827. *Some Transformations of α-Acetamido-β-hydroxy-*p*-nitropropiophenone.*

By V. Petrow, O. Stephenson, and B. Sturgeon.

The stability of α-acetamido-β-hydroxy-*p*-nitropropiophenone (I) towards various reagents has been examined and some new transformation products have been obtained.

Some of the reactions observed were also shown by certain aryl analogues of the parent compound.

Studies on the stability of α-acetamido-β-hydroxy-*p*-nitropropiophenone (I) towards various reagents led to the formation of compounds active against *E. histolytica* and thence to the series of transformations recorded below.

Treatment of (I) and of the corresponding *N*-ethoxycarbonyl and *N*-propionyl derivatives with concentrated hydrochloric, formic, or phosphoric acid resulted in the formation of a pale yellow product, $C_9H_7O_4N$, which yielded *p*-nitrobenzoic acid on oxidation with hydrogen peroxide in acetic acid. Its constitution as 1-*p*-nitrophenylpropane-1 : 2-dione (II) followed from its conversion into a dioxime, a mono- and a bis-phenylhydrazone, and a quinoxaline derivative (with *o*-phenylenediamine). Reaction with benzaldehyde and aniline gave 4-*p*-nitrophenyl-1-phenyl-3 : 4-diphenyliminobut-1-ene (III) (cf. Borsche and Titsingh, *Ber.*, 1909, **42**, 4283). The *p*-chloro- and the *p*-bromo-derivative of α-acetamido-β-hydroxypropiophenone behaved in the same way, passing readily into the corresponding diketones on acidolysis. Formation of (II) from (I) no doubt occurs through intermediate production of (VI), followed by fission as indicated in (XIII). (VI) is also an intermediate in the acid hydrolysis of (I) to (II).

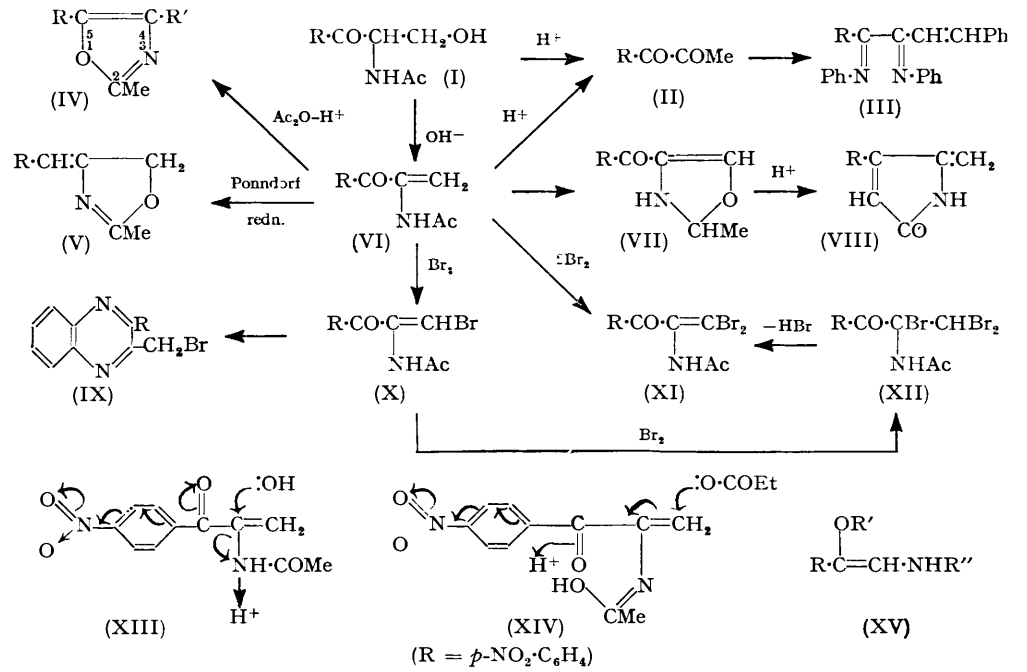
Treatment of (I) with pyridine at 100° yielded a mixture of products A, m. p. 124°, and B, m. p. 187—192°; the proportions depended on the time of heating, as the former compound passed into the latter under these experimental conditions. Analysis showed that the two compounds were isomeric and differed from (I) by removal of the elements of water. That such removal involved the terminal hydroxyl group of (I) followed from the observation that α-acetamido-β-acetoxy- and -β-benzoyloxy-*p*-nitropropiophenone were likewise converted into a mixture of A and B when heated with pyridine in the same way.

Formulation of product A as α-acetamido-*p*-nitroacrylophenone (VI) was indicated by spectroscopic data and finally proved by the bromination studies outlined below. The infra-red absorption spectrum of the material revealed a carbonyl group conjugated with an unsaturated linkage, together with an imino-residue which was not hydrogen-bonded. The presence of the *p*-nitrobenzoyl moiety in the molecule was proved by oxidation with hydrogen peroxide in glacial acetic acid to *p*-nitrobenzoic acid in nearly quantitative yield. The carbonyl group was further characterised by preparation of a phenyl- and a *p*-tolylhydrazone and of an azine. Ponndorf reduction, however, failed to give the corresponding alcohol but gave instead a dehydration product of the latter, also encountered during Ponndorf reduction of (I) (cf. Long and Troutman, *J. Amer. Chem. Soc.*, 1949, **71**, 2473) and probably best represented by (V). Warm mineral acids effected quantitative conversion of (VI) into (II), and it is thus probable that (V) is also an intermediate in the acid hydrolysis of (I) to (II) [see also the conversion of ethyl α-dichloroacetamido-*p*-nitrocinnamate into *p*-nitrophenylpyruvic acid (Huebner and Scholz, *ibid.*, 1951, **73**, 2089)].

Formulation of product A as (VI) was also supported by the observation that the same compound was readily obtained in excellent yield by direct condensation of ω-acetamido-*p*-nitroacetophenone with formaldehyde in acetic acid solution containing dimethylamine (*i.e.*, acetate ion). α-Carbethoxy-, α-dichloroacetamido-, and α-propionamido-*p*-nitroacrylophenone were similarly prepared. Product A was also formed from (I) by treatment with a basic catalyst in acetic acid solution.

Reaction of (VI) with one molar proportion of bromine led to a monobromo-derivative formulated as α-acetamido-β-bromo-*p*-nitroacrylophenone (X). Evidence for this constitution rested upon (i) the formation of *p*-nitrobenzoic acid on chromic acid oxidation from which it follows that the bromine atom is not situated in the aryl nucleus, and (ii)

degradation of (X) by hydrochloric acid to a mixture which, when condensed with *o*-phenylenediamine, yielded 2-bromomethyl-3-*p*-nitrophenylquinoxaline (IX), also obtained directly from (II) *via* its ω-bromo-derivative.



Treatment of (VI) with acetic anhydride containing a little sulphuric acid gave an acetate which passed, on mild alkaline hydrolysis, into an alcohol isomeric with (VI) and assigned the constitution 4-hydroxymethyl-2-methyl-5-*p*-nitrophenyloxazole (IV; R′ = CH_2·OH). 2-Methyl-5-*p*-nitrophenyl-4-propionoxymethyloxazole (IV; R′ = CH_2·O·COEt) was likewise obtained by employing propionic anhydride, its formation from (VI) presumably taking place by the mechanism indicated in (XIV). *Inter alia*, we observed, on one occasion, the conversion of (I) into (IV; R′ = CH_2·OH) on treatment with concentrated sulphuric acid, but attempts to repeat the preparation proved unsuccessful.

The presence of a hydroxyl group in (IV; R′ = CH_2·OH) was shown by formation of a phenylurethane and by treatment with thionyl chloride which gave a chloro-derivative similarly formed in low yield from (I). The constitution of this chloro-compound as a 2-methyl-5-*p*-nitrophenyloxazole derivative followed from its ultra-violet absorption spectrum which showed very close similarity to that of authentic 2-methyl-5-*p*-nitrophenyloxazole (IV; R′ = H) obtained from α-acetamido-*p*-nitroacetophenone by treatment with concentrated sulphuric acid (cf. Lister and Robinson, *J.*, 1912, 1297) or from α-amino-*p*-nitroacetophenone hydrochloride by reaction with acetic anhydride. Catalytic reduction of (IV; R′ = CH_2·OH), followed by acetylation, gave 5-*p*-acetamidophenyl-4-acetoxymethyl-2-methyloxazole.

The facility with which compounds of type (VI) pass into oxazoles (IV) was further shown by the behaviour of α-acetamido-β-bromo-*p*-nitroacrylophenone (X) with acetic anhydride and concentrated sulphuric acid: 4-diacetoxymethyl-2-methyl-5-*p*-nitrophenyloxazole [IV; R′ = $-CH(OAc)_2$] was readily obtained. The formulation of this compound as a 2-methyl-5-*p*-nitrophenyloxazole derivative followed from its ultra-violet absorption spectrum. Its constitution as the 4-aldehyde diacetate was confirmed by hydrolysis to the free aldehyde and conversion of the latter without isolation into a semicarbazone and into 4-hydroxymethyl-2-methyl-5-*p*-nitrophenyloxazole (IV; R′ = CH_2·OH) by Ponndorf reduction.

Another rearrangement of the same type was achieved in the following way. Bromination of (X) with one, or of (VI) with two molar equivalents of bromine, led to the formation of an unstable tribromide formulated as (XII), which passed into α-acetamido-ββ-dibromo-*p*-nitroacrylophenone (XI) in boiling acetic acid. The last compound (XI), when treated with acetic anhydride–sulphuric acid, gave 2-methyl-5-*p*-nitrophenyloxazole-4-carboxylic acid (IV; R′ = CO_2H), characterised as the ethyl ester and identified by decarboxylation to 2-methyl-5-*p*-nitrophenyloxazole (IV; R′ = H).

Evidence for the structure of product B (see p. 4066) is less satisfactory. The compound evidently contains the *p*-nitrobenzoyl residue as it yields *p*-nitrobenzoic acid on oxidation with hydrogen peroxide in acetic acid. Its ultra-violet absorption spectrum, though generally similar to such *p*-nitrobenzoyl derivatives as (I) and (VI), differs from them in showing a shoulder in the region of 290 mμ. Its infra-red absorption spectrum revealed the presence of an imino-group which was hydrogen-bonded, a carbonyl group as in (I), and the possibility of an unsaturated linkage αβ to the carbonyl group. The whole infra-red absorption spectrum, however, was very complicated and the large number of bands between 8 and 15 mμ suggested a highly resonant structure with more than one form. It seems difficult to avoid drawing the conclusion that the compound is a labile dihydro-oxazole with (VII) as the " imine form." Unfortunately attempts to confirm the presence of an imino-group in (VII) by reaction with acetic and propionic anhydride were not entirely satisfactory, as the beautifully crystalline derivatives obtained gave equivocal analytical data.

Careful treatment of (VII) with cold concentrated hydrochloric or sulphuric acid led to the formation of an isomer, m. p. 233°, of unknown structure with an absorption spectrum almost identical with that of (VII) but lacking the inflection at 290 mμ. Further reaction of this material [or of (VII) or (I)] with hot concentrated hydrochloric or other acid, *e.g.*, formic, acetic, and propionic, resulted in the production of a high-melting product, $C_{11}H_8O_3N_2$, in very low yield, evidently formed from it by a rearrangement involving loss of the elements of water and provisionally formulated as (VIII), in accordance with which the ultra-violet absorption spectrum of the compound shows a general resemblance to that of (VI).

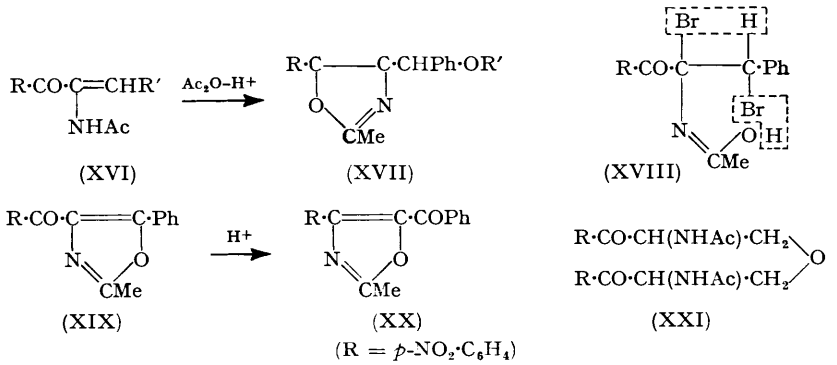
The facility with which the foregoing transformations occur appears to be related to the $+I$ effect of the methyl group present in the acyl residue in (I). Thus, whereas α-propionamido-, α-benzamido-, α-dichloroacetamido-, and α-ethoxycarbonylamido-β-hydroxy-*p*-nitropropiophenone (cf. I) undergo ready dehydration to the corresponding α-acylamido-*p*-nitroacrylophenone (cf. VI), only the first of the derivatives is then readily convertible into an isomer of type (VII).

Attempts to prepare the 3-phenyl analogue of (VI) by condensing ω-acetamido-*p*-nitroacetophenone with benzaldehyde in boiling acetic anhydride led only to the formation of the enol acetate (XV; R′ = R″ = Ac), which passed into ω-acetamido-*p*-nitroacetophenone phenylhydrazone on treatment with phenylhydrazine. Rather surprisingly, reaction of ω-acetamido-*p*-nitroacetophenone with propionic anhydride resulted in the formation of the dipropionate (XV; R′ = R″ = COEt), also obtained from ω-propionamido-*p*-nitroacetophenone. Acetylation of the last compound with acetic anhydride, however, gave (XV; R′ = Ac, R″ = COEt). The desired α-acetamidostyryl *p*-nitrophenyl ketone (XVI; R′ = Ph) was ultimately obtained by condensing ω-acetamido-*p*-nitroacetophenone with benzaldehyde in ethanol in the presence of a basic catalyst (see also Collins, Ellis, Hansen, Mackenzie, Moualim, Petrow, Stephenson, and Sturgeon, *J. Pharm. Pharmacol.*, 1952, **4**, 693). α-Acetamido-*p*-nitro-, -*o*-hydroxy-, and -*p*-methoxy-styryl *p*-nitrophenyl ketone were similarly prepared by employing *p*-nitrobenzaldehyde, salicylaldehyde, and *p*-anisaldehyde in the reaction.

In contrast to (VI; R′ = H), (XVI; R′ = Ph) failed to isomerise to a product of type (VII) in refluxing pyridine during 2 hours and was recovered unchanged after prolonged heating with anhydrous formic acid at 95°. Treatment with hydrogen peroxide in acetic acid, too, followed a different pattern, an epoxide being obtained. No reaction occurred with phenylhydrazine. Its formulation as (XVI; R′ = Ph) followed, however, from its behaviour on vigorous hydrolysis with concentrated hydrochloric acid, degradation typical of (VI; R′ = H) and not shown by (VII) and (VIII) being observed with formation of 1-*p*-

nitrophenyl-3-phenylpropane-1 : 2-dione (cf. II). Treatment of (XVI; R′ = C_6H_4·OMe-*p*) with hot concentrated hydrochloric acid gave 3-*p*-methoxyphenyl-1-*p*-nitrophenylpropane-1 : 2-dione.

Acetylation of (XVI; R′ = Ph) in boiling acetic anhydride gave a product which did not appear to be an acetyl derivative of (XVI; R′ = Ph) *per se* as it failed to undergo hydrolysis with aqueous-ethanolic sodium carbonate. Its ultra-violet absorption spectrum, too, though generally similar to that of the parent compound, nevertheless showed an additional maximum at 301 mμ. We therefore prefer a cyclic structure for this compound and assign it the constitution 3-acetyldihydro-2-methyl-4-*p*-nitrobenzoyl-5-phenyloxazole. Its reconversion into (XVI; R′ = Ph) on treatment with hot aqueous-ethanolic N/4-hydrochloric acid, though different from the behaviour of the related compound (VII) (see above), is nevertheless compatible with the proposed structure as the stability of (VII) would clearly be influenced in the required direction by the $-I$ effect of the 5-phenyl substituent.



(XVI) (XVII) (XVIII)

(XIX) (XX) (XXI)

(R = *p*-NO_2·C_6H_4)

Reaction of (XVI; R′ = Ph) at room temperature with acetic anhydride containing a trace of concentrated sulphuric acid followed the pattern established for (VI; R′ = H) with formation of 4-α-acetoxybenzyl-2-methyl-5-*p*-nitrophenyloxazole (XVII; R′ = Ac), readily hydrolysed by aqueous-ethanolic sodium carbonate to the alcohol (XVII; R′ = H). Reaction with bromine, in contrast, failed to give the phenyl analogue of (X), a bromine-free product, identified as 2-methyl-4-*p*-nitrobenzoyl-5-phenyloxazole (XIX) and evidently formed as indicated in (XVIII), being obtained. The constitution assigned to (XIX) followed from (i) its ultra-violet absorption spectrum which showed a maximum at 267 mμ characteristic of the oxazole structure and (ii) its behaviour with dilute hydrochloric acid when, in common with other 4-acyl-5-aryloxazoles, it rearranged to an isomeric compound formulated as 5-benzoyl-2-methyl-4-*p*-nitrophenyloxazole (XX) (see Cornforth, "The Chemistry of Penicillin," Princeton Univ. Press, Princeton, N. Jersey, 1949, p. 700). Vigorous acidolysis of (XIX) gave *p*-nitrobenzoic acid admixed with a smaller quantity of benzoic acid. Bromination of α-acetamido-*p*-methoxystyryl 1-*p*-nitrophenyl ketone (XVI; R′ = C_6H_4·OMe-*p*) similarly furnished 5-*p*-methoxyphenyl-2-methyl-4-*p*-nitrobenzoyloxazole (cf. XIX), from which *p*-nitrobenzoic acid was obtained by treatment with hot concentrated hydrochloric acid.

The marked lability of (I) was further shown by the observation that when heated in ethanol in the presence of small quantities of sodium carbonate or other weakly basic substance it readily gave a product, $C_{22}H_{22}O_9N_4$, evidently formed from 2 mols. of (I) by elimination of the elements of water. As alkaline reagents are known to effect dehydration of (I) to (VI) (see above) it seems reasonable to conclude that carbonate effects conversion of part of the α-acetamido-β-hydroxy-*p*-nitropropiophenone (I) into the αβ-unsaturated ketone (VI), which then undergoes base-catalysed addition of the primary alcohol (I) to give 2 : 6-diacetamido-1 : 7-di-*p*-nitrophenyl-4-oxaheptane-1 : 7-dione (XXI) [cf. for example, the base-catalysed addition of methanol to 3β-acetoxypregna-5 : 16-dien-20-one to give 3β-acetoxy-16-methoxypregnan-20-one (Marker, *J. Amer. Chem. Soc.*, 1949, **71**, 4149; Fukushima and Gallagher, *ibid.*, 1950, **72**, 2306)]. In support of this formulation we find

that the product has an absorption spectrum which resembles that of the parent compound (I) and also forms a bisphenylhydrazone. Acetic anhydride is without action upon it but propionic anhydride gives a well-defined propionyl derivative. Reaction with acetic anhydride containing a trace of sulphuric acid leads to loss of the elements of water with formation in low yield of a product, $C_{22}H_{20}O_8N_4$, of unestablished structure.

Experimental

Ultra-violet absorption spectra were determined in *iso*propanolic solution.

1-p-*Nitrophenylpropane*-1 : 2-*dione* (II).—(*a*) α-Acetamido-β-hydroxy-*p*-nitropropiophenone (5 g.) was heated with formic acid (15 ml. of 98%) for 4 hr. on the steam-bath. After dilution somewhat, the mixture was allowed to cool and the separated crystals (3·0 g.) were collected and purified from light petroleum (b. p. 60—80°). 1-p-*Nitrophenylpropane*-1 : 2-*dione* formed lemon-yellow prismatic needles, m. p. 91—92° (Found: C, 56·2; H, 3·6; N, 7·4. $C_9H_7O_4N$ requires C, 56·0; H, 3·7; N, 7·3%), $\lambda_{max.} = 270$ mμ ($E^{1\%}_{1\,cm.} = 700$).

(*b*) The dione (II) was obtained (82% yield) by heating (I) (10 g.) with phosphoric acid (40 ml. of B.P.) for 40 min. on the steam-bath.

(*c*) The alcohol (I) (100 g.) was heated on the steam-bath with concentrated hydrochloric acid for 30 min. When the mixture cooled, (II) separated (38 g.) and was collected. The filtrate was extracted with chloroform, then evaporated to dryness under reduced pressure. Crystallisation of the residue from ethanol furnished *α-amino-β-hydroxy*-p-*nitropropiophenone hydrochloride* (47 g.), needles, m. p. 188° (decomp.) (Found: N, 11·5; Cl, 14·7. $C_9H_{10}O_4N_2$,HCl requires N, 11·4; Cl, 14·4%). This was converted into (II) in 39% yield by heating it on the steam-bath with concentrated hydrochloric acid for 45 min.

(*d*) When α-acetamido-*p*-nitroacrylophenone (1 g.) (VI; see below) in cold concentrated hydrochloric acid (10 ml.) was warmed on the steam-bath, separation of (II) rapidly occurred and was complete in a few minutes. After crystallisation from light petroleum the diketone was obtained in nearly quantitative yield, and had m. p. 88—89° (Found: C, 56·0; H, 3·9; N, 7·3%), not depressed on admixture with a sample prepared by (*a*) above.

The *dioxime* of (II), after crystallisation from aqueous ethanol, formed small needles, m. p. 213—216° (Found: N, 19·0. $C_9H_9O_4N_3$ requires N, 18·8%). Heating (II) (970 mg.) in alcohol (70 ml.) with phenylhydrazine (2·16 g.) in acetic acid (5 ml.) on the steam-bath for ¾ hr. gave the *monophenylhydrazone* as bright yellow needles, m. p. 212—213° (from alcohol) (Found: C, 63·1; H, 4·9; N, 15·0. $C_{15}H_{13}O_3N_3$ requires C, 63·6; H, 4·6; N, 14·8%). The acetic acid mother-liquors, after concentration and dilution, deposited the *bisphenylhydrazone*, dark red needles, m. p. 164° (Found: C, 68·0; H, 4·8; N, 19·5. $C_{21}H_{19}O_2N_5$ requires C, 67·5; H, 5·1; N, 18·8%). The *quinoxaline* derivative, after crystallisation from light petroleum (b. p. 80—100°), was obtained in plates, m. p. 131° (Found: C, 67·6; H, 4·4; N, 15·8. $C_{15}H_{11}O_2N_3$ requires C, 67·9; H, 4·2; N, 15·8%). 4-p-*Nitrophenyl*-1-*phenyl*-3 : 4-*diphenyliminobut*-1-*ene* (III), prepared by treating (II) (500 mg.) in alcohol (20 ml.) with benzaldehyde (500 mg.) and aniline (500 mg.) for 3½ hr. on the steam-bath, separated from aqueous ethanol in dark red shining plates, m. p. 183—185° (Found: C, 77·8; H, 5·4; N, 9·6. $C_{28}H_{21}O_2N_3$ requires C, 77·9; H, 4·9; N, 9·7%).

1-Phenylpropane-1 : 2-dione was prepared by heating α-acetamido-β-hydroxypropiophenone (1 g.) with formic acid (3 ml. of 98%) for 4 hr. on the steam-bath. It was characterised by conversion into the *dioxime*, m. p. 238—239° (Found: C, 60·8; H, 5·6. $C_9H_{10}O_2N_2$ requires C, 60·6; H, 5·7%).

1-p-*Bromophenylpropane*-1 : 2-*dione*, prepared from α-acetamido-β-hydroxy-*p*-bromopropiophenone (Buu-Hoï, Nguyen-Hoán, Jacquignon, and Khoi, *Compt. rend.*, 1950, **230**, 662), crystallised from light petroleum (b. p. 40—60°) as lemon-yellow prismatic needles, m. p. 48—50° (Found: C, 47·1; H, 2·8; Br, 35·7. $C_9H_7O_2Br$ requires C, 47·6; H, 3·1; Br, 35·2%). The *monophenylhydrazone* formed silky yellow needles, m. p. 200° (Found: C, 56·7; H, 4·2; N, 8·9. $C_{15}H_{13}ON_2Br$ requires C, 56·8; H, 4·1; N, 8·8%), after crystallisation from ethyl acetate–light petroleum (b. p. 60—80°).

α-Acetamido-p-*nitroacrylophenone* (VI).—(*a*) α-Acetamido-β-hydroxy-*p*-nitropropiophenone (50 g.) was heated with pyridine (250 ml.) for 1 hr. on the steam-bath, the solvent was then removed under reduced pressure, and the residue extracted with benzene (300 ml.). The resulting extract was percolated through a column of activated alumina (20 sq. cm. × 20 cm.) and evaporated to small bulk under reduced pressure. Addition of light petroleum (b. p. 60—80°) led to the separation of *α-acetamido*-p-*nitroacrylophenone* (20 g.) in silver plates, m. p. 124—125°

(Found : C, 56·7; H, 4·1; N, 12·1. $C_{11}H_{10}O_4N_2$ requires C, 56·4; H, 4·3; N, 12·0%). The *phenylhydrazone* formed felted red plates, m. p. 269—270° (Found : C, 63·2; H, 5·1; N, 17·6. $C_{17}H_{16}O_3N_4$ requires C, 63·0; H, 4·9; N, 17·3%), after crystallisation from 2-ethoxyethanol. The p-*tolylhydrazone*, after crystallisation from a large volume of ethanol, formed orange-red needles, m. p. 280° (Found : C, 64·3; H, 5·5; N, 16·8. $C_{18}H_{18}O_3N_4$ requires C, 63·9; H, 5·4; N, 16·6%). The *azine* separated from methanol in orange needles, m. p. 193—194° (Found : C, 54·4; H, 4·5; N, 17·6. $C_{22}H_{20}O_6N_6,H_2O$ requires C, 54·8; H, 4·6; N, 17·4%).

(*b*) ω-Acetamido-*p*-nitroacetophenone (22·2 g.) in warm acetic acid (50 ml.) was treated successively with 36% formaldehyde solution (8·3 ml.) and aqueous dimethylamine (13·6 ml. of 33%) with cooling at *ca.* 30° and the whole set aside overnight at room temperature. The separated crystals (19 g.) were collected and purified, to give (VI), m. p. 123° (Found : C, 56·1; H, 4·5; N, 12·0%), alone or on admixture with a sample prepared by (*a*) above.

(*c*) α-*Acetamido*-β-*acetoxy*-p-*nitropropiophenone*, rosettes of needles, m. p. 130—131° (Found : C, 53·2; H, 4·7; N, 9·6. $C_{13}H_{14}O_6N_2$ requires C, 53·1; H, 4·8; N, 9·5%), was prepared in 84% yield by treating (I) (5 g.) and acetic anhydride (20 ml.) with 2 drops of concentrated sulphuric acid, pouring the mixture into water after 30 min., and crystallising the separated solids from benzene. It was also obtained, in 81% yield, by heating (I) (12 g.) with acetyl chloride (160 ml.) for 30 min., concentrating the mixture, and crystallising the residue from benzene–light petroleum (b. p. 60—80°). It was converted into a mixture of (VI) and (VII) (see below) by heating it (i) with pyridine, (ii) with sodium acetate in ethanol, or (iii) with ethanol alone.

4 : 5-*Dihydro*-2-*methyl*-4-p-*nitrobenzylideneoxazole* (V), prepared by reducing (VI; 50 g.) in *iso*propanol (430 g.) with aluminium *iso*propoxide (52 g.), formed yellow arrowheads, m. p. 170° (Found : C, 60·5; H, 4·1; N, 13·0. $C_{11}H_{10}O_3N_2$ requires C, 60·5; H, 4·6; N, 12·9%), after crystallisation from benzene. The *picrate* separated from ethanol in yellow prisms, m. p. 150° (Found : C, 45·3; H, 2·5; N, 15·6. $C_{11}H_{10}O_3N_2,C_6H_3O_7N_3$ requires C, 45·6; H, 2·9; N, 15·7%).

α-*Acetamido*-β-*bromo*-p-*nitroacrylophenone* (X).—The ketone (VI; 2·3 g.) in acetic acid (25 ml.) was treated with bromine (1·6 g.) at room temperature. Exothermic addition occurred, followed by evolution of hydrogen bromide. Water (80 ml.) was added after 10 min. and the precipitated solids were collected, dried (1·9 g.) and crystallised from aqueous ethanol. α-*Acetamido*-β-*bromo*-p-*nitroacrylophenone* formed cream-coloured plates, m. p. 162° (decomp.) (Found : C, 42·6; H, 2·9; N, 8·5; Br, 26·0. $C_{11}H_9O_4N_2Br$ requires C, 42·2; H, 2·9; N, 8·9; Br, 25·6%).

2-*Bromomethyl*-3-p-*nitrophenylquinoxaline* (IX).—(*a*) 1-*p*-Nitrophenylpropane-1 : 2-dione (9 g.) in warm acetic acid (35 ml.) was treated with bromine (8 g.) in acetic acid (8 ml.). Next morning the mixture was diluted with water, and the precipitated oil washed by decantation. Treatment with *o*-phenylenediamine (6 g.) in ethanol for a few minutes under reflux, followed by crystallisation from 2-ethoxyethanol, gave the *quinoxaline* (IX), cream-coloured needles, m. p. 200—201° (Found : C, 52·3; H, 2·9; N, 12·3; Br, 23·3. $C_{15}H_{10}O_2N_3Br$ requires C, 52·3; H, 2·9; N, 12·2; Br, 23·3%).

(*b*) The foregoing bromo-compound (X) (200 mg.) was heated with concentrated hydrochloric acid (2 ml.) at 100° for 15 min., after which the product was extracted with chloroform and treated with ethanolic *o*-phenylenediamine (300 mg.), to give (IX) (100 mg.), m. p. 198°, alone or on admixture with a specimen prepared as in (*a*) above.

4-*Acetoxymethyl*-2-*methyl*-5-p-*nitrophenyloxazole* (IV; R′ = ·CH_2·OAc).—The ketone (VI) (1 g.) in acetic anhydride (10 ml.) and concentrated sulphuric acid (0·1 ml.) was set aside overnight, then the mixture was decomposed with water and the precipitated solids were collected and crystallised, initially from ethanol and subsequently from chloroform–light petroleum (b. p. 60—80°). 4-*Acetoxymethyl*-2-*methyl*-5-p-*nitrophenyloxazole* (>40%) formed flat yellow plates, m. p. 139—140° (Found: C, 56·7; H, 4·4; N, 9·9. $C_{13}H_{12}O_5N_2$ requires C, 56·5; H, 4·3; N, 10·1%).

4-*Hydroxymethyl*-2-*methyl*-5-p-*nitrophenyloxazole* (IV; R′ = ·CH_2·OH), fibrous yellow needles, m. p. 196° (decomp.) (Found : C, 57·0; H, 4·3; N, 12·0. $C_{11}H_{10}O_4N_2$ requires C, 56·4; H, 4·3; N, 12·0%), after crystallisation from methanol, separated after a few minutes when the foregoing compound was dissolved by warming in methanol containing a trace of sodium methoxide. The same compound was also obtained (*ca.* 60%) by treating (I) (5 g. with concentrated sulphuric acid (15 ml.) for 3 hr. at room temperature with stirring, followed by heating for a few minutes on the steam-bath and precipitation in water. The *phenylurethane* crystallised from ethanol in needles, m. p. 131° (Found : C, 61·4; H, 4·7; N, 12·4. $C_{18}H_{15}O_5N_3$ requires C, 61·2; H, 4·4; N, 11·9%).

4-*Chloromethyl*-2-*methyl*-5-p-*nitrophenyloxazole* (IV; R′ = ·CH_2Cl).—The hydroxymethyl ketone (I) (20 g.) was added portionwise to thionyl chloride (100 ml.). After 2 hr. at room temperature the mixture was taken to dryness under reduced pressure and the residue re-evaporated with ethyl acetate. Extraction with warm light petroleum (b. p. 60—80°) containing a little chloroform furnished 4-*chloromethyl*-2-*methyl*-5-p-*nitrophenyloxazole*, yellow needles, m. p. 121—122° (Found: C, 52·2; H, 3·7; N, 11·1; Cl, 14·0. $C_{11}H_9O_3N_2Cl$ requires C, 51·5; H, 3·5; N, 10·9; Cl, 13·8%), after crystallisation from a large volume of light petroleum. The same compound was also obtained from (IV; R′ = CH_2·OH) by similar treatment. Hydrolysis with aqueous ethanol containing sodium acetate furnished the parent alcohol, m. p. 196°, alone or on admixture with an authentic specimen.

2-*Methyl*-5-p-*nitrophenyl*-4-*propionoxymethyloxazole* (IV; R′ = ·CH_2·O·COEt), prepared by treating (VI) (1·9 g.) with propionic anhydride (20 ml.) containing 3 drops of concentrated sulphuric acid, separated from light petroleum (b. p. 60—80°) in yellow needles (850 mg.), m. p. 120—121° (Found: C, 57·8; H, 4·8; N, 10·2. $C_{14}H_{14}O_5N_2$ requires C, 57·9; H, 4·8; N, 9·7%). Hydrolysis gave the alcohol, m. p. 196°.

5-p-*Acetamidophenyl*-4-*acetoxymethyl*-2-*methyloxazole*, obtained by catalytic reduction of (IV; R′ = ·CH_2·OAc) in ethanolic solution employing a palladium–charcoal catalyst, followed by acetylation, formed prisms, m. p. 147° (Found: C, 63·0; H, 5·5; N, 9·6. $C_{15}H_{16}O_4N_2$ requires, C, 62·5; H, 5·6; N, 9·8%), after crystallisation from ethyl acetate–light petroleum.

4-*Diacetoxymethyl*-2-*methyl*-5-p-*nitrophenyloxazole* [IV; R′ = ·$CH(OAc)_2$], prepared by treating (X) (1 g.) in acetic anhydride (10 ml.) with concentrated sulphuric acid (3 drops) and pouring into water after 24 hr., formed cream prisms (450 mg.), m. p. 132° (Found: C, 53·9; H, 4·2; N, 8·4. $C_{15}H_{14}O_7N_2$ requires C, 53·9; H, 4·2; N, 8·4%), after crystallisation from chloroform–light petroleum (b. p. 60—80°).

On hydrolysis by warming with dilute hydrochloric acid for a few minutes, followed by reaction with excess of semicarbazide buffered with sodium acetate, the *semicarbazone* of the free aldehyde was obtained, as flat yellow needles, m. p. 239—240° (Found: C, 49·8; H, 3·8; N, 24·2. $C_{12}H_{11}O_4N_5$ requires C, 49·8; H, 3·8; N, 24·2%), after crystallisation from ethanol.

Ponndorf reduction of the foregoing diacetate furnished 4-hydroxymethyl-2-methyl-5-*p*-nitrophenyloxazole (78%), m. p. 196°, alone or on admixture with an authentic specimen.

α-*Acetamido*-ββ-*dibromo*-p-*nitroacrylophenone* (XI).—(*a*) A solution of (VI) (2·3 g.) in acetic acid (15 ml.) was treated with bromine (3·0 g.) in acetic acid (5 ml.). Bromine was absorbed, hydrogen bromide was evolved, and solids separated. After 5 min. the orange-red mixture was heated under reflux until straw-yellow in colour; then it was diluted with water until crystallisation commenced and cooled to 0°. Purification of the product from aqueous ethanol furnished the *dibromo-ketone*, yellow prisms (2·8 g.), m. p. 169° (Found: C, 34·0; H, 2·3; N, 6·8; Br, 40·9. $C_{11}H_8O_4N_2Br_2$ requires C, 33·6; H, 2·0; N, 7·1; Br, 40·8%).

(*b*) An identical product was obtained by analogous treatment of (X).

2-*Methyl*-5-p-*nitrophenyloxazole*-4-*carboxylic acid* (IV; R′ = CO_2H), prepared by treating the foregoing compound with acetic anhydride–sulphuric acid, formed yellow needles, m. p. 192—194° (decomp.) (Found: C, 52·9; H, 3·1. $C_{11}H_8O_5N_2$ requires C, 53·2; N, 3·2%), after crystallisation from methanol. The *ethyl* ester crystallised from ethanol as yellow needles, m. p. 116° (Found: C, 56·4; H, 4·3; N, 10·1. $C_{13}H_{12}O_5N_2$ requires C, 56·3; H, 4·3; N, 10·1%).

Decarboxylation of the acid above its m. p. for 10 min. gave 2-*methyl*-5-p-*nitrophenyloxazole* (IV; R′ = H), irregular cream-coloured plates, m. p. 162—163°, alone or on admixture with an authentic specimen. This compound was prepared (65%) by heating α-amino-*p*-nitroacetophenone hydrochloride (10 g.) with acetic anhydride (60 ml.) under reflux for 4 hr., followed by evaporation of the solution to dryness, or in 95% yield by the action of concentrated sulphuric acid (10 ml.) on ω-acetamido-*p*-nitroacetophenone (3 g.) at room temperature overnight (m. p. 164° from benzene) (Found: C, 56·9; H, 4·2; N, 13·7. $C_{10}H_8O_3N_2$ requires C, 57·5; H, 3·9; N, 13·7%). Its picrate, after crystallisation from ethanol, formed yellow needles, m. p. 180° (Found: C, 44·6; H, 3·0; N, 16·2. $C_{10}H_8O_3N_2,C_6H_3O_7N_3$ requires C, 44·3; H, 2·5; N, 16·2%).

Dihydro-2-*methyl*-4-p-*nitrobenzoyloxazole* (VII) was obtained as a bright yellow solid, m. p. 187—192° (Found: C, 55·8; H, 4·8; N, 11·9. $C_{11}H_{10}O_4N_2$ requires C, 56·4; H, 4·3; N, 12·0%), after crystallisation from ethanol–light petroleum (b. p. 60—80°), by heating (i) (VI) with ethanol under reflux for 11 hr., (ii) (I) in acetic or propionic acid on the steam-bath for 5 hr., (iii) (I) under reflux with ethanol or *iso*propanol for 18 hr.

Acetylation with acetic anhydride for 2 hr. under reflux gave a substance in prismatic needles, m. p. 209° (Found: C, 55·1, 55·6, 55·5; H, 4·9, 4·8, 4·7; N, 10·2, 10·4, 10·3%), after crystallisation from ethyl acetate. Propionylation, followed by purification from ethyl acetate–

light petroleum (b. p. 60—80°), gave a substance, m. p. 160—162° (Found : C, 56·2, 56·4; H, 5·4, 4·8; N, 10·4, 10·7%).

The same acyl derivatives were obtained directly from (I) by refluxing with the appropriate anhydride.

Dissolution of (VII) in concentrated sulphuric or hydrochloric acid, followed by dilution of the mixture with water after 3 or 16 hr. respectively, led to formation of an *isomer*, small buff crystals, m. p. 233° (decomp.) (Found : C, 56·1; H, 4·3; N, 11·8%), after crystallisation from a large volume of ethanol.

5-*Methylene*-4-p-*nitrophenyl*-2-*oxo*-Δ^3-*pyrroline* (VIII) was prepared in very low yields by heating the foregoing compound, m. p. 233°, (I), or (X) with acetic, concentrated hydrochloric, formic, or propionic acid. It separated from acetic acid in small, pale yellow needles, m. p. 262° (Found : C, 61·3, 61·3; H, 3·2, 3·4; N, 13·0. $C_{11}H_8O_3N_2$ requires C, 61·1; H, 3·7; N, 13·0%).

α-*Dichloroacetamido*-p-*nitroacrylophenone*, prepared from ω-dichloroacetamido-*p*-nitroacetophenone by reaction with formaldehyde in the presence of dimethylamine, separated from methanol in very pale yellow plates, m. p. 117° (Found : C, 43·3; H, 2·6; N, 9·6; Cl, 23·8. $C_{11}H_8O_4N_2Cl_2$ requires C, 43·6; H, 2·7; N, 9·2; Cl, 23·4%), $\lambda_{max.}$ 257 mμ ($E^{1\%}_{1cm.}$ = 600). During 40 hours' refluxing in ethanol–benzene it was converted into an *isomer* which separated as pale yellow crystals, m. p. 194—195° (Found : C, 44·1; H, 2·6; N, 9·3%).

2-*Ethoxycarbonylamino*-p-*nitroacrylophenone* separated from aqueous methanol in cream prismatic needles, m. p. 116° (Found : C, 54·6; H, 4·7; N, 10·5. $C_{12}H_{12}O_5N_2$ requires C, 54·5; H, 4·6; N, 10·6%), $\lambda_{max.}$ = 259 mμ ($E^{1\%}_{1cm.}$ = 540).

p-*Nitro*-α-*propionamidoacrylophenone* was prepared by heating β-hydroxy-*p*-nitro-α-propionamidopropiophenone (5 g.) with pyridine (30 ml.) at 100° for 30 min., followed by chromatography of the product in benzene solution on alumina (9 sq. cm. × 10 cm.). The eluate yielded the *acrylophenone* as flat needles, m. p. 75—76° (Found: C, 58·3; H, 4·7; N, 11·2. $C_{12}H_{12}O_4N_2$ requires C, 58·0; H, 4·8; N, 11·3%), after crystallisation from ether–light petroleum (b. p. 40—60°). The fraction adsorbed on the alumina, after elution with ethyl acetate–benzene, yielded yellow needles, m. p. 170—172° (after sintering at 160°) (Found : C, 58·3; H, 4·7; N, 11·2. $C_{12}H_{12}O_4N_2$ requires C, 58·0; H, 4·8; N, 11·3%), after crystallisation from benzene–ethyl acetate. The constitution of *dihydro*-2-*ethyl*-4-p-*nitrobenzoyloxazole* (cf. VII) is assigned to this compound on the basis of its ultra-violet absorption spectrum (cf. Table).

2-*Acetamido*-1-p-*nitrophenylvinyl acetate* (XV; R′ = R″ = Ac), yellow needles (4·6 g.), m. p. 210—211° (Found : N, 10·5. $C_{12}H_{12}O_5N_2$ requires N, 10·6%), after crystallisation from alcohol, separated when ω-acetamido-*p*-nitroacetophenone (5·55 g.) and benzaldehyde (2·26 ml.) in acetic anhydride (20 ml.) were heated under reflux for 2 hr. and the mixture was decomposed by addition of an equal volume of alcohol. The same compound was obtained in identical yield when benzaldehyde was omitted from the reaction mixture. Reaction [1 g. in alcohol (50 ml.) and acetic acid (3 ml.)] with phenylhydrazine (1·5 ml.) for 15 min. on the steam-bath gave ω-*acetamido*-p-*nitroacetophenone phenylhydrazone*, bright red needles, m. p. 206—208° (Found : C, 61·9; H, 4·9; N, 18·1. $C_{16}H_{16}O_3N_4$ requires C, 61·5; H, 5·2; N, 17·9%), after crystallisation from methanol.

1-p-*Nitrophenyl*-2-*propionamidovinyl propionate* (XV; R′ = R″ = Et·CO) obtained by heating ω-acetamido-*p*-nitroacetophenone (5·55 g.) with propionic anhydride (20 ml.) for 75 min. under reflux, separated from alcohol in pale yellow felted needles (4·5 g.), m. p. 195—197° (Found : C, 57·3; H, 6·0; N, 9·6. $C_{14}H_{16}O_5N_2$ requires C, 57·5; H, 5·5; N, 9·6%). The same compound was obtained when *p*-nitro-ω-propionamidoacetophenone (2 g.) was refluxed with propionic anhydride (10 ml.) for 10 min.

2-*Benzamido*-1-p-*nitrophenylvinyl acetate* (XV; R′ = Ac, R″ = Bz), formed by acetylation of ω-benzamido-*p*-nitroacetophenone, formed bright yellow needles, m. p. 219° (Found : C, 62·0; H, 4·2; N, 8·5. $C_{17}H_{14}O_5N_2$ requires C, 62·6; H, 4·3; N, 8·6%), from alcohol.

1-p-*Nitrophenyl*-2-*propionamidovinyl acetate* (XV; R′ = Ac, R″ = Et·CO), obtained by acetylation of ω-propionamido-*p*-nitroacetophenone, separated from ethanol in bright yellow needles, m. p. 184—186° (Found : C, 56·2; H, 4·9; N, 9·8. $C_{13}H_{14}O_5N_2$ requires C, 56·1; H, 5·1; N, 10·1%).

α-*Acetamidostyryl* p-*nitrophenyl ketone* (XVI; R′ = Ph), bright yellow prisms, m. p. 178—180° (Found : C, 65·9; H, 4·5; N, 9·2. $C_{17}H_{14}O_4N_2$ requires C, 65·8; H, 4·6; N, 9·0%), after crystallisation from methanol, separated (56%) when a solution of ω-acetamido-*p*-nitroacetophenone (22·2 g.), benzaldehyde (10·6 g.), and dimethylamine (1·5 ml. of 33% aqueous solution) in alcohol (150 ml.) was heated at 65—70° for 3½ hr. and then left overnight.

The product was recovered unchanged after 2 hours' refluxing (2·7 g.) with pyridine (25 ml.).

2-Acetamido-2 : 3-epoxy-1-p-nitrophenyl-3-phenylpropan-1-one (1 g.), pale yellow rosettes of needles, m. p. 153—154° (Found: C, 62·6; H, 4·2; N, 9·0. $C_{17}H_{14}O_5N_2$ requires C, 62·6; H, 4·2; N, 8·6%), $\lambda_{max.}$ 260 mμ ($E^{1\%}_{1cm.}$ = 620), after crystallisation from aqueous methanol, separated when a mixture of the foregoing compound (2·0 g.) in acetic acid (40 ml.) and hydrogen peroxide (10 ml. of 100-vol.) was kept at room temperature and then poured into water.

1-p-Nitrophenyl-3-phenylpropane-1 : 2-dione, obtained by heating (XVI; R′ = Ph) (3 g.) in ethanol (50 ml.) and concentrated hydrochloric acid (20 ml.) for 3 hr. on the water-bath, followed by cooling, formed bright yellow needles (1·9 g.)· m. p. 129—131° (Found: C, 66·9; H, 4·0; N, 5·1. $C_{15}H_{11}O_4N$ requires C, 66·9; H, 4·1; N, 5·2%), $\lambda_{max.}$ 268 ($E^{1\%}_{1cm.}$ = 590) and 342 mμ ($E^{1\%}_{1cm.}$ = 505), from methanol. The *dioxime*, after crystallisation from aqueous methanol,

Compound	$\lambda_{max.}$ (mμ)	*E*	$\lambda_{max.}$ (mμ)	*E*
ω-Acetamido-*p*-nitroacetophenone	262	610	—	—
p-Nitrobenzaldehyde	262	940	—	—
(I)	263	560	—	—
(II)	270	700	—	—
(VI)	262	545	—	—
(X)	260	535	—	—
(VII)	260	410	Shoulder 290+	(150)
Isomer of (VII) (m. p. 233°)	265	625	—	—
Ethyl analogue of (VII)	258	466	Shoulder	(160)
Propionyl derivative of (VII)	260	388	Shoulder 290+	(180)
(VIII)	275	610	Shoulder 300	(540)
(XXI)	264	503	—	—
(XXI) after treatment with Ac_2O–H_2SO_4	257	445	Shoulder 290+	(230)
α-Dichloroacetamido-*p*-nitroacrylophenone	257	600	—	—
α-Ethoxycarbonylamino-*p*-nitroacrylophenone	259	540	—	—
p-Nitroacetophenone	231	638	327	915
(IV; R′ = H)	232	525	326	872
(IV; R′ = CH_2·OH)	229	435	327	695
(IV; R′ = CH_2·OAc)	226	435	322	605
(IV; R′ = CH_2Cl)	226	430	324	650
(V)	234	515	333	785
(XV; R′ = R″ = Ac)	243	525	348	630
(XVI; R′ = Ph)	271	727	—	—
Epoxide of (XVI; R′ = Ph)	260	620	—	—
Acetyl derivative of (XVI; R′ = Ph)	264	570	301	470
(XVI; R′ = C_6H_4·OMe-*p*)	275	520	343	390
(XIX; R = C_6H_4·OMe-*p*)	267	695	325	340
(XX)	268	495	330	470
(XVII; R′ = H)	333	523	—	—
(XVII; R′ = Ac)	324	455	—	—
1-*p*-Nitrophenyl-3-phenylpropane-1 : 2-dione	268	590	342	505

formed silver plates, m. p. 184—185° (Found: C, 59·7; H, 4·4; N, 14·0. $C_{15}H_{13}O_4N_3$ requires C, 60·2; H, 4·4; N, 14·0%). The *quinoxaline* derivative formed colourless silky needles, m. p. 167° (Found: C, 73·6; H, 4·6; N, 12·0. $C_{21}H_{15}O_2N_3$ requires C, 73·9; H, 4·4; N, 12·3%), from ethanol.

Reaction with acetic anhydride under reflux for 3 hr. furnished *3-acetyldihydro-2-methyl-4-p-nitrobenzoyl-5-phenyloxazole*, needles, m. p. 172—173° (Found: C, 64·9; H, 4·7; N, 8·2. $C_{19}H_{16}O_5N_2$ requires C, 64·8; H, 4·6; N, 8·0%), $\lambda_{max.}$ 264 ($E^{1\%}_{1cm.}$ = 570) and 301 mμ ($E^{1\%}_{1cm.}$ = 470), after crystallisation from dilute ethanol.

4-α-Acetoxybenzyl-2-methyl-5-p-nitrophenyloxazole (XVII; R′ = Ac), buff crystals, m. p. 121—122° (Found: C, 65·1; H, 4·6; N, 8·1. $C_{19}H_{16}O_5N_2$ requires C, 64·8; H, 4·6; N, 8·0%), after purification from ethanol, separated when a solution of (XVI; R′ = Ph) (2·0 g.) in acetic anhydride containing 2 drops of concentrated sulphuric acid was left for 2 days at room temperature and then decomposed with ice-water. Hydrolysis with 5% sodium carbonate solution for 15 min. under reflux furnished the free *alcohol*, buff needles, m. p. 149—150° (Found: C, 65·6; H, 4·5; N, 9·0. $C_{17}H_{14}O_4N_2$ requires C, 65·8; H, 4·6; N, 9·0%), after crystallisation from methanol.

2-Methyl-4-p-nitrobenzoyl-5-phenyloxazole (XIX).—The ketone (XVI; R′ = Ph) (6·2 g.), dissolved in warm acetic acid (40 ml.), was treated with bromine (3·2 g.) in a little acetic acid. Immediate absorption of bromine occurred, followed by evolution of hydrogen bromide. After being kept at room temperature overnight the solution was poured into ice-water and the pre-

cipitated solids were collected and purified from alcohol. 2-*Methyl*-4-p-*nitrobenzoyl*-5-*phenyloxazole* (6·0 g.) formed flat bright lemon-yellow needles, m. p. 128—130° (Found: C, 66·3; H, 3·8; N, 8·8. $C_{17}H_{12}O_4N_2$ requires C, 66·2; H, 3·9; N, 9·1%). The same product was obtained when the reaction was repeated with 2 mols. of bromine. Peroxide oxidation of this product furnished benzoic and *p*-nitrobenzoic acids.

5-*Benzoyl*-2-*methyl*-4-p-*nitrophenyloxazole* (XX), prepared by heating the foregoing compound (300 mg.) with concentrated hydrochloric acid (3 ml.) on the steam-bath for 1 hr., separated from aqueous methanol in pale yellow prisms, m. p. 90° (Found: C, 66·5; H, 4·0; N, 8·9. $C_{17}H_{12}O_4N_2$ requires C, 66·2; H, 3·9; N, 9·1%).

α-*Acetamido*-3-p-*methoxystyryl* p-*Nitrophenyl Ketone* (XVI; R′ = *p*-MeO·C_6H_4).—A solution of ω-acetamido-*p*-nitroacetophenone (22·2 g.), *p*-anisaldehyde (13·6 g.), dimethylamine (2 ml. of 33% aqueous solution), and alcohol (200 ml.) was heated under reflux for 5 hr. Next morning unchanged ω-acetamido-*p*-nitroacetophenone (9 g.) was removed and the filtrate heated in an open flask for 6 hr. on the water-bath. Addition of a little light petroleum (b. p. 60—80°) led to slow separation of α-*acetamido*-3-p-*methoxystyryl* p-*nitrophenyl ketone* (10 g.), orange-yellow prisms, m. p. 148—150° (Found: C, 63·9; H, 5·0; N, 8·1. $C_{18}H_{16}O_5N_2$ requires C, 63·5; H, 4·7; N, 8·2%), after crystallisation from spirit.

Hydrolysis with ethanolic hydrochloric acid furnished 3-p-*methoxyphenyl*-1-p-*nitrophenylpropane*-1 : 2-*dione*, orange needles, m. p. 165—168° (Found: C, 63·9; H, 4·4; N, 4·8. $C_{16}H_{13}O_5N$ requires C, 64·2; H, 4·4; N, 4·7%), after crystallisation from alcohol, which was characterised by conversion into the *quinoxaline* derivative, needles, m. p. 148—149° (Found: C, 70·1; H, 4·3; N, 12·2. $C_{21}H_{15}O_3N_3$ requires C, 70·6; H, 4·2; N, 11·8%), from spirit.

5-p-*Methoxyphenyl*-2-*methyl*-4-p-*nitrobenzoyloxazole*, prepared as was the phenyl analogue (XIX), after crystallisation from alcohol, formed yellow needles, m. p. 166—168° (Found: C, 64·2; H, 4·4; N, 8·1. $C_{18}H_{14}O_5N_2$ requires C, 63·9; H, 4·2; N, 8·3%).

α-*Acetamido*-p-*nitrostyryl* p-*nitrophenyl ketone*, obtained by condensation of ω-acetamido-*p*-nitroacetophenone and *p*-nitrobenzaldehyde in alcohol with dimethylamine as catalyst, formed small yellow needles, m. p. 232° (Found: C, 57·8; H, 3·9; N, 11·7. $C_{17}H_{13}O_6N_3$ requires C, 57·5; H, 3·7; N, 11·8%), from acetic acid.

α-*Acetamido*-o-*hydroxystyryl* p-*nitrophenyl ketone* formed bright yellow crystals, m. p. 166—171° (decomp.) (Found: C, 63·1; H, 4·3; N, 8·3. $C_{17}H_{14}O_5N_2$ requires C, 62·6; H, 4·3; N, 8·5%), after repeated crystallisation from ethanol.

2 : 6-*Diacetamido*-1 : 7-*di*-p-*nitrophenyl*-4-*oxaheptane*-1 : 7-*dione* (XXI).—α-Acetamido-1-hydroxy-*p*-nitropropiophenone (10 g.), suspended in boiling alcohol (60 ml.), was treated with anhydrous sodium carbonate (1 g.), and the reddish-brown mixture heated under reflux for 1 hr. After cooling, the separated solids (7·6 g.) were collected and purified from aqueous pyridine. The *product* formed crystals, m. p. 235° (decomp.) (Found: C, 54·2; H, 4·7; N, 11·8. $C_{22}H_{22}O_9N_4$ requires C, 54·3; H, 4·6; N, 11·5%), $\lambda_{max.}$ 264 mμ ($E^{1\%}_{1cm.}$ = 503) [Found: Active hydrogen (Zerewitinoff), 0·78. Required for 4H, 0·83%]. The same product was obtained when other basic catalysts, *e.g.*, pyridine, sodium hydrogen carbonate, sodium acetate, and magnesium oxide, were used in place of sodium carbonate. The *bisphenylhydrazone* formed unstable orange crystals, m. p. 160—170° (Found: C, 61·1; H, 5·0; N, 16·7. $C_{34}H_{34}O_7N_8$ requires C, 61·2; H, 5·1; N, 16·8%). Propionic anhydride gave a *product*, needles (from alcohol), m. p. 170—171° (Found: C, 57·1; 57·2; H, 4·8, 4·5; N, 9·6, 9·9. $C_{27}H_{30}O_{10}N_4$ requires C, 56·8; H, 5·3; N, 9·8%). Acetic anhydride containing a few drops of concentrated sulphuric acid gave a dehydration *product*, plates (from acetic acid), m. p. 273° (Found: C, 56·3; H, 4·1; N, 11·9. $C_{22}H_{20}O_8N_4$ requires C, 56·4; H, 4·3; N, 12·0%).

Ultra-violet Absorption Spectra.—Some of the spectra determined are tabulated.

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