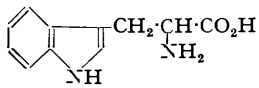
331. *Some Benziminazolylalanines.*

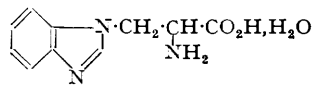
By P. Mamalis, V. Petrow, and B. Sturgeon.

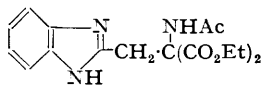
Some *benziminazolylalanines* structurally related to the bacterial metabolite tryptophan (I) have been prepared by condensation of the appropriate *chloromethylbenziminazoles* with acetamidomalonic ester, followed by acid hydrolysis. Biological study of these compounds failed to reveal activity against a variety of organisms.

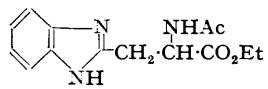
The concept that a substance structurally related to a metabolite may interfere with the function of that metabolite in living cells provides a unique starting point for the synthesis of biologically active compounds. Experimentally illustrated in the case of sulphanilamide and *p*-aminobenzoic acid (cf. Fildes, *Lancet*, 1940, **238**, 955), its application to the field of essential amino-acids has led to the preparation of bacterial inhibitors of quite remarkable activity.

Tryptophan (I) is now largely accepted as an essential metabolite in bacterial species, whilst its analogues occasionally show competitive growth inhibition. Thus the *Bz*-methyltryptophans (Rydon, *J.*, 1948, 705) show varying degrees of activity against *Bacterium typhosum* 3390 (Fildes and Rydon, *Brit. J. Exp. Path.*, 1947, **28**, 211), and 5-methyltryptophan inhibits the growth of *B. coli* (Anderson, *Science*, 1945, **101**, 565). Apart from β-(3-thionaphthenyl)alanine * (Elliott and Harington, *J.*, 1949, 1374; Avakian, Moss, and Martin, *J. Amer. Chem. Soc.*, 1948, **70**, 3075), the preparation of heterocyclic types related to (I) has received scant attention. We now report the synthesis of some tryptophan analogues derived from benziminazole, a ring system shown in these laboratories to be present in vitamin B_{12} (Beavan, Holiday, Johnson, Ellis, Mamalis, Petrow, and Sturgeon, *J. Pharm. Pharmacol.*, 1949, **1**, 957).

(I.) 

 (II.)

(III.) 

 (IV.)

Treatment of 1-hydroxymethylbenziminazole with thionyl chloride gave 1-*chloromethylbenziminazole hydrochloride* which condensed readily with ethyl acetamidomalonate in the presence of two moles of sodium ethoxide. As the resulting ester could not be isolated in a crystalline state, the product was directly hydrolysed yielding β-(1-*benziminazolyl*)-α-*alanine monohydrate* (II). The molecule of water in (II) was retained even after the substance had been dried *in vacuo*, and indeed hydration seemed a characteristic of this series of compounds. Accurate analytical data were thus difficult to obtain.

Attempts to extend the above reaction to the alkylbenziminazoles proved unsuccessful. 5-Methylbenziminazole gave what was apparently an inseparable mixture of 5- and 6-methyl-1-hydroxymethylbenziminazole when treated with formaldehyde in methanol. 5 : 6-*Dimethyl*-1-*hydroxymethylbenziminazole* proved rather unstable, decomposing readily with liberation of formaldehyde, and no attempt was made to chlorinate it. 2-Methyl- and 2-ethyl-benziminazole failed to form 1-hydroxymethyl derivatives under these conditions (cf. Bachmann and Lovell, *J. Amer. Chem. Soc.*, 1946, **68**, 2496). The condensation of these two compounds with 1-acetamidoacrylic acid (cf. Adams and Johnson, *J. Amer. Chem. Soc.*, 1949, **71**, 705) appeared to offer an alternative approach, but, in dioxan, only the preferential polymerisation of the acrylic acid occurred. Addition of quinol inhibited the latter reaction but the required addition still failed to take place.

Condensation of 2-chloromethylbenziminazole or its hydrochloride with ethylacetamidomalonate and sodium ethoxide in boiling ethanol gave *ethyl acetamido*-(2-*benziminazolylmethyl*)-*malonate* (III) (65%), together with small quantities of a by-product, readily isolated from the reaction mixture by virtue of its insolubility in benzene. The by-product was identified as *ethyl* α-*acetamido*-β-(2-*benziminazolyl*)*propionate* (IV) by comparison with an authentic specimen prepared from the amino-acid (see below). 4-*Methyl*-, 5-*methyl*-, and 5 : 6-*dimethyl*-2-*chloromethylbenziminazole hydrochloride*, under the same conditions, gave only the corresponding *acetamidopropionic esters* (cf. IV) in *ca.* 40% yields. Evidence for the formation of the malonic esters (cf. III) was obtained in the case of the 5-methyl isomer, but the

* The "β" in this name refers to the position of the substituent and the substance might be termed "β-(3-thionaphthenyl)-α-alanine." Ed.

material could not be obtained crystalline. *Ethyl acetamido-(1-methyl-2-benziminazolylmethyl)-malonate*, on the other hand, was the sole product of reaction between 1-methyl-2-chloromethylbenziminazole and the acetamidomalonic ester. Hydrolysis of these intermediates (types III and IV) with hydrobromic acid gave the corresponding amino-acids. β-(2-Benziminazolyl)-α-alanine and its 1-, 4-, and 5-methyl derivatives formed *monohydrates*, whilst β-(5 : 6-dimethyl-2-benziminazolyl)-α-alanine was obtained as the *dihydrate*.

Attempts to prepare α-amino-γ-(2-benziminazolyl)butyric acid by condensing *o*-phenylenediamine with glutamic acid were uniformly unsuccessful. *5-[2-(2-Benziminazolyl)ethyl]-hydantoin* was readily prepared by reaction of the diamine with β-(5-hydantoinyl)propionic acid in 4N-hydrochloric acid, but its subsequent conversion into the amino-acid could not be accomplished.

Inter alia preparation of 5 : 6-*dimethyl-2-benzamidomethylbenziminazole* was achieved by fusion of 4 : 5-dimethyl-*o*-phenylenediamine with hippuric acid and this substance furnished 5 : 6-*dimethyl-2-aminomethylbenziminazole dihydrochloride* on hydrolysis with concentrated hydrochloric acid. 2'-Phthalimidoethyl-*o*-phenylenediamine (Karrer and Naef, *Helv. Chim. Acta*, 1936, **19**, 1026) was converted into the *benziminazole* and thence, by hydrolysis with hydrazine, etc., into 1-(2-*aminoethyl*)*benziminazole dihydrochloride*.

Biological Results.—Dr. S. W. F. Underhill and his staff (Physiological Department, The British Drug Houses Ltd.,) have kindly examined β-(1-benziminazolyl)-, β-(2-benziminazolyl)-, and β-(5-methyl-2-benziminazolyl)-α-alanine hydrate for a variety of biological properties. The compounds failed to affect the growth of *Lactobacillus lactis* Dorner (experiments with Miss F. E. Larkin, B.Sc.). They showed negligible activity against a variety of Gram-positive and Gram-negative organisms, including *Mycobacterium tuberculosis* (experiments with Mr. J. T. Gunner). They were likewise inactive against *Trichomonas vaginalis* (experiments with Miss M. Cash, B.Sc.) and *Entamœba histolytica* (experiments with Mr. J. T. Gunner). β-(2-Benziminazolyl)-α-alanine hydrate had a low toxicity on intravenous administration to albino mice, but proved an irritant at the point of injection when administered either intravenously or subcutaneously. It appeared to have little action on the central nervous system (experiments with Miss J. M. Lesford, B.Sc.).

Experimental.

M. p.s are uncorrected. Analyses are by Drs. Weiler and Strauss, Oxford. The benziminazolyl-α-alanines described below gave purple colours with a ninhydrin reagent in aqueous solution.

1-*Chloromethylbenziminazole Hydrochloride.*—1-Hydroxymethylbenziminazole (16 g.) (Bachmann and Lowell, *loc. cit.*) was added in portions to thionyl chloride (150 ml.), and the clear solution heated under reflux for about 1 hour. Evaporation *in vacuo* gave a yellow gum which crystallised on treatment with methanol. 1-*Chloromethylbenziminazole hydrochloride* (17 g.) separated from alcohol–benzene in needles, m. p. 173—174° (decomp.) (Found : N, 13·6. $C_8H_8N_2Cl_2$ requires N, 13·8%).

β-(1-*Benziminazolyl*)-α-*alanine Monohydrate.*—Sodium (2·3 g.) was dissolved in dry alcohol (150 ml.), and the coldsolution treated with ethyl acetamidomalonate (11·7 g.), followed by 1-chloromethylbenziminazole hydrochloride (10·8 g.). After 2 hours' boiling, the mixture, freed from salt, was evaporated to dryness under reduced pressure and the residual gum purified by passing a filtered benzene solution through a column of alumina. Evaporation of the eluate gave a yellow gum (10·7 g.) which was hydrolysed by boiling it with concentrated hydrobromic acid (150 ml.) for 4 hours. β-(1-*Benziminazolyl*)-α-*alanine dihydrobromide*, isolated by evaporation to dryness, separated from water–acetone in prisms, m. p. 192° (decomp.) (Found : Br, 43·0. $C_{10}H_{11}O_2N_3,2HBr$ requires Br, 43·7%). An aqueous solution of this hydrobromide was made faintly alkaline with potassium hydrogen carbonate and then adjusted to pH 6 with acetic acid. β-(1-*Benziminazolyl*)-α-*alanine monohydrate* separated and was recrystallised from water–alcohol, forming prisms (4·5 g.), m. p. 196° (with foaming) (Found : C, 53·3; H, 5·6; N, 19·0. $C_{10}H_{11}O_2N_3,H_2O$ requires C, 53·8; H, 5·8; N, 18·9%).

5- *and* 6-*Methyl-1-hydroxymethylbenziminazole.*—A solution of 5-methylbenziminazole (1·0 g.) in methanol (15 ml.) was treated with formaldehyde solution (1 ml.; 40%) and set aside overnight. Concentration gave colourless needles, m. p. 137—140°, unchanged by further recrystallisation from methanol This was probably a mixture of 5- and 6-methyl-1-hydroxymethylbenziminazole (Found : N, 17·6. $C_9H_{10}ON_2$ requires N, 17·3%).

5 : 6-*Dimethyl-1-hydroxymethylbenziminazole* separated immediately on addition of formaldehyde to a methanolic solution of the base. It was purified by digestion with acetone and formed colourless prisms, m. p. 195—197° (decomp.) (Found : N, 16·2. $C_{10}H_{12}ON_2$ requires N, 15·9%).

2-*Hydroxymethylbenziminazoles.*—The appropriate *o*-phenylenediamine (0·1 mol.) was heated at 140—150° for 2 hours with 66% glycollic acid (0·2 mol.). The melt was triturated with dilute aqueous ammonia, and the product recrystallised from water containing a little alcohol (charcoal).

1-Methyl-2-hydroxymethylbenziminazole (70%) separated from benzene in colourless plates, m. p. 145° (Found : C, 66·2; H, 6·3; N, 17·1. Calc. for $C_9H_{10}ON_2$: C, 66·6; H, 6·2; N, 17·3%). This compound has previously been prepared by Hughes and Lions (*J. Proc. Roy. Soc., New South Wales*, 1938, **71**, 209) by methylation of 2-hydroxymethylbenziminazole.

4-*Methyl-2-hydroxymethylbenziminazole* formed silver platelets (75%), m. p. 198°, from water (Found : C, 66·2; H, 6·3; N, 17·4%).

5-*Methyl*-2-*hydroxymethylbenziminazole* crystallised in silver platelets (76%), m. p. 202—203°, from water containing a little alcohol (Found : C, 66·7; H, 6·3; N, 17·0%).

5 : 6-*Dimethyl*-2-*hydroxymethylbenziminazole* (55%) formed leaflets (from alcohol), m. p. 253—254° (Found : N, 15·6%).

2-*Chloromethylbenziminazoles.*—The 2-hydroxymethylbenziminazoles were chlorinated in the manner described for 1-hydroxymethylbenziminazole.

2-*Chloromethylbenziminazole hydrochloride* (80%) crystallised from methanol–ethyl acetate in yellow needles, m. p. 229° (decomp.) (Found : N, 13·9; Cl, 34·5. $C_8H_8N_2Cl_2$ requires N, 13·8; Cl, 35·0%). The free chloro-compound separated from aqueous alcohol in fine needles, m. p. 159° (Found : N, 17·0; Cl, 21·3. Calc. for $C_8H_7N_2Cl$: N, 16·8; Cl, 21·3%). Bloom and Day (*J. Org. Chem.*, 1939, **4**, 14) record the m. p. as 161°.

1-Methyl-2-chloromethylbenziminazole (85%) separated from light petroleum (b. p. 60—80°) in long needles, m. p. 96° (Found : N, 15·6; Cl, 19·8. Calc. for $C_9H_9N_2Cl$: N, 15·5; Cl, 19·6%). Hughes and Lions (*loc. cit.*) give m. p. 94°.

4-*Methyl*-2-*chloromethylbenziminazole hydrochloride* separated (80%) from alcohol–benzene in platelets, m. p. 251—252° (decomp.) (Found : N, 12·8; Cl, 32·2. $C_9H_{10}N_2Cl_2$ requires N, 12·9; Cl, 32·7%).

5-*Methyl*-2-*chloromethylbenziminazole hydrochloride* (75%) formed felted needles, m. p. 216° (decomp.), from alcohol–benzene (Found : N, 13·0; Cl, 32·1%).

5 : 6-*Dimethyl*-2-*chloromethylbenziminazole hydrochloride* (70%) crystallised from methanol–ethyl acetate in buff-coloured prisms, m. p. 282° (decomp.) (Found : N, 12·1. $C_{10}H_{12}N_2Cl_2$ requires N, 12·1%).

Condensation of 2-*Chloromethylbenziminazole with Ethyl Acetamidomalonate.*—2-Chloromethylbenziminazole (12·3 g.) and ethyl acetamidomalonate (16 g.) were condensed in dry ethanol (150 ml.) containing sodium ethoxide (from 1·7 g. of sodium) by the standard procedure. The product was extracted with boiling benzene (300 ml.), and the insoluble material (1·5 g.) recrystallised from alcohol–benzene to give *ethyl α-acetamido-β-(2-benziminazolyl)propionate* (IV) in fine needles, m. p. 214° (Found : C, 60·6; H, 5·9; N, 15·1. $C_{14}H_{17}O_3N_3$ requires C, 61·1; H, 6·2; N, 15·2%), not depressed on admixture with a specimen prepared as below. The benzene solution was chromatographed on a column of alumina (4 × 50 cm.), and the column washed with benzene–ethyl acetate (1 : 1; 500 ml.). Evaporation of the eluate gave a yellow gum which crystallised on treatment with a little ethyl acetate. *Ethyl acetamido-(2-benziminazolylmethyl)malonate* (17 g., 65%) separated from benzene–light petroleum in rhombs, m. p. 162—163° (Found : C, 58·3; H, 5·9; N, 12·3. $C_{17}H_{21}O_5N_3$ requires C, 58·8; H, 6·0; N, 12·1%). Condensation of 2-chloromethylbenziminazole hydrochloride with ethyl acetamidomalonate in the presence of 2 mols. of sodium ethoxide gave essentially the same result.

β-(2-Benziminazolyl)-α-alanine Monohydrate.—Hydrolysis of either of the foregoing intermediates with concentrated hydrobromic acid, followed by isolation in the manner described above for the isomeric amino-acid, gave β-(2-benziminazolyl)-α-alanine as the *monohydrate* which crystallised from water–alcohol in fine white needles, m. p. 210° (with foaming) (Found : C, 54·2; H, 5·9; N, 18·5. $C_{10}H_{11}O_2N_3,H_2O$ requires C, 53·8; H, 5·8; N, 18·9%). The *hydrobromide* formed colourless crystals (from water–acetone), m. p. 237° (decomp.) (Found : N, 14·7; Br, 28·0. $C_{10}H_{11}O_2N_3$,HBr requires N, 14·8; Br, 28·2%).

Ethyl α-Acetamido-β-(2-benziminazolyl)propionate.—Dry hydrogen chloride was passed into a suspension of the amino-acid (1·4 g.) in boiling absolute ethanol (50 ml.) for 1 hour, whereafter the solution was evaporated to dryness. The residue was warmed with acetic anhydride (20 ml.) for 1 hour and the excess then removed under reduced pressure. Crystallisation of the residue from aqueous alcohol containing a little ammonia and then from alcohol–light petroleum gave *ethyl α-acetamido-β-(2-benziminazolyl)propionate*, colourless needles (500 mg.), m. p. 216° (Found : C, 61·0; H, 6·0; N, 15·2. $C_{14}H_{17}O_3N_3$ requires C, 61·1; H, 6·2; N, 15·2%), not depressed on admixture with a specimen prepared as above.

Ethyl acetamido-(1-methyl-2-benziminazolylmethyl)malonate, prepared from 1-methyl-2-chloromethyl benziminazole (6·9 g.), ethyl acetamidomalonate (8·4 g.), and dry alcohol (100 ml.), containing sodium (0·85 g.), separated from light petroleum (b. p. 80—100°) containing a little benzene in fine needles (9·0 g.), m. p. 133—134° (Found : C, 59·7; H, 6·2; N, 12·0. $C_{18}H_{23}O_5N_3$ requires C, 59·8; H, 6·4; N, 11·6%).

β-(1-Methyl-2-benziminazolyl)-α-alanine monohydrate was obtained as a gel by hydrolysis of the foregoing ester. On drying *in vacuo* over phosphoric oxide, it formed a friable white powder, m. p. *ca.* 216—219° (with foaming) (Found : C, 54·8; H, 6·0; N, 17·4. $C_{11}H_{13}O_2N_3,H_2O$ requires C, 55·7; H, 6·2; N, 17·8%).

β-(4-Methyl-2-benziminazolyl)-α-alanine Monohydrate.—4-Chloromethylbenziminazole hydrochloride (7·7 g.) and ethyl acetamidomalonate (8·8 g.) were condensed in boiling ethanol (120 ml.) containing sodium (1·75 g.). The reaction product in benzene (100 ml.) was chromatographed on a column of alumina (3·5 × 25 cm.), and the column washed with benzene (300 ml.) containing 10% of ethanol. Evaporation of the eluate gave a reddish gum which crystallised on treatment with ethyl acetate. *Ethyl α-acetamido-β-(4-methyl-2-benziminazolyl)propionate* (4 g., 40%) separated from alcohol–light petroleum in needles, m. p. 172° (Found : C, 62·4; H, 6·7; N, 14·4. $C_{15}H_{19}O_3N_3$ requires C, 62·3; H, 6·6; N, 14·5%). Hydrolysis gave *β-(4-methyl-2-benziminazolyl)-α-alanine monohydrate*, needles (from water), m. p. 210° (with foaming) (Found : C, 56·2; H, 6·5; N, 18·2. $C_{11}H_{13}O_2N_3,H_2O$ requires C, 55·7; H, 6·2; N, 17·8%).

β-(5-Methyl-2-benziminazolyl)-α-alanine Monohydrate.—5-Methyl-2-chloromethylbenziminazole hydrochloride (6·0 g.) was condensed with ethyl acetamidomalonate (7·5 g.) in dry ethanol (120 ml.) containing sodium ethoxide (2 mols.). The crude product was stirred with benzene giving *ethyl α-acetamido-β-(5-methyl-2-benziminazolyl)propionate* (3·9 g., 50%), colourless needles (from alcohol–benzene), m. p. 209° (Found : C, 62·2; H, 6·7; N, 14·6%). The benzene-soluble fraction was not obtained crystalline, even after repeated chromatographic purification. On hydrolysis with concentrated hydrobromic acid it gave β-(5-methyl-2-benziminazolyl)-α-alanine, also obtained by hydrolysis of the acetamidopropionic ester. This compound, isolated as the *monohydrate*, formed colourless needles, m. p. 196° (with foaming), from water (Found : C, 56·6; H, 6·4; N, 17·7%). The *hydrobromide* separated from water–acetone

in colourless crystals, m. p. 245° (decomp.) (Found : N, 13·8. $C_{11}H_{13}O_2N_3$,HBr requires N, 14·0%), and the *picrate* in yellow needles, m. p. 208° (decomp.) (Found : N, 18·6. $C_{11}H_{13}O_2N_3$,$C_6H_3O_7N_3$ requires N, 18·8%), from alcohol.

β-(5 : 6-Dimethyl-2-benziminazolyl)-α-alanine Dihydrate.—Condensation of 5 : 6-dimethyl-2-chloromethylbenziminazole hydrochloride (5·5 g.) with ethyl acetamidomalonate (5·2 g.) gave *ethyl α-acetamido-β-(5 : 6-dimethyl-2-benziminazolyl)propionate*, colourless needles (from alcohol–light petroleum), m. p. 182°, which appeared to retain a molecule of ethanol after drying at 78°/100 mm. (Found : C, 61·2; H, 6·8; N, 12·1. $C_{16}H_{21}O_3N_3$,C_2H_5·OH requires C, 61·6; H, 7·3; N, 12·0%). Hydrolysis gave β-(5 : 6-dimethyl-2-benziminazolyl)-α-alanine which separated from water containing a little acetic acid as the *dihydrate*, m. p. 210° (with foaming) (Found : C, 53·8; H, 7·1; N, 15·2. $C_{12}H_{15}O_2N_3$,$2H_2O$ requires C, 53·8; H, 7·1; N, 15·7%).

5-[2-(2-*Benziminazolyl*)*ethyl*]*hydantoin.*—β-(5-Hydantoinyl)propionic acid (4 g.; Dakin, *Biochem. J.*, 1919, **13**, 406) and *o*-phenylenediamine (2 g.) were heated under reflux in 4N-hydrochloric acid (20 ml.) for 1 hour. The *product* separated on basification with aqueous ammonia, and was recrystallised from water (charcoal), forming fine needles, m. p. 247—248° (decomp.) (Found : C, 58·7; H, 4·9; N, 22·6. $C_{12}H_{12}O_2N_4$ requires C, 59·0; H, 4·9; N, 22·9%).

1-(2-*Hydroxyethyl*)*benziminazole.*—2-Nitro-2′-hydroxyethylaniline (6·1 g.) was reduced in alcoholic solution when shaken with hydrogen in the presence of palladised charcoal. The diamine was transferred to 4N-hydrochloric acid (40 ml.) and heated at 100° with formic acid (15 ml.) for 40 minutes, whereafter the product was precipitated with ammonia solution and extracted with chloroform. 1-(2-Hydroxyethyl)benziminazole (3·8 g., 75%) formed colourless needles, m. p. 108°, from benzene. The picrate formed long yellow needles (from 2-ethoxyethanol), m. p. 205° (Found : N, 17·8. Calc. for $C_9H_{10}ON_2$,$C_6H_3O_7N_3$: N, 17·9%).

2-*Methyl*-1-(2-*hydroxyethyl*)*benziminazole.*—This *benziminazole* was prepared as above, the formic acid being replaced by acetic acid, and separated (65%) from ethyl acetate–light petroleum in prisms, m. p. 148° (Found : C, 68·4; H, 6·9; N, 15·9. $C_{10}H_{12}ON_2$ requires C, 68·2; H, 6·9; N, 15·9%).

2-*Ethyl*-1-(2-*hydroxyethyl*)*benziminazole* formed prismatic needles (70%), m. p. 133°, from aqueous alcohol (Found : N, 14·7. $C_{11}H_{14}ON_2$ requires N, 14·7%).

5 : 6-*Dimethyl*-2-*aminomethylbenziminazole Dihydrochloride.*—4 : 5-Dimethyl-*o*-phenylenediamine (from the catalytic reduction of 4·15 g. of 5-nitro-*o*-4-xylidine) and hippuric acid (4·6 g.) were fused at 170° for 15 minutes. The product was ground and then recrystallised from aqueous alcohol, giving 5 : 6-*dimethyl*-2-*benzamidomethylbenziminazole* in wisps, m. p. 233—234° (Found : C, 68·9; H, 6·6. $C_{17}H_{17}ON_3$,H_2O requires C, 68·7; H, 6·4%). This compound (2·1 g.) was heated under reflux for 8 hours with concentrated hydrochloric acid, whereafter the solution was evaporated to dryness. Benzoic acid was removed by extraction with ether and the residue recrystallised from alcohol–ether. 5 : 6-*Dimethyl*-2-*aminomethylbenziminazole dihydrochloride* formed needles (900 mg.), m. p. 266—268° (Found : N, 16·9. $C_{10}H_{13}N_3$,2HCl requires N, 17·3%).

1-(2-*Aminoethyl*)*benziminazole.*—2′-Phthalimidoethyl-*o*-phenylenediamine (3 g.; Karrer and Naef, *Helv. Chim. Acta*, 1936, **19**, 1026) and 95% formic acid (12 ml.) were heated under reflux for 1 hour. On basification with aqueous ammonia, 1-(2-*phthalimidoethyl*)*benziminazole* (80%) separated and was recrystallised from alcohol, forming prisms, m. p. 211° (Found : N, 14·1. $C_{17}H_{13}O_2N_3$ requires N, 14·4%). This intermediate (2·5 g.) and hydrazine hydrate (25 ml.) were heated under reflux for 2 hours. The solution was evaporated, and the residue treated with dilute hydrochloric acid and filtered from phthalhydrazide. 1-(2-*Aminoethyl*)*benziminazole dihydrochloride* (750 mg.) was isolated from the filtrate by evaporation to dryness and was recrystallised from alcohol, forming needles, m. p. 280° (Found : C, 46·6; H, 5·5; N, 17·8; Cl, 30·6. $C_9H_{11}N_3$,2HCl requires C, 46·2; H, 5·6; N, 18·0; Cl, 30·3%).

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