

92. *A Reaction of Certain Diazosulphonates derived from β -Naphthol-1-sulphonic Acid. Part XIX. Derivatives of 4'-Nitro-2'-methoxybenzene-2-naphthol-1-diazosulphonate.*

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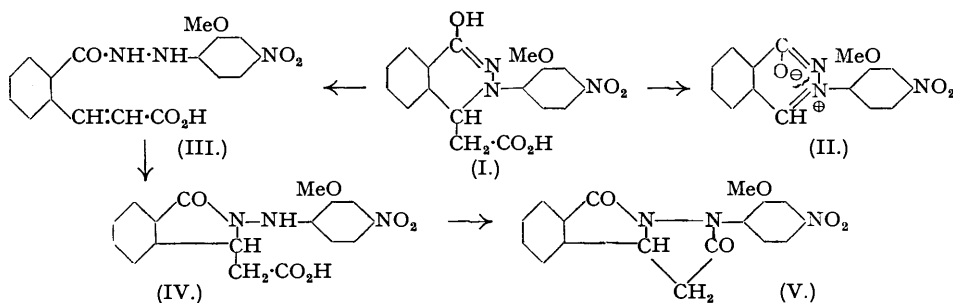
Although the reactions and the properties of the products in the present series in general approximated to those recorded for analogous compounds containing the nitro- or amino-group in the 4'-position, some interesting differences have been found. The methoxyl group is more stable than the phthalazine ring under demethylating conditions, and the corresponding hydroxy-compound could not be prepared from 1-hydroxy-3-(4'-nitro-2'-methoxyphenyl)-3:4-dihydrophthalazine-4-acetic acid (I). Attempted demethylation of (I) with fuming hydrochloric acid at 180° gave 4'-nitro-2'-methoxy-3-phenylphthalaz-1-one (II) and 2-(4'-nitro-2'-methoxyphenylamino)isoindolinone-3-acetic acid (IV). Both (II) and (IV) are also formed by refluxing (I) with aqueous sulphuric acid. Compound (IV) must be formed from (I) by opening of the phthalazine ring to benzo-4'-nitro-2'-methoxyphenylhydrazide-2- β -acrylic acid (III), followed by closure under the acid conditions to the 5-membered ring compound (IV). Compound (IV) is the first example of a compound of this type with a nitro-group in the 4'-position, as hitherto analogues have only been obtained with the nitro-group in the 2'-position. Rapid acidification of sodium 1-(4'-nitro-2'-methoxybenzeneazo)- β -naphthaquinone-1-sulphonate in sodium hydroxide and boiling the product with dilute hydrochloric acid gave a mixture of (I) and (IV). Conversion of the alcohol compounds of methylated bases from 4'- or 3'-nitro-3-phenylphthalaz-1-one into 4-keto-1-methoxy-3-(4'- or 3'-nitrophenyl)-3:4-dihydrophthalazine by heating has been found to be an oxidation process. 1-Hydroxy-3-(4'-amino-2'-methoxyphenyl)-3:4-dihydrophthalazine-4-acetic acid behaves in an unusual manner when boiled with mineral acid for, although the anticipated 4'-amino-2'-methoxy-3-phenylphthalaz-1-one (VIII; R = H) is formed, the main product is its 4-methyl derivative (VIII; R = Me), decarboxylation occurring preferentially to the elimination of acetic acid.

THE preparation of phthalazine derivatives from 2-halogeno- and 2:6-dihalogeno-4-nitroanilines and from 5-nitro-*o*-toluidine has already been described (Rowe *et al.*, *J.*, 1931, 1073; 1932, 11, 473; 1935, 1134). In extending the series, it was desired to include a 2-hydroxy-nitroamine, but attempts to produce phthalazine derivatives from 4-nitro-2-aminophenol were unsuccessful. Phthalazine compounds were therefore prepared from 5-nitro-2-anisidine with a view to subsequent conversion into the 2'-hydroxy-derivatives by demethylation, and in order to determine the influence of the methoxyl groups on the course of the reaction and its products.

Although the reactions and the properties of the products in this series in general approximated to those recorded for analogous compounds containing the nitro- or amino-group in the 4'-position, some interesting differences have been found.

Sodium hydrogen 3-(4'-nitro-2'-methoxyphenyl)-3:4-dihydrophthalazine-1-sulphonate-4-acetate is readily prepared from 4'-nitro-2'-methoxybenzene-2-naphthol-1-diazosulphonate *via* sodium 1-(4'-nitro-2'-methoxybenzeneazo)- β -naphthaquinone-1-sulphonate. Boiling with chloric acid converts it into 1-hydroxy-3-(4'-nitro-2'-methoxyphenyl)-3:4-dihydroacetic acid (I).

The methoxyl group is more stable than the phthalazine ring under demethylating conditions and the corresponding hydroxy-compound could not be prepared from (I). With boiling hydriodic acid (*d* 1.7) compound (I) gave ammonium iodide, indicating disruption of the phthalazine ring, and, after treatment of the product with sodium hydrogen sulphite solution, only an unidentified acid was obtained. Attempted demethylation of (I) with hydrobromic and acetic acids at 180° gave an intractable resin, whilst attempted demethylation with fuming hydrochloric acid at 180° gave 4'-nitro-2'-methoxy-3-phenylphthalaz-1-one (II) and 2-(4'-nitro-2'-methoxyphenylamino)isoindolinone-3-acetic acid (IV).

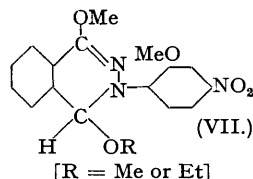
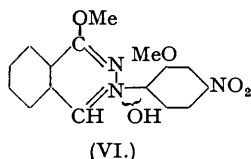


(IV) must be derived from (I) by opening of the phthalazine ring to benzo-4'-nitro-2'-methoxyphenylhydrazide-2- β -acrylic acid (III), followed by closure under the acid conditions employed to a 5-membered ring, this view being supported by the yellow colour of an alkaline solution of (IV), whereas analogues of (III) dissolve in alkalis with a bluish-violet colour (cf. Rowe *et al.*, *J.*, 1935, 1800; 1936, 1102), and by its ready conversion into the anhydro-compound, 2 : 5-diketo-3-(4'-nitro-2'-methoxyphenyl)isoindolinopyrazolidocoline (V), by means of acetic anhydride. Although long boiling with acetic anhydride and pyridine opens the phthalazine ring of 1-hydroxy-3-(2'-nitrophenyl)-3 : 4-dihydrophthalazine-4-acetic acid with subsequent ring closure and elimination of water to form 2 : 5-diketo-3-(2'-nitrophenyl)isoindolinopyrazolidocoline (*J.*, 1935, 1804), compound (I) under similar conditions is merely converted into its *O*-acetyl derivative.

2-(4'-Nitro-2'-methoxyphenylamino)isoindolinone-3-acetic acid (IV) is the first example of a compound of this type with a nitro-group in the 4'-position, as hitherto analogues have only been obtained with the nitro-group in the 2'-position. When sodium 1-(2'-nitrobenzeneazo)- β -naphthaquinone-1-sulphonate is treated with sodium hydroxide and the mixture rapidly acidified, sodium benzaldehyde-2'-nitrophenylhydrazone- ω -sulphonate-2- β -acrylic acid is obtained and is converted by boiling dilute hydrochloric acid into a mixture of benzo-2'-nitrophenylhydrazide-2- β -acrylic acid and 2-(2'-nitrophenylamino)isoindolinone-3-acetic acid (*J.*, 1935, 1800). Sodium 1-(4'-nitro-2'-methoxybenzeneazo)- β -naphthaquinone-1-sulphonate, treated similarly with sodium hydroxide and the mixture acidified after only 15 seconds, gave a product from which sodium benzaldehyde-2'-methoxy-4'-nitrophenylhydrazone- ω -sulphonate-2- β -acrylic acid could not be isolated by fractional crystallisation, but, after boiling with dilute hydrochloric acid, a mixture (13.8%) of (I) and (IV) was obtained.

Heating 1-hydroxy-3-(2', 3', or 4'-nitrophenyl)-3 : 4-dihydrophthalazine-4-acetic acid with fuming hydrochloric acid at 180° also gave interesting results. The 4'-nitro-compound gave 4'-nitro-3-phenylphthalaz-1-one (14.9%) and 2-(4'-nitrophenylamino)isoindolinone-3-acetic acid (0.7%) (see Rowe, McFadyen, and Peters, following paper), whereas from the 3'-nitro-isomeride, only 3'-nitro-3-phenylphthalaz-1-one (45.9%) was formed and no trace of the corresponding isoindolinone derivative was detected. Contrary to anticipation, the 2'-nitro-isomeride gave resins, from which neither 2'-nitro-3-phenylphthalaz-1-one nor 2-(2'-nitrophenylamino)isoindolinone-3-acetic acid could be isolated. On the other hand, 1-hydroxy-3-(4'-chloro-2'-nitrophenyl)-3 : 4-dihydrophthalazine-4-acetic acid afforded a little (1%) 2-(4'-chloro-2'-nitrophenylamino)isoindolinone-3-acetic acid and a resin which appeared to consist essentially of 4'-chloro-2'-nitro-3-phenylphthalaz-1-one.

By refluxing (I) with aqueous sulphuric acid (b. p. 140°), not only is (II) formed, as would be expected, but also (IV) in about the same proportion as is obtained by heating (I) with fuming hydrochloric acid at 180°. With methyl sulphate, 4'-nitro-2'-methoxy-3-phenylphthalaz-1-one (II) gave a product which appears to be derived from (VI) by partial loss of water, resembling in this respect the analogous 2' : 6'-dihalogeno-compounds (*J.*, 1931, 1076).

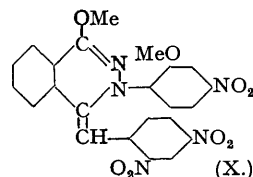
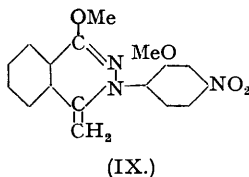
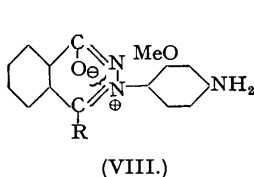


The methylated base crystallises from methyl or ethyl alcohol forming *compounds* (VII) which are combination products of the base and alcohol; when heated first at 100° and then at 140°, these merely lose the combined alcohol (cf. 2' : 6'-dihalogeno-compounds, *loc. cit.*). This behaviour is unlike that of the analogous substances derived from 4'- or 3'-nitro-3-phenylphthalaz-1-one (Rowe, Himmat, and Levin, *J.*, 1928, 2554, 2562), for these are converted into 4-keto-1-methoxy-3-(4'- or 3'-nitrophenyl)-3 : 4-dihydrophthalazine by heating in this manner. Examination of the latter conversion has now shown that it is an oxidation process, for when methylated 4'-nitro-3-phenylphthalaz-1-one, crystallised from methyl alcohol, is heated in an atmosphere of carbon dioxide the transformation does not occur, whereas when heated in a measured volume of air the conversion proceeds readily with the absorption of 4 atoms of oxygen per molecule of methylated base.

4'-Nitro-2'-methoxy-3-phenyl-4-methylphthalaz-1-one, prepared by the action of cold acid dichromate on (I) is converted by methyl sulphate and subsequent basification into

4'-nitro-1 : 2'-dimethoxy-3-phenyl-4-methylene-3 : 4-dihydrophthalazine (IX) which has similar properties to those of the analogues previously described (Rowe and Twitchett, *J.*, 1936, 1704). It condenses with chloro-2 : 4-dinitrobenzene forming 4'-nitro-1 : 2'-dimethoxy-3-phenyl-4-(2'' : 4''-dinitrobenzylidene)-3 : 4-dihydrophthalazine (X). An attempt to confirm this type of constitution by refluxing 1-methoxy-3-(4'-nitrophenyl)-4-(2'' : 4''-dinitrobenzylidene)-3 : 4-dihydrophthalazine with aqueous sulphuric acid (1 : 1) for some hours failed; no 2 : 4-dinitrobenzaldehyde was formed because the sulphate is too stable for hydrolysis to occur.

When heated with dilute hydrochloric acid at 180° (cf. Rowe *et al.*, *J.*, 1937, 98), 4'-nitro-2'-methoxy-3-phenylphthalaz-1-one and its 4-methyl derivative are converted into 4'-nitro-2'-methoxy-3-phenylphthalaz-4-one and its 1-methyl derivative, respectively; the constitutions of



the transformation products were confirmed synthetically by condensing *p*-nitro-*o*-methoxyphenylhydrazine with *o*-phthalaldehydic acid and acetophenone-*o*-carboxylic acid, respectively.

Reduction of 4'-nitro-2'-methoxy-3-phenylphthalaz-1-one and its 4-methyl derivative with sodium sulphide gives substances which are essentially 4'-amino-2'-methoxy-3-phenylphthalaz-1-one and its 4-methyl derivative (VIII; R = H or Me), respectively, although analyses indicate that they are derived from (VIII) by combination with 1 mol. of water, tenaciously retained. The *acetyl* compounds, however, crystallise from water without combining with it. 4'-Amino-2'-methoxy-3-phenyl-4-methylphthalaz-1-one is unaffected by treatment with alkaline hydrosulphite, and in this respect is unlike 4'-amino-3-phenyl-2'-methylphthalaz-1-one and its 4-methyl derivative which are converted by this means into 1-keto-3-(4'-amino-2'-methylphenyl)tetrahydrophthalazine and its 4-methyl derivative, respectively (Rowe and Siddle, *J.*, 1932, 478). Reduction with zinc and hydrochloric acid however, readily gives 4'-amino-2'-methoxy-*N*-phenyl-3-methylphthalimidine, and 4'-amino-2'-methoxy-*N*-phenylphthalimidine is similarly prepared from (II) or (VIII; R = H).

1-Hydroxy-3-(4'-amino-2'-methoxyphenyl)-3 : 4-dihydrophthalazine-4-acetic acid behaves in an exceptional manner when boiled with mineral acid. The anticipated 4'-amino-2'-methoxy-3-phenylphthalaz-1-one (VIII; R = H) is formed, but the main product of the reaction is its 4-methyl derivative (VIII; R = Me), decarboxylation occurring preferentially to the elimination of acetic acid. Similar behaviour has hitherto been observed only with 1-hydroxy-3-(benzeneazobenzene)-3 : 4-dihydrophthalazine-4-acetic acid (Rowe and Tomlinson, *J.*, 1932, 1120). When hydrochloric acid is used in this reaction, the initial formation of a sparingly soluble hydrochloride of 1-hydroxy-3-(4'-amino-2'-methoxyphenyl)-3 : 4-dihydrophthalazine-4-acetic acid favours the production of the 4-methyl derivative, whereas when the amino-acid is added to boiling hydrochloric acid so that a solution is immediately formed, the proportion of 4'-amino-2'-methoxy-3-phenylphthalaz-1-one in the product is considerably increased at the expense of its 4-methyl derivative. Similar behaviour was observed in the production of 4'-amino-2'-methoxy-*N*-phenylphthalimidine and its 3-methyl derivative from 1-hydroxy-3-(4'-amino-2'-methoxyphenyl)-3 : 4-dihydrophthalazine-4-acetic acid with tin and hydrochloric acid.

EXPERIMENTAL.

Sodium Hydrogen 3-(4'-Nitro-2'-methoxyphenyl)-3 : 4-dihydrophthalazine-1-sulphonate-4-acetate.—A filtered solution of commercial 50% sodium β -naphthol-1-sulphonate (50 g.) in water (160 c.c.) was stirred slowly at 0° into a solution of diazotised 5-nitro-*o*-anisidine prepared by adding 2*N*-sodium nitrite solution (52 c.c.) to a suspension of the base (16.8 g.) in dilute hydrochloric acid (1 : 2, 180 c.c.) at 0–5°. 4'-Nitro-2'-methoxybenzene-2-naphthol-1-diazosulphonate separated as an orange precipitate. It was filtered off, washed free from acid, mixed with cold water (300 c.c.), and dissolved by adding a cold solution of anhydrous sodium carbonate (30 g.) in water (120 c.c.). The orange solution was added immediately to a cold solution of sodium hydroxide (25 g.) in water (50 c.c.); the temperature rose about 6° and the deep violet liquid after being kept overnight, had become yellowish-brown. The product was isolated in the usual manner after separation from 4'-nitro-2'-methoxybenzeneazo-8-naphthol (1.54 g.; 4.8%). The sodium hydrogen salt (34.4 g.; 73.2%) crystallised from water in amber-coloured, irregular prisms, containing 3H₂O, m. p. 111–114° with evolution of water and partial re-solidification (Found : S, 6.3. C₁₇H₁₄O₈N₃Na, 3H₂O requires S, 6.45%). Water of crystallisation was not completely removed at 200°; the anhydrous compound crystallised from absolute alcohol in deep yellow, small prisms, m. p. 283–284° (decomp.) after darkening at 265° (Found : S 7.0.

$C_{17}H_{14}O_8N_3SNa$ requires S, 7.2%). It is a yellow acid dye of greater tinctorial power than the analogue from *p*-nitroaniline, but also fugitive to light.

1-Hydroxy-3-(4'-nitro-2'-methoxyphenyl)-3:4-dihydrophthalazine-4-acetic Acid (I).—A solution of sodium hydrogen 3-(4'-nitro-2'-methoxyphenyl)-3:4-dihydrophthalazine-1-sulphonate-4-acetate (50 g.) in water (400 c.c.) was boiled and concentrated hydrochloric acid (250 c.c.) added gradually until the evolution of sulphur dioxide had ceased and the product was crystalline (about 12 hours). It was washed with boiling water and crystallised from ethyl acetate. The acid (I) formed pale yellow prisms, m. p. 231—233° (decomp.) (35.8 g.; 88.8%) (Found: C, 57.1; H, 4.4; N, 11.7; OMe, 8.5. $C_{17}H_{14}O_8N_3$ requires C, 57.1; H, 4.2; N, 11.8; OMe, 8.7%). It dissolved in sodium carbonate and hydroxide with orange and deep red colours, respectively, and in cold concentrated sulphuric acid with an orange colour, being reprecipitated unaltered on dilution.

Derivatives of (I).—The methyl ester crystallised from methyl alcohol in pale yellow prisms, m. p. 184—185° (Found: C, 58.1; H, 4.6; N, 11.5. $C_{18}H_{17}O_8N_3$ requires C, 58.2; H, 4.6; N, 11.3%). The ethyl ester crystallised from alcohol in pale yellow, minute prisms, m. p. 155—156° (Found: C, 59.1; H, 5.2; N, 10.9. $C_{19}H_{19}O_8N_3$ requires C, 59.2; H, 4.9; N, 10.9%). Both esters were insoluble in sodium carbonate solution, but dissolved in aqueous sodium hydroxide with an orange colour. The *O*-acetyl derivative crystallised from ethyl acetate in pale yellow prisms, m. p. 186—187° (Found: C, 57.25; H, 4.3; N, 10.6. $C_{19}H_{17}O_7N_3$ requires C, 57.1; H, 4.3; N, 10.5%), soluble in cold sodium carbonate with a deep yellow colour and in sodium hydroxide with a deep red colour, hydrolysis of the acetyl group occurring in the latter case. The *N*-methyl ether, 1-*keto*-3-(4'-nitro-2'-methoxyphenyl)-2-methyltetrahydrophthalazine-4-acetic acid (cf. Rowe and Peters, *J.*, 1933, 1069), crystallised from acetic acid in pale yellow prisms, m. p. 222—223° (Found: C, 58.3; H, 4.8; N, 11.6; OMe, 8.1. $C_{18}H_{17}O_8N_3$ requires C, 58.2; H, 4.85; N, 11.3; OMe, 8.35%), soluble in cold dilute alkali solutions with a yellow colour. Its methyl ester crystallised from methyl alcohol in pale yellow plates, m. p. 152—153° (Found: C, 59.2; H, 5.0. $C_{19}H_{19}O_8N_3$ requires C, 59.2; H, 4.9%), insoluble in cold alkalis and hydrolysed by boiling aqueous sodium hydroxide.

1:4-Diketo-3-(4'-nitro-2'-methoxyphenyl)tetrahydrophthalazine (cf. Rowe, Gillan, and Peters, *J.*, 1935, 1811).—Powdered potassium permanganate (5 g.) was added gradually during 10 minutes to a fine suspension of (I) (5 g.) in water (50 c.c.) at 70°; the reaction was vigorous. The mixture was boiled, filtered, and acidified with hydrochloric acid after removal of some resinous matter from the cooled filtrate. The yellow, resinous precipitate was crystallised from dilute acetic acid (1:1) (0.25 g.; 5.7%) and then from alcohol (charcoal); the compound formed colourless needles, m. p. 256—257° (Found: C, 57.7; H, 3.8; N, 13.6; OMe, 9.8. $C_{15}H_{11}O_5N_3$ requires C, 57.5; H, 3.5; N, 13.4; OMe, 9.9%), soluble in aqueous alkalis with a yellow colour.

1-Hydroxy-3-(4'-amino-2'-methoxyphenyl)-3:4-dihydrophthalazine-4-acetic Acid.—Prepared from (I) (20 g.) by reduction with alkaline sodium hydrosulphite and precipitation with acid (13.3 g.; 72.6%), or less conveniently by heating a fine suspension of (I) (5 g.) in acid stannous chloride (20 g. in 50 c.c. of concentrated hydrochloric acid) on the steam-bath until dissolved (10 minutes) and isolating the amino-acid by rendering the solution alkaline with sodium carbonate, filtering, and precipitating from the filtrate by acidification (3.7 g.; 81.9%), the acid crystallised from a large volume of boiling water, or by adding hydrochloric acid to a hot solution in aqueous sodium carbonate, in colourless prisms, m. p. 203—204° (decomp.) (Found: C, 62.3; H, 5.2; N, 12.8; OMe, 9.3. $C_{17}H_{17}O_4N_3$ requires C, 62.4; H, 5.2; N, 12.8; OMe, 9.5%).

Action of Hydriodic Acid on (I).—A suspension of (I) (4 g.) in hydriodic acid (*d* 1.7; 20 c.c.) was heated in an oil-bath at 125—135° for 2½ hours; dissolution gradually proceeded and the volume was halved by evaporation. The solution was poured into a cold solution of sodium hydrogen sulphite (10 g.) in water (50 c.c.), stirred until the dark brown precipitate had dissolved, and treated with concentrated aqueous sodium carbonate until neutral to Congo-red. Next day, the yellow precipitate was collected; the filtrate, made alkaline with sodium hydroxide and boiled, gave much ammonia, indicating disruption of the phthalazine ring. The product (2.05 g.) crystallised from water (charcoal) in small, colourless needles which melted at 175—177°, then partially solidified, and by further heating slowly decomposed evolving gas (Found: C, 48.65; H, 5.15; N, 6.85; S, 4.1%), but this acid was not identified.

Action of Fuming Hydrochloric Acid and Aqueous Sulphuric Acid on (I).—The compound (4 g.) was heated with fuming hydrochloric acid (6 c.c.) in a sealed tube to 180° in ¼ hour and kept at 180° for ½ hour. The mixture was made alkaline with aqueous sodium carbonate and kept for some hours with occasional stirring, the precipitate (for filtrate, see below) was then digested with boiling dilute sulphuric acid (1:5; 100 c.c.), and the solution was filtered from some tar, boiled (charcoal), and filtered. The crystals which separated on standing were basified by digestion with warm sodium carbonate solution; 4'-nitro-2'-methoxy-3-phenylphthalaz-1-one (II) (0.6 g.; 18.0%), crystallised first from alcohol and then from benzene-pyridine in pale yellow, hair-like needles, m. p. 228—229° (Found: C, 60.5; H, 4.0; N, 14.2; OMe, 10.2. $C_{15}H_{11}O_4N_3$ requires C, 60.6; H, 3.7; N, 14.1; OMe, 10.4%), readily soluble in pyridine or alcohol, but almost insoluble in benzene. The alcoholic solution deposited pale yellow, hair-like needles, m. p. 207—209°, containing 1 mol. of solvent of crystallisation which was removed by heating at 130—140° for 2 hours (Found: loss, 12.5. $C_{15}H_{11}O_4N_3$ requires loss, 13.4%). It was insoluble in aqueous sodium carbonate, but dissolved in sodium hydroxide solution with an orange colour. With mineral acids, salts were formed, the sulphate and hydrochloride crystallising in colourless needles; the picrate crystallised from alcohol in pale yellow needles, m. p. 229—231° (Found: C, 48.0; H, 2.8; N, 16.0. $C_{21}H_{14}O_{11}N_8$ requires C, 47.9; H, 2.7; N, 16.0%).

The filtrate mentioned above was rendered faintly acid with hydrochloric acid, and the precipitate collected, dried, and extracted with boiling ethyl acetate (charcoal); the concentrated filtrate gave 2-(4'-nitro-2'-methoxyphenylamino)isoindolinone-3-acetic acid (IV) (0.24 g.; 6.0%) which crystallised from ethyl acetate (charcoal) in very pale yellow needles, m. p. 231—232° (Found: C, 57.0; H, 4.2; N, 11.8; OMe, 8.8. $C_{17}H_{15}O_8N_3$ requires C, 57.1; H, 4.2; N, 11.8; OMe, 8.7%), slightly soluble in aqueous sodium hydrogen carbonate with a pale yellow colour and evolution of carbon dioxide. It dissolved in

aqueous sodium carbonate with an orange colour which became orange-red on addition of sodium hydroxide, and was precipitated unaltered by adding hydrochloric acid to the solution. The methyl ester crystallised from methyl alcohol in pale yellow needles, m. p. 144—146° (Found: C, 58.0; H, 4.4; N, 11.4. $C_{18}H_{17}O_5N_3$ requires C, 58.2; H, 4.6; N, 11.3%). When (IV) (1 g.) was boiled with acetic anhydride (4 c.c.) for $\frac{1}{2}$ hour, or with addition of pyridine (0.25 c.c.) for a few minutes, it was converted into 2:5-diketo-3-(4'-nitro-2'-methoxyphenyl)isoindolinopyrazolidocoline (V) (0.85 g.; 89.5%) which crystallised from acetic acid in almost colourless prisms, m. p. 227—228° (Found: C, 60.1; H, 3.85; N, 12.4. $C_{17}H_{13}O_5N_3$ requires C, 60.2; H, 3.8; N, 12.4%), insoluble in cold alkalis, but slowly soluble in boiling aqueous sodium hydroxide, with an orange-red colour. Compound (V) was best hydrolysed to (IV) by boiling an acetic acid solution with hydrochloric acid for $\frac{1}{2}$ hour.

A mixture of (IV) and (II) was also obtained by refluxing a fine suspension of (I) (20 g.) in water (120 c.c.) and concentrated sulphuric acid (100 c.c.) for $1\frac{1}{2}$ hours. The greenish-black product was diluted with water (400 c.c.), boiled, and filtered hot; the black residue (for filtrate, see below), after being washed with hot water, was dissolved in cold aqueous 10% sodium carbonate, the solution filtered, and the filtrate acidified with hydrochloric acid. The dried precipitate was dissolved in boiling ethyl acetate and the solution filtered; the concentrated filtrate deposited pale yellow needles of (IV), m. p. 231—232° (0.6 g.; 3.0%). The filtrate mentioned above, after standing over-night, deposited hair-like needles, which were digested with warm dilute sodium carbonate solution, filtered off (for filtrate, see below), and crystallised first from alcohol and then from benzene-pyridine to form pale yellow, hair-like needles of (II), m. p. 228—229° (3.6 g.; 21.6%). The sodium carbonate extract mentioned above was acidified with hydrochloric acid; the dried precipitate crystallised from ethyl acetate in pale yellow needles of (IV), m. p. 231—232° (0.6 g.; 3.0%).

Compound (IV) was prepared in quantity as follows. A cold solution of sodium hydroxide (125 g.) in water (250 c.c.) was rapidly stirred into a solution of sodium 1-(4'-nitro-2'-methoxybenzeneazo)- β -naphthaquinone-1-sulphonate prepared from 5-nitro-*o*-anisidine (84 g.) as already described (cf. p. 463). After 15 seconds, the mixture was acidified by adding hydrochloric acid (715 c.c.) together with ethyl acetate (300 c.c.) to control frothing. The mixture was then made alkaline with sodium carbonate, 4'-nitro-2'-methoxybenzeneazo- β -naphthol (25.2 g.; 15.6%) filtered off, and the filtrate rendered faintly acid to Congo-red with hydrochloric acid and saturated with sodium chloride. A mixture of sodium benzaldehyde 4'-nitro-2'-methoxyphenylhydrazone- ω -sulphonate-2- β -acrylate and sodium hydrogen 3-(4'-nitro-2'-methoxyphenyl)-3:4-dihydrophthalazine-1-sulphonate-4-acetate was obtained. Attempts to separate this mixture by fractional precipitation of a solution in aqueous sodium carbonate by means of hydrochloric acid were unsuccessful. The mixture was hydrolysed by boiling with dilute hydrochloric acid until the evolution of sulphur dioxide had ceased, and the product crystallised from ethyl acetate (charcoal). The pale yellow crystals (70 g.), together with a further amount obtained by concentrating the filtrate, were boiled with 4 times their weight of acetic anhydride for 15 minutes; the solution, after being kept over-night, deposited almost colourless prisms of 2:5-diketo-3-(4'-nitro-2'-methoxyphenyl)isoindolinopyrazolidocoline (V), m. p. 227—228° (23.35 g.; 13.8%), hydrolysed to (IV) as described above.

Action of Methyl Sulphate on 4'-Nitro-2'-methoxy-3-phenylphthalaz-1-one (II).—Methyl sulphate (0.5 g.) was added to a solution of (II) (1 g.) in dry nitrobenzene (4 c.c.); after $\frac{1}{2}$ hour at 120°, the nitrobenzene was removed with steam, and the cooled aqueous residue filtered and basified with aqueous sodium carbonate. The washed and dried precipitate (1.0 g.) crystallised from ethyl acetate in small yellow prisms which reddened progressively above 160°, softened at about 205°, and melted at 261—264°. The analytical results for this specimen did not agree with formula (VI), but suggest that the substance is derived from it by partial loss of water (cf. analogous compounds, Rowe, Dunbar, and Williams, *J.*, 1931, 1076) (Found: C, 60.15; H, 4.5; N, 13.5; OMe, 17.4). When the base (1 g.) was heated with acetic acid (1 c.c.) and hydrobromic acid (2 c.c.) at 150° for $\frac{1}{2}$ hour, most of it was recovered unchanged; the remainder was converted by partial demethylation into (II) (0.15 g.; 16.6%).

The methylated base was insoluble in cold aqueous alkalis, but dissolved readily in cold concentrated hydrochloric acid with a pale yellow colour. Addition of 20% perchloric acid (10 c.c.) to a solution of the base (1 g.) in concentrated hydrochloric acid (3 c.c.), and cooling in a freezing mixture for $\frac{1}{2}$ hour, gave a crystalline precipitate of 4'-nitro-1:2'-dimethoxy-3-phenylphthalazinium perchlorate (1.24 g.; 93.9%) which crystallised from 50% acetic acid containing a little perchloric acid in colourless, lustrous leaflets with a faint yellow tinge, m. p. 209—211°; these explode when strongly heated (Found: C, 46.4; H, 3.35; N, 10.2; Cl, 8.5. $C_{18}H_{14}O_8N_3Cl$ requires C, 46.7; H, 3.4; N, 10.2; Cl, 8.6%).

The methylated base dissolved readily in methyl or ethyl alcohol, and the solutions deposited crystals which consisted of the combination products of the base with 1 mol. of alcohol (VII). The base crystallised from methyl alcohol in yellow prisms, m. p. 161—163° (Found: C, 59.7; H, 5.1; N, 12.0; OMe, 25.2; (freshly prepared material), 26.6. $C_{17}H_{17}O_5N_3$ requires C, 59.5; H, 5.0; N, 12.2; OMe, 27.1%), and from ethyl alcohol in yellow prismatic needles, m. p. 116—117° (Found: C, 60.9; H, 5.5; N, 11.8; OR (calc. as OMe), 25.3. $C_{18}H_{19}O_5N_3$ requires C, 60.5; H, 5.3; N, 11.8; OR (calc. as OMe), 26.05%).

4'-Nitro-2'-methoxy-3-phenylphthalaz-4-one.—(1) Following the method of Davies (*J.*, 1922, 121, 715), 5-nitro-*o*-anisidine was converted into *p*-nitro-*o*-methoxyphenylhydrazine, orange needles (from alcohol), m. p. 152—153° (Found: C, 45.8; H, 5.0; N, 22.9. $C_9H_9O_3N_3$ requires C, 45.9; H, 4.9; N, 22.9%). A hot solution of the latter (1.83 g.) in alcohol (60 c.c.) was added to a hot solution of *o*-phthalaldehydic acid (1.5 g.) in water (40 c.c.) and the mixture refluxed (cf. Rowe and Levin, *J.*, 1928, 2555). The lactone form of *o*-carboxybenzaldehyde *p*-nitro-*o*-methoxyphenylhydrazone crystallised in orange prismatic needles, m. p. 223—224° (Found: C, 57.1; H, 4.0; N, 13.4. $C_{15}H_{13}O_5N_3$ requires C, 57.1; H, 4.1; N, 13.3%), soluble in aqueous sodium carbonate and sodium hydroxide with yellow and red colours, respectively. Water was eliminated by dissolving the compound in cold concentrated sulphuric acid and pouring on ice after $\frac{1}{2}$ hour. 4'-Nitro-2'-methoxy-3-phenylphthalaz-4-one crystallised from alcohol in pale cream-coloured prisms, m. p. 175—176° (Found: C, 60.8; H, 3.7; N, 13.9; OMe, 10.0. $C_{15}H_{11}O_4N_3$ requires C, 60.6; H, 3.7; N, 14.1; OMe, 10.4%), insoluble in alkalis or hydrochloric acid.

(2) 4'-Nitro-2'-methoxy-3-phenylphthalaz-1-one (1 g.) was heated with aqueous hydrochloric acid (18 c.c.; 1 : 8) at 180° for 6 hours (cf. Rowe, Adams, Peters, and Gillam, *J.*, 1937, 98). After unaltered material (0.26 g.; 26%) had been extracted with boiling dilute hydrochloric acid, 4'-nitro-2'-methoxy-3-phenylphthalaz-4-one crystallised from alcohol in pale cream prisms, m. p. and mixed m. p. 175—176° (0.53 g.; 53%).

4'-Amino-2'-methoxy-3-phenylphthalaz-4-one.—Hot solutions of stannous chloride (4 g.) in hydrochloric acid (10 c.c.) and 4'-nitro-2'-methoxy-3-phenylphthalaz-4-one (1 g.) in acetic acid (5 c.c.) were mixed and brought to b. p.; after cooling, the colourless needles were collected and basified with aqueous sodium hydroxide. The amino-compound crystallised from alcohol in colourless plates, m. p. 215—216° (0.7 g.; 77.8%) (Found: C, 67.6; H, 4.8; N, 15.6; OMe, 11.9. $C_{15}H_{13}O_2N_3$ requires C, 67.4; H, 4.9; N, 15.7; OMe, 11.6%). It was also obtained (50.7%) by treating *o*-carboxybenzaldehyde *p*-nitro-*o*-methoxyphenylhydrazine similarly. The acetyl derivative crystallised from alcohol in colourless prisms, m. p. 232—233° (Found: C, 66.0; H, 5.0; N, 13.5. $C_{17}H_{15}O_3N_3$ requires C, 66.0; H, 4.85; N, 13.6%).

4'-Amino-2'-methoxy-3-phenylphthalaz-1-one (VIII; R = H).—A solution of sodium sulphide crystals (32 g.) in water (32 c.c.) was added to a boiling suspension of (II) (4 g.) in water (400 c.c.); the resulting deep red solution became orange after boiling for 10 minutes and, when cool, deposited long, golden-yellow needles, m. p. 225—226° (decomp.) (2.0 g.). The substance crystallised from absolute alcohol (charcoal) in yellow prisms, m. p. 260—261° (decomp.) after softening and darkening at 240° (Found: C, 64.6; H, 5.2; N, 15.1; OMe, 11.6%). Since the analytical result for carbon was not what was anticipated, the base was purified by conversion into its acetyl derivative which was subsequently hydrolysed.

4'-Acetamido-2'-methoxy-3-phenylphthalaz-1-one crystallised from water in fine, colourless needles m. p. 285—286° (Found: C, 65.9; H, 5.0; N, 13.6. $C_{17}H_{15}O_3N_3$ requires C, 66.0; H, 4.85; N, 13.6%), which became yellow on exposure to light and air. The acetyl compound (1 g.) was hydrolysed by boiling with concentrated hydrochloric acid (20 c.c.) for 10 minutes and basifying the colourless needles of the hydrochloride by digesting with dilute sodium carbonate solution. 4'-Amino-2'-methoxy-3-phenylphthalaz-1-one crystallised from absolute alcohol in pale yellow prisms, m. p. 267—268° (decomp.) after softening at 261° (Found: C, 64.8; H, 4.9; N, 15.1. $C_{15}H_{13}O_2N_3$ requires C, 67.4; H, 4.9; N, 15.7%). Thus, in spite of the higher m. p. of this specimen of the base, the analytical result for carbon remained unsatisfactory.

4'-Amino-2'-methoxy-*N*-phenylphthalimidine.—(a) This was most conveniently prepared by adding zinc dust (3 g.) in small portions during $\frac{1}{2}$ hour to a vigorously boiling solution of (II) (2 g.) in hydrochloric acid (40 c.c.) and water (100 c.c.). The cooled solution was made alkaline with sodium hydroxide, the dried precipitate extracted with boiling alcohol, and the extract concentrated. The phthalimidine (1.05 g.; 61.4%) crystallised from alcohol (charcoal) in colourless, lustrous, rectangular plates, m. p. 237° (Found: C, 70.6; H, 5.6; N, 11.0; OMe, 12.75. $C_{15}H_{14}O_2N_2$ requires C, 70.9; H, 5.5; N, 11.0; OMe, 12.2%). The acetyl derivative crystallised from dilute acetic acid in colourless needles, m. p. 247—248° (Found: C, 68.8; H, 5.5; N, 9.7. $C_{17}H_{16}O_3N_2$ requires C, 68.9; H, 5.4; N, 9.5%).

(b) The phthalimidine was obtained by reducing 4'-amino-2'-methoxy-3-phenylphthalaz-1-one (1 g.) in hydrochloric acid (20 c.c.) and water (50 c.c.) with zinc dust (1 g.).

(c) Powdered 1-hydroxy-3-(4'-amino-2'-methoxyphenyl)-3 : 4-dihydrophthalazine-4-acetic acid (10 g.) was added in portions to boiling concentrated hydrochloric acid (200 c.c.) and the solution refluxed for 14 hours with gradual addition of granulated tin (20 g.). The phthalimidine (0.85 g.; 10.9%) was isolated by rendering the product alkaline with aqueous sodium hydroxide and extracting the dried precipitate with alcohol. When, in a similar experiment, 1-hydroxy-3-(4'-amino-2'-methoxyphenyl)-3 : 4-dihydrophthalazine-4-acetic acid was ground with the concentrated hydrochloric acid and the suspension of the difficultly soluble hydrochloride boiled (much frothing) until dissolved ($\frac{1}{2}$ hour) and then reduced, a mixture of the phthalimidine (0.37 g.; 4.8%) and its 3-methyl derivative (0.4 g.; 4.9%) was obtained, separation being effected by fractional crystallisation from alcohol.

(d) A suspension of 1-hydroxy-3-(4'-nitro-2'-methoxyphenyl)-3 : 4-dihydrophthalazine-4-acetic acid (20 g.) in stannous chloride (80 g.) and hydrochloric acid (200 c.c.) was warmed on the steam-bath until dissolved (15 minutes); hydrochloric acid (300 c.c.) was added and the solution refluxed for 14 hours with gradual addition of granulated tin (40 g.). The cooled solution was made alkaline with aqueous sodium hydroxide and the dried precipitate extracted with boiling alcohol (150 c.c.); the extract, on keeping, deposited crystals of the phthalimidine (0.7 g.; 4.9%). The filtrate, on concentration, gave a mixture (0.95 g.) of colourless leaflets of 4'-amino-2'-methoxy-*N*-phenylphthalimidine and yellow prisms of 4'-amino-2'-methoxy-3-phenylphthalaz-1-one, identified by mechanical separation and mixed m. p. determinations.

4'-Nitro-2'-methoxy-3-phenyl-4-methylphthalaz-1-one.—A solution of (I) (40 g.) in cold concentrated sulphuric acid (400 c.c.) was poured on ice (1200 g.) and stirred mechanically, and powdered potassium dichromate (18 g.) was added gradually during $\frac{1}{2}$ hour. After 3 hours' stirring, the crystalline precipitate was collected and digested with warm water for several hours, during which decomposition slowly occurred with evolution of carbon dioxide. The mixture was rendered faintly alkaline with aqueous sodium carbonate, and the precipitate collected and crystallised from boiling dilute hydrochloric acid (charcoal). 4'-Nitro-2'-methoxy-3-phenyl-4-methylphthalaz-1-one hydrochloride (22.5 g.; 57.8%) was basified by grinding with dilute sodium carbonate solution. 4'-Nitro-2'-methoxy-3-phenyl-4-methylphthalaz-1-one crystallised from benzene-pyridine (2 : 1) (charcoal) in pale yellow prisms, m. p. 223—224° (decomp.) (Found: C, 61.8; H, 4.3; N, 13.5; OMe, 9.8. $C_{16}H_{13}O_4N_3$ requires C, 61.7; H, 4.2; N, 13.5; OMe, 10.0%), readily soluble in pyridine or alcohol, almost insoluble in benzene. It was insoluble in aqueous sodium carbonate, but dissolved in aqueous sodium hydroxide with an orange colour; the hydrochloride and sulphate crystallised in small colourless prisms. The picrate formed yellow prisms (from alcohol), m. p. 216—217° (decomp.) (Found: C, 48.95; H, 3.2; N, 15.5. $C_{22}H_{16}O_{11}N_6$ requires C, 48.9; H, 3.0; N, 15.55%).

Action of Methyl Sulphate on 4'-Nitro-2'-methoxy-3-phenyl-4-methylphthalaz-1-one.—A solution of 4'-nitro-2'-methoxy-3-phenyl-4-methylphthalaz-1-one (10 g.) in hot dry nitrobenzene (40 c.c.) was

treated with methyl sulphate (4 c.c.) as already described for (II). Crystallisation of the orange-red base from ethyl acetate gave 4'-nitro-1 : 2'-dimethoxy-3-phenyl-4-methylene-3 : 4-dihydrophthalazine (IX), dark red, almost black prisms with a green reflex, m. p. 146—147° (8.8 g.; 84.2%) (Found : C, 62.9; H, 4.6; N, 13.1; OMe, 18.6. $C_{17}H_{15}O_4N_3$ requires C, 62.8; H, 4.6; N, 12.9; OMe, 19.1%), insoluble in alkalis, but soluble in acids. When the base was heated with acetic acid and hydrobromic acid at 150° for $\frac{1}{2}$ hour, it was not re-converted into 4'-nitro-2'-methoxy-3-phenyl-4-methylphthalaz-1-one (cf. Rowe, Levin, and Peters, *J.*, 1931, 1071), unaltered material only being recovered. Longer heating (1 hour) gave an unidentified substance, soluble in aqueous sodium carbonate with a yellow colour.

4'-Nitro-1 : 2'-dimethoxy-3-phenyl-4-methylphthalazinium perchlorate, prepared in a similar manner to 4'-nitro-1 : 2'-dimethoxy-3-phenylphthalazinium perchlorate, crystallised from 50% acetic acid containing perchloric acid in colourless prisms with a yellow tinge, m. p. 199—200° (74.4%); when heated strongly, the salt melts and explodes (Found : C, 47.5; H, 3.8; N, 10.0; Cl, 8.5. $C_{17}H_{15}O_8N_3Cl$ requires C, 47.9; H, 3.8; N, 9.9; Cl, 8.3%).

4'-Nitro-1 : 2'-dimethoxy-3-phenyl-4-(2' : 4'-dinitrobenzylidene)-3 : 4-dihydrophthalazine (X).—This compound, prepared from 4'-nitro-1 : 2'-dimethoxy-3-phenyl-4-methylene-3 : 4-dihydrophthalazine (2 g.) as described by Rowe and Twitchett (*J.*, 1936, 1712) for the 4'-nitro-analogue, crystallised from acetic anhydride in deep orange-red, almost black prisms with a green reflex, m. p. 226—227° (2.42 g.; 80.1%) (Found : C, 56.5; H, 3.5; N, 14.2; OMe, 12.6. $C_{23}H_{17}O_8N_5$ requires C, 56.2; H, 3.5; N, 14.3; OMe, 12.6%).

4'-Nitro-2'-methoxy-3-phenyl-1-methylphthalaz-4-one.—(a) A solution of *p*-nitro-*o*-methoxyphenylhydrazine in alcohol was added to an aqueous solution of an equimolecular proportion of acetophenone-*o*-carboxylic acid at about 70° (cf. Rowe, Heath, and Patel, *J.*, 1936, 313); *o*-carboxyacetophenone *p*-nitro-*o*-methoxyphenylhydrazone (or its lactone form) crystallised in glistening yellow leaves (94.2%) (Found : C, 58.2; H, 4.5; N, 12.8. $C_{16}H_{15}O_5N_3$ requires C, 58.4; H, 4.6; N, 12.8%), soluble in aqueous sodium carbonate and sodium hydroxide with yellow and orange colours, respectively. When heated, it became pale yellow at about 180° owing to formation of 4'-nitro-2'-methoxy-3-phenyl-1-methylphthalaz-4-one, and then melted at 237—238°, but this conversion was more conveniently effected by dissolving in cold concentrated sulphuric acid and pouring on ice next day; the product crystallised from alcohol in colourless, rhomboidal plates, m. p. 237—238° (Found : C, 61.8; H, 4.15; N, 13.7; OMe, 10.4. $C_{16}H_{13}O_4N_3$ requires C, 61.7; H, 4.2; N, 13.5; OMe, 10.0%), insoluble in sodium hydroxide or hydrochloric acid.

(b) The hydrochloride of 4'-nitro-2'-methoxy-3-phenyl-4-methylphthalaz-1-one (1.5 g.) was heated with hydrochloric acid (1.5 c.c.) and water (16.5 c.c.) at 180° for 6 hours (cf. Rowe, Adams, Peters, and Gillam, *loc. cit.*); the product, after purification by extraction with boiling dilute hydrochloric acid, was 4'-nitro-2'-methoxy-3-phenyl-1-methylphthalaz-4-one (0.74 g.; 55%).

4'-Amino-2'-methoxy-3-phenyl-1-methylphthalaz-4-one.—This compound was prepared similarly to 4'-amino-2'-methoxy-3-phenylphthalaz-4-one, except that acetic acid (10 c.c.) was used, and crystallised from alcohol in small, colourless plates or prisms, m. p. 258—259° (86.4%) (Found : C, 68.1; H, 5.4; N, 15.3; OMe, 11.4. $C_{16}H_{15}O_2N_3$ requires C, 68.3; H, 5.3; N, 14.95; OMe, 11.0%). It was also prepared (84.3%) by treating *o*-carboxyacetophenone-*p*-nitro-*o*-methoxyphenylhydrazone similarly. The acetyl derivative crystallised from dilute acetic acid in colourless needles, from acetic anhydride in small colourless prisms, and from alcohol in prismatic needles which, after being heated at 120° for 2 hours and cooled, spontaneously fracture into fine curved needles; all forms melt at 237—238° (Found in material crystallised from dilute acetic acid : C, 65.0; H, 5.3; N, 12.6. Found in material from alcohol : C, 64.6; H, 5.4; N, 12.65. Found in material heated at 120° for 2 hours : C, 64.2; H, 5.25. $C_{18}H_{17}O_3N_3$ requires C, 66.9; H, 5.3; N, 13.0. $C_{18}H_{17}O_3N_3 \cdot \frac{1}{2}H_2O$ requires C, 65.1; H, 5.4; N, 12.65%). Similar observations are recorded by Rowe *et al.* (*J.*, 1935, 1801) in the case of the acetyl derivative of 2 : 5-diketeto-3-(2'-aminophenyl)isoidolinopyrazolidocoline.

4'-Amino-2'-methoxy-3-phenyl-4-methylphthalaz-1-one (VIII; R = Me).—A solution of sodium sulphide crystals (8 g.) in water (8 c.c.) was added to a boiling solution of 4'-nitro-2'-methoxy-3-phenyl-4-methylphthalaz-1-one (1 g.) in water (100 c.c.); the deep purple-red solution became orange after boiling for a few minutes and crystals began to separate. The amino-compound (0.8 g.; 88.5%) crystallised from alcohol in pale yellow prisms, m. p. 287—288° (decomp.) after darkening at 260° (Found : C, 64.1; H, 5.6; N, 14.0; OMe, 10.1. $C_{16}H_{15}O_2N_3 \cdot H_2O$ requires C, 64.2; H, 5.7; N, 14.05; OMe, 10.4%). The acetyl derivative crystallised from water (charcoal) in colourless prisms, m. p. 296—297° (decomp.) (Found : C, 66.8; H, 5.5; N, 13.1. $C_{18}H_{17}O_3N_3$ requires C, 66.9; H, 5.3; N, 13.0%), which became brown on exposure to light and air.

4'-Amino-2'-methoxy-3-phenyl-4-methylphthalaz-1-one could not be prepared from 1-hydroxy-3-(4'-amino-2'-methoxyphenyl)-3 : 4-dihydrophthalazine-4-acetic acid by the action of cold acid dichromate (cf. Rowe, Levin, and Peters, *J.*, 1931, 1071). Treatment of a solution of the amino-acid in aqueous sodium carbonate with potassium permanganate (cf. Rowe, Dunbar, and Williams, *J.*, 1931, 1087) gave impure 4'-amino-2'-methoxy-3-phenyl-4-methylphthalaz-1-one (11.6%). More satisfactory results were obtained by the following methods :

(a) A solution of the amino-acid (40 g.) in concentrated sulphuric acid (200 c.c.) and water (240 c.c.) was refluxed for 2 hours. Considerable frothing occurred initially. The brown solution was diluted with water (800 c.c.), boiled (charcoal), filtered, cooled, and made alkaline with anhydrous sodium carbonate. Next day, the crystalline precipitate was repeatedly extracted with boiling water and the combined extracts were concentrated. The product (7.7 g.) crystallised from water (charcoal) in yellow prisms, m. p. 267—268° (decomp.), and was a mixture of 4'-amino-2'-methoxy-3-phenylphthalaz-1-one and its 4-methyl derivative in the proportion of about 1 : 12, as shown by acetylation and fractional crystallisation of the acetyl derivatives from water.

A similar mixture was produced by grinding the amino-acid (10 g.) with cold concentrated hydrochloric acid (250 c.c.), refluxing the suspension of the difficultly soluble hydrochloride until dissolved ($\frac{1}{2}$ hour; considerable frothing), and boiling for 16 hours. The deep brown filtered solution was almost neutralised with sodium hydroxide, cooled, filtered, and made alkaline with sodium carbonate. The greenish-yellow

precipitate (2.5 g.) crystallised from water (charcoal) in yellow prisms, m. p. 267—268° (decomp.), identical with the mixture described above. On the other hand, when the amino-acid (10 g.) was added in portions during 5 minutes to boiling concentrated hydrochloric acid (250 c.c.) it immediately dissolved almost completely. After 16 hours' refluxing and subsequent treatment of the product as described above, a mixture (3.45 g.) of 4'-amino-2'-methoxy-3-phenylphthalaz-1-one and its 4-methyl derivative in the proportion of about 1 : 5.5 was obtained.

(b) A solution of the amino-acid (4 g.) in water (40 c.c.) and sodium hydroxide (4 g.) was refluxed; crystals of 4'-amino-2'-methoxy-3-phenyl-4-methylphthalaz-1-one separated progressively and were removed at intervals (after 12 hours' boiling, 0.98 g.; 28.5%). No 4'-amino-2'-methoxy-3-phenylphthalaz-1-one was formed.

(c) A solution of the amino-acid (2 g.) in water (40 c.c.) and sodium hydroxide (4 g.) was treated at 50° for $\frac{1}{2}$ hour with hydrogen peroxide (8 c.c. of 20 vol.), added in two portions; the pale yellow solution deepened in colour and was heated on the steam-bath for 15 minutes to give 4'-amino-2'-methoxy-3-phenyl-4-methylphthalaz-1-one (1.2 g.; 69.8%).

4'-Amino-2'-methoxy-N-phenyl-3-methylphthalimidine.—Zinc dust (20 g.) was gradually added during $\frac{1}{2}$ hour to a vigorously boiling solution of the hydrochloride of 4'-nitro-2'-methoxy-3-phenyl-4-methylphthalaz-1-one (10 g.) in hydrochloric acid (200 c.c.) and water (200 c.c.). After the cooled solution had been made alkaline with aqueous sodium hydroxide, the pink precipitate was dried, extracted with alcohol (charcoal), filtered, and the filtrate concentrated. *4'-Amino-2'-methoxy-N-phenyl-3-methylphthalimidine* (5.1 g.; 66.1%) crystallised from alcohol in colourless prisms, m. p. 191—192° (Found: C, 71.7; H, 6.0; N, 10.6; OMe, 11.3. $C_{18}H_{18}O_2N_2$ requires C, 71.6; H, 6.0; N, 10.45; OMe, 11.6%). The *acetyl* derivative crystallised from ethyl acetate in colourless prisms, m. p. 209—210° (Found: C, 69.6; H, 5.9; N, 9.2. $C_{18}H_{18}O_2N_2$ requires C, 69.7; H, 5.8; N, 9.0%).

The amino-phthalimidine was also prepared (a) by reducing 4'-amino-2'-methoxy-3-phenyl-4-methylphthalaz-1-one as described in the case of the corresponding 4'-nitro-compound, and (b) together with an equal proportion of 4'-amino-2'-methoxy-N-phenylphthalimidine by boiling a suspension of the difficultly soluble hydrochloride of 1-hydroxy-3-(4'-amino-2'-methoxyphenyl)-3 : 4-dihydrophthalazine-4-acetic acid with tin and hydrochloric acid (cf. p. 466).

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