456. *The Nitration of 2-Hydroxy-4 : 6-dimethylquinoline and the Preparation of Some Related Compounds.*

By J. L. C. Marais and O. G. Backeberg.

The nitration of 2-hydroxy-4 : 6-dimethylquinoline, first studied by Balaban and reported by him to form the 3-nitro-derivative, has been reinvestigated and found to occur in position 5; in addition, a number of intermediate and related compounds is described.

4 : 6-Dimethyl- and 2 : 4 : 6-trimethyl-quinoline have also been found to be nitrated in position 5.

Acetoacetanilides cannot be cyclised by the action of heat : the product formed is not a quinoline derivative but a symmetrical diphenylurea.

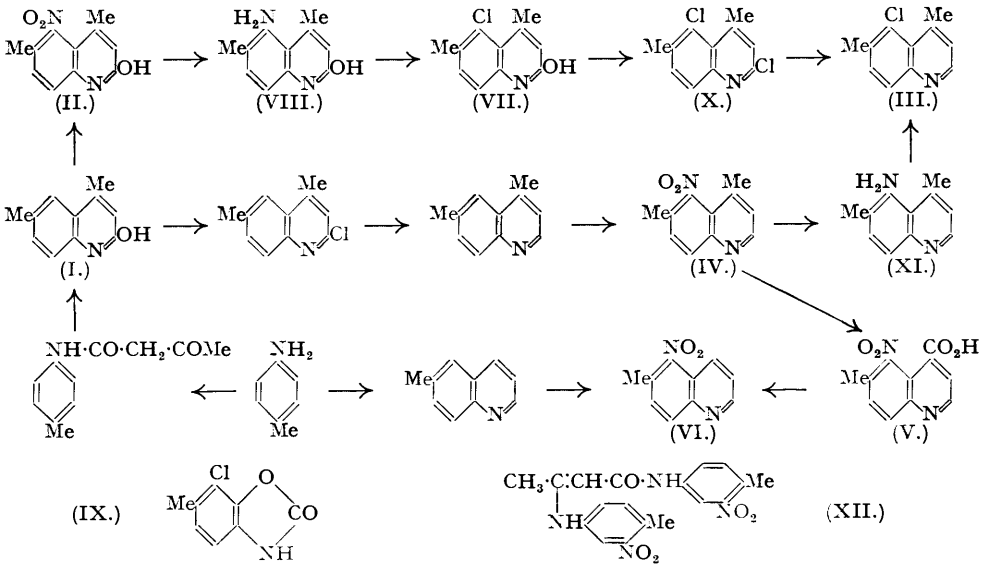
Balaban (*J.*, 1930, 2346), reporting on the nitration of a number of methyl-substituted 2-hydroxy-4-methylquinolines, stated that nitration occurred in the benzene ring except with the 4 : 6-dimethyl compound (I), where it occurred in position 3.

In general, he determined the orientation of the nitration products by oxidising them to the corresponding benzoxazolones, but he assumed that nitration of the 6-methyl compound had occurred in position 3 because Kaufmann and de Petherd (*Ber.*, 1917, **50**, 336) reported that trinitration of carbostyril formed the 3 : 6 : 8-substitution product, and since he was able to show that nitration had not occurred in position 8, and, because position 6 was occupied, the 3-position was the only one available for substitution. Apart from the fact that the mononitration of (I) and the trinitration of carbostyril are not comparable, it is well known that the heterocyclic ring in quinoline and its derivatives is very resistant to nitration, and a re-investigation of Balaban's nitration product has shown that it is 5-nitro-2-hydroxy-4 : 6-dimethylquinoline.

Attempts to synthesise the 5(or the 7)-nitro-dimethyl compound by cyclisation of 3-nitro-4-methylacetoacetanilide were unsuccessful; when this was warmed on the water-bath with concentrated sulphuric acid, hydrolysis to 3-nitro-4-methylaniline took place, and heating in an inert solvent (cf. Kermack and Muir, *J.*, 1933, 300) afforded *s*-di-(3-nitro-4-methylphenyl)-urea. Kermack and Muir stated that *o*-chloroacetoacetanilide could be cyclised to 8-chloro-2-hydroxylepidine by the action of concentrated sulphuric acid or by heating it in medicinal paraffin at 250°. Repetition of this work showed that, although in the former case cyclisation did take place to some extent (cf. Johnson and Hamilton, *J. Amer. Chem. Soc.*, 1941, **63**, 2867), the product in the latter case was not a quinoline derivative but *s*-di-(*o*-chlorophenyl)urea. It would seem that acetoacetanilides cannot be cyclised by the action of heat but are thereby converted into symmetrical diphenylureas (cf. Leuthardt and Brunner, *Helv. Chim. Acta*, 1947, **30**, 958).

The orientation of Balaban's nitro-compound was determined as follows: (i) 2-Hydroxy-4 : 6-dimethylquinoline (I) was nitrated, and the product converted by the stages shown into 5-chloro-4 : 6-dimethylquinoline (III). (ii) 4 : 6-Dimethylquinoline formed a nitro-derivative, shown to be 5-nitro-4 : 6-dimethylquinoline (IV), which could be converted into the same chloro-quinoline (III). Thus, both the compound (I) and 4 : 6-dimethylquinoline were nitrated in position 5. (iii) On oxidation, the last nitro-compound (IV) formed a carboxylic acid (V) which, on decarboxylation, yielded 5-nitro-6-methylquinoline (VI), previously prepared by Noelting and Trautmann (*Ber.*, 1890, **23**, 3654) and by Bogert and Fisher (*J. Amer. Chem. Soc.*, 1912, **34**, 1569) by nitration of 6-methylquinoline; the former authors determined the orientation of this compound unambiguously.

The nitration of 2 : 4 : 6-trimethylquinoline was also studied : the product proved to be the 5-nitro-derivative. This was established by converting it into the corresponding chloro-



compound, condensing this with phthalic anhydride to the 2-phthalone, and oxidising the latter to the 2-carboxylic acid. On decarboxylation, this acid formed 5-chloro-4 : 6-dimethylquinoline (III).

7-Chloro-6-methylquinoline does not appear to have been previously prepared, and the 8-chloro-isomer was prepared by Mazonski, Mielecki, and Sucharda (*Rocz. Chem.*, 1936, **16**, 519) by a somewhat unusual reaction, *viz.*, by heating *p*-nitrotoluene and glycerol with hydrochloric acid at 160—170°; both these compounds were accordingly prepared, and obtained in good yield, from the corresponding chlorotoluidines by the Skraup reaction as modified by Cohn (*J. Amer. Chem. Soc.*, 1930, **52**, 3685).

Experimental.

(Standardised, short-stem Anschütz thermometers were used for all m. p. determinations.)

5-Nitro-2-hydroxy-4 : 6-dimethylquinoline (II).—This compound was prepared according to Balaban (*loc. cit.*) in 95% yield. It was reduced to the 5-amino-compound (VIII) by tin and glacial acetic acid; from 25 g. of the nitro-compound, after the usual procedure, the amine was obtained as a brown powder (14·4 g.). It crystallised from alcohol in light-brown plates, m. p. 280°; Balaban gives m. p. 264°.

5-Chloro-2-hydroxy-4 : 6-dimethylquinoline (VII).—The foregoing amine (VIII) (15·45 g.) was dissolved with mechanical stirring in hot dilute (1 : 1) hydrochloric acid (235 c.c.) and cooled to 0°; some hydrochloride of the base separated. Sodium nitrite (6·6 g.) in water (16 c.c.) was added in portions, a clear orange-brown solution being obtained. The well-cooled diazotised solution was added dropwise with continuous shaking to a solution of cuprous chloride (from 10·84 g. of copper sulphate) heated on the water-bath, and the heating continued for a further hour. The brown solid which separated was filtered off, washed, and dried; yield 17 g. The *5-chloro*-compound crystallised from dioxan (charcoal) in fine, colourless needles, m. p. 264° (Found : C, 63·8; H, 4·9; N, 6·75. $C_{11}H_{10}ONCl$ requires C, 63·6; H, 4·8; N, 6·7%). Roberts and Turner (*J.*, 1927, 1840) stated that the Sandmeyer method did not give good yields of chloroquinoline derivatives and recommended the Gattermann copper-powder procedure; without exception, the chloro-compounds here described were obtained in excellent yield by the Sandmeyer method.

7-Chloro-6-methylbenzoxazolone (IX).—Attempts to oxidise Balaban's nitro-compound under a variety of conditions to a benzoxazolone derivative led only to the recovery of the unchanged material; when the nitro-group was replaced by chlorine, the resulting compound (VII) was unchanged when subjected to oxidation under the conditions used by Balaban. However, a small yield of a product, which, in the light of the results of this investigation, must have been *7-chloro-6-methylbenzoxazolone* (IX), was obtained under the following conditions. The chloro-compound (VII) (3 g.) was dissolved in aqueous pyridine containing potassium hydroxide (1·25 g.). The solution was boiled under reflux, and potassium permanganate (12·5 g.) added in portions during 30 minutes, boiling being continued for a further hour. The solution was filtered and pyridine removed by steam-distillation; a brown solid separated which crystallised from acetic acid in brown needles (0·2 g.), m. p. 270—280° [Found : C,

52·0; H, 3·3; N, 7·7%; *M* (micro-Rast), 182. $C_8H_6O_2NCl$ requires C, 52·3; H, 3·3; N, 7·6%; *M*, 183·5].

2 : 5-*Dichloro*-4 : 6-*dimethylquinoline* (X).—The 5-chloro-compound (VII) (5 g.) was boiled under reflux with phosphoryl chloride (15 c.c.) for 30 minutes. The bulk of the excess of phosphoryl chloride was removed from the clear solution under diminished pressure, and the residue treated with cold water. The resulting-2 : 5-*dichloro*-compound was filtered off, washed, and dried; yield 5·44 g. It crystallised from alcohol (charcoal) in colourless needles, m. p. 122·5° (Found : N, 6·3. $C_{11}H_9NCl_2$ requires N, 6·2%).

2-Chloro-5-nitro-4 : 6-dimethylquinoline was obtained in theoretical yield by the same method from the 5-nitro-compound, and crystallised from alcohol (charcoal) in yellow needles, m. p. 162°; Balaban, using phosphorus pentachloride in addition, got a 32·4% yield and m. p. 157°. The same product was obtained from 2-chloro-4 : 6-dimethylquinoline in 90% yield by the method used by Price, Velzen, and Guthrie (*J. Org. Chem.*, 1947, **12**, 203) for nitration of 2 : 6-dimethylquinoline.

5-*Chloro*-4 : 6-*dimethylquinoline* (III).—The dichloro-compound (X) (2·3 g.) was dissolved in glacial acetic acid (20 c.c.) to which water (1·7 c.c.) had been added. The solution, contained in a reflux apparatus fitted with a mechanical stirrer, was heated in a bath at 70°. Zinc (1 g.; 20-mesh) was added at once, and stirring continued for 6 hours; the solution, which had become cloudy, was decanted from excess of zinc, which was washed with a little acetic acid. The whole was made alkaline with sodium hydroxide and steam-distilled; an oil slowly passed over. The distillate was saturated with salt and extracted with ether, the extract dried (Na_2SO_4), the ether removed, and the residual oil distilled; b. p. 289—290°/624 mm.; m. p. 33·5—34·5°; yield 1·95 g. (Found : C, 69·2; H, 5·3; N, 7·5. $C_{11}H_{10}NCl$ requires C, 68·95; H, 5·2; N, 7·3%). The *picrate* formed fine yellow needles from alcohol, m. p. 218° (Found : N, 13·8. $C_{11}H_{10}NCl,C_6H_3O_7N_3$ requires N, 13·85%); the *styphnate*, glistening yellow needles (from alcohol), m. p. 222° (decomp.) (Found : N, 12·9. $C_{11}H_{10}NCl,C_6H_3O_8N_3$ requires N, 12·8%), and the *mercurichloride*, colourless needles (from dilute hydrochloric acid), m. p. 198—200° (Found : N, 3·0. $C_{11}H_{10}NCl,HgCl_2$ requires N, 3·0%). The above method of reduction gave good yields (*ca.* 90%) when applied to the other 2-chloroquinoline derivatives described later, whereas Mikhailov's method (*J. Gen. Chem. Russia*, 1936, **6**, 511) resulted in hydrolysis to the corresponding 2-hydroxy-compound.

4 : 6-*Dimethylquinoline*.—This compound was prepared in 86·8% yield by reduction of 2-chloro-4 : 6-dimethylquinoline by the method described above. It had b. p. 263—266°/621 mm., m. p. 20·5°; the picrate had m. p. 243°; Manske *et al.* (*Canadian J. Res.*, 1942, **20**, *B*, 133) reported 249°, Ewins and King (*J.*, 1913, **103**, 104) 236—237°, and Knorr (*Annalen*, 1888, **245**, 366) m. p. 230°. The required chloro-compound used in the reduction was obtained in theoretical yield by the action of phosphoryl chloride on the corresponding 2-hydroxy-compound, and had m. p. 98°; Kaslow and Sommer (*J. Amer. Chem. Soc.*, 1946, **68**, 644) reported m. p. 95—96°.

5-*Nitro*-4 : 6-*dimethylquinoline* (IV).—4 : 6-Dimethylquinoline (7 g.), dissolved in concentrated sulphuric acid (35 c.c.), was stirred mechanically and cooled to −5°. A mixture of fuming nitric acid (4·5 c.c.; *d* 1·5) and concentrated sulphuric acid (9 c.c.) was gradually added to the solution, the temperature being kept below 0°. The solution was stirred for a further 30 minutes, poured on ice, and made alkaline with aqueous ammonia; a pale yellow solid (9 g.) separated. It crystallised from high-boiling light petroleum in pale yellow stout rhombs, m. p. 65° (Found : C, 65·6; H, 5·1; N, 13·75. $C_{11}H_{10}O_2N_2$ requires C, 65·35; H, 4·95; N, 13·9%). The *picrate* formed small yellow needles (from alcohol), m. p. 214° (decomp.) (Found : N, 16·4. $C_{11}H_{10}O_2N_2,C_6H_3O_7N_3$ requires N, 16·2%), and the *styphnate*, deep yellow needles (from alcohol), m. p. 231° (decomp.) (Found : N, 15·5. $C_{11}H_{10}O_2N_2,C_6H_3O_8N_3$ requires N, 15·7%).

5-*Amino*-4 : 6-*dimethylquinoline* (XI).—2 G. of the above nitro-compound (IV) were reduced with dilute acetic acid and iron filings according to the method of Noelting and Trautmann (*loc. cit.*), yielding 1·2 g. of pure *amine*, which crystallised from high-boiling light petroleum in stout brown needles, m. p. 97° (Found : N, 16·5. $C_{11}H_{12}N_2$ requires N, 16·3%). The *acetyl* derivative crystallised from water in fine colourless plates as the monohydrate, m. p. 129—130° (Found : N, 12·3; H_2O, 7·5. $C_{13}H_{14}ON_2,H_2O$ requires N, 12·1; H_2O, 7·7%); when dried at 105° for 4 hours it afforded the anhydrous compound, m. p. 147—148°. The amine (XI) was converted into the corresponding 5-chloro-compound (III) previously described, by the Sandmeyer procedure; the free base, its picrate, and styphnate were identical with the compounds obtained from the reduction of 2 : 5-dichloro-4 : 6-dimethylquinoline (X).

5-*Nitro*-6-*methylquinoline*-4-*carboxylic Acid* (V).—The nitro-compound (IV) (2 g.) was added to sodium dichromate (4 g.) in sulphuric acid (3·3 c.c. of concentrated acid in 10 c.c. of water), and the mixture gently heated under reflux for 2 hours; oxidation set in suddenly, with separation of the carboxylic acid. The reaction mixture was poured into water, and the yellow carboxylic acid (0·6 g.) filtered off and purified by dissolution in sodium hydroxide and reprecipitation with acid, had m. p. 266° (decomp.). It was insoluble in the usual organic solvents [Found : C, 57·1; H, 3·7; N, 12·1%; *M* (neutralisation equiv.), 229·1. $C_{11}H_8O_4N_2$ requires C, 56·9; H, 3·45; N, 12·1%; *M*, 232]. The acid was decarboxylated by heating 1 g. in a test-tube over a small flame; the resulting sublimate was extracted with hot dilute hydrochloric acid, and the solution filtered and made alkaline. 5-Nitro-6-methylquinoline (0·2 g.) crystallised from very dilute alcohol (charcoal) in fine yellow needles, m. p. 116—117°, not depressed by admixture with an authentic specimen prepared according to Noelting and Trautmann (*loc. cit.*). The *picrate* formed yellow microcrystalline aggregates (from alcohol), m. p. 194° (Found : N, 16·9. $C_{10}H_8O_2N_2,C_6H_3O_7N_3$ requires N, 16·8%), and the *styphnate*, mustard-coloured needles (from alcohol), m. p. 208° (decomp.) (Found : N, 16·1. $C_{10}H_8O_3N_2,C_6H_3O_8N_3$ requires N, 16·2%).

5-*Chloro*-6-*methylquinoline* was obtained in theoretical yield from the corresponding 5-amino-compound by the Sandmeyer method. It crystallised from dilute alcohol in glistening plates, m. p. 47° (Found : C, 67·7; H, 4·6; N, 7·6. $C_{10}H_8NCl$ requires C, 67·6; H, 4·5; N, 7·9%); the *picrate* was yellow aggregates (from alcohol), m. p. 210° (Found : N, 13·9. $C_{10}H_8NCl,C_6H_3O_7N_3$ requires N, 13·8%);

the *styphnate* found shining yellow needles (from alcohol), m. p. 217° (decomp.) (Found : N, 13·35. $C_{10}H_8NCl,C_6H_3O_8N_3$ requires N, 13·25%).

3-*Chloro*-4-*methylacetoacetanilide* was prepared from 3-chloro-4-methylaniline (10 g.) according to Limpach's method (*Ber.*, 1931, **64**, 970) in 88% yield. It crystallised from very dilute alcohol in colourless glistening plates, m. p. 109·5—110° (Found : N, 6·4. $C_{11}H_{12}O_2NCl$ requires N, 6·2%). This compound is mentioned in U.S.P. 2,112,764 but not described.

7-*Chloro*-2-*hydroxy*-4 : 6-*dimethylquinoline*.—3-Chloro-4-methylacetoacetanilide (10 g.) mixed with concentrated sulphuric acid (10 c.c.) was heated on the water-bath for 2 hours. After cooling, the solution was poured into water, and the colourless product (8·9 g.) crystallised from dilute acetic acid in small colourless prisms, m. p. 327° (copper block). As this product was different from the 5-chloro-compound (VII), it could only be the 7-*chloro*-isomer (Found : C, 63·6; H, 4·9; N, 6·8. $C_{11}H_{10}ONCl$ requires C, 63·6; H, 4·85; N, 6·75%).

2 : 7-*Dichloro*-4 : 6-*dimethylquinoline* was obtained in theoretical yield from the foregoing compound by the action of phosphoryl chloride. It crystallised from alcohol in long shining needles, m. p. 139° (Found : N, 6·1. $C_{11}H_9NCl_2$ requires N, 6·2%).

7-*Chloro*-4 : 6-*dimethylquinoline* was obtained in 85% yield by reduction of the 2-chloro-compound with zinc and acetic acid. It crystallised from dilute alcohol in long shining needles, m. p. 104° (Found : C, 69·2; H, 5·1; N, 7·2. $C_{11}H_{10}NCl$ requires C, 68·95; H, 5·2; N, 7·3%); the *picrate* formed yellow needles (from alcohol), m. p. 248° (decomp.) (Found : N, 13·8. $C_{11}H_{10}NCl,C_6H_3O_7N_3$ requires N, 13·85%), and the *styphnate* golden-yellow plates (from alcohol), m. p. 244° (decomp.) (Found : N, 13·0. $C_{11}H_{10}NCl,C_6H_3O_8N_3$ requires N, 12·8%).

7-*Chloro*-6-*methylquinoline* was obtained in small yield by decarboxylation of the oxidation product from 7-chloro-4 : 6-dimethylquinoline according to the procedure outlined above. It crystallised from dilute alcohol or from high-boiling light petroleum in shining plates, m. p. 77—78° (Found : C, 67·5; H, 4·6; N, 7·7. $C_{10}H_8NCl$ requires C, 67·6; H, 4·5; N, 7·9%). This compound was also prepared from 3-chloro-4-methylaniline by the Skraup reaction as modified by Cohn (*loc. cit.*). The mixture of 5- and 7-chloro-isomers was obtained in 73·5% yield, and fractional crystallisation from high-boiling light petroleum gave pure 7-chloro-compound as the less soluble product; 10 g. of mixed isomers yielded 4·1 g. of pure 7-chloro-compound. The 5-chloro-compound was not isolated in a pure condition from the mother-liquors. The *picrate* of the 7-chloro-compound formed small yellow needles (from alcohol), m. p. 279—280° (decomp.) (Found : N, 13·8. $C_{10}H_8NCl,C_6H_3O_7N_3$ requires N, 13·8%).

2-*Chloro*-4-*methylacetoacetanilide* was obtained in 41% yield by the method of Limpach (*loc. cit.*). It crystallised from dilute alcohol in colourless, shining needles, m. p. 90·5° (Found : C, 58·8; H, 5·4; N, 6·4. $C_{11}H_{12}O_2NCl$ requires C, 58·5; H, 5·3; N, 6·2%).

8-*Chloro*-2-*hydroxy*-4 : 6-*dimethylquinoline*.—6 G. of the above acetoacetanilide, on cyclisation with concentrated sulphuric acid as previously described, yielded 0·4 g. of the *quinoline* after crystallisation from alcohol; this formed colourless, shining needles, m. p. 235° (Found : C, 63·7; H, 4·9; N, 6·8. $C_{11}H_{10}ONCl$ requires C, 63·6; H, 4·8; N, 6·75%).

8-*Chloro*-6-*methylquinoline*.—Obtained in 58% yield from 2-chloro-4-methylaniline by the Skraup reaction as modified by Cohn (*loc. cit.*), this (b. p. 191—192°/26 mm.) crystallised from high-boiling light petroleum in stout colourless prisms, m. p. 61·5°; the picrate crystallised from alcohol as yellow needles, m. p. 219—220°; Mazonski, Mielecki, and Sucharda (*loc. cit.*) reported 62·5° and 213°, respectively.

Reaction between 3-*Nitro*-4-*methylaniline and Ethyl Acetoacetate*.—This reaction was carried out according to (i) Limpach (*loc. cit.*) and (ii) Ainley and King as modified by Carmack (*J. Amer. Chem. Soc.*, 1946, **68**, 1809). (i) From 4 g. of base, prepared according to Ullmann and Dootson (*Ber.*, 1918, **51**, 9), 2 g. of 3-*nitro*-4-*methylacetoacetanilide* were obtained; it crystallised from dilute alcohol in cream-coloured needles, m. p. 84·5° (Found : N, 11·9. $C_{11}H_{12}O_4N_2$ requires N, 11·9%). This compound is mentioned in B.P. 450,021 but not described. (ii) The syrupy reaction product obtained from 46·5 g. of 3-nitro-4-methylaniline, after removal of excess of ethyl acetoacetate, was gently warmed with 200 c.c. of 4% sodium hydroxide and filtered from insoluble material. The filtrate was acidified with dilute hydrochloric acid, and the gummy product which separated solidified in the ice-chest; it was filtered off, washed, and dried, giving 22·5 g. of crude 3-nitro-4-methylacetoacetanilide, m. p. 82·5° after one crystallisation from dilute alcohol. The sodium hydroxide-insoluble material was treated with cold dilute hydrochloric acid, filtered off, washed, and extracted with alcohol, leaving a small quantity of insoluble residue. On evaporation of the alcoholic extract, 14 g. of crude β-(3-*nitro*-4-*methylanilino*)-*crotono*-3-*nitro*-4-*methylanilide* (XII) were obtained, which crystallised from alcohol in orange-yellow, microcrystalline plates, m. p. 176° (Found : C, 58·3; H, 5·0; N, 15·15. $C_{18}H_{18}O_5N_4$ requires C, 58·4; H, 4·9; N, 15·15%). When this was warmed with dilute hydrochloric acid for one minute, it was hydrolysed to a mixture of 3-nitro-4-methylaniline and the corresponding acetoacetanilide.

The alcohol-insoluble residue referred to above consisted of 0·5 g. of brown solid; it crystallised from dilute acetic acid in pale brown plates, m. p. 256—257° (Found : N, 17·0. Calc. for $C_{15}H_{14}O_5N_4$: N, 17·0%), unaltered by admixture with *s*-di-(3-nitro-4-methylphenyl)urea prepared according to Sonn's method (*Ber.*, 1914, **47**, 2437); m. p.s 251—252° and 245° were reported by Vittenet (*Zentr.*, 1899, **21**, 659) and by Manuelli and Ricca-Rosellini (*Gazzetta*, 1899, **29**, II, 124), respectively.

Attempted Cyclisation of 3-*Nitro*-4-*methylacetoacetanilide*.—Warming with concentrated sulphuric acid in the usual manner caused hydrolysis, and only 3-nitro-4-methylaniline was isolated; heating this in an oil-bath at 160—170° for 2 hours, or in medicinal paraffin at 240° for 5 minutes (cf. Kermack and Muir, *loc. cit.*), afforded *s*-di-(3-nitro-4-methylphenyl)urea described above, but no quinoline derivative.

Experiments with o-*Chloroacetoacetanilide*.—Cyclisation with concentrated sulphuric acid formed 8-chloro-2-hydroxy-4-methylquinoline, m. p. 214·5°, in 26% yield, confirming the result obtained by

Johnson and Hamilton (*loc. cit.*), but, when the acetoacetanilide was heated in medicinal paraffin at 240° for 5 minutes according to Kermack and Muir (*loc. cit.*), the product was not a quinoline derivative, but *s*-di-(*o*-chlorophenyl)urea, m. p. 235·5°, identical with the compound prepared from *o*-chloroaniline by Sonn's method (*loc. cit.*).

5-*Nitro*-2 : 4 : 6-*trimethylquinoline*.—2 : 4 : 6-Trimethylquinoline (24 g.), m. p. 45°, on nitration by the procedure described for the preparation of 5-nitro-4 : 6-dimethylquinoline, gave 28·5 g. of the 5-*nitro*-compound, which crystallised from dilute alcohol in pale yellow plates, m. p. 84·5° (Found : C, 66·5; H, 5·6; N, 13·0. $C_{13}H_{12}O_2N_2$ requires C, 66·7; H, 5·55; N, 13·0%); the *picrate* crystallised from alcohol as yellow plates, m. p. 175° (Found : N, 15·95. $C_{12}H_{12}O_2N_2,C_6H_3O_7N_3$ requires N, 15·7%). Attempts to convert this nitro-compound into a 2-phthalone led to extensive charring.

5-*Amino*-2 : 4 : 6-*trimethylquinoline* was prepared by reduction of the above nitro-compound according to Price *et al.* (*loc. cit.*) in 94% yield. It crystallised from water in small pale yellow needles, m. p. 139—139·5° (Found : N, 15·2. $C_{12}H_{14}N_2$ requires N, 15·05%); the *picrate* formed fine golden-yellow needles, m. p. 227° (decomp.), from alcohol (Found : N, 17·1. $C_{12}H_{14}N_2,C_6H_3O_7N_3$ requires N, 16·9%).

5-*Chloro*-2 : 4 : 6-*trimethylquinoline*, prepared in 94% yield from the above amine by Sandmeyer's method as above, crystallised from high-boiling light petroleum in colourless needles, m. p. 49—50°. It was slowly volatile in steam (Found : N, 6·7. $C_{12}H_{12}NCl$ requires N, 6·8%); the *picrate* formed fine yellow needles, m. p. 207°, from alcohol (Found : N, 13·0. $C_{12}H_{12}NCl,C_6H_3O_7N_3$ requires N, 12·9%).

5-*Chloro*-4 : 6-*dimethylquinoline*-2-*phthalone*.—The above 5-chloro-compound (2 g.) was mixed with phthalic anhydride (1·5 g.) and fused zinc chloride (0·2 g.) and heated in an oil-bath at 170—180° for 3 hours. The cooled product was dissolved in acetic acid and poured into water, giving 2 g. of a yellow amorphous solid. This crystallised from dioxan in small dark-yellow needles, m. p. 268° (Found : C, 71·3; H, 4·2; N, 4·4. $C_{20}H_{14}O_2NCl$ requires C, 71·55; H, 4·2; N, 4·2%). On oxidation with nitric acid according to Koenigs and Mengel (*Ber.*, 1904, **37**, 1322), the *phthalone* formed the corresponding 2-carboxylic acid which was insoluble in the usual organic reagents. It was decarboxylated by carefully heating the dry substance in a test-tube; a small quantity of oil was formed which was dissolved in alcohol and converted into the picrate, which after crystallisation from alcohol had m. p. 218°, unchanged by admixture with the picrate of 5-chloro-4 : 6-dimethylquinoline (III).

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UNIVERSITY OF THE WITWATERSRAND,
JOHANNESBURG, SOUTH AFRICA.

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