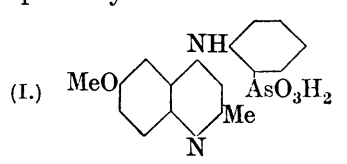
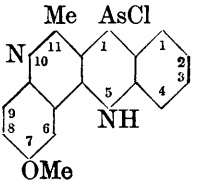
XVII.—*Quinoline Compounds containing Arsenic. Part II. Synthesis of 6-Methoxyquinoline Derivatives of Aminophenylarsinic Acids by the Use of 4-Bromo-6-methoxy-2-methylquinoline.*

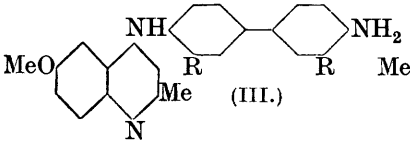
By Robert Henry Slater.

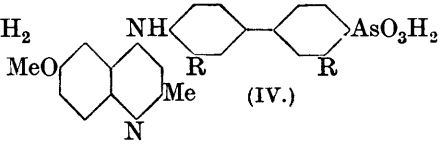
In continuation of the investigations described in Part I (Slater, J., 1930, 1209), several new 6-methoxyquinolylarsinic acids have been prepared in order that their chemotherapeutic activities in malaria and in trypanosomiasis might be ascertained. Since 4-chloro-6-methoxy-2-methylquinoline does not condense readily with *o*-aminophenylarsinic acid, *o*-tolidine, or *o*-dianisidine, and gives a diquinolyl derivative with *pp'*-diaminodiphenylmethane instead of the desired monoquinolyl compound (Slater, *loc. cit.*), it has now been successfully replaced in all four condensations by the analogous but more reactive *4-bromo-6-methoxy-2-methylquinoline*, prepared from 4-hydroxy-6-methoxy-2-methylquinoline (Conrad

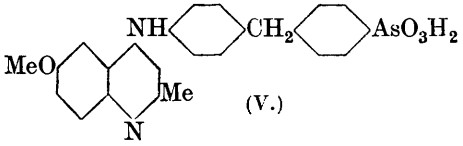
and Limpach, *Ber.*, 1888, **21**, 1650) by the action of phosphoryl bromide at 80—90°: o-6′-*methoxy*-2′-*methyl*-4′-*quinolylaminophenylarsinic acid* (I) (compare Burton and Gibson, J., 1926, 459; Wintersteiner and Lieb, *Ber.*, 1928, **61**, 1126), 4-o-*tolidino*-6-*methoxy*-2-*methylquinoline* (III; R = Me), 4-o-*dianisidino*-6-*methoxy*-2-*methylquinoline* (III; R = OMe), and p-6-*methoxy*-2-*methyl*-4-*quinolylamino*-p′-*aminodiphenylmethane*, respectively, were thus obtained under the conditions described later. The last three compounds were converted by the Bart reaction into 4′-6″-*methoxy*-2″-*methyl*-4″-*quinolylamino*-3 : 3′-*dimethyldiphenylylarsinic acid* (IV; R = Me), 4′-6″-*methoxy*-2″-*methyl*-4″-*quinolylamino*-3 : 3′-*dimethoxydiphenylylarsinic acid* (IV; R = OMe), and p-6-*methoxy*-2-*methyl*-4-*quinolylaminodiphenylmethane*-p′-*arsinic acid* (V) respectively.

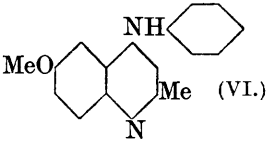












By reduction in boiling alcohol–hydrochloric acid solution by sulphur dioxide in presence of a trace of iodine, compound (I) was converted into 12-*chloro*-7-*methoxy*-11-*methyl*-5 : 12-*dihydroquinbenzarsazine* (II) (compare Burton and Gibson, *loc. cit.*, p. 458), which on oxidation gave 7-*methoxy*-11-*methylquinbenzarsazinic acid* (II, with AsO·OH in place of AsCl) (compare Gibson and Johnson, J., 1927, 2512). This acid is amphoteric and exhibits a brilliant blue fluorescence in dilute acid or alkali solution. Phosphoryl chloride converted the arsinic acid (I) into 7-*methoxy*-11-*methylquinbenzarsazinyl chloride*.

The arsinic acid (I) dissolved in boiling acetic anhydride and in boiling hydrochloric acid. The former solution, after decomposition with excess of water, exhibited a brilliant blue fluorescence, but no

fluorescence was observed with the hydrochloric acid solution even on prolonged boiling. It would, therefore, appear that boiling acetic anhydride, but not boiling hydrochloric acid, readily effects ring closure (compare Gibson and Johnson, *loc. cit.*, p. 2501).

The parent base of this group, namely, 4-*anilino*-6-*methoxy*-2-*methylquinoline* (VI), was readily obtained by condensing aniline with 4-chloro-6-methoxy-2-methylquinoline (Conrad and Limpach, *loc. cit.*, p. 1651) at 180°.

Some of the compounds now described give (as stated in the experimental section) brilliant colorations when they are added under suitable conditions to a dilute solution of iodine in aqueous potassium iodide (compare Part I, *loc. cit.*; Kermack, Slater, and Spragg, *Proc. Roy. Soc. Edinburgh*, 1930, **50**, 243).

A solution of the acetyl derivative of 4-*o*-dianisidino-6-methoxy-2-methylquinoline in warm dilute acetic acid shows a remarkable tendency to gelatinise on cooling. This property is exhibited in comparatively small concentrations, and the gel obtained with a 0·5% solution resembles moderately concentrated gelatin.

The above quinolylarsinic acids and some of the intermediate compounds are being tested by the Joint Committee on Chemotherapy formed by the Medical Research Council and the Department of Scientific and Industrial Research in respect of their chemotherapeutic actions. The results of these tests will be published later.

Experimental.

4-*Bromo*-6-*methoxy*-2-*methylquinoline*.—4-Hydroxy-6-methoxy-2-methylquinoline was obtained in good yield by the following modification of the method of Conrad and Limpach (*loc. cit.*, p. 1649). A solution of *p*-anisidine (61·5 g.) in ethyl acetoacetate (65 g.) was kept at 37° for 3 days, the water liberated was then removed under diminished pressure at 60°, and the ethyl β-*p*-methoxyphenylaminocrotonate heated very rapidly to 250—260°. The flame was removed whenever the vigorous reaction, which took place at this temperature, began to subside. The solid, light brown residue was repeatedly extracted with hot dilute hydrochloric acid (5%) and the combined extracts were boiled with animal charcoal for a few minutes, filtered, and rendered alkaline with ammonium hydroxide solution. The pale yellow crystalline precipitate of 4-hydroxy-6-methoxy-2-methylquinoline was washed with water and dried at 100°; m. p. 296—298° (slight decomp.); yield, 57·5 g. (61% of the theoretical). Conrad and Limpach obtained a 37% yield.

A mixture of 4-hydroxy-6-methoxy-2-methylquinoline (25 g.) and phosphoryl bromide (50 g.) was vigorously shaken at 80—90° for 1 hour. The product was decomposed with water (400 c.c.) at 60°

and the dark brown solution was boiled with animal charcoal for 10 minutes, filtered, and rendered alkaline with sodium hydroxide solution. The brown flocculent base liberated crystallised from light petroleum (b. p. 60—80°) in sheaves of fine, pale yellow, rectangular, prismatic needles (15·5 g.), m. p. 117—118° (Found : C, 52·5; H, 4·2; N, 5·3. $C_{11}H_{10}ONBr$ requires C, 52·4; H, 4·0; N, 5·6%).

4-Bromo-6-methoxy-2-methylquinoline is slightly soluble in hot water, readily soluble in ethyl and methyl alcohol, ethyl acetate, acetone, ether, chloroform, benzene, acetic acid, and dilute mineral acids, but much less soluble in ligroin and light petroleum. The acetic acid and dilute nitric acid solutions exhibit a blue fluorescence, and the solution in dilute sulphuric acid a greenish-blue fluorescence which changes to violet on further dilution. No fluorescence is observed with a solution in dilute hydrochloric acid.

o-6′-Methoxy-2′-methyl-4′-quinolylaminophenylarsinic Acid (I).—4-Bromo-6-methoxy-2-methylquinoline (8·5 g.) and *o*-aminophenylarsinic acid (5·4 g.) were dissolved in dry amyl alcohol (70 c.c.), and potassium carbonate (16 g.) and traces of copper-bronze and iodine added. The mixture was kept at 130—140° for 22 hours and cooled, and the amyl alcohol removed by distillation in steam. The residual dark reddish-brown solution was boiled for a few minutes, and the solid residue extracted thrice with small quantities of warm dilute aqueous sodium hydroxide. The hydrogen-ion concentration of the combined filtrates was adjusted with hydrochloric acid to p_H 7·3; the *arsinic acid*, thereby quantitatively precipitated as a light brown, gelatinous solid, was purified by several reprecipitations from its solution in warm dilute aqueous sodium hydroxide (animal charcoal) at its isoelectric point (p_H 7·3) with hydrochloric acid. The white gelatinous solid thus obtained was washed with water and dried at 100°; m. p. 302—303° (decomp.) (yield, 5·9 g.) (Found : As, 19·3. $C_{17}H_{17}O_4N_2As$ requires As, 19·3%).

The arsinic acid is practically insoluble in water and in the usual neutral organic solvents, but it is readily soluble in acetic acid and in a mixture of alcohol and hydrochloric acid. A saturated solution in hot dilute acetic acid deposits well-shaped, colourless, rhombic prisms on cooling. The acid dissolves readily in dilute sodium and ammonium hydroxide solutions and in moderately concentrated hydrochloric acid. A colloidal solution of the arsinic acid does not give a coloration with $N/1000$-iodine. If, however, a few drops of concentrated hydrochloric acid are added to the mixture, a brilliant violet coloration appears; this disappears on the addition of more hydrochloric acid. A solution in warm concentrated sulphuric acid exhibits a blue fluorescence which persists on dilution with water.

The sodium salt is precipitated in stellate clusters of fine, colourless, prismatic needles when concentrated sodium hydroxide solution is added to a solution of the arsinic acid in dilute alkali. The following salts are precipitable from an aqueous solution of the ammonium salt: magnesium salt, pale yellow, amorphous, insoluble in hot water; barium salt, fine feathery needles, moderately soluble in cold water, readily soluble in hot water; silver salt, pale yellow, amorphous, insoluble in hot water: mercuric salt, white, curdy, insoluble in hot water. The calcium salt appears to be readily soluble. It is slowly precipitated, however, in sheaves of fine slender needles when excess of a concentrated calcium chloride solution is added to the ammonium salt solution.

12-*Chloro*-7-*methoxy*-11-*methyl*-5 : 12-*dihydroquinbenzarsazine* (II).—The preceding arsinic acid (1·9 g.) was dissolved in a mixture of alcohol (15 c.c.) and hydrochloric acid (10 c.c.; *d* 1·19), and a small crystal of iodine added. The clear brown solution was gently boiled, and sulphur dioxide bubbled through. In a few minutes a copious, light brown, crystalline mass was precipitated (1·7 g.): this, recrystallised from hot water, formed small, pale yellow, rhombohedral plates, which darkened slightly at 235° and melted at 245—247° (decomp.) (Found: Cl, 9·0; As, 20·2. $C_{17}H_{14}ON_2ClAs$ requires Cl, 9·5; As, 20·1%).

The *quinbenzarsazine* is moderately soluble in hot water, but practically insoluble in the usual neutral organic solvents. It dissolves readily in acetic acid. It is slightly soluble in hot dilute sodium hydroxide solution and in boiling hydrochloric acid; these solutions deposit stellate clusters of fine, rectangular, prismatic needles on cooling.

7-*Methoxy*-11-*methylquinbenzarsazinic Acid*.—12-Chloro-7-methoxy-11-methyl-5 : 12-dihydroquinbenzarsazine (0·9 g.) was dissolved in hot acetic acid (5 c.c.) and cooled, and hydrogen peroxide (10 c.c.; 10 vols.) added. The pale yellow solution rapidly turned reddish-brown and exhibited a brilliant blue fluorescence. After 5 minutes, the solution was warmed on the water-bath to complete the oxidation and its reaction was then adjusted with aqueous sodium hydroxide to p_H 7·0 : the *arsazinic acid*, quantitatively precipitated as a pale yellow, gelatinous solid, was dissolved in dilute aqueous sodium hydroxide, reprecipitated at its isoelectric point (p_H 7·0) with hydrochloric acid, washed with water, and dried at 100° (yield, 0·7 g.). The acid was unmelted at 310° (turning slightly brown) (Found: As, 20·5. $C_{17}H_{15}O_3N_2As$ requires As, 20·3%).

The arsazinic acid is practically insoluble in water and in the usual neutral organic solvents. It dissolves readily in acetic acid, dilute aqueous sodium and ammonium hydroxide solutions, and in

hot concentrated hydrochloric acid : these solutions exhibit a blue fluorescence. The hydrochloric acid solution deposits small prismatic needles on cooling. A solution in warm concentrated sulphuric acid exhibits a brilliant blue fluorescence which is not destroyed on dilution with water.

The sodium salt is precipitated in a white gelatinous state when concentrated sodium hydroxide solution is added to a solution of the arsazinic acid in dilute alkali : this dissolves on heating and crystallises on cooling in fine, colourless, sharp-pointed, prismatic needles. The following salts are precipitable from an aqueous solution of the ammonium salt : magnesium salt, sheaves of fine, long, colourless needles, soluble in hot water; barium salt, white, gelatinous, soluble in hot water, crystallises on cooling in stellate clusters of fine prismatic needles; calcium salt, white, gelatinous, insoluble in hot water; silver salt, white, gelatinous, insoluble in hot water; mercuric salt, white, curdy, insoluble in hot water.

7-*Methoxy*-11-*methylquinbenzarsazinyl Chloride*.—The arsinic acid (I) (1·9 g.) was added to phosphoryl chloride (8 c.c.) so that the temperature did not rise above 80°. When the vigorous reaction had subsided, the product was warmed on the water-bath until evolution of hydrogen chloride ceased and was then cautiously decomposed with water. The bright yellow solid which separated was dissolved in warm dilute acetic acid (10%), and the filtered solution neutralised with dilute aqueous sodium hydroxide; the *arsazinyl chloride* was then completely precipitated as a pale yellow gelatinous solid. This was washed with water and dried (yield, 1·4 g.). It darkened slightly at 150° and melted at 165—167° (Found : Cl, 8·9; As, 19·6. $C_{17}H_{14}O_2N_2ClAs$ requires Cl, 9·1; As 19·3%).

The arsazinyl chloride is readily soluble in acetic acid, slightly soluble in acetone and in boiling benzene, and practically insoluble in ligroin, light petroleum, and water. It slowly dissolves in boiling dilute aqueous sodium hydroxide, the solution exhibiting a bright blue fluorescence. It is readily soluble in boiling dilute hydrochloric acid.

4-o-*Tolidino*-6-*methoxy*-2-*methylquinoline* (III; R = Me).—A mixture of 4-bromo-6-methoxy-2-methylquinoline (5·0 g.) and *o*-tolidine (10 g.), heated at 140—150° for 9 hours, became almost completely solid. The product was digested with excess of boiling dilute hydrochloric acid (10%), which converted it into a practically insoluble, light brown hydrochloride. This was washed with dilute hydrochloric acid (10%), and converted by means of warm aqueous sodium hydroxide into the free *base* (7·2 g.), which crystallised from aqueous alcohol (40% alcohol) in fine, pale yellow rhombohedra,

m. p. 152° with loss of solvent of crystallisation. After being heated for 5 hours at 100°, the compound had m. p. 199—200° (Found: C, 78·3; H, 6·7; N, 10·9. $C_{25}H_{25}ON_3$ requires C, 78·3; H, 6·6; N, 11·0%).

The base is insoluble in water, readily soluble in chloroform and acetone, moderately soluble in ethyl alcohol, methyl alcohol, ethyl acetate and acetic acid, sparingly soluble in ether, benzene, and ligroin, and practically insoluble in light petroleum. It is slightly soluble in boiling dilute hydrochloric acid, and, on cooling, the hydrochloride crystallises in colourless octahedra. The sulphate is deposited from solution in warm dilute sulphuric acid as a white gelatinous mass. The base dissolves in dilute nitric acid to give a brown solution. A solution of the diazo-chloride gives a blood-red azo-dye with an alkaline solution of β-naphthol. A dilute solution of the base in aqueous alcohol or acetic acid gives a reddish-brown coloration with *N*/1000-iodine.

The *acetyl* derivative, prepared by means of boiling acetic anhydride, crystallised from alcohol–light petroleum (b. p. 60—80°) in large, colourless, rectangular plates, m. p. 182—183° (Found: N, 9·6. $C_{27}H_{27}O_2N_3$ requires N, 9·9%). It is readily soluble in ethyl alcohol, methyl alcohol and acetic acid, moderately soluble in chloroform and acetone, slightly soluble in ethyl acetate and benzene, and practically insoluble in water and light petroleum. A dilute alcoholic or acetic acid solution does not give a coloration with *N*/1000-iodine. Hydrochloric acid gradually precipitates the hydrochloride from an alcoholic solution in rosettes of fine, slender, prismatic needles.

4′-6″-Methoxy-2″-methyl-4″-quinolylamino-3 : 3′-dimethyldiphenylylarsinic Acid (IV; R = Me).—A well-stirred mixture of 4-*o*-tolidino-6-methoxy-2-methylquinoline (7·7 g.) and hydrochloric acid (11·4 c.c. of hydrochloric acid, *d* 1·19; 20 c.c. of water) was cooled to 0° and diazotised (sodium nitrite, 1·6 g.; water, 10 c.c.) below 3°. A pale orange diazonium salt soon separated, and after 30 minutes the mixture was neutralised at 0° with 5*N*-sodium hydroxide, and sodium arsenite solution (a mixture of arsenious oxide, 6 g., in 5*N*-sodium hydroxide, 12 c.c.; sodium carbonate, 12 g., in water, 36 c.c.; and 10% copper sulphate solution, 1·2 c.c., to which was added sufficient aqueous ammonium hydroxide solution to give the soluble complex salt) added. The whole was kept at room temperature for 18 hours and then warmed gently on the water-bath until evolution of nitrogen ceased. After filtration, the solid, dark brown residue was extracted thrice with small quantities of hot aqueous sodium hydroxide (5%). The reaction of the combined filtrates was adjusted with hydrochloric acid to p_H 7·0; the *arsinic*

acid was then quantitatively precipitated as a light brown, gelatinous solid. This was collected and repeatedly dissolved in warm dilute aqueous sodium hydroxide (animal charcoal) and reprecipitated at the above isoelectric point (p_H 7·0) with hydrochloric acid. The acid was finally obtained as a white gelatinous solid, which was washed with water and dried at 100°. It darkened slightly at 300° and melted at 304—305° (decomp.); yield, 4·4 g. (Found : As, 15·4. $C_{25}H_{25}O_4N_2As$ requires As, 15·2%).

The arsinic acid is practically insoluble in water and in the usual neutral organic solvents. It is moderately soluble in acetic acid but only slightly soluble in a mixture of alcohol and hydrochloric acid. A saturated solution in hot dilute acetic acid crystallises on cooling in large, colourless, well-shaped, rhombic prisms. The acid dissolves readily in dilute aqueous sodium and ammonium hydroxide solutions, but is only slightly soluble in moderately concentrated hydrochloric acid. A solution in warm concentrated sulphuric acid exhibits a light blue fluorescence which disappears on dilution with water. A solution in dilute acetic acid gives a light brown precipitate when added to *N*/1000-iodine; this gradually changes to dark brown on standing.

The white gelatinous sodium salt is readily produced when concentrated sodium hydroxide solution is added to a solution of the arsinic acid in dilute alkali; it dissolves on boiling, but is reprecipitated in a gelatinous state on cooling. The magnesium, calcium, barium, silver and mercuric salts are precipitable in a white amorphous condition from an aqueous solution of the ammonium salt : these are practically insoluble in hot water.

4-o-*Dianisidino*-6-*methoxy*-2-*methylquinoline* (III; R = OMe).—A mixture of 4-bromo-6-methoxy-2-methylquinoline (2·5 g.) and *o*-dianisidine (7·0 g.) containing a trace of finely divided copper-bronze, heated at 135—140° during 8 hours, became dark brown and almost completely solid. The product was digested with boiling dilute hydrochloric acid (5%), and the dirty grey, gelatinous hydrochloride, which separated on cooling, was washed with dilute hydrochloric acid and converted into the crude *base* (4·1 g.) by warming with aqueous sodium hydroxide. On attempting to purify the base by crystallisation from aqueous alcohol (animal charcoal), a considerable quantity of dark brown, resinous material separated and only a small amount (1·3 g.) of fine, pale yellow, rectangular, prismatic needles, m. p. 195—196°, was obtained (Found : C, 72·0; H, 6·1; N, 10·1. $C_{25}H_{25}O_3N_3$ requires C, 72·3; H, 6·1; N, 10·1%). The resinous material had phenolic properties and was probably formed by demethylation by the hydrobromic acid liberated.

Attempts to improve the yield of base by carrying out the con-

densation in either boiling amyl alcohol or nitrobenzene in presence of anhydrous potassium carbonate and traces of finely divided copper-bronze and iodine were unsuccessful, resinous products being obtained in both cases. A very good yield was obtained, however, by carrying out the condensation under diminished pressure as follows. 4-Bromo-6-methoxy-2-methylquinoline (2·5 g.) and *o*-dianisidine (7·0 g.) were heated together at 140°/10—15 mm. The melt rapidly became very viscous with slight frothing and in about 20 minutes had almost completely solidified. The product was extracted with boiling dilute hydrochloric acid (5%), and the practically colourless, gelatinous hydrochloride, which was precipitated on cooling, was washed with dilute hydrochloric acid. The pale yellow base, which separated on the addition of ammonium hydroxide solution, was of a high degree of purity and crystallised readily from aqueous alcohol as described above (yield, 4·0 g.).

The base is insoluble in water, readily soluble in ethyl alcohol, methyl alcohol, chloroform, acetone, ethyl acetate, and acetic acid, moderately soluble in benzene and ether, but much less soluble in ligroin and light petroleum. A dilute alcoholic solution gives a red coloration with $N/1000$-iodine: this disappears on warming and does not reappear on cooling. A dilute acetic acid solution under the same conditions gradually gives with $N/1000$-iodine a chocolate coloration which disappears on warming but reappears on cooling. The base is slightly soluble in boiling dilute hydrochloric, sulphuric, and nitric acids, and white gelatinous precipitates of the corresponding salts separate on cooling. A solution of the diazo-chloride gives a crimson azo-dye on treatment with an alkaline solution of β-naphthol.

The *acetyl* derivative crystallises from aqueous alcohol (10% alcohol) in sheaves of fine, colourless, slender needles, m. p. 140° with loss of a molecule of water of crystallisation (Found: C, 68·6; H, 6·1; N, 8·9. $C_{27}H_{27}O_4N_3,H_2O$ requires C, 68·2; H, 6·1; N, 8·8%). After dehydration at 150° the compound has m. p. 200—201°. It is readily soluble in ethyl alcohol, methyl alcohol, chloroform, acetone, ethyl acetate and acetic acid, moderately soluble in benzene, and slightly soluble in ether, light petroleum, and boiling water. The benzene solution exhibits a greenish-blue fluorescence. A dilute alcoholic solution gives a brilliant blue coloration with $N/1000$-iodine: this disappears on warming and does not reappear on cooling. A dilute acetic acid solution, under the same conditions, gives with iodine an intense red coloration which rapidly changes to violet: this practically disappears on warming but reappears on cooling. This violet coloration is given down to a concentration of about $N/64{,}000$-iodine. A violet coloration is also

produced when a dilute aqueous solution of potassium iodide is added to a mixture of an acetic acid solution of the acetyl compound and bromine water. Hydrochloric acid slowly precipitates the hydrochloride from an alcoholic solution in sheaves of fine feathery needles.

4'-6''-Methoxy-2''-methyl-4''-quinolylamino-3 : 3'-dimethoxydiphenylylarsinic Acid (IV; R = OMe).—This acid was obtained from 4-*o*-dianisidino-6-methoxy-2-methylquinoline (III; R = OMe) by the Bart reaction under practically the same conditions as were used for the preparation of 4'-6''-methoxy-2''-methyl-4''-quinolylamino-3 : 3'-dimethyldiphenylylarsinic acid (base, 4·2 g.; hydrochloric acid, 5·7 c.c. of *d* 1·19 in water, 15 c.c.; sodium nitrite, 0·8 g., in water, 8 c.c.). The hydrogen-ion concentration of the alkaline filtrate was adjusted with hydrochloric acid to p_H 7·0 and the *arsinic acid*, then completely precipitated as a dirty grey, gelatinous solid, was repeatedly dissolved in warm dilute aqueous sodium hydroxide (animal charcoal) and reprecipitated at the above isoelectric point (p_H 7·0) with hydrochloric acid. The acid was finally obtained as a pale grey, gelatinous solid, which was washed with water and dried at 100° (yield, 3·7 g.). It darkened slightly at about 220° and melted at 243—245° (decomp.) (Found: As, 14·4. $C_{25}H_{25}O_6N_2As$ requires As, 14·3%).

The arsinic acid is practically insoluble in water and in the usual neutral organic solvents. It is moderately soluble in acetic acid: a saturated solution in hot dilute acetic acid slowly crystallises on cooling in sheaves of fine long needles. The acid dissolves readily in dilute aqueous sodium and ammonium hydroxides to give reddish-brown solutions, but it is only slightly soluble in moderately concentrated hydrochloric acid. A solution in warm concentrated sulphuric acid exhibits a blue fluorescence which disappears on dilution with water. A solution in dilute acetic acid slowly gives a dark brown flocculent precipitate when added to *N*/1000-iodine.

The light grey gelatinous sodium salt is readily produced in the usual way. The magnesium, calcium, and barium salts are white and gelatinous, and the silver and mercuric salts are pale yellow and curdy: all are insoluble in water.

p-6-*Methoxy*-2-*methyl*-4-*quinolylamino*-p'-*aminodiphenylmethane*.—A mixture of *pp'*-diaminodiphenylmethane (6 g.) and 4-bromo-6-methoxy-2-methylquinoline (2·5 g.), heated at 135—140°/10—15 mm., rapidly became very viscous with slight frothing and in about 30 minutes was converted into a light brown, crystalline solid. This was extracted with a slight excess of boiling dilute hydrochloric acid (5%), and the pale greenish-yellow, gelatinous hydrochloride, which readily separated on cooling, was filtered off, washed with dilute hydrochloric acid, and warmed with ammonium hydroxide

solution. The *base* (3·7 g.) liberated crystallised from aqueous alcohol (20% alcohol) in pale yellow, rectangular, prismatic needles (radially arranged), m. p. 135—145° with loss of a molecule of water of crystallisation (Found : C, 74·1 ; H, 6·7 ; N, 10·6. $C_{24}H_{23}ON_3,H_2O$ requires C, 74·4 ; H, 6·5 ; N, 10·8%).

The base is insoluble in water. It is readily soluble in ethyl alcohol, methyl alcohol, chloroform, acetone, ethyl acetate and acetic acid, slightly soluble in ether and benzene, and practically insoluble in light petroleum. A dilute alcoholic or acetic acid solution does not give a coloration with $N/1000$-iodine. This is in sharp contrast to the behaviour of the corresponding diquinolyl derivative, which gives with iodine a deep purple coloration (compare Slater, *loc. cit.*, p. 1215). A dilute alcoholic or acetic acid solution containing both the mono- and the di-quinolyl compound also gives a deep purple coloration on the addition of iodine even when the former is present in large excess, and the non-production of a colour, under these conditions, with the monoquinolyl derivative alone indicates that it is free from contamination with the diquinolyl compound. The base is slightly soluble in boiling dilute hydrochloric, sulphuric and nitric acids and, on cooling, crystalline precipitates of the corresponding salts separate. A solution of the diazo-chloride gives a scarlet azo-dye on treatment with an alkaline solution of β-naphthol.

p-6-*Methoxy*-2-*methyl*-4-*quinolylaminodiphenylmethane*-p'-*arsinic Acid* (V).—This acid was obtained from *p*-6-methoxy-2-methyl-4-quinolylamino-p-aminodiphenylmethane by the Bart reaction under practically the same conditions as were used for the preparation of the preceding arsinic acids (base, 3·7 g. ; hydrochloric acid, 5·7 c.c. of *d* 1·19, in water, 15 c.c. ; sodium nitrite, 0·8 g., in water, 5 c.c.), but the temperature was kept at 15—20° since diazotisation does not take place below 15°. The reaction of the alkaline filtrate was adjusted with hydrochloric acid to p_H 6·5 and the *arsinic acid* was then completely precipitated as a pale yellow, gelatinous solid, which was purified as in the other cases. It darkened slightly at 280° and charred at about 300° (Found : As, 16·0. $C_{24}H_{23}O_4N_2As$ requires As, 15·7%). The yield was rather small.

The arsinic acid is practically insoluble in water and in the usual neutral organic solvents. It is readily soluble in acetic acid and in dilute aqueous sodium and ammonium hydroxide solutions, but only slightly soluble in moderately concentrated hydrochloric acid. A solution in concentrated sulphuric acid exhibits a brilliant purplish-blue fluorescence which is destroyed on dilution with water. A dilute acetic acid solution of the arsinic acid gives a light brown, amorphous precipitate with $N/1000$-iodine : this dissolves on warm-

ing but is reprecipitated on cooling. The white gelatinous sodium salt is readily produced in the usual way.

4-*Anilino*-6-*methoxy*-2-*methylquinoline* (VI).—A mixture of 4-chloro-6-methoxy-2-methylquinoline (5·2 g.) and aniline (10 g.) was heated along with a trace of finely divided copper-bronze at 180° for 5 hours, and the light brown product was rendered alkaline with aqueous sodium hydroxide and distilled in steam to remove the excess of aniline. The solid residue was dissolved in alcohol, and the filtered solution saturated with dry hydrogen chloride; the *monohydrochloride* of the base then separated in fine, pale yellow, sharp-pointed, rectangular, prismatic needles (6·0 g.), which darkened slightly at 300° but were unmelted at 310° (Found: C, 67·5; H, 6·0; N, 9·3. $C_{17}H_{16}ON_2,HCl$ requires C, 67·9; H, 5·7; N, 9·3%). The free base, liberated by warm aqueous sodium hydroxide, crystallised from benzene, containing a few chips of potassium hydroxide, in tufts of fine, slender, colourless needles, m. p. 208—209°. The base is insoluble in water. It is readily soluble in ethyl alcohol, methyl alcohol, chloroform, acetone, ethyl acetate, ether, and acetic acid, moderately soluble in benzene and ligroin, and slightly soluble in light petroleum, boiling dilute hydrochloric, sulphuric and nitric acids; when these acid solutions are cooled, crystalline precipitates of the corresponding salts separate.

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