the precipitated cuprous cyanide was removed. The filtrate was evaporated to dryness under reduced pressure and the last traces of water were removed by evaporation to dryness three times with absolute alcohol. A mixture of the solid residue and absolute alcohol (100 ml.) was saturated with dry hydrogen chloride, kept overnight, then refluxed for 4 hr., and the alcohol was removed under reduced pressure. The residue was basified with saturated sodium carbonate solution and extracted with ether. Distillation of the dried (Na_2SO_4) extract gave the *ester* (12·5 g.), b. p. 112—115°/2 mm. (Found: C, 68·2; H, 8·0. $C_{11}H_{15}O_2N$ requires C, 68·4; H, 7·8%). The *picrate* separated from ethanol in needles, m. p. 129—130° (Found: C, 48·6; H, 4·5. $C_{11}H_{15}O_2N,C_6H_3O_7N_3$ requires C, 48·3; H, 4·3%).

[*Added, February 3rd*, 1956.—Berson and Cohen (*J. Org. Chem.*, 1955, **20**, 1461) have prepared methyl 5-ethyl-2-methylpyridine-4-carboxylate from 5-ethyl-2-methyl-4-nitropyridine *N*-oxide by a different method, involving five stages.]

5-Ethyl-2-methylpyridine-4-carboxylic Acid.—The above ester (0·8 g.) was refluxed with 20% potassium hydroxide solution (5 ml.) for 1½ hr. The solution was adjusted to pH 4 with dilute hydrochloric acid and extracted for 30 hr. continuously with ether. The ether was removed and the *acid* was sublimed at 140°/0·1 mm.; it had m. p. 226—228° (Found: C, 65·5; H, 6·9. $C_9H_{11}O_2N$ requires C, 65·5; H, 6·7%).

4-Acetyl-5-ethyl-2-methylpyridine.—To a suspension of potassium ethoxide (from potassium, 6·3 g.) in dry benzene were added the above ester (12·5 g.) and ethyl acetate (32 ml.). The mixture was refluxed on the water-bath for 12 hr. and water (140 ml.) was added. The solution was washed with ether to recover the uncondensed esters. Concentrated hydrochloric acid (280 ml.) was added to the aqueous solution, and the mixture was heated in the water-bath overnight. The solution was evaporated to dryness under reduced pressure, basified with saturated sodium carbonate solution, and extracted with ether. Distillation of the dried (Na_2SO_4) extract gave the *ketone* (7·3 g.), b. p. 114—118°/20 mm. (Found: C, 73·8; H, 8·3. $C_{10}H_{13}ON$ requires C, 73·6; H, 8·0%). The *picrate* crystallised from methanol in plates, m. p. 132—134° (Found: C, 49·2; H, 4·4. $C_{10}H_{13}ON,C_6H_3O_7N_3$ requires C, 49·0; H, 4·1%). The *oxime* crystallised from methanol in needles, m. p. 107° (Found: C, 67·3; H, 8·3. $C_{10}H_{14}ON_2$ requires C, 67·4; H, 7·9%).

4 : 5-Diethyl-2-methylpyridine.—A solution of the ketone (7·3 g.) in 17% hydrochloric acid (100 ml.) was added to freshly amalgamated zinc wool (25 g.). The mixture was refluxed for 10 hr. and concentrated hydrochloric acid (5 ml.) was added every 3 hr. The solution was decanted from the zinc, basified with excess of 40% sodium hydroxide solution, and extracted with ether. Distillation of the dried (Na_2SO_4) extract gave the base (4·3 g.), b. p. 88—92°/20 mm. (Found: C, 80·1; H, 10·4; N, 9·5. Calc. for $C_{10}H_{15}N$: C, 80·5; H, 10·1; N, 9·4%). The picrate crystallised from ethyl acetate in needles, m. p. 162—164° (Found: C, 50·7; H, 4·9.

Calc. for $C_{10}H_{15}N,C_6H_3O_7N_3$: C, 50·8; H, 4·8%). The *styphnate* crystallised from methanol in needles, m. p. 155—156° (Found: C, 48·7; H, 4·8. $C_{10}H_{15}N,C_6H_3O_8N_3$ requires C, 48·7; H, 4·6%). The residue from the above distillation gave *5-ethyl-4-1′-hydroxyethyl-2-methylpyridine*, b. p. 100—105°/0·1 mm. (Found: C, 72·8; H, 9·4. $C_{10}H_{15}ON$ requires C, 72·7; H, 9·1%), whose *picrate* crystallised from alcohol and had m. p. 137—139° (Found: C, 48·3; H, 4·5. $C_{10}H_{15}ON,C_6H_3O_7N_3$ requires C, 48·7; H, 4·6%).

The hydroxyethyl base (1·3 g.) was heated under reflux for 6 hr. with constant-boiling hydriodic acid (8·3 g.) and red phosphorus (0·4 g.). The mixture was diluted with water and filtered, and the filtrate basified with 20% sodium hydroxide solution and extracted with ether. Distillation of the dried (Na_2SO_4) extract gave 4 : 5-diethyl-2-methylpyridine, whose picrate was identical in m. p. and mixed m. p. with that described above.

4 : 5-*Diethyl-2-styrylpyridine*.—4 : 5-Diethyl-2-methylpyridine (4·3 g.), freshly distilled benzaldehyde (11 ml.), acetic anhydride (11 ml.), and xylene (12 ml.) were refluxed together for 70 hr. The solution was acidified (Congo-red) with 17% hydrochloric acid and steam-distilled to remove excess of benzaldehyde. After cooling, the mixture was basified with 20% sodium hydroxide solution and extracted with chloroform. Distillation of the dried (Na_2SO_4) extract gave (i) 4 : 5-diethyl-2-methylpyridine (1 g.) and (ii) the *product* (4·3 g.), b. p. 140—150°/0·1 mm. (Found: N, 5·5. $C_{17}H_{19}N$ requires N, 5·9%), whose picrate crystallised from acetone in needles, m. p. 241—243° (decomp.) (Found: C, 59·2; H, 4·8. Calc. for $C_{17}H_{19}N,C_6H_3O_7N_3$: C, 59·2; H, 4·7%). Kao and Robinson[11] gave m. p. 143—144°, but Sir Robert considers that this is probably a misprint in Dr. Kao's doctorate thesis.

4 : 5-*Diethylpyridine-2-carboxylic Acid* (III; R = Et).—A solution of the above styrylpyridine (2 g.) in acetone (25 ml.) was cooled in ice and stirred while finely powdered potassium permanganate (7 g.) was gradually added. The mixture was stirred for 1 hr. longer and then manganese dioxide was filtered off, washed with acetone, and extracted with hot water. The extract was acidified with dilute hydrochloric acid and cooled in ice, and the benzoic acid (1 g.) was extracted with ether. The aqueous solution was adjusted to pH 4 and extracted for 30 hr. continuously with ether. The ether was removed from the extract and the *product* (0·6 g.), m. p. 147—148°, crystallised from methanol (Found: C, 66·9; H, 7·6. $C_{10}H_{13}O_2N$ requires C, 67·0; H, 7·3%). Light absorption: $\lambda_{max.}$ 2680 and 2300 Å (log ε 3·61 and 3·90 respectively), $\lambda_{min.}$ 2520 Å (log ε 3·44). The acid of natural origin had m. p. 147—148° alone or mixed with our synthetic acid.

Decarboxylation of 4 : 5-*Diethylpyridine-2-carboxylic Acid*.—The synthetic acid (50 mg.), mixed with excess of dry, freshly precipitated copper powder, was gently heated with a free flame. The distillate gave a picrate which crystallised from ethanol in needles, m. p. 138—139°, not depressed on admixture with an authentic sample from 4 : 5-diethylpyridine (Found: C, 49·3; H, 4·5. Calc. for $C_9H_{13}N,C_6H_3O_7N_3$: C, 49·5; H, 4·4%).

Ethyl 4 : 5-*Diethylpyridine-2-carboxylate*.—The acid (0·6 g.), esterified with ethanol (10 ml.) and with dry hydrogen chloride at 0°, at room temperature overnight, and then at the b. p. for 2 hr., gave the *ester* (0·6 g.), b. p. 140—145°/3 mm. (Found: C, 69·9; H, 8·6. $C_{12}H_{17}O_2N$ requires C, 69·6; H, 8·2%), whose *picrate* (from ethanol) had m. p. 88—90° (Found: C, 49·6; H, 4·7. $C_{12}H_{17}O_2N,C_6H_3O_7N_3$ requires C, 49·5; H, 4·6%).

2-*Carbamoyl*-4 : 5-*diethylpyridine*.—The crude ester (0·5 g.) was kept with concentrated ammonia solution (5 ml.) for 48 hr. at room temperature and stirred for 2 hr. The *amide* (0·4 g.) was filtered off and sublimed at 100—120°/0·1 mm.; it had m. p. 177—178° (Found: C, 67·6; H, 7·8. $C_{10}H_{14}ON_2$ requires C, 67·4; H, 7·9%).

2-*Cyano*-4 : 5-*diethylpyridine*.—The amide (0·4 g.) and phosphorus oxychloride (1 ml.) were refluxed for 2 hr. The excess of oxychloride was removed under reduced pressure, and the residue basified with saturated sodium carbonate solution and extracted with chloroform. Distillation of the dried (Na_2SO_4) extract gave the *cyanopyridine* (0·2 g.), b. p. 150—160°/20 mm. (Found: C, 75·2; H, 7·6. $C_{10}H_{12}N_2$ requires C, 75·0; H, 7·5%).

2-*Butyryl*-4 : 5-*diethylpyridine*.—A solution of the above nitrile (1·3 g.) in anhydrous ether (75 ml.) was added gradually with stirring at room temperature to a solution of *n*-propylmagnesium bromide (from magnesium, 0·6 g., and *n*-propyl bromide, 2·7 g., in anhydrous ether, 15 ml.). The mixture was refluxed for 3 hr., and then decomposed by saturated ammonium chloride solution (30 ml.) and concentrated hydrochloric acid (5 ml.). The solution was basified with 10% sodium hydroxide solution, and extracted with ether. Distillation of the dried (Na_2SO_4) extract gave the *ketone* (1·2 g.), b. p. 142—146°/3 mm. (Found: C, 76·6; H, 9·1. $C_{13}H_{19}ON$ requires C, 76·1; H, 9·3%). The *picrate* (from ethanol) had m. p. 97—98° (Found: C, 53·1; H, 5·4. $C_{13}H_{19}ON,C_6H_3O_7N_3$ requires C, 52·6; H, 5·1%). The *phenylhydrazone*

picrate crystallised from ethanol as orange needles, m. p. 211—212° (Found : C, 57·1; H, 5·3. $C_{19}H_{25}N_3,C_6H_3O_7N_3$ requires C, 57·25; H, 5·3%). The red p-*methoxyphenylhydrazone picrate* (from ethanol) had m. p. 160—161° (Found : C, 56·3; H, 5·6. $C_{26}H_{30}O_8N_6$ requires C, 56·3; H, 5·4%).

2-(4 : 5-*Diethyl*-2-*pyridyl*)-3-*ethylindole* (I; R = Et).—The above ketone (0·334 g.) and freshly distilled phenylhydrazine (0·18 g,) were heated together in a vacuum on the steam-bath for 2 hr. The residual mass was dissolved in absolute alcohol (20 ml.), cooled in ice, and saturated with dry hydrogen chloride. The solution was kept at room temperature for 1 hr. and refluxed for 2 hr.; ammonium chloride separated, and, after cooling, the hydrochloride crystallised as yellow needles. The mixture was evaporated to dryness under reduced pressure, water was added, and the mixture was basified with saturated sodium carbonate solution and extracted with ether. Distillation of the dried (Na_2SO_4) extract gave the indole (0·3 g.) as a pale yellow, viscous oil, b. p. (bath-temp.) 200—210°/0·4 mm., which solidified on trituration with ether and crystallised from methanol as pure white prisms, m. p. 110—111°, not depressed on admixture with alstyrine obtained by degradation of corynantheine and alstonine (Found : C, 81·8; H, 7·9. Calc. for $C_{19}H_{22}N_2$: C, 82·0; H, 7·9%). Light absorption : $\lambda_{max.}$ 3250 Å (log ε 4·36), $\lambda_{min.}$ 2740 Å (log ε 3·63). The *picrate* (from ethanol), m. p. 218—221°, did not depress the m. p. of the picrate of the compound of natural origin (Found : C, 58·9; H, 5·2. $C_{19}H_{22}N_2,C_6H_3O_7N_3$ requires C, 59·1; H, 4·9%). The yellow *hydrochloride* (from ethyl acetate) softened at 190° and melted completely at 203° (Found : C, 72·2; H, 7·7. $C_{19}H_{22}N_2$,HCl requires C, 72·5; H, 7·3%).

2-*Carbamoyl*-5-*ethylpyridine*.—As in the above synthesis of 2-carbamoyl-4 : 5-diethylpyridine, a mixture of ethyl 5-ethylpyridine-2-carboxylate [1] (4 g.) and concentrated ammonia solution (40 ml.) gave the *amide* (3·0 g.), which crystallised from water as needles, m. p. 147—148°, and sublimed at 120°/0·05 mm. (Found : C, 64·25; H, 6·9. $C_8H_{10}ON_2$ requires C, 64·0; H, 6·7%).

2-*Cyano*-5-*ethylpyridine*.—As above, this amide (3 g.) and phosphorus oxychloride (6 g.) gave the *nitrile* (1·7 g.), b. p. 132°/20 mm. (Found : C, 72·4; H, 6·2. $C_8H_8N_2$ requires C, 72·7; H 6·1%).

2-*Butyryl*-5-*ethylpyridine*.—As in the synthesis of 2-butyryl-4 : 5-diethylpyridine, this nitrile (1·7 g.) in ether (50 ml.) and *n*-propylmagnesium bromide [from magnesium (0·5 g.) and *n*-propyl bromide (2·8 g.) in ether (15 ml.)] yielded the ketone (1·3 g.), b. p. 120—125°/20 mm. (Found : C, 74·4; H, 9·2; N, 7·6. Calc. for $C_{11}H_{15}ON$: C, 74·6; H, 8·5; N, 7·9%). The picrate (from ethanol) had m. p. 118—120° (Found : C, 49·8; H, 4·7. Calc. for $C_{11}H_{15}ON,C_6H_3O_7N_3$: C, 50·2; H, 4·4%). The phenylhydrazone picrate separated from ethanol as orange needles, m. p. 178° (Found : C, 55·5; H, 5·0. Calc. for $C_{17}H_{21}N_3,C_6H_3O_7N_3$: C, 55·6; H, 4·7%). The p-*methoxyphenylhydrazone picrate* separated from ethanol as orange plates, m. p. 176—177° (Found : C, 54·7; H, 4·9. $C_{18}H_{23}ON_3,C_6H_3O_7N_3$ requires C, 54·8; H, 4·9%).

3-*Ethyl*-2-(5-*ethyl*-2-*pyridyl*)-5-*methoxyindole* (IV; R = H).—The above ketone (1·2 g.) and *p*-methoxyphenylhydrazine (from *p*-methoxyphenylhydrazine hydrochloride, 1·3 g.) were heated in a steam-bath in a vacuum for 2 hr. The *indole*, which was obtained as in the case of 2-(4 : 5-diethyl-2-pyridyl)-3-ethylindole, distilled as a yellow viscous oil, b. p. (bath-temp.) 200—220°/0·4 mm., and solidified on trituration with light petroleum (b. p. 60—80°), then crystallised therefrom as yellow prisms, m. p. 111—112° (Found : C, 76·9; H, 7·0. $C_{18}H_{20}ON_2$ requires C, 77·1; H, 7·2%). Light absorption : $\lambda_{max.}$ 3320 Å (log ε 4·49), $\lambda_{min.}$ 2720 Å (log ε 3·76). The *picrate* (from ethanol) had m. p. 201—203° (Found : C, 56·6; H, 4·5. $C_{18}H_{20}ON_2,C_6H_3O_7N_3$ requires C, 56·6; H, 4·5%).

2-(4 : 5-*Diethyl*-2-*pyridyl*)-3-*ethyl*-5-*methoxyindole* (IV; R = Et).—As above, 2-butyryl-4 : 5-diethylpyridine and *p*-methoxyphenylhydrazine gave the *indole*, b. p. (bath-temp.) 200—220°/0·1 mm., which separated from light petroleum (b. p. 60—80°) as pale yellow needles, m. p. 118° (Found : C, 77·7; H, 7·9. $C_{20}H_{24}ON_2$ requires C, 77·9; H, 7·8%). Light absorption : $\lambda_{max.}$ 3290 Å (log ε 4·43), $\lambda_{min.}$ 2730 Å (log ε 3·67). A mixture of the base with 3-ethyl-2-(5-ethyl-2-pyridyl)-5-methoxyindole had m. p. 85—95°. The *picrate* (from ethanol) had m. p. 225° (decomp.) (Found : C, 57·6; H, 4·9. $C_{20}H_{24}ON_2,C_6H_3O_7N_3$ requires C, 58·1; H, 5·0%).

Thanks are offered to Professor P. Karrer for samples of alstyrine and 3 : 4-diethylpyridine picrate, to Dr. T. M. Sharp for a sample of alstyrine, to Professor M.-M. Janot for one of 4 : 5-diethylpyridine-2-carboxylic acid, to Mr. R. E. Dodd for the measurement of the infrared spectra, to the Department of Scientific and Industrial Research for a maintenance grant (to T. B. L.), and to Professor G. R. Clemo, F.R.S., for his interest.

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[*Received, November 1st,* 1955.]